Universitat Autònoma de Barcelona

CHARACTERISTICS AND HEALTH DETERMINANTS OF FOREIGN BORN POPULATION
With special emphasis on sexually transmitted infections and longitudinal studies in Europe and Spain

Cristina Hernando Rovirola

DOCTORAL THESIS

CHARACTERISTICS AND HEALTH DETERMINANTS OF FOREIGN BORN POPULATION

With special emphasis on sexually transmitted infections and longitudinal studies in Europe and Spain

Doctoranda: Cristina Hernando Rovirola

Co-directors: Jordi Casabona Barbarà i Meritxell Sabidó Espin

UNIVERSITAT AUTÒNOMA DE BARCELONA

DEPARTAMENT DE PEDIATRIA, D'OBSTETRÍCIA I GINECOLOGIA I DE MEDICINA PREVENTIVA

DOCTORAT EN METODOLOGIA DE LA RECERCA BIOMÈDICA I SALUT PÚBLICA

2019

Jordi Casabona Barbarà

Co-director

Meritxell Sabidó Espin

Co-directora

Cristina Hernando Rovirola

Doctoranda

2019

Veure en la foscor és claredat.

Saber cedir és fortalesa.

Utilitza la teva pròpia llum

per retornar a la font de llum.

Això és practicar l'eternitat.

Tao Te Ching. Lao Tzu. Traducció d'Stephen Mitchell

Seeing in the dark is clarity.

Knowing to give up is strength.

Use your own light

to return to the source of the light.

This is to practice eternity.

Tao Te Ching. Lao Tzu. Translated by Stephen Mitchell

Ver en la oscuridad es claridad.

Saber ceder es fortaleza.

Usa tu propia luz

Para retornar a la funte de luz.

Esto es practicar la eternidad.

Tao Te Ching. Lao Tzu. Traducción de Stephen Mitchell

AGRAÏMENTS

Gràcies a en Jordi i a la Meritxell, co-directors d'aquesta tesi, per donar-me l'oportunitat de treballar amb vosaltres i de fer la tesi. Gràcies per tots els consells, suggerències, mails i skypes a hores i llocs inversemblants. Gràcies per tots els aprenentatges, que són molts,

Gràcies a tots els companys i companyes del CEEISCAT amb qui he treballat, per la vostra bona predisposició a ajudar-me en tot moment i per ensenyar-me els valors i els aventatges del treball en equip,

Gràcies a l'Elena i a totes les persones del Subprograma Immigració i Salut,

Gràcies a en Teymur, a en Gianfranco, a en Magnus i a la Michelle,

Gràcies a la Maria Teresa, en Felip, la Ma Teresa, la Gemma i a en Xavier, per sempre ser-hi, sostenir, acollir, escoltar, abraçar i estimar. Gràcies a la Clara per formar part d'aquest equipu!

Gràcies a totes les persones que heu fet amb mi algun tram del camí, totes heu sigut indispensables, valuoses i molt estimades,

Gràcies a la Vida, per ser infinita.

INDEX

ABBREVIATIONS

AMR	Antimicrobial resistant
aOR	Adjusted odds ratio
ART	Antiretroviral treatment
ARV	Antiretroviral drug
CIBERESP	Consortium of Biomedical Research of Epidemiology and Public Health
CI	Confidence interval
cOR	Crude odds ratio
ECDC	European Centre for Disease Prevention and Control
ESCS	Extended-spectrum cephalosporins cefixime and ceftriaxone
EEA	European Economic Area
EU	European Union
Euro-GASP	European Gonococcal Antimicrobial Surveillance Programme
HBV	Hepatitis B virus
HCV	Hepatitis C virus
HIV/AIDS	Human immunodeficiency virus infection and acquired immune deficiency syndrome
IDU	Injecting drug users
IOM	International Organization for Migration
MDR TB	Multi drug resistant tuberculosis infection
MSM	Men who have sex with men

MTCT	Mother to child transmission
NAAT	Nucleic acid amplification testing
NG	*Neisseria gonorrhoeae* infection
Non-European countries	Non-EU
PELFI	Platform of Longitudinal Studies on Foreign-Born Families (Plataforma de Estudios Longitudinales de Familias Inmigrantes)
PELFI cohort Badalona/SC	PELFI cohort Badalona/Santa Coloma de Gramanet
PR	Participation rate
RR	Retention rate
SD	Standard deviation
SMH	Subprogramme on Migration and Health
STIs	Sexually transmitted infections
TB	Tuberculosis
UK	United Kingdom
WHO	World Health Organization
WHO AFR	WHO African Region
WHO AMR	WHO American Region
WHO EUR	WHO European Region
WHO REM	WHO Eastern Mediterranean Region
WHO SEA	WHO South East Asia Region
WHO WPR	WHO Western Pacific Region

EXECUTIVE SUMMARY

Currently, there is not a consensual definition of migrants in health research at national and international levels (1). According with international institutions such as the World Health Organization (WHO) and the European Centre for Disease Control (ECDC) (2,3), in our research we considered migrant population those who were born in other different country than the country of the study. In this thesis, we use the term foreign-born population to refer to migrant population.

Currently, health research on foreign-born population has high priority for the World Health Organization (WHO) (4), arising as an emergent and of high interest issue for Public Health and epidemiological research in Europe and in Spain (2,5–11). Currently, in Europe, significant gaps in knowledge on health status of European (EU) foreign-born exist, as well as their responses to interventions and how to adapt health services to the new social reality (5,12). In addition, barriers and facilitators of participation of foreign-born population to health research are largely unexplored (10).

In Spain, the implementation of the Subprogramme on Migration and Health (SMH) in 2011 within the Consortium of Biomedical Research of Epidemiology and Public Health (CIBERESP) reflects the relevance of the health status of foreign-born population for Public Health and epidemiological research. CIBERESP is a Spanish Center of Excellence in Epidemiological Research that gathers a heterogeneous network of professionals from the academic field, public administrations and research centers; with the aim to provide updated information on the health situation in our context, on the main biological, environmental and social determinants of health involved in the more frequent diseases, and on the study of inequalities. The mission of CIBERESP is to generate relevant knowledge for decision-making, with a view to prevention, both of the disease and its consequences. Most of our research was carried out within the SMH research activities. This thesis presents a range of relevant topics on foreign-born population health, with the main goal of improving the available information about the health status of the foreign-born population and on the facilitators of the participation in research of this population in Europe, and in particular in Spain, in order to contribute to improving the health policies addressed to this group. We present three articles as the compendium of articles of this thesis together with three complementary

articles, with the aim to provide wide data for a better understanding of the framework of our research and for achieving the objectives of this thesis.

In order to assess what is known on foreign-born population health, the first research activity performed in the SMH was a *scoping review* of published articles from 1998 to 2012 on the health status of foreign-born population in Spain. Research groups reviewed the articles in their area of expertise. My participation in this project was in two different aspects: 1) as a member of a SMH research group dedicated to HIV and other sexual transmitted infections (STIs), we conducted a *scoping review* of studies on HIV/AIDS infection and other STIs on foreign-born population in Spain published from 1998 to 2012; and 2) due to my role as Project Manager of the SMH, I was involved in the coordination and the publication of the *scooping review* as a monograph (13) and took part in a study that described the general characteristics of the total articles that were included in this monograph.

The main objective of the *scoping review* of studies on HIV/AIDS infection and other STIs on foreign-born population in Spain published from 1998 to 2012 was to describe the methodological characteristics and the main results of studies on HIV and other STIs, including the epidemiological, clinical and microbiological and molecular fields. A total of 41 studies were included. Most studied population was from Latin America (48.8% of the studies).When foreing-born were compared to natives, men who have sex with men (MSM) from Latin America (18.1% vs. 5.0%, $p<0.001$), transvestite and transsexual sex workers from Latin America (23.3% vs. 9.3%), pregnant women (0.9% vs. 0.5%) –particularly those originated from sub-Saharan Africa (11.8% vs. 0.1% and 18.9% vs. 0%, both $p<0.05$ in two studies)-, and men and women from sub-Saharan Africa (9.1% and 7.5% vs. 1.8%) presented higher prevalence of HIV infection. Delayed diagnosis of HIV infection was high in both groups (natives: 34.6%, foreign-born: 43.0%), and particularly high within foreign-born patients from Sub-Saharan Africa (41.0% and 53.0%) than in natives (30.0%). Those originated from sub-Saharan Africa also showed an increase of resistances to antiretroviral treatment (ART) (from 7.7% to 13.0% from 2000 to 2010). Compared to native women, foreign-born women had more than double losses to follow up (25.5% vs 11.6%), worse immunological response to ART, more changes of ART treatment and shorter time to treatment failure (124 weeks [95% CI, 64-183] vs 151 [95% CI, 127-174]). As conclusions, proportion of late diagnosis was high in both populations, and foreign-born population had an important role in the new HIV diagnoses in Spain. Particular

foreign-born sub-groups such as those from sub-Saharan Africa, adolescents and foreign-born women presented a disadvantaged situation. As recommendations, the review identified the need to generalize the performance of HIV serology in the health system and implement preventive and rapid diagnosis programs for HIV and other STIs designed specifically for the foreign-born population and implemented with a gender perspective. It is essential to avoid the implementation of new barriers of accessing and/or using of health services. The main results of the *scoping review* were published as: Hernando Rovirola C, Ortiz-Barreda G, Galán Montemayor JC, Sabidó Espin M, Casabona Barbarà J. Infección VIH/Sida y otras infecciones de transmisión sexual en la población inmigrante en España: revisión bibliográfica. Rev Esp Salud Pública. 2014 Dec;88(6):763–81(14). This article has been included in the thesis as a complementary article.

Within the framework of the *scooping review* carried out by the SMH, due to my role as Project Manager of the SMH, I also participated in the coordination of the review and in the development of the 12 articles that were part of a special issue published in the Revista Española de Salud Pública in 2014 (13). As a result of these activities, I took part in a study that described the general characteristics of the total articles included in the literature review: the temporal distribution of the publications and their main objectives, methodology, results and conclusions. Findings of the study showed that the most studied health topics were infectious diseases (70% of the included articles, n=217), and that methodologies and terminologies used were heterogeneous. The main recommendations of the study were to conduct longitudinal studies that can include time of residence in the host country, and to harmonize foreign-born related data collected in information systems. Main findings were published as: Ronda-Pérez E, Ortiz-Barreda G, Hernando C, Vives-Cases C, Gil-González D, Casabona J. Características generales de los artículos originales incluidos en las revisiones bibliográficas sobre salud e inmigración en España. Rev Esp Salud Pública. 2014 Dec;88(6):675–85 (15). This article has been included in the thesis as a complementary article.

In order to continue improving the knowledge on the health status of foreign-born population, we conducted a descriptive cross-sectional study that focused on antimicrobial resistant (AMR) *Neisseria gonorrhoeae* infection (NG) within EU foreign-born population using data from the

European Gonococcal Antimicrobial Surveillance Programme[1] (Euro-GASP) from 2010 to 2014. Historically, NG has shown an extraordinary ability to develop AMR. In the last decade, *in vitro* and clinical resistance, resulting in treatment failures, to the extended-spectrum cephalosporins (ESCs) cefixime and ceftriaxone, as well as azithromycin have also emerged (16–18) in the European Region[2]. Currently, due to the potential risk of developing cephalosporin resistance, NG is considered a major Public Health threat worldwide (17,19,20). Thus, the Global Action Plan (21) and the European Response Plan (22), respectively developed by the WHO and the European Centre for Disease Prevention and Control (ECDC), strongly emphasised to strengthen gonococcal AMR surveillance. Mobile populations (international travellers, sexual tourists and long-distance truck drivers) and migration flows are considered key populations for gonorrhoea control by WHO and can have a significant role in the international spread of AMR gonococcal strains (2,17,21,22). Euro-GASP is thesentinel surveillance system coordinated by ECDC that monitors antimicrobial susceptibility of gonococcal isolates across Member States of the European Union[3] (EU) and the European Economic Area[4] (EEA). This study was undertaken during a 3-month research stay in the HIV/AIDS Infection Department and other STIs of the ECDC in 2016, in Stockholm (Sweden). We analysed Euro-GASP isolates (n=9529) with the aim of assessing the proportion of AMR gonococcal isolates among foreign-born patients and compared to native patients, and describing the epidemiological and clinical characteristics associated with resistant NG among foreign-born patients. The study findings showed that compared to native patients, EU foreign-born patients had higher proportion of isolates producing penicillinase (8.4% vs. 11.7%, p=0.02); similar level of

[1] Euro-GASP participating countries includes The Netherlands, Ireland, United Kingdom, Greece, Italy, Denmarck, Malta, Slovakia, Belgium, Slovenia, Germany, Hungary, Portugal, Austria, Spain, France, Cyprus, Latvia, Norway, Sweden, Estonia, Iceland, Poland, Romania

[2] European Region includes Andorra, Austria, Belgium, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Luxembourg, Malta, Monaco, The Netherlands, Norway, Portugal, San Marino, Slovenia, Spain, Sweden, Switzerland, United Kingdom, Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Bulgaria, Georgia, Kyrgyzstan, Poland, Romania, Slovakia, Tajikistan, The former Yugoslav Republic of Macedonia, Turkey, Turkmenistan, Uzbekistan, Yugoslavia, Belarus, Estonia, Hungary, Kazakhstan, Latvia, Lithuania, Republic of Moldova, Russian Federation, Ukraine

[3] EU includes the 28 member countries of the European Union: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sewden, United Kingdom (EU 28)

[4] EEA includes the 28 member countries of the European Union and Iceland, Liechtenstein, and Norway

azithromycin resistance (7.5% vs. 7.2%, p=0.8), of ciprofloxacin resistance (50.0% vs. 46.3%, p=0.07) and of decreased susceptibility to ceftriaxone (1.9% vs. 2.8%, p=0.10); and lower rate of cefixime resistance (5.7% vs. 3.6%, p=0.02). However, compared to native patients born in EU/EEA, foreign-born patients born outside EU/EEA had higher proportion of isolates with decreased susceptibility to ceftriaxone (1.8% vs. 3.5%, p=0.02). Within foreign-born patients born outside EU/EEA, those originary from the Eastern Mediterranean Region and non-EU/EEA countries presented higher rates of isolates with decreased susceptibility to ceftriaxone than native patients (1.9% vs. 9.6% and 8.7% respectively, p<0.01). In multivariable analysis, foreign-born patients with AMR isolates were more likely to be from non-EU/EEA countries (adjusted odds ratio [aOR]: 3.2, 95% confidence interval [CI] 1.8-5.8) and Eastern Mediterranean Region (aOR: 1.8, 95% CI 1.1-3.3); and heterosexual males (aOR: 1.8, 95% CI 1.2-2.7). We concluded that importation of AMR gonococcal strains into the EU/EEA from other geographic regions worldwide poses a threat for emergence and subsequent rapid spread of gonococcal AMR in Europe. As recommendations, we emphasized the need for improving the completeness of demographic and risk factor data in Euro-GASP and could state that it is crucial to further strengthen Euro-GASP and implement quality assured surveillance of gonococcal AMR for Public Health purposes in the whole European Region. Further research to improve understanding of sexual networks within foreign-born populations could help to inform effective tailored-made interventions. Main findings will be published as: Hernando C, Spiteri G, Sabido M, Montoliu A, Gonzalez V, Casabona J, Cole MJ, Noori T, Unemo M. Antimicrobial resistance in Neisseria gonorrhoeae isolates from foreign-born population in the European Gonococcal Antimicrobial Surveillance Programme. Sex Transm Infect. *Ahead of print*. This article has been included in the compendium of articles of this thesis.

The second part of the research included in this thesis was focused on methodological aspects of research on health status of foreign-born populations, particularly on improving knowledge of those factors experienced by foreign-born population as barriers of participation in longitudinal health research. It is known that research on migration and health presents several difficulties (10,23–25). Most of available data of the health of foreign-born population comes from cross-sectional studies (13). However, the recommendations made by the WHO indicate that it is necessary to monitor migrants health over time and to carry out studies with analytical designs in order to achieve a better understanding of the relationship between migration and health (13,26).

Prospective longitudinal design allows identifying associations between health and demographic factors, such as time of residence in the host country, and exposure to stressors (27–30). It is recognized that time of residence is an essential factor that influence the health status of foreign-born population (8,31–36). In Europe, there is an increasing interest for conducting such studies on foreign-born population. As an example, the HELIUS cohort, in the Netherlands, and the German National Cohort, in Germany, are currently ongoing (37,38). On the other hand, it has been stated that foreign-born population is underrepresented and often excluded from health studies (29,30,34). This is partly explained because the identification, participation, and re-contact of this population is limited by a wide range of idiomatic, cultural and socio-economic factors (5,32,39–43). Moreover, researchers must adapt their methods to include, for example, participants who are unable to read or write in the majority language of the host country, or that are illiterate. At the same time, data collection must reassure privacy, potential misuse of data and the political sensitivity of "ethnic monitoring" (4). A better understanding of factors that foreign-born population may experience as facilitators and barriers of participation in health studies (40,44) will facilitate access of foreign-born population to health research (43,45), and in turn improve their recruitment and retention in prospective cohort studies (45,46). With the aim to improve the available information about barriers of participation in research of foreign-born population, we first conducted a systematic review of longitudinal health studies on foreign-born population. The aim was to evaluate whether population characteristics, sample frame, recruitment, cohort design, and data collection methods had an influence on participation and follow-up rates of this population in longitudinal cohorts. After the selection process, 9 cohort studies were included. Participation (PR) and retention (RR) rates were high in studies that included families as study unit (PR=70% and RR=95.1%), groups perceived to be at high risk (PR=91% and 91.7%, RR=73% and 49%), studies where the researchers had close community ties, and studies where complete contact information had been collected (PR=88% and RR=83% and 80%). Lower PR and RR were associated with longer time between baseline and follow up, and with targeting irregular workers (PR=57% and RR=30%). Recent cohort studies on foreign-born population used sophisticated and innovative designs, such as studying several health areas, including different generations of the same family, conducting medical exams and analysing biological samples, and having an unlimited duration with an undetermined number of follow-ups. Few data about strategies used for recontacting participants in the follow-up wave was available. We concluded that funding and logistical challenges associated

with cohort studies may be increased by different factors that may influence PR and RR, such as identification of documented foreign-born participants through governmental records, early follow up, use of a variety of recruitment strategies, including digital technologies, to locate participants and maintaining personal relationship throughout the study. As recommendations, continuity of financing and commitment and persistence of project staff are essential for carrying out longitudinal projects. The main results of the study were published as: Hernando C, Sabidó M, Ronda E, Ortiz-Barreda G CJ. A systematic review of longitudinal cohort studies on the health of migrant populations. Soc Med. 2015;9(2):73–85(47). This article has been included in the thesis as a complementary article.

In light of the lack of evidence on barriers of participation in health research of foreign-born populationin our study setting, we conducted a qualitative study aimed to evaluate the interest and acceptability of the implementation of a cohort study on families originated from Pakistan, Latin America, Morocco and China in the city of Badalona. Personal interviews and discussion groups were conducted with 76 participants and 9 key informants. The main findings of this study showed that foreign-born participants were willing to participate in health surveys and biological samples testing, and to accept the participation of their children in them. Undertaking biological samples and getting knowledge of the health status of their children were found as the greatest motivation of participation. The main barriers of participation were language difficulties, time constraints and mobility issues. Focusing on foreign-born families instead of individuals may facilitate participation in the study. Those with higher risk of travelling abroad, greater language difficulties and less Internet use may be more difficult to re-contact. We concluded that including foreign-born families and offering biological samples testing and clinical examinations may facilitate participation in a study. Ensure privacy, confidentiality, proximity, respecting cultural values, as well as using interviewers with the same foreign-born background, gender and socio-economic status as participants are essential to build trust between participants and the research team. The study was conducted with funding from ISCIII (PI13/01962). The main results of the study were published as: Hernando C, Sabido M, Casabona J. Facilitators and barriers of participation in a longitudinal research on migrant families in Badalona (Spain): A qualitative approach. Health Soc Care Community. 2018;26(1):e64-e74. doi: 10.1111/hsc.12478. Epub 2017 Jul 24 (48). This article has been included in the compendium of articles of this thesis. Furthermore, lessons learnt were used

to carry out a guide of good practices (http://www.ciberesp.es/programas-de-investigacion/subprogramas-estrategicos/subprograma-inmigracion-y-salud-ciberesp-sis-ciberesp) (Annex 1) for the implementation of a cohort on foreign-born population originated from Pakistan, Latin America, Morocco and China.

In 2014, several research groups participating in SMH joined efforts and constituted the research project named "Platform of longitudinal studies on migrant families, PELFI" ("Plataforma de Estudios Longitudinales de Familias Inmigrantes, PELFI"). PELFI is a multi-center study of cohorts on foreign-born families with the objective of improving knowledge about their health status and their health determinants, and describe how these evolve according with time of residence of this population in the host country. Currently, PELFI includes three cohorts that are ongoing in three different Spanish cities. Each PELFI cohort has specific objectives and uses recruitment strategies appropriate to the context and geographic origins included. At the same time, PELFI cohorts share inclusion criteria and modules of the health questionnaire, which will allow building the multicentric cohort. Our work focused on the PELFI cohort Badalona/Santa Coloma de Gramanet (Badalona/SC). The main objective of the PELFI cohort Badalona/SC was to describe the relationship of determinants of health with the family unit and the migratory experience. The study was conducted with funding from ISCIII (PI13/01962). Main findings of the study were published as: Hernando C, Gaillardin F, Ferrer L, Cayuela A, Ronda E, Casabona J. Facilitadores de la participación e implementación de la subcohorte PELFI de familias inmigrantes. Gac Sanit. 2019;33(1): 45-52. doi: 10.1016/j.gaceta.2017.07.010. Epub 2017 Sep 22 (49). This article has been included in the compendium of articles of this thesis.

Within all the studies presented, I actively participated in all phases of a research project: protocol development, design of data collection tools, field work (recruitment of participants and data collection), and data analysis, and writing of the manuscripts. A wide range of methods were used, such as bibliographic reviews, analysis of data from a surveillance network; qualitative methodology; and design and implementation of a cohort of foreign-born families. Conducting a research stay in ECDC analyzing data from the Euro-GASP sentinel network added and broadened the scope of the thesis, challenged me with the analysis of a large database, as well as strengthened my network.

INTRODUCTION

Defining foreign-born populations

Along history, poverty, war, conflicts, natural disasters, inequality, unemploymentand other social, economical, religious and cultural crisis may result in large-scale flows of population. Currently, society is increasingly interconnected worldwide and access to transportation of individuals and goods have made easier, cheaper and faster for people to move (50). Migration is a complex phenomenon that gathers a heterogeneus population group (26). In 2017, the stock of international migrants, the total number of people residing in a country other than their country of birth, was estimated at 258 million compared to about 173 million in 2000, and 102 million in 1980 (an increase of 85 million and 156 million, respectively) (51). Among the international migrant population, 150.3 million were migrant workers, 124.8 million were women, 36.1 million were children, 25.4 million were registered refugees, and 4.8 million were international students (51). Two thirds of international migrants live in Asia (80 million) or Europe (78 million), followed by North America (58 million), Africa (25 million), South America and Caribbean (10 million) and Oceania (8 million) (51). Currently there is no consensus on a single definition of 'foreign-born' worldwide. Foreign-born condition might be defined by foreign birth, by foreign citizenship, by their movement into a new country to stay temporarily or to settle for the long-term, and by their regular or irregular legal situation (26,52).Furthermore, second or third generation, the offspring of those who migrated, need also to be considered (26).

Different definitions of migrants are used by international institutions. According to the International Organization for Migration (IOM), migrant is any person who is moving or has moved across an international border or within a State away from his/her habitual place of residence, regardless of the person's legal status, whether the movement is voluntary or involuntary, what the causes for the movement are, or what the length of the stay is (53). This definition includes a wide spectrum of populations: migrants in regular and irregular or "undocumented" situations, labour migrants, unskilled labour migrants who come from lower and middle-income countries, family members of existing migrants, refugees and asylum seekers from known areas of conflict, victims of trafficking, displaced persons, internal migrants, and migrants who remain in the host country as "settlers", move on to another country as "transit migrants", or move back and forth between the

home and host countries as “circular migration” (4,7,54). The WHO considers migrants “those who have left their country of birth to reside elsewhere” (4). Other national and international institutions, such as the National Institute of Statistics of Spain (55) and ECDC (2) use a definition of migrant based on the country of birth. Our research was focused on international migration. According to all this and to what has been recommended (56), we considered migrants those who were born in a different country that the one currently they live. Along this thesis, principally we use the terms “foreign-born population” to refer to immigrant population.

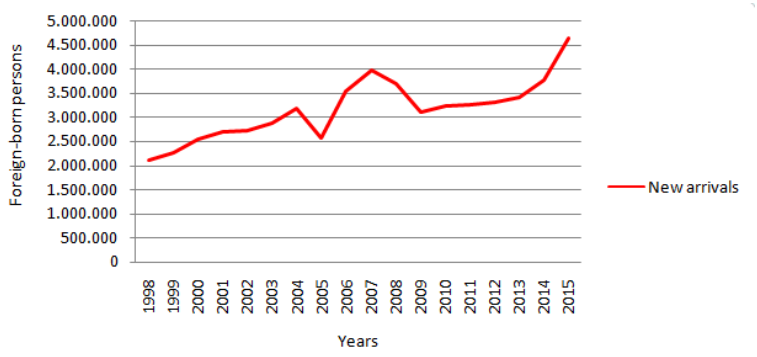
Foreign-born population in Europe today: a demographic change

Migration is a prominent economic and political issue in Europe as well as in most of the developed world and is bound to become ever more salient over the next few decades (57). Europe has a long history of internal migration flows. Such flows often occurred in response to the constant shifts of economic and geopolitical power between Europe’s constituent nation states (57). After the Second World War and together with the economic expansion of Western Europe, labour foreign-born population increasingly settled on a permanent basis (4). By the 1980s, former “temporary” guest workers had turned into permanent residents (57), and many of them started to bring their families to Europe. Family reunification was considered a fundamental right, anchored in article 19 of the European Social Charter of 1961. Large-scale immigration from the rest of the world is a more recent phenomenon. It started in the early 1950s, when European colonial powers such as the United Kindgodm (UK) and France, but also Belgium, the Netherlands and Portugal lost their colonies abroad, triggering large population movements from Africa, the Caribbean, and South Asia. Foreign-born population inflows turned many ethnically homogeneous countries into multi-ethnic societies (57). Afterwards, particular periods as after the fall of the Berlin Wall, the disintegration of the Soviet Union and the Yugoslavian war, triggered large flows of workers and asylum seekers from Central and Eastern Europe to Western Europe (57,58). Since 1990s reasons for migration and countries of origin became increasingly diversified due to political and economic reasons (2,58), and Southern European Countries, such as Italy, Greece, Spain and Portugal, started to become net immigration countries, attracting workers from Latin America and the North of Africa (57). Since 2011, geopolitical instability and wars in the Southern and Eastern Mediterranean, Middle East and North Africa has been contributing to exceptional inflows of migrants to Europe across the Mediterranean sea, dramatically increasing the number of people seeking refugee status in Europe

(59). More recently, the main drivers for recent migration to Europe have been the expansion of the EU, the growing phenomena of internal EU migration, global economic disparities, the demand for both skilled and unskilled labour from outside the EU, and the arrival of displaced individuals from areas of conflict, persecution and/or natural disaster (7,57,60).

In EU foreign arrivals increased from 2.099.113 milion in 1998 to 4.650.963 million in 2015 (Figure 1), and on 1st January 2016 foreign-born population reached 54.4 million[5] (Figure 2), 10.7% of the general population (61). The history of foreign-born population flows along time draws different migration patterns in the European Region. While in many Western European countries with long standing and stable international foreign-born population flows, migrants and their descendants have acquired a demographic and social stratification over time, some European countries only recently have had increases in the number of economic immigrants and asylum seekers (4,62). In the last years, international migrant population has presented a relevant increase (6), transforming European societies in multicultural (63). Migration has become one of the key components of the current demographic change (61).

Figure 1. New arrivals of foreign-born persons in European Union, from 1998 to 2015:

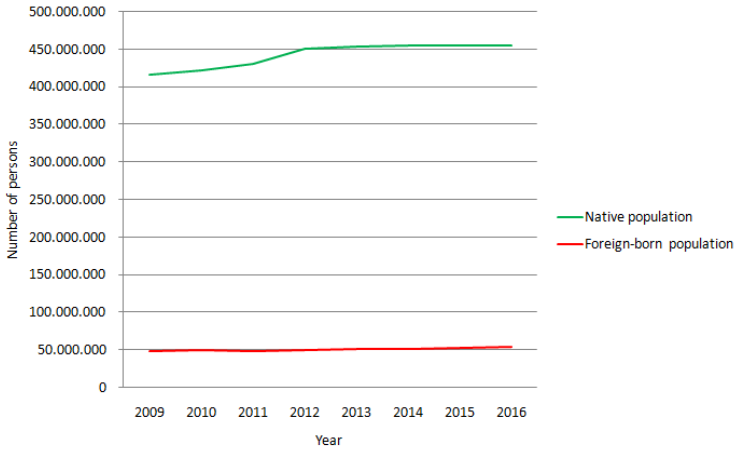


(Source: Eurostat (http://appsso.eurostat.ec.europa.eu/nui/show.do) (64)

[5]The 28 member countries of European Union: Belgium, France, Germany, Italy, Luxembourg, Netherlands, Denmark, Ireland, United Kingdom, Greece, Portugal, Spain, Austria, Finland, Sweden, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia, Bulgaria, Romania, Croatia

In 2007 and 2008 due to the hit of the international economic crisis world wide the number of migrants, especially those from non-European countries (non-EU[6]), modestly declined (6). But since 2009, and particularly since 2014, foreign arrivals progressively increased again (Figure 1), reaching 4.7 million of foreign arrivals in 2015 (Figure 1). Among them, it is estimated that 2.7 million people (57.5%) were from non-EU and 1.9 million (40.4%) were from another EU Member State (61). Especially from 2009 to 2016, number and proportion of foreign-born population continuously increased (64) (Figure 2 and 3).

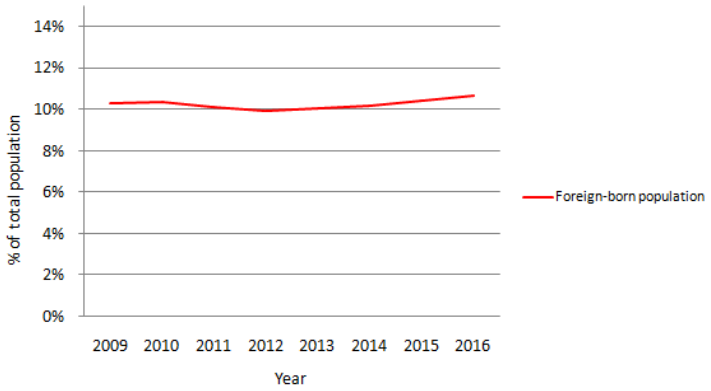
Figure 2. Population in European Union by country of birth, from 2009 to 2016:



Source: EUROSTAT. Migration and migrant population statistics. Statistics explained. Available from: http://ec.europa.eu/eurostat/statistics-explained/index.php/Migration_and_migrant_population_statistics

[6]Andorra, Armenia, Azebaijan, Belarus, Georgia, Iceland, Liechtenstein, Moldova, Monaco, Norway, Russia, San Marino, Switzerland, Ukrain, Vatican City, Albania, Montenegro, Serbia, The former Yugoslav Republic of Macedonia, Turkey, Bosnia and Herzegovina, Kosovo

Figure 3. Proportion of foreign-born population in European Union, from 2009 to 2016:



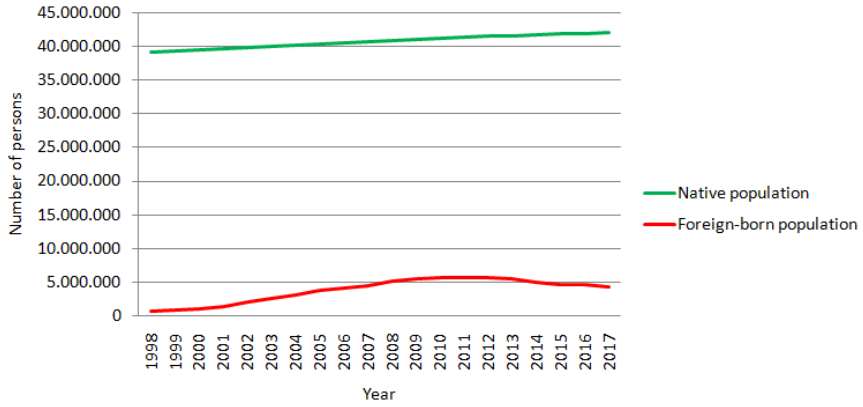
Source: EUROSTAT. Migration and migrant population statistics. Statistics explained. Available from: http://ec.europa.eu/eurostat/statistics-explained/index.php/Migration_and_migrant_population_statistics

Recent migration flows in Spain and in Catalonia: A demographic change

Historically, Spain had been an emigration country (65). From 1998 to 2008, the growing economy and the high demand of the labour market were the main attraction factors of a massive and extremely rapid migratory phenomenon (10,66,67). Frequently, available jobs were those of less quality, often irregular ones, characterized by unfavourable labour conditions and low salaries, making them unattractive to the local population (58). Then the demand for foreign unskilled workers, especially in the sectors of construction, services and domestic employment and agriculture, increased (33). Foreign-born population residing in Spain increased from 637.085 inhabitants (1.6% of the general population) in 1998 to 5.268.762 milion (11.4%) in 2017 (68) (Figure 4 and Figure 5). This phenomenon was of such importance, that during this period foreign migration, mostly young people with high diversity of geographical areas and cultures (69–71), became the main contribution to the overall growth of the Spanish population replacing births (67). Furthermore, the Spanish migration route was one of the main paths of migrants into Europe (67,71). In 2015 Spain was the fourth EU country that reported the largest total number of new arrivals (342.100 persons), after Germany (1.543.800 persons), the United Kingdom (631.500 persons) and France (363.900 persons) (61); as well as the fourth European country with the largest

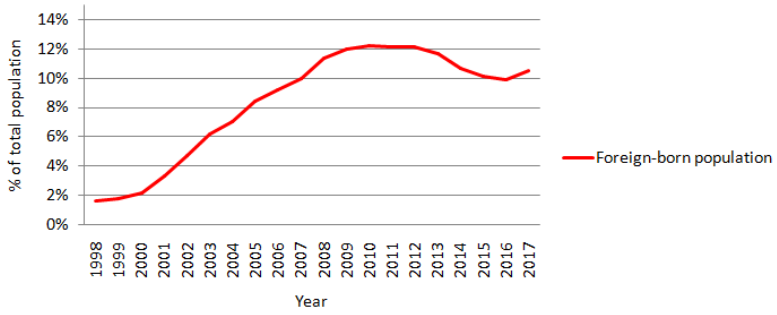
numbers of foreign population (4.729.644 million), after Germany (8.7 million), the United Kingdom (5.6 million) and Italy (5.0 million) (as of 1st January 2016) (61).

Figure 4. Population in Spain by country of birth, from 1998 to 2017 (2017 provisional data)[7]:



Source: Instituto Nacional de Estadística (INE). Estadística del Padrón continuo. Principales series de población desde 1998. Available from: www.ine.es/jaxi/Datos.htm?path=/t20/e245/p08/l0/&file=02002.px

Figure 5. Proportion of foreign-born population in Spain, from 1998 to 2017 (2017 provisional data):

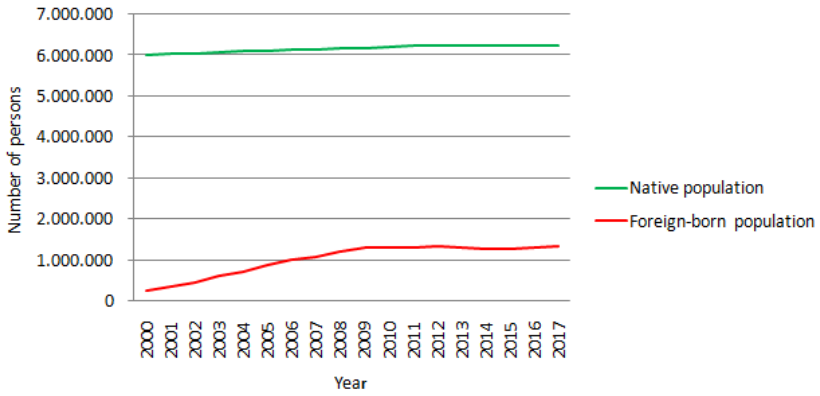


[7]The Spanish National Institute of Statistics does not account as migrants those who acquired Spanish nationality (there were more than 100.000 annual nationalizations in 2010 and 2012; and until 250.000 in 2013 (67)) leading to a loose of migrant population in the statistics (74). It is considered that possibly, most of those who acquired Spanish nationalization are still residing in Spain (67).

In 2008, the outbreak of the economic crisis had a particular impact on construction and services, sectors that were employing the majority of migrant workers, and sharply increased the rate of unemployment among migrant population (29.7% in migrants vs. 16.8% in natives in 2009) (66,72). Emigration of young foreign-born and native workers increased, mostly of them foreign-born, looking for a labour opportunity (66,73,74). Migration balance (number of immigrations minus number of emigrations, including foreign-born migrants and natives) was negative from 2009 to 2015 (Figure 6). Nonetheless, from 2013 to 2016 number of immigrations slightly increased (from 280.772 persons in 2013 to 417.033 persons in 2016), and number of emigrations slightly decreased (from 532.303 persons in 2013 to 327.906 persons in 2016). As a result, in 2016 migration balance was positive again (75).

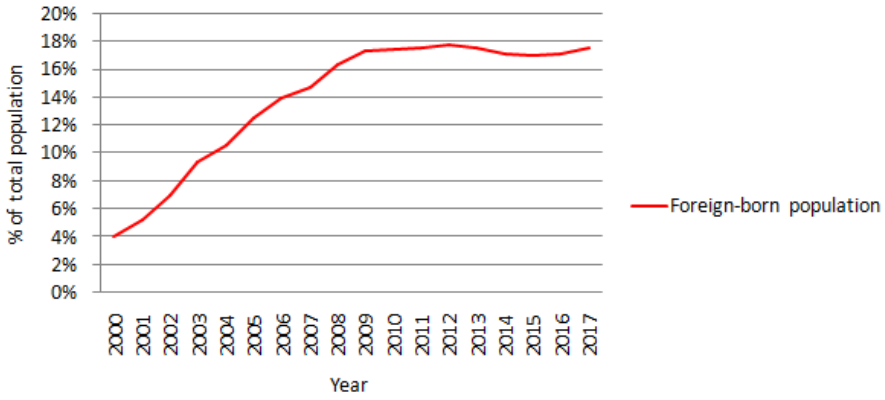
Catalonia, with 7.5 million inhabitants, experienced similar migrant flows than Spain in the last years. Until the 1980s the number of foreign-born population was small. During the 1990s, foreign-born progressively increased, especially those from North African countries such as Morocco and Senegal. From 2000 to 2008 foreign-born population increased from 253.050 inhabitants (4.0% of general population) to 1.204.711 inhabitants (16.3 %) (76) (Figure 7 and Figure 8). From 2009 to 2016, an increase of emigration of foreign-born and also of native population due to the economic crisis (77), together with the acquisition of Spanish nationality by international migrants contributed to maintain stable the number of foreign-born population (from 1.297.990 persons; 17.3% of the general population to 1.292.896 persons; 17.1% of the general population) (76) (Figure 7 and Figure 8). From 2012 to 2014, the migration balance was negative for the first time in the XXIst century (78) (Figure 9). Nonetheless, from 2015 to 2017 foreign-born population slightly increased again, from 1.279.621 persons (17.0% of the general population) in 2015 to 1.328.672 persons in 2017 (17.5% of the general population) (76) (Figure 7 and Figure 8). In 2015 and 2016 migration balance was positive again (78).

Figure 6. Population of Catalonia by country of birth, from 2000 to 2017 (2017 provisional data):



Source: Institut d'Estadística de Catalunya (IDESCAT). Padró municipal d'habitants. Available from: https://www.idescat.cat/pub/?id=pmh&n=674

Figure 7. Proportion of foreign-born population in Catalonia, from 2000 to 2017:



Source: Institut d'Estadística de Catalunya (IDESCAT). Padró municipal d'habitants. Available from: https://www.idescat.cat/pub/?id=pmh&n=674

MIGRANT POPULATION AND HEALTH

The universal right to health and access to health services

The right of all individuals to health and access to health services is stated by the 1946 Constitution of the World Health Organization (WHO) (81) and by the Article 12 of the International Covenant on Economic, Social and Cultural Rights (82). This article states that "the enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being" irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status or ability to pay. In 2008, the World Health Assembly Resolution 61.17 (83) focused specifically on ensuring equitable access to health promotion, disease prevention and care for migrants (6). Member States in the European Region committed themselves to meet its obligation to respect, protect and fulfil the right to health of all persons within its jurisdiction; as well as to recognize universality, solidarity and equal access as the guiding values for organizing and financing their health systems (6,84).

Migrant health as a complex and dynamic phenomenon

Migrant health is related to a complex and dynamic interaction of multiple factors. Although immigrants usually have good health and socioeconomic status within their original countries, they come from geographical regions or transit countries where transmissible infections and tropical diseases are more prevalent than in the host country. Different factors are related with health status of foreign born population, such as factors related to: a) the socio-demographic and economic characteristics of migrants: gender, age country of birth, administrative status, living conditions, education, employment, length of stay, etc.), patterns of disease in migrants' countries of origin, behavioural factors (disease specific risk and protecting factors, mobility related factors); b) the migratory process: experiences during migration, the trauma that can be associated with the causes of migration and the migratory process, disruption of health services in the country of origin; and c) the resettlement environment are important factors in the final health status of immigrants (4,6,62,84–86). Factors such as country of origin, the specific health outcome considered, length of residence and socioeconomic conditions of stay can have a major impact on migrant's health, and so studies can report differing observations (87).

Foreign born may bring health risks to the host country, as lack of immunization, and they may be exposed to new risk factors in transit or at their destination (87). In the host country, foreign-born people who recently arrived frequently present a lack of relevant health issues ("healthy immigrant effect") (69,88,89), but, compared to natives, their state of health worsens (14,16,31,33,35,36,88–93) and their use of health services increases (31,32,94) with time of residence. Thus, the combination of the loose of protective factors of the country of origin such as support from extended family, the exposition to new health risks, and inequities in social determinants of health in the host country (4,95) might increase the vulnerability of migrant population to health problems and might limit their access or use of health services (2,4,84). In the host country, social determinants of health (96) such as stigma and isolation, poverty, poor living conditions and unemployment, language barriers, religion, gender roles, health beliefs, practices and perceptions about health services, and lack of entitlement to healthcare services particularly among those who have irregular administrative status (2,4,84) play an important role on migrant's health. In Spain, data from the Spanish Health National Surveys 2006 and 2012 reported lower proportion of university studies, higher unemployment, lower social support and higher risk of worse living conditions and of belonging to the lower social class; among migrant population compared to natives (97). Foreign born population may be more vulnerable to health problems due to inequities on social health determinants compared to native population. Thus, foreign-born is a very heterogeneous population, where the effects of the migratory process, social determinants of health and the risks and exposures in the origin, transit and destination environments interact with biological and social factors to create different health outcomes (87). Differences on health outcomes have been reported (69) according to the characteristics and the country of origin of the foreign born population, between countries and depending on health conditions being studied (86).

As an overview of health status of foreign born population at European level, mortality estimates tend to be lower in migrants than in the European host population for all-cause mortality, neoplasms, mental and behavioural conditions, injuries, endocrine conditions and digestive conditions. Mortality ratios are estimated to be higher for infections, external causes, diseases of the blood and blood-forming organs and cardiovascular diseases. Regarding infectious diseases, migrants can be more vulnerable to infectious diseases in places or origin, transit and destination because of exposure to infections, lack of access to health care, interrupted care and poor living

conditions. Foreign born from areas of higher endemicity may carry a burden of tropical and parasitic infections that are not normally seen in Europe. Foreign born from countries with high prevalence of TB are at greater risk of infection, depending on the living conditions in their country of origin, during the migratory process and the living and working conditions in the host country. Worryingly, latent TB can be undetected, facilitating that the activation of latent infection following arrival in the host country is one of the main drivers of TB among foreign born. Foreign born may have lower uptake of recently introduced vaccinations, such as for human papillomavirus or influenza. Regarding HIV infection, the proportion of foreign born patients with HIV infections varies widely across the EU, ranging from less than 1.0% in Stonia to over 70% Sweden in 2011 (2). Among the foreign born cases, 54.3% were from sub-Saharan Africa, 12.2% from Latin America, 9.5% from western Europe, 6.0% from central Europe, 5.0% from south and southeast Asia, 4.1% from eastern Europe, 4.0% from the Caribbean and 5.0% from countries in other regions (2). Regarding the gender of the foreign born HIV patients, 73% were among men, but proportion of women was higher (with a male-to-female ratio of 2.7, particularly within sub-Saharan Africa cases, with a male-to-female ratio was 0.7) than within native cases (male-to-female ratio of 5.3) (2). Mostly western countries, with low endemic levels, show a higher proportion of cases within the foreign born population. Globally, from 2007 to 2011 foreign born represented 40% of reported cases of HIV in the EU/EEA. Although much of the focus has rightly concentrated on migrants from high-prevalence countries, there is increasing evidence that migrants are at risk of HIV acquisition after arrival in the EU/EEA, including migrants from countries with generalised HIV epidemics who may acquire HIV infection via heterosexual transmission as well as migrant MSM from other regions, including Latin America (2). Clinically, foreign born patients present a higher proportion of late HIV diagnosis and poorer clinical outcomes (2). Regarding TB infection, foreign born in EU/EEA presented higher proportion of TB cases (in 2010 the 25% of TB cases occurred within foreign born) occurring at younger age that native cases, but it is considered that there is not an increase of the risk of TB for host populations (2). Related to multidrug-resistant TB, some results suggested it is less common within foreign born (2) but another in study this population presented a disproportionate burden of multi-drug resistance TB compared with host populations, with many patients from Eastern Europe and central Asia, countries with a high burden of this pathology (87).

High rates of chronic hepatitis B among migrants in Europe reflect the significant proportion of new foreign born from countries of high hepatitis B endemicity. Those foreign born from countries with high endemic disease present higher proportions of HBV and HCV infections, most of them being infected at birth or during early childhood (2,98). Data on HCV was insufficient to quantify the extent of the problem (2), in a study older migrants presented an increased risk, with a seroprevalence of anti-HCV antibodies of 2.2–5.6% (99). Although available data on NG infection was limited, notificated NG infection cases within foreign born presented a higher proportion of heterosexual transmissions compared to MSM transmission than natives, as well as a higher proportion of sex workers among gonorrhoea cases (2). Although available data on syphilis was scarce, notification rates were significantly higher in males than in females in both groups, with stronger gender differences among non-migrants. Heterosexual transmission was slightly more frequent than MSM transmission within foreign born, whereas MSM transmissions was higher than the heterosexual within natives (2). Finally, lower rates of childhood vaccinations have been reported within foreign-born population in the EU/EEA (100). Related to non-communicable diseases, in general, migrants present lower prevalence rates than native population for many non-communicable diseases on arrival, but time of residence may be positively associated with an increase in risk for obesity, cardiovascular diseases, stroke or cancer, with important differences depending on the country of origin of foreign born and across European countries. In conditions such as stroke and myocardial infarction lower socio-economic status was found to be one of the most significant risk factors regardless of geographical origin (101,102). Different studies found a higher risk of ischemic heart disease and stroke in foreign born from south Asia, eastern Europe and the Middle East than native population in Western Europe (103). In Italy, the general foreign born population presented a higher risk of stroke (104), male foreign born from south Asia showed a higher mortality rate for ischemic heart disease (105), and those from Africa reported a higher rates of cerebro-vascular disease, hypertension and heart failure (106) than natives. In The Netherlands, Moroccan foreign born presented a lower risk of stroke than natives (101). Foreign born population presents a lower risk for all neoplasms except cervical cancer, but present higher frequency of late diagnosis than natives. In general, foreign born present a higher incidence and prevalence rates for diabetes than native population. Most of cases initiated diabetes at younger age, presenting more chronic complications, particularly microvascular complications such as nephropathy, diabetic retinopathy and peripheral neuropathy, and with higher mortality rates from diabetes; with

differences across EU countries and depending on the country of origin of foreign born patients -those from north Africa, sub-Saharan Africa, Asia and the Middle East presented higher rates (107)-. A wide range of proportions of mental disorders have been reported within foreign born population, and migration is a risk factor for mental disorders in children. Within labour migrants, the largest group of migrants globally, male migrants experience significantly more work-related injuries than non-migrant workers, whereas rates for female migrants appear to be similar to those of the host population. Migrant children may be more prone to health issues related to diet, both malnutrition and overweight/obesity (87). Furthermore, more barriers of accessing and using of health services have been reported within foreign-born population (32,108).

In Spain, foreign born presented poorer self-rated health than natives, especially among women; a new onset of mental disorders within men and an equalization of the previously lower use of psychotropic drugs within foreign born men. The loose of the "healthy immigrant effect" and the impact of the economic crisis on migrants' health were suggested as the potential explanation of differences in health outcomes (33). Results from one study with 3.132 foreign born from low and middle-income countries who were attended in public primary health care (86), showed a higher rate of chronic HBV infection in men than women. Within foreign born, those who were from Europe (15%) and Africa (5%) had the highest proportion of cases. Foreign born from Morocco were more likely to present global HBV infection. Regarding HCV, foreign born from Eastern Mediterranean region showed the highest proportion of cases (8.2%). Female gender showed lower odds for HIV infection. Proportion of latent TB was high (28.1%), with no differences for gender, age, geographical origin o length of residence. Foreign born patients with more than 5 years of residence in Spain presented the highest values of active and latent TB. Regarding the beginning of the economic crisis and its impact on health status of foreign born, in 2008 in Spain, different austerity policies were adopted (109). Measures such as the labour reform –with an increase of labour precariousness and unemployment rate- and the reduction of public spending in social policies, increased social inequities (67), with higher rates of unemployment -with important differences by nationality (67)-, and worse living and working conditions within foreign-born population compared to natives (33,89). It is possible that it may have had consequences on migrants' health, especially worsening mental health outcomes (33,89). The Real Decreto Ley 16/2012 (RDL16/2012), named "the urgent mesures for guaranteeing the sustainability

of Health National System and improve quality and security of its services", excluded foreign born with irregular administrative status from health care, with the exception of emergencies and care attention to pregnant women and those younger of 18 years (110). It is known that implementing access barriers to health services may increase vulnerability to health inequities in host countries (62,111–113), in this case at least within irregular migrants, and may increase health needs in the medium and long term (86). Although it was seen a constant use of health services from 2006 to 2012 within foreign born and native population (114), several consequences were described, such as accessing barriers to healthcare continuum due to an increase in bureaucracy that difficulted the obtantion of the individual health card, as well as using barriers due to the increase in waiting times. In addition, the deterioration of living and working conditions within foreign born limited the use of services during working hours, increased difficulties to afford public transport to go to the health services and to afford co-payments of medicines, and led to delays in seeking care and treatment interruptions (115,116).

SUBPROGRAMME ON MIGRATION AND HEALTH (SMH)

It has been claimed that EU countries and health systems must support migrants' right to health (109). In this line, health research within foreign-born population has high priority for WHO (4), arising as an emergent and of high interest issue by Public Health and epidemiological research in Europe and in Spain (2,5–11). In Spain, the implementation of the SMH in 2011 within the Consortium of Biomedical Research of Epidemiology and Public Health (CIBERESP) reflects the relevance of the health status of foreign-born population for Public Health and epidemiological research. The mission of the SMH is to monitor and improve knowledge about the health status of the immigrant population in Spain related to communicable and noncommunicable diseases, as well as the biological, behavioral and structural determinants of health. SMH gathers multidisciplinary research groups from across the territory that have expertise in research areas such as health determinants, transmitted diseases, non-transmitted diseases and methodological aspects. The SMH promotes collaboration and synergy among inter-disciplinary research groups.

At the beginning of its research activities, several research groups of the SMH joined efforts and conducted a comparative analysis between National Health Survey 2012 and 2006, aimed to improve the knowledge on the health status of foreign-born population in Spain (117). Main results of the study showed that foreign-born participants originated from countries with advanced economy were generally not disadvantaged in terms of living conditions and health, suggesting that level of economic development of the country of birth is a major determinant of health. Social class explained or modified some of the associations between country of birth and health indicators, and also marked differences within the foreign-born population. The living and working conditions were key determinants of health for which the foreign-born population was disadvantaged and showed a negative trend. Regarding the state of health, sub-groups of foreign-born population, especially those originated from lower income countries, presented worse health indicators in some areas of health. Mental health worsened within men from both populations, but more importantly within foreign-born men, while it improved within women; foreign-born women from low income countries –particularly those from Latin America and Africa- presented higher rates of obesity and overweight and hypertension than native women; foreign-born men from Eastern Europe showed higher proportion of daily consumption of alcohol than natives; men and women from foreign-born from low-income countries showed lower rate of phsysical activity, lower proportion of consumption of fruit and fish, and higher rate of consumption of sweetened soft drinks. Analysis of the data by time of residency showed very interesting results. Those foreign-born participants from low-income countries with longer time of residency presented worsened mental health, and increases of rates of hypertension, hypercholesterolemia, smoking -among men-, and intensive alcohol drinking -within women-. They also drew a trend towards less use of health services, but with differences by level of care, origin and gender. Generally, findings also showed larger inequalities among foreign-born women. Another research carried out by SMH (109) reported that foreign-born population were more vulnerable to some infectious diseases, such as TBand Chagas disease -Spain is among the countries with the highest prevalence of Chagas disease in Europe (118)-; lower use of mental health services, and identified foreign-born women a especially vulnerable sub-group with greater risk of negative outcomes (119) such as pre-term birth and low birth weight and a relevant vulnerability to HIV/STI transmission. Foreign-born and native population had similar health status regarding the most prevalent chronic conditions.

In Spain immigration is a recent phenomenon. An exponential increase of foreign born population arrived within short time: from the late 1990s, during the first decade of 21st century, and has continued with lower numbers. Most of foreign born (85%-90%) were from low and middle-income countries (86) and presented a high degree of socio-demographic and cultural diversity (10), drawning a new socio-demographic reality with new health needs (10,69). This scenario offers an unique opportunity for research for better understanding the health status of the foreign-born population, the complex interaction of a wide variety of determinants of health on foreign-born's health status and the evolution of health status with time of residence (13). Within this framework, the SMH coordinates research and knowledge translation activities through multidisciplinary collaboration, with the aim to support evidence-based policy and practice with respect to foreign-born health.

HIV AND OTHER SEXUALLY TRANSMITTED INFECTIONS WITHIN MIGRANT POPULATION

STIs cause a major burden of disease worldwide with important consequences for health as cronic pain and infertility (2,120). In Europe, HIV infection remains a major Public Health challenge (121). Recently, it has been described that migrants suffer disproportionally from STIs in every European Member State, particularly female migrants who may be especially vulnerable to acquiring these infections (2,4). In 2014, an analysis of the burden of infectious diseases among migrant populations in the EU/EEA (2) reported evidence showing that migrants carry a disproportionate burden of HIV and chronic hepatitis B. European data reported high proportions of foreign-born patients among the new HIV diagnoses and increasing evidence of on-going HIV infection within this population in the host country (92). However, drawing overall conclusions about infectious disease burden among migrants was challenging due to limitations in the data and differences in reporting between countries. However, it is considered that there is still uncertainty on the contribution of migration to the burden of infectious disease in the EU/EEA (62). In order to stop the spread of STIs, it has been claimed the need to improve the knowledge about STIs epidemiology, in order to inform policy and prevention methods, which is crucial (120). According with this need, in this thesis we focused on the study of STIs in migrant population, particularly HIV

infection (2,121) and antimicrobial resistances to NG infection (17,19,20), which remain major Public Health challenges in Europe and worldwide.

HIV/AIDS infection in migrant population

The HIV is a retrovirus that can be transmitted via the exchange blood, breast milk, semen and vaginal secretions from infected individuals. HIV targets the CD4 cells of the immune system. Immunodeficiency results in increased susceptibility to a wide range of infections, cancers and other diseases that people with healthy immune systems can fight off. Without treatment, patients with HIV infection can develop severe illnesses such as tuberculosis, cryptococcal meningitis, severe bacterial infections and cancers such as lymphomas and Kaposi's sarcoma, among others. Serological tests, such as RDTs or enzyme immunoassays (EIAs), detect the presence or absence of antibodies to HIV-1/2 and/or HIV p24 antigen. A combination, in a specific validated order that is based on HIV prevalence of the population being tested, of HIV tests can provide an HIV positive diagnosis. HIV testing should be voluntary. A combination of 3 or more anti retroviral drugs (ARV) may suppress viral replication. Since 2016 WHO recommends to provide lifelong antiretroviral treatment (ART) to all people living with HIV, including children, adolescents and adults, pregnant and breastfeeding women, regardless of clinical status or CD4 cell count (Consolidated guidelines on the use of antiretroviral drugs for treating and preventing HIV infection). By mid-2019, 182 countries already have adopted this recommendation. In 2018, 23.3 million people living with HIV, a global ART coverage of 62% of people living with HIV, were receiving ART globally. However, more efforts are needed to scale up treatment, particularly for children and adolescents (only 54% of them were receiving ARVs at the end of 2018) (122).

HIV transmission remains a major public health concern and affects more than 2 million people in the WHO European Region, particularly in the eastern part of the Region. Nearly 160.000 people were diagnosed with HIV in the European Region in 2017, including 25.000 in the EU/EEA. The increasing trend in new HIV diagnoses continued for the Region overall, despite decreasing rates of new HIV diagnoses in the EU/EEA (123). The HIV epidemic differs importantly across European countries (123), communities and individuals (121,124), and interventions to control the epidemic

should be based on evidence and adapted to national and local epidemiology (123). The HIV epidemic remains concentrated in key populations at higher risk (groups of people who are most likely to be exposed to, or to transmit HIV and whose engagement is critical to a successful response), with variations across geographical areas (125). Migrant population is considered a key population at higher risk of HIV infection (125). Population mobility has been identified as a key driver of the HIV epidemic (126), both linking geographically separate epidemics (127) and intensifying transmission through inducing riskier behaviours that increase the vulnerability to HIV infection (126,128,129). Moreover, this can be intensified by other determinants, such as; family fragmentation; adaptation to the host culture; language barriers; poor living conditions; job insecurity; unequal access to preventive, diagnostic and treatment health services in host communities (130–132), and it may be exacerbated by health inequalities between migrant and native populations. In WHO European Region, from 2007 to 2011, 58% of HIV diagnoses with heterosexual transmission were among migrants. In the host country, those foreign-born socially marginalized, with illegal administrative status or with stigmatized behaviour present higher risk of HIV infection than native population (2). In the EU/EEA there is an increasing evidence indicating that a high proportion of new HIV diagnoses within foreign-born population acquired the infection after their arrival in the host country (133,134). In addition, it has been described that sub-groups of migrant population are at higher risk of acquiring HIV infection in the host country than in the country of origin (1,2,111,135,136). For example, there is evidence that MSM, especially those from Latin America, are frequently vulnerable to HIV (130,137), particularly during the post migration process (92,137).

In Spain, in the last years the epidemiology of HIV infection has changed importantly in terms of mode of transmission and socio-demographic characteristics. Initially, HIV infection was concentrated within injecting drug users. Since 1995 onwards, the rate of HIV infection in this population decreased and sexual transmission progressively increased. Nowadays, heterosexual transmission is the most important transmission route, with a progressive increase of MSM transmission (138). In 2016, the overall rate of new diagnoses of HIV was 8.60 per 100.000 inhabitants, higher than the average of the EU and Western Europe countries. The majority of migrants with HIV infection were originating from Latin America (1,139). However, those originated from Sub-Saharan Africa presented higher incidence rate than native population (1). Within cases

with heterosexual transmission, foreign-born patients accounted for 48.2%, most of them originated from sub-Saharan Africa and Latin America. Within those with MSM transmission, 19.0% of the cases were from Latin America and 4.9% from other Western European countries (140).

In Catalonia in 2014, the prevalence of HIV infection was 0.46%, similar to that in France (0.40%) and higher than other northern European countries as Germany (0.10%) or United Kingdom (0.30%) (138). Among new HIV diagnoses, 41% were in foreign-born. Among them, 53% were originating from Latin America and Caribbean, and showed especially high proportion of MSM and injecting drug users who shared serynges (67.6%) (138). Reflecting the relevance of this situation, migrant population have been acknowledged as one of the priority groups for HIV prevention and care (137,141) and the current European Action Plan (2016) calls for fast actions for successfully preventing transmission among migrant populations (125).

Neisseria gonorrhoeae infection in migrant population

Globally, NG infection represents 106 million of the estimated 498 million new cases of curable STIs that occur every year (21). NG is a gram-negative bacterium that microscopically appears as diplococci. Human being is the only natural host of the gonococcus, which is transmitted by anal, vaginal or oral sex, and can cause infections in the genitals, rectum and throat. Also, mother to child transmission during delivery can occur. Clinically, NG infection may range from asymptomatic to severe sequelae such as infertility, ectopic pregnancy, and chronic pelvic pain (16,19,120,142). It is also worrying that NG infection increases the risk of acquiring and transmitting HIV (22,142). In Europe, reported NG infection increased during the last years (143) (in 2013, 52.995 cases of NG infection were reported -16.9 cases notified per 100.000 population-, an increase -of up to 79% since 2008- in most EU/EEA member States), and currently it is the second most frequently reported STI, after *Chlamydia trachomatis* infection (144,145). Cases of NG infection were reported three times more often in men than in women, 39% of them were in young people between 15 and 24 years, most of them were heterosexual, and 43% were reported in MSM (144). Successful treatment reduces transmission and the risk of complications of NG infection (22), but is currently threatened by the capacity of NG for developing antimicrobial resistance.

Historically, NG has shown an extraordinary ability to develop antimicrobial resistance (AMR) to all antimicrobials introduced for treatment of gonorrhoea. In the European Region, high prevalence of resistance to penicillin G, tetracyclines and ciprofloxacin have been observed since many years. Since 1940s onwards penicillins were the main treatment used, but in mid-1980s penicillins, tetracyclines and macrolides were no longer effective. Fluoroquinolones were the first choice, but they were available only until mid-to-late 1990s. In the last decade, *in vitro* and clinical resistance, resulting in treatment failures, to the ESCs cefixime and ceftriaxone, as well as azithromycin have also emerged (16,18,22,146–151). With the main goal of slowing the development and onward dissemination of AMR and preventing treatment failures, dual therapy is currently recommended. In Europe and in many other international regions the combination of ceftriaxone (500 mg single dose intramuscularly) plus azithromycin (2 g single oral dose) is recommended for empirical first-line of uncomplicated NG infection in Europe and in many other regions internationally (16,18,152). Worringly, in the last decade, *in vitro* and clinical resistance, resulting in treatment failures, to the ESCs cefixime and ceftriaxone, as well as relatively high rates of azithromycin resistance have been reported in Europe and globally (16–18,22,149–153), threatening the effectiveness of these dual antimicrobial treatment regimens, which are currently among the last evidence-based options for treatment. The first global failure to treat gonorrhoea with dual antimicrobial therapy was reported in 2016 (154), and most recently, the first gonococcal strain with ceftriaxone resistance combined with high-level resistance to azithromycin was reported from England (155) followed by two similar cases in Australia (156). In Spain, a study conducted on 110 samples reported an association between resistant NG infections and heterosexual men, older age, concurrent STI, and unsafe sexual behaviors (157). In 2012, the first two cases of ESCs-resistant and multidrug-resistant NG (showing resistance to penicillin, ceftriaxone, cefixime, cefotaxime, ciprofloxacin and tetracycline) from two MSM patients who had been sexually related were reported (158). The genotype of this strain was identical to another ESCs-resistant and multidrug-resistant NG that had been also isolated in 2012 in a MSM patient in France (159), suggesting possible European spread of this ESCs-resistant and multidrug-resistant NG strain (158). In 2013 in Catalonia, resistant and decreasing sensibility to ceftriaxone and cefixime strains were isolated; together with an increase of the minimum inhibitory concentrations (MIC), the lowest concentration of antibiotic that inhibits visible growth of the bacteria (160) compared with those reported in previous years (161). The high incidence of infections accompanied by a dwindling of treatment options draws a global scenario

where NG has the potential to become untreatable, particularly in settings with a high burden of NG infections, leading to significant increases in morbidity and mortality. Due to the development of difficult to treat or possibly untreatable gonorrhoea, AMR NG is considered a major Public Health challenge today (21) and a priority global health issue by WHO (152).

The current emergency of untratable NG infection requests high quality surveillance of AMR for optimisation of treatment and monitoring NG resistance (19,21,22,142,162), leding to revisions to national guidelines for NG treatment (19) and guiding public health intervention strategies (112). Since 2014, the European Gonococcal Antimicrobial Surveillance Programme (Euro-GASP) monitors antimicrobial NG susceptibility in the EU/EEA (162), with 23 participating countries (Austria, Belgium, Cyprus, Germany, Denmark, Estonia, Greece, France, Hungary, Ireland, Iceland, Italy, Latvia, Malta, Netherlands, Norway, Poland, Portugal, Romania, Sweden, Slovenia, Slovakia and United Kingdom). Since 2010, Euro-GASP collects data on country of birth and other epidemiological data linked to isolates, allowing for identifying isolates from foreign-born and native patients.

LONGITUDINAL HEALTH STUDIES

In Spain, there is not a well established tradition of follow-up studies of representative population-based cohorts (163). A follow-up of a sample of the elderly people in Barcelona provided useful information about mortality determinants (164). In Spain, there are cohorts of volunteers or workers conducted as part of integrated European projects, such as the cardiovascular risk factors MONICA project (165) and the EPIC study (166,167) on diet and cancer.In the last years, population-based cohorts have been implemented in Catalonia, as in 2013 the cohort on Maturity and Satisfactory Ageing with the objective of characterizing the aging process according to the demographic characteristics of the municipalities of the province (168); and since 1978, Regicor, aimed to investigate the distribution of risk factors and ischemic heart disease, as well as the best forms of prevention (169). In the field of migrant's health, the longitudinal study named Immigration, Work and Health Project (in Spanish: Inmigración, Trabajo y Salud –ITSAL-), was

carried out in Spain in 2011. It included 1.841 foreign-born workers from Equator, Morocco and Romania and 509 Spanish workers with the aim to study self-reported working exposure (170,171). From our knowledge, there are no further experiences of longitudinal health studies on foreign-born populations in our country.

In longitudinal studies, non-response reduces the effective sample size and can introduce bias (172) and it is the major concern for survey research, and in particular for cohort studies (173). In longitudinal studies three types of attrition: failure to locate, refusal to participate and mortality have been described (174). Although loses in the follow-up do not necessarily invalidate the research, frequently strategies to minimize them are used (175). It has been recommended to pay special attention to those being late responders, unemployed, retired, or students at baseline (175).

PELFI. LONGITUDINAL HEALTH STUDIES ON FOREIGN-BORN POPULATION CONDUCTED BY THE SUBPROGRAMME ON MIGRATION AND HEALTH

Time of residence is recognized an essential factor that influence the health status of migrant population (8,31–36), and in accordance with the recommendations made by WHO, monitoring migration health over time is essential for a better understanding of the relationship between migration and health (26). Prospective longitudinal design allows to identify associations between demographic factors, such as time of residence in the host country, and exposure to stressors (27) that could significantly increase the current understanding of the risk profile for the major determinants of disease that affects this population (28). Their conclusions provide firm basis for the development of effective preventive and treatment strategies (29,30). However, data related to the evolution of health behaviors and health outcomes among foreign-born population according to time of residence is still largely unknown (36). Cohort studies conducted on foreign-born populations are scarce (15), and longitudinal evidence available on foreign-born health comes largely from cohorts chosen from the general population or from cohorts that study specific diseases (176–178). In the last years there is an increasing interest for conducting prospective

longitudinal studies on migrants' health. In Europe, currently there are two longitudinal studies on going: the HELIUS cohort, established in Amsterdam, that includes several generations of families from Surinam, Turkey, Morocco, Ghana and Holland; and the German National Cohort with mothers from Turkey and their newborns (37,38).

In Spain, in 2013, different research groups that belonged to SMH implemented a coordinated research project named MEISI: Changes in health and attention to migrants and vulnerable populations, in a context of crisis. Analysis of multiple sources of evidence. The demographic and social reality, the deterioration of the economic context, together with the political austerity measures that were implemented as a consequence of the economic crisis, motivated the conducting of the MEISI project. MEISI was formed by 3 coordinated studies: a) MEISI I: Access and quality of health care for vulnerable populations in Spain in the context of the economic crisis, with the main aim of analyzing the influence of the economic crisis on the access and quality of health care for vulnerable populations in Spain; b) MEISI II: PELFI cohort Badalona/SC: Evolution of biological and structural determinants in a cohort of migrant families; and c) MEISI III: Impact of the economic crisis on the main infectious diseases of mandatory declaration: population-based study, that had the objective of determining the differential epidemiological characteristics of sexually transmitted infections (gonorrhea and syphilis), HIV, TB, hepatitis (A, B and C), and vaccine diseases (measles, rubella, mumps and whooping cough) in natives and migrants before and after the beginning of the economic crisis (2000-2016). The main objective of MEISI was to know the impact of the economic crisis on the accessibility of migrant population to health services (MEISI I), on health status and health determinants of migrant population (MEISI II) and on communicable diseases such as Tuberculosis, Hepatitis A, B, C or Whooping Cough (MEISI III). The project was conducted with funding from ISCIII (P13/01962).

In 2014, several researching groups from the SMH joined efforts and constituted the research project named "Platform of longitudinal studies on migrant families, PELFI" ("Plataforma de Estudios Longitudinales de Familias Inmigrantes, PELFI"). PELFI is a multi-center study of cohorts on foreign-born families with the objective of improving knowledge about their health status and health determinants, and describe how these evolve according with time of residence in the host country. Currently PELFI includes three cohorts that are on going in three diferent cities: a) PELFI cohort Badalona/SC: Evolution of biological and structural determinants in a cohort of migrant

families, that has the main objective of describing the evolution and correlation of the determinants of health in a cohort of migrant families and their context; b) PELFI cohort Alacant: Work, immigration and health in a cohort of migrant population in Spain, with the main objective of analyzing employment and work conditions and the state of physical and mental health in a cohort of migrant population, and the influence that the change of health determinants have in their health problems during follow-up; and c) PELFI cohort Barcelona: Relationship of the psychosocial environment of adolescents with their mental health (REPASAME), with the main objective of analyzing the conditions of the psychosocial environment and mental health of foreign-born adolescents (12-17 years) at the implementation of a cohort, and the influence that change of health determinants have in their health problems during follow-up.

Each PELFI cohort has specific objectives and uses recruitment strategies appropriate to their environment and geographical areas of origin included. PELFI cohorts share inclusion criteria and modules of the health questionnaire, what it will allow building the multicentric cohort. The project was conducted with funding from ISCIII: P13/01962 for PELFI cohort Badalona/SC; P14/01146 for PELFI cohort Alacant; and P14/02005 for PELFI cohort Barcelona. Specifically, our work was focused on the PELFI cohort Badalona/SC. The main objective of the PELFI cohort Badalona/SC was to describe the relationship of determinants of health with the family unit and the migratory experience. The cohort included foreign-born families originated from Latin America, Morocco, Pakistan, China and a control group of native families, that participated in the interview and in the clinical sub-sample, where medical examinations such us blood and feaces test were carried out. PELFI cohorts will contribute to improve monitorization and better understanding of health status and risk factors among migrant population in Europe and in Spain, as well as for providing useful information for the elaboration of interventions that contribute to improving the health status of foreign-born population and to increase the cost-effectiveness of existing health resources.

Overcoming barriers of participation of foreign-born population on longitudinal health studies:

As it has been explained above, monitorization and understanding of health status and risk factors among foreign-born population is essential for hosting countries (60). It is recognized the existence

of significant gaps in knowledge about the health status of migrant population and their responses to interventions; resulting in a real challenge for health services to offer the adequate responses adapted to the new social reality (5,12). Currently, there is an important need for more available research data on migrant health status. However, it has been described that foreign-born population is infra-represented and excluded from health studies (29,30,34).

Health research on foreign-born population face extra difficulties and challenges (29,30,34). Identification, participation, and re-contact of migrant population in health research is limited by a wide range of idiomatic, cultural and socio-economic factors (5,32,39–43), such as fear and mistrust in research (179,180), lack of interest in research (179), fear and mistrust with institutions and government, lack of personal benefit (181), intrusive questions of the survey, confidentiality and racial profiling, economic (182) and time constraints (183), transportation and mobility issues (184–186), high disease burden, personal biases, lack of research knowledge, misconceptions of experimentation and explotation and childcare and eldercare responsibilities (39,40,179,187,188). In addition, researchers must adapt their methods to include, for example, people who cannot read or write in the majority language, or at all (189). At the same time, data collection must pay serious attention to issues of privacy, potential misuse of data and the political sensitivity of "ethnic monitoring" (4).

Then, for studying migrant's health is essential to minimize barriers of accessing and participation of foreign-born population on health research. The most studied attitudes and beliefs towards health research have been those from African Americans (190). In Spain, there is a lack of studies on improving knowledge on existing difficulties faced by migrant population for participating in health research in general, and in longitudinal studies in particular. However, available publications recommend to improve the understanding of barriers of participation in every study setting due to the wide heterogeneity among foreign-born populations and among study settings (29,40). In the the PELFI cohort Badalona/SC, we assessed the implementacion of facilitators of participation, and the participation and retention rates that were obtained.

Justification of the project

In Europe, international migrant population has presented a relevant increase for the last years (6), and it is expected that will continue its upward trend in the upcoming decades (6). Foreign-born population is definitely contributing to shape a new socio-demographic reality with new health needs (10,69). The migratory phenomenon is complex and dynamic, and it will be permanently changing in response to structural and socio-economic factors at global and local level (6). In Spain, the immigration flow was intense and massive with the arrival of high numbers of foreign-born people with a wide diversity of geographical areas of origin and cultures (69–71). In Catalonia, since 2000 to our days the proportion of foreign-born population has been even higher than in Spain (the highest proportion of migrant population reached in Catalonia was 17.7% in 2012 and in Spain 12.2% in 2010), and was able to modify the socio-demographic structure of the metropolitan area of Barcelona and other large cities (73).

Health status of migrant population is related to a complex and dynamic interaction of multiple factors related to the country of origin, the migration process and the host country (4,10,84). For hosting countries is essential to improve monitorization and better understanding of health status and risk factors among foreign-born population (60). In Europe, it has been reported significant gaps in knowledge about health status of foreign-born population, as well as of responses of this population to health interventions and better knowledge on how to adapt health services to the new social reality (5,12). More research data is essential by host countries for improving knowledge on migrant health and on health determinants and how these evolve according with time of residence in the host country, with the aim to adequate health services to migrants' health needs, to design effective prevention and clinical management strategies, and to directly inform clinical practice and policy-makers to be able to tackle the existing health inequities between migrants and natives (4,6,7,84,191,192). Health research within foreign-born population has high priority for WHO (4), arising as an emergent and of high interest issue by Public Health and epidemiological research in Europe and in Spain (2,5–11). In Spain, foreign-born health is an emergent topic for health research and faces particular and unexplored challenges. The constitution of the SMH in 2011, with the goal of improving and monitoring the knowledge on the Spanish foreign-born health, reflects the relevance of this topic for Public Health and epidemiological research in our country. As members of the SMH's research group named HIV/AIDS infection and other sexually

transmitted infections, we conducted our research within the framework of SMH and its comprehensive research activities on migrant health status and on particular challenges of health research on migrant population. Our research aimed to improve the knowledge on health status of Spanish and EU foreign born population, to identify barriers and facilitators of participation of this population in a cohort health study, and to design and implementate a prospective cohort health study in our site of study.

The research that we carried out on HIV and NG infection improved the available knowledge on the health status of foreign-born population, and particularly on the frequency of AMR within foreign-born population participating in Euro-GASP. Our conclusions might contribute to reinforce the currently ongoing Euro-GASP and promote a GASP for the whole European Region. Moreover, they will also contribute to stress the relevance of improving the reporting of variables associated with foreign-born population such as country of birth within the European surveillance systems.

The systematic review of longitudinal cohort studies on migrant population and the qualitative study on barriers of participation to health research, aimed at contributing to facilitate and improve participation of foreign-born population to health research, and in particular in prospective cohort studies. Our experience and main study outcomes of these researches were applied to the PELFI cohort Badalona/SC and facilitated its implementation. In addition, it may be useful for other researchers conducting similar studies on migrant population.

The successful implementation of the PELFI cohort Badalona/SC shows the viability of implementing a cohort of foreign-born families in our study setting using community recruiting strategies. PELFI cohort Badalona/SC was part of a broader coordinated project named MEISI: multiple evidence on health, health care, immigration and vulnerable populations. MEISI was conducted by research groups participating in SMH. The PELFI cohort Badalona/SC minimized barriers of participation, simultaneously combined different community recruiting strategies such as “opportunistic captation” and “snow ball”, included less studied foreign-born origins such as Pakistan and China, and studied foreign-born families rather than individuals; which are novel and unexplored methodological approaches for studying migrant population in our country. With our experience and findings we produced a “Guide to good practices for the implementation of a cohort on foreign-born populations from Pakistan, Latin America, Morocco and China” (available in

(http://www.ciberesp.es/programas-de-investigacion/subprogramas-estrategicos/subprograma-inmigracion-i-salud-ciberesp-sis-ciberesp) in order to facilitate the implementation of future cohort studies with similar characteristics.

Findings and conclusions from the studies that were conducted contributed to improve knowledge on health status of migrant population in Europe and in Spain; and to the successful recruitment and participation of the PELFI cohort Badalona/SC. Our results showed the feasibility of implementing a cohort of migrant families from different geographical origins in our study setting. Prospective cohort studies will contribute to improve monitorization and better understanding of health status and risk factors among migrant population in Europe and in Spain, as well as for providing useful information for the elaboration of interventions that contribute to improving the health status of foreign-born population and to increase the cost-effectiveness of existing health resources.

PURPOSE AND OBJECTIVES

GENERAL PURPOSE

To improve the available information on the state of health of the foreign-born population and on the facilitators of the participation in research of this population in Europe and in Spain, with the goal of improving the health policies addressed to this group.

RESEARCH QUESTIONS

1- What has been done in research on the health of the foreign-born population in Spain?

2- Are there differences between the epidemics of HIV and other sexually transmitted infections (STIs) among the foreign-born and the native populations?

3- Which strategies work best for carrying out longitudinal studies in foreign-born population?

4- Is it feasible to carry out a cohort study on foreign-born population on aspects related to health in Spain?

In order to answer these questions, four specific objectives have been identified with various operational objectives:

RESEARCH QUESTION 1: What has been done in research on the health of the foreign-born population in Spain?

SPECIFIC OBJECTIVE 1: To describe the studied areas and the methodological characteristics of the health research, and in particular on the HIV infection and other STIs, carried out in foreign-born population from 1998 to 2012 in Spain.

- **OPERATIONAL OBJECTIVE 1.1:** Coordination of a *scoping review* of the scientific articles published from 1998 to 2012 of studies on the health of the foreign-born population related to different groups of pathologies and health topics.

- **OPERATIONAL OBJECTIVE 1.2:** To describe the methodological characteristics of the studies carried out so far in Spanish on the health of foreign-born population.

- **OPERATIONAL OBJECTIVE 1.3:** To carry out a systematic review of longitudinal studies on the health of the foreign-born population.

RESEARCH QUESTION 2: Are there differences between the epidemics of HIV and other sexually transmitted infections (STIs) among the foreign-born and the native populations?

SPECIFIC OBJECTIVE 2: To describe the different epidemiological characteristics of the HIV/AIDS infection and the antimicrobial resistances of *Neisseria gonorrhoeae* infection in the foreign-born and native populations.

- **OPERATIONAL OBJECTIVE 2.1:** Carrying out a bibliographic review of articles published from 1998 to 2012 of studies conducted in Spain on the HIV/AIDS infection and other STIs in the foreign-born population.
- **OPERATIONAL OBJECTIVE 2.2:** To analyze the data collected in Euro-GASP from 2010 to 2014 on the infection by *Neisseria gonorrhoeae* resistant to penicillin, azithromycin, cefixime, ciprofloxacin and ceftriaxone, in the foreign-born and native population.

RESEARCH QUESTION 3: Which strategies work best for carrying out longitudinal studies in foreign-born population?

SPECIFIC OBJECTIVE 3: To identify and describe the facilitators of the participation of the foreign-born population in longitudinal health studies.

- **OPERATIONAL OBJECTIVE 3.1:** To carry out a systematic review of longitudinal studies on the health of the foreign-born population.
- **OPERATIONAL OBJECTIVE 3.2:** To carry out a qualitative study of the foreign-born population from Latin America (Bolivia, Equator, Peru and Colombia), Pakistan, Morocco and China residing in Badalona and Santa Coloma de Gramanet (PI13 / 01962).

RESEARCH QUESTION 4: Is it feasible to carry out a cohort study on foreign-born population on aspects related to health in Spain?

SPECIFIC OBJECTIVE 4: To design and implement the PELFI cohort on foreign-born families in Badalona and Santa Coloma de Gramanet (PI13 / 01962).

- **OPERATIONAL OBJECTIVE 4.1:** To implement the PELFI cohort on foreign born families in Badalona and Santa Coloma de Gramanet using strategies that facilitates the participation of the foreign-born population.

- **OPERATIONAL OBJECTIVE 4.2:** To estimate participation and adherence in the PELFI cohort on foreign-born families in Badalona and Santa Coloma de Gramanet by means of: a) the cooperation rate of the study, by the geographical origin and the recruitment strategy; and b) the retention rate of the participants in the first follow-up and by the geographical origin.

Table 1. Correspondence between the operational objectives and the publications included in the doctoral thesis:

OPERATIONAL OBJECTIVE	REFERENCE	TYPE OF PUBLICATION
1.1. Coordination of a *scoping review* of the scientific articles published from 1998 to 2012 of studies on the health of the foreign-born population related to different groups of pathologies and health topics.	Monograph on foreign-born health in Spain[a]: Delgado-Rodríguez M. La salud de los inmigrantes en España. Rev Esp Salud Pública. 2014;88(6):671–4.	Supplementary publication
1.2. To describe the methodological characteristics of the studies carried out so far in Spain on the health of foreign-born population.	Ronda-Pérez E, Ortiz-Barreda G, Hernando C, Vives-Cases C, Gil-González D, Casabona J. Características generales de los artículos originales incluidos en las revisiones bibliográficas sobre salud e inmigración en España. Rev Esp Salud Pública. 2014 Dec;88(6):675–85. Hernando Rovirola C, Ortiz-Barreda G, Galán Montemayor JC, Sabidó Espin M, Casabona Barbarà J. Infección VIH/Sida y otras infecciones de transmisión sexual en la población inmigrante en España: revisión bibliográfica. Rev Esp Salud Pública. 2014 Dec;88(6):763–81.	Supplementary publication
1.3. To carry out a systematic review of longitudinal studies on the health of the foreign-born population.	Hernando C, Sabidó M, Ronda E, Ortiz-Barreda G CJ. A systematic review of longitudinal cohort studies on the health of migrant populations. Soc Med. 2015;9(2):73–85.	Supplementary publication
2.1. Carrying out a bibliographic review of articles published from 1998 to 2012 of studies conducted in Spain on the HIV/AIDS infection and other STIs in the foreign-born population.	Hernando Rovirola C, Ortiz-Barreda G, Galán Montemayor JC, Sabidó Espin M, Casabona Barbarà J. Infección VIH/Sida y otras infecciones de transmisión sexual en la población inmigrante en España: revisión bibliográfica. Rev Esp Salud Pública. 2014 Dec;88(6):763–81.	Supplementary publication
2.2. To analyze the data collected in Euro-GASP from 2010 to 2014 on the infection by *Neisseria gonorrhoeae* resistant to penicillin, azithromycin, cefixime, ciprofloxacin and ceftriaxone, in the foreign-born and native population.	Hernando C, Spiteri G, Sabido M, Montoliu A, Gonzalez V, Casabona J, Cole MJ, Noori T, Unemo M. Antimicrobial resistance in Neisseria gonorrhoeae isolates from foreign-born population in the European Gonococcal Antimicrobial Surveillance Programme. Sex Transm Infect. *Ahead of print*	Compendium of articles

3.1. To carry out a systematic review of longitudinal studies on the health of the foreign-born population.	Hernando C, Sabidó M, Ronda E, Ortiz-Barreda G CJ. A systematic review of longitudinal cohort studies on the health of migrant populations. Soc Med. 2015;9(2):73–85.	Supplementary publication
3.2. To carry out a qualitative study of the foreign-born population from Latin America (Bolivia, Equator, Peru and Colombia), Pakistan, Morocco and China residing in Badalona and Santa Coloma de Gramanet (PI13 / 01962).	Hernando C, Sabido M, Casabona Jordi. Facilitators and barriers of participation in a longitudinal research on migrant families in Badalona (Spain): A qualitative approach. Health Soc Care Community. 2018;26(1):e64-e74. doi: 10.1111/hsc.12478. Epub 2017 Jul 24.	Compendium of articles
4.1. To implement the PELFI cohort on foreign-born families in Badalona and Santa Coloma de Gramanet using strategies that facilitates the participation of the foreign-born population.	Hernando C, Gaillardin F, Ferrer L, Cayuela A, Ronda E, Casabona J. Facilitadores de la participación e implementación de la subcohorte PELFI de familias inmigrantes. Gac Sanit. 2019;33(1): 45-52. doi: 10.1016/j.gaceta.2017.07.010. Epub 2017 Sep 22.	Compendium of articles
	Guia de bones pràctiques per a la implementació d'una cohort en població immigrada procedent de Pakistan, Amèrica Llatina, Marroc i Xina (http://www.ciberesp.es/programas-de-investigacion/subprogramas-estrategicos/subprograma-inmigracion-i-salud-ciberesp-sis-ciberesp) (Annex 1).	Supplementary publication
4.2. To estimate participation and adherence in the PELFI cohort on foreign-born families in Badalona and Santa Coloma de Gramanet by means of: a) the cooperation rate of the study, by the geographical origin and the recruitment strategy; and b) the retention rate of the participants in the first follow-up and by the geographical origin.	Hernando C, Gaillardin F, Ferrer L, Cayuela A, Ronda E, Casabona J. Facilitadores de la participación e implementación de la subcohorte PELFI de familias inmigrantes. Gac Sanit. 2019;33(1): 45-52. doi: 10.1016/j.gaceta.2017.07.010. Epub 2017 Sep 22.	Compendium of articles

[a]We included our participation in the coordination of the bibliographic review and in the published monograph as a complementary publication, although it is a collaborative work in which several authors participated because these activities allow us to describe and locate the context in which we conducted our research included in the doctoral thesis, particularly in the beginning, and provide relevant information in this regard.

METHODS

Complementary publication:

Monograph on the health status of foreign born population in Spain:

Delgado-Rodríguez M. La salud de los inmigrantes en España. Rev Esp Salud Publica. 2014;88(6):671–4

- Objective of the study: To synthesize scientific knowledge about the state of health and the use of healthcare services by the foreign born population in Spain, and its health determinants, as well as identify possible existing gaps to address in future research (13).
- Design: Bibliographic review or *scoping review*.
- Bibliographic research: It was conducted according to the main research lines of the SMH: 1) health inequalities, 2) labour health, 3) access to health services, 4) prevention of cancer, 5) nutrition, 6) mental health, 7) HIV/AIDS infection and other STIs, 8) parasitic diseases and imported mycosis, 9) tuberculosis, 10) epidemiology of hepatitis viruses, 11) molecular epidemiology, and 12) bacterial resistance to antibiotics. Each research group that was part of the SMH chose the most representative Medical Subject Headings (MESH) and terms of reference of its area of knowledge. Bibliographic research was carried out by an experienced person, Gaby Ortiz, who was subcontracted specifically to carry out this study. The bibliographic researches were made in theMedline databases through Pubmed and MEDES-MEDicina in Spanish. These databases were chosen for their higher visibility in the health area, both nationally and internationally. The research period was from January 1st of 1998 to December 31st of 2012, thus allowing the inclusion of the production of scientific articles generated since the beginning of the migratory phenomenon in Spain. The limiting term of reference for content was the human species. Publications written in Spanish or English were selected. Three thematic filters were developed: 1) On health status: each research group facilitated the most representative MESH words in its research field; 2) On foreign born population: Emigrants and Immigrants, Emigration and Immigration, Transients and Migrants and Ethnic Groups; 3) On country of birth: we used the one that was developed by Valderas J, and collaborators (193). In the case of MEDES-MEDicina in Spanish, which does not have a thesaurus, the following combination of keywords was used: “migración” OR “migrantes” OR “migrante” OR “inmigración”, “inmigrantes” OR “inmigrante”. The search

was limited by type of publication: original articles. Foreign born was defined according to the definition of the International Organization for Migration (IOM) (194): "persons and family members who decide to move to another country to improve their material or social conditions and improve the perspectives for themselves or for their family".

- Selection of articles: It was carried out in three phases: 1) Initial screening of titles and abstracts: Gaby Ortiz selected from the revision of the titles and abstracts the bibliographical references that met the inclusion criteria of the study; 2) Each research group made the initial selection of the articles based on the reading of the titles and abstracts, making a decision regarding inclusion of the references according to whether they respected the objective of the study; 3) Each line of research assessed the eligibility of the articles by reviewing the full text of the selected bibliographical references.
- Inclusion and exclusion criteria: The inclusion criteria were: 1) Qualitative and quantitative original studies, published in scientific journals on: a) Health status, b) Programs and/or preventive activities, c) Social, labour, cultural and/or economic determinants of health, and d) Access and use of healthcare services in the foreign born population carried out in Spain; 2) Studies that included foreign born population from Central and South America, Africa, Asia and Eastern Europe carried out in Spain; 3) Studies that even though they did not specify the nationality or the country of origin of the study sample, included the categories "immigrants", "foreigners" or analogues. The exclusion criteria were: 1) Studies focused on topics not related to the main subject of the bibliographic review, articles with no abstract available, repeated in other databases, editorials of scientific magazines and reviews were excluded; 2) The following types of publications: a) review articles on scientific and systematic literature, b) Opinions, comments, editorials, letters or conference summaries, c) Descriptions or case series of native and immigrant, were excluded; and 3) Articles that focused on foreign born population originated from North America, Oceania or Western Europe (Germany, Andorra, Austria, Belgium, Vatican City, Croatia, Denmark, Greece, Finland, France, Holland, Ireland, Iceland, Italy, Liechtenstein, Luxembourg, Malta, Monaco, Norway, Portugal, United Kingdom, San Marino, Sweden and Switzerland). Subsequently, the full text of the articles was reviewed to verify that they met the inclusion criteria. Initially 2625 bibliographic references were identified. Within them, 2183 (83.1%) studies

were excluded because they were not related to the main objective of the bibliographic review or not to meet the inclusion criteria. Finally, 311 articles were included.

- Data collection: A specific tool for this study was designed to extract and synthesize the content of the included articles. This tool included the following sections: objectives, methodology, main results and conclusions from the complete reading of the article. The collection tool was adapted for qualitative studies. The information was provided by each SMH research group. Subsequently, the answers were digitalized using Google DRIVE. The extracted results were automatically recorded in an Excel spreadsheet.
- Ethical considerations: It was not necessary to request the approval of the ethics committee.

Complementary publication:

Ronda-Pérez E, Ortiz-Barreda G, Hernando C, Vives-Cases C, Gil-González D, Casabona J. Características generales de los artículos originales incluidos en las revisiones bibliográficas sobre salut e inmigración en España. Rev Esp Salud Publica. 2014 Dec;88(6):675–85

- Objective of the study: To describe the general characteristics of the articles included in the *scoping review*.
- Design: Bibliographic review or *scoping review*.
- Bibliographic research: as explained above.
- Selection of articles: as explained above. The articles identified as eligible in the *scoping review* (n=311) were included.
- Inclusion and exclusion criteria: as explained above.
- Data collection: as explained above.
- Main outcomes: Year of publication, health area of research, study design, identification of the foreign born population, country or countries of origin included, sex of participants, administrative status, grouping by countries.
- Statistical analysis: Descriptive study.
- Ethical considerations: It was not necessary to request the approval of the ethics committee.

Complementary publication:

Hernando Rovirola C, Ortiz-Barreda G, Galán Montemayor JC, Sabidó Espin M, Casabona Barbarà J. Infección VIH/Sida y otras infecciones de transmisión sexual en la población inmigrante en España: revisión bibliográfica. Rev Esp Salud Publica. 2014 Dec;88(6):763–81

- Objective of the study: To describe methodological characteristics and main results obtained in the research on HIV/AIDS and other STIs on Spanish foreign born population in epidemiological, clinical and microbiological/molecular areas.
- Design: Bibliographic review or *scoping review* (195) of published articles from 1998 to 2012 as well as studies carried out in Spain on HIV/AIDS infection and other STIs in foreign born population.
- Bibliographic research: as explained above. To perform the bibliographic research in the Medline database through Pubmed, a filter on the HIV/AIDS infection and other STIs was developed as follows: HIV Infections, HIV, HIV-1, HIV-2, human immunodeficiency virus, acquired immunodeficiency Syndrome, Sexually Transmitted Diseases, Syphilis, new diagnosed, HIV-1 subtypes, transmitted drug resistance, molecular epidemiology and phylogeny. The bibliographical references of the articles included were reviewed.
- Inclusion and exclusion criteria: The inclusion criteria were: 1) Studies on the HIV/AIDS infection and other STIs; 2) With participants originated from Latin America, Africa, Asia and Eastern Europe; 3) Respect the foreign born definition of the International Organization for Migration (IOM) (194): "persons and family members who decide to move to another country to improve their material or social conditions and improve the perspectives for themselves or for their family"; 4) Carried out in Spain; 5) In humans; and 6) Published in Spanish or English. The exclusion criteria were: 1) Studies carried out in foreign born population from other geographical areas than those indicated; 2) Narrative or systematic reviews of literature, communications to congresses and gray literature.
- Selection of articles: Initially, 277 published articles were identified. After the initial selection of the articles based on the reading of the titles and abstracts, 235 (85.0%) references were excluded. Of these, nine (3.8%) references were excluded for not having a summary, five (2.2%) for not being original articles, six to be duplicated (2.5%) and 215 (91.5%) for not respecting the objectives of the review. After reading the full text, eight (19%) articles were

excluded, because they did not meet the selection criteria. Seven articles with HIV/AIDS infection as the main topic that had been identified by other SMH groups were included. Finally, 41 articles were included, 38 of them were quantitative studies, and three were qualitative studies.

- Data collection: as explained above.
- Variables of the study: a) General characteristics: authors, title, year of publication and scientific journal; b) Methodological aspects: objective of the study, material and methods (type of epidemiological design, design direction), population and sampling (duration of the study, sample size, type of population, range of ages, country or groups of countries of origin, type of collected data), study variables (identification of the foreign born population, administrative status, grouping by countries); c) Results; d) Discussion: limitations, generalization of results, conclusions and recommendations; and e) Financing.
- Main outcomes: a) Socio-demographic characteristics: geographical origin, age, sex and level of studies; b) Knowledge on HIV/AIDS and other STIs infection and risk behaviours: knowledge of HIV infection, use of condom and types of transmission; c) Clinical characteristics: prevalence of HIV infection, prevalence of hidden HIV infection, prevalence of HBV, HCV and STIs, incidence of tuberculosis, proportion of foreign born patients within the new diagnoses of HIV infection, late diagnosis of HIV infection, beginning of ARV treatment at the time of diagnosis, late initiation of ARV treatment, patients retained in HIV care services, switches of ARV treatment, ARV treatment failure, time to ARV treatment failure, and mortality rate; d) Molecular epidemiology of the HIV virus: subtypes of the HIV virus, recombinant forms, resistances to the ARV treatment.
- Statistical analysis: Descriptive study.
- Ethical considerations: It was not necessary to request the approval of the ethics committee.

Complementary publication:

Hernando C, Sabidó M, Ronda E, Ortiz-Barreda G CJ. A systematic review of longitudinal cohort studies on the health of migrant populations. Soc Med. 2015;9(2):73–85

- Objective of the study: To compare cohort studies of foreign born population and to describe trends between the characteristics of sampling, recruitment strategies, cohort design, and data collection and the participation and retention rates.
- Design: Systematic review of longitudinal studies on foreign born population.
- Bibliographic research: The bibliographic research was carried out by two independent researchers, Cristina Hernando and Meritxell Sabidó, from December 2012 to March 2013. Medline database of Pubmed and Web of Science were chosen for conducting the bibliographic research due to their relevance in the area of health at the international level. The bibliographic research was determined according to the type of publication: original articles but not limited by geographical origin or year of publication, due to the expectation that the number of identified studies would be reduced. MeSH, keywords and relevant free words in the text were used. Three thematic filters were developed: 1) On the type of study: Longitudinal Studies, Cohort Studies, Follow-Up Studies, Prospective Studies, Cross-Sectional Studies, Clinical Trials; 2) On foreign born population: Emigration and Immigration, Emigrants and Immigrants, Transients and Migrants, Ethnic Groups; 3) On health status: Health, Indicators of Health Status, Access to Healthcare Services, Health Surveys, Socio-economic factors, Prevention and control. Boolean operators "AND" and "OR" were used to retrieve all available scientific literature.We considered foreign born those "persons with country of birth or nationality different from the country of study", based on the definition provided by Malmusi D et al (56).
- Inclusion and exclusion criteria: The inclusion criteria were: 1) Studies with prospective longitudinal design; 2) Study sample focused on foreign born population; and 3) Studies with objectives related to health status and access to and/or use of healthcare services. The exclusion criteria were: 1) Studies with non-longitudinal design; 2) Summary not available; 3) Passive recruitment, 4) Cohort not exclusively conducted on foreign born population; 5) Analysis of secondary data; 6) Articles aimed at the study of ethnic minorities, refugees and/or asylum seekers.

- Selection of studies: Two independent researchers, Cristina Hernando and Meritxell Sabidó, carried out the selection of the identified references based on the reading of the titles and the abstracts. Out of the 545 bibliographic references that were initially identified, 13 articles were selected. After reading the full text, nine articles were included in the review. In case of identifying more than one publication from a single study, the article that described the methodology in more detail was chosen. References of the included articles were reviewed.
- Data collection: A specific data collection tool was designed using an Excel spreadsheet. Two independent researchers, Cristina Hernando and Meritxell Sabidó, carried out the extraction and synthesis of the content of the included references from the complete reading of the article. The data collection tool included the following sections: general characteristics of the studies, design, sampling, methodology used, participation and financing.
- Variables of the study: a) General characteristics of the studies: authors, country where the study was carried out, publication year, health area that was studied, socio-demographic characteristics of the population of the study; b) Design: duration -in years- of the study, number of follow ups, time -months- between the follow ups; c) Sampling: strategies and/or sources of recruitment, sample size, sampling type; d) Methods: use of gratifications, types of interview, conducting medical examinations; e) Participation; f) Financing; g) Methodological quality of the studies using the criteria of the Newcastle-Ottawa Quality Assessment Scale for Cohort Studies -Newcastle-Ottawa- (196).
- Main outcomes: Participation rate (proportion of interviewed participants among all the participants contacted) and retention rate (proportion of the participants interviewed in the follow ups among those who had participated in the baseline assessment)(197).
- Statistical analysis: Descriptive study.
- Ethical considerations: It was not necessary to request the approval of the ethics committee.

Publication included in the compendium of articles:

Hernando C, Spiteri G, Sabido M, Montoliu A, Gonzalez V, Casabona J, Cole MJ, Noori T, Unemo M, Euro-GASP network. Antimicrobial resistance in *Neisseria gonorrhoeae* isolates from foreign-born population in the European Gonococcal Antimicrobial Surveillance Programme. Sex Transm Infect. *Ahead of print*

- Objective of the study: To improve the knowledge of the distribution of antimicrobial resistant NG strains within foreign born and native population in EU/EEA through: a) Describing and comparing the prevalence of antimicrobial resistances to ciprofloxacin, azithromycin, cefixime and ceftriaxone; of penicillinase production and of decreased sensitivity to ceftriaxone within samples from foreign born and native patients; b) And from patients from EU/EEA countries and non-EU/EEA countries; c) Describing and comparing the epidemiological characteristics of foreign born and native patients with resistant NG infection; and d) Evaluating the association of epidemiological and clinical characteristics with the risk of presenting resistant NG infection within foreign born participants.
- Design: Cross-sectional study.
- Population of the study: Samples of NG infection collected by Euro-GASP from 2010 to 2014 (n=9529 samples). Within isolates with a known country of birth (n=4098), we considered isolates from patients whose country of birth was different from the participating country as being isolates from foreign born patients (n=704) (2). Samples from participants who were born in the reporting country were considered samples from native patients (n=3394) (194). Each country that participated in the Euro-GASP (The Netherlands, Ireland, United Kingdom, Greece, Italy, Denmark, Malta, Slovakia, Belgium, Slovenia, Germany, Hungary, Cyprus, Portugal, Austria, Spain, France, Latvia, Norway, Sweden, Estonia, Iceland, Poland and Romania) collected around 100 samples (United Kingdom, Spain and The Netherlands collected 200 samples, as they reported a higher prevalence of NG infection) in patients with NG infection. One sample per patient and per episode of NG infection was collected. The collection periods were from April to May and from October to November during 2010-2013; and from September to November in 2014 (198).
- Inclusion and exclusion criteria: Samples from participants with known country of birth were included in the analysis. Samples notified by countries that had inconsistently participated

(those that had notified isolates discontinuously during the study) participated in Euro-GASP (Estonia, Iceland, Poland and Romania) were excluded.

- Data collection: Euro-GASP collected epidemiological data of the patients who delivered the samples.
- Variables of the study: Year of diagnosis, age, area of origin (defined according to WHO geographical areas: European Region -EU/EEA countries and non-EU/EEA countries-, Eastern Mediterranean Region, Region of the Americas, African Region , Southeast Asia Region, and West Pacific Region), sexual orientation (heterosexual women, heterosexual men and MSM), site of infection (ano-rectal, uro-genital and pharyngeal), status of HIV infection (positive, negative), previous diagnosis of gonorrhoea (yes, no), and probable country of infection (participating country, others).
- Main outcomes. Antimicrobial sensitivity, which was interpreted based on minimal inhibitory concentrations (MIC): the minimum concentration of an antimicrobial that inhibits the visible growth of the bacteria; in accordance with the MIC values proposed by the European Committee on Antimicrobial Susceptibility Testing (EUCAST) (199). We considered clinical breakpoints (susceptible, resistant) were as follows: ceftriaxone and cefixime (MIC≤0.12 mg/L, MIC>0.12 mg/L), azithromycin (MIC≤0.25 mg/L, MIC>0.5 mg/L), and ciprofloxacin (MIC≤0.03 mg/L, MIC>0.06 mg/L). Furthermore, strains with a ceftriaxone MIC of 0.12 mg/L have previously caused gonorrhoea treatment failures and were considered to have a "decreased sensitivity".
- Statistical analysis: Pearson test $\chi 2$ or Fisher's exact test (in those cases where the cells had values less than five) were performed, taking into consideration the difference with $p<0.05$ as significant. Uni and multivariate logistic regression analysis were expressed with crudeand adjusted OR. Those associations that were significant ($p<0.10$) in the univariate model were initially included in the multivariate model. Through conducting "backward stepwise approach", the significant associations ($p<0.05$) were retained in the model. The statistical analysis was conducted using the SPSS v.20 statistical package.
- Ethical considerations: It was not necessary to request the approval of the ethics committee.

Publication in the compendium of articles:

Hernando C, Sabido M, Casabona Jordi. Facilitators and barriers of participation in a longitudinal research on migrant families in Badalona (Spain): A qualitative approach. Health Soc Care Community. 2018; 26(1):e64-e74. doi: 10.1111/hsc.12478. Epub 2017 Jul 24.

- Objective of the study: To describe the willingness, the barriers and facilitators of participation, and the reasons to participate in a cohort health study that conducts health interviews on health and medical examinations in foreign born families residing in Badalona and Santa Coloma de Gramanet.
- Design: Qualitative study.
- Population of the study: From May to November 2014, two independent researchers, Cristina Hernando and Percy Fernández, carried out the recruitment of the participants through different local entities and services (cultural or neighbourhood associations, foundations, entities, non-governmental organizations (NGOs), churches, health services and schools) with a high proportion of foreign born users in Badalona and Santa Coloma de Gramanet. A convenience sample of 76 foreign born participants from Bolivia, Equator, Peru, Colombia, Pakistan, Morocco and China; and 9 key informants (a translator/mediator from Morocco, a translator/mediator from Pakistan, a member of an association of neighbours from Pakistan, a member of a Chinese cultural association, a member of a NGO, the director of a school, a doctor specialized in Pediatrics of a Primary Care Centre (CAP), a nurse of the International Health Unit of Barcelonès Nord and Maresme, and a priest from an Evangelical Church in Badalona) were recruited. We considered foreign born as "persons with other country of birth or nationality than the country of study", based on the definition provided by Malmusi D et al (56). We considered a foreign born key informant a foreign born person who had a significant role in his own community; and a native key informant an individual with extensive personal and labour experience with the local foreign born population. The most frequent nationalities in our location of the study were included. Regarding Latin America participants, those who were from Andean countries were selected as being the most representatives in our location of the study, and they were considered in a single group.

- Selection criteria: The selection criteria were to be 18-65 years old, to be born in Bolivia, Equator, Peru, Colombia, Pakistan, Morocco and China; to be part of a family (father and/or mother) with at least one child, who had lived together for at least 6 months; and residing in Badalona or Santa Coloma de Gramanet, regardless of time of residence, employment and administrative status. The exclusion criteria were having a partner born in the country of the study and to belong to off spring of foreign born.

- Data collection: Two researchers, Cristina Hernando and Percy Fernández, held 26 semi-structured individual interviews (11 of them were conducted with participants from Latin America, and 5 with participants from each one of the other geographical areas included in the study), and 8 discussion groups (2 groups with participants originated from each one of the included geographical areas: Latin America, Pakistan, Morocco and China). Each discussion group had 5-10 participants. The discussion groups with participants from Pakistan and Morocco were separated by sex according to the recommendations made by the key informants. The key informants performed translation tasks. Discussion groups and individual interviews were recorded in audio, and subsequently, were transcribed literally. Specific interview guides for semi-structured interviews and for discussion groups were designed and validated through two individual interviews and a discussion group (in which a third researcher was watching and taking notes). A Participant Data Sheet was designed to collect socio-demographic data of the participants. The written informed consent of all the participants was obtained. An economic gratification of 10 Euros was offered to all participants.

- Variables of the study: a) Participation in a cohort study that will conduct health interviews and medical exams (desire and reasons to participate, also their children), b) Recruitment strategies (barriers and facilitators), c) Participation in the interview (perceptions, beliefs, barriers and facilitators), d) Participation in medical exams (perceptions, beliefs, barriers and facilitators), e) Economic gratifications (fears, acceptance, types of gratifications), f) Re-contact in the follow up wave (preferences, barriers and facilitators), g) Socio-demographic variables: sex, age, country of birth, year of arrival in Spain, time of residence in Badalona and other cities, other people with whom they live, level of studies, employment status,

economic incomes, possession of health card, residence permit and duration of the interview.

- Main outcomes: Four categories of codes were generated: desire and reasons for participating, barriers and facilitators of participation.

- Statistical analysis: It was conducted by Cristina Hernando and Percy Fernández. A thematic analysis was carried out by combining two procedures: a) initially, following the methodology of the Grounded Theory (200,201), the inductive coding of the collected information was carried out and the identified codes were integrated into families of codes ; b) secondly, following the method of the thematic analysis (202,203), patterns (themes) were identified, analysed and described. The code book was built based on topics that emerged from interview questions and from the readings of the interviews (open coding). The open codification process was conducted using the Atlas-ti® software. Finally, 137 codes emerged. The differences between the two researchers were solved by consensus. Related to the socio-demographic data, a descriptive analysis (frequencies) of the main socio-demographic characteristics of the participants was carried out.

- Ethical considerations: This study was a part of the project called "Evolution of biological and structural determinants in a cohort on immigrant families (PI13/1962)", which was approved by the Ethics Committee of the Germans Trias i Pujol Hospital Foundation (FHGTiP) (PI-14-092).

Article included in the compedium of the articles of this thesis:

Hernando C, Gaillardin F, Ferrer L, Cayuela A, Ronda E, Casabona J. Facilitadores de la participación e implementación de la subcohorte PELFI de familias inmigrantes. Gac Sanit. 2019; 33(1): 45-52. doi: 10.1016/j.gaceta.2017.07.010. Epub 2017 Sep 22.

- Objectives of the study: The study had two main objectives: 1) To describe the recruitment, data collection and socio-demographic characteristics according to the geographical origin and sex of the participants; and 2) To assess the recruitment and data collection strategies that facilitated the participation in the PELFI Badalona/SC cohort.

- Design: Prospective longitudinal study.

- Study population: The recruitment of participants was carried out by: 1) Field team researchers, consisting of eight foreign born people from the local communities (1 man and 1 woman from Pakistan, 2 men and 2 women from Morocco, and 1 man and 1 woman from China) and five natives who worked as social analysts and had experience in studies with foreign born population; and 2) Two researchers: Cristina Hernando and Florianne Gaillardin. Three different recruitment strategies were carried out: 1) Information meetings; 2) Opportunistic recruitment in target locations; and 3) Snowball technique used in the family and community networks by participating families and foreign born interviewers. The study population was foreign born and natives families. We considered foreign born those "persons with other country of birth or nationality than the country of study", based on the definition provided by Malmusi D, et al (56). “Family” was considered as the nucleus consisting of father and/or mother with at least one child, who shared a common budget and who had lived together for at least six months as described in the definition used in the National Health Survey 2011-2012 (204). Families in which at least one member completed the health interview were considered participant families [F]. Families that were contacted but in which no member was interviewed were considered of having refused to participate [R]. The participating families were invited to participate in the clinical sub-sample until the desired sample of the study was achieved. A convenience sample of 110 families (90 foreign born families and a control group of 20 native families) and a clinical sub-sample of 25 families were identified.

- Selection criteria: Foreign born and native families whose progenitors were born in Equator, Bolivia, Peru, Colombia, Pakistan, Morocco, China or Spain, with at least one childand residing in Badalona or Santa Coloma de Gramanet, regardless of the time of residence, and employment and administrative status were selected. The participating geographical origins were selected according to: a) The most frequent geographical origins in Badalona and Santa Coloma de Gramanet; b) The least studied groups (Morocco, Pakistan and China) or with higher recruitment difficulties (Morocco); and c) The geographical origins included in the other PELFI cohorts (205). Regarding Latin American participants, those who were from Andean countries were selected as being the most representatives and were considered as a single group. Families with a native progenitor were excluded.
- Data collection: Data collection was carried out from October 2015 to April 2016, through health interviews and the analysis of biological samples (clinical sub-sample). Different health surveys were designed specifically for this study for mothers (84 questions), parents (69 questions) and offspring >16 years (79 questions). Health questionnaires included socio-demographic, economic, labour and mental health variables common to the rest of PELFI cohorts (205); and other sections that were specific for Badalona/SC cohort: home conditions, social support, intra-family relationships, perception of discrimination, sexual and reproductive health, self-perceived health status and use of healthcare services (questionnaires are available at http://www.ciberesp.es/programas-de-investigacion/subprogramas-estrategicos/subprograma-migracion-y-salud-ciberesp-sis-ciberesp). The interviews had an estimated duration of 45-60 minutes. In the clinical sub-sample, weight, size, blood pressure and peak flow were measured; those older than 6 months delivered samples of faeces and skin smears, and received tuberculin test (purified proteinic derivate [PPD]), by using Mantoux technique; those older than 18 years delivered blood and urine samples. Health questionnaires and informed consent were translated by official translators into the official language of the participating countries: Urdu, Arabic and Mandarin. Models of informed consent for adults and offspring <18 years were designed for participating in the health interview and in the clinical sub-sample (Appendix 2 and 3). The signed informed consent of all the participants in the study was obtained. The health questionnaire was was carried out as a pilot test on a family from Latin America. Matching of sex and geographical origin between interviewers and participants was offered to families

from Pakistan and Morocco. The interviews were conducted using tablets (program "Survey to go"). Economic gratifications were offered to all participants in the study, 10 Euros upon completion of the health interview and 10 Euros per medical examination. A follow up was conducted after 12 months of the baseline assessment.

- Variables of the study: a) Socio-demographic characteristics: sex, age, years of residence, Spanish nationality, level of studies, knowledge of language, number of children and social class (I, II, III: non-manual workers; IV: skilled manual workers and semi-qualified; V: unskilled manual workers) (206).

- Main outcomes: Cooperation and retention rates that were calculated following the recommendations of The American Association for Public Opinion Research (AAPOR) (197). Cooperation rate was defined as (I/I+P+R+O), where I: completed interviews, P: partially answered interviews, R: refuse to participate; O: others (not found, deaths, etc). Instead of questionnaires, we used families [F]. All the families that fulfilled the selection criteria and provided a phone number were contacted to be interviewed. All interviews were completed and there was no case included in the "other" category. It was considered a participating family one in which at least one member completed the interview. The analysis included: a) Cooperation rate of the study ([F]/[F]+[R]); b) Cooperation rate according to the geographical origin; c) Cooperation rate according to the recruitment strategy; and d) Cooperation rate in the clinical sub-sample.

- Statistical analysis: a) Descriptive analysis (cooperation rates) of the participation in the baseline assessment of the cohort; b) Descriptive analysis (absolute and relative frequencies) of the reasons for not participating; c) Descriptive analysis (absolute and relative frequencies in categorical variables, and mean and standard deviation in the continuous variables age and years of residence) according to geographical origin; and d) Bivariate analysis of socio-demographic characteristics according to gender using the Chi-square or Fischer Exact tests for categorical variables and the Anova test for continuous variables (age). The SPSS v.20 statistical package was used.

- Ethical considerations: This study is part of the project called "Evolution of biological and structural determinants in a cohort of foreign born families (PI13/1962)", which was

approved by the Ethics Committee of the Germans Trias i Pujol Hospital Foundation (FHGTiP) (PI-14-092).

RESULTS

The following is a summary of the most relevant results of the studies that we conducted and that provide answers to the research questions and specific and operational objectives that we posed.

Ronda-Pérez E, Ortiz-Barreda G, Hernando C, Vives-Cases C, Gil-González D, Casabona J. Características generales de los artículos originales incluidos en las revisiones bibliográficas sobre salud e inmigración en España. Rev Esp Salud Publica. 2014 Dec;88(6):675–85.

Out of the 2625 bibliographic references that were identified, 311 met the inclusion criteria. More than three-quarters of the articles (n=256, 82%) were published from 2004 to 2010. From 1998 to 2009, the volume of published articles increased yearly, especially in the area of transmissible diseases. From 2009 to 2011, the number of annual publications showed a downward trend. The studies that reported the countries of origin of foreign born participants included Equator, Colombia, Bolivia, Paraguay, Peru, Equatorial Guinea, Algeria, Morocco and Romania. Table 2 summarizes the general characteristics of the included studies in the scooping review.

Table 2. General characteristics of studies included in the scooping review on foreign born health conducted by SMH (n=311):

GENERAL CHARACTERISTICS OF THE REVIEWED ARTICLES	No. (%)
Foreign born definition based on the country of origin or country of birth	221 (71%)
Cross-sectional design	158 (55.8%)
Focused on infectious diseases	217 (69.7%)
Used primary sources of information	192 (61.7%)
Compared foreign born to native participants	196 (63.1%)
Longitudinal design	79 (28.0%)
Used secondary sources of information	99 (31.8%)
Only included foreign born population	87 (27.9%)
Used qualitative methodology	15 (4.8%)
Reported the administrative (regular or irregular) status	49 (15.9%)

Hernando Rovirola C, Ortiz-Barreda G, Galán Montemayor JC, Sabidó Espin M, Casabona Barbarà J. Infección VIH/Sida y otras infecciones de transmisión sexual en la población inmigrante en España: revisión bibliográfica. Rev Esp Salud Publica. 2014 Dec;88(6):763–81.

In the area of HIV/AIDS infection, out of the 277 bibliographic references that were initially identified, 41 met the inclusion criteria. Qualitative methodology was used in three studies. The most studied geographic origins were Latin America (n=20, 48.8%) and sub-Saharan Africa (n=19, 46.3%). A smaller number of articles (n=15, 36.6%) included participants from Asia, with reduced samplesbeing studied. In the majority of the articles (n=22, 53.6%), most of the participants, both foreign born and native, were men. About a fifth of the studies (n=8, 19.5%) included exclusively foreign born participants and specified the administrative status. The populations that were included in the studies were: HIV positive patients (n=12, 29.3%), sex workers (n=5, 12.2%), maternal-fetal transmission (n=4, 9.7%), foreign born population (n=2, 4.9%), people who carried out the HIV test (n=2, 4.9%) and penitentiary population (n=1, 2.4%). Paediatric population (<16 years) was included in 17% of the studies (n=7). Only one study (2.4%) focused on to compare foreign born population from high income countries with those from low income countries, resistances to antiretroviral treatment, hidden HIV infection and the acceptability of blood tests.

Hernando C, Sabidó M, Ronda E, Ortiz-Barreda G CJ. A systematic review of longitudinal cohort studies on the health of migrant populations. Soc Med. 2015;9(2):73–85.

Out of 545 bibliographic references that were initially identified, nine studies (10 cohorts) met the inclusion criteria of the study. Within the ended studies, the most frequent duration of study was two years (n=4), and the most frequent was conducting the first follow up 12 months after the baseline (n=5). The most studied health areas were labour health (n=4) and mental health (n=4). Different strategies were used for conducting face-to-face interviews (n=7): a) a friend or a relative performed translation tasks (n=2); b) the head of household, when it was necessary, provided health information about the other participant members of the family (n=2); and c) only a family

member, the mother, was interviewed and provided health information on the other participant members of the family (n=1). Only two studies described the strategies used in the follow-up for re-contacting the participants: phone calls and repeated phone calls together with email and letters during four weeks. The cohorts that studied foreign born families (n=4) used different ways to define and to identify the participant families: a) two studies included the head of household and relatives living in the same household; b) one study considered all the members who were included in the same visa application; and c) one study considered the index case, the partner, the parents and the children of the index case, including three generations in total, using the census of inhabitants. Table 3 summarizes the methodological characteristics of the cohort studies included in the bibliographic review.

Table 3. Methodological characteristics of the cohort studies on foreign born population included in the review (n=9):

FIRST AUTHOR, PUBLICATION YEAR, AND STUDY LOCATION	STUDIED HEALTH AREA POPULATION OF STUDY	NUMBER OF FOLLOW UPS AND NUMBER OF MONTHS BETWEEN FOLLOW UPS	RECRUITMENT STRATEGY	STUDY SIZE (PARTICIPANTS)	ECONOMIC GRATIFICATIONS	DATA COLLECTION	ANALYSIS OF BIOLOGICAL SAMPLES	PARTICIPATION RATE	RETENTION RATE
Chou KL 2006 Australia	Mental health Recent foreign born >50 years old and residing in urban areas	1 Follow up wave 12 Months	Random sample using a government record (Settelment database)	431	NS	Face-to-face interviews, self-administered questionnaires, linkage with data of official records	No	NS	83.30%
Stoecklin-Marois MT 2011 USA	Labour and environmental health Latin workers residing in Mendota (California)	2 Follow ups 19 and 17 months	Door to door	843: 467 heads of household and 376 spouses	NS	Face-to-face interviews	Anthropometric measurements, spirometry, urine sample, air sample, study of skin atopia	70%	NS
Cooper SP 2006 USA	Labour health Latin workers residing in Starr County	2 Follow ups 12 and 24 months	Random sample using a government record (New Generation System)	267	Gift card (15$) in each follow up survey	Face-to-face interviews	No	Cohort 1: 57.7% Cohort 2: 59.8%	Cohort 1: 95.1%; Cohort 2: 94.5%
Delclos CD 2011	Labour health Workers (30%	1 Follow up		2434	No	Face-to-face interviews	No	57%	30%

Spain	irregulars) from Colombia, Equator, Morocco and Romania; with >1 year of residence in Spain	48 Months	Block-walking approach Convenience sample						
Ristner M 1997 Israel	Mental health Recent foreign borns from former Soviet Union and residing in Jerusalem	1 Follow up 12 Months	Door to door Convenience sample	419	NS	Face-to-face interviews and self-administered questionnaire	No	91.70%	49%
Cwikel J 1997 Israel	Mental health Foreign born from former Soviet Union, particularly from exposed and non exposed areas to Chernobyl accident	1 Follow up 12 Months	Governmental record, recorded respondents of a previous massive call, and personal contacts	708	NS	Face-to-face interviews	Blood pressure	91%	73%
Cobb-Clark D 2001 Australia	Labour health Recent foreign born residing in urban areas	Cohort A: 2 Follow ups 12 and 36 months Cohort B: 1 Follow up 12 Months	Random sample using a government record	LSAI[b] 1: 5192 visa applicants and 1837 spouses LSAI 2: 3124 visa applicants and 1094 spouses	NS	Face-to-face interviews	No	LSIA 2 (a): 58.9%	Wave 1 LSAI 1: 86%; Wave 2 LSAI 1: 72% LSAI 2: NE

Kuhns LM 2007 USA	Sexual risk behaviours Latin gays, bisexuals and transgender residing in Chicago	2 Follow ups 3 and 6 months	Respondent driven sampling Convenience sample	643	50$ for completing the survey and 20$ for each peer recruited (up to 60$), refreshments	On line self-administered questionnaires	No	88%	Wave 1: 83%; Wave 2: 80%
Stronks K[a] 2013 Holland	Mental health, cardio-vascular and infectious diseases Foreign born from Surinam (Caribbean and South Asia), Turkey, Morocco, Ghana and native participants residing in Amsterdam	NS 60 months	Random sample using the census of inhabitants	30.000	NS	Self-administered questionnaire (on paper or on-line), linkage to general practitioner, hospital discharge, pharmacy, health care insurance and vaccination registries	Anthropometric measurements, blood pressure, blood, urine and faeces samples, nasal and throat swabs, and vaginal swab (self-administered)	20-30%[c]	NS

[a]NS: not specified; [b]Recruitment was underway at the moment of the study;
[b]LSAI: Longitudinal Survey of Immigrants to Australia;
[c]Estimated, from a communication in the Congrés de la Societat Espanyola d'Epidemiologia 2014

Hernando Rovirola C, Ortiz-Barreda G, Galán Montemayor JC, Sabidó Espin M, Casabona Barbarà J. Infección VIH/Sida y otras infecciones de transmisión sexual en la población inmigrante en España: revisión bibliográfica. Rev Esp Salud Publica. 2014 Dec;88(6):763–81.

The main results of the study were:

Most frequent type of transmission of HIV infection in foreign born participants by geographical origin:

- The most frequent type of transmission by the geographical origin was linked to the most frequent sexual risk behaviours that existed in the geographical area of origin: those from Latin America presented higher frequence of transmission in MSM, those from North Africa and sub-Saharan Africa presented higher prevalence of heterosexual transmission, and those from Eastern Europe and sub-Saharan Africa higher proportion of injecting drug users (IDU) transmission,

Type of transmission by country of origin:

- The most frequent type of transmission was sexual intercourse in both populations,
- Foreign born participants presented higher proportion of heterosexual and homosexual transmission, and lower frequency of IDU transmission than natives,

Prevalence of HIV infection by country of origin:

- Compared to native participants, the following sub-groups of foreign born participants presented a higher prevalence of HIV infection: a) MSM from Latin America (18.1% vs. 5%, $p<0.001$); b) heterosexual men and women from sub-Saharan Africa (9.1% and 7.5% vs. 1.8%); c) transvestite and transgender sex workers of Latin America (23.3% vs. 9.3%); and d) pregnant foreign born women (0.9% vs. 0.5%) -among them, the prevalence of HIV infection was especially high with pregnant women from sub-Saharan Africa (11.8 vs. 0.1% and 18.9% vs. 0%, both $p<0.05$ in two different studies),
- Compared to native men, the proportion of hidden HIV infection was higher in foreign born men (0.61%),
- On the other hand, female foreign born sex workers and imprisoned foreign born men presented lower degree prevalence of HIV infection than female sex workers and imprisoned native men,

Prevalence of STIs by country of origin:

- Particular sub-groups of foreign born participants presented a higher degree of STIs: pregnant foreign born women, especially those from Latin America and Eastern Europe, presented higher prevalence of HBV (2.6%) and syphilis (3.5%) than pregnant native women; female foreign born sex workers presented a higher prevalence of syphilis and gonorrhoea than female native sex workers; transvestite and transgender male sex workers originated from Latin America presented a higher prevalence of syphilis (31.7%) than native people; foreign born patients of a specialized HIV/STI clinic presented a higher frequency of seropositive hepatitis B (anti-HBc) (19.5% vs. 8.3%) and syphilis (3.2% vs. 1.1%) than natives,
- Imprisoned foreign born men presented a lower frequency of HBV and HCV than imprisoned native men,

Prevalence of HIV and other STIs co-infection:

- Overall, the foreign born population with HIV infection had lower proportion of hepatitis C co-infection than native population with HIV infection,
- Foreign born participants with HIV infection from sub-Saharan Africa and Eastern Europe presented a higher prevalence of hepatitis B co-infection than native participants with HIV infection,

Clinical characteristics of foreign born population with HIV/AIDS infection by geographical origin:

- Patients from sub-Saharan Africa presented higher rates (41%-53%) of delay to diagnosis than those originated from Latin America and Asia (30%). No differences were observed when comparing the low income countries (Africa -South-Africa was excluded-, Asia –Japan was excluded-, Latin America and The Caribbean) with those with higher income (European countries, USA, Canada, Japan, Australia, New Zealand; and patients with Spanish nationality that were included in a third group);

- Patients from sub-Saharan Africa presented an increase of proportion of resistances to ARV treatment (from 7.7% to 13%). Such an increase was higher within sub-Saharan Africa women than in men,

- Native patients and those from Latin America presented a decrease of proportion of resistances to ARV treatment (from 13.2% to 8% and from 10.2% to 8.6%, respectively),

Clinical characteristics of HIV/AIDS infection by country of birth:

- Within new HIV diagnoses, the proportion of foreign born cases increased between 40-70% in adults and children,
- Both populations presented high frequencies (43%-34.6%) of late HIV diagnose. In two studies, foreign born patients originated from sub-Saharan Africa (41%-53%) presented a higher prevalence of delay to diagnose than natives (30%),
- At the time of diagnosis no differences were observed in the clinical and immune status, and in the proportion of patients who initiated ARV treatment between these populations in most of the included studies,
- No differences were observed in the proportion of patients who initiated late ARV treatment or in mortality rates in most of the included studies,

Clinical characteristics of HIV/AIDS infection in foreign born and native patients by gender:

- More than 50% of new diagnoses of HIV infection within foreign born were in women,
- Foreign born women with HIV infection significantly presented more loses of follow up (25.5% vs. 11.6%), more changes of ARV treatment, worse immune response to ARV treatment (lower increase of CD4+ and lower reduction of viral load, $p<0.05$), and shorter time for treatment failure (124 weeks) than native women.

Hernando C, Spiteri G, Sabido M, Montoliu A, Gonzalez V, Casabona J, Cole MJ, Noori T, Unemo M. Antimicrobial resistance in Neisseria gonorrhoeae isolates from foreign-born population in the European Gonococcal Antimicrobial Surveillance Programme. Sex Transm Infect. *Ahead of print*

From 2010 to 2014, Euro-GASP studied 9529 isolates of NG infection. Among those isolates with known country of birth (43%, n=4098), 704 (17.2%) were from patients who were born abroad. The most frequent geographical origin of foreign born patients was Europe (n=345, 49%), more specifically 35.9% (n=253) were from EU/EEA countries and 13.1% (n=92) from non EU/EEA

countries. Taking into consideration all the isolates with NG infection resistant to at least one antimicrobial, foreign born and native patients presented a similar proportion of isolates with resistant NG (53.5% vs. 52%, p=0.45). Compared to isolates of native patients, isolates of foreign born patients presented lower proportion of cefixime resistance (5.7% vs. 3.6%, p=0.02) and higher frequency of isolates with penicillinase production (8.4% vs. 11.7%, p=0.02). Patients from non EU/EEA countries and from the Eastern Mediterranean had significantly higher proportions of isolates with resistant NG to at least one antibiotic than native patients (53.5% vs. 78.3% and 68.7% respectively, p<0.01). In Table 4 we synthesize the proportion of isolates with resistant NG infection and decreased sensitivity to ceftriaxone by geographical area of origin.

Table 4. Proportion of isolates with resistant NG infection and decreased sensitivity to ceftriaxone by geographical area of origin, Euro-GASP 2010-2014:

	COUNTRY OF BIRTH OF FOREIGN BORN[a]								NATIVES No. (%)	p-value[b]
	WHO EUR		WHO EMR No. %)	WHO AMRO No. (%)	WHO AFR No. %)	WHO SEAR No. %)	WHO WPR No. %)	TOTAL foreign born No. (%)		
	EU/EEA No. (%)	Non EU/EEA No. (%)								
CIPROFLOXACIN RESISTANT (n=4088)[c,d]	103 (40.7)	66 (71.7)	55 (66.3)	54 (31.0)	20 (36.4)	14 (63.6)	14 (56.0)	326 (46.3)	1693 (50.0)	0.07
AZITHROMYCIN RESISTANT (n=4048)[d]	17 (6.7)	10 (11.2)	6 (7.6)	15 (8.6)	0 (0.0)	1 (4.8)	1 (4.0)	50 (7.2)	251 (7.5)	0.8
CEFIXIME RESISTANT (n=4050)[d]	6 (2.4)	8 (9.1)	7 (8.9)	2 (1.1)	1 (1.8)	1 (4.5)	0 (0.0)	25 (3.6)	192 (5.7)	0.02
CEFTRIAXONE RESISTANT (n=4098)[d]	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	4 (0.1)	1.0
DECREASED SUSCEPTIBILITY TO CEFTRIAXONE (n=4098)[d]	4 (1.6)	8 (8.7)	8 (9.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	20 (2.8)	63 (1.9)	0.10
PENICILLINASE PRODUCTION (n=3352)	21 (11.6)	9 (11.4)	11 (16.7)	7 (7.4)	4 (10.3)	1 (7.1)	4 (28.6)	57 (11.7)	240 (8.4)	0.02
RESISTANT ISOLATES (n=4098)	118 (46.6)	72 (78.3)	57 (68.7)	68 (39.1)	22 (40.0)	14 (63.6)	15 (60.0)	366 (52.0)	1817 (53.5)	0.45

[a]Divided into WHO regions: EUR, European Region [28 European Union (EU) countries, three European Economic Area (EEA) countries and 23 non-EU/EEA countries]; EMR, Eastern Mediterranean Region; AMRO, Region of the Americas; AFR, African Region; SEAR, South-East Asia Region; and WPR, Western Pacific Region.

[b]p-value(using Pearson χ^2-test or by Fisher's exact test if cell numbers were less than 5) between total number of isolates from foreign-born and native patients

[c]Number of isolates with known country of birth tested for each antimicrobial

[d]The clinical breakpoints (susceptible, resistant) were as follows: ceftriaxone and cefixime (MIC≤0.12 mg/L, MIC>0.12 mg/L), azithromycin (MIC≤0.25 mg/L, MIC>0.5 mg/L), and ciprofloxacin (MIC≤0.03 mg/L, MIC>0.06 mg/L). Furthermore, strains with a ceftriaxone MIC of 0.12 mg/L have previously caused gonorrhoea treatment failures and can be considered to have a decreased susceptibility.

All samples of foreign born participants were sensitive to ceftriaxone. Those originated from non-EU/EEA countries showed a significantly higher proportion of isolates with decreased sensitivity to ceftriaxone (1.8% vs. 3.5%, p=0.02) than those from EU/EEA countries. In particular, those from the Eastern Mediterranean and non-EU/EEA countries showed significantly higher frequency (1.9% vs. 9.6% and 8.7% respectively, p<0.01) of isolates with decreased sensitivity to ceftriaxone than native patients. Table 5 describes the proportion of isolates with resistant and decreased sensitivity to ceftriaxone NG infection, in patients born in non-EU/EEA countries and in EU/EEA countries.

Table 5. Proportion of isolates with resistant and decreased sensitivity (to ceftriaxone) NG infection, in patients born in non-EU/EEA (n=451) countries and in EU/EEA countries (n=3647), Euro-GASP 2010-2014:

RESISTANT AND WITH DECREASED SENSITIVITY SAMPLES	BORN IN NON-EU/EEA COUNTRIES, No. (%)	BORN IN EU/EEA COUNTRIES, No. (%)	TOTAL, No. (%)	p-value[a]
Ciprofloxacine (n=4088)[b]	223 (49.4)	1796 (49.4)	2019 (49.4)	1.0
Azithromicine (n=4048)	33 (7.5)	268 (7.4)	301 (7.4)	1.0
Cefixime (n=4050)	19 (4.3)	198 (5.5)	217 (5.4)	0.3
Ceftriaxone (n=4098)	0 (0.0)	4 (0.1)	4 (0.1)	1.0
Decreased sensitivity to ceftriaxone (n=4098)	16 (3.5)	67 (1.8)	83 (2.0)	0.02
Penicillinase production (n=3352)	36 (11.8)	261 (8.6)	297 (8.9)	0.07
Resistant and with decreased sensitivity samples(n=4098)	248 (55.0)	1935 (53.1)	2183 (53.3)	0.45

[a]p-value calculated using Pearson χ^2-test or by Fisher's exact test if cell numbers were less than 5;
[b]Number of isolates with known country of birth tested for each antimicrobial

Compared to native patients, foreign born participants with resistant NG infection were younger (82.9% vs. 89.6% were <45 years, p<0.01), presented a higher proportion of rectal NG infection (11% vs. 18.4%, p<0.01), a lower frequency of uro-genital NG infection (83.9% vs. 74.7%, p<0.01), and a higher proportion of NG infection acquired abroad (5.7% vs. 11%, p<0.01). In univariate analysis, foreign born patients with NG infection resistant to at least one antimicrobial were found to be more likely from non-EU/EEA countries (cOR: 4.1, 95% CI 2.3-7.1), from Eastern Mediterranean (cOR: 2.5, CI 95% 1.4-4.2), the heterosexual men community (cOR: 2.3, 95% CI 1.6-3.2), with urogenital infection (cOR: 1.9, 95% CI 1.3-2.8), with negative HIV serology (cOR: 1.7, 95% CI 1.1-2.7), and without previous episodes of NG infection (cOR: 1.7, 95% CI 1.0-2.9). In multivariate analysis, the associations remained significant for being from non-EU/EEA countries (aOR: 3.2, CI 95% 1.8-5.8), from Eastern Mediterranean (aOR: 1.8, CI 95% 1.1-3.3) and heterosexual men (aOR: 1.8, CI 95% 1.2-2.7). In Table 6 the main results are presented.

Table 6. Univariate and multivariate analysis of foreign born patients with resistant NG infection (n=366), Euro-GASP 2010-2014:

EPIDEMIOLOGICAL AND CLINICAL CHARACTERISTICS		RESISTANT SAMPLES OF FOREIGN BORN PATIENTS				
		No. (%)	[a]cOR		[a]aOR	
			(95% CI)	p-value	(95% CI)	p-value[b]
YEAR OF DIAGNOSE (n=704)	2010	31/50 (62.0)	1	0. 21		
	2011	66/143 (46.2)	0.5 (0.2-1.0)	0.05		
	2012	99/183 (54.1)	0.7 (0.3-1.3)	0.32	-	-
	2013	84/173 (48.6)	0.5 (0.3-1.1)	0.09		
	2014	86/155 (55.5)	0.7 (0.3-1.4)	0.41		
AGE (years) (n=701)	<25	96/177 (54.2)	0.7 (0.4-1.4)	0.25		
	25-44	231/461 (50.1)	0.6 (0.3-1.1)	0.40	-	-
	≥45	38/63 (60.3)	1	0.13		
GEOGRAPHICAL ORIGIN (n=704)	EU/EEA[c]	118/253 (46.6)	1	<0.01	1	<0.01
	Non-EU/EEA[c]	72/92 (78.3)	4.1 (2.3-7.1)	<0.01	3.2 (1.8-5.8)	<0.01
	EMR[c]	57/83 (68.7)	2.5 (1.4-4.2)	<0.01	1.8 (1.1-3.3)	0.02
	AMRO[c]	68/174 (39.1)	0.7 (0.4-1.0)	0.12	0.7 (0.5-1.1)	0.21
	AFR[c]	22/55 (40.0)	0.7 (0.4-1.3)	0.37	0.6 (0.3-1.2)	0.17
	SEAR[c]	14/22 (63.6)	2.0 (0.8-4.9)	0.13	1.9 (0.7-5.0)	0.13
	WPR[c]	15/25 (60.0)	1.7 (0.7-3.9)	0.20	1.6 (0.7-3.9)	0.23
SEXUAL ORIENTATION (n=677)	Heterosexual women	29/67 (43.3)	1.0 (0.6-1.7)	<0.01	1.0 (0.6-1.8)	<0.01
	Heterosexual men	158/248 (63.7)	2.3 (1.6-3.2)	0.94	1.8 (1.2-2.7)	0.81
	MSM	155/362 (42.8)	1	<0.01	1	<0.01
SITE OF INFECTION (n=694)	Ano-rectal	66/164 (40.2)	1	<0.01		
	Urogenital	268/469 (57.1)	1.9 (1.3-2.8)	<0.01		-
	Pharingeal	25/61 (41.0)	1.0 (0.5-1.8)	0.92		

HIV STATUS (n=555)	Positive Negative	42/115 (36.5) 223/440 (50.7)	1 1.7 (1.1-2.7)	<0.01	-	-
PREVIOUS GONORREA (n=425)	Yes No	31/68 (45.6) 212/357 (59.4)	1 1.7 (1.0-2.9)	0.03	-	-
PROBABLE COUNTRY OF INFECTION (n=319)	Reporting country Other countries	162/286 (56.6) 20/33 (60.6)	1 1.1 (0.5-2.4)	0.66	-	-

[a]cORc, crude odds ratio; aOR, adjusted odds ratio,

[b]p-value(using Pearson χ^2-test or by Fisher's exact test if cell numbers were less than 5) between total number of isolates from foreign-born and native patients,

[c] Divided into WHO regions: EUR, European Region [28 European Union (EU) countries, three European Economic Area (EEA) countries and 23 non-EU/EEA countries]; EMR, Eastern Mediterranean Region; AMRO, Region of the Americas; AFR, African Region; SEAR, South-East Asia Region; and WPR, Western Pacific Region

Hernando C, Sabidó M, Ronda E, Ortiz-Barreda G CJ. A systematic review of longitudinal cohort studies on the health of migrant populations. Soc Med. 2015;9(2):73–85.

Participation and retention rates presented important differences within the reviewed studies. It was possible to identify some trends:

a) Regarding the population of the study: a study that included foreign born with irregular administrative status obtained the lowest participation (57%) and retention (30%) rates. The studies that included foreign born families reported retention rates from 72% to 95.1%;
b) Within cohorts that carried out medical examinations and analysis of biological samples (n=2), one study reported the participation rate (70%).
c) Regarding the time between the baseline assessment and the first follow up: one study that conducted the first follow up 12 months after the baseline assessment achieved the highest retention rate (95.1%). One study that conducted the first follow up 48 months after the baseline assessment reported a retention rate of 30% (it should be mentioned that this study included foreign born population with irregular administrative status);
d) Regarding the recruitment strategies: the studies that used government records (n=5) obtained the highest participation and retention rates (95.1% and 94.5% respectively). Within those studies that used community strategies, a study that conducted recruitment of participants through *Respondent driven sampling* achieved the highest participation and retention rates, 88.0% and 83.0% respectively;
e) Regarding data collection, studies that conducted face-to-face interviews obtained higher participation and retention rates (91.7%-95%) than those that used online self-administered questionnaires (88-83%);
f) The studies that translated health questionnaires into the native language of the country of origin of the participants obtained participation rates from 91.7% to 88%;
g) It was not possible to identify a clear trend related to the characteristics of the interviewers;
h) Furthermore, using simultaneous and repeatedly different re-contact strategies obtained retention rates from 80% to 83%.

Table 7 summarizes the main results.

Table 7. Participation and retention rate based on the methodological strategies used in cohort studies conducted on foreign born population (n=9):

METHODS		PARTICIPATION RATE (%)	RETENTION RATE (%)
STUDY POPULATION	Recent migrants and regular administrative status (n=4)	58.9	72.0-86.0
	Irregular administrative status (n=1)	57.0	30.0
	Foreign born families (n=4)	20.0 (estimated[a])-70.0	72.0-95.1
TIME FROM BASELINE ASSESSMENT AND FIRST FOLLOW UP WAVE (months)	3 months (n=1)	-	83.0
	6 months (n=1)	-	80.0
	12 months (n=6)	-	49.0-95.1
	24 months (n=1)	-	94.5
	36 months (n=1)	-	72.0
	48 months (n=1)	-	30.0
RECRUITMENT STRATEGY	Government records(n=4)	57.7-95.1	59.8-94.5
	Door to door (n=2)	70.0-91.7	49.0
	Block walking approach (n=1)	57.0	30.0
	Census of inhabitants (n=1)	20.0-30.0	-
	Respondent driven sampling (n=1)	88.0	80.0-83.0
INTERVIEW	Face-to-face interviews (n=7)	57.0- 91.7	30.0-95.0
	On-line self-administered questionnaires (n=2)	20.0-88.0	80.0-83.0 (n=1)
LANGUAGE OF HEALTH QUESTIONNAIRES	Official language of the host country (n=2)	57.0	30.0-83.3
	Official language of the country of origin (n=2)	70.0-91.7	49.0 (n=1)
	Both languages (n=2)	57.7-88.0	80.0-95.1
	>50 languages (n=1)	58.9	72.0-86.0
DATA COLLECTION	Head of household provided information of not found family members (n=2)	58.9-70.0	72.0-86.0
	The mother provided information on all family members (n=1)	57.7-59.8	94.5-95.1
INTERVIEWER PROFILE	Matching of geographical origin (n=3)	20.0 (estimated)-70.0	30.0 (n=1)
	Relatives or friends conducted translation tasks (n=2)	58.9-83.3	72.0-86.0
	Bilingual researchers (n=1)	88.0	80.0-83.0
RE-CONTACT	Phone calls (n=1)	57.0	30.0

	Phone calls, E-mails and post mail letters (for 4 weeks) (n=1)	88.0	80.0-830
MEDICAL EXAMS AND ANALYSIS OF BIOLOGICAL SAMPLES	(n=2)	20.0[a] (estimated)-70.0	-

[a]Oral communication in the Congrés de la Societat Espanyola d'Epidemiologia 2014

Hernando C, Sabidó M, Casabona J. Facilitators and barriers of participation in a longitudinal research on migrant families in Badalona (Spain): a qualitative approach. Heal Soc Care Community. 2017

Main results of this study described the barriers of participation in a cohort health study experienced by the foreign born population residing in our site of study, as well as suggested different strategies with the aim to minimize such barriers. Tables 8, 9 and 10 summarize barriers and facilitators of participation according to the characteristics of the foreign born participants and of the cohort study. Table 11 presents the strategies for minimizing barriers to participation in a cohort health study that were suggested by foreign born participants.

Table 8. Barriers and facilitators of participation in a cohort health study based on geographical origin of foreign born population:

GEOGRAPHICAL ORIGIN	FACILITATORS OF PARTICIPATION	BARRIERS OF PARTICIPATION
LATIN AMERICA	Lack of language barriers	Lack of available time. Especially women who work in domestic service (extended workdays) or women who are heads of mono-parental families
PAKISTAN	Matching of gender and geographical origin between participant and interviewer (+) To facilitate information about the study to the husbands and other family members: providing informative letters into urdu (the official language of Pakistan), using written re-contact methods as msm, E-mail and/or WhatsApp	Language barriers Regarding to the health questionnaires, refusal of questions related to the sexual and reproductive health areas and to the consumption of toxics (alcohol and tobacco)
MOROCCO	Matching of sex and geographical origin between participant and interviewer (+) To facilitate information about the study to the husbands and other family members: providing informative letters into arabic (the official language of Morocco), using written re-contact methods as msm, E-mail and/or WhatsApp	Language barriers Regarding to the health questionnaires, refusal of questions related to the sexual and reproductive health areas and to the consumption of toxics (alcohol and tobacco) Distrust towards to a health study specifically aimed at the foreign born population (-)
CHIINA	To integrate a Chinese participant to the research field team with a relevant hierarchical influence in the local community To conduct the health interview at the same time and place than recruitment (although it limits accessing to the household and to the offspring)	Language barriers Lack of available time Frequent travels to China: the adults for health, family or business reasons; the offspring for improving knowledge of Chinese language and culture, and for building family bonds Refusal to carry out the health interview at the family household (+) Hierarchical relationships (possible selection bias)

(+): in most of cases; (-): in less cases.

Table 9. Facilitators and barriers of participation in a cohort health study based on the stage of the study:

PHASE OF THE STUDY	FACILITATORS OF PARTICIPATION	BARRIERS OF PARTICIPATION
INTRODUCING THE STUDY	To inform exhaustively and comprehensively about the objectives and procedures of the study To facilitate informative letters to the husbands and other family members To avoid requiring long amounts of time and displacement of the participants	Unknowledge of health studies Distrust towards to a health study specifically aimed at the foreign born population (-) Language barriers Lack of available time
RECRUITMENT	Using community strategies Offering financial gratifications (+) Building proximity and confidence bonds To know and respect the cultural values existing in every foreign born population To include the offspring in the study To carry out analysis of biological samples (+) To know the existence of hierarchical relationships, especially in the Chinese community	Unknowledge of health studies Language barriers Lack of available time Distrust towards to a health study specifically aimed at the foreign born population (-) Change of city or country (geographical mobility) Fears to receive financial gratifications (-) To carry out analysis of biological samples (-)
INTERVIEW	To conduct the interview at the hosehold of the participants (+) To guarantee proximity avoiding the displacement of the participants To guarantee privacy and confidenciality (possible difficulties at the households) Matching of sex and geographical origin between participant and interviewer (especially to participants from Pakistan and Morocco) (+) To use digital tablets for conducting the interviews Interview at same time as recruitment (especially for	Refusal to carry out the health interview at the family household (especially in participants originated from China) (-) Matching of sex and geographical origin between participant and interviewer (especially to participants from Pakistan and Morocco): gender and cultural barriers, fear of lack of confidenciality (-) Language barriers Refusal of questions related to the sexual and reproductive health areas and to the consumption of toxics (alcohol and tobacco) (especially in participants originated from Pakistan

	participants from China)	and Morocco)
ANALYSIS OF BIOLOGICAL SAMPLES	To inform exhaustively and comprehensively about the objectives, proceures and final destination of the biological samples To facilitate and expedite the appointment and the extraction time of the samples To carry out the collection of biological samples at the earliest time in the morning To guarantee the proximity of the health centre To facilitate health results and pharmacological treatment To identfy pregnant participants or with cronic diseases	Distrust towards to a health study Distrust and/or unknowledge of healthcare services in the host country (especially in participants originated from China and possibly in those with shorter time of residence) Perception of intrusion in the private life (-) Language barriers Lack of available time Change of city or country (geographical mobility) Believes about the quality and security of the medical exams (higher confidence in hospital settings than in primary care) (-) To carry out frequents medical exams To analyse less frequent and known samples (feaces test and swab of the skin) To match with the celebration of religious rites, as Ramadan Pregnant women (fear to health complications) Cronic diseases (fear to health complications)
RE-CONTACT	To use simultaneously and repeatedly phone calls, msm, E-mail and WhatsApp Using msm messages do not require to have access to or to have the ability of using Internet, also work as reminders of the appointments and allow to inform other family members Using E-mail and WhatsApp also work as reminders of the appointments and allow to inform other family members Schools give a perception of trust and teachers can make reminders	Language barriers Lack of available time Change of city or country (geographical mobility) Using E-mail and WhatsApp require to have access to and to have the ability of using Internet Using post mail letters require fixed address Through the schools facilitate to have access to foreign born population only with schooled children

(+): in most of cases in the studied sample; (-): in a reduced group of cases in the studied sample.

Table 10. Facilitators and barriers of participation in a cohort health study based on socio-demographic characteristics of the population of study:

SOCIO-DEMOGRAPHIC CHARACTERISTICS	FACILITATORS OF PARTICIPATION	BARRIERS OF PARTICIPATION
UNEMPLOYED	More available time Higher interest and acceptance in financial gratifications	Higher re-contact difficulties: higher risk of making a changeof city or country (geographical mobility) looking for labour opportunities, less use of Internet due to financial constraints
WOMEN	-	Lack of available time To avoid those hours dedicated to take care of children and other family members Higher language barriers, especially those sub-groups of women with lower level of studies and/or less labour experience and/or less social network with natives
SHORT TIME OF RESIDENCE (<5 YEARS)	More available time Higher interest and acceptance in financial gratifications	Higher difficulties of identification and recruitment (hidden-population) Higher language barriers
WORKING OR FAMILY RESPONSIBILITIES	-	Lack of available time

Table 11. Facilitators of participation suggested by foreign born population from Pakistan, Morocco, Latin America and China in cohort health studies:

BARRIER OF PARTICIPATION	STRATEGIES TO MINIMIZE BARRIERS
UNKNOWLEDGE AND DISTRUST	To foster relationships of trust by guaranteeing privacy and confidentiality, facilitating proximity, knowing and respecting gender roles that exist in each foreign born community
LACK OF AVAILABLE TIME	To offer time flexibility to carry out the interviews, avoiding those periods of the day when mothers take care of their children or other family members including at night and the weekends To conduct the interviews at the workplace To facilitate that another family member, preferably the mother, will provide health information on those absent family members
LANGUAGE BARRIERS	To match sex and geographical origin and sex of interviewers and participants To use translators and/or mediators Little interest in the translation of the data collection instruments
GENDER AND CULTURAL BARRIERS	Matching of gender, geographical origin and migratory history (first generation) between participants and interviewers
LACK OF PRIVACY AND CONFIDENTIALITY	To prevent the offspring or other relatives from participating in the translation
DISPLACEMENT TO OTHER CITY OR COUNTRY (GEOGRAPHICAL MOBILITY)	Studying families To recruit participants at schools To conduct health data collection through another relative or through on-line Internet platforms and applications
SITE OF THE INTERVIEW	To offer different locations that guarantees seriousness, privacy and confidentiality for conducting the health interviews, as Primary Care Centers and Civic Centers, near to the place of residence of the participants

Hernando C, Gaillardin F, Ferrer L, Cayuela A, Ronda E, Casabona J. Facilitadores de la participación e implementación de la sub-cohorte PELFI de familias inmigradas en Badalona y Santa Coloma de Gramanet. Gac Sanit

Hernando C, Gaillardin F, Ferrer L, Cayuela A, Ronda E, Casabona J. Facilitators of participation and implementation of PELFI Badalona y Santa Coloma de Gramanet cohort on foreign born families. Gac Sanit

In the implementation of PELFI Badalona/SC cohort, 200 foreign born families were interested on participating in the study and facilitated their contacts. Finally, 115 families, 95 were foreign borns and 20 were natives, participated in the baseline of the cohort. Table 12 describes the composition of participating families according to the geographical origin. At least one member of all participanting families completed the health interview. Among them, 26 families also participated in the clinical sub-sample.The lack of desire of participating (60%) was the most freqüent reason to refuse to participate in the cohort.

Table 12. Composition of participating families according to geographical origin, baseline of PELFI Badalona/SC cohort:

	GEOGRAFICAL ORIGIN					
	PAKISTAN No. (%)	**MOROCCO No. (%)**	**LATIN AMERICA No. (%)**	**CHINA No. (%)**	**SPAIN No. (%)**	**TOTAL No. (%)**
PARTICIPATING FAMILIES No. (%)	40 (35.0)	39 (34.0)	11 (9.0)	5 (4.5)	20 (17.5)	115 (100)
FATHERS AND MOTHERS No. (%)	76 (37.5)	66 (32.5)	17 (8.5)	6 (3.0)	38 (18.5)	203 (100)
OFFSPRING >16 YEARS No. (%)	(46.0)	15 (29.0)	5 (9.5)	0 (0.0)	8 (15.5)	52 (100)

At individual level, 203 adults (113 mothers and 90 parents) and 52 offspring >16 years (Table 12) participated in the baseline of the PELFI Badalona/SC cohort. Within the progenitors, 55.7% were women, with an average age of 42 (SD=9.1) and 12.2 years (SD=5.7) as an average time of residence. Foreign born progenitors had lower social class than native ($p<0.05$). Foreign born mothers presented lower level of studies than natives ($p <0.05$). Within the offspring >16 years, 57.7% were men, with an average age of 21 (SD=3.5) and 9.4 years (SD=5.0) as an average time of residence. No children >16 years of the Chinese community participated in the baseline. Table 13 and Table 14 describe the socio-demographic characteristics of progenitors and offspring >16 years of participating families according to geographical origin.

Table 13. Socio-demographic characteristics of the progenitors of participating families according to the geographical origin, baseline of PELFI Badalona/SC cohort:

SOCIO-DEMOGRAPHIC CHARACTERISTICS	GEOGRAPHICAL ORIGIN					
	PAKISTAN No. (%)	MOROCCO No. (%)	LATIN AMERICA No. (%)	CHINA No. (%)	SPAIN No. (%)	TOTAL No. (%)
WOMEN No. (%)	40 (52.6)	39 (59.1)	11 (64.7)	3 (50.0)	20 (52.6)	113 (55.7)
AGE (mean, SD)	42.7 (10.7)	40.5 (8.7)	43.4 (7.5)	43 (4.3)	42.8 (7.1)	42.1 (9.1)
TIME OF RESIDENCE (years) (mean, SD)	9.8 (5.0)	14.6 (6.0)	13.6 (3.0)	12.3 (2.6)	-	12.2 (5.7)
SPANISH NATIONALITY No. (%)	7 (9.2)	23 (34.8)	16 (94.1)	0 (0.0)	-	46 (27.9)
LEVEL OF STUDIES[a]						
PRIMARY OR LESS No. (%)	36 (47.4)	28 (42.4)	4 (23.5)	4 (66.7)	11 (28.9)	83 (40.9)
SECONDARY/PROFESSIONAL TRAINING No. (%)	34 (44.7)	32 (48.5)	9 (52.9)	2 (33.3)	19 (50.0)	96 (47.3)
UNIVERSITY No. (%)	6 (7.9)	6 (9.1)	4 (23.5)	0 (0.0)	8 (21.1)	24 (11.8)
UNDERSTANDING SPANISH SUFFICIENTLY OR CORRECTLY No. (%)	35 (46.1)	51 (77.3)	-	0 (0.0)	-	86 (58.1)
SPEAKING SPANISH SUFFICIENTLY OR CORRECTLY No. (%)	36 (47.4)	51 (77.3)	-	0 (0.0)	-	87 (58.8)
SOCIAL CLASS I, II, III[b] No. (%) (n=129)	6 (14.5)	4 (10.5)	0 (0.0)	0 (0.0)	14 (44.0)	24 (18.6)
SOCIAL CLASS IV No. (%)	28 (68.0)	20 (52.5)	8 (50.0)	1 (50.0)	15 (47.0)	72 (55.8)
SOCIAL CLASS V No. (%)	7 (17.0)	14 (37.0)	8 (50.0)	1 (50.0)	3 (9.0)	33 (25.6)

[a]: level of completed studies;

[b]: I, II, III: non-manual workers; IV: qualified and semi-qualified manual workers; V: no qualified manual workers

Table 14. Socio-demographic characteristics of the offspring >16 years of participating families by the geographical origin, baseline of PELFI Badalona/SC cohort:

SOCIO-DEMOGRAPHIC CHARACTERISTICS	GEOGRAPHICAL ORIGIN				
	PAKISTAN No. (%)	MOROCCO No. (%)	LATIN AMERICA No. (%)	SPAIN No. (%)	TOTAL No. (%)
MEN No. (%)	19 (79.2)	7 (46.5)	2 (40.0)	2 (25.0)	30 (57.7)
AGE (mean, SD)	21.1 (3.2)	20.5 (4.0)	21.0 (4.3)	21.2 (2.8)	21.0 (3.5)
TIME OF RESIDENCE (years) (mean, SD)	7.0 (2.6)	15.4 (5.4)	10.6 (2.6)	-	9.4 (5.0)
SPANISH NATIONALITY No. (%)	2 (8.3)	5 (55.5)	3 (75.0)	-	10 (27.0)
LEVEL OF STUDIES[a]					
PRIMARY OR LESS No. (%)	8 (33.3)	3 (20.0)	0 (0.0)	1 (12.5)	12 (23.0)
SECONDARY/PROFESSIONAL TRAINING No. (%)	16 (66.7)	9 (60.0)	5 (100.0)	7 (87.5)	37 (71.2)
UNIVERSITY No. (%)	0 (0.0)	3 (20.0)	0 (0.0)	0 (0.0)	3 (5.8)
UNDERSTANDING SPANISH SUFFICIENTLY OR CORRECTLY No. (%)	20 (83.3)	9 (100.0)	-	-	29 (88.0)
SPEAKING SPANISH SUFFICIENTLY OR CORRECTLY No. (%)	19 (79.2)	9 (100.0)	-	-	28 (84.8)

[a]: level of completed studies

Cooperation rate of the study was calculated according with the recommendations of the American Association for Public Opinion Research (AAPOR) (197). Within the 200 families that were contacted (after being informed of the objectives and procedures of the study they provided their phone number to be contacted to participate), we considered as participating families ([F], n=115 and n=26 in the interview and in the sub-clinical sample respectively) that family in which at least one member was interviewed. Table 15 summarizes cooperation rate of the study and based on the recruitment strategy and the geographical origin of the participants. We considered as families that refused to participate those families that although initially facilitated their contact, subsequently refused to participate in the interview or clinical sub-sample ([R], n=85 and n=13 in the interview and in the clinical sub-sample respectively).

Table 15. Cooperation rate by recruitment strategy and geographical origin, baseline of PELFI Badalona/SC cohort:

COOPERATION RATE		**% ([F]/[F]+[R])**
BASELINE OF PELFI BADALONA/SC COHORT	HEALTH INTERVIEW	57.5% (115/115+85)
	CLINICAL SUB-SAMPLE	66.6% (26/26+13)
RECRUITMENT STRATEGY[a]	INFORMATION MEETINGS	43.5% (20/46)
	OPPORTUNISTIC RECRUITMENT IN TARGET LOCATIONS	55.5% (46/83)
	SNOWBALL	69% (49/71)
GEOGRAPHICAL ORIGIN[b]	SPAIN	80% (20/25)
	LATIN AMERICA	68.75% (11/16)
	PAKISTAN	60.5% (40/66)
	MOROCCO	48.75% (39/80)
	CHINA	38.5% (5/13)

[a]($[ER_1]=[F_1]/[F_1]+[R_1]) \times 100$)
[b]($[OG_1]=([F_1]/[F_1]+[R_1]) \times 100$)

The first follow up wave was conducted 12 months after the baseline assessment. Only the health interview was conducted. In total, 88 families with 150 progenitors (83 mothers and 67 fathers) and 45 offspring >16 years participated. The overall retention rate was 76.5% (88/115). According to geographical origin, the native families presented the highest retention rate (100%, 20/20). Families originated from Pakistan, Morocco and Latin America presented similar retention rates around 72-77% (72.5%, 29/40; 77%, 30/39; and 73%, 8/11; respectively). The offspring >16 year presented a retention rate of 86.5%, higher than the retention rate of their parents, 73.9%. Table 16 summarizes the retention rate of the first follow up and by the geographical origin of participants.

Table 16. Retention rate of the study and by geographical origin, first follow up wave of PELFI Badalona/SC cohort:

RETENTION RATE		**% ([F]/[F]+[R])**
FIRST FOLLOW UP OF PELFI BADALONA/SC COHORT	GLOBAL	76.5% (88/115)
	PROGENITORS	73.9% (150/203)
	OFFSPRING >16 YEARS	86.5% (45/52)
GEOGRAPHICAL ORIGIN	SPAIN	100% (20/20)
	LATIN AMERICA	73% (8/11)
	PAKISTAN	72.5% (29/40)
	MOROCCO	77% (30/39)
	CHINA	20% (1/5)

DISCUSSION

In Spain, the implementation of the SMH in 2011 within the Consortium of Biomedical Research of Epidemiology and Public Health (CIBERESP), reflected the relevance of the health status of foreign born population for Public Health and epidemiological research. The SMH develops its research activities through the participation and cross sectional coordination of research groups across the Spanish territory, each of them with expertise on different areas of health and health research (health inequities, labour health, accessibility to health services, cancer prevention, nutrition, mental health, HIV/AIDS infection and STIs, parasitic diseases and imported mycoses, tuberculosis –TB-, and epidemiology of hepatitis virus). The first research activity performed in the SMH was a *scoping review* of studies carried out in Spain in foreign born population published from 1998 to 2012, aimed to be aware of the bibliography published so far and the possible existing gaps of knowledge (14) in the health areas included in the SMH. Conducting the study lead to the establishment of collaborative relationships within research groups, to carry out a comprehensive study on what had been done on health research of foreign born population in Spain until that moment, and to identify existing gaps of knowledge. In this period, I worked as Project Manager of the SMH and was part of the research group number 43 of the DAPET program of CIBERESP. Due to these different roles, we participated in the coordination tasks during the *scoping review* and in the elaboration of the review of articles on HIV and other STIs that was included in the monograph. Coordination tasks consisted of supporting bibliographic research and the different research groups during the study, resolution of doubts, re-distribution of articles included according to the area of expertise of the groups, and presentation of the work carried out to publishers of different scientific journals in order to evaluate their publication. We have decided to include the published monograph as a complementary publication in this thesis, although it is a collaborative work in which several authors participated, because the main results of the *scoping review* will help us to better describe and locate the context in which our research work in this thesis was carried out, particularly at the beginning, and provide relevant information in this regard.

Main results of the *scoping review* showed differences in the state of health of Spanish foreign born population compared to natives, with differences by gender, age, geographical origin and the studied

disease. Foreign born population is exposed to lower socio-economic status than natives and, despite a lower prevalence of chronic diseases, it appears to experience more mental health problems and worse self-rated health, especially in women and with longer stay (36). In the area of occupational health, main results identified a higher incidence of injury accidents, a lower rates of disability, a higher prevalence of work presenteeism, exposure to psychosocial factors, and precariousness of working conditions within foreign born workers. This situation was similar to the one that it was described by studies from European countries such as Germany, United Kingdom and Belgium; United States and Australia, where migration began in 1960s. It is worth to notice that a lower presenteeism and a higher sick leaves were associated with length of residence in Spain, and it was identified the need for increasing education of foreign born workers in prevention risks and working rights (207). In the field of mental health, the migration process and working and psychosocial factors were identified as risk factors for mental health within foreign born population. Within this population, worse mental health was found within women, those with lower socio-economic level, separated or divorced, or from developing countries who were unemployed and with less social support. Other risk factors for mental disorders were being a young woman, an economic migrant, the substance abuse (tobacco and alcohol), having a chronic illness, and the perceived discrimination within foreign born workers. Foreign born from Morocco presented a higher distrust and language and cultural barriers, difficulting their access to health care services. Near 50% of foreign born patients left the treatment with tricyclic antidepressants treatment before than two months. It was identified the probable infradiagnose of depression and anxiety within foreign born population, indicating the need for cultural adaptation of the scales used with diagnosis purposes (208). Regarding diet, physical activity and other cardiometabolic risk factors, it was found a higher proportion of obesity within foreign born than in natives, regardless of the length of residence in Spain. Foreign born consumed less tobacco and alcohol but also did less physical activity than natives (209). In the area of prevention of cancer, foreign born population had a lower participation in early detection of breast and cervical cancer. Related to breast cancer, foreign born women had less knowledge about the benefits of screening (55.7%), a less frequent positive attitude (72.6%), perceived themselves as more vulnerable, identified more barriers (23.7%) and less benefits of screening (77.3%) than native women. Most of the studies identified less participation of the foreign population at the time of cytology with respect to the native population,

and African women were less likely to have a mammogram than native women (108,210). Within female sex workers, those from north Africa presented a higher prevalence of high-risk human papilomavirus infection (65%) than natives (near 30%) (210). Related to infectious diseases, in 2008, the 20-40% of new TB diagnoses in Spain were in foreign born patients (211). In 2012 in Barcelona, 32% of the TB cases were within foreign born patients, most of them were from Latin America (32.4%), particularly Bolivia, Equator and Peru; and from Asia (31%), particularly from Pakistan. Foreign born patients with TB were younger and presented a significant higher proportion of drug resistance (7% presented resistance to isoniazid) than native patients (3.8%). The higher proportion of drug resistance within foreign born patients was due to the uneffective TB control programs existing in their countries of origin (212). Regarding drug resistant TB within foreign born population, different studies showed a higher proportion (2.5-4 times more frequent) of multi-drug resistant TB (MDR TB) strains in this population than in natives, and in 2007, proportion of foreign born patients with MDR TB achieved 70%. The highest proportions were seen in foreign born patients from South America (39.4%), particularly from Equator; and from Eastern Europe (30.2%), particularly Romania. Influence of imported MDR TB strains on local transmission was scarce (211), while transmission from native to foreign born population was identified (213). Studies on molecular epidemiology indicated that migration contributes to modify the types and genotypes of circulating pathogens in Spain, at least for TB and HIV cases, which can lead to changes in treatment patterns, morbidity, and in the frequency of resistance mutations (213). Main results of the review on HIV and other STIs studies are described later. Regarding hepatitis infection, higher prevalence of HBV infection were found in those from Eastern Europe, Asia and sub-Saharan Africa; and of HCV infection in those from Africa and Eastern Europe than in natives; which are geographical areas that present higher prevalences of hepatitis B and C infections than the general population in Spain. Foreign born from Latin America presented lower proportions than native patients. Foreign born from geographical areas with high prevalence of chronic HBV and HCV should be considered a priority intervention and monitoring population group (214). Within the small number of studies on NG infection, 28% of cases of NG infection were within foreign born patients, 17% of them were from Latin America and 10% from Central Europe, which are geographical areas with high resistance to macrolides (30%) and cephalosporins (20%). In Europe, the genotype associated with resistance to azithromycin and ceftriaxone is G1407. In 13 countries,

including Spain, it is also the most prevalent genotype. In Spain, two cases of *N. gonorrhoeae* resistant to broad-spectrum cephalosporin have been described belonging to the G1407 genotype (158). It was highlighted that the high spread of a multi-resistant clone in Europe, including Spain, is a very worrying finding that requires the implementation of surveillance measures due to the existing risk of untreatable NG infection (211). In the field of imported parasitic diseases, the most frequent were intestinal parasitosis, malaria, Chagas disease and filariasis. The Chagas disease is considered the most important emergent disease in Spain for the last decades, due to the important proportion of Latin America foreign born with this pathology and to the several cases of congenital Chagas disease due to mother-to-child transmission that have been registered in Spain. Within Latin America patients who were attended to referral units of tropical medicine or migrant health, 6.5-31% were affected by the Chagas disease. Most of the patients were women (54-78.2%), 30-40 years old and from rural areas of Bolivia (60-97% of the cases), followed by Paraguay, Argentina, Equator, Peru and Brazil. Mother to child transmission of Chagas disease is challenging: in 2014, when the article was published, only three Autonomous Communities in Spain had mother to child transmission prevention programs (215). Regarding accessing barriers to healthcare services, no differences were seen in the use of primary care between general foreign born and native population, although those foreign born from Eastern Europe, Africa and Asia presented a lower accessing to primary healthcare services. In line with international findings, foreign born patients showed less use of specialized care than native, probably related to the existence of socio-economic accessing barriers, which were also identified within natives; as well as a higher use of emergency care than natives, possibly due to accessing barriers related to the organization of healthcare services, such as office hours incompatible with the working hours of foreign born workers. Differences by geographical origin and the region of Spain were found. The limited provision of information and the requirements for adquisition of the personal health card were identified as accessing barriers to healthcare services (108).

One of the objectives of the *scooping review* was identify the existence of gaps of knowledge on health research in Spain. Within the reviewed studies, a limited proportion disaggregated data on by geographical origin, and those studies that did it used different criteria, such as country of birth vs. nationality, and heterogeneous geographic areas such as high vs. low income countries, continents or subcontinents (108). International literature points to the importance of analyzing the foreign born

population in a disaggregated way, due to the high heterogenicity of this population (54). The specific countries of origin that were specified were mostly Latin American countries, such as Equator, Colombia, Bolivia, Paraguay, Peru; followed by African countries such as Equatorial Guinea, Algeria and Morocco. Participants from Romania were also studied. Within the reviewed studies on HIV/STIs, the most frequent geographical origin of foreign born patients was Latin America (n=20 studies, 48.8%) followed by sub-Saharan Africa (n=19 studies, 46.3%). More than one third (n=15, 36.6%) of the studies included participants from Asia, although using small samples. Other geographical origins such as Morocco, Romania, Pakistan and China were less studied. Language and socio-cultural proximity, higher level of studies, especially secondary studies, and the frequent longer time of residence of foreign born from Latin America compared to other geographical origins that arrived later, such as Romanians, can explain, at least partially, these differences. Foreign born with irregular administrative status, who are considered a "hard-to-reach" population had been poorly studied (n=49, 15.9%). Most of the studies did not refer to the economic income nor the labour status of the participants, thus limiting the ability of the studies to conducting stratified analysis according to socio-economic levels. Frequently, the generalization of the results to the entire population was not possible, due to the use of convenience samples, which are not representative of the entire foreign born population nor of the different geographical origins. Overall, the articles included in the monograph noticed infra-representation of sub-groups of foreign born population, such as certain geographical origins such as Asia, children, pregnant women and female sex workers, and lack of available data in the respective areas of knowledge. Furthermore, keeping in mind that, in Spain, the migratory phenomenon was characterized by an exponential increase of foreign born population within a short time, with a high degree of socio-demographic and cultural diversity (10); the volume, characteristics and scope of the research that was conducted during these first years appears to be limited for providing an adequate knowledge and evidence of the health status of this population in Spain (10). The results of the *scoping review* showed a decrease of the number of published articles from 2009 onwards. This decline may be related to the impact of the economic crisis on health research, by means of a decrease of the research budget in general, and particularly for studies on foreign born population, as well as the need of local researchers to move to foreign countries. Also, it was remarkable the small number of studies that used qualitative methodology (n=15, 4.8%). The main objective of qualitative methodology is to

improve knowledge on desires, feelings, beliefs and meanings of the subjects and the community (216). Thus, qualitative methodology is most probably an essential tool for studying the recent and highly diverse changes that Spanish society is experiencing related to the migratory phenomenon (10). At European level it has been described that many issues have only been studied in certain countries, and research is hampered by the lack of available data, leading to an important shortage of information on the state of health of migrants in many countries. Overall, health risks and health needs of foreign populations are poorly understood, and there are significant gaps in knowledge related to their responses to interventions and ways to adapt the healthcare services to their health needs (90). Health services have the challenge of adapting to the new social reality and offering the adequate responses, but often lack the tools that are needed to engage migrant populations in health promotion, education, prevention and treatment services (5,12). It has been requested to have more epidemiological research data available with the aim to adequate health services to migrants' health needs, to design effective prevention and clinical management strategies, and to directly inform clinical practice and policy-makers to be able to tackle the existing health inequities between migrants and natives (4,191).

Within the studies included in the *scoping review*, the most frequent definition of foreign born population that had been used was based on the country of birth of the participants (71% of articles). Globally, the most frequent definitions of foreign born population used in health research are based on country of birth and nationality. Currently, the lack of a consensual definition of foreign born population at estate and international levels facilitates that heterogeneous definitions will be used by different registries and institutions, with important implications for health research (1,87). For example, international organisations such as ECDC and WHO identify foreign born population according to the country of birth (2,3), but European HIV/AIDS surveillance systems define them according to the nationality (217). In the studies included in this doctoral thesis, we defined foreign born population according to the country of birth. However, both definitions, country of birth and nationality, present several limitations. Both definitions fail to identify second generations of foreign born in census of inhabitants and other official records. In our country, all who were born in Spain have

Spanish nationality and will be identified as natives according to both the country of birth and nationality. Currently, offspring of those foreign born who immigrated constitute an important proportion of young population in Spain (67). In the long term, the ability of the host society to include this population will be an essential factor for determining the social cohesion in the host country (67). For these reasons, it is essential to improve knowledge and monitor the evolution of the health status of this sub-group of foreign born population. Reflecting such importance, the cohort studies on going in Europe, the HELIUS Cohort in Holland (37) and the National German Cohort in Germany (38), include different generations of the same families in the studies. Facilitating the identification of this sub-group of foreign born population in health, population and government registries constitutes a gap that until now has not been addressed by the official institutions, and remains a challenge for health research on foreign born population. Furthermore, using a definition based on the country of birth does not reflect the high diversity of the migrated population residing in different European countries, nor the time of residence in the host country, or the previous residence in other host countries (62). Researchers and institutions have claimed that it is necessary to define and standardize a consensual definition of foreign born population at national, state and international levels (15). Due to the high diversity of foreign born population, recently, in the field of STIs, it has been suggested to establish the collection of a set of socio-demographic variables, in order to draw a framework in which to monitor the state of health of foreign born population. These variables are country of birth, administrative status, year of arrival, time of residence, type of transmission, poverty, level of studies, work status, gender and age (62). However, expecting that the collection of such variables in some cases may be not feasible, we consider that the essential variable to be collected could be gender, age, country of birth and year of arrival. Where possible, it is worthwhile to collect information on economic income.

Main results of our review of articles on HIV/STIs showed that HIV epidemics within the Spanish foreign born population present a complex scenario. Compared to native HIV patients, foreign born HIV patients were younger, had less knowledge of HIV infection and presented higher proportion of cases within women. Specific sub-groups of foreign born population, as MSM from Latin America, heterosexual men and women from sub-Saharan Africa, transvestite men and transgender sex workers from Latin America, and foreign born pregnant women, especially those originated from sub-Saharan Africa, presented higher prevalence of HIV infection than native patients. It is also remarkable that

men and women from sub-Saharan Africa presented an increase in the frequency of resistances to the ARV treatment, and this increase was higher within women. Related to proportions of STIs, sub-groups of foreign born participants, such as pregnant women, especially those from Latin America and Eastern Europe, female sex workers, and transvestite and transgender men sex workers from Latin America presented higher prevalence of HBV, syphilis and gonorrhoea.

Even though European data from the last years showed that the most frequent geographical origin of foreign born HIV patients was sub-Saharan Africa (54.3%) (2,139), current data from Europe, Spain and Catalonia shows that the epidemic of the HIV infection is focused on MSM, especially on MSM from Latin America (92,139). It is known that foreign born population has higher HIV infection prevention needs than natives (92), and that, in particular, Latin MSM are especially vulnerable to HIV infection in the host country (137).

According with European data, MSM have an increased risk of HIV, STI, and hepatitis infection (218). Foreign born MSM presented a higher level of high-risk sexual behaviour associated with transmission than native MSM such as condomless anal intercourse, multiple sexual partnerships, rougher sex, especially under the influence of drugs and alcohol ('chemsex') (92,218). Moreover, homosexuality remains highly stigmatized in many countries (218). In Spain, the high prevalence of HIV infection presented by Latin population is attributed to the presence and interaction of different factors such as: a) social determinants as travel conditions, uprooting, stigmatization, lack of social and family support, job insecurity, and legal difficulties that affect this group during the migratory process and in the host country; b) the existence among a part of the Latin population that belong to high-risk groups with a large percent of HIV infection in the country of origin as MSM; and c) the lower barriers to access to health services due to the lack of language and cultural barriers, the higher level of studies, and the longer time of residence that, in general, the Latin population presents compared to other geographical origins. Also, it has been described that as they perceive themselves as being at high risk for HIV, they are more likely to have ever been tested for HIV than the native-born MSM (219,220). MSM are a hard-to-reach group for delivering effective and sustained health education and prevention

communication (218). Related to communication interventions target at this sub-group, it is recommended that they are supported by current data and evidence, adapted to the local context, able to respond to evolving needs and preferences in the target group, and followed by a monitoring and evaluation plan. To ensure greater effectiveness, prevention messages need to be as concise and simple as possible, they have to be repeated, redesigned and repackaged, combined with a 'call to action', they have to use suitable terminology, and a style and imagery adapted to the context (218).

Studies included in the review showed an increase of the proportion (40-70%) of foreign born patients among new HIV diagnoses in adults and children. In 2014, at European level, 31% of new HIV diagnoses were foreign born patients, and among them, 22% originated from outside the European Region. The most frequent geographical origin was sub-Saharan Africa, but its proportion has decreased, especially among women (137); with an increase of the proportion of patients from other European countries, Latin America, Asia and the Middle East. In these cases, most of the new diagnoses were within MSM (137). The combination of various factors have been suggested to explain the high proportion of foreign born patients among the new HIV diagnoses, as the high proportion of foreign born from countries with endemic HIV infection, the stabilization or decline of the incidence of HIV infection within native population in some countries, and the stabilization or slight increase in the absolute number of cases of HIV infection within foreign born (1). In Spain, according to data from 2016, 33.6% of new HIV diagnoses were in foreign born patients. Within them, proportion of women was higher (57.9%) than in natives, and the most frequent geographical origin was Latin America (16.6% of the total of new HIV diagnoses). In Spain, it is considered that the increase or stability of new HIV diagnoses within foreign born population, especially among those coming from areas with high prevalence of HIV infection; the control of the transmission in IDU; and the control of the vertical transmission of the HIV infection within native population can explain the high proportion of foreign born cases among the new HIV diagnoses. It is worth to note that there is growing evidence to suggest that a significant proportion of migrants who are HIV positive, including those who originate from countries of high HIV prevalence, acquire infection after they have arrived in Europe (31,57,58). This has important implications for those HIV prevention programmes that are focused on pre-arrival risks (87).

Both populations, foreign born and native HIV patients, presented high frequencies (43% and 34.6% respectively) of late diagnosis (CD4+ count <350 cells/mm^3 or AIDS), in line with data at European level, that also shows that foreign born are more likely to be diagnosed later in their HIV infections (2,87). Possibly, at least in part, such high proportion of late diagnosis are related to the perception of risk, prevention and stigma of the HIV infection within the general Spanish population that contribute to maintain such high proportions. HIV patients from sub-Saharan Africa presented a higher proportion of late diagnosis than native patients (41% vs. 36.7% and 41% vs. 30%). Among foreign born patients, men and women from sub-Saharan Africa, male and female sex workers and MSM presented the highest risk. Several studies conducted in Europe, Spain and Catalonia considered being a foreign born as a risk factor for late diagnosis (92,137,221). Lower knowledge of the HIV infection, together with higher language barriers and higher stigma of the HIV infection in the case of those originating from sub-Saharan Africa, as well as the lower utilization of public health services in the case of male and female sex workers and MSM, may explain the higher vulnerability of these sub-groups of foreign born population. Stigma and limited access to care appear to be primary drivers of poor HIV outcomes among migrants in high-income countries (222). Regarding stigma, high levels of HIV-related stigma have been identified within those who were older (223) and with long time of residence (12.5 median years) (224).

Most of the reviewed studies that compared foreign born to native patients did not report differences in the clinical or immune situation at the time of diagnosis, in the proportion of patients who started ARV treatment at the time of diagnosis, in the late initiation of ARV treatment, or in mortality rates. These data suggest that if foreign born patients are successfully adhered into the healthcare system, clinical assistance is successful (14,92,177). On the contrary, data at European level reported worse health conditions within foreign born HIV patients, especially those from Latin America, North Africa and the Middle East (124), and worse prognostic indicators as lower CD4+ count at the time of diagnosis (302 cells/mm^3 vs 379 cells/mm^3), and a higher proportion of late diagnosis (37% vs. 44-55%) (2). These differences are considered, at least partly, to be due to the existence of barriers to access to the healthcare services that foreign born population experience in many European countries, resulting from the lack of capacity to respond to the specific needs of this population (225,226). It is known that

the existence of barriers to access to prevention programs and to ARV treatment services within foreign born population contributes to the increase of the prevalence of HIV infection in this population (227). This is a clear indication that it is indispensable to maintain universal access of foreign born population to the public health system (178).

Regarding gaps of knowledge on HIV/STIs among Spanish foreign born population, prevalence of hidden HIV infection was poorly studied (one study reported higher proportion in foreign born men (0.61%) than in natives). In Europe it has been described a very low risk of transmitting communicable diseases from the foreign born population to the host population, while there is increasing evidence that a significant proportion of foreign born HIV positive acquire the infection after they have arrived in the European Region (2,87). Currently, MSM foreign born is the sub-group at a higher risk for post-migration transmission, due to the frequently stigma associated with homosexuality that may impact upon their sexual knowledge and behaviours (134). However, many countries may be under-estimating the degree to which this is occurring (134). In the *scooping review* no articles studying the proportion of HIV infection acquired in the host country were identified.

In our research aimed at improving the knowledge of the health status of the foreign born population, we conducted a study of antimicrobial resistances of NG infection using data collected by Euro-GASP. Currently, there are fewer studies on surveillance systems which limit an understanding of the total impact of migration on European infectious disease epidemiology (87). Currently there is not evidence of high rates of transmission of AMR from the foreign born to the host population (87). However, rates of AMR are rising globally and there is concern that increased displacement and migration might contribute to the burden of AMR in Europe. Although surveillance for AMR in the WHO European Region is among the most advanced in the world, there are limited data available on the role of displacement and migration on the burden in Europe. Careful surveillance of the onset of antimicrobial resistances of NG infection is essential (21,113,228) to monitor the emergence and dissemination of resistant NG (229), to optimize antimicrobial treatment (19,21,22), update national treatment guidelines (19,152) and guide interventions in public health (112,142). In the EU/EEA, dual treatment with a single 250 mg dose of ceftriaxone intramuscular and 1 gram of azithromycin oral route (152), is

recommended to treat empirically uncomplicated NG infection with the aim of slowing the development and dissemination of antimicrobial resistances (16,18,19).

According to European data, in the last few years, a decrease of resistances to cefixime has been reported, with a downward trend observed throughout Europe since 2010 (228) and in other regions around the world, suggesting an improvement of the sensitivity levels of NG to cefixime at global level (19,145,230,231). Currently, it appears to remain stable at around 2%. The proportion of resistances to ciprofloxacin and penicillin G remain high; and to azithromycin remain high and stable between 7-8% (150). On the contrary, cases of resistance to ceftriaxone have been extremely rare (16–18,22,148–151). Currently, it is considered that the development of antimicrobial resistances to ceftriaxone and the emergence of untreatable NG, especially in environments where dual antimicrobial treatment is not available, is a real threat (232). Further research is required to identify and test new alternatives to ceftriaxone for the treatment of NG infection. Currently, the research on therapies for treating NG infection focuses on known antimicrobials such as gentamicin, which is considered it is not appropriate as first-line treatment for NG infection but remains potentially useful for patients with isolated genital infection, or who are allergic or intolerant to ceftriaxone, or harbour a ceftriaxone-resistant isolate (233,234); new antimicrobials, as solthomycin, a fourth generation macrolide (235); and on the developing of an effective vaccine (236).

In our study, foreign born patients presented similar proportions ($p>0.05$) of resistance to azithromycin (7.2% vs. 7.5%), ciprofloxacin (46.3% vs. 50.0%) and a decreased sensitivity to ceftriaxone (2.8% vs. 1.9%); lower proportion of resistance to cefixime (3.6% vs. 5.7%, $p=0.02$); and higher frequency of samples that produced penicillinase (11.7% vs. 8.4%, $p=0.02$) than native patients. Historically, most resistant NG strains have emerged in the Western Pacific Region, spreading afterwards around the world (17,18). Recently, first cases of NG infection resistant to ceftriaxone have been notified in Canada (237,238), and Singapore (239), as well as a rapid increase in the proportion of decreased susceptibility to azithromycin in United States (240), suggesting international spread NG strains associated with high-level ceftriaxone resistance (238). In order to explain the emergence of antimicrobial resistances in this geographical area, different factors have been described concerning the high proportions of NG infection (the highest incidence of NG infection around the world) (152),the

lack of effective infection control measures, the wide use and misuse of antimicrobials and the lack of an optimal surveillance system for monitoring antimicrobial resistances and cases of treatment failure (241,242). It is considered that mobile populations have significantly contributed to the international dissemination of resistant NG, being currently considered key to control resistant NG by WHO (2,17,21,22,95). Specifically, international travellers, sexual tourists, long-distance truck drivers and forced migration play an important role in the dissemination of resistant NG (2,21,22,243). Recently, two of the first three notified cases of NG that presented combined resistance to ceftriaxone and high levels of resistance to azithromycin were international male travellers who had sex with people residing in South East Asia, notified in England (n=1) and in Australia (n=2) (155,156). In Europe, data on imported resistant NG as well as on distribution and prevalence of strains of NG with reduced sensitivity to ceftriaxone is scarce (244). Recent data from Euro-GASP indicate that, globally, most resistant NG infections (94%) were likely to be acquired in the reporting country (228). However, in our study, higher proportion of foreign born patients presented a foreign country as the probable source of infection (11% vs. 5.7%, $p < 0.01$). Another sub-group of European foreign born population that can be especially vulnerable to resistant NG are those foreign born who travel to the country of origin to visit friends and relatives, especially if they travel to geographical areas with high incidences of NG and with a high risk of emergency of resistant NG strains.

Although all samples from foreign born patients were sensitive to ceftriaxone, those originated from outside the EU/EEA showed higher frequency of decreased susceptibility to ceftriaxone (3.5% vs. 1.8 %, $p=0.02$) compared to those born in the EU/EEA. Particularly, those patients originated from the Eastern Mediterranean region and non-EU/EEA European countries presented proportions of decreased sensitivity to ceftriaxone significantly higher (9.6% and 8.7% vs. 1.9%, respectively, $p<0.01$) than native patients. This data suggests that the importation of NG strains with decreased sensitivity to ceftriaxone from Eastern Mediterranean Region and non-EU/EEA European countries may currently have an important weight in the EU/EEA. Regarding imported NG strains, it has been described that being resistant to the antimicrobial treatment, forming mixed infections with the local NG strain or the occurrence of frequent importation events are factors that increase the probability of persistence of imported NG strains (245).

During the last two decades, most non-EU/EEA countries and different countries in the Eastern Europe have notified higher incidence of levels of NG infection than those notified by EU/EEA countries. In particular Russia (incidence of 42.0 in 2010), Belarus (36.2 in 2010) and the Republic of Moldova (35.9 in 2010) presented the highest incidences (http://data.euro.who.int/cisid) (232).In non-EU/EEA countries, reliable data on the incidence of NG is limited and possibly underestimated (246,247). From our knowledge, there is no available recently published data on the region of the Eastern Mediterranean. In many non-EU/EEA countries one finds a combination of factors that predispose to the emergence and rapid national and international dissemination of antimicrobial resistant NG, as a relatively high proportion of NG infection, suboptimal laboratory diagnostics, lack of gonococcal culture, suboptimal laboratory tests and reagents, scarce surveillance of both gonorrhoea cases and gonococcal AMR, and misuse of antimicrobials of uncertain quality and origin without prescription from a physician (151,232,246,247). Regarding lack of gonococcal culture, is worth to note that nucleic acid amplification testing (NAAT) has become the preferred method for detecting NG, thus resulting in a decline in the number of cultures available for antimicrobial susceptibility testing. In contrast to culture, NAAT is highly sensitive and non invasive specimens such as first-void urine can be used, which allows testing in remote areas where time-to-culture from collection is lengthy. Despite the advantages of NAAT, culture is still required for antibiotic susceptibility testing. Current guidelines recommend culture in cases of suspected treatment failure or AMR, for example in a case of a sexual contact with an individual from a country with high prevalence of AMR or use of an alternative treatment regimen (237). Due to all this, and given the important flows of population originating from countries not belonging to the EU/EEA migrating to the European Region, it is currently considered that there is a high risk of emergency and rapid spread of resistant NG from these countries to the European Region (148). Important efforts have been made to improve this situation, as the national program GASP in Russia implemented in 2004 (RU-GASP), the surveillance program of resistant NG in countries of the former Soviet Union, and the publication of quality surveillance data provided by specific countries as Belarus and Kyrgyzstan (148,149). Thus, it is imperative to implement a surveillance program of resistant NG (GASP) in the areas of Eastern Europe and Central Asia (151,246,247).

In our study, foreign born patients were younger than natives (89.6% vs. 82.9% were <45 years, p<0.01). Within foreign born patients, heterosexual men (aOR: 1.8, 95% CI 1.2-2.7) showed a higher risk of resistant NG to at least one antimicrobial. These results are in line with recent data from Euro-GASP, where geometric means were higher for both cefixime and ceftriaxone MICs for heterosexual males compared to MSM (p<0.001) and females (cefixime: p=0.014, ceftriaxone: p=0.025) (248). In England and Wales, a higher rate of decreased susceptibility to ceftriaxone was notified within MSM compared to heterosexual males (249). Data from England and Wales also indicated that older heterosexual men (particularly those ≥35 years old), with rapid partner turnover and with a history of sex abroad, were at greater risk of NG infection with decreased sensitivity to ceftriaxone (in this case, defined as MIC≥0.015 mg/L) (249). These data suggest the emergence of NG strains with MIC "more sensitive" and "less sensitive" to ceftriaxone in Europe, especially within heterosexual men over 25 years of age (248). However, it is important to remember that the emergence and spread of antimicrobial resistant NG can be an extremely dynamic phenomenon and may change from one type of transmission to another very quickly, presenting clusters with specific epidemiological characteristics at local level (250). Results of the study show that geographical origin and sexual orientation of patients with gonorrhoea can have an important role in the international dissemination of antimicrobial resistant NG strains. With the aim of preventing the spread of resistant NG, it is necessary to improve surveillance systems of NG and closely monitor treatment failures in order to adequately inform local, national and international treatment guidelines. It is essential to provide Euro-GASP with the technical and human resources that are needed in order to improve the representativeness of its data, by increasing the number of participating countries and analysed samples, facilitating and promoting the realization of cultures, and improving the information of the epidemiological data reported, especially data related to the country of birth, the probable country of infection and sexual orientation (150). Given the high heterogeneity of the foreign born population, it is necessary to carry out more specific studies to improve knowledge of sexual behaviour and sexual networks in this population, and thus better understand the role of population flows in the spreading of antimicrobial resistant NG.

The second part of the research included in this thesis was focused on barriers of participation to cohort health studies in foreign born population residing in our study location and on the

implementation of the PELFI Badalona/SC cohort. Within foreign born population, time of residence is considered an essential health determinant (34). Thus, longitudinal design is ideal to monitor the evolution of health determinants and health status of the foreign born population as residence time increases in the host country. Both nationally and internationally, it is important to remember that the number of longitudinal health studies carried out on foreign born population is small (47,189). In the *scoping review* carried out by SMH, only 28% of the studies used longitudinal design. Most of them were cohorts of general population (176), or clinical longitudinal studies as CORIS cohort (177) and PISCIS cohort (178), in which foreign born participants constituted a small percentage of the total population of study. Currently, as a result of the high interest and relevance of longitudinal design for studying foreign born health, in Europe there are two ongoing cohort studies specifically designed for studying foreign born population: the HELIUS Cohort in Holland (37) and the National German Cohort in Germany (38). Longitudinal studies present significant logistical and financial challenges (251,252). In addition, longitudinal studies on foreign born population reported lower participation and retention rates than in natives (253). A wide range of factors have been described within foreign born population that can explain these differences, such as distrust in research and government institutions, lack of interest, personal benefit or knowledge about health research, intrusive perception of survey questions, issues of confidentiality and racial profiling, economic and time constraints, and transportation and mobility issues. The combination of these factors makes identification, participation and re-contacting more difficult than for native population, and collaborates to maintain migrant populations under-represented and excluded in health research (5,40,41,43,188). Thus, identifying and minimizing participation barriers for foreign born population will facilitate the improvement of indicators of participation, which is essential for successfully conducting longitudinal health research on this population. From our knowledge, there is no information available on barriers of participation of Spanish foreign born. In order to better understand existing barriers of participation in longitudinal studies, we first conducted a systematic review of longitudinal studies designed specifically for foreign born population, followed by a qualitative study with participants from Pakistan, Morocco, Latin America and China residing in Badalona and Santa Coloma de Gramanet, aimed to identify barriers of participation in our study location. The main results of our study contributed to minimize participation

barriers in the implementation of PELFI Badalona/SC cohort, facilitating recruitment, data collection and contacting participants for a follow-up.

Although there are limitations in comparing studies with different objectives, methods and population being studied, the systematic review of longitudinal studies (47) allowed the identification of factors and trends that can influence participation and retention rates of foreign born population in cohort studies. Earlier studies tended to study a single health condition or risk exposure, included single participants, without medical exams nor the collection of biological samples, with a limited duration (two years was the most frequent duration) and one or two follow-ups. On the other hand, the cohort studies carried out more recently and those that are currently underway in Europe studied several health areas, included different generations of the same family, conducted medical exams and analysed biological samples, and had an unlimited duration with an undetermined number of follow-ups. Regarding inclusion of foreign born families, the reviewed cohorts considered different "family" definitions and used different recruitment strategies: vises were used to identify main applicants and their spouses; a record of school children allowed the identification of first-degree relatives of the students; and a census of inhabitants was used to identify different generations of the same family. Furthermore, a study that conducted recruitment community strategies included all family members who lived in the same household. The cohorts that included families reported a higher participation and retention rates than a cohort that included single participants with an irregular administrative situation, which reported the lowest participation rates. The perception of the seriousness of the risk exposure or of the studied health condition also played an important role in participation. Regarding data collection, cohorts that conducted face-to-face interviews and made efforts to minimize language barriers had higher participation rates than those that used self-administered questionnaires. In relation to the interviews, using friends or relatives in order to minimize language barriers or allowing a participant, as the mother of the participant family, to provide health information of other family members, facilitated data collection and increased retention rate, as well as reduced the budget of the study. However, one cannot discard the possibility that these strategies may facilitate the presentation of biased information: participation of relatives and/or friends in the interview may threaten confidentiality and privacy, thus decreasing the reliability of the collected information; and memory

bias: a mother that provides health information on her offspring may more easily remember and report certain health events that she considered as negative (186). On the other hand, collecting health information through official records and databases (for discharge from hospitals or dropping out of work) was a successful strategy for collecting epidemiological and health information over time. Regarding retention rate, cohorts in which the research field team realized personal and frequent contacts with the study population, and those that conducted the first follow up before or at 12 months after the baseline, reported higher retention rates. We noticed that none of the reviewed cohorts collected information on the migratory process or the health status after returning to the country of origin. Health outcomes are often a result of an entire lifetime of risks and exposures, which may have occurred before, during or after the displacement or migratory process. It has been recommended to use a life-course approach for improving knowledge on migrant's health, by means of collecting health determinants, exposures, health risks, etc., from the country of origin, during the migratory process, in the host society, and finally after returning to the country of origin. However, such approach is limited by lack of data, especially on elderly migrants (34,87,254).

The review of cohort studies also showed the relevant role that socio-demographic characteristics of the study population have on the participation rate of the study. Specific sub-groups of foreign born population, like those with an irregular administrative situation (24,28) or who arrived recently to the host country (time of residence shorter than 5 years (56), are considered to be "hard-to-reach population" (255,256). These sub-groups present greater difficulties of identification, recruitment and follow-up and because of their precarious social and economic situations they often do not want to be identified and refuse to participate in health studies. Accordingly, within the studies included in the review, foreign born participants with an administrative irregular situation were poorly represented (11.1%). In order to facilitate access and participation in health research on these sub-groups, it is recommended to use sampling and recruitment strategies specifically designed for them. For example, *Respondent driven sampling* strategy was successfully used in studies carried out on this sub-groups of foreign born population (252,255,257,258). On the contrary, foreign born families often show family re-unification, along-term migratory project related to the schooling of the offspring, alower risk of geographical mobility and a longer time of residence in the host country than other sub-groups such as

single men or those with an irregular administrative situations, as well as a higher frequency of a regular administrative situation (in our study on facilitators of participation, all participants came from foreign born families and had a regular administrative situation). Thus, greater stability of foreign born families compared to other sub-groups of foreign born population (47), as well as close bonds within different members of the same family, contribute to the fact that such families, unlike single individuals, facilitate participation, data collection and the follow up of foreign born population, thus facilitating their participation and retention in cohort studies. In addition, "including families" in health studies can also facilitate identification and participation of offspring of foreign born. Differences in the health status of the offspring of foreign born compared to the first generation who immigrated have been reported (4). Specific factors such as acculturation, ethnic identity formation, and bilingualism affect the development of the children of foreign born families (259). Exposition to different health determinants and risks facilitates that children present different health outcomes than their parents. As explained above, to identify this sub-group of foreign born population in the official records, such as a census of inhabitants, is currently difficult to do. Finally, including families can help to minimize loses of follow-up and conducting “life-course approach” at the follow up stage. Being successful in re-contacting a participant can facilitate re-contacting the rest of the family members who participated, even those who emigrated to another country or returned to the country of origin. Despite the potential benefits, it is also necessary to keep in mind that this strategy can present both memory and information biases.

In the study of barriers of participation, foreign born participants indicated that it was essential to receive exhaustive and understandable information on the objectives and procedures of the study, as well as to guarantee privacy and confidentiality and facilitate proximity during the study. In the implementation of PELFI Badalona/SC cohort, we noticed that it was necessary to provide written information about the study, so those with whom we had contacted, particularly Maghreb and Pakistani women, could also inform other family members. Within foreign born population, the advice given by the whole family has greater weight in the decision to participate in research studies compared to natives (41,188). Frequently, women from Maghreb and Pakistani communities explained they needed the consent of their husband to participate in the study. Cultural and gender barriers may limit participation of foreign born women from these communities in a cohort study. Providing written

information in the native language of each community in order to inform husbands and other family members can facilitate participation of these women as well as of the whole family unit in a cohort study.

The notion of explaining the benefits of such studies is an essential factor in the successful participation in health studies (39). In the study of barriers of participation, receiving economic benefits, the improvement of the health status of each individual and of their children under 18 years old thanks to medical exams and the analysis of biological samples, as well as the medical treatment in those cases in which this was necessary, were the most important benefits for the participants in a cohort of the foreign born population. A small group of participants claimed that they would reject economic benefits as they thought that this could result in legal problems. It will be necessary to identify and clarify the existence of beliefs and fears about economic benefits that can limit participation. Sums of 10 euros were offered for every completed interview and 10 euros more for completing the analysis of biological samples. Despite the small amount of money, using financial rewards no doubt facilitated participation in the segments of foreign born population with the most vulnerable economic conditions, particularly in those families who recently arrived in the host country or who had been unemployed for the last few years. Even though, this does involve the risk of producing a biased selection.

In the study of barriers of participation, most participants stated that they would accept to carry out medical examinations for themselves as well as for their young children. Previous cohort studies successfully conducted analysis of biological samples in foreign born participants (37,252). In PELFI Badalona/SC cohort specific facilitators of participation of foreign born participants in medical exams described by previous studies were used, such as comprehensive information on the procedures, shortening the required time and procedures for collecting the samples, giving health results, facilitating pharmacological treatment and avoiding specific dates such as Ramadan (40,189). The participants in the clinical sub-sample gave blood, faeces, urine analysis, peak-flow, and performed the tuberculin test using the Mantoux technique. In PELFI Badalona/SC cohort, the carrying-out of analysis of biological samples required greater efforts of coordination (a foreign born researcher accompanied the families to do the extraction of the samples, appointments must be at the earliest time in the

morning) and met logistical difficulties (faeces samples needed to be stored in the fridge), as well as requiring a higher budget (the collaboration of a Primary Health Center was needed).

Available literature on improving the participation of the foreign born population in health research indicates that integrating foreign born participants into the research field team facilitates participation of the population (260), as it allows to minimize language and cultural barriers and increase the confidence of the foreign born population (170,189,260,261). The study on barriers of participation facilitated that we build trusted and collaborative ties with the foreign born population residing in Badalona and Santa Coloma de Gramanet. As a result, a group of foreign born participants (one man and one woman from Pakistan, two men and two women from Morocco, and one man and one woman from China) was selected to join a group of social analysts (n=5) who had experience in research with foreign born population and constituted the research field team, who conducted the recruitment and the health interviews of the participants. No foreign borns from Latin America were included in the field research team, because we considered that language, cultural and gender barriers were very low within this community. Within the foreign born researchers, those who were from Pakistan were the most time efficient recruiting participants. We attributed such differences to the close ties and confidence that every foreign born researcher had with the local community. Globally, foreign born researchers achieved a higher number of contacts using less time than native ones, due to the confidence and proximity among foreign born people, as well as the lack of language and cultural barriers. Thus, their participation was essential to achieve the desired study sample. Participating families from Latin America were recruited requiring less time than other geographical origins, confirming that the participation of this community in health studies is easier than other geographical origins and that it was not necessary to include Latin participants in the field research team. Integrating foreign born participants into the research team required more time, the use of more human resources and overall budget.

Regarding the characteristics of the interviewer, in the study of barriers of participation, foreign born women from Morocco and Pakistan claimed that they would prefer female, instead of male, interviewers. Previous studies showed the benefits (170,261) or recommended (260) the use of

interviewers of the same origin and gender as the participants to minimize cultural and gender barriers (189,262), especially among Muslim women (189). Using interviewers with similar foreign born background (first generation), gender and geographical origin as the participants promotes confidence (40) and proximity, minimizes social and ethno-cultural barriers, facilitates recruitment, data collection and follow up, improves participation and retention rates (189), and minimizes biases of native researchers that are considered inherent and potentially present in inter-cultural studies (39). Language and ethno-cultural matching facilitates the translation of words and the comprehension of the content (25,41,263). Finally, some authors recommend that interviewers have similar socio-economic status and life experiences than participants (5,23,264,265). In PELFI Badalona/SC cohort health interviews with participants from Morocco and Pakistan were conducted making sure that the gender and geographical origin of interviewers and participants were the same, with the aim to minimize language, cultural and gender barriers. However, a small number of women felt a lack of privacy and even risk to be judged by Muslim interviewers, especially regarding sexual and reproductive health questions, and recommended to use native researchers. Based on our experience, we concluded that, generally, the matching of interviewers and participants facilitates participation and data collection, but in some cases, especially within the Muslim community and in the areas of health with important socio-cultural taboos such as sexual and reproductive health, the reliability of the interviews can be limited. It is necessary to ask for the preferences of foreign born participants regarding the profile of the interviewer, and also to have available a heterogeneous team of interviewers with foreign born and native origins, with the aim to meet particular needs of privacy and confidentiality. A last aspect to be assessed is that the use of interviewers who reside in the same city as participants can limit privacy and reliability, and eventually facilitate distrust and rejection towards the study.

In the implementation of the PELFI Badalona/SC cohort, also with the aim to minimize language barriers and facilitate data collection, health questionnaires were translated into the official languages of the countries of origin of participants. It is described that language barriers have greater impact on those participants with a shorter time of residence in the host country (32). Surprisingly, in our study a high proportion of participants presented important language barriers despite of having >10 years living in the host country. As well, greater language difficulties were related to geographical origin

(Chinese community), to the employment situation (those who had worked and socialized with the native population presented less language barriers), to the level of studies (those with higher level of studies had lower language barriers), and to socio-demographic characteristics (those with shorter time of residence presented higher language barriers). The translation of the health questionnaires required time and budget, and in addition it was difficult to assess the reliability of the translation. Furthermore, in the case of interviews with participants from Pakistan and Morocco in which sex and geographical origin of interviewers matched with participants, the real benefit from translating the health questionnaire was very small.

Regarding to cohorts of PELFI project, Alicante, Barcelona and Badalona/SC cohorts share inclusion criteria certain parts of the health questionnaire which helps to build a multicentre cohort. Among the strengths and benefits of PELFI cohorts, we can highlight the inclusion of foreign born families and geographical origins that have been less studied until now. Each PELFI cohort has specific objectives and uses methodologies according to the location and population of the study. The main objective of PELFI Badalona/SC cohort is to describe health determinants and their relationship to the structure and dynamics of the family unit and the migratory experience. We are not aware of other studies in Spain that mention the challenges of including foreign born population in health studies, nor the role of the structure and the dynamics of the family on the health of the foreign born population. Unlike PELFI Alicante and Barcelona cohort, PELFI Badalona/SC cohort carefully matched the geographical origin and gender of interviewers and foreign born participants (those from Pakistan and Morocco), offered economic incentives, health questionnaires included other sections and standardized scales than the ones of the other PELFI cohorts, and biological samples of a sub-group of the participating families (clinical sub-sample) were analysed.

In PELFI Badalona/SC cohort, the desired population of the study was a convenience sample of 110 families, 30 originated from Pakistan, 25 from Morocco, 15 from Latin America, 20 from China and 20 from Spain. Sample size of the study were calculated according to several factors: 1) the feasibility of implementing a cohort study including those less studied groups such as those originating from the Maghreb, Pakistan and Chinese (260), or those who presented more recruitment difficulties as participants of Maghreb community (170); 2) the most frequent geographical origins residing in our

study location; 3) the geographical origins recruited in PELFI Alicante and Barcelona cohorts (205), in order to provide greater diversity to the study population of PELFI multicentre cohort; and 4) the available budget. In Badalona, in 2014, the year of preparation of the study, 18% (n=61.133) (76) of the general population were foreign born. Within them, the most frequent geographical origins were Latin America (21% came from Bolivia, Peru, Equator and Colombia), Morocco (15.6%), Pakistan (13.5%) and China (11%) (76). PELFI Alicante and Barcelona cohorts included families from Colombia, Equator and Morocco; and PELFI Badalona/SC cohort included families from Morocco, Pakistan, Latin America and China. All PELFI cohorts included a control group of native families. PELFI Badalona/SC cohort achieved 200 contacts from families interested in participating in the study. Among them, 115 families finally participated in the cohort. Cooperation rate of the study was 57.7%, lower than the cooperation rate of the clinical sub-sample, that was 66.6%. In the systematic review of longitudinal studies, cohorts that recruited Latin families using school records and cohorts that recruited different geographical origins through a governmental record reported similar participation rates, around 59%, as PELFI Badalona/SC cohort. Those cohorts that carried out community recruiting strategies reported higher rates, as the MENDOTA cohort that recruited Latin families (participation rate of 70%), and PELFI Alicante and Barcelona cohorts (cooperation rate of 82%). A previous longitudinal study conducted in Spain, ITSAL longitudinal study, in which foreign born workers with irregular administrative situation were included, reported a much lower participation rate (40%). ITSAL longitudinal study also reported more difficulties in recruiting participants from Morocco, and especially women, compared with those originating from Latin America and Romania (170). Unfortunately, we do not have information on participation rates of HELIUS Cohort and the National German Cohort, currently underway in Europe. Despite the limitations for comparing studies, the results suggest the relevance of the geographical origin, of the study of population and of the recruitment strategies in the participation rate of foreign born population in cohort health studies.

In PELFI Badalona/SC cohort, native families presented the highest cooperation rate (80%), but Chinese families presented the lowest cooperation (38.5%) and retention (20%) rates. None of the Chinese families participated in the clinical sub-sample nor did Chinese offspring >16 years old participated in the cohort study. Different factors can explain the scarce participation of the Chinese community in the

cohort, such as the important language and cultural barriers that existed in this community, the lack of available time, the high geographical mobility of Chinese foreign born participants, the mistrust towards health research and official institutions, the use of Traditional Chinese Medicine in the host country (266,267), and the poor relationships of this community with health care services and professionals, as well as with the schools in the host country. Often the Chinese foreign born population uses Traditional Chinese Medicine and/or travels to the country of origin in order to meet their health needs and receive healthcare. Probably, these practices reduce the unmet health needs of this population, as well as their knowledge and confidence towards the healthcare system and professionals, and the medical examinations in the host country. The combination and interaction of these factors reduce dramatically the benefits that the Chinese population can get by participating in health research, and tends to increase their lack of interest in and their rejection of a cohort study.

On the contrary, participation of the Chinese community in the study of barriers of participation was much higher than in the cohort study. In the study of barriers of participation, the desired number of individual interviews was achieved and the two discussion groups carried out with Chinese participants gathered the largest number of participants, n=10, compared to the rest of geographical origins. A key factor that can explain such differences was that in the study of barriers of participation, a Chinese participant with considerable influence within the local community was integrated in the research field team. After the study, this participant travelled to China and could not take part in the research field team of PELFI Badalona/SC cohort. It is well known that hierarchy is a relevant social value that influences interpersonal relationships and behaviours within the Chinese community (268). Including a Chinese participant with an important hierarchical role in its community in the research field team can facilitate the access to, the recruitment and the participation of the Chinese community. In PELFI Badalona/SC cohort, it was, in fact, the most relevant facilitator of participation identified in the Chinese community. However, it is necessary to take into account that this strategy can present selection and information biases. With the aim to minimize this risk, it is necessary to guarantee the heterogeneity of the participants. As a lesson learned, we suggest to include several Chinese researchers who belong to different segments of the local Chinese community, and to promote that participant Chinese families conduct snowball strategy to recruit more Chinese families.

On the other hand, published studies identified the lack of available time as the most important barrier of participation within foreign born population (39), and specially within the Chinese community (262). In the study of barriers of participation, Chinese community and participants who worked long hours, particularly women (frequently originating from Latin America) who were heads of mono-parental families, presented the most important restriction of available time within foreign born participants. In the implementation of PELFI Badalona/SC cohort, different strategies were used aimed to maximize proximity and minimize the amount of time required for participating in the cohort. Regarding data collection, almost 90% of the health surveys were carried out at the household of the participants. Offering such flexibility, as well as for the day and time to conduct the interviews (interviewers had the ability to travel and conducted interviews at the workplace, at night or during the weekends) was an important facilitator of participation, especially for those who were employed and for offspring >16 years old. However, it was not a facilitator for participants originating from China who rejected being interviewed at home more frequently than others with different geographical origins.

Due to the difficulties we had in recruiting Chinese participants, we decided to conduct simultaneously recruitment and data collection with participants of this community. Then, at soon as a participant originating from China was recruited, the health interview was conducted. This strategy was culturally adapted for Chinese participants (269,270), in order to minimize the amount of time required for participation in the cohort and to make sure that we had the desired number of Chinese families in the study. But it did limit the access to the household and to other family members, such as the children or second generation of the foreign born. As a result, no children >16 years originating from China participated in the cohort. Future studies that include participants from this community will need to use original and new strategies to recruit the offspring of this community, as for example contacting people not directly from the family, for example through schools, sport clubs or cultural associations. The HELIUS cohort study and the National German Cohort include different generations of the same families in the studies. Participation outcomes of these studies may help to clarify if a multi-generational approach may reach this sub-group of population, or on the contrary, if specific studies designed to target the offspring of foreign born are needed.

Regarding recruitment, PELFI cohorts used different recruitment strategies simultaneously. Community strategies of recruitment facilitate participation of foreign born population (5), diversify the population in the studies, help to build relationships of confidence, encourage collaboration (5,39,271), and contribute to improve retention of foreign born participants (5,39,182,272). The Alicante and Barcelona cohorts used convenience sampling (meetings were held with mediation agents and key members of the neighbourhoods who contacted the families and with their authorization provided their contact to the interviewers), snowball strategy and opportunistic recruitment in target locations. Overall in both cohorts, 67.9% of families were recruited by convenience sampling, 29.7% through snowball strategy and 2.4% by opportunistic recruitment in target locations. In Alicante cohort, 95.9% of participants were recruited through convenience sampling, with 91.7% of cooperation rate; while Barcelona it obtained 40.9% of participants, with 74.4% of cooperation rate. These results show the high capacity of this strategy for recruiting foreign born families. Factors that can explain this are confidence, proximity, and lack of language barriers. In Badalona/SC cohort, information meetings, opportunistic recruitment in target locations and snowball strategy were conducted. Information meetings took place in schools and with associations; recruitment in target locations was carried out in schools, primary care centres and mosques; and snowball strategy was conducted by participant families and foreign born interviewers through their social networks (with a maximum of 3 successful contacts given by the same family or interviewer). Within participant families in Badalona/SC cohort, 42.6% were recruited by snowball strategy, 40% by opportunistic recruitment in target locations and 17.4% through information meetings. Table 17 summarizes de number of participating families by recruitment strategies in PELFI cohorts.

Table 17. Number of participating families by recruitment strategies, baseline PELFI cohorts:

PELFI COHORT	RECRUITMENT STRATEGY	NUMBER OF FAMILIES N (%)
ALICANTE-BARCELONA	CONVENIENCE SAMPLING	170 (67.9)
	SNOWBALL STRATEGY	74 (29.7)
	OPPORTUNISTIC RECRUITMENT IN TARGET LOCATIONS	6 (2.4)
	TOTAL	250(100)
BADALONA/SC	INFORMATION MEETINGS	20 (17.4)
	SNOWBALL STRATEGY	49 (42.6)
	OPPORTUNISTIC RECRUITMENT IN TARGET LOCATIONS	46 (40)
	TOTAL	115 (100)

In PELFI Badalona/SC cohort, recruitment in target locations obtained most of the contacts of families interested in participating in the cohort (41.5% of families), and snowball strategy presented the highest cooperation rate (69%). Simultaneously using different strategies, especially recruitment in target locations and snowball strategy, demonstrated the usefulness for recruiting foreign born families (n=115), and even for overcoming the desired study sample (n=110). Several factors can explain the higher effectiveness of snowball strategy for recruiting participating families such as the confidence and proximity existing within family and social networks, the probable satisfaction and/or perception of the benefits of the participating families that conducted the snowball recruitment, and the lack of language and cultural barriers. Minimizing time and physical displacement for receiving information on the study were also relevant. The effectiveness of snowball strategy is demonstrated by the success of one of its variants, *Respondent Driven Sampling*, for recruiting "hard-to-reach population" as recent foreign born (<5 years residing in the host country) and in an irregular administrative situation (258). However, as already noted, snowball strategy, which involve referral chains of sampling, may present selection bias which may limit validity of the sample. While these issues may not be problematic for studies which do not require representativeness for generalizability, they do have limited use in quantitative research (258). Combining snowball strategy and recruitment in target locations can minimize this bias. While opportunistic recruitment obtained a continuous flow of contacts with heterogeneous characteristics, snowball strategy recruited higher numbers of

participating families using shorter time. On the contrary, information meetings presented the lowest capacity for recruiting foreign born families (in some cases, although invitation letters had been sent and some participants confirmed their assistance, no one came to the meeting). Language barriers, lack of time, lack of knowledge on research studies and mistrust towards official institutions can explain the small number of contacts that were obtained through information meetings. In conclusion, proximity, creating an atmosphere of confidence, lack of language barriers, and the simultaneous use of different community strategies for recruiting foreign born families encourages high cooperation rates and minimizes possible biases.

It is worth to note that the clinical sub-sample presented a cooperation rate of 66.6%, higher than the cooperation rate of families that conducted health interviews (57.7%). Within those who refused to participate in the clinical sub-sample, several reasons were found: mistrust towards health studies after having had negative experiences with the healthcare system and/or professionals or simple having no knowledge of the health system in the host country. The desired number of participant families from China (n=5) in the clinical sub-sample was not achieved (n=3). As mentioned above, the important language and cultural barriers that this community presents, the use of Traditional Chinese Medicine in the host country and in the country of origin, and a smaller number of health needs, all contribute to weaker relations with healthcare services and professionals, as well as reducing interest in or non-acceptance of having health exams performed. The results show the acceptance of foreign born population to carry out analysis of biological samples and the viability for conducting them in a cohort study. In brief, families from China presented less interest in participating in the clinical sub-sample than other geographical origins.

Regarding the follow up, foreign born participants may present more loses of follow up than natives (42), especially those with a higher risk of geographical mobility (273) and greater language barriers (41). Regarding geographical mobility, foreign born population at working age presents a greater risk of geographical mobility than the native population due to a higher impact of the economic crisis on the foreign born population, job insecurity and long-term unemployment (97). Frequent travels to the country of origin or other countries, as well as fear or refusal of having contact with official or unknown

institutions, are other factors that may increase the risk of geographical mobility (274,275). In the study of participation barriers, the long-term unemployed participants of all geographical origins including those from China were at a higher risk of geographical mobility. In the Chinese community, adults frequently travel to the country of origin of the family, often for health or working reasons, and children often leave for several months in order to keep family bonds and improve the knowledge of the language and culture of the country of origin. As a lesson learned, recruiting families with children in school may facilitate access to segments of foreign born population that will probably have a more stable implication in the host community, minimize the risk of geographical mobility and loses of follow up and incrementing participation and retention rates. This fact, together with the family project related to the children in school, facilitates that foreign born families may present higher participation and retention rates than other foreign born sub-groups such as families without school children, single young men and possibly also Latin American women who are heads of mono-parenteral families, or workers in an irregular administrative situation.

In the study of barriers of participation, participants suggested different strategies to ensure a successful follow up. Foreign born participants suggested using free mobile phone applications to re-contact participants, such as WhatsApp and E-mail; and native key informants suggested using phone calls. Apparently, in 2014, when the study was conducted, the frequent use of the Internet within foreign born population was partially unknown by native key informants. Nowadays, due to the cheap services and available devices, we think that the use of mobile phones and Internet is probably generalized within this population. Using written messages like sms, WhatsApp and E-mail can facilitate informing other family members and also it is useful as a reminder of the appointment. However, it requires having access to the Internet and having the ability to use these applications. Although the extended use of Internet within our society, we cannot rule out that it may limit the success of this strategy in some, we would expect in a small number of cases in our context. Using sms does not require having access to the Internet network and can be more accessible to the overall foreign born population. Other re-contact strategies suggested by foreign born participants were using post mail letters and re-contacting through the school. Using post mail letters creates a structure and simplifies informing other family members, but it also requires a fixed residence. Usually schools are

secure and well-known environments for foreign born population, offering proximity and confidence. Although one study (276) recommended contacting a relative or a friend of the participants who could help with the contacting at the follow up stage, all the interviewed participants refused this strategy, explaining that they wanted to protect their privacy and confidentiality.

In PELFI Badalona/SC cohort, the first follow up was conducted 12 months after the baseline. Retention rate was 75% of the participant families. Such high retention rate confirmed that implementing a cohort of foreign born families in our study location, minimizing barriers of participation and using different strategies according with epidemiological characteristics of the population of the study, is feasible. It was remarkable that the retention rate of offspring >16 years, 90%, was higher than the retention rate of progenitors, 73.9%. This suggests that re-contacting offspring or second generation of foreign born may be easier and more effective than re-contacting their progenitors. Furthermore, successful re-contacting of offspring or second generation may also facilitate retention of the rest of the family members. According to geographical origin, families originated from China presented the lowest retention rate, 20%, compared to the rest of participating geographical origins, which presented similar retention rates, 71-75%. Thus, consistently during the study, both parents and offspring from China presented higher difficulties with participation and retention in health interviews and in the clinical sub-sample. Our study failed to get information on the retention rate of offspring from China.

It is necessary that future studies explore original and new methods and strategies for collecting data in those cases with failed follow up. As examples of such strategies, we suggest conducting health interviews through other family members, using self-administered or online health questionnaires, conducting face-to-face online interviews through the use of free mobile phone applications such as zoom, skype, etc. To our knowledge, free online strategies have not been used for collecting health data or re-contacting participants in cohort studies on foreign born population. It will be necessary to assess possible information and memory biases presented by these strategies, as well as the feasibility of designing self-administered questionnaires in the original language of the country of origin of the participants, and the ability of foreign born population to use on-line platforms. Within the cohorts included in the review of longitudinal studies, two studies were based on linkage of data between

registries. Chou KL, in 2006, in Australia, performed face-to-face interviews, self-administered questionnaires, and linkage with official registries (277). The on going HELIUS cohort, in The Netherlands, collects data through self-administered questionnaires and through linkage between a variety of registries such as general practitioner, hospital discharge, pharmacy, health care insurance and vaccination registries. Current existing evidence on foreign born health has mainly been derived from self-reported or community-level data, or from subsets of foreign born groups. In this context, conducting registry-based studies may allow to access to local, regional or nationwide data (37,278,279). The biggest and most widely recognised advantage of using register-based health data is the larger, often nationwide, sample size (280). Some European countries have a long tradition of registry-based epidemiological research. The General Practice Research Database in theUK, established in 1987, was designed from its inception to be used for epidemiologic research. It is one of the most commonly used data resources in pharmacoepidemiological research and collects health information and drug prescriptions from over 460 primary healthcare practices, covering about 5% of the UK population (278). Most of such studies have been carried out in Nordic countries, probably due to the long-standing tradition that these countries have of collecting data for health registries as well as a high public acceptability of register data use (280). Nordic countries such as Denmark, Finland, Iceland, Norway and Sweden have established national databases to track prescription drugs in ambulatory care. The databases covered 25 million inhabitants, and included data of: patient-specific data, prescriber data, drug data and pharmacy data. Some countries included additional variables in their databases. In 2007 encompassed 17 million prescription drug users (68% of the total population). The linkage of drug exposure to other health registries offers an unique potential for cross-national comparison of drug utilization (281). Linkage between registries has also been used in random clinical trials. In Denmark, the Aarhus University Clinical Trial Candidate Database consists of encrypted data from the Danish National Registry of Patients allowing an immediate estimation of the number of patients with a specific discharge diagnosis in each hospital department or outpatient specialist clinic in the Central Denmark Region. This database allows to shorten the clinical trial start-up times (282). In Spain, efforts have been made to collect and organize health research information in the Business Intelligence field (283), and to investigate the impact of secure sending methods on the efficiency (to quantify productivity loss due to the encryption, the secure transmission, and the subsequent

decryption) in the transmission (284). Taking advantage of the comprehensive national and regional registries may undoubtedly facilitate data collection and follow up in health cohort studies on foreign born population. Prospective cohorts of foreign born patients can be set up through database registries, and be updated as new data become available. However, registry based studies have different limitations. Usually, register data are not collected specifically for research purposes, most health records are collected for administration purposes and, so, variables may change over time as social and health policies change. Different factors may limit the completeness or quality of data collected by the records, affecting the validity of the studies. For example, in the case of prescription records, drugs bought abroad will be unrecorded, may miss the indication for the prescribed medication, or may present discrepancies in the coding of the diagnoses. Accessing barriers may limit the collected data, cultural factors may lead to misrecord of sensitives issues such as suicide, and under-reporting of emigration may lead to an overestimation of foreign born population sizes. Finally, relevant data related to migratory process such as reasons for migration, length of stay, or health behavior data are typically not reported in health records, as well as resources, networks, time and methods for pooling data are needed (280,281). In Catalonia, primary health data can be used for research purpouses. Among epidemiological variables the nationality is collected (285), facilitating the identification of foreign born population (286). A step forward would consist on linkage of this primary health care data with electronical medical records and pharmacy prescription data from the hospital level, as well as with laboratory information.

The high proportions of women within foreign born population at international (in 2017, women meant 48.3%, n=124.8 million, of international migrants -the total number of people residing in a country other than their country of birth worldwide (51)-), and at national level (in 2018, in Spain, 49.86%, n=2.360.813 people, of the foreign born population were women (68)), indicate the relevant weight of foreign born women within the foreign born population. Regarding foreign born women, we noticed the following in this thesis: sub-groups of foreign born women presented a more unfavourable state of health and specific barriers to participation in health cohort studies. Our results are consistent with articles that indicate that foreign born women residing in high-income countries have lower participation in screening tests as compared to the general population (279,287). Regarding HIV/STIs

infection, foreign born women presented a higher proportion of new HIV diagnoses than foreign born men, and compared to native women presented a significantly higher proportion of loses of follow-up (25.5% vs. 11.6%), of switches of ARV treatment, worse immune response to ARV treatment (lower increase of CD4+ and lower reduction of viral load, $p<0.05$), shorter time to treatment failure (124 weeks), as well as, a less effective follow up during pregnancy. Several factors described within foreign born patients can explain these results, such as greater difficulties to carry out follow up visits, especially among foreign born women, lower educational level, greater stigma for being HIV infected, and a higher proportion of foreign born sex workers among women with HIV infection (288). On this topic, a study with data on foreign born population with HIV infection from Catalonia identified a lower knowledge on types of HIV transmission (69.7 vs. 77.7%) and lower access to healthcare services, also in female sex workers (65.6% vs. 82.4%), than in natives (92). Regarding transmission from mother to child, proportion of foreign born cases within new HIV paediatric diagnosis increased. In addition, pregnant foreign born women presented a higher proportion of HIV infection and syphilis compared to pregnant native women. This data suggest that HIV transmission from mother to child may be currently on-going in Spain, especially within sub-groups of foreign born women particularly at risk. This data represents a very worry full scenario of the epidemic of HIV/AIDS infection within foreign born women in Spain. Regarding participation in a cohort health study, sub-groups of foreign born women presented greater language difficulties than foreign born men (due to the lack of experience in the labour market and lower level of education), greater gender barriers (especially among women from Morocco and Pakistan), as well as lack of time available for participating in health research due to the prioritization of family care and the lack of family and/or social network. Within participants in PELFI Badalona/SC cohort, foreign born women presented lower level of studies and were from a lower social class than native women, indicating that foreign born women participating in our study belonged to more vulnerable social strata. In conclusion, facilitating access of foreign born women in early prevention and diagnosis programs and increasing their participation in cohort health studies are essential to improve the state of health of foreign born women and our knowledge on their health status and on the whole foreign born population.

LIMITATIONS

The existence of several limitations in the interpretation of the results must be taken into consideration.

In the bibliographical reviews that we carried out (47,195):

- Although we conducted extensive and thorough bibliographic research, we cannot rule out that we were not able to identify all available articles. It should also be noted that grey literature was excluded from the review.
- The reviewed studies on HIV/STIs infection on foreign born population may include loses of information due to the return of foreign born population to the country of origin or to the emigration to another country. The interpretation of mortality figures may therefore be limited by what is known as "salmon effect", namely the greater probability that the foreign born people with poorer health would return to their country of origin (289).

Regarding the study of antimicrobial resistant NG:

- Data collected by surveillance programs such as Euro-GASP are considered to be barely representative of the general population. In Euro-GASP, specific sub-groups of population may be over- or infra-represented. For example, it is considered that heterosexual men may be over-represented in Euro-GASP, due to the higher number of cases of symptomatic urogenital gonorrhoea, the high sensitivity of culture in these cases and the possible proportion of undisclosed or incorrectly classified MSM. On the other hand, population <25-years old may be under-represented, probably due to the ongoing programs of detection of *Chlamydia trachomatis* infection, targeted at this group, and in which molecular detection of C. trachomatis and NG is performed instead of culture. In addition, the low proportion of samples from patients from Asia and sub-Saharan Africa (17.2% and 9.1% respectively), the two geographical origins outside the European Region that are most common across European countries, suggested that these groups may be sub-represented in Euro-GASP data.
- The absence of participation of some EU countries along with differences in representativeness limited the generalizibility of the findings. Most of the samples of foreign born patients (60.9%)

were notified by three countries: Holland (34.9%), Ireland (13.1%) and United Kingdom (12.9%). The number of participating countries (23), of countries that notified "country of birth" (n=14, 60.8%), and the high percentage (57%) and heterogeneous distribution of "missing" in the "country of birth" variable, limited the interpretation of results of our study. Diversity of access and modalities of coverage of healthcare services that foreign born population experience across the EU/EEA countries can explain, at least partially, these results.

- The results might also not be representative of all foreign-born cases of gonorrhoea as some categories of foreign-born persons such as refugees, undocumented migrants, trafficked people, migrant MSM, and subgroups of migrant women, sub-groups of foreign born population that may present higher challenges in accessing health care services. Foreign born population presents differences in accessing and/or using healthcare services, also in those countries with universal access to healthcare services (113), due to language, cultural and/or legal barriers (112,113,290).
- Other limitations were the low reporting data in epidemiological variables, as "probable country of infection", and lack of systematic collection of other variables such as recent travels to countries of high risk, level of studies, economical income or labour situation, which did not allow to make stratified analyses according to the socio-economic characteristics of the participants. Ethical or legal limitations that exist in some countries may limit information on epidemiological variables that are collected.
- In our study, we examined together those samples that presented antimicrobial resistance to at least one of the antimicrobials included in the study. Proportion of samples resistant to ciprofloxacin (almost 50% of resistant samples) was much higher than azithromycin (around 7.5%) and cefixime (about 5%), indicating that the results we obtained must be interpreted carefully.

Regarding the study on barriers of participation:

- The purpose of the qualitative methodology is aimed to identify the widest possible spectrum of experiences, beliefs and feelings existing in a group of population (216). Taking this into

account, the results of our study are specific to the foreign born population residing in Badalona and Santa Coloma de Gramanet, and cannot be generalized to other Spanish cities.

- In the case of participants from Latin America, the study only included those from Andean countries in order to facilitate homogeneity of this group of participants. However, it did not allow the application of the results to the entire foreign born population originated from all of Latin America.
- On the other hand, it is not possible to rule out the influence of several biases, such as an information bias due to the lack of trust of foreign born population towards a research health study. It should be noted that although efforts were made to maximize diversity of the study population (different recruitment strategies and data collection methods), it may exist participation bias of those families who were more concerned about their health status or more familiar with the healthcare system or other services and social resources. According to the bibliography, language barriers experienced by foreign born population can facilitate a selection bias of some geographical origins in research studies, as Latin America participants (32), and possibly of participants with longer time of residence too.
- Regarding using economic incentives, they can result in a selection bias of participants with lower socio-economic status (97), while usually they are not relevant for those segments of population that belong to higher socioeconomic strata (187). Finally, in the discussion groups with Chinese participants, the relevance of the value of hierarchy in interpersonal relationships within members of this community may also produce an information bias (268).

In the study of the implementation of PELFI Badalona/SC cohort:

- Having selected a sample of convenience does not allow generalizing the results of the study to the whole foreign born population. Although using probabilistic techniques allows to establish representative samples, they often obtain low rates of participation of foreign born population (205). On the other hand, including foreign born families facilitated participation in the study, but also limited participation of younger participants, with shorter time of residence or with an irregular administrative situation. Other limitations were the reduced number of included families, especially those from Latin America and China. Due to limitations of the available

budget, a reduced number of families were included in the clinical sub-sample, and native families were excluded. A health questionnaire was used as a pilot test conducted on only one family from Latin America. Health questionnaires were translated by official translators into Arabic, Urdu and Mandarin, the official languages of participants in the study. Foreign born interviewers from Pakistan, Morocco and China reviewed the translated questionnaires to verify reliability and made the necessary changes.

CONCLUSIONS

1) Globally, foreign born population is under-represented and excluded from health research. In Spain, there is a lack of information on the health status, health determinants, opinions, beliefs and feelings of foreign born population. Evidence on the state of health of other origins than Latin America, as well as methodological aspects able to ease and improve participation of foreign born population to health research, are limited. Although time of residence is essential for a better understanding of health status of foreign born population, there is a lack of cohort studies specifically designed for this population at national and international level. There is also a lack of studies of the foreign born patients attended in the public primary health care centers (86).
2) Particular sub-groups of foreign born population are key groups for the control of HIV/AIDS infection and AMR gonococcal infection, such as:
    - Consistently, the studies included in this thesis described higher vulnerability within foreign born women. Compared to foreign born men, particular sub-groups of foreign born women presented worse social determinants of health, worse health outcomes in the area of HIV/STIs, and specific barriers of participation in longitudinal health studies.
    - For the last years MSM, especially MSM from Latin America, are the target population group for the control of HIV/AIDS epidemic in Europe and Spain (92,139). Higher HIV infection prevention needs (92) and higher risk behaviors have been described in this sub-group, that is considered to be especially vulnerable to HIV infection in the host country (137).
    - In Spain, current prevention and early diagnosis programs of HIV/AIDS infection and other STIs show a limited effectiveness within the foreign born population. Specific sub-groups, such as men and women from sub-Saharan Africa, adolescents, sex workers, MSM, migrant women of all geographical origins (including pregnant women) and those with irregular administrative status presented higher vulnerability (greater risk or worse health outcomes) to HIV infection than natives.
    - In Europe, importation of AMR gonococcal strains from other geographic regions worldwide, and in particular gonococcal strains with decreased susceptibility to

ceftriaxone from non-EU/EEA WHO European countries and Eastern Mediterranean WHO region, maybe relevant.

3) In our study setting, offering comprehensive and understandable information about the study, facilitating proximity, guaranteeing privacy and confidentiality and receiving benefits from participation were requested by foreign born participants for participating in a cohort study. Health information from medical examinations and analysis of biological samples of themselves and their children was an important perceived benefit of participating in a cohort study. The main barriers of participation were the lack of available time, the change of place of residence and the language difficulties. The implementation of the PELFI Badalona/SC cohort was encouraged by different facilitators of participation such as integrating foreign born participants in the research field team, including foreign born families instead of single participants, shortening required time for participating, using several recruitment strategies simultaneously, matching gender and geographical origin of the Muslim interviewers, offering flexibility of time and place for conducting the interviews, conducting medical examinations and analysis of biological samples (the clinical sub-sample presented a higher PR -66.6%- than the health interviews -57.7%-), and conducting a follow up 12 months after baseline.
4) In our study setting, most of the foreign born population was willing to participate in health research. However, foreign born families presented lower participation rate (38.5%-68.75% vs. 80%) and retention rate (20%-77% vs. 100%) than native families. Within foreign born families, adults and children from China presented higher difficulties of recruitment and data collection, and much lower cooperation (38.5%) and retention rates (20%) than families from Pakistan, Morocco and Latin America (cooperation rates: 60.5%, 48.7%, 68.7% respectively; and retention rates: 72.5%, 77% and 73% respectively). Exploring specific strategies for faciliting participation of the Chinese adults and offspring are needed, such as including researchers from China with a relevant hierarchical role within the local community, conducting immediate interviews at the same time as recruitment, as well as identifying Chinese offspring beyond family ties, such as schools, cultural or sports associations, is needed.
5) Foreign born families presented differences of participation based on the recruitment strategies. Combining the use of social networks of foreign born participants with opportunistic

recruitment in target locations facilitated the participation of a heterogeneous sample of foreign born families. Conducting record linkage among national or regional population and health records may facilitate data collection, follow-up, and may lower the budget in cohort health studies. Promoting the homogeneous identification of foreign born population and the offspring across the different databases is essential.

6) Including foreign born families –parent/s and offspring- in cohort studies may facilitate participation and adherence in a cohort, identification of the offspring, successful recruitment and re-contact of foreign born participants, as well as the collection of health data of those who travelled to another country or returned to the country of origin ("life-course-approach"). On the other hand, it can limit participation of recently arrived foreign born population (<5 years of residence) and with irregular administrative situation.
7) Implementing a multicentric cohort project in diferent Spanish cities is feasible through the collaboration among research groups that belong to SMH. Implementing a health cohort study that conducted health interviews and medical examinations on foreign born families of the most frequent geographic origins in our place of the study and with long periods of residence in Badalona and Santa Coloma de Gramanet was feasible, using different facilitators of participation according to the geographical origin and gender of the participants. Lessons learned as well as the main results of the study have methodological interest in carrying out cohort health studies on foreign born population, and for other study designs, and can help other researchers working in this field of Public Health.

RECOMMENDATIONS

1) Health research in foreign born population needs to standardize and systematically incorporate variables related to epidemiological, behavioural, socio-economic and demographic characteristics at national and international levels. Population and health records must routinely gather information on country of birth and nationality and make easier the identification of the offspring of foreign born. Linkage between generations might be feasibile through family's identification or through algorithms that identify residents in the same household. Healthcare databases might be an efficient resource to conduct research on the health of foreign born once core data on this group has been added. Specially in Catalonia, the involvement of public primary healthcare centers may facilitate to optimize resources and provide longitudinal follow up and a timely response to the health needs of the foreign born population (86).
2) For improving knowlegde of health status of migrant population, it is necessary to facilitate access of this population to health research, particularly to foreign born women, to increase the number of longitudinal studies, to include the offspring of foreign born and of those less studied foreign born sub-groups, such as foreign born from Asia and from other geographical origins different than Latin America, MSM, those who recently arrived at the host country or those who have irregular administrative status. Facilitating the participation of hard to reach migrants in longitudinal studies can be improved by means of several of the methods mentioned in this research.
3) It is necessary to design and implement new prevention and early diagnosis programs for the HIV/AIDS infection and other specific STIs specifically targeted to foreign born population, and especially to the most vulnerable sub-groups. This must minimize gender, geographical origin, language barriers and access to and use of the healthcare services, taking into account the perception of risk and stigma, and including the participation of non-governmental organizations that work with the sub-groups of the most vulnerable foreign born population. More efforts are needed to achieve a better uptake of HIV test among foreign born with the aim to address the high proportion of late HIV diagnosis reported by this population (2), using communication interventions adapted to the local

context and the target group (218). Similarly, it is necessary to adapt health services specialized in HIV infection in order to reduce language, cultural, gender and accessibility barriers that the foreign born population may encounter.

4) It is necessary to implement a comprehensive and quality assured surveillance of gonococcal AMR in the whole European Region, as well as further strengthening the Global GASP for public health purposes. In Europe, it is essential to further strengthen Euro-GASP by means of: increasing the number of participating countries and examined isolates, facilitating and promoting culture of *N. gonorrhoeae*, achieving more complete reporting of epidemiological data, particularly data on country of birth and sexual orientation, increasing the representativeness of the data, designing and implementing effective disease-control measures targeted at foreign-born from countries with higher levels of gonococcal AMR and those visiting friends and relatives, conducting further research to improve understanding of sexual networks within foreign-born and sexual tourism populations, which will help to implement effective tailor-made interventions.
5) It is advisable that future cohort studies on migrant population include migrant families –parent/s with offspring/s-, carry out medical examinations, implement specific facilitators of participation and will use different interviewer profiles taylored to each geographical origin and according to the study's objectives and the socio-demographic characteristics of the study population, assess the acceptance and reliability of new data collection strategies such as face-to-face online health interviews conducted with free and online applications using mobile phone, and assess the suitability of conducting linkage of data between epidemiological and health records.
6) It is necessary that health interventions targeted at foreign-born population should be part of general structural interventions that simultaneously address the social welfare of migrants and their social determinants of health. Particularly, it is necessary to improve living and working conditions, to maintain universal access to the public health system, to minimize the existing barriers for accessing and using health services, including surveillance networks such as Euro-GASP and HIV services that migrant population presents, together with initiatives to facilitate detection of and appropriate high-quality treatment for

antibiotic-resistant infections during transit and in host countries, and to avoid the implementation of new barriers to health services.

INDEX OF FIGURES

INDEX OF TABLES

BIBLIOGRAPHIC REFERENCES

1. Caro-Murillo AM, Castilla Catalan J, del Amo Valero J. [Epidemiology of HIV infection in immigrants in Spain: information sources, characteristics, magnitude and tendencies]. Gac Sanit. 2010;24(1):81–8.

2. ECDC. Assessing the burden of key infectious diseases affecting migrant populations in the EU/EEA. Stockholm; 2014.

3. World Health Organization (WHO). Toolkit for assessing health system capacity to manage large influxes of refugees, asylum-seekers and migrants. Copenhagen; 2016.

4. World Health Organization (WHO). How health systems can address health inequities linked to migration and ethnicity. Copenhagen; 2010.

5. Katigbak C, Foley M, Robert L, Hutchinson MK. Experiences and Lessons Learned in Using Community-Based Participatory Research to Recruit Asian American Immigrant Research Participants. J Nurs Scholarsh an Off Publ Sigma Theta Tau Int Honor Soc Nurs. 2016 Mar;48(2):210–8.

6. Simon J, Kiss N, Łaszewska A, Mayer S. Public health aspects of migrant health: a review of the evidence on health status for labour migrants in the European Region. Copenhagen.; 2015.

7. Peiro M, Roumyana B. Migrant health policy. The portuguese and spanish EU presidencies. Eurohealth. 2010;16(1):1–4.

8. Gushulak BD, MacPherson DW. The basic principles of migration health: population mobility and

gaps in disease prevalence. Emerg Themes Epidemiol. 2006;3:3.

9. McKay L, Macintyre S, Ellaway A. Migration and Health: A review of the International Litarature. Glasgow; 2003.

10. Oliva J, Pérez G. [Immigration and health]. Gac Sanit. 2009 Dec;23 Suppl 1:1–3.

11. Berra S, Elorza-Ricart J. Salud y uso de los servicios sanitarios en población inmigrante y autóctona de España. Madrid; 2009.

12. Generalitat de Catalunya. Pla Director d'Immigració en l'Àmbit de la Salut. Barcelona; 2006.

13. Delgado-Rodríguez M. La salud de los inmigrantes en España. Rev Esp Salud Publica. 2014;88(6):671–4.

14. Hernando Rovirola C, Ortiz-Barreda G, Galán Montemayor JC, Sabidó Espin M, Casabona Barbarà J. [HIV and other sexually transmitted infections among migrant population in Spain: a scoping review]. Rev Esp Salud Publica. 2014;88(6):763–81.

15. Ronda-Pérez E, Ortiz-Barreda G, Hernando C, Vives-Cases C, Gil-González D, Casabona J. [General characteristics of the original articles included in the scoping review on health and immigration in Spain]. Rev Esp Salud Publica. 2014 Dec;88(6):675–85.

16. Bignell C, Unemo M. 2012 European guideline on the diagnosis and treatment of gonorrhoea in adults. Int J STD AIDS. 2013 Feb 1;24(2):85–92.

17. Unemo M, Shafer WM. Antimicrobial Resistance in Neisseria gonorrhoeae in the 21st Century: Past, Evolution, and Future. Clin Microbiol Rev. 2014 Jul 1;27(3):587–613.

18. Unemo M. Current and future antimicrobial treatment of gonorrhoea - the rapidly evolving Neisseria gonorrhoeae continues to challenge. BMC Infect Dis. 2015 Aug 21;15(1):364.

19. Kirkcaldy R, Harvey A, Papp J, del Rio C, Soge O, Holmes K, et al. Neisseria gonorrhoeae Antimicrobial Susceptibility Surveillance. The Gonococcal Isolate Surveillance Project, 27 Sites, United States, 2014. Morb Mortal Wkly Rep (MMWR Surveill Summ). 2016;65(7):1-19.

20. Unemo M, Del Rio C, Shafer WM. Antimicrobial Resistance Expressed by Neisseria gonorrhoeae: A Major Global Public Health Problem in the 21st Century. Microbiol Spectr. 2016 Jun;4(3).

21. WHO. Global action plan to control the spread and impact of antimicrobial resistance in Neisseria gonorrhoeae. Geneva; 2012.

22. ECDC. Response plan to control and manage the threat of multidrug-resistant gonorrhoea in Europe. Stockholm; 2012.

23. Lindenberg CS, Solorzano RM, Vilaro FM, Westbrook LO. Challenges and strategies for conducting intervention research with culturally diverse populations. J Transcult Nurs Off J Transcult Nurs Soc. 2001 Apr;12(2):132–9.

24. Levecque K, Benavides F, Ronda E, Van Ronen R. Use of existing health information systems for migrant health research in Europe: challenges and opportunities. In: Health inequalities and risk factors among migrants and ethnic minorities. Antwerp: Apeldoorn: Garant Publishers; 2012. p. 53–68.

25. Chen H, Kramer EJ, Chen T, Chung H. Engaging Asian Americans for mental health research: challenges and solutions. J Immigr Health. 2005 Apr;7(2):109–16.

26. International Organization for Migration (IOM). International migration, health and human rights. Geneva; 2013.

27. Perera S, Gavian M, Frazier P, Johnson D, Spring M, Westermeyer J, et al. A longitudinal study of demographic factors associated with stressors and symptoms in African refugees. Am J Orthopsychiatry. 2013 Oct;83(4):472–82.

28. McBryde ES, Denholm JT. Risk of active tuberculosis in immigrants: effects of age, region of origin and time since arrival in a low-exposure setting. Med J Aust. 2012 Oct;197(8):458–61.

29. ECDC. Improving HIV data comparability in migrant populations and ethnic minorities in EU/EEA/EFTA countries: findings from a literature review and expert panel. Stockholm; 2011.

30. Logie H, Hogan R, Peut A. Longitudinal studies of ageing: Implications for future studies. Canberra; 2004.

31. Sanz Barbero B. [Comment. Sociodemographic variables, life-styles, and self-perceived health in migrants]. Gac Sanit. 2008;22(5):413–4.

32. Carrasco-Garrido P, Jiménez-García R, Barrera VH, de Andrés AL, de Miguel AG. Significant differences in the use of healthcare resources of native-born and foreign born in Spain. BMC Public Health. 2009;9:201.

33. Gotsens M, Malmusi D, Villarroel N, Vives-Cases C, Garcia-Subirats I, Hernando C, et al. Health inequality between immigrants and natives in Spain: the loss of the healthy immigrant effect in times of economic crisis. Eur J Public Health. 2015 Dec;25(6):923–9.

34. Spallek J, Zeeb H, Razum O. What do we have to know from migrants' past exposures to understand their health status? a life course approach. Emerg Themes Epidemiol. 2011;8(1):6.

35. Salinero-Fort MÁ, Jiménez-García R, del Otero-Sanz L, de Burgos-Lunar C, Chico-Moraleja RM, Martín-Madrazo C, et al. Self-reported health status in primary health care: the influence of immigration and other associated factors. Caylà JA, editor. PLoS One. 2012 Jun 4;7(6):e38462.

36. Malmusi D, Ortiz-Barreda G. [Health inequalities in immigrant populations in Spain: a scoping review]. Rev Esp Salud Publica. 2014;88(6):687–701.

37. Stronks K, Snijder MB, Peters RJG, Prins M, Schene AH, Zwinderman AH. Unravelling the impact of ethnicity on health in Europe: the HELIUS study. BMC Public Health. 2013;13:402.

38. Brand T, Samkange-Zeeb F, Ellert U, Keil T, Krist L, Dragano N, et al. Acculturation and health-related quality of life: results from the German National Cohort migrant feasibility study. Int J Public Health. 2017 Mar 2;

39. Ejiogu N, Norbeck JH, Mason MA, Cromwell BC, Zonderman AB, Evans MK. Recruitment and retention strategies for minority or poor clinical research participants: lessons from the Healthy Aging in Neighborhoods of Diversity across the Life Span study. Gerontologist. 2011 Jun;51 Suppl 1:S33-45.

40. Ford ME, Siminoff LA, Pickelsimer E, Mainous AG, Smith DW, Diaz VA, et al. Unequal burden of disease, unequal participation in clinical trials: solutions from African American and Latino community members. Health Soc Work. 2013 Feb;38(1):29–38.

41. Woodward-Kron R, Hughson J-A, Parker A, Bresin A, Hajek J, Knoch U, et al. Culturally and

Linguistically Diverse Populations in Medical Research: Perceptions and Experiences of Older Italians, Their Families, Ethics Administrators and Researchers. J Public health Res. 2016 Apr 26;5(1):667.

42. Lwin Z, Broom A, Cosman R, Livingstone A, Sawkins K, Good P, et al. Culturally and linguistically diverse patient participation in glioma research. Neuro-oncology Pract. 2014 Sep 1;1(3):101–5.

43. Goff SL, Youssef Y, Pekow PS, White KO, Guhn-Knight H, Lagu T, et al. Successful Strategies for Practice-Based Recruitment of Racial and Ethnic Minority Pregnant Women in a Randomized Controlled Trial: the IDEAS for a Healthy Baby Study. J racial Ethn Heal disparities. 2016 Dec 11;3(4):731–7.

44. Gadegbeku CA, Stillman PK, Huffman MD, Jackson JS, Kusek JW, Jamerson KA. Factors associated with enrollment of African Americans into a clinical trial: results from the African American study of kidney disease and hypertension. Contemp Clin Trials. 2008 Nov;29(6):837–42.

45. Wendler D, Kington R, Madans J, Van Wye G, Christ-Schmidt H, Pratt L, et al. Are racial and ethnic minorities less willing to participate in health research? PLoS Med. 2006;3(2:e19.).

46. Brown DR, Topcu M. Willingness to participate in clinical treatment research among older African Americans and Whites. Gerontologist. 2003 Feb;43(1):62–72.

47. Hernando C, Sabidó M, Ronda E, Ortiz-Barreda G CJ. A systematic review of longitudinal cohort studies on the health of migrant populations. Soc Med. 2015;9(2):73–85.

48. Hernando C, Sabidó M, Casabona J. Facilitators and barriers of participation in a longitudinal research on migrant families in Badalona (Spain): a qualitative approach. Heal Soc Care

Community. 2017;

49. Hernando Rovirola C, Gaillardin F, Ferrer Serret L, Cayuela Mateo A, Ronda Pérez E, Casabona Barbarà J. Facilitators of participation and implementation of the immigrant families' PELFI Sub-Cohort. Gac Sanit. 2017;

50. United Nations. International migration report 2015. Highlights. New York; 2016.

51. Global Migration Data Analysis Centre (GMDAC). Global Migration Indicators 2018. Berlin; 2018.

52. ANDERSON B, BLINDER S. Who counts as a migrant? Definitions and their consequences. Oxford.; 2017.

53. International Organization for Migration (IOM). Who is a migrant? [Internet]. 2018. Available from: https://www.iom.int/who-is-a-migrant

54. Stronks K, Ravelli AC, Reijneveld SA. Immigrants in the Netherlands: equal access for equal needs? J Epidemiol Community Health. 2001 Oct;55(10):701–7.

55. Izquierdo A, López D. El rastro demográfico de la inmigración en España: 1996-2002.

56. Malmusi D, Jansà JM, del Vallado L. [Recommendations for health research and information on definitions and variables for the study of the foreign-born immigrant population]. Rev Esp Salud Publica. 2007;81(4):399–409.

57. de la Rica S, Glitz A, Ortega F. Immigration in Europe: Trends, Policies and Empirical Evidence. IZA Discussion Paper No. 7778. Bonn;

58. Van Mol C, de Valk H. Migration and Immigrants in Europe: Chapter 3: A Historical and

Demographic Perspective. In: B. Garcés-Mascareñas, R. Penninx (eds.), Integration Processes and Policies in Europe, IMISCOE Research Series.

59. Napoli C, Riccardo F, Declich S, Dente MG, Pompa MG, Rizzo C, et al. An early warning system based on syndromic surveillance to detect potential health emergencies among migrants: results of a two-year experience in Italy. Int J Environ Res Public Health. 2014 Aug;11(8):8529–41.

60. Ostera GR, Blum JR, Mejia R. Immigrant Populations: Global Health in our Backyard. Ann Glob Heal. 2014;80(6):429–31.

61. EUROSTAT. Eurostat. Migration and Citizenship Data. [Internet]. [cited 2016 Jun 15]. Available from: http://ec.europa.eu/eurostat/web/population-demography-migration-projections/migration-and-citizenship-data.

62. Riccardo F, Dente MG, Kärki T, Fabiani M, Napoli C, Chiarenza A, et al. Towards a European Framework to Monitor Infectious Diseases among Migrant Populations: Design and Applicability. Int J Environ Res Public Health. 2015 Sep;12(9):11640–61.

63. Sundquist J. Migration, equality and access to health care services. Vol. 55, Journal of epidemiology and community health. England; 2001. p. 691–2.

64. EUROSTAT. Migration and migrant population statistics. [Internet]. Statistics explained. [cited 2017 Mar 26]. Available from: http://ec.europa.eu/eurostat/statistics-explained/index.php/Migration_and_migrant_population_statistics

65. Reher D, Cortés Alcalá L, González Quiñones F, Requena M, Sánchez Domínguez M, Sanz Gimeno A, et al. Encuesta Nacional de Inmigrantes (ENI 2007): una monografía. Madrid; 2008.

66. Red Europea de Migración. Informe anual de estadísticas de migración y protección internacional. Madrid.; 2009.

67. Alonso X, Pajares M, Recolons L. Inmigración y crisis en España. Barcelona; 2015.

68. Instituto Nacional de Estadística (INE). INE. Estadística del Padrón continuo. Principales series de población desde 1998. [Internet]. [cited 2017 Sep 9]. Available from: www.ine.es/jaxi/Datos.htm?path=/t20/e245/p08/l0/&file=02002.px

69. Hernández Quevedo C, Jiménez Rubio D. Salud y acceso a los servicios sanitarios en España: la realidad de la inmigración. 2010.

70. Domingo A, Valls M. Migraciones internacionales y población de nacionalidad extranjera. En Cabré, A. et al. ¿Ascenderán las tasas de actividad en Europa del sur?: pronósticos desde un enfoque sociodemográfico. 2001;

71. Cabré A, Domingo A, Menacho T, Pimentel Siles M (coord. . Demografía y crecimiento de la población española durante el siglo XX. Monográfico: Procesos Migratorios, economía y personas. Mediterráneo Económico Almer Caja Rural Intermediterránea Cajamar. 2002;1:121–38.

72. Determinación de las necesidades de mano de obra y de migración laboral de nacionales de terceros países en España. Madrid.; 2015.

73. Serra del Pozo P, Smilges Gaffe A. La población extranjera de Badalona en el contexto de la crisis económica. Estud Geográficos. 2013;LXXIV(275):639–82.

74. Instituto Nacional de Estadística (INE). Principales series de población desde 1998. [Internet]. [cited 2014 Feb 11]. Available from: http://www.ine.es/jaxi/Tabla.htm?path=/t20/e245/p08/l0/&file=01004.px&L=0

75. Instituto Nacional de Estadística (INE). INE. Estadística del padrón continuo. Datos provisionales a 1 de enero de 2017. [Internet]. [cited 2017 Sep 9]. Available from: www.ine.es/jaxi/Tabla.htm?path=/t20/e245/p08/l0/&file=02002.px

76. IDESCAT, (Institut d'Estadística de Catalunya I. Padró municipal d'habitants. [Internet]. 2017 [cited 2017 Jan 4]. Available from: https://www.idescat.cat/pub/?id=pmh&n=674

77. Ortega-Rivera E, Solana M. Migracions dels segles XX i XXI: una mirada candeliana. Col•lecció Ciutadania i Immigració, núm. 11. Capítol 2: Migracions a Catalunya: cinc dècades de canvis i continuïtats; pàg 50-53. Barcelona; 2015.

78. IDESCAT, (Institut d'Estadística de Catalunya I. Població. Immigracions, emigracions i saldos migratoris. [Internet]. 2016 [cited 2018 Jan 5]. Available from: https://idescat.cat/pub/aec/1015/2015

79. Instituto Nacional de Estadística (INE). INE. Principales series de población desde 1998. Población (españoles/extranjeros) por País de Nacimiento, sexo y año. [Internet]. [cited 2017 Sep 25]. Available from: http://www.ine.es/jaxi/Tabla.htm?path=/t20/e245/p08/l0/&file=01006.px&L=0

80. Estadística del Padrón Continuo. Datos provisionales a 1 de enero de 2017. Datos a nivel nacional, comunidad autónoma y provincia.

81. World Health Organization (WHO). Constitution of the World Health Organization. New York; 1946.

82. United Nations (UN). International Covenant on Economic, Social and Cultural Rights. New York.; 1966.

83. World Health Organization (WHO). Sixty-first World Health Assembly. Health of migrants. Geneva.; 2008.

84. World Health Organization (WHO). Strategy and action plan for refugee and migrant health in the WHO European Region. Regional committee for Europe 66th session. Copenhagen.; 2016.

85. World Health Organization (WHO). World Health Organization. Seventieth World Health Assembly update. 2017.

86. Hladun O, Grau A, Esteban E, Jansa JM. Results from screening immigrants of low-income countries: data from a public primary health care. J Travel Med. 2014;21(2):92–8.

87. World Health Organization (WHO). Report on the health of refugees and migrants in the WHO European Region. No Public Health without refugee and migrant health. Marmorvej; 2018.

88. Abraído-Lanza AF, Dohrenwend BP, Ng-Mak DS, Turner JB. The Latino mortality paradox: a test of the "salmon bias" and healthy migrant hypotheses. Am J Public Health. 1999 Oct;89(10):1543–8.

89. Vázquez ML, Vargas I, Aller M-B. [The impact of the economic crisis on the health and healthcare of the immigrant population. SESPAS report 2014]. Gac Sanit. 2014 Jun;28 Suppl 1:142–6.

90. Williams R. Health and length of residence among south Asians in Glasgow: a study controlling for age. J Public Health Med. 1993 Mar;15(1):52–60.

91. Gimeno-Feliu LA, Calderón-Larrañaga A, Diaz E, Poblador-Plou B, Macipe-Costa R, Prados-Torres A. The healthy migrant effect in primary care. Gac Sanit. 2015 Jan;29(1):15–20.

92. Reyes-Urueña J, Campbell C, Hernando C, Vives N, Folch C, Ferrer L, et al. Differences between migrants and Spanish-born population through the HIV care cascade, Catalonia: an analysis using multiple data sources. Epidemiol Infect. 2017 Mar 8;1–12.

93. Uretsky MC, Mathiesen SG. The effects of years lived in the United States on the general health status of California's foreign-born populations. J Immigr Minor Heal. 2007 Apr;9(2):125–36.

94. Bas-Sarmiento P, Fernández-Gutiérrez M, Albar-Marín MAJ, García-Ramírez M. [Perceptions and experiences of access to health services and their utilization among the immigrant population]. Gac Sanit. 29(4):244–51.

95. World Health Organization (WHO). Global action plan for the prevention and control of noncommunicable diseases 2013–2020. Geneva.; 2013.

96. World Health Organization (WHO). World Health Organization. Social determinants of health. [Internet]. 2014 [cited 2017 Sep 9]. Available from: www.euro.who.int/en/health-topics/health-determinants/social-determinants/social-determinants

97. González-Rábago Y, La Parra D, Martín U, Malmusi D. Participación y representatividad de la población inmigrante en la Encuesta Nacional de Salud de España 2011-2012. Gac Sanit. 2014 Jul;28(4):281–6.

98. Rossi C, Shrier I, Marshall L, Cnossen S, Schwartzman K, Klein MB, et al. Seroprevalence of chronic hepatitis B virus infection and prior immunity in immigrants and refugees: a systematic review and meta-analysis. PLoS One. 2012;7(9):e44611.

99. Greenaway C, Thu Ma A, Kloda LA, Klein M, Cnossen S, Schwarzer G, et al. The Seroprevalence of Hepatitis C Antibodies in Immigrants and Refugees from Intermediate and High Endemic Countries: A Systematic Review and Meta-Analysis. PLoS One. 2015;10(11):e0141715.

100. Driedger M, Mayhew A, Welch V, Agbata E, Gruner D, Greenaway C, et al. Accessibility and Acceptability of Infectious Disease Interventions Among Migrants in the EU/EEA: A CERQual. Int J Environ Res Public Health. 2018 Oct;15(11).

101. Agyemang C, van Oeffelen AA, Norredam M, Kappelle LJ, Klijn CJM, Bots ML, et al. Socioeconomic inequalities in stroke incidence among migrant groups: analysis of nationwide data. Stroke. 2014 Aug;45(8):2397–403.

102. Dzayee DAM, Beiki O, Ljung R, Moradi T. Downward trend in the risk of second myocardial infarction in Sweden, 1987-2007: breakdown by socioeconomic position, gender, and country of birth. Eur J Prev Cardiol. 2014 May;21(5):549–58.

103. Sohail QZ, Chu A, Rezai MR, Donovan LR, Ko DT, Tu J V. The Risk of Ischemic Heart Disease and Stroke Among Immigrant Populations: A Systematic Review. Can J Cardiol. 2015 Sep;31(9):1160–8.

104. Fedeli U, Pigato M, Avossa F, Ferroni E, Nardetto L, Giometto B, et al. Large variations in stroke hospitalization rates across immigrant groups in Italy. J Neurol. 2016 Mar;263(3):449–54.

105. Fedeli U, Ferroni E, Pigato M, Avossa F, Saugo M. Causes of mortality across different immigrant groups in Northeastern Italy. PeerJ. 2015;3:e975.

106. Fedeli U, Avossa F, Ferroni E, Schievano E, Bilato C, Modesti PA, et al. Diverging patterns of cardiovascular diseases across immigrant groups in Northern Italy. Int J Cardiol. 2018 Mar;254:362–7.

107. Stirbu I, Kunst AE, Bos V, Mackenbach JP. Differences in avoidable mortality between migrants and the native Dutch in The Netherlands. BMC Public Health. 2006 Mar;6:78.

108. Llop-Gironés A, Vargas Lorenzo I, Garcia-Subirats I, Aller M-B, Vázquez Navarrete ML. [Immigrants' access to health care in Spain: a review]. Rev española salud pública. 2014;88(6):715–34.

109. CIBERESP Subprogram on Migrationand Health. Policy brief. Migration and Health in Spain.

110. BOE núm. 98. Real Decreto-ley 16/2012, de 20 de abril, de medidas urgentes para garantizar la sostenibilidad del Sistema Nacional de Salud y mejorar la calidad y seguridad de sus prestaciones. Madrid.; 2012.

111. World Health Organization (WHO). Migration and health: key issues. [Internet]. 2015 [cited 2017 Sep 10]. Available from: www.euro.who.int/en/health-topics/health-determinants/migration-and-health/news/news/2015/09/population-movement-is-a-challenge-for-refugees-and-migrants-as-well-as-for-the-receiving-population/migration-and-health-key-issues

112. Suk JE, Semenza JC. Future Infectious Disease Threats to Europe. Am J Public Health. 2011 Nov;101(11):2068–79.

113. Semenza JC, Giesecke J. Intervening to reduce inequalities in infections in Europe. Am J Public Health. 2008 May;98(5):787–92.

114. Garcia-Subirats I, Vargas I, Sanz B, Malmusi D, Ronda E, Ballesta M, et al. Changes in access to health services of the immigrant and native-born population in Spain in the context of economic crisis. Int J Environ Res Public Health. 2014 Sep 30;11(10):10182–201.

115. Porthé V, Vargas I, Malmusi D, Sanz B, Otero L, Bosch L, et al. Economic crisis, cutbacks and migrants' access to healthcare in Spain: health workers' perspective: M.Luisa Vázquez. Eur J Public Health. 2015 Oct 5;25(suppl_3).

116. Porthe V, Vargas I, Sanz-Barbero B, Plaza-Espuna I, Bosch L, Vazquez ML. Changes in access to health care for immigrants in Catalonia during the economic crisis: Opinions of health professionals and immigrant users. Health Policy. 2016 Nov;120(11):1293–303.

117. Malmusi D, Gotsens M. Estad o de salud, determinantes y uso de servicios de la población inmigrada en España. Encuestas Nacionales de Salud 2006 y 2012. Subprograma Inmigración y Salud Ciberesp. 2014.

118. Basile L, Jansa JM, Carlier Y, Salamanca DD, Angheben A, Bartoloni A, et al. Chagas disease in European countries: the challenge of a surveillance system. Euro Surveill Bull Eur sur les Mal Transm = Eur Commun Dis Bull. 2011 Sep;16(37).

119. Basile L, Oliveira I, Ciruela P, Plasencia A. The current screening programme for congenital transmission of Chagas disease in Catalonia, Spain. Euro Surveill Bull Eur sur les Mal Transm = Eur Commun Dis Bull. 2011 Sep;16(38).

120. WHO: Sexually Transmitted Infections. Fact sheet N°110. [Internet]. Available from: http://www.who.int/mediacentre/factsheets/fs110/en/(

121. World Health Organization (WHO). European Action Plan for HIV/AIDS 2012-2015. Copenhagen.; 2011.

122. World Health Organization (WHO). WHO: HIV/AIDS. Fact sheet 2019 July 25th [Internet]. 2019. Available from: https://www.who.int/news-room/fact-sheets/detail/hiv-aids

123. European Centre for Disease Prevention and Control (ECDC). HIV/AIDS surveillance in Europe 2018-2017 data. Copenhagen.; 2018.

124. Cianelli R, Villegas N. Social Determinants of Health for HIV Among Hispanic Women. Hisp Heal Care Int. 2016;14(1):4–9.

125. World Health Organization (WHO). Action plan for the health sector response to HIV in the WHO European Region. Copenhagen; 2016.

126. Deane KD, Parkhurst JO, Johnston D. Linking migration, mobility and HIV. Trop Med Int Health. 2010 Dec;15(12):1458–63.

127. Fakoya I, Álvarez-Del Arco D, Woode-Owusu M, Monge S, Rivero-Montesdeoca Y, Delpech V, et al. A systematic review of post-migration acquisition of HIV among migrants from countries with generalised HIV epidemics living in Europe: mplications for effectively managing HIV prevention programmes and policy. BMC Public Health. 2015 Jan;15(1):561.

128. Coffee M, Lurie MN, Garnett GP. Modelling the impact of migration on the HIV epidemic in

South Africa. AIDS. 2007 Jan;21(3):343–50.

129. Saigí N, Espelt A, Folch C, Sarasa-Renedo A, Castellano Y, Majó X, et al. Differences in illegal drug consumption between native and immigrants in a large sample of injected drug users in Catalonia (Spain). Adicciones. 2014;26(1):69–76.

130. Joint United Nations Programme on HIV/AIDS (UNAIDS). The Gap Report UNAIDS. Geneva, Switzerland; 2014.

131. Weine SM, Kashuba AB. Labor migration and HIV risk: a systematic review of the literature. AIDS Behav. 2012 Aug;16(6):1605–21.

132. European Centre for Disease Prevention and Control (ECDC). Migrant health: Epidemiology of HIV and AIDS in migrant communities and ethnic minorities in EU/EEA countries. Stockholm, Sweden; 2010.

133. Rice BD, Elford J, Yin Z, Delpech VC. A new method to assign country of HIV infection among heterosexuals born abroad and diagnosed with HIV. AIDS. 2012 Sep;26(15):1961–6.

134. European Centre for Disease Prevention and Control. Migrant health: Sexual transmission of HIV within migrant groups in the EU/ EEA and implications for effective interventions. Stockholm, Sweden; 2013.

135. López-Vélez R, Navarro M, Jiménez C. Estudio de Inmigración y Salud Pública: Enfermedades Infecciosas Importadas. Madrid; 2007.

136. (ECDC) EC for DP and C. HIV/AIDS surveillance in Europe 2014. Stockholm; 2015.

137. Hernando V, Alvárez-Del Arco D, Alejos B, Monge S, Amato-Gauci AJ, Noori T, et al. HIV infection in migrant populations in the European Union and European Economic Area in 2007-2012; an epidemic on the move. J Acquir Immune Defic Syndr. 2015 Jun;

138. CEEISCAT. SIVES. Sistema Integrat de Vigilància Epidemiològica de la SIDA/VIH/ITS a Catalunya. Informe epidemiològic CEEISCAT. Barcelona; 2015.

139. Hernando V, Alvarez-del Arco D, Alejos B, Monge S, Amato-Gauci AJ, Noori T, et al. HIV Infection in Migrant Populations in the European Union and European Economic Area in 2007-2012: An Epidemic on the Move. J Acquir Immune Defic Syndr. 2015 Oct;70(2):204–11.

140. Nacional P, Epidemiología. sobre el S-SG de P de la S y E/ CN de. Área de Vigilancia de VIH y Comportamientos de Riesgo. Vigilancia Epidemiológica del VIH y Sida en España 2016: Sistema de Información sobre Nuevos Diagnósticos de VIH y Registro Nacional de Casos de Sida. Plan Nacional sobre el Sida. Madrid.; 2017.

141. European Commission. Action Plan on HIV/AIDS in the EU and neighbouring countries: 2014-2016. 2014.

142. Semchenko EA, Seib KL. Intractable problems require novel solutions: it's time to get serious about developing a gonorrhoea vaccine. Sex Transm Infect. 2016 Dec;92(8):561–2.

143. (ECDC) EC for DP and C. "Europe sees constant increase in gonorrhea infections: A threat for treatment success: Drug-resistant gonococci." [Internet]. ScienceDaily. 2016 [cited 2017 Mar 25]. Available from: www.sciencedaily.com/releases/2016/05/160531112840.htm

144. ECDC. Sexually transmitted infections in Europe 2013. Stockholm; 2015.

145. Gonococcal resistance to antimicrobials surveillance program (GRASP). Surveillance of antimicrobial resistance in Neisseria gonorrhoeae 2014. London; 2015.

146. Tapsall JW, Ndowa F, Lewis DA, Unemo M. Meeting the public health challenge of multidrug- and extensively drug-resistant *Neisseria gonorrhoeae*. Expert Rev Anti Infect Ther. 2009 Sep 10;7(7):821–34.

147. Ndowa FJ, Ison CA, Lusti-Narasimhan M. Gonococcal antimicrobial resistance: the implications for public health control. Sex Transm Infect. 2013 Dec 15;89 Suppl 4(Suppl 4):iv1-2.

148. Lebedzeu F, Golparian D, Titov L, Pankratava N, Glazkova S, Shimanskaya I, et al. Antimicrobial susceptibility/resistance and NG-MAST characterisation of Neisseria gonorrhoeae in Belarus, Eastern Europe, 2010-2013. BMC Infect Dis. 2015 Jan;15:29.

149. Kubanova A, Kubanov A, Frigo N, Solomka V, Semina V, Vorobyev D, et al. Russian gonococcal antimicrobial susceptibility programme (RU-GASP)--resistance in Neisseria gonorrhoeae during 2009-2012 and NG-MAST genotypes in 2011 and 2012. BMC Infect Dis. 2014 Jun;14:342.

150. Cole MJ, Spiteri G, Jacobsson S, Woodford N, Tripodo F, Amato-Gauci AJ, et al. Overall Low Extended-Spectrum Cephalosporin Resistance but high Azithromycin Resistance in Neisseria gonorrhoeae in 24 European Countries, 2015. BMC Infect Dis. 2017 Sep;17(1):617.

151. Wi T, Lahra MM, Ndowa F, Bala M, Dillon J-AR, Ramon-Pardo P, et al. Antimicrobial resistance in Neisseria gonorrhoeae: Global surveillance and a call for international collaborative action. PLoS Med. 2017 Jul;14(7):e1002344.

152. WHO. WHO guidelines for the treatment of Neisseria gonorrhoeae. Geneva; 2016.

153. Lahra MM, Martin I, Demczuk W, Jennison A V, Lee K-I, Nakayama S-I, et al. Cooperative Recognition of Internationally Disseminated Ceftriaxone-Resistant Neisseria gonorrhoeae Strain. Emerg Infect Dis. 2018 Apr;24(4).

154. Fifer H, Natarajan U, Jones L, Alexander S, Hughes G, Golparian D, et al. Failure of Dual Antimicrobial Therapy in Treatment of Gonorrhea. Vol. 374, The New England journal of medicine. United States; 2016. p. 2504–6.

155. Eyre DW, Sanderson ND, Lord E, Regisford-Reimmer N, Chau K, Barker L, et al. Gonorrhoea treatment failure caused by a Neisseria gonorrhoeae strain with combined ceftriaxone and high-level azithromycin resistance, England, February 2018. Euro Surveill Bull Eur sur les Mal Transm = Eur Commun Dis Bull. 2018 Jul;23(27).

156. Whiley DM, Jennison A, Pearson J, Lahra MM. Genetic characterisation of Neisseria gonorrhoeae resistant to both ceftriaxone and azithromycin. Vol. 18, The Lancet. Infectious diseases. United States; 2018. p. 717–8.

157. Fuertes de Vega I, Baliu-Pique C, Bosch Mestres J, Vergara Gomez A, Valles X, Alsina Gibert M. Risk factors for antimicrobial-resistant Neisseria gonorrhoeae and characteristics of patients infected with gonorrhea. Enferm Infecc Microbiol Clin. 2017 Jan;

158. Camara J, Serra J, Ayats J, Bastida T, Carnicer-Pont D, Andreu A, et al. Molecular characterization of two high-level ceftriaxone-resistant Neisseria gonorrhoeae isolates detected in Catalonia, Spain. J Antimicrob Chemother. 2012 Aug;67(8):1858–60.

159. Unemo M, Golparian D, Nicholas R, Ohnishi M, Gallay A, Sednaoui P. High-Level Cefixime- and

Ceftriaxone-Resistant Neisseria gonorrhoeae in France: Novel penA Mosaic Allele in a Successful International Clone Causes Treatment Failure. Antimicrob Agents Chemother. 2012 Mar 1;56(3):1273–80.

160. ECDC. Gonococcal Antimicrobial Surveillance Reporting Protocol 2016 (Euro-GASP). Stockholm; 2016.

161. Serra-Pladevall J, Barbera-Gracia MJ, Roig-Carbajosa G, Juve-Saumell R, Gonzalez-Lopez JJ, Bartolome-Comas R, et al. [Neisseria gonorrhoeae: antimicrobial resistance and study of population dynamics. Situation in Barcelona in 2011]. Enferm Infecc Microbiol Clin. 2013 Nov;31(9):579–83.

162. Spiteri G, Cole M, Unemo M, Hoffmann S, Ison C, van de Laar M. The European Gonococcal Antimicrobial Surveillance Programme (Euro-GASP)—a sentinel approach in the European Union (EU)/European Economic Area (EEA). Sex Transm Infect. 2013 Dec 15;89(Suppl 4):iv16–8.

163. Garcia M, Schiaffino A, Fernandez E, Marti M, Salto E, Perez G, et al. The Cornella Health Interview Survey Follow-Up (CHIS.FU) Study: design, methods, and response rate. BMC Public Health. 2003 Mar;3:12.

164. Alonso J, Orfila F, Ruigomez A, Ferrer M, Anto JM. Unmet health care needs and mortality among Spanish elderly. Am J Public Health. 1997 Mar;87(3):365–70.

165. The World Health Organization MONICA Project (monitoring trends and determinants in cardiovascular disease): a major international collaboration. WHO MONICA Project Principal Investigators. J Clin Epidemiol. 1988;41(2):105–14.

166. Riboli E. Nutrition and cancer: background and rationale of the European Prospective Investigation into Cancer and Nutrition (EPIC). Ann Oncol Off J Eur Soc Med Oncol. 1992 Dec;3(10):783–91.

167. [The European prospective investigation on diet, cancer, and health (EPIC) in Spain. Group EPIC of Spain]. Med Clin (Barc). 1994 May;102(20):781–5.

168. Corominas Barnadas JM, Lopez-Pousa S, Vilalta-Franch J, Calvo-Perxas L, Juvinya Canal D, Garre-Olmo J. [MESGI50 study: description of a cohort on Maturity and Satisfactory Ageing]. Gac Sanit. 2017 Nov;31(6):511–7.

169. Grau M, Subirana I, Elosua R, Solanas P, Ramos R, Masia R, et al. Trends in cardiovascular risk factor prevalence (1995-2000-2005) in northeastern Spain. Eur J Cardiovasc Prev Rehabil. 2007 Oct;14(5):653–9.

170. Delclos CE, Benavides FG, García AM, López-Jacob MJ, Ronda E. From questionnaire to database: field work experience in the 'Immigration, work and health survey' (ITSAL Project). Gac Sanit. 2011 Sep;25(5):419–22.

171. Ronda E, Agudelo-Suarez AA, Garcia AM, Lopez-Jacob MJ, Ruiz-Frutos C, Benavides FG. Differences in exposure to occupational health risks in Spanish and foreign-born workers in Spain (ITSAL Project). J Immigr Minor Heal. 2013 Feb;15(1):164–71.

172. Edwards P, Roberts I, Clarke M, DiGuiseppi C, Pratap S, Wentz R, et al. Increasing response rates to postal questionnaires: systematic review. BMJ. 2002 May;324(7347):1183.

173. Jacomb PA, Jorm AF, Korten AE, Christensen H, Henderson AS. Predictors of refusal to

participate: a longitudinal health survey of the elderly in Australia. BMC Public Health. 2002;2:4.

174. de Graaf R, Bijl R V, Smit F, Ravelli A, Vollebergh WA. Psychiatric and sociodemographic predictors of attrition in a longitudinal study: The Netherlands Mental Health Survey and Incidence Study (NEMESIS). Am J Epidemiol. 2000 Dec;152(11):1039–47.

175. Eagan TML, Eide GE, Gulsvik A, Bakke PS. Nonresponse in a community cohort study: predictors and consequences for exposure-disease associations. J Clin Epidemiol. 2002 Aug;55(8):775–81.

176. Jayaweera H, Quigley MA. Health status, health behaviour and healthcare use among migrants in the UK: evidence from mothers in the Millennium Cohort Study. Soc Sci Med. 2010 Sep;71(5):1002–10.

177. Caro-Murillo AM, Gutiérrez F, Manuel Ramos J, Sobrino P, Miró JM, López-Cortés LF, et al. [HIV infection in immigrants in Spain: Epidemiological characteristics and clinical presentation in the CoRIS Cohort (2004-2006)]. Enferm Infecc Microbiol Clin. Jan;27(7):380–8.

178. Jaen A, Casabona J, Esteve A, Miro JM, Tural C, Ferrer E, et al. [Clinical-epidemiological characteristics and antiretroviral treatment trends in a cohort of HIV infected patients. The PISCIS Project]. Med Clin (Barc). 2005 Apr;124(14):525–31.

179. Wilets I, O'Rourke M, Nassisi D. How patients and visitors to an urban emergency department view clinical research. Acad Emerg Med. 2003 Oct;10(10):1081–5.

180. Corbie-Smith G, Thomas SB, St George DMM. Distrust, race, and research. Arch Intern Med. 2002 Nov 25;162(21):2458–63.

181. Unson CG, Dunbar N, Curry L, Kenyon L, Prestwood K. The effects of knowledge, attitudes, and significant others on decisions to enroll in a clinical trial on osteoporosis: implications for recruitment of older African-American women. J Natl Med Assoc. 2001 Oct;93(10):392–401; discussion 402-4.

182. Burroughs AR, Visscher WA, Haney TL, Efland JR, Barefoot JC, Williams RB, et al. Community recruitment process by race, gender, and SES gradient: lessons learned from the Community Health and Stress Evaluation (CHASE) Study experience. J Community Health. 2003 Dec;28(6):421–37.

183. Jaber LA. Barriers and strategies for research in Arab Americans. Diabetes Care. 2003 Feb;26(2):514–5.

184. Schenk L, Neuhauser H. [Participation of migrants in health surveys conducted by telephone: potential and limits]. Gesundheitswesen. 2005 Oct;67(10):719–25.

185. Nordstrom DL, Krauska M, DeStefano F, Colt JS, Zahm SH. Ability to trace migrant farmworkers ten years after initial identification in a Northern State (Wisconsin). Am J Ind Med. 2001 Nov;40(5):592–5.

186. Cooper SP, Burau K, Hanis C, Henry J, MacNaughton N, Robison T, et al. Tracing migrant farmworkers in Starr County, Texas. Am J Ind Med. 2001 Nov;40(5):586–91.

187. Evans MK, Lepkowski JM, Powe NR, LaVeist T, Kuczmarski MF, Zonderman AB. Healthy aging in neighborhoods of diversity across the life span (HANDLS): overcoming barriers to implementing a longitudinal, epidemiologic, urban study of health, race, and socioeconomic status. Ethn Dis.

2010;20(3):267–75.

188. Jones C, Jablonski RA. “I don’t want to be a guinea pig”: recruiting older African Americans. J Gerontol Nurs. 2014 Mar 1;40(3):3–4.

189. Aroian KJ, Katz A, Kulwicki A. Recruiting and retaining Arab Muslim mothers and children for research. J Nurs Scholarsh. 2006;38(3):255–61.

190. UyBico SJ, Pavel S, Gross CP. Recruiting vulnerable populations into research: a systematic review of recruitment interventions. J Gen Intern Med. 2007 Jun 10;22(6):852–63.

191. World Health Organization (WHO). Public Health Aspects of Migration in Europe (PHAME). Public health aspects of migration in Europe. Newsletter. Issue 5. [Internet]. 2015. Available from: www.euro.who.int/__data/assets/pdf_file/0008/277217/PHAME-Newsletter_5th-Issue.pdf

192. Terraza-Núñez R, Toledo D, Vargas I, Vázquez ML. Perception of the Ecuadorian population living in Barcelona regarding access to health services. Int J Public Health. 2010 Oct 26;55(5):381–90.

193. Valderas JM, Mendivil J, Parada A, Losada-Yanez M, Alonso J. [Development of a geographic filter for PubMed to identify studies performed in Spain]. Rev Esp Cardiol. 2006 Dec;59(12):1244–51.

194. Perruchoud R, Redpath-Cross J. Glossary on Migration 2on edition. Ginebra; 2011.

195. Arksey H, O’Malley L. Scoping studies: towards a methodological framework. Int J Soc Res Methodol. 2005;8(1):19–32.

196. Wells G, Shea B, O’Connell D, Peterson J, Welch V, Losos M, et al. Quality Assessment Scales for

Observational Studies. Otawa.; 2004.

197. The American Association for Public Opinion Research. Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys. 9th edition. 2016.

198. ECDC. Gonococcal Antimicrobial Surveliance Reporting Protocol 2016. Euro-GASP. Stockholm; 2016.

199. The European committee on antimicrobial susceptibility testing. Breakpoint tables for interpretation of MICs and zone diameters. Version 8.0. Basel.; 2018.

200. Willig C. Willlig, C. (2008). Introducing qualitative research in psychology. Adventures in theory and method . Berkshire/New York: Open Unive. Philadelphia; 2008. 20 p.

201. Jeon Y-H. The application of grounded theory and symbolic interactionism. Scand J Caring Sci. 2004 Sep;18(3):249–56.

202. Braun V, Clarke V. Using thematic analysis in psychology. Qual Res Psychol. 2006;3(2):77-101.

203. Chapman AL, Hadfield M, Chapman CJ. Qualitative research in healthcare: an introduction to grounded theory using thematic analysis. J R Coll Physicians Edinb. 2015;45(3):201–5.

204. Ministerio de Sanidad Servicios Sociales e Igualdad. Encuesta Nacional de Salud 2011-2012. [Internet]. 2013. Available from: http://www.msssi.gob.es/estadEstudios/estadisticas/encuestaNacional/encuestaNac2011/NotaTecnica2011-12.pdf

205. Cayuela-Mateo A, Martínez-Martínez JM, Ferrer Serret L, Felt E, Casabona I Barbarà J, Collazos

Sanchez F, et al. [PELFI Project: Recruitment and Sociodemographic Characteristics of Immigrant and Autochthonous Families from Alicante and Barcelona City Subcohorts]. Rev Esp Salud Publica. 2017 Feb 9;91.

206. Domingo-Salvany A, Bacigalupe A, Carrasco JM, Espelt A, Ferrando J, Borrell C. Propuestas de clase social neoweberiana y neomarxista a partir de la Clasificación Nacional de Ocupaciones 2011. Gac Sanit. 2013;27(3):263–72.

207. Ronda-Pérez E, Agudelo-Suárez AA, López-Jacob MJ, García AM, Benavides FG. Condiciones de trabajo y salud de los trabajadores inmigrantes en España: revisión bibliográfica. Rev Esp Salud Publica. 2014 Dec;88(6):703–14.

208. Collazos Sánchez F, Ghali Bada K, Ramos Gascón M, Qureshi Burckhardt A. Salud mental de la población inmigrante en España. Rev Esp Salud Publica. 2014 Dec;88(6):755–61.

209. Fernandes Custodio D, Ortiz-Barreda G, Rodríguez-Artalejo F. Alimentación, actividad física y otros factores de riesgo cardiometabólico en la población inmigrante en España: revisión bibliográfica. Rev Esp Salud Publica. 2014 Dec;88(6):745–54.

210. Rodríguez-Salés V, Ortiz-Barreda G, Sanjosé S de. Revisión bibliográfica sobre la prevención del cáncer en personas inmigrantes residentes en España. Rev Esp Salud Publica. 2014 Dec;88(6):735–43.

211. Galan Montemayor JC, Moreno Bofarull A, Baquero Mochales F. [Impact of the migratory movements in the bacterial resistance to antibiotics]. Rev Esp Salud Publica. 2014;88(6):829–37.

212. Casals M, Rodrigo T, Camprubí E, Orcau À, Caylà JA. Tuberculosis e inmigración en España:

revisión bibliográfica. Rev Esp Salud Publica. 2014 Dec;88(6):803–9.

213. Gonzalez-Candelas F, Alma Bracho M, Comas I, d'Auria G, D Unkova M, Garcia R, et al. [Molecular epidemiology studies on the immigrant population in Spain]. Rev Esp Salud Publica. 2014;88(6):819–28.

214. Calderón Sandubete E, Yang Lai R, Calero Bernal ML, Martínez Rísquez MT, Calderón Baturone M, Horra Padilla C de la. [Chronic viral hepatitis B and C in immigrant population, Spain]. Rev española salud pública. 2014;88(6):811–8.

215. Vilajeliu Balague A, de Las Heras Prat P, Ortiz-Barreda G, Pinazo Delgado MJ, Gascon Brustenga J, Bardaji Alonso A. [Imported parasitic diseases in the immigrant population in Spain]. Rev Esp Salud Publica. 2014;88(6):783–802.

216. Cristancho SM, Goldszmidt M, Lingard L, Watling C. Qualitative research essentials for medical education. Singapore Med J. 2018 Dec;59(12):622–7.

217. Del Amo J, Broring G, Hamers FF, Infuso A, Fenton K. Monitoring HIV/AIDS in Europe's migrant communities and ethnic minorities. AIDS. 2004 Sep;18(14):1867–73.

218. European Centre for Disease Prevention and Control (ECDC). Communication strategies for the prevention of HIV, STI and hepatitis among MSMin Europe. Stockholm.; 2016.

219. Fernández-Dávila P, Folch C, Ferrer L, Soriano R, Diez M, Casabona J. Who are the men who have sex with men in Spain that have never been tested for HIV? HIV Med. 2013 Oct;14 Suppl 3:44–8.

220. Hoyos J, Fernández-Balbuena S, de la Fuente L, Sordo L, Ruiz M, Barrio G, et al. Never tested for

HIV in Latin-American migrants and Spaniards: prevalence and perceived barriers. J Int AIDS Soc. 2013 Jan;16:18560.

221. Oliva J, Díez M, Galindo S, Cevallos C, Izquierdo A, Cereijo J, et al. Predictors of advanced disease and late presentation in new HIV diagnoses reported to the surveillance system in Spain. Gac Sanit. Jan;28(2):116–22.

222. Ross J, Cunningham CO, Hanna DB. HIV outcomes among migrants from low-income and middle-income countries living in high-income countries: a review of recent evidence. Curr Opin Infect Dis. 2018 Feb;31(1):25–32.

223. Yang Y, Wang J, Lin F, Zhang T, Yu F, Zhao Y, et al. Stigma against HIV/AIDS among female sex workers and general migrant women in eastern China. BMC Womens Health. 2015 Jan;15:2.

224. Levison JH, Bogart LM, Khan IF, Mejia D, Amaro H, Alegria M, et al. "Where It Falls Apart": Barriers to Retention in HIV Care in Latino Immigrants and Migrants. AIDS Patient Care STDS. 2017 Sep;31(9):394–405.

225. Royo-Bordonada MÁ, Díez-Cornell M, Llorente JM. Health-care access for migrants in Europe: the case of Spain. Lancet (London, England). 2013 Aug;382(9890):393–4.

226. European Centre for Disease Prevention and Control (ECDC). Thematic report: Migrants Monitoring implementation of the Dublin Declaration on Partnership to Fight HIV/AIDS in Europe and Central Asia: 2012 progress. Stockholm, Sweden; 2013.

227. Atun RA, McKee M, Coker R, Gurol-Urganci I. Health systems' responses to 25 years of HIV in Europe: inequities persist and challenges remain. Health Policy. 2008 May;86(2–3):181–94.

228. (ECDC). EC for DP and C. Gonococcal antimicrobial susceptibility surveillance in Europe, 2014. Stockholm.; 2016.

229. Cole MJ, Spiteri G, Chisholm SA, Hoffmann S, Ison CA, Unemo M, et al. Emerging cephalosporin and multidrug-resistant gonorrhoea in Europe. Euro Surveill Bull Eur sur les Mal Transm = Eur Commun Dis Bull. 2014 Nov;19(45):20955.

230. Cole MJ, Spiteri G, Jacobsson S, Pitt R, Grigorjev V, Unemo M. Is the tide turning again for cephalosporin resistance in Neisseria gonorrhoeae in Europe? Results from the 2013 European surveillance. BMC Infect Dis. 2015 Dec 11;15(1):321.

231. Lahra MM, Australian Gonococcal Surveillance Programme. Australian Gonococcal Surveillance Programme annual report, 2013. Commun Dis Intell Q Rep. 2015 Mar 31;39(1):E137-45.

232. Unemo M, Ison CA, Cole M, Spiteri G, van de Laar M, Khotenashvili L. Gonorrhoea and gonococcal antimicrobial resistance surveillance networks in the WHO European Region, including the independent countries of the former Soviet Union. Sex Transm Infect. 2013 Dec 15;89(Suppl 4):iv42–6.

233. Ross JDC, Brittain C, Cole M, Dewsnap C, Harding J, Hepburn T, et al. Gentamicin compared with ceftriaxone for the treatment of gonorrhoea (G-ToG): a randomised non-inferiority trial. Lancet (London, England). 2019 Jun;393(10190):2511–20.

234. Ross JD, Harding J, Duley L, Montgomery AA, Hepburn T, Tan W, et al. Gentamicin as an alternative to ceftriaxone in the treatment of gonorrhoea: the G-TOG non-inferiority RCT. Vol. 23, Health technology assessment (Winchester, England). England; 2019. p. 1–104.

235. Chen MY, McNulty A, Avery A, Whiley D, Tabrizi SN, Hardy D, et al. Solithromycin versus ceftriaxone plus azithromycin for the treatment of uncomplicated genital gonorrhoea (SOLITAIRE-U): a randomised phase 3 non-inferiority trial. Lancet Infect Dis. 2019 Aug;19(8):833–42.

236. Mahmood MS, Asad-Ullah M, Batool H, Batool S, Ashraf NM. Prediction of epitopes of Neisseria Gonorrhoeae against USA human leukocyte antigen background: An immunoinformatic approach towards development of future vaccines for USA population. Mol Cell Probes. 2019 Feb;43:40–4.

237. Smyczek P, Chu A, Berenger B. Emerging international strain of multidrug-resistant Neisseria gonorrhoeae: Infection in a man with urethral discharge. Can Fam Physician. 2019 Aug;65(8):552–4.

238. Lefebvre B, Martin I, Demczuk W, Deshaies L, Michaud S, Labbe A-C, et al. Ceftriaxone-Resistant Neisseria gonorrhoeae, Canada, 2017. Emerg Infect Dis. 2018 Feb;24(2).

239. Ko KKK, Chio MTW, Goh SS, Tan AL, Koh TH, Abdul Rahman NB. First Case of Ceftriaxone-Resistant Multidrug-Resistant Neisseria gonorrhoeae in Singapore. Vol. 63, Antimicrobial agents and chemotherapy. United States; 2019.

240. Bazan JA, Williams Roberts M, Soge OO, Torrone EA, Dennison A, Ervin M, et al. Rapid Increase in Gonorrhea Cases With Reduced Susceptibility to Azithromycin in Columbus, Ohio. Sex Transm Dis. 2018 Feb;45(2):e5–6.

241. WHO. Report of the expert consultation and review of the latest evidence to update guidelines

for the management of sexually transmitted infections. Geneva;

242. Tapsall JW. Antibiotic resistance in Neisseria gonorrhoeae. Clin Infect Dis. 2005 Aug 15;41 Suppl 4:S263-8.

243. MacPherson DW, Gushulak BD, Baine WB, Bala S, Gubbins PO, Holtom P, et al. Population mobility, globalization, and antimicrobial drug resistance. Emerg Infect Dis. 2009 Nov;15(11):1727–32.

244. Tapsall JW. Neisseria gonorrhoeae and emerging resistance to extended spectrum cephalosporins. Curr Opin Infect Dis. 2009 Feb;22(1):87–91.

245. Hui BB, Whiley DM, Donovan B, Law MG, Regan DG. Identifying factors that lead to the persistence of imported gonorrhoeae strains: a modelling study. Sex Transm Infect. 2017 May;93(3):221–5.

246. Unemo M, Shipitsyna E, Domeika M. Recommended antimicrobial treatment of uncomplicated gonorrhoea in 2009 in 11 East European countries: implementation of a Neisseria gonorrhoeae antimicrobial susceptibility programme in this region is crucial. Sex Transm Infect. 2010 Nov;86(6):442–4.

247. Unemo M, Shipitsyna E, Domeika M. Gonorrhoea surveillance, laboratory diagnosis and antimicrobial susceptibility testing of Neisseria gonorrhoeae in 11 countries of the eastern part of the WHO European region. APMIS. 2011 Sep;119(9):643–9.

248. Cole MJ, Spiteri G, Town K, Unemo M, Hoffmann S, Chisholm SA, et al. Risk Factors for Antimicrobial-Resistant Neisseria gonorrhoeae in Europe. Sex Transm Dis. 2014 Dec;41(12):723–

9.

249. Town K, Obi C, Quaye N, Chisholm S, Hughes G, GRASP Collaborative Group. Drifting towards ceftriaxone treatment failure in gonorrhoea: risk factor analysis of data from the Gonococcal Resistance to Antimicrobials Surveillance Programme in England and Wales. Sex Transm Infect. 2017 Feb;93(1):39–45.

250. Risley CL, Ward H, Choudhury B, Bishop CJ, Fenton KA, Spratt BG, et al. Geographical and demographic clustering of gonorrhoea in London. Sex Transm Infect. 2007 Jul 11;83(6):481–7.

251. Kuhns LM, Vazquez R, Ramirez-Valles J. Researching special populations: retention of Latino gay and bisexual men and transgender persons in longitudinal health research. Health Educ Res. 2008 Oct;23(5):814–25.

252. Stoecklin-Marois M, Hennessy-Burt T, Schenker M. Engaging a Hard-to-Reach Population in Research: Sampling and Recruitment of Hired Farm Workers in the MICASA Study. J Agric Saf Heal. 2011;17(4):291–302.

253. Johnson T, O'Rourke D, Burris J, Owens L. Culture and survey nonresponse. In: Groves RM, Dillman DA, Eltinge JL, Little RJA, editors. Survey Nonresponse. In New York.: John Wiley & Sons; 2002. p. 55– 70.

254. Razum O. Commentary: of salmon and time travellers--musing on the mystery of migrant mortality. Int J Epidemiol. 2006 Aug;35(4):919–21.

255. Shaghaghi A, Bhopal RS, Sheikh A. Approaches to Recruiting "Hard-To-Reach" Populations into Re-search: A Review of the Literature. Heal Promot Perspect. 2011;1(2):86–94.

256. Agadjanian V, Zotova N. Sampling and surveying hard-to-reach populations for demographic research: A study of female labor migrants in Moscow, Russia. Demogr Res. 2012;25(5):131–50.

257. Sadler GR, Lee H-C, Lim RS-H, Fullerton J. Recruitment of hard-to-reach population subgroups via adaptations of the snowball sampling strategy. Nurs Health Sci. 2010 Sep 1;12(3):369–74.

258. Bonevski B, Randell M, Paul C, Chapman K, Twyman L, Bryant J, et al. Reaching the hard-to-reach: a systematic review of strategies for improving health and medical research with socially disadvantaged groups. BMC Med Res Methodol. 2014 Mar 25;14:42.

259. Cowden JD, Kreisler K. Development in Children of Immigrant Families. Pediatr Clin North Am. 2016 Oct;63(5):775–93.

260. Monge S, Ronda E, Pons-Vigués M, Vives Cases C, Malmusi D, Gil-González D. [Methodological limitations and recommendations in publications on migrant population health in Spain]. Gac Sanit. 2015 Nov;29(6):461–3.

261. Reiss K, Dragano N, Ellert U, Fricke J, Greiser KH, Keil T, et al. Comparing sampling strategies to recruit migrants for an epidemiological study. Results from a German feasibility study. Eur J Public Health. 2014 Oct 1;24(5):721–6.

262. Hernando C, Fernández-Dávila P. Experiencias y significados relacionados con la salud y el acceso y uso del sistema sanitario de la población inmigrante de Badalona y Santa Coloma de Gramanet. Badalona; 2016.

263. Chang TE, Brill CD, Traeger L, Bedoya CA, Inamori A, Hagan PN, et al. Association of Race, Ethnicity and Language with Participation in Mental Health Research Among Adult Patients in

Primary Care. J Immigr Minor Heal. 2015 Dec 15;17(6):1660–9.

264. Muhammad M, Wallerstein N, Sussman AL, Avila M, Belone L, Duran B. Reflections on Researcher Identity and Power: The Impact of Positionality on Community Based Participatory Research (CBPR) Processes and Outcomes. Crit Sociol. 2015 Nov;41(7–8):1045–63.

265. Byrd GS, Edwards CL, Kelkar VA, Phillips RG, Byrd JR, Pim-Pong DS, et al. Recruiting intergenerational African American males for biomedical research Studies: a major research challenge. J Natl Med Assoc. 2011 Jun;103(6):480–7.

266. Green G, Bradby H, Chan A, Lee M. "We are not completely Westernised": dual medical systems and pathways to health care among Chinese migrant women in England. Soc Sci Med. 2006 Mar;62(6):1498–509.

267. Wade C, Chao MT, Kronenberg F. Medical pluralism of Chinese women living in the United States. J Immigr Minor Heal. 2007 Oct 7;9(4):255–67.

268. Llosada J, Vallverdú I, Miró M, Pijem C, Guarga A. [The access to health services and their use by immigrant patients: the voice of the professionals]. Aten primaria. 2012 Feb;44(2):82–8.

269. Lin JS, Finlay A, Tu A, Gany FM. Understanding immigrant Chinese Americans' participation in cancer screening and clinical trials. J Community Health. 2005 Dec;30(6):451–66.

270. Taylor-Piliae RE, Froelicher ES. Methods to Optimize Recruitment and Retention to an Exercise Study in Chinese Immigrants. Nurs Res. 2007 Mar;56(2):132–6.

271. Bastani R, Maxwell AE, Kagawa-Singer M, Glenn BA, Parada K. Stimulating cancer research in

Asian communities and training the next generation of scientists. Cancer. 2005 Dec 15;104(12 Suppl):2926–30.

272. Carter-Edwards L, Fisher JT, Vaughn BJ, Svetkey LP. Church rosters: is this a viable mechanism for effectively recruiting African Americans for a community-based survey? Ethn Health. 2002 Feb;7(1):41–55.

273. Pica M, López-Jacob MJ, García AM, Martínez JM, Benavides FG, Ronda E. [Re-contact with immigrant workers in Spain through telephone interview (ITSAL II)]. Arch Prev Riesgos Labor. 2014 Jul 1;17(3):132–41.

274. Groves R, Dilman D, Eltinge J, Roderick J. Survey non response. 1st editio. Sons. JW&, editor. New York.; 2002. 520 p.

275. Ribisl K, Walton M, Mowbray C, Luke D, Davidson W, Bootsmiller B. Minimizing participant attrition in panel studies through use of effective retention and tracking strategies: review and recommendations. Eval Progr Plann. 1996;19:1–25.

276. Sundquist J. Ethnicity, social class and health. A population-based study on the influence of social factors on self-reported illness in 223 Latin American refugees, 333 Finnish and 126 south European labour migrants and 841 Swedish controls. Soc Sci Med. 1995 Mar;40(6):777–87.

277. Chou K-L. Psychological distress in migrants in Australia over 50 years old: a longitudinal investigation. J Affect Disord. 2007 Feb;98(1–2):99–108.

278. Jick SS, Kaye JA, Vasilakis-Scaramozza C, Garcia Rodriguez LA, Ruigomez A, Meier CR, et al. Validity of the general practice research database. Pharmacotherapy. 2003 May;23(5):686–9.

279. Leinonen MK, Campbell S, Ursin G, Trope A, Nygard M. Barriers to cervical cancer screening faced by immigrants: a registry-based study of 1.4 million women in Norway. Eur J Public Health. 2017 Oct;27(5):873–9.

280. Patel K, Kouvonen A, Close C, Vaananen A, O'Reilly D, Donnelly M. What do register-based studies tell us about migrant mental health? A scoping review. Syst Rev. 2017 Apr;6(1):78.

281. Furu K, Wettermark B, Andersen M, Martikainen JE, Almarsdottir AB, Sorensen HT. The Nordic countries as a cohort for pharmacoepidemiological research. Basic Clin Pharmacol Toxicol. 2010 Feb;106(2):86–94.

282. Norrelund H, Mazin W, Pedersen L. Existing data sources for clinical epidemiology: Aarhus University Clinical Trial Candidate Database, Denmark. Clin Epidemiol. 2014;6:129–35.

283. Tilve Alvarez CM, Ayora Pais A, Ruiz Romero C, Llamas Gomez D, Carrajo Garcia L, Blanco Garcia FJ, et al. Integrating medical and research information: a big data approach. Stud Health Technol Inform. 2015;210:707–11.

284. Perez JL, Servia F, Mato V, Vazquez JM, Pereira J, Dorado J, et al. Efficiency in the transmission of information through digital imaging and communications in medicine using security mechanisms: tests with DISCUS. Telemed J E Health. 2010 Jun;16(5):620–6.

285. Garcia-Gil MDM, Hermosilla E, Prieto-Alhambra D, Fina F, Rosell M, Ramos R, et al. Construction and validation of a scoring system for the selection of high-quality data in a Spanish population primary care database (SIDIAP). Inform Prim Care. 2011;19(3):135–45.

286. Rodriguez-Sales V, Roura E, Ibanez R, Peris M, Bosch FX, de Sanjose S. Coverage of Cervical

Cancer Screening in Catalonia for the Period 2008-2011 among Immigrants and Spanish-Born Women. Front Oncol. 2013;3:297.

287. Moen KA, Kumar B, Qureshi S, Diaz E. Differences in cervical cancer screening between immigrants and nonimmigrants in Norway: a primary healthcare register-based study. Eur J Cancer Prev. 2017 Nov;26(6):521–7.

288. Perez Molina JA, Rillo MM, Suarez-Lozano I, Casado Osorio JL, Cobo RT, Gonzalez PR, et al. Do HIV-Infected Immigrants Initiating HAART have Poorer Treatment-Related Outcomes than Autochthonous Patients in Spain? Results of the GESIDA 5808 Study. Curr HIV Res. 2010 Oct;8(7):521–30.

289. Norredam M, Hansen OH, Petersen JH, Kunst AE, Kristiansen M, Krasnik A, et al. Remigration of migrants with severe disease: myth or reality?--a register-based cohort study. Eur J Public Health. 2015 Feb 1;25(1):84–9.

290. Deblonde J, Sasse A, Del Amo J, Burns F, Delpech V, Cowan S, et al. Restricted access to antiretroviral treatment for undocumented migrants: a bottle neck to control the HIV epidemic in the EU/EEA. BMC Public Health. 2015 Dec 10;15(1):1228.

ANNEX 1. Guide of good practices for the implementation of a cohort on foreign born population

The main results and the lessons learned from the qualitative study on participation barriers in a health cohort study and from the implementation of the Badalona / SC cohort, allowed developing a Good Practices Guide for the implementation of a cohort on foreign born participants from Pakistan, Latin America, Morocco and China. This guide may be of interest to other researchers who work in foreign born's health in Spain and elsewhere. The guide is available at:http://www.ciberesp.es/programas-de-investigacion/subprogramas-estrategicos/subprograma-inmigracion-i-salud-ciberesp-sis-ciberesp.

ANNEX 2. INFORMED CONSENT. HEALTH QUESTIONNAIRE

CONSENTIMIENTO EXPRÉS – Entrevista

Presentación:

Le solicitamos su consentimiento a participar en el estudio "***Evolución de los determinantes biológicos y estructurales en una cohorte de familias inmigradas***" para mejorar el conocimiento de factores que determinan el estado de salud de la población inmigrante. El estudio forma parte de las actividades del Subprograma Inmigración y Salud CIBERESP y está coordinado por el CEEISCAT (Centre d'Estudis Epidemiològics sobre les Infeccions de Transmissió Sexual i la Sida de Catalunya). Los participantes son componentes de familias inmigrantes, hasta los 65 años de edad. Un/a traductor/intérprete dará soporte a los participantes que lo necesiten en cualquier momento del estudio.

Qué comporta su participación:

En 2015 y en 2016 se solicitará a los participantes responder a una encuesta sobre su salud, conductas y aspectos sociales de usted y su familia. En agradecimiento a su colaboración, en cada ocasión que responda la encuesta recibirá 10 euros.

Trato de los datos personales:

Se recogerá el nombre y apellidos de los participantes, juntamente con el número de la Tarjeta Sanitaria (CIP). Dicha información se custodiará en un lugar seguro y manteniendo siempre todas las medidas de protección de datos personales y confidencialidad necesarias, de acuerdo con la legislación vigente[8]. Se construirá un código identificador específico para cada participante, que se utilizará siempre que sea posible en los circuitos de recogida de información para anonimizar la información recogida.

Declaración del participante:

Como participante del estudio, declaro que he leído toda la información del consentimiento exprés, y he tenido la oportunidad de hacer las preguntas que he creído convenientes, por las que he recibido una respuesta satisfactoria. Con la cumplimentación de este consentimiento exprés manifiesto que mi participación en el estudio es libre, voluntaria, inequívoca, específica e informada.

[8] Ley Orgánica 15/1999, de 13 de diciembre de Protección de datos de Carácter Personal y el Real Decreto 1720/2007, de 21 de diciembre, por el que se aprueba el Reglamento de Desarrollo de la ley sobre protección de datos. Así mismo, se garantiza el cumplimiento de la normativa nacional vigente en cuanto a la investigación con muestras biológicas:Ley de Investigación Biomédica 14/2007 y Real Decreto 1716/2011.

Conozco que tengo pleno derecho a no participar en el estudio, y que ello no conlleva ninguna repercusión negativa en mi relación con el sistema sanitario ni con los profesionales de la salud.

La información generada por mí en la encuesta no será utilizada con ninguna otra finalidad diferente de las manifestadas en el consentimiento exprés. En caso de realizar una cesión de datos a otros estudios de cohortes nacionales o internacionales, se realizará de manera anónima. También serán anónimos los datos en participaciones en publicaciones y otros eventos científicos.

Se garantizará la confidencialidad de la información obtenida de los análisis, a la que sólo tendrán acceso los investigadores participantes en el proyecto, dirigidos por el investigador principal; que se identifica a continuación en este documento.

Derechos de protección de datos:

Conozco que como participante puedo ejercer los derechos de protección de datos (ARCO) en cualquier momento del estudio: acceder a la información generada por mí, rectificar datos que se hayan recogido de manera errónea, cancelar una parte de la recogida de información, y/u oponerme al mantenimiento de la información, solicitando su eliminación y destrucción. Para tal fin puedo contactar con el Investigador Principal del proyecto, Dr. Jordi Casabona Barbarà, en el Centre d'Estudis Epidemiològics sobre les Infeccions de Transmissió Sexual i la Sida de Catalunya (CEEISCAT), Hospital Universitari Germans Trias i Pujol, Ctra. de Canyet s/n, 08916 Badalona, Tel.: 93 497 88 91, Fax: 93 497 88 89, ceeiscat@iconcologia.cat

Su conformidad:

Firmas de conformidad de los miembros de la unidad familiar.
En el caso de menores es imprescindible la firma del padre, madre o tutor.
Los mayores de 12 años y que participen en el estudio deben firmar el consentimiento.

Nombre y apellidos del participante(madre y tutor legal para menores)::	Nombre y apellidos del investigador:
CIP: Código estudio:	
Firma:	Firma del investigador:

Nombre y apellidos del	Nombre y apellidos del investigador:

participante(padre y tutor legal para menores):	
CIP: Código estudio:	
Firma:	Firma del investigador:

Nombre y apellidos del participante(hijo 1, incluir edad):	Nombre y apellidos del investigador:
CIP: Código estudio:	
Firma:	Firma del investigador:

Nombre y apellidos del participante(hijo 2, incluir edad):	Nombre y apellidos del investigador:
CIP: Código estudio:	
Firma:	Firma del investigador:

Nombre y apellidos del participante(hijo 3, incluir edad):	Nombre y apellidos del investigador:
CIP: Código estudio:	
Firma:	Firma del investigador:

Nombre y apellidos del participante(hijo 4, incluir edad):	Nombre y apellidos del investigador:

CIP: Código estudio:	
Firma:	Firma del investigador:

Código familia:	Padre 1	Madre 2	1ºHijo/a 3	2ºHijo/a 4	3ºHijo/a 5	4ºHijo/a 6	5ºHijo/a 7	1ºOtro/a 8	2ºOtro/a 9	3ºOtro/a 10	4ºOtro/a 11
Entrevista											

Badalona. Fecha: _____ / _____ / _____

ANNEX 3. INFORMED CONSENT. ANALYSIS OF BIOLOGICAL SAMPLES

CONSENTIMIENTO EXPRÉS – Muestras biológicas

Les solicitamos su consentimiento a participar en el estudio "***Evolución de los determinantes biológicos y estructurales en una cohorte de familias inmigradas***" para mejorar el conocimiento de factores que determinan el estado de salud de la población inmigrante. El estudio forma parte de las actividades del Subprograma Inmigración y Salud CIBERESP y está coordinado por el CEEISCAT (Centre d'Estudis Epidemiològics sobre les Infeccions de Transmissió Sexual i la Sida de Catalunya). Los participantes son componentes de familias inmigrantes, hasta los 65 años de edad. Un/a traductor/intérprete dará soporte a los participantes que lo necesiten en cualquier momento del estudio.

Qué comporta su participación:

1) En 2015 y en 2016 se solicitará a los participantes responder a una encuesta sobre su salud, conductas y aspectos sociales de usted y su familia. Sólo mayores 16 años.
2) Realizar una exploración física básica (tensión arterial, peso, talla y capacidad pulmonar). Sólo mayores 18 años.
3) Recoger una muestra de sangre (obtenida por punción a la altura del codo que realizará un profesional de enfermería)[9]. Sólo mayores 18 años.
4) Recoger una muestra de orina (que recogerá usted misma/o, le explicaremos cómo). Sólo mayores 18 años.
5) Recoger una muestra de heces que recogerá usted misma/o, le explicaremos cómo.
6) Realizar un frotis en piel (mediante el suave roce de un algodón en la mano derecha, que realizará un profesional de enfermería),
7) Y una pequeña inoculación en la piel del antebrazo para saber si han estado en contacto con el microorganismo que causa la tuberculosis. La prueba la realiza personal de enfermería y necesitará visitarles para conocer el resultado entre las 48-72 horas posteriores.

En agradecimiento a su colaboración, en cada ocasión que respondan a la encuesta o participen en el estudio de muestras biológicas, recibirán 10 euros por participante.

Dónde se realizará el análisis de las muestras biológicas:

- El análisis de una parte de la sangre y la orina se realizará en el Servicio de Microbiología del Hospital Universitari Germans Trias i Pujol de Badalona,
- El frotis de piel en el Servicio de Microbiología del Hospital Ramón y Cajal de Madrid,
- Otra parte de la sangre y las heces en los laboratorios del Hospital de Badalona o en el Laboratorio del Servicio de Atención al Viajero de Santa Coloma de Gramanet.

9

la punción venosa puede provocar un pequeño morado que desaparece a los pocos días

Después de la validación de los resultados, todas las muestras biológicas serán destruidas.

Qué se analizará:

(1) En sangre: valores básicos de salud (bioquímica, hemograma, coagulación), la presencia de infección por virus del VIH, hepatitis B y C, sífilis, Chagas y Strongyloides,
(2) En orina: la presencia de patógenos causantes de infecciones de transmisión sexual (7 microorganismos),
(3) En heces: la presencia de parásitos,
(4) En piel: la presencia de resistencias a antibióticos de la flora bacteriana,
(5) Mediante el Mantoux: haber estado en contacto con el microorganismo que puede producir la tuberculosis.

Serán informados de los resultados de la exploración física y de los análisis por parte de personal médico.

Trato de los datos personales:

Se recogerán nombres y apellidos juntamente con el número de la Tarjeta Sanitaria (CIP). Dicha información se custodiará en un lugar seguro y manteniendo siempre todas las medidas de protección de datos personales y confidencialidad necesarias de acuerdo con la legislación vigente[10]. Se construirá un código identificador específico para cada participante, que se utilizará siempre que sea posible en los circuitos de recogida de información para anonimizar la información recogida.

Declaración de los participantes:

Como participante del estudio, declaro que he leído toda la información del consentimiento exprés, y he tenido la oportunidad de hacer las preguntas que he creído convenientes, por las que he recibido una respuesta satisfactoria. Con la cumplimentación de este consentimiento manifiesto que mi participación en el estudio es libre, voluntaria, inequívoca, específica e informada. Conozco que tengo pleno derecho a no participar en el estudio, y que ello no conllevarà ninguna repercusión negativa en mi relación con el sistema sanitario ni con los profesionales de la salud.

La información generada por mí: encuesta, exploración física, muestras biológicas de sangre, orina, heces, piel, y prueba de tuberculina, no será utilizada para realizar ningún análisis genético ni con ninguna otra finalidad diferente de las manifestadas en este consentimiento. En caso de realizar una cesión de datos a otros estudios de cohortes nacionales o internacionales, se realizará de manera

10

Ley Orgánica 15/1999, de 13 de diciembre de Protección de datos de Carácter Personal y el Real Decreto 1720/2007, de 21 de diciembre, por el que se aprueba el Reglamento de Desarrollo de la ley sobre protección de datos. Así mismo, se garantiza el cumplimiento de la normativa nacional vigente en cuanto a la investigación con muestras biológicas :Ley de Investigación Biomédica 14/2007 y Real Decreto 1716/2011.

anónima. También serán anónimos los datos en participaciones en publicaciones y otros eventos científicos.

Se garantizará la confidencialidad de la información obtenida de los análisis, a la que sólo tendrán acceso los investigadores participantes en el proyecto, dirigidos por el investigador principal; que se identifica a continuación en este documento.

Derechos de protección de datos:

Conozco que como participante puedo ejercer los derechos de protección de datos (ARCO) en cualquier momento del estudio: acceder a la información generada por mí, rectificar datos que se hayan recogido de manera errónea, cancelar una parte de la recogida de información, y/u oponerme al mantenimiento de la información, solicitando su eliminación y destrucción, de las muestras biológicas (sangre, orina, heces y/o piel), de la prueba de tuberculina, y/o de la encuesta. Para tal fin puedo contactar con el Investigador Principal del proyecto, Dr. Jordi Casabona Barbarà, en el Centre d'Estudis Epidemiològics sobre les Infeccions de Transmissió Sexual i la Sida de Catalunya (CEEISCAT), Hospital Universitari Germans Trias i Pujol, Ctra. de Canyet s/n, 08916 Badalona, Tel.: 93 497 88 91, Fax: 93 497 88 89, ceeiscat@iconcologia.cat

Su conformidad:

Firmas de conformidad de los miembros de la unidad familiar.
En el caso de menores es imprescindible la firma del padre, madre o tutor.
Los mayores de 12 años deben firmar el consentimiento.

Nombre y apellidos del participante(madre y tutor legal para menores):	Nombre y apellidos del investigador:
CIP: Código estudio:	
Firma:	Firma del investigador:

Nombre y apellidos del participante(padre y tutor legal para menores):	Nombre y apellidos del investigador:
CIP: Código estudio:	
Firma:	Firma del investigador:

Nombre y apellidos del participante(hijo 1, incluir edad):	Nombre y apellidos del investigador:
CIP: Código estudio:	
Firma:	Firma del investigador:

Nombre y apellidos del participante(hijo 2, incluir edad):	Nombre y apellidos del investigador:
CIP: Código estudio:	
Firma:	Firma del investigador:

Nombre y apellidos del participante(hijo 3, incluir edad):	Nombre y apellidos del investigador:
CIP: Código estudio:	
Firma:	Firma del investigador:

Nombre y apellidos del participante(hijo 4, incluir edad):	Nombre y apellidos del investigador:
CIP: Código estudio:	
Firma:	Firma del investigador:

Nombre y apellidos del participante(hijo 5, incluir edad):	Nombre y apellidos del investigador:

CIP: Código estudio:	
Firma:	Firma del investigador:

Código familia:	Padre 1	Madre 2	1ºHijo/a 3	2ºHijo/a 4	3ºHijo/a 5	4ºHijo/a 6	5ºHijo/a 7	1ºOtro/a 8	2ºOtro/a 9	3ºOtro/a 10	4ºOtro/a 11
Pruebas											

Badalona. Fecha: _____ / _____ / _____

ANNEX 4. ORAL COMUNICATIONS IN NATIONAL AND INTERNATIONAL CONGRESSES

Oral communications in national and international congresses:

- Retos metodológicos en estudios longitudinales de salud en población migrante: revisión sistemática. Cristina Hernando, Meritxell Sabidó, Elena Ronda, Jordi Casabona. Congreso Ibero-Americano Epidemiología y Salud Pública, Granada, 2013.
- Quality of variables associated with migration in HIV/AIDS' surveillance in Catalonia. Cristina Hernando, Núria Vives, Meritxell Sabidó, Jordi Casabona. 5th European Conference on Migrant and Ethnic Minority Health, Granada, 2014.
- Infección VIH/Sida y otras ITS en la población inmigrante en España. Revisión de la literatura. Cristina Hernando, Gaby Ortiz-Barreda, Meritxell Sabidó, Jordi Casabona. XXXII Reunión Científica de la Sociedad Española de Epidemiología (SEE), Alicante, 2014.
- Significados y percepción del estado de la salud de la población inmigrante de Badalona. C. Hernando, P. Fernández-Dávila, M. Sabidó, J. Casabona. II Congreso Ibero-Americano Epidemiología y Salud Pública, XXXI Reunión Científica de la SEE, Mesa Salud e inmigración, Santiago de Compostela, septiembre de 2015.
- Relaciones sexuales y uso de los métodos anticonceptivos entre los hijos e hijas de inmigrantes de Badalona. Cristina Hernando, Núria Roca, Carmen Vega, Meritxell Sabidó, Jordi Casabona. II Congreso Ibero-Americano de Epidemiología y Salud Pública, Santiago de Compostela, 2015.
- Aceptabilidad para participar en un estudio de cohorte de familias inmigrantes de Badalona. Cristina Hernando, Percy Fernández, Jordi Casabona. II Congreso Ibero-Americano de Epidemiología y Salud Pública, Santiago de Compostela, 2015.
- Significados y percepción del estado de la salud de la población inmigrante de Badalona. Cristina Hernando, Percy Fernández-Dávila, Jordi Casabona. II Congreso Ibero-Americano de Epidemiología y Salud Pública, Santiago de Compostela, 2015.
- Understanding the acceptability of the migrant population to participate in longitudinal studies. A qualitative approach. Cristina Hernando, Florianne Gaillardin, Laia Ferrer, Meritxell Sabidó, Jordi Casabona. 6th European Conference on Migrant and Ethnic Minority Health, 2016. (This oral communication was presented by Florianne Gaillardin)
- Pregúntele si ha tomado medicamentos de su país! Cristina Hernando, Meritxell Sabidó, Florianne Gaillardin, Jordi Casabona. XXXIV Reunión Anual de la Sociedad Española de Epidemiología (SEE), Sevilla, 2016.

Colaboration in oral communications:

- *Scoping review* sobre inmigración y salud en España: consideraciones metodológicas. Elena Ronda, Diana Gil, Carmen Vives, Cristina Hernando, Gabriela Ortiz-Barreda, Meritxell Sabidó, Jordi Casabona y Grupo Salud e Inmigración CIBERESP. Congreso Ibero-Americano Epidemiología y Salud Pública, Granada, 2013.
- La desigualdad social es el mayor condicionante en la salud de los jóvenes de origen inmigrante. Núria Roca, Carme Vega, Cristina Hernando. VIII Congreso sobre migraciones internacionales en España, 2015.
- Clase social y origen como determinantes de la salud de los hijos e hijas inmigradas de Catalunya. Núria Roca, Carme Vega, Cristina Hernando. 6TH ISIH-International in sickness and in health conference, 2015.

ANNEX 5. Compendium of articles included in this thesis

Accepted: 20 June 2017

DOI: 10.1111/hsc.12478

ORIGINAL ARTICLE

WILEY Health and Social Care in the community

Facilitators and barriers of participation in a longitudinal research on migrant families in Badalona (Spain): A qualitative approach

Cristina Hernando MD MPH[1,2] | Meritxell Sabidó MD MPH PhD[3,4] | Jordi Casabona MD MPH PhD[1,2,4,5]

[1]PhD on Pediatrics, Obstetrics and Gynecology, Preventive Medicine and Public Health, Department of Pediatrics, Obstetrics and Gynecology, and Preventive Medicine, Autonomous University of Barcelona, Bellaterra, Spain

[2]Health Department, Centre for Epidemiological Studies on HIV/STI in Catalonia (CEEISCAT), Generalitat of Catalonia, Germans Trias i Pujol University Hospital (Maternity 2nd floor), Badalona, Spain

[3]TransLab. Medical Science Department, University of Girona, Girona, Spain

[4]CIBER of Epidemiology and Public Health (CIBERESP), Health Institute Carlos III, Madrid, Spain

[5]Health Sciences Research Institute of the Germans Trias i Pujol Foundation (IGTP), Badalona, Spain

Correspondence
Cristina Hernando, Centre for Epidemiological Studies on HIV/STI in Catalonia (CEEISCAT), Germans Trias i Pujol University Hospital (Maternity 2nd floor), Badalona, Spain.
Email: chernando@gmail.com

Funding information
This work has been financed by the ISCIII, PI13/01962 and co-funded by the European Regional Development Fund (FEDER). The founding sponsors had no role in the design of the study; in the collection, analyses or interpretation of data; in the writing of the manuscript; and in the decision to publish the results.

Abstract

Migrant populations are under-represented in health research. We conducted a community-based qualitative study with the aim to examine the willingness, barriers, facilitators and reasons for participating in longitudinal health research among migrants. In Badalona and Santa Coloma de Gramanet (Barcelona) from May to November 2014, 26 individual interviews and 8 discussion groups were conducted with a convenience sample of 76 migrants born in Colombia, Peru, Ecuador, Bolivia, Morocco, Pakistan and China; and 9 key informants. Grounded Theory methods and thematic analysis was used to analyse the data. Atlas-ti(R) software was used. Participants were willing to participate in health surveys and biological samples testing, and agreed to be re-contacted after 12 months. Participants agreed to the same participation for their children. Participants reported that undertaking biological samples and knowledge of the health status of their children were the greatest benefits of participation in health research. Barriers to participation reported by participants were language difficulties, time constraints and mobility issues. Facilitators of participation included offering complete and understandable information about the study objectives and procedures; offering interviewers with the same migrant background, gender, country of origin and socioeconomic status as participants; building trust through ensuring proximity, privacy and confidentiality; respecting cultural relationships; and receiving monetary compensation and test results. Focusing on migrant families instead of individuals may facilitate participation in the study. Despite being beneficial in general, receipt of monetary compensation, inclusion of questions related to sexual and reproductive health, and blood sample testing resulted in distrust for a small number of participants. The simultaneous use of several Internet tools was the most recommended tool for re-contact. Those with higher risk of mobility, greater language barriers and less Internet use were more difficult to re-contact. Study findings will help to improve participation and retention of migrants in longitudinal research.

KEYWORDS
attitudes, cohort studies, families, health promotion, migrants, participation and empowerment

1 | INTRODUCTION

Migrant health is a topic of interest for public health and epidemiological research (Gushulak, Pace, & Weekers, 2010). National and international data suggest the existence of health disparities related to lifestyles, mental health, infectious diseases and health service access of the migrant population (Delgado-Rodríguez, 2014; Gushulak et al., 2010). Currently, migrants' health risks and health needs are poorly understood, and there are significant gaps in knowledge about their health status, responses to interventions and ways to adapt health services to their social reality (Katigbak, Foley, Robert, & Hutchinson, 2016). Better understanding of health risk factors and health needs among migrant populations is needed (ECDC, 2015).

In migrant populations, a range of language, cultural and socioeconomic factors such as fear and distrust in research and government institutions; lack of interest, personal benefit or knowledge about research; intrusive nature of survey questions; issues of confidentiality and racial profiling; economic and time constraints; and transportation and mobility issues; make identification, participation and re-contacting more difficult than for native-born populations. These factors collaborate to maintain migrant populations under-represented and excluded in health research (Ejiogu et al., 2011; Evans et al., 2010; Ford et al., 2013; Goff et al., 2016; Jones & Jablonski, 2014; Katigbak et al., 2016; Woodward-Kron et al., 2016).

Despite the challenges, studies on hidden populations—such as ethnic minorities—have proved that minorities may be as willing to enrol in health research as majority white population (Brown & Topcu, 2003), and have highlighted the importance of facilitating access, offering opportunities for participation and using patient-centred strategies (Brown & Topcu, 2003; Goff et al., 2016). As reported by UyBico, Pavel, & Gross (2007), native-born African Americans are a widely studied ethnic minority group. There is less knowledge about migrant populations in general. The heterogeneity among populations and among study settings suggests that a better understanding of attitudes and beliefs of migrant populations about health research is important.

In Spain, in 2013, migrants represented 11.7% of the population (National Institute of Statistics, 2013) and transformed the structure of the Spanish population. In 2014, the Subprogram on Migration and Health (SMH) initiated the Project for Longitudinal Studies of Migrant Families (Plataforma de Estudios Longitudinales con Familias Inmigrantes, PELFI), a multi-centric longitudinal study on migrant families with the aim of improving knowledge about the health determinants of migrants. Previous longitudinal studies that successfully recruited migrant families (Stoecklin-Marois, Hennessy-Burt, & Schenker, 2011) and achieved high participation (57.7%–59.8%) and retention (95.1%–94.5%) rates (Cooper et al., 2006) suggest that including families may help to improve the difficulties of enrolling migrant populations offering the advantage of accessing to a more settled and stable population. A better understanding of the barriers and facilitators of participation (Ford et al., 2013; Gadegbeku et al., 2008) will help facilitate participation of migrant populations in PELFI and in health research in general.

What is known about this topic

- Migrant populations are under-represented in health research.
- The study of migrant populations is challenging due to language, cultural and socioeconomic factors.
- A better understanding of barriers and facilitators will improve migrant participation.

What this paper adds

- Migrants are willing to participate in health research. Offering blood tests and information on children's health status are the most valued benefits of participation.
- Employed participants, mono-parental families and the Chinese community had greater time constraints. Unemployed and Chinese children presented higher risk of changing place of residence. Telephone call, text message, WhatsApp and email will help to re-contact participants.
- Findings may improve participation and retention of migrants in health research.

This study aims to examine the willingness, barriers and facilitators and reasons for participation in longitudinal health research among migrant families born in Colombia, Peru, Ecuador, Bolivia, Morocco, Pakistan and China. The findings of the study help in the design of tailored interventions and strategies for inclusion of migrant families, in longitudinal studies in particular, to improve participation, retention and the reliability of the data.

2 | DESIGN AND METHODS

2.1 | Study context and setting

This study is part of a broader project titled "Development of biological and structural determinants in a cohort of immigrant families (PI13/1962)", included in the Project for Longitudinal Studies of Migrant Families (Plataforma de Estudios Longitudinales con Familias Inmigrantes, PELFI). The project was approved by the Ethics Committee of the Fundació Hospital Germans Trias i Pujol (FHGTiP) (PI-14-092). The study was carried out from May to November 2014 in Badalona and Santa Coloma de Gramanet, municipalities of the metropolitan area of Barcelona with 15% and 23% of migrant population respectively (IDESCAT, 2014).

2.2 | Study design

We conducted a qualitative study to explore the perspectives, beliefs, expectations and feelings—and their relationship to health behaviours and attitudes—of migrants of different nationalities. We used a community-based approach, partnering with local associations

and services—schools, primary healthcare centres (PHCC), migrant associations, religious services and non-governmental organisations (NGOs)—deeply rooted within the community social fabric. Community-based research helps to overcome mistrust and language and cultural barriers, facilitates access and recruitment of the population, and fosters engagement and collaboration (Ejiogu et al., 2011; Katigbak et al., 2016).

2.3 | Sampling

Local associations and services from different areas of the studied region disseminated brochures in Spanish, Pakistani, Moroccan and Chinese among migrant communities and facilitated the identification of eligible participants. They also identified key informants with migrant and native backgrounds. We considered key informants to be migrants recognised as community leaders and natives with significant personal or labour relationships with migrant communities: migrant mediators, members of migrant cultural associations, directors of NGOs and schools, health professionals and an evangelical church pastor. A convenience sample of 76 participants was recruited through the social networks of key informants (n = 32, 42.1%), meetings at schools (n = 17, 22.4%), migrant cultural associations and non-governmental organisations (NGOs) (n = 14, 18.4%), an evangelical church (n = 8, 10.5%) and migrants' own initiatives (n = 5, 6.6%).

2.4 | Participants

Participants were migrants aged 18–65 residing in Badalona or Santa Coloma de Gramanet born in Colombia, Peru, Ecuador, Bolivia, Morocco, Pakistan and China, who are members of a family (father and/or mother and children) with at least one child, living together for at least 6 months, regardless of time of residence, labour situation and legal status. Our definition of migrant was those born in a country other than the one in which they currently reside (Malmusi, Jansà, & del Vallado, 2007). The included nationalities were among the most frequent in our study location (IDESCAT, 2014). For the purposes of this study, Latin American migrants were selected from Andean countries, as they were considered to be more representative of the migrants living in our study area. Those with a native-born partner/spouse and the second generation and beyond were excluded, as these groups are considered to be subgroups of migrants.

2.5 | Data collection and procedure

Participants were informed about the procedures and objectives of the study. Migrant key informants provided oral translation throughout the data collection. All participants signed written informed consent and received 10 Euros as compensation for time and travel expenses. Guides for individual interviews and focus groups were designed and pilot-tested through two individual interviews and one discussion group. The interview model used emphasises experience and meaning (Seidman, 2006) with the aim of exploring subjective meanings. Discussion groups may increase the feeling of safety by gathering a group of people of the same origin (Woodward-Kron et al., 2016), and allowed for clarification of shared cultural understanding and collective identity (Barbour, 2007; Kitzinger, 1995).

In total, 26 semi-structured individual interviews and 8 discussion groups were conducted by two researchers. Eleven interviews were conducted with Latin American participants, and 5 were conducted with each of the other geographical origins. Interviews took place in the same recruitment places and at a civic centre to avoid mobility difficulties. Two discussion groups were carried out with Latin American participants and with each of the other geographical origins (n = 8), with 5–10 participants in each discussion group. The Pakistani and Moroccan groups were separated by sex to facilitate communication and to improve data reliability, according to the recommendations of the key informants.

Individual interviews lasted an average of 52 min (range of 30–100 min), and discussion groups averaged 88 min (range of 62–107). At the beginning of the interviews, the researchers explained that a study on migrant families was going to be carried out, which involved conducting a health survey and a medical examination (with collection and testing of blood, urine, stool and the skin swab of a hand), and that a 12-month follow-up would be conducted (wave two). The guides for interviews and focus groups included the same topics: willingness to participate in health research; willingness to participate in a health survey and undergo biological samples testing; agreement to conducting the health survey and biological samples testing with their children; perceptions, beliefs, difficulties and preference of means for conducting face-to-face interviews and biological samples collection; receiving incentives; and re-contacting at a later date (12 months later). A participant data form was designed to record socio-demographic information. Interviewer observations were also collected.

2.6 | Analysis

Recordings of the interviews were tagged with an anonymous study identification code and delivered to an external supporting research team to be transcribed literally. The transcripts and recordings were reviewed together to ensure the reliability of the data. Socio-demographic characteristics were extracted from participant data forms and tabulated in an Excel spread sheet.

The transcription data were thematically analysed by two researchers combining two procedures: Grounded Theory (Willlig, 2008) was used as a method of inductive coding and integration of codes; and thematic analysis (Braun & Clarke, 2006) was used to identify, analyse and report patterns (themes). Open coding was performed using the Atlas-ti® program. The codebook was built from the themes that emerged both from the interview guide and from the reading of each of the interviews (open coding). The codes created were reviewed to check for repetitions or to reassign infrequent codes to more common ones. The analysis process was completed using thematic analysis. In cases where the codes contained several themes, we attempted to assign each to a single category. Codes were grouped in order to produce an analytical account of how the themes represented in the codes interact with each other. Differences between two researchers were resolved by

consensus. Four categories of codes emerged: willingness and reasons for participation, and barriers and facilitators of study participation.

3 | RESULTS

The results were organised into five main areas: study participation, sampling strategy, health survey participation, medical examination participation and follow-up (wave two). The specific narratives of each geographical origin appear in the text.

Almost 60% of participants were women, older than age 40, with more than 10 years of residence in Spain. Most of the Latin American participants were from Ecuador (60%) and Bolivia (22%), which were the most frequent Latin nationalities residing in Badalona (Ajuntament de Badalona, 2015). Table 1 shows the main socio-demographic characteristics of the participants.

3.1 | Study participation

Most of the participants reported that they would be willing to participate in a study conducting medical examinations and that their children would also participate in it. Reasons for participation included considering health research positive and necessary, the opportunity to learn about their health status and that of their families, to contribute to knowledge about the migrant population, the desire to help physicians, researchers and society, and to contribute to improving the health system (Table 2).

> *It is necessary, because there are so many immigrants in Spain, and to help with your work too. And for migrants as well, because if doctors are more acquainted with them, with their cultures and customs, if they know more, it will be better.*
>
> *(Interview 14 – Man – China)*

Lack of time availability and mobility emerged as barriers to study participation (Table 2).

> *The problem is my work. I work from 7 to 7; today asking for work leave is very risky. If they can see me on a Saturday, I wouldn't have any problem.*
>
> *(Interview 24 – Man – Bolivia)*

> *Yes, but… I am not sure I will be here, it depends on the crisis.*
>
> *(Discussion group 3 – Morocco – Men)*

Participants recommended offering flexible times, avoiding times that mothers dedicate to taking care of their children and interviewing working men at night or during the weekend. Key informants identified Latin American women who were single parents or who worked in domestic service, and Chinese migrants as those with greater time constraints due to their long work schedules (Table 2). Related to mobility, unemployed participants indicated that they planned to travel to another country to look for a job or would go back to their home countries. In discussion groups, Chinese participants' mobility was frequent and usual—this was the same for their offspring—for personal issues or for spending time with their families, while the other communities, above all the Moroccan community, reported mobility related to work opportunities. Key informants reported that migrants were more mobile due to the unemployment as a result of the economic crisis; that accessing the Chinese population was more difficult than other nationalities (Table 2); and that Chinese children spent frequent periods of time in China to go to school and stay with their families.

As a participation facilitator, offering complete and understandable information was essential. When introducing the study to the communities, Chinese discussion groups highlighted the need to solve language difficulties, and key informants recommended the inclusion of the concept of health and perspectives of each migrant community.

3.2 | Sampling strategy

Considerations about distrust in research, receiving compensation, proximity and cultural relationships played a role in the decision to participate. The majority reported they would accept compensation for participation and would prefer economic compensations. We observed that those unemployed or who had more recently arrived were more interested in monetary compensation. Few participants said that they were afraid that receiving money could be a potential source of legal problems. Some participants preferred to receive information related to health behaviours, such as nutrition talks for their children. Key informants suggested using a supermarket or transportation gift card in order to avoid the poor use of the payment.

> *Money above all; money I think. Or a supermarket gift certificate.*
>
> *(Interview 3 – Woman – Bolivia)*

> *It's going to cause problems because they charge you this money. Spending a bit of time or taking the metro is not so important. The most important thing is that it doesn't cause problems.*
>
> *(Interview 13 – Woman – China)*

The most preferred place for recruiting participants was the school, followed by the PHCC, associations and religious centres. They also suggested using participants' social networks.

3.3 | Health survey participation

In general, participants were willing to respond to a health survey. A source of rejection for both genders of all nationalities, but particularly among Pakistani, were questions about sexual health due to traumatic experiences, the presumption (in the case of Moroccan and Pakistani women) that their husbands would not allow them to respond and the desire to protect privacy (Table 2). Moroccan and Pakistani key informants said that the truthfulness of responses could be doubtful. A Moroccan woman declined to be asked about the consumption of alcohol.

TABLE 1 Socio-demographic characteristics of the participants in individual interviews and focus groups (n = 76)

	Socio-demographic characteristics	Study participants *N* (%)
Total	–	76 (100)
Sex	Men	33 (43.5)
	Women	43 (56.6)
Municipality	Badalona	52 (68.5)
	Santa Coloma de Gramanet	24 (31.5)
Country of origin	Bolivia	5 (7)
	Colombia	3 (4)
	Ecuador	14 (18)
	Peru	1 (1)
	Morocco	15 (20)
	Pakistan	15 (20)
	China	23 (30)
Time of residence in Spain (n = 73)	5 years or less	8 (11)
	6–10 years	22 (30)
	More than 10 years	43 (59)
	Average (*SD*)	11.5 (5.5)
Age (n = 75)	Age <40	26 (35)
	Age 40 or over	49 (65)
	Average (*SD*)	41.5 (10)
Education level	No studies	5 (7)
	Primary or incomplete secondary	25 (33)
	Complete secondary	32 (42)
	Vocational training	8 (10)
	Higher education	6 (8)
Occupation (n = 75)	Unemployed	24 (31.5)
	Employed	25 (33.5)
	Homemaker	26 (35)

> *She doesn't like sexuality; she thinks these are personal things.*
>
> *(Interview 5 – Woman – China)*

> *[About questions regarding sexuality] You don't even mention it. If I speak with my wife about this topic there is no problem, but if someone else gets in the middle we are ashamed.*
>
> *(Interview 7 – Man – Morocco)*

Language difficulties and lack of time availability were health survey participation barriers (Table 2). Participants and key informants, except for those from Latin America, reported important language difficulties within their communities and highly recommended using translators.

> *She has a phone, but even though they call her..., it's the language problem.*
>
> *(Interview 16 – Woman – Morocco)*

No one suggested translating the survey into the languages of migrants' mother tongues. We observed that Moroccan male workers and Moroccan and Pakistani participants with higher education levels had a better command of the Spanish language, while it was worse among most of the Pakistani and Chinese participants. Those who were employed reported a lack of time availability due to working hours. For overcoming this issue, they suggested allowing mothers to respond to the survey on behalf of absent family members and offering flexible schedules and dates, including night times and weekends. For Pakistani participants, interviewing at night or on weekends would facilitate the participation of the head of the household.

Proximity, privacy, confidentiality and interviewers of the same sex as participants were identified as facilitators of health survey participation (Table 2). Related to proximity, most participants agreed to conduct interviews at home, although most of the Chinese and some of the Moroccans preferred community centres, as they reported in the discussion groups. Regarding privacy and confidentiality, Latin American, Moroccan and Pakistani women preferred to conduct the survey without the presence of their husbands and children (Table 2).

TABLE 2 Verbatim text extracted from contributions of the participants and key informants in the individual interviews (n = 26) and focus groups (n = 50)

Study participation	*Willingness to participate*
	"They will be more motivated [to participate] because of the health of their children". (Interview 17 – Woman – Morocco)
	"Look, it is about health. I think that it will be easy within our community". (Key informant 9 – Man – Pakistan)
	"It is good, it is fine, because you do it for me, finding out if I have a [health] problem. And my children will do it as well". (Interview 10 – Woman – Ecuador)
	"She says it is interesting. She says that yes, she would participate". (Interview 22 – Woman – Morocco)
	"Yes, for studying health yes". (Interview 23 – Man – Bolivia)
	"E1: Yes, because my children will benefit too" Discussion group 7 - Latin America
	"E6: I think it is very positive, very necessary to participate in all this. E2: Yes, all of them say they will participate with the health survey and the biological samples testing". (Discussion group 4 – Women – Morocco)
	"Yes, it is always good conducting a blood test, I will participate because of this". (Interview 3 – Woman – Bolivia)
	"Yes, why not, I like helping people". (Interview 17 – Woman – Morocco)
	"E4: Yes, for assuring that the health condition is fine. E2: For example, you can find out if you have a health problem and treating it. E1: If you are sick, you can know why". (Discussion group 4 – Women – Morocco)
	"To rule out that there is not any health problem in our family". (Discussion group 7 – Latin America)
	"Communication is more difficult with some migrant groups than with others. When we made the health study, it was most difficult with Chinese, but finally, we could talk with them, we could". (Key informant 4 – Woman – Autochthonous)
	Lack of time availability and future mobility—change of place of residence
	"I am waiting for an answer. If I get a job in Girona I will go away at the beginning of the next month, then, I do not know how I could participate". (Interview 1 – Man – Colombia)
	"She would not participate because she does not have time, she works". (Interview 2 – Woman – China)
	"Yes, if my working hours allow me, yes [I will participate]". (Interview 12 – Woman – Bolivia)
	"It depends on how much it affects me. If you can do it during the weekend, then, yes, I will participate. […] I have two jobs, I have very little time." (Interview 26 – Man – Colombia)
	"E4: I do not know if I will be here, it depends on the crisis. If I stay here I will participate". (Discussion group 3 – Men – Morocco)
	"Many Latin American women work in domestic services; the work hours are difficult. Because now there are a lot of people unemployed, people are really mobile, they leave for 4 months, come back and later leave again, due to the working situation. The Chinese send their children to China to learn the language and the culture, and later they come back to Spain." (Key informant 4 – Woman – Autochthonous)
Health survey participation	*Acceptability of questions regarding sexual health*
	"E1: If you ask me questions I will answer everything. [And your wife?] E1: Well, I do not know what she will feel about it, that is another thing". (Discussions group 6 – Men – Pakistan)
	"If you ask me about sexuality issues, yes, I would feel uncomfortable". (Interview 11 – Woman – Ecuador)
	"She prefers you do not ask about sexuality in front of her husband and her children, because it is her private life". (Interview 17 – Woman – Morocco)
	"If you conduct the survey with me [the translator] and her husband is at home, it will be a problem". (Interview 20 – Woman – Pakistan)
	"A female interviewer cannot ask the husband about sexuality issues to the husband. The interviewer must be a man. For men will be difficult to answer such private things to a woman, they will see her as a woman, not as a professional". (Discussion group 5 –Woman – Pakistan)
	"[Would you have a problem responding to questions about sexuality?] Not at all, […] no one spoke to me about these things and I became a mother at 16. We are poorly informed, they don't tell us about sexuality, I have four girls and an adolescent, so I try to put them on the right track, and it's not a problem for me". (Interview 25 – Woman – Ecuador)
	Language difficulties and lack of time availability
	"I will see if I have time, if I have time". (Interview 2 – Woman – China)
	"Her husband is working. The only thing she asks for is not using the hours she spends with the kids". (Interview 13 – Woman – China)
	"She says that in her case, she does not know how to speak Spanish, and I am working the whole day". (Discussion group 5 – Women – Pakistan)
	Proximity, privacy, confidentiality and interviewer profile
	"She says that it would be better to meet at another place". (Interview 13 – Woman – China)
	"She prefers conducting the survey out of home".(Interview 22 – Woman – Morocco)
	"He says he will not allow to anyone to go in his home, he says that bad people may go in, even the police cannot go in without permission. At any other place is fine, but not at his home". (Discussion group 2 – China)
	"E4: I prefer you come to my home". (Discussion group 7 – Latin American)
	"In some cases it is not a good idea that men come to the home. If a woman comes it is fine, but only a woman". (Discussion group 5 – Women – Pakistan)
	"If you want to talk to a woman, talk to her when she is not in the presence of her husband or children. If you want to talk to a man, the wife and children should not be present. Apart from this, I don't think there would be any other problem." (Key informant 9 – Man – Pakistan)

(Continues)

TABLE 2 (Continued)

Medical examination participation	*Willingness and benefits to participate*
	"Yes, I would agree [conducting biological samples testing with her children]. Yes, if one of us goes, then, we all three will go at the same time". (Interview 3 – Woman – Bolivia)
	"Yes, of course [about conducting biological samples testing with her children]". (Interview 6 – Woman – Pakistan)
	"Yes, I will conduct the biological samples testing. And my family too, because I want to know about their health status now". (Interview 8 – Man – Pakistan)
	"He does not want to conduct biological samples testing. He says that he does medical tests very often and it is not necessary. He says that his daughter works, and his grandsons go to the school, maybe they will not have time". (Interview 14 – Man – China)
	"She says she does not have time to participate. The others say yes, they will conduct the biological samples testing, they think it is a good thing, in order to know about their health. [And if we ask about conducting the test with their children, what do they think?] They agree". (Discussion group 1 – China)
	"They are also interested in doing tests of all types. Usually they can only do the analysis in the early morning hours." (Key informant 5 – Woman – China)
	"They are really worried about their health, if access is easier, people will collaborate." (Key informant 9 – Man – Pakistan)
	Familiarity with the samples
	"Yes, there is not any problem. But about the faecal [tests], the urine is common, but the faeces are new. There is not any problem, but she does not know what her husband and her daughters will think, it is new for all of them". (Interview 16 – Woman – Morocco)
	"The urine and the blood, I can do it, but you have to tell me more about the skin test. Will it be collected using a piece of cotton?" (Interview 17 – Woman – Morocco)
	"P6: Yes, I undergo medical examinations at work every year, but it is not too much. P1: About the faecal test, here they have not ever done it to me. I have lived here for 20 years and never… Yes, I would like to do it" (Discussion group 8 – Latin America)
	Health service preferred
	"At the health centre, because it is the nearest place". (Interview 3 – Woman – Bolivia)
	"[In what health service would you prefer to conduct the biological samples testing?] At the hospital, because I feel safer there". (Interview 11 – Woman – Ecuador)
	"At the hospital because at the health centre they do not work on weekends, at the hospital they work from Monday to Monday". (Interview 24 – Man – Bolivia)
Re-contact (wave two)	*Re-contact method preferred*
	"E3: By email. I: Do you use email? All of you? E3: Yes. E2: Yes. I: And WhatsApp? E1: Well, I have it but I prefer email". (Discussion group 5 – Women – Pakistan)
	"By email or by letter. But I would prefer by email. Today everybody has email. In your mobile phone you have Internet, you get it immediately". (Interview 23 – Man – Bolivia)
	"By phone, because most of them do not have email". (Discussion group 6 – Men – Pakistan)
	"By a phone call. It is the most direct way". (Interview 12 – Woman – Bolivia)
	"I would like text message and email". (Interview 9 – Man – Morocco)
	"If you send me a text message I will remember it". (Interview 10 – Woman – Ecuador)
	"I use everything, WhatsApp, email, mobile phone… Well, I am not an expert but I know about everything". (Interview 7 – Man – Morocco)
	"She prefers a text message, then she will not lose it or forget it". (Interview 2 – Woman – China)
	"E2: Through the school this time, because my address or telephone number could change, well, I don't know. Because the child will still be here [in school], he is in third grade and will be here until sixth". (Discussion group 7 – Latin America)
	"A phone call is the easiest, they often don't use email, and I don't know about text messages. We always use the phone." (Key informant 4 – Women – Autochthonous)
	Providing a second contact
	"[Could you give us the phone of another person for contacting you?] I do not think so, I am not responsible, I prefer you contact me directly". (Interview 8 – Man – Pakistan)
	"She cannot give you the phone number of a friend. She can give you her phone number and email, and in case that you do not locate her by phone, then you send her an email". (Interview 22 – Woman – Morocco)

Both genders from Morocco and Pakistan reported that they would not respond to questions on sexual health with an interviewer of the opposite gender, and recommended using interviewers of the same sex as participants (Table 2). Key informants pointed out that interviewers must ensure privacy and confidentiality to build trust in the study.

3.4 | Medical examination participation

Most of the participants were willing to undertake medical examination for themselves and their children. The majority perceived higher benefit from conducting biological samples testing (blood and urine tests) than from the health survey (Table 2). The time of the

procedure, pain involved in delivering the samples, conducting frequent medical examinations (follow-up of chronic diseases or medical check-ups in the home country), compliance with religious practices such as Ramadan and distrust in research were potential barriers. Participants requested reducing the usual time needed for making the appointment and collecting the samples, due to time constraints. Key informants confirmed the importance of facilitating access to provision of the samples (shortening the appointment request time and expediting sample collection), and concentrating collection in the early hours of the morning (Table 2). In discussion groups, Pakistani and Latin women asked more questions related to biological sample collection procedures. A minority of participants asked questions about how samples would be used and about the conservation and elimination procedures that followed. As facilitators to participation, participants reported receiving information about the procedures, receiving the test results, familiarity with medical examinations—such as blood donors or have carried out work-related medical examinations—and proximity to the health centre where medical examinations were carried out (Table 2). Blood and urine tests showed higher acceptance than stool tests and skin swab analyses, which were less frequent and more unknown (Table 2).

> *It's not a problem for me, I have done it many times, blood test, urine test, even one related to the heart. I think it is good, because at the end they will provide the results.*
>
> *(Interview 7 – Man – Morocco)*

Regarding proximity, most participants preferred to attend the closest PHCC. Those who preferred the hospital considered that it offered a safer environment, with wider scheduling times and higher quality tests (Table 2).

> *At the closest health centre, because to go to the hospital we have to take the car, and it is very far away.*
>
> *(Interview 2 – Woman – China)*

3.5 | Re-contact (wave two)

All participants willing to participate agreed to be re-contacted after 12 months. Most of the participants recommended using telephone calls and mobile phone text messages (Table 2). In the discussion groups, Chinese reported the need to overcome language barriers when calling them. Those who used Internet suggested using WhatsApp and email (Table 2). Key informants reported greater use of the Internet among Latin Americans and minor use among Moroccans and Pakistanis. Some participants proposed re-contact via postal letter, because it is more formal; or through the school, due to a feeling of confidence and the fact that teachers can remind about appointments (Table 2). In the discussion groups, Latin participants proposed re-contacting through the school because their children would be in school for the next years (Table 2). In order to maintain privacy and confidentiality, most of the participants declined to provide the telephone number or email of a family member or friend for facilitating re-contact (Table 2).

> *Telephone, it is the most direct way.*
>
> *(Interview 12 – Woman – Bolivia)*

> *By email or by letter, but more-so email, because everyone has email. Now you even have internet on a mobile phone, it arrives immediately.*
>
> *(Interview 23 – Man – Bolivia)*

> *The majority don't have email. They have to go to an internet café to open their email.*
>
> *(Discussion group 6 – Men – Pakistan)*

Key informants recommended simultaneous and repeated contacts by telephone call, text message and email, and indicated that text messages allow for reminding about appointments and for informing other family members. Autochthonous key informants preferred phone calls (Table 2).

4 | DISCUSSION

Our study results report the points of view of migrants of the most frequent nationalities in our setting regarding participation barriers and facilitators to participation in longitudinal research.

Most participants were willing to participate and reported a wide range of benefits—as reported in other studies—for themselves, their families (Evans et al., 2010; Woodward-Kron et al., 2016), the whole society (Ford et al., 2013; Gadegbeku et al., 2008), the health system and science (Ford et al., 2013). Previous studies showed that perceiving the direct benefit of research participation enhances recruitment (Ejiogu et al., 2011), while the lack of benefit reduces the motivation to participate (Goff et al., 2016). In our study, conducting biological samples testing and provision of information about the health status of children were the greatest perceived benefits among the participants. In the current context of economic crisis and austerity policies, offering a complete medical examination may make research participation more attractive. Additionally, studying children may facilitate the acceptance of other family members to participate.

Building trust is essential (Aroian, Katz, & Kulwicki, 2006). Previous studies found higher distrust among African Americans than in white Americans (Corbie-Smith, Thomas, & St George, 2002) and among older as opposed to younger migrants (Jones & Jablonski, 2014). According to our informants, trust is built on privacy, confidentiality, proximity and knowing and respecting cultural relationships. On the basis of these values, most participants recommended the use of community contexts (local services and entities) as recruiting points, as found by Ford et al. (2013). Most agreed to conduct the surveys at home, except mainly the Chinese, and would conduct medical examinations at the nearest PHCC.

Cultural needs and sensitivities must be considered (Hernández, Nguyen, Casanova, Suárez-Orozco, & Saetermoe, 2013; Jones & Jablonski, 2014). One of the most relevant cultural needs that we observed was the need of Muslim women in obtaining informed

agreement of their husbands to participate. In addition, the Chinese key informant had a high capacity to successfully recruit participants, reflecting the hierarchical relationships existing within this community (Llosada, Vallverdú, Miró, Pijem, & Guarga, 2012). In order to promote participation, researchers may provide Muslim women with informative brochures to easily inform their husbands. These should be extended to all nationalities, because as described previously (Jones & Jablonski, 2014; Woodward-Kron et al., 2016), migrant families might play a more important role in the decision to research participation than natives. Regarding Chinese participants, enrolling a Chinese community leader with a strong influence in the local community is a key to successfully accessing eligible Chinese participants.

Although medical examinations may be relatively intrusive and time-consuming, most participants were willing to conduct them. The disparate participation rates achieved by longitudinal studies (70% (Stoecklin-Marois et al., 2011) and 20%–30% (Stronks et al., 2013)) suggest that facilitating the access to conducting them is essential. Participants highlighted offering complete and exhaustive information, shortening the collection process, guaranteeing the quality of analysis, delivering the test results and facilitating access to medical treatment as participation facilitators, similar to the findings of Ford et al. (2013) about participation in clinical trials. Periods of religious practices that include a feast, like Ramadan, should be avoided (Aroian et al., 2006). Pregnancy and chronic health problems should be investigated, and the possibilities of health complications due to the research should be clarified. Assuring full disclosure of testing procedures and test results has been shown to contribute to ease of participation (Unson, Dunbar, Curry, Kenyon, & Prestwood, 2001). A novel approach could involve enrolling committed participants who will spread their positive experiences and promote the health benefits of research participation in their communities.

In our study, the main participation barriers were language difficulties, lack of time availability and mobility. It was surprising that we found important language difficulties within the study population despite an average residence of more than 10 years in Spain. Factors that may contribute to explain language difficulties are the education level (more than 40% of participants did not have secondary studies), the more recent arrival of Pakistani migrants, and among the Chinese, the greater distance between cultures and the often minor interaction with natives. According to Ejiogu et al. (2011), time constraints are considered one of the most powerful and difficult participation barriers. In our study, time constraints were particularly important among employed participants, mono-parental families and the Chinese community. Human and economic resources will be needed in order to offer night and weekend times to conduct the study. Regarding mobility, those who were unemployed and looking for a job and Chinese children were at higher risk of mobility, and therefore at higher risk of being lost at follow-up. Investing resources in those migrant groups considered more vulnerable to participation barriers will help to optimise the study budget.

Using interviewers with the same migrant background (first generation), gender and geographical origin as participants will help to overcome cultural, gender and literacy barriers. Previous studies reported that interviewers with migrant background foster trust (Ford et al., 2013), improve participation and retention rates (Aroian et al., 2006) and overcome personal bias of native-born staff that is potentially present in cross-cultural research (Ejiogu et al., 2011). Although a study found that decisions related to participation were independent of the race of the researchers, other studies have supported linguistic and ethno-cultural matching between participants and researchers (Chang et al., 2015; Woodward-Kron et al., 2016). Other authors prioritised the sharing of the same socioeconomic status and similar life experiences for successfully bridging social distances between interviewers and participants (Katigbak et al., 2016; Muhammad et al., 2015). It is important to keep in mind that those who will fit such a profile may be non-professional interviewers, requiring more training and a greater budget.

Re-contacting difficulties (wave two) will be greater among those with a higher risk of mobility (Pica et al., 2014), greater language barriers (Woodward-Kron et al., 2016) and less Internet use. We observed a general use of mobile phones, although the use of the Internet was inferior among participants with economic constraints and probably among women who had less socialisation. Telephone calls, text messages, WhatsApp messages and emails are accessible tools that are easy to use and low cost. Text messages, WhatsApp messages and emails allow informing other family members and overcoming language barriers. Text messages do not require Internet use and can be used more widely. The preference for telephone calls among native key informants probably indicates their lack of knowledge of Internet use among migrants. In contrast to what literature recommends (Ribisl et al., 1996), participants refused to provide contact information of a close friend or relative for re-contacting in order to prioritise privacy.

There are some limitations to the interpretation of these results. Young participants, those with shorter times of residence and undocumented migrants were the ones more difficult to recruit, probably because they may require specific recruitment strategies (Agadjanian & Zotova, 2012). Although we attempted to maximise the diversity of the study population and the information collected, we cannot exclude a bias towards participants more concerned about their health status or more familiarised with the health system or social resources. Offering an economical compensation represents a minor motivation for higher socioeconomic individuals (Evans et al., 2010) and it may contribute to a possible bias towards participants with lower socioeconomic status. It is possible that hierarchical authority structures among Chinese population (Llosada et al., 2012) have introduced an information bias into the Chinese discussion groups. Overall, we cannot discard an information bias due to the potential distrust in research. Included Latin American participants primarily were from Andean countries, preventing any generalisations to all Latin American migrant population. Lastly, the experiences described in this study may be specific to the migrant population of our research setting and cannot be generalised to other Spanish cities. Some strengths to this study were the inclusion of Moroccan, Pakistani and Chinese communities—that have been studied very little—and efforts made to overcome language difficulties and foster trust.

In conclusion, studying migrant families—including migrants' children—as well as offering biological samples testing and clinical

examinations may facilitate participation in the project. Privacy, confidentiality, proximity, respecting cultural values, as well as using interviewers with the same migrant background, gender and socioeconomic status as participants are crucial to build trust between participants and the research team. Although some main barriers for participation were transversal to all nationalities, some specific issues related to socioeconomic and cultural background have been identified. The reported study findings will help to improve the participation and retention of migrants in this particular project, in other longitudinal research and in studies with other designs and methodologies.

ACKNOWLEDGEMENTS

We acknowledge Percy Fernández-Dávila for development interview guidelines and for participating in the fieldwork and qualitative analysis. In addition, thanks to Elena Ronda and Laia Ferrer for reviewing the manuscript and for their comments for improving it. The authors thank the following for their invaluable contributions: Badalona City Hall, Catalan Institute of Health (Institut Català de Salut, ICS), Atention Services of Badalona (Badalona Serveis Assistencials, BSA), Health Support Team of Badalona (Tècniques de Salut de Badalona: Marta Ribó, Ana Belén Ramos and Ana Sebastián), La Salut Alta Foundation, Red Cross of Badalona, Carles Blanc Foundation, Consortium South Badalona (Consorci Badalona Sud), Association for the Multiculturality, the Information and the Social Coexistence (Associació per a la Multiculturalitat, la Información i la Convivencia Social, AMICS), Cultural Association of the Popular Republic of China (Associació Cultural de la República Popular Xinesa), Miguel Hernández School, Josep Carner School, Pedro Botey School, Itaca School, Primary Health Care Center Montigalà (Centre d'Atenció Primària Montigalà), Health Attention to the Traveler Center of Santa Coloma de Gramanet (Centre d'Atenció al Viatger de Santa Coloma de Gramenet) and Evangelist Church of Badalona (Iglesia Evangelica de Badalona). Finally, we thank Emily Felt for her translation of the English.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

CH, MS and JC conceived and designed the study; CH conducted the field work; CH analysed the data; CH wrote the manuscript; MS and JC reviewed the manuscript and made important contributions. All authors have reviewed the submitted manuscript and approved the manuscript for submission.

REFERENCES

Agadjanian, V., & Zotova, N. (2012). Sampling and surveying hard-to-reach populations for demographic research: A study of female labor migrants in Moscow, Russia. *Demographic Research*, *25*, 131–150.

Ajuntament de Badalona (2015). Padró d'habitants 01/01/2015. Retrieved 10 July 2016, from http://badalona.cat/portalWeb/getfile?_nfpb=true&_pageLabel=contingut_estatic&dDocName=AJB071842&dID=82382&rendition=Web.

Aroian, K. J., Katz, A., & Kulwicki, A. (2006). Recruiting and retaining Arab Muslim mothers and children for research. *Journal of Nursing Scholarship*, *38*, 255–261.

Barbour, R. (2007). *Doing focus groups*. London: SAGE Publications.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*, 77–101.

Brown, D. R., & Topcu, M. (2003). Willingness to participate in clinical treatment research among older African Americans and Whites. *The Gerontologist*, *43*, 62–72.

Chang, T. E., Brill, C. D., Traeger, L., Bedoya, C. A., Inamori, A., Hagan, P. N., … Trinh, N.-H. (2015). Association of race, ethnicity and language with participation in mental health research among adult patients in primary care. *Journal of Immigrant and Minority Health*, *17*, 1660–1669.

Cooper, S. P., Burau, K. E., Frankowski, R., Shipp, E. M., Del Junco, D. J., Whitworth, R. E., … Hanis, C. L. (2006). A cohort study of injuries in migrant farm worker families in South Texas. *Annals of Epidemiology*, *16*, 313–320.

Corbie-Smith, G., Thomas, S. B., & St George, D. M. M. (2002). Distrust, race, and research. *Archives of Internal Medicine*, *162*(21), 2458–2463.

Delgado-Rodríguez, M. (2014). La salud de los inmigrantes en España. *Revista Española de Salud Pública*, *88*, 671–674.

ECDC (2015). *Thematic report: Migrants. Monitoring implementation of the Dublin Declaration on Partnership to Fight HIV/AIDS in Europe and Central Asia: 2014 progress report*. In: ECDC (ed.). Stockholm.

Ejiogu, N., Norbeck, J. H., Mason, M. A., Cromwell, B. C., Zonderman, A. B., & Evans, M. K. (2011). Recruitment and retention strategies for minority or poor clinical research participants: Lessons from the healthy aging in neighborhoods of diversity across the Life Span study. *The Gerontologist*, *51*(Suppl 1), S33–S45.

Evans, M. K., Lepkowski, J. M., Powe, N. R., LaVeist, T., Kuczmarski, M. F., & Zonderman, A. B. (2010). Healthy aging in neighborhoods of diversity across the life span (HANDLS): Overcoming barriers to implementing a longitudinal, epidemiologic, urban study of health, race, and socioeconomic status. *Ethnicity & Disease*, *20*, 267–275.

Ford, M. E., Siminoff, L. A., Pickelsimer, E., Mainous, A. G., Smith, D. W., Diaz, V. A., … Tilley, B. C. (2013). Unequal burden of disease, unequal participation in clinical trials: Solutions from African American and Latino community members. *Health & Social Work*, *38*, 29–38.

Gadegbeku, C. A., Stillman, P. K., Huffman, M. D., Jackson, J. S., Kusek, J. W., & Jamerson, K. A. (2008). Factors associated with enrollment of African Americans into a clinical trial: Results from the African American study of kidney disease and hypertension. *Contemporary Clinical Trials*, *29*, 837–842.

Goff, S. L., Youssef, Y., Pekow, P. S., White, K. O., Guhn-Knight, H., Lagu, T., … Lindenauer, P. K. (2016). Successful strategies for practice-based recruitment of racial and ethnic minority pregnant women in a randomized controlled trial: The IDEAS for a healthy baby study. *Journal of Racial and Ethnic Health Disparities*, *3*, 731–737.

Gushulak, B., Pace, P., & Weekers, J. (2010). Migration and health of migrants. In T. Koller (Ed.), *Poverty and social exclusion in the WHO European Region: Health systems respond* (pp. 257–281). Copenhagen: WHO Regional Office for Europe.

Hernández, M. G., Nguyen, J., Casanova, S., Suárez-Orozco, C., & Saetermoe, C. L. (2013). Doing no harm and getting it right: Guidelines for ethical research with immigrant communities. *New Directions for Child and Adolescent Development*, *2013*, 43–60.

IDESCAT (2014). Padró municipal d'habitants. Població segons país de naixement i sexe. Retrieved from http://www.idescat.cat/pub/?fil=77&col=3&id=pmh&n=7567&geo=mun%253A082457&t=201400.

Jones, C., & Jablonski, R. A. (2014). 'I don't want to be a guinea pig': Recruiting older African Americans. *Journal of Gerontological Nursing*, *40*, 3–4.

Katigbak, C., Foley, M., Robert, L., & Hutchinson, M. K. (2016). Experiences and lessons learned in using community-based participatory research to recruit Asian American immigrant research participants. *Journal of Nursing Scholarship*, *48*, 210–218.

Kitzinger, J. (1995). Qualitative research. Introducing focus groups. *BMJ (Clinical Research Ed.)*, *311*, 299–302.

Llosada, J., Vallverdú, I., Miró, M., Pijem, C., & Guarga, A. (2012). The access to health services and their use by immigrant patients: The voice of the professionals. *Atencion Primaria*, *44*, 82–88.

Malmusi, D., Jansà, J. M., & del Vallado, L. (2007). Recommendations for health research and information on definitions and variables for the study of the foreign-born immigrant population. *Revista Española de Salud Pública*, *81*, 399–409.

Muhammad, M., Wallerstein, N., Sussman, A. L., Avila, M., Belone, L., & Duran, B. (2015). Reflections on researcher identity and power: The impact of positionality on Community Based Participatory Research (CBPR) processes and outcomes. *Critical Sociology*, *41*, 1045–1063.

National Institute of Statistics (INE) (2013). Estadística del Padrón Continuo. Datos Provisionales a 1 de Enero de 2013. Retrieved 4 August 2016, from http://www.ine.es/prensa/np776.pdf.

Pica, M., López-Jacob, M. J., García, A. M., Martínez, J. M., Benavides, F. G., & Ronda, E. (2014). [Re-contact with immigrant workers in Spain through telephone interview (ITSAL II)]. *Archivos de Prevencion de Riesgos Laborales*, *17*, 132–141.

Ribisl, K., Walton, M., Mowbray, C., Luke, D., Davidson, W., & Bootsmiller, B. (1996). Minimizing participant attrition in panel studies through use of effective retention and tracking strategies: Review and recommendations. *Evaluation and Program Planning*, *19*, 1–25.

Seidman, I. (2006). *Interviewing as qualitative research* (3rd ed.). New York: Teachers College Press.

Stoecklin-Marois, M., Hennessy-Burt, T., & Schenker, M. (2011). Engaging a hard-to-reach population in research: Sampling and recruitment of hired farm workers in the MICASA study. *Journal of Agricultural Safety and Health*, *17*, 291–302.

Stronks, K., Snijder, M. B., Peters, R. J. G., Prins, M., Schene, A. H., & Zwinderman, A. H. (2013). Unravelling the impact of ethnicity on health in Europe: The HELIUS study. *BMC Public Health*, *13*, 402. http://doi.org/10.1186/1471-2458-13-402.

Unson, C. G., Dunbar, N., Curry, L., Kenyon, L., & Prestwood, K. (2001). The effects of knowledge, attitudes, and significant others on decisions to enroll in a clinical trial on osteoporosis: Implications for recruitment of older African-American women. *Journal of the National Medical Association*, *93*, 392–404.

UyBico, S. J., Pavel, S., & Gross, C. P. (2007). Recruiting vulnerable populations into research: A systematic review of recruitment interventions. *Journal of General Internal Medicine*, *22*, 852–863.

Willlig, C. (2008). *Introducing qualitative research in psychology. Adventures in theory and method*. Berkshire/New York: Open Unive.

Woodward-Kron, R., Hughson, J.-A., Parker, A., Bresin, A., Hajek, J., Knoch, U., … Story, D. (2016). Culturally and linguistically diverse populations in medical research: perceptions and experiences of older Italians, their families, ethics administrators and researchers. *Journal of Public Health Research*, *5*, 667.

How to cite this article: Hernando C, Sabidó M, Casabona J. Facilitators and barriers of participation in a longitudinal research on migrant families in Badalona (Spain): A qualitative approach. *Health Soc Care Community*. 2017;00:1–11. https://doi.org/10.1111/hsc.12478

Gac Sanit. 2019;33(1):45–52

Original

Facilitadores de la participación e implementación de la subcohorte PELFI de familias inmigrantes

Cristina Hernando Rovirola[a,b,*], Florianne Gaillardin[b], Laia Ferrer Serret[b,c], Ana Cayuela Mateo[d], Elena Ronda Pérez[c,d] y Jordi Casabona Barbarà[b,c,e,f]

[a] Doctorado en Pediatría, Obstetricia y Ginecología, Medicina Preventiva y Salud Pública, Facultad de Medicina, Universidad Autónoma de Barcelona, Bellaterra (Barcelona), España
[b] Centre d'Estudis Epidemiològics sobre les ITS i Sida de Catalunya, Instituto Catalán de Oncología, Agencia de Salud Pública de Cataluña, Generalitat de Cataluña; Hospital Universitari Germans Trias i Pujol, Badalona (Barcelona), España
[c] Centros de Investigación Biomédica en Red (CIBER), España
[d] Área de Medicina Preventiva y Salud Pública, Universidad de Alicante, Alicante, España
[e] Instituto de Investigación Fundación Germans Trias i Pujol, Badalona (Barcelona), España
[f] Departamento de Pediatría, Obstetricia y Ginecología, y Medicina Preventiva, Universidad Autónoma de Barcelona, Badalona (Barcelona), España

INFORMACIÓN DEL ARTÍCULO

Historia del artículo:
Recibido el 7 de marzo de 2017
Aceptado el 13 de julio de 2017
On-line el 22 de septiembre de 2017

Palabras clave:
Familia
Salud
Estudios longitudinales
Participación
Emigración e inmigración
España

RESUMEN

Objetivo: PELFI es un estudio multicéntrico de cohortes de familias inmigradas en España. Los objetivos de este manuscrito son: 1) describir el reclutamiento, la recogida de información y las características sociodemográficas según origen y sexo de los participantes de las familias; y 2) valorar las estrategias de reclutamiento y recogida de información que facilitaron la participación en la subcohorte PELFI Badalona/SC.
Método: Estudio descriptivo con una muestra de conveniencia de familias inmigrantes y autóctonas residentes en Badalona y Santa Coloma de Gramanet. Se encuestaron los padres, madres e hijos >16 años, y se realizaron exámenes médicos.
Resultados: Participaron 115 familias. Entre las estrategias de reclutamiento, la bola de nieve logró el 69% de cooperación. La tasa de cooperación del estudio fue del 57,5% y de los exámenes médicos del 66,6%. La cooperación de las familias chinas fue del 38,5% y no se reclutaron hijos >16 años. El 28% de las encuestas se realizaron en fin de semana o por la noche. Las familias tenían un tiempo medio de residencia de 12,2 años. El 71,2% de los hijos >16 años tenían estudios secundarios finalizados. Los inmigrantes tenían una clase social más baja que los autóctonos ($p<0,05$) y las mujeres inmigradas menor nivel de estudios ($p<0,05$).
Conclusiones: Interaccionar frecuentemente con la comunidad, utilizar simultáneamente distintas estrategias de reclutamiento, incorporar investigadores del mismo origen geográfico que los participantes, minimizar las barreras idiomáticas y ofrecer flexibilidad de tiempo y lugar facilitó la participación. Las familias chinas presentaron mayores dificultades. Las conclusiones facilitarán la implementación de futuras cohortes de características similares.

Facilitators of participation and implementation of the immigrant families' PELFI Sub-Cohort

Keywords:
Family
Health
Longitudinal studies
Patient participation
Emigration and immigration
Spain

ABSTRACT

Objective: PELFI is a multicentre cohort study of migrant families in Spain. The objectives of this manuscript were: 1) to describe the recruitment strategies, data collection and the main socio-demographic characteristics according to geographical origin and sex of participants of the families; and 2) to assess the recruitment and data collection strategies that facilitated participation in the basal assessment of the Badalona and Santa Coloma de Gramanet cohort.
Method: Descriptive study on a convenience sample of migrant and native families residing in Badalona and Santa Coloma de Gramanet. Health interviews were conducted on fathers, mothers and children>16 years; and medical examinations were performed.

* Autora para correspondencia.
Correo electrónico: jcasabona@iconcologia.net (C. Hernando Rovirola).

https://doi.org/10.1016/j.gaceta.2017.07.010

Results: There were 115 participating families. Within the recruitment strategies, snow ball achieved 69% cooperation. The cooperation rate of the study was 57.5% and that of the clinical sub-sample was 66.6%. Cooperation rate of the Chinese families was 38.5% and Chinese children >16 years old were not recruited. Twenty-eight percent of the interviews were conducted at weekends or during the evening. Families had a mean of 12.2 years of residence. Seventy-one point two percent of the children >16 years had completed secondary studies. The migrants had lower social class than natives ($p < 0.05$) and the migrant women had lower levels of education ($p < 0.05$).
Conclusions: Interacting frequently with the community, using different recruitment strategies simultaneously, incorporating researchers from the same geographical origin as participants, minimising language barriers and offering flexibility in conducting data collection facilitated the participation of the migrant families. The Chinese families presented greater difficulties. The study findings will facilitate the implementation of future cohort studies with similar characteristics.

Introducción

En España, la llegada de población inmigrante durante la primera década del siglo xxi tuvo tal envergadura que modificó la estructura sociodemográfica del área metropolitana de Barcelona y otras grandes ciudades[1]. En nuestro país, el estado de salud de la población inmigrante se considera una prioridad en salud pública[2]. Datos internacionales indican que la población inmigrante presenta factores lingüísticos, culturales y socioeconómicos que limitan su identificación, participación y repetición del contacto en investigación, por lo que estudiar la salud de esta población se considera un reto[3].

Una revisión bibliográfica indica que la mayor estabilidad de las familias inmigrantes facilita su participación en investigación[4]. En España, la elevada frecuencia de la reagrupación familiar y de hogares constituidos por familias (más del 60%) muestran que un segmento importante de la población inmigrante vive en familia[5]. A pesar de ello, se dispone de escasa información sobre la utilización de la familia inmigrante como unidad de estudio. Según indican otros autores, las estrategias comunitarias de reclutamiento son otro facilitador de la participación de esta población[6].

Datos nacionales muestran mejores indicadores de salud en la población inmigrante reciente *(healthy migrant effect)*[7] y mayor empeoramiento de la salud con el tiempo de residencia en la población inmigrante que en la autóctona[8]. Por ello, en el estudio de la salud de esta población y de la evolución de sus determinantes es esencial incluir el tiempo de residencia, y los estudios longitudinales se consideran el diseño más adecuado para ello. En España se dispone de la experiencia del estudio longitudinal ITSAL realizado con trabajadores inmigrantes[9].

En 2014 se constituyó el Proyecto de Estudios Longitudinales de Familias Inmigrantes (PELFI), un estudio multicéntrico de cohortes de familias inmigrantes con el objetivo de estudiar la magnitud, la distribución y los determinantes de los problemas de salud en la población inmigrante española. Actualmente, PELFI incluye las subcohortes de Alicante, Barcelona[10] y Badalona/Santa Coloma de Gramanet (SC), que comparten criterios de inclusión y módulos del cuestionario de salud que permitirán construir la cohorte multicéntrica. Cada subcohorte tiene objetivos específicos y utiliza estrategias de reclutamiento adecuadas a su entorno y a los orígenes geográficos incluidos. El principal objetivo específico de la subcohorte Badalona/SC es describir la relación de los determinantes de salud con la unidad familiar y la experiencia migratoria. A diferencia de las otras subcohortes, se incluyeron familias de Pakistán y China, se ofreció paridad de origen y sexo entre encuestadores y participantes, y se realizaron análisis de muestras biológicas.

Este artículo tiene los objetivos específicos de: 1) describir el reclutamiento, la recogida de información y las características sociodemográficas según el origen y el sexo de los participantes de las familias; y 2) valorar las estrategias de reclutamiento y de recogida de información que facilitaron la participación en la subcohorte PELFI Badalona/SC.

Métodos

Tipo de estudio

Estudio descriptivo con familias inmigrantes y autóctonas.

Ámbito de estudio

El estudio se realizó en Badalona/SC (área metropolitana de Barcelona). En 2014, en Badalona/SC el 18% (61.133)[11,12] de la población era extranjera. Los orígenes geográficos más frecuentes eran América Latina (el 21% procedían de Bolivia, Perú, Ecuador y Colombia), Marruecos (15,6%), Pakistán (13,5%) y China (11%)[11].

Población de estudio

La población de estudio fueron familias inmigrantes y autóctonas. Definimos familia como la unidad formada por al menos padre o madre e hijo(a)/s que comparten un presupuesto común y conviven desde hace al menos 6 meses[13]. Consideramos inmigrantes a las personas nacidas en un país diferente de España[14]. Se incluyeron los orígenes geográficos más frecuentes en Badalona/SC. Se seleccionaron familias inmigrantes y autóctonas monoparentales o biparentales cuyos progenitores hubieran nacido en Ecuador, Bolivia, Perú, Colombia, Pakistán, Marruecos, China o España, independientemente del tiempo de residencia, su situación laboral y legal, y con un hijo/a como mínimo. Se excluyeron las familias inmigrantes con un progenitor autóctono.

Muestreo, selección y tamaño de muestra

Uno de los propósitos era generar información útil para la implementación de cohortes en colectivos menos estudiados (Marruecos, Pakistán y China)[15] o con mayores dificultades de reclutamiento (Marruecos)[9]. También se seleccionaron los orígenes geográficos según su frecuencia en el territorio y los incluidos en las otras subcohortes PELFI[10]. La subcohorte Badalona/SC es la única fuente de familias pakistaníes y chinas en la subcohorte multicéntrica PELFI. Teniendo en cuenta la financiación disponible, se definió una muestra de conveniencia de 90 familias inmigrantes y un grupo control de 20 familias autóctonas. Se consideraron familias participantes aquellas en que como mínimo uno/a de sus integrantes fue encuestado/a. Entre las participantes se seleccionaron 25 familias en las

que se realizaron análisis de muestras biológicas (submuestra clínica).

Instrumentos de recogida de información

Se diseñó específicamente para este estudio una encuesta para madres (incluía 84 preguntas), padres (para evitar repeticiones se suprimió el módulo *Estructura familiar*, incluyendo 69 preguntas) e hijos/as mayores de 16 años (se suprimió el módulo *Recursos económicos* y se añadió *Vida escolar*, incluyendo 79 preguntas), con una duración estimada de 45-60 minutos. Los cuestionarios incluyeron variables sociodemográficas, económicas y de salud laboral y mental comunes con las subcohortes PELFI[10]. Para los objetivos de este trabajo, la descripción sociodemográfica incluyó sexo, edad, años de residencia, nacionalidad española, nivel de estudios, competencia idiomática (entiende y habla el español nada o poco *vs*. bastante o correctamente), número de hijos/as y clase social. Se utilizó la clase social basada en la ocupación principal de quienes habían trabajado los últimos 6 meses, utilizando la clasificación propuesta por la Sociedad Española de Epidemiología (I, II, III: trabajadores no manuales; IV: trabajadores manuales cualificados y semicualificados; V: trabajadores manuales no cualificados)[16]. Se consideraron Ecuador, Bolivia, Perú y Colombia como América Latina.

Las encuestas incluían otras secciones y escalas estandarizadas para responder a los objetivos específicos de la subcohorte Badalona/SC: condiciones del hogar; soporte social, que incluía la escala *Cuestionario de apoyo social funcional Duke-UNC-11*[17]; relaciones intrafamiliares, que incluía la *Escala de Evaluación de Relaciones Intrafamiliares*[18]; percepción de discriminación, con la herramienta *The every day discrimination scale*[19]; salud sexual y reproductiva; salud autopercibida con la escala EuroQol 5 D 3L[20]; y uso de los servicios sanitarios. Los cuestionarios pueden consultarse en:http://www.ciberesp.es/programas-de-investigacion/subprogramas-estrategicos/subprograma-inmigracion-y-salud-ciberesp-sis-ciberesp.

Se realizaron exámenes médicos que consistieron en exploración física (peso, talla, presión arterial y *peak flow*); recogida de muestras de heces, frotis de piel y Mantoux a los mayores de 6 meses; y también de sangre y orina a los mayores de 18 años.

Recogida de datos

Previamente se había realizado un estudio cualitativo[21] en el mismo lugar de estudio con la colaboración de entidades (organizaciones no gubernamentales y asociaciones de inmigrantes) y servicios (escuelas y centros de atención primaria) de Badalona/SC. Esta experiencia permitió seleccionar un equipo de inmigrantes (un hombre y una mujer de Pakistán; dos hombres y dos mujeres de Marruecos; y un hombre y una mujer de China) que recibieron formación para realizar las encuestas. Dicho equipo y un equipo de cinco analistas sociales experimentados en estudiar población inmigrante constituyeron el equipo de campo, que realizó el reclutamiento y las encuestas.

El trabajo de campo se realizó entre octubre de 2015 y abril de 2016. Se llevaron a cabo tres estrategias de reclutamiento (fig. 1):

- Reuniones organizadas por entidades y escuelas con la finalidad de reclutar participantes. Los interlocutores de entidades y escuelas presentaban el estudio a sus usuarios y les invitaban a participar en reuniones con el equipo de campo en sus sedes.
- Captación oportunista en lugares diana: el equipo de campo acudía a escuelas, centros de atención primaria y mezquitas en las franjas horarias de mayor concurrencia. El equipo de campo informaba sobre el estudio, respondía preguntas y recogía el número telefónico de los que querían participar.
- Bola de nieve en las redes familiares y comunitarias de las familias participantes y los encuestadores inmigrantes. Se aceptó un máximo de tres contactos útiles por familia. Posteriormente se llamaba a los contactos para ser entrevistados. Durante las entrevistas, se ofrecía sistemáticamente participar en la submuestra clínica hasta obtener la muestra deseada.

Las encuestas y los consentimientos informados se tradujeron al idioma oficial de los países participantes: urdu, árabe y mandarín. La encuesta fue pilotada con una familia latina. Los encuestadores inmigrantes revisaron las traducciones y encuestaron a las familias pakistaníes, magrebíes y chinas. En las pakistaníes y las magrebíes se ofreció paridad de sexo entre encuestadores y participantes con el objetivo de minimizar las barreras de participación culturales y de género[22]. Las encuestas se realizaron en el domicilio o en los lugares que los participantes indicaban, mediante tabletas (*software* "Survey to go"). La comprobación de las tabletas permitió realizar el seguimiento de la recogida de información. De acuerdo con estudios anteriores[3,22], para facilitar la participación en la submuestra clínica se informó sobre los procedimientos, se agilizó el proceso de recogida de muestras, se facilitaron los resultados y el tratamiento, y se evitó coincidir con las fechas del Ramadán. Cada participante recibió 10 € por encuesta completada y 10 € por examen médico realizado.

Los participantes fueron informados en urdu, árabe, mandarín y español sobre los objetivos y los procedimientos del estudio, y firmaron su consentimiento. El protocolo del estudio fue aprobado por el Comité de Ética del Hospital Germans Trias i Pujol (Núm PI-14-092). Se planificó realizar un seguimiento transcurridos 12 meses de la valoración basal.

Análisis estadístico

Basándonos en las recomendaciones de The American Association for Public Opinion Research[23], se calculó la tasa de cooperación global del estudio dividiendo las familias participantes [F] entre [F] más las familias que facilitaron su contacto, pero rechazaron ser entrevistadas [R]: ([F]/[F]+[R]). La tasa de cooperación también se calculó según el origen geográfico, la estrategia de reclutamiento y en la submuestra clínica (fig. 1). Se realizó un análisis descriptivo univariado de las características sociodemográficas de los participantes en la valoración basal según el origen geográfico mediante el cálculo de proporciones para las variables categóricas, y con media y desviación estándar para las continuas (edad y años de residencia). Se realizó un análisis bivariado de las características sociodemográficas comparando entre hombres y mujeres mediante las pruebas de ji al cuadrado o exacta de Fischer para variables categóricas, y Anova para variables continuas (edad), mediante SPSS v.20. En el análisis de la competencia idiomática se eliminaron las familias autóctonas (todas dominaban el español) y latinas, y también los/las hijos/as mayores de 16 años nacidos/as en España (n = 6). En el análisis de la nacionalidad y de los años de residencia de los hijos mayores de 16 años se eliminaron los autóctonos (n = 8) y los nacidos en España (n = 6).

Resultados

Participaron 115 familias. Se superó el número deseado de familias magrebíes y latinas. La captación oportunista en lugares diana logró la mayoría de los contactos (41,5%). La bola de nieve logró la mayor tasa de cooperación (69%) (fig. 1). El 42,6% de la muestra de estudio fue reclutada por bola de nieve, el 40% por captación oportunista en lugares diana y el 17,4% mediante reuniones en entidades. El motivo más frecuente de rechazo (60%) fue la falta de deseo de participar (tabla 1).

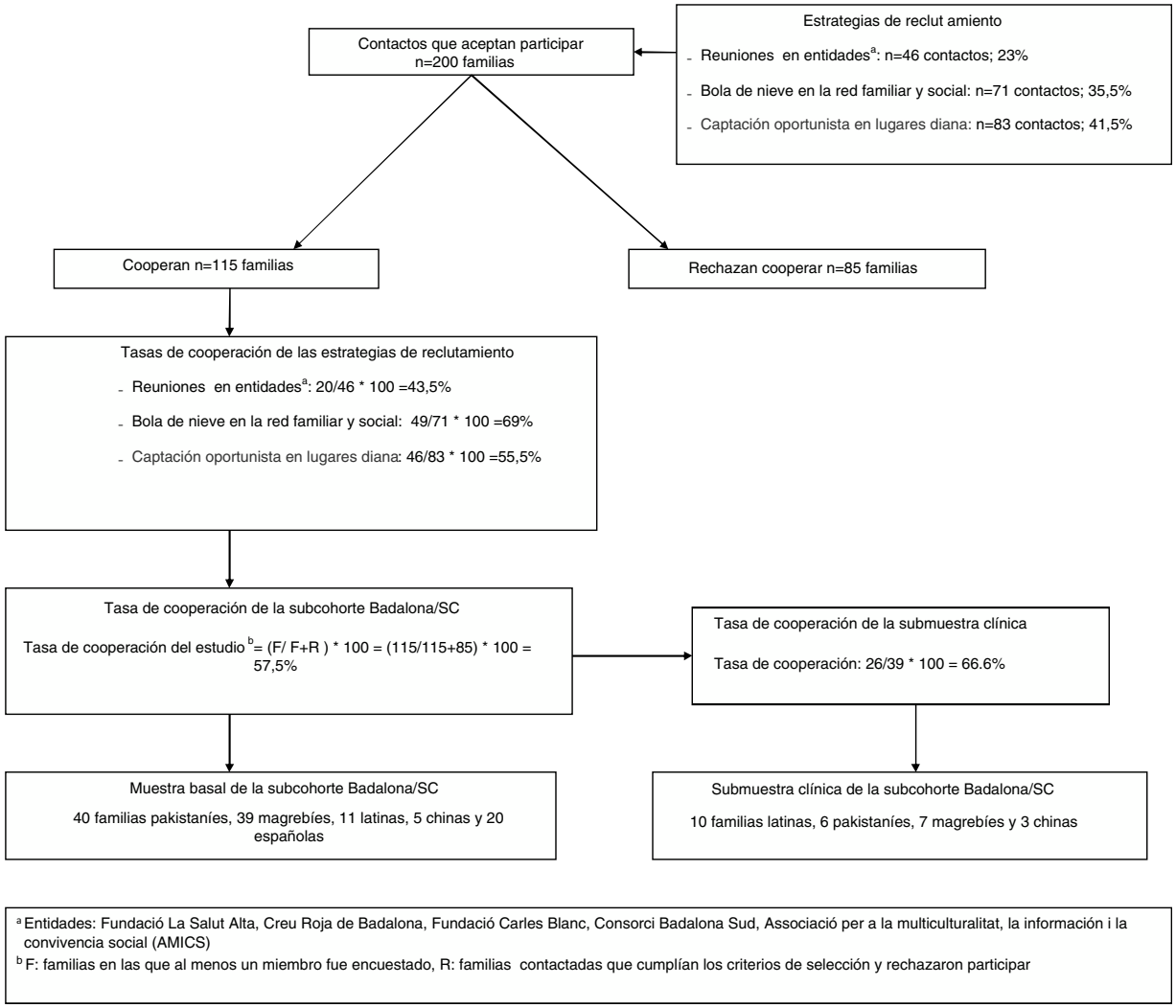


Figura 1. Diagrama del reclutamiento de las familias participantes en la valoración basal de la subcohorte PELFI Badalona/SC.

Tabla 1
Frecuencias absolutas y relativas de los motivos de no participar según el origen geográfico de las familias

Motivo de no participar	Pakistán N (%)	Marruecos N (%)	América Latina N (%)	China N (%)	España N (%)	Total (% col)
Falta de deseo de participar	22 (43,2)	18 (35,3)	3(6,0)	6 (11,5)	2 (4,0)	51 (60,0)
No responde o teléfono incorrecto	2 (12,5)	13 (81,2)	0 (0,0)	0 (0,0)	1 (6,3)	16 (18,5)
La pareja no desea participar	0 (0,0)	8 (80,0)	1 (10,0)	0 (0,0)	1 (10,0)	10 (11,5)
Falta de tiempo	1 (33,3)	0 (0,0)	1 (33,3)	0 (0,0)	1 (33,4)	3 (4,5)
No acuden o anulan la cita	0 (0,0)	2 (66,7)	0 (0,0)	1 (33,3)	0 (0,0)	3 (3,5)
Encontrarse fuera del país	1 (100,0)	0 (0,0)	0 (0,0)	0 (0,0)	0 (0,0)	1 (1,0)
Barrera idiomática	0 (0,0)	0 (0,0)	0 (0,0)	1 (100,0)	0 (0,0)	1 (1,0)
Total	26 (30,6)	41 (48,2)	5 (5,9)	8 (9,4)	5 (5,9)	85 (100,0)

La tasa de cooperación del estudio fue del 57,5%, y en la submuestra clínica fue del 66,6%. Las familias chinas presentaron la menor tasa de cooperación (38,5%). En este colectivo no se reclutaron hijos mayores de 16 años ni se logró la participación de las familias deseadas en la submuestra clínica (fig. 1).

El 86% de las encuestas se realizaron en el domicilio, el 7,5% (n = 19) en una cafetería o bar, el 4% (n = 10) en el lugar de trabajo, el resto en entidades y un caso en una plaza. El 28% de las encuestas tuvieron lugar en fin de semana o después de las 20:00 h; en ambos casos principalmente fueron hijos mayores de 16 años (47% *vs*. 23,3% de padres y madres). Las compensaciones económicas facilitaron la participación en algunos casos, especialmente en las familias que habían llegado recientemente o que estaban sin trabajo.

Las tablas 2, 3 y 4 muestran las personas participantes y sus características sociodemográficas. Los padres y las madres tenían una edad media de 42 años (desviación estándar [DE]: 9,1) y una residencia media de 12,2 años (DE: 5,7). El 71,2% de los hijos mayores de 16 años tenían estudios secundarios. La tabla 5 muestra las características sociodemográficas en función del sexo. Hombres y mujeres inmigrantes tenían más baja clase social que los autóctonos (p <0,05); las mujeres inmigrantes también tenían menor nivel de estudios que las autóctonas (p <0,05).

Tabla 2
Miembros de las familias que participaron en la valoración basal según el origen geográfico

	Origen geográfico					
	Pakistán N (%)	Marruecos N (%)	América Latina N (%)	China N (%)	España N (%)	Total N (%)
Familias	40 (35,0)	39 (34,0)	11 (9,0)	5 (4,5)	20 (17,5)	115 (100,0)
Padres y madres	76 (37,5)	66 (32,5)	17 (8,5)	6 (3,0)	38 (18,5)	203 (100,0)
Hijos >16 años	24 (46,0)	15 (29,0)	5 (9,5)	0 (0,0)	8 (15,5)	52 (100,0)

Tabla 3
Descripción de las características sociodemográficas de los padres y las madres de las familias participantes según el origen geográfico

Características sociodemográficas	Origen geográfico					
	Pakistán N (%)	Marruecos N (%)	América Latina N (%)	China N (%)	España N (%)	Total N (%)
Sexo femenino	40 (52,6)	39 (59,1)	11 (64,7)	3 (50,0)	20 (52,6)	113 (55,7)
Edad (media, DE)	42,7 (10,7)	40,5 (8,7)	43,4 (7,5)	43 (4,3)	42,8 (7,1)	42,1 (9,1)
Años de residencia (media, DE)	9,8 (5,0)	14,6 (6,0)	13,6 (3,0)	12,3 (2,6)	-	12,2 (5,7)
Nacionalidad española	7 (9,2)	23 (34,8)	16 (94,1)	0 (0,0)	-	46 (27,9)
Estudios[a] primarios o menos	36 (47,4)	28 (42,4)	4 (23,5)	4 (66,7)	11 (28,9)	83 (40,9)
Estudios secundarios o formación profesional	34 (44,7)	32 (48,5)	9 (52,9)	2 (33,3)	19 (50,0)	96 (47,3)
Estudios universitarios	6 (7,9)	6 (9,1)	4 (23,5)	0 (0,0)	8 (21,1)	24 (11,8)
Entiende el español bastante o correctamente	35 (46,1)	51 (77,3)	-	0 (0,0)	-	86 (58,1)
Habla el español bastante o correctamente	36 (47,4)	51 (77,3)	-	0 (0,0)	-	87 (58,8)
Clase social I, II, III[b] (n=129)	6 (14,5)	4 (10,5)	0 (0,0)	0 (0,0)	14 (44,0)	24 (18,6)
Clase social IV	28 (68,0)	20 (52,5)	8 (50,0)	1 (50,0)	15 (47,0)	72 (55,8)
Clase social V	7 (17,0)	14 (37,0)	8 (50,0)	1 (50,0)	3 (9,0)	33 (25,6)

DE: desviación estándar.
[a] Nivel de estudios finalizados.
[b] I, II, III: trabajadores no manuales; IV: trabajadores manuales cualificados y semicualificados; V: trabajadores manuales no cualificados.

Tabla 4
Descripción de las características sociodemográficas de los/las hijos/as mayores de 16 años de las familias participantes según el origen geográfico

Características sociodemográficas	Origen geográfico				
	Pakistán N (%)	Marruecos N (%)	América Latina N (%)	España N (%)	Total N (%)
Sexo masculino	19 (79,2)	7 (46,5)	2 (40,0)	2 (25,0)	30 (57,7)
Edad (media, DE)	21,1 (3,2)	20,5 (4,0)	21,0 (4,3)	21,2 (2,8)	21,0 (3,5)
Años de residencia (media, DE)	7,0 (2,6)	15,4 (5,4)	10,6 (2,6)	-	9,4 (5,0)
Nacionalidad española	2 (8,3)	5 (55,5)	3 (75,0)	-	10 (27,0)
Estudios[a] primarios o menos	8 (33,3)	3 (20,0)	0 (0,0)	1 (12,5)	12 (23,0)
Estudios secundarios o formación profesional	16 (66,7)	9 (60,0)	5 (100,0)	7 (87,5)	37 (71,2)
Estudios universitarios	0 (0,0)	3 (20,0)	0 (0,0)	0 (0,0)	3 (5,8)
Entiende el español bastante o correctamente	20 (83,3)	9 (100,0)	-	-	29 (88,0)
Habla el español bastante o correctamente	19 (79,2)	9 (100,0)	-	-	28 (84,8)

DE: desviación estándar.
[a] Nivel de estudios finalizados.

Discusión

Este estudio muestra la viabilidad de implementar una cohorte de familias inmigrantes en Badalona/SC. La realización simultánea de captación oportunista y de bola de nieve logró un flujo continuo de familias participantes, superando la muestra deseada. La bola de nieve se ha utilizado en otros estudios para reclutar *hard-to-reach populations*[24]. La captación oportunista permitió diversificar los ámbitos de recogida de contactos y minimizar el sesgo de selección que la bola de nieve puede presentar[24].

El origen geográfico, las estrategias de reclutamiento y la interacción frecuente y sin barreras con la comunidad local (buena accesibilidad y visibilidad del equipo investigador, participación en eventos sociales, etc.) fueron factores clave que influyeron en la participación de la población inmigrante. El origen y la estrategia de reclutamiento ya se han descrito en la literatura como factores relevantes en el diseño del estudio[4]. Otros estudios de cohorte que reclutaron familias latinas utilizando un registro escolar[25] y familias de distintos orígenes mediante un registro gubernamental[26] presentaron tasas de participación similares a las obtenidas en la subcohorte Badalona/SC. Las familias reclutadas en escuelas pueden permanecer en el lugar de estudio hasta que los hijos finalicen los estudios, facilitando la participación y la retención. Otros estudios que establecieron relaciones frecuentes y sin barreras con la comunidad local, como la cohorte Mendota, que reclutó familias latinas en domicilios[27], y las subcohortes PELFI Alicante y Barcelona[10], que reclutaron familias latinas y magrebíes mediante bola de nieve y captación oportunista en lugares diana, obtuvieron mayores tasas de participación y cooperación, respectivamente.

El colectivo chino presentó retos propios de investigación. La adaptación cultural de las estrategias de reclutamiento para facilitar la participación, siguiendo las recomendaciones de estudios anteriores[28,29], incluyendo investigadores de origen chino, fue insuficiente. Diversos autores han descrito la importancia que atribuye este colectivo a la jerarquía social[30]. Este hecho puede explicar las dificultades de reclutamiento que experimentó el investigador chino, que no disponía de una posición social relevante dentro de su colectivo[24], y de la bola de nieve, a diferencia de los otros orígenes geográficos. En futuros estudios, incluir investigadores chinos con relevante influencia social en su comunidad puede ser más

Tabla 5
Comparación de las características sociodemográficas de los hombres y las mujeres según el origen geográfico

Características sociodemográficas	Hombres				Mujeres		
		Inmigrantes N (%) (IC95%)	Autóctonos N (%) (IC95%)	p	Inmigrantes N (%) (IC95%)	Autóctonas N (%) (IC95%)	p
Padres y madres	Edad (media, DE)	45,5 (10,6) (43,0-48,0)	44,2 (8,7) (39,9-48,6)	0,64	39,1 (7,4) (37,5-40,6)	41,4 (5,2) (39,0-43,9)	0,18
	Estudios[a] primarios o menos	32 (44,4) (32,7-56,2)	8 (44,4) (20,5-68,4)	0,81	40 (43,0) (32,8-53,2)	3 (15,0) (1,2-31,2)	0,02
	Estudios secundarios o formación profesional	32 (44,4) (32,7-56,2)	7 (38,9) (15,4-62,4)		45 (48,4) (38,1-58,7)	12 (60,0) (37,7-82,2)	
	Estudios universitarios	8 (11,1) (3,7-18,5)	3 (16,7) (1,3-34,6)		8 (8,6) (2,8-14,4)	5 (25,0) (5,3-44,7)	
	Clase social[b] I, II, III	4 (5,9) (1,7-11,6)	5 (27,8) (6,2-49,4)	0,01[d]	6 (20,7) (5,0-36,1)	9 (64,3) (37,5-91,1)	0,02[d]
	Clase social IV	44 (64,7) (53,1-79,4)	11 (61,1) (37,6-84,6)		13 (44,8) (25,9-63,8)	4 (28,6) (3,3-53,9)	
	Clase social V	20 (29,4) (18,3-40,4)	2 (11,1) 4,0-26,3)		10 (34,5) (16,4-52,6)	1 (7,1) (0,7-21,6)	
	Total	72 (43,6) (36,0-51,3)	18 (47,4) (31,2-63,0)	NA	93 (56,4) (48,7-64,0)	20 (52,6) 36,4-68,8)	NA
Hijos >16 AÑOS	Edad (media, DE)	21,4 (3,7) (19,9-22,9)	20,0 (4,2) (18,1-58,1)	0,62	19,8 (3,1) (18,2-21,5)	21,6 (2,5) (19,0-24,4)	0,20
	Estudios primarios o menos	7 (25,0) (8,0-42,0)	0 (0,0) (0,0-0,0)	1,0[d]	4 (25,0) (17,4-51,3)	1 (16,7) (1,7-51,3)	1,0[d]
	Estudios secundarios o más[c]	21 (75,0) (58,0-92,0)	2 (100,0) (34,0-100,0)		12 (75,0) (51,7-98,2)	5 (83,3) (48,7-97,9)	
	Total	28 (63,6) (42,1-100,0)	2 (25,0) (7,9-57,9)	NA	16 (36,4) (21.6-51,1)	6 (75,0) (48,9-78,4)	NA

DE: desviación estándar; IC95%: intervalo de confianza del 95%; NA: no aplicable.
[a] Nivel de estudios finalizados.
[b] I, II, III: trabajadores no manuales; IV: trabajadores manuales cualificados y semicualificados; V: trabajadores manuales no cualificados.
[c] Incluye estudios secundarios, formación profesional y estudios universitarios.
[d] Prueba exacta de Fischer.

efectivo. En la submuestra clínica, la menor participación que presentó el colectivo chino puede relacionarse con la utilización de la medicina tradicional china en el país de acogida[31]. Estas prácticas pueden limitar el conocimiento y la confianza de este colectivo hacia los servicios sanitarios locales, y disminuir el interés por realizar exámenes médicos. Para corregir estas debilidades se realizaron otras estrategias específicas para esta comunidad, como hacer la encuesta en el momento de la captación. Aunque esta estrategia no permitió acceder a los domicilios ni a los hijos mayores de 16 años, facilitó encuestar a padres y madres.

La falta de deseo fue el motivo más frecuente para rechazar la participación en el estudio. En un estudio sobre facilitadores de la participación en investigación, la mayoría de participantes inmigrantes mostró su interés por realizar exámenes médicos[21]. Otras cohortes de familias inmigrantes mostraron la viabilidad de realizar exámenes médicos[27,32], aunque añaden dificultades logísticas y aumentan el presupuesto del estudio. La implementación de la submuestra clínica en la subcohorte Badalona/SC mostró la aceptación de los exámenes médicos por las familias inmigrantes. Ello sugiere que realizar exámenes médicos, juntamente con el deseo de conocer la salud de la familia, puede aumentar el interés y facilitar la participación en una cohorte de salud.

Otra estrategia que facilitó la implementación del estudio fue ofrecer flexibilidad de lugar y tiempo para realizar las encuestas, especialmente entre los que trabajaban y en los/las hijos/as mayores de 16 años. La traducción de los cuestionarios disminuyó las barreras idiomáticas, aunque requirió tiempo y presupuesto. La utilización de tabletas facilitó la supervisión del trabajo de campo, y contribuyó a garantizar la privacidad y la confidencialidad.

Otros estudios han recogido las ventajas[9,33] o han recomendado[15] utilizar encuestadores/as del mismo origen y sexo que los/las participantes. En general, la paridad de origen y sexo fue beneficiosa, aunque un reducido número de participantes de cultura musulmana prefería un encuestador autóctono ante preguntas socialmente sensibles, como las de salud sexual. Es posible que la afinidad cultural y de valores pueda limitar la veracidad de las respuestas de cuestiones socialmente sensibles. Posiblemente, utilizar encuestadores/as del mismo origen y sexo que los/las participantes, pero que pertenezcan a una comunidad diferente, podría facilitar la realización de esta parte de la encuesta.

Este estudio presenta algunas limitaciones, como el reducido número de familias incluidas y el reclutamiento de conveniencia. La escasa presencia de inmigrantes recientes (menos de 6 meses de residencia) se justifica por tratarse de una población de difícil acceso y que requiere estrategias específicas de reclutamiento[34]. Es posible que se haya producido un sesgo de participación de familias más preocupadas por su salud o más proactivas en la búsqueda de recursos sociales. Las compensaciones económicas pueden seleccionar participantes con menos recursos económicos. Se limitó el tamaño de la submuestra clínica por limitaciones de presupuesto. Pilotar la encuesta con una familia latina puede limitar la validez de algunas cuestiones según los diferentes orígenes. Como fortaleza, la formación de los/las encuestadores/as y la utilización de tabletas aportan consistencia en los seguimientos.

En Europa existe un interés creciente por realizar estudios de cohortes en familias inmigrantes, como reflejan los estudios que actualmente están en marcha: la cohorte HELIUS, establecida en Holanda, que estudia familias de Surinam, Turquía, Marruecos y Ghana[32]; y la German National Cohort con familias turcas[35]. En España, el mantenimiento y la aplicabilidad del proyecto PELFI dependerán de la obtención de la financiación necesaria.

Conclusión

Interaccionar frecuentemente con la comunidad, utilizar de manera simultánea diversas estrategias de reclutamiento, incorporar investigadores/as del mismo origen geográfico, minimizar las barreras idiomáticas y ofrecer flexibilidad para realizar las

encuestas y los exámenes médicos facilitaron la participación de las familias inmigrantes con largos tiempos de residencia. El colectivo chino presentó mayores dificultades de participación. Los hallazgos del estudio podrán facilitar el diseño y la implementación de futuras cohortes de características similares.

¿Qué se sabe sobre el tema?

La salud de la población inmigrante puede empeorar con el tiempo de residencia. La población inmigrante presenta más dificultades para participar en estudios de salud que la autóctona. Se desconoce el papel de la estructura y la dinámica familiar, y del proceso migratorio, sobre la salud de esta población.

¿Qué añade el estudio realizado a la literatura?

Conocer la viabilidad de una cohorte de familias inmigrantes en España y la cooperación según la estrategia de reclutamiento y el origen. Completar las zonas geográficas incluidas en la cohorte PELFI. Utilizar diversas estrategias de reclutamiento simultáneas, incluir otros orígenes geográficos, la familia como unidad de estudio, encuestadores pares por origen y sexo, y analizar muestras biológicas.

Editora responsable del artículo

Julia Bolívar-Muñoz.

Declaración de transparencia

La autora principal (garante responsable del manuscrito) afirma que este manuscrito es un reporte honesto, preciso y transparente del estudio que se remite a Gaceta Sanitaria, que no se han omitido aspectos importantes del estudio, y que las discrepancias del estudio según lo previsto (y, si son relevantes, registradas) se han explicado.

Contribuciones de autoría

C. Hernando, L. Ferrer y J. Casabona concibieron el trabajo y participaron en el diseño del estudio. C. Hernando, F. Gaillardin, L. Ferrer y J. Casabona supervisaron los aspectos de su realización. C. Hernando y F. Gaillardin coordinaron el trabajo de campo, con el soporte de L. Ferrer. C. Hernando realizó el análisis y la interpretación de los datos, y junto con F. Gaillardin y L. Ferrer redactaron el primer borrador del manuscrito. E. Ronda, A. Cayuela y el resto de autores/as aportaron ideas, interpretaron los hallazgos, realizaron una revisión crítica del borrador del manuscrito y aprobaron la versión final.

Financiación

Este estudio ha sido financiado por el ISCIII, PI13/01962, cofinanciado por los Fondos Europeos de Desarrollo Regional (FEDER), y por los fondos del Subprograma Inmigración y Salud de CIBERESP.

Conflictos de intereses

Ninguno.

Agradecimientos

Los/las autores/as desean agradecer las inestimables contribuciones de Meritxell Sabidó, por la revisión del manuscrito, y del Ayuntamiento de Badalona, el Institut Català de la Salut (ICS), Badalona Serveis Assistencials (BSA), Técnicas de Salud de Badalona (Marta Ribó, Ana Belén Ramos y Ana Sebastián), Fundació La Salut Alta, Creu Roja de Badalona, Fundació Carles Blanc, Consorci Badalona Sud, Associació per a la Multiculturalitat, la Informació i la Convivencia Social (AMICS), Asociación Cultural de la República Popular China, Escuela Miguel Hernández, Escuela Josep Carner, Escuela Pedro Botey, Escuela Itaca, Centro d'Atenció Primaria Montigalà y Centre d'Atenció al Viatger de Santa Coloma de Gramanet.

Bibliografía

1. Serra del Pozo P, Smilges Gaffe A. La población extranjera de Badalona en el contexto de la crisis económica. Estudios Geográficos. 2013;LXXIV:639–82.
2. Oliva J, Pérez G. Inmigración salud. Gac Sanit. 2009;23 (Supl 1):1–3.
3. Ford ME, Siminoff LA, Pickelsimer E, et al. Unequal burden of disease, unequal participation in clinical trials: solutions from African American and Latino community members. Health Soc Work. 2013;38:29–38.
4. Hernando C, Sabidó M, Ronda E, et al. A systematic review of longitudinal cohort studies on the health of migrant populations. Social Medicine. 2015;9:73–85.
5. Reher D, Cortés Alcalá L, González Quiñones F, et al. Encuesta Nacional de Inmigrantes (ENI 2007). Madrid. 2008;153. Disponible en: http://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736177005&menu=resultados&idp=1254735573002
6. Katigbak C, Foley M, Robert L, et al. Experiences and lessons learned in using community-based participatory research to recruit Asian American immigrant research participants. J Nurs Scholarsh. 2016;48:210–8.
7. Gimeno-Feliu LA, Calderón-Larrañaga A, Díaz E, et al. The healthy migrant effect in primary care. Gac Sanit. 2015;29:15–20.
8. Gotsens M, Malmusi D, Villarroel N, et al. Health inequality between immigrants and natives in Spain: the loss of the healthy immigrant effect in times of economic crisis. Eur J Public Health. 2015;25:923–9.
9. Delclos CE, Benavides FG, García AM, et al. From questionnaire to database: field work experience in the 'Immigration, work and health survey' (ITSAL Project). Gac Sanit. 2011;25:419–22.
10. Cayuela-Mateo A, Martínez-Martínez JM, Ferrer Serret L, et al. Proyecto PELFI: reclutamiento y características sociodemográficas de las familias inmigradas y autóctonas de las sub-cohortes de Alicante y Barcelona. Rev Esp Salud Publica. 2017;9:91.
11. IDESCAT. Padró municipal d'habitants. Població segons país de naixement i sexe. 2014. (Consultado el 31/12/2016.) Disponible en: http://www.idescat.cat/pub/?fil=77&col=3&id=pmh&n=7567&geo=mun%253A082457&t=201400
12. IDESCAT. Anuario estadístico de Cataluña. Población. Provincias. 2016. (Consultado el 1/8/2016.) Disponible en: http://www.idescat.cat/pub/2015
13. Ministerio de Sanidad, Servicios Sociales e Igualdad. Encuesta Nacional de Salud 2011-2012. 2013. Disponible en: http://www.msssi.gob.es/estadEstudios/estadisticas/encuestaNacional/encuestaNac2011/NotaTecnica2011-12.pdf
14. Malmusí D, Jansà JM, del Vallado L. Recomendaciones para la investigación e información en salud sobre definiciones y variables para el estudio de la población inmigrante de origen extranjero. Rev Esp Salud Publica. 2007;81:399–409.
15. Monge S, Ronda E, Pons-Vigués M, et al. Limitaciones y recomendaciones metodológicas en las publicaciones sobre salud de la población inmigrante en España. Gac Sanit. 2015;29:461–3.
16. Domingo-Salvany A, Bacigalupe A, Carrasco JM, et al. Propuestas de clase social neoweberiana y neomarxista a partir de la Clasificación Nacional de Ocupaciones 2011. Gac Sanit. 2013;27:263–72.
17. Broadhead WE, Gehlbach SH, De Gruy FV, et al. The Duke-UNC Functional Social Support Questionnaire. Measurement of social support in family medicine patients. Med Care. 1988;26:709–23.
18. Rivera ME, Andrade P. Escala de evaluación de las relaciones intrafamiliares (E.R.I.). Uaricha Revista de Psicología. 2010;14:12–29.
19. Lewis TT, Yang FM, Jacobs EA, et al. Racial/ethnic differences in responses to the everyday discrimination scale: a differential item functioning analysis. Am J Epidemiol. 2012;175:391–401.
20. EuroQol Group. User Guide Basic information on how to use the EQ-5D-3L instrument. Rotterdam; 2015. Disponible en: http://www.euroqol.org/fileadmin/user_upload/Documenten/PDF/Folders_Flyers/EQ-5D-3L_UserGuide_2015.pdf
21. Hernando C, Sabidó M, Casabona J. Facilitators and barriers of participation in a longitudinal research on migrant families in Badalona (Spain): a qualitative approach. Health Soc Care Community. 2017, http://dx.doi.org/10.1111/hsc.12478 [Epub ahead of print].
22. Aroian KJ, Katz A, Kulwicki A. Recruiting and retaining Arab Muslim mothers and children for research. J Nurs Scholarsh. 2006;38:255–61.

23. The American Association for Public Opinion Research. Standard definitions: final dispositions of case codes and outcome rates for surveys. 9 th ed. 2016. 90 p. Disponible en: http://www.aapor.org/AAPOR_Main/media/publications/Standard-Definitions20169theditionfinal.pdf
24. Bonevski B, Randell M, Paul C, et al. Reaching the hard-to-reach: a systematic review of strategies for improving health and medical research with socially disadvantaged groups. BMC Med Res Methodol. 2014;14:42.
25. Cooper SP, Burau KE, Frankowski R, et al. A cohort study of injuries in migrant farm worker families in South Texas. Ann Epidemiol. 2006;16:313–20.
26. Cobb-Clark D. The Longitudinal Survey of Immigrants to Australia. Aust Econ Rev. 2011;34:467–77.
27. Stoecklin-Marois M, Hennessy-Burt T, Schenker M. Engaging a hard-to-reach population in research: sampling and recruitment of hired farm workers in the MICASA Study. J Agric Saf Health. 2011;17:291–302.
28. Lin JS, Finlay A, Tu A, et al. Understanding immigrant Chinese Americans' participation in cancer screening and clinical trials. J Community Health. 2005;30:451–66.
29. Taylor-Piliae RE, Froelicher ES. Methods to optimize recruitment and retention to an exercise study in Chinese immigrants. Nurs Res. 2007;56:132–6.
30. Llosada Gistau J, Vallverdú Duch I, Miró Orpinell M, et al. Acceso y uso de los servicios sanitarios por parte de los pacientes inmigrantes: la voz de los profesionales. Aten Primaria. 2012;44:82–8.
31. Green G, Bradby H, Chan A, et al. 'We are not completely Westernised': dual medical systems and pathways to health care among Chinese migrant women in England. Soc Sci Med. 2006;62:1498–509.
32. Stronks K, Snijder MB, Peters RJG, et al. Unravelling the impact of ethnicity on health in Europe: the HELIUS study. BMC Public Health. 2013;13:402.
33. Reiss K, Dragano N, Ellert U, et al. Comparing sampling strategies to recruit migrants for an epidemiological study. Results from a German feasibility study. Eur J Public Health. 2014;24:721–6.
34. Agadjanian V, Zotova N. Sampling and surveying hard-to-reach populations for demographic research: a study of female labor migrants in Moscow. Russia. Demogr Res. 2012;25:131–50.
35. Brand T, Samkange-Zeeb F, Ellert U, et al. Acculturation and health-related quality of life: results from the German National Cohort migrant feasibility study. Int J Public Health. 2017;62:521–9.

ORIGINAL ARTICLE

Antimicrobial resistance in *Neisseria gonorrhoeae* isolates from foreign-born population in the European Gonococcal Antimicrobial Surveillance Programme

Cristina Hernando Rovirola,[1,2] Gianfranco Spiteri,[3] Meritxell Sabidó Espin,[4,5] Alexandra Montoliu,[2,6] Victoria Gonzalez,[2,7] Jordi Casabona Barbarà,[2,5,6,8] Michelle Jayne Cole,[9] Teymur Noori,[3] Magnus Unemo[10]

[1]PhD on Preventive Medicine, Universitat Autònoma de Barcelona, Bellaterra, Cerdanyola, Spain

[2]Centre for Epidemiological Studies on HIV/STI in Catalonia (CEEISCAT), Agència de Salut Publica de Catalunya (ASPC), Generalitat de Catalunya, Badalona, Spain

[3]European Centre for Disease Prevention and Control (ECDC), Stockholm, Sweden

[4]TransLab, Medical Science Department, Universitat de Girona, Girona, Spain

[5]CIBER Epidemiología y Salud Pública (CIBERESP), Madrid, Spain

[6]Health Sciences Research Institute of the Germans Trias i Pujol Foundation (IGTP), Badalona, Spain

[7]Laboratory of Microbiology, Germans Trias i Pujol Hospital (HGTiP), Badalona, Spain,

[8]Department of Pediatrics, Obstetrics and Gynecology, and Preventive Medicine, Universitat Autònoma de Barcelona, Badalona, Spain

[9]National Infection Service, Public Health England, London, United Kingdom

[10]WHO Collaborating Centre for Gonorrhoea and other STIs, Örebro University, Örebro, Sweden.

Correspondence to

Cristina Hernando, CEEISCAT, Hospital Universitari Germans Trias i Pujol (Maternity 2nd floor), Carretera Canyet s/n. PC: 08916, Badalona, Spain; chernando@gmail.com;Phone: +34 93 497 35 54

And

Prof Magnus Unemo, WHO Collaborating Centre for Gonorrhoea and Other Sexually Transmitted Infections, Department of Laboratory Medicine, Clinical Microbiology, Örebro University Hospital, SE-701 85 Örebro, Sweden; magnus.unemo@regionorebrolan.se; Phone: +46 19 602 2038

Word count: Abstract: 299 words; Main text: 2988 words

KEY MESSAGES

- Importation of antimicrobial resistant (AMR) gonococcal strains and particularly those with decreased susceptibility to ceftriaxone, into the EU/EEA from other geographic regions worldwide is of importance.
- Area of geographic origin and sexual orientation of patients are both important risk factors for AMR in gonococcal strains.
- Robust surveillance of *Neisseria gonorrhoeae* antimicrobial susceptibility globally is essential to identify emerging AMR, monitor AMR trends and inform treatment guidelines.
- Implementation of more effective disease-control measures, including these related to foreign born populations that originate from countries with increased AMR, is needed.

ABSTRACT

Objectives International spread has contributed substantially to the high prevalence of antimicrobial resistant (AMR) *Neisseria gonorrhoeae* infections worldwide. We compared the prevalence of AMR gonococcal isolates among native persons to foreign-born (reporting country different from country of birth) persons, and describe the epidemiological and clinical characteristics of foreign-born patients and their associations to AMR.

Methods We analysed isolates and patient data reported to the European Gonococcal Antimicrobial Surveillance Programme (Euro-GASP) 2010-2014 (n=9529).

Results Forty-three percent of isolates had known country of birth and 17.2% of these were from persons born abroad. Almost 50% of foreign-born were from the WHO European Region (13.1% from non-EU/EEA countries). Compared to isolates from natives, isolates from foreign-born had a similar level ($p>0.05$) of azithromycin resistance (7.5% vs. 7.2%), ciprofloxacin resistance (50.0% vs. 46.3%), and of decreased susceptibility to ceftriaxone (1.9% vs. 2.8%); a lower rate of cefixime resistance (5.7% vs. 3.6%, $p=0.02$), and a higher proportion of isolates producing penicillinase (8.4% vs. 11.7%, $p=0.02$). Among isolates from persons born outside EU/EEA, the level of decreased susceptibility to ceftriaxone was higher (1.8% vs. 3.5%, $p=0.02$), particularly in those from the WHO Eastern Mediterranean Region and non-EU/EEA WHO European countries (1.9% vs. 9.6% and 8.7% respectively, $p<0.01$). In multivariable analysis, foreign-born patients with AMR isolates were more likely to be from non-EU/EEA WHO European countries (aOR: 3.2, 95%CI 1.8-5.8), WHO Eastern Mediterranean countries (aOR: 1.8, 95%CI 1.1-3.3); and heterosexual males (aOR: 1.8, 95%CI 1.2-2.7).

Conclusions Importation of AMR strains remains an important threat in the EU/EEA. Research to improve understanding of sexual networks within foreign born and sexual tourism populations could help to inform effective tailor-made interventions. The Euro-GASP demonstrates the public health value of quality assured surveillance of gonococcal AMR and the need for strengthened AMR surveillance, particularly in the non-EU/EEA WHO European Region.

Key words: Gonorrhoea, Treatment, Ceftriaxone, Antimicrobial resistance, Surveillance, Euro-GASP, Europe, Migrants

INTRODUCTION

Neisseria gonorrhoeae (gonococcus) has shown an extraordinary ability to develop antimicrobial resistance (AMR) to any antimicrobial introduced for gonorrhoea treatment. In the World Health Organization (WHO) European Region, a high prevalence of resistance to ciprofloxacin, penicillins and tetracycline have been observed for many years. In the last decade, *in vitro* and clinical resistance, resulting in treatment failures, to the extended-spectrum cephalosporins (ESCs) cefixime and ceftriaxone, as well as azithromycin have also emerged.[1-8]

To mitigate the emergence and/or dissemination of AMR gonococcal strains, ceftriaxone (500 mg single dose intramuscularly) plus azithromycin (2 g single oral dose) is currently recommended for empirical first-line dual therapy of uncomplicated gonorrhoea in Europe. Similar dual therapy regimens are recommended inmany other regions internationally.[1,8,9] The emergence of ceftriaxone resistance and relatively high rates of azithromycin resistance reported in Europe and globally[1-3,5-10] threaten the effectiveness of these regimens, which are currently the last evidence-based options for first-line empirical treatment. The first global failure to treat gonorrhoea with dual antimicrobial therapy was reported in 2016.[11] In early 2018, the first gonococcal strain with ceftriaxone resistance combined with high-level resistance to azithromycin was reported from England[12] followed by two similar cases in Australia.[13] Due to the development of difficult-to-treat or possibly untreatable gonorrhoea, AMR *N. gonorrhoeae* has been designated as a priority global health issue by WHO.[9]

Robust gonococcal AMR surveillance is essential to monitor the emergence and spread of AMR gonococcal strains,[2,3,6-8] which has been strongly emphasised by the Global Action Plan [14] and the European Response Plan,[3] developed by the WHO and the

European Centre for Disease Prevention and Control (ECDC), respectively. Since 2009, ECDC has coordinated the European Gonococcal Antimicrobial Surveillance Programme (Euro-GASP), which is a sentinel surveillance system that monitors antimicrobial susceptibility of gonococcal isolates across Member States of the European Union (EU) and the European Economic Area (EEA). Linking the laboratory data to epidemiological data of the corresponding patients, Euro-GASP allows surveillance to be focused in subpopulations and analysis of patient risk groups.[3,6]

In Europe, international migration has been significant during recent decades.[15,16] Particular groups of migrants, especially those of lower socioeconomic status, refugees and sex workers, can be more at risk and suffer disproportionally from STIs,[17] including gonorrhoea.[18,19] Migrants and other mobile populations can play a significant role in the international transmission of AMR including AMR gonococcal strains, and are considered key populations for gonorrhoea control by WHO.[2,3,14,20] Historically, most gonococcal AMR is considered to have initially developed in the WHO Western Pacific Region (WPR), particularly in Japan, and subsequently spread globally.[2,8] The reasons for the initial emergence of gonococcal AMR in WPR are multifaceted and include the high rates of gonorrhoea, the lack of effective disease-control measures, the extensive use and misuse of antimicrobials, and the lack of optimal monitoring of AMR and treatment failures.[2,8,9,14]

The objectives of this study were to investigate the prevalence of AMR gonococcal isolates among foreign-born cases of gonorrhoea reported through Euro-GASP from 2010 to 2014, compare isolates from such cases to gonococcal isolates from native born cases, and describe the epidemiological and clinical characteristics of foreign-born patients with AMR gonococcal isolates (resistance to at least one antimicrobial); with the purpose of improving

the understanding of the distribution of AMR gonococcal strains among patient populations in the EU/EEA and inform targeted interventions.

MATERIAL AND METHODS

Data source

We analysed Euro-GASP isolates and corresponding patient data from 2010 to 2014. Euro-GASP has been described in detail elsewhere.[3,6,21] Briefly, participating sites in each Euro-GASP country collected around 100 gonococcal isolates (200 isolates in the United Kingdom, Spain and the Netherlands, which report higher numbers of gonorrhoea cases) from consecutive gonorrhoea patients (one isolate per patient and infection episode). The collection periods were April-May and October-November during 2010-2013, and September-November in 2014. We defined persons as foreign-born when the reporting country differed from the country of birth[20] and native as those with reporting country identical to country of birth.[22] Geographic region of origin was assigned based on WHO definitions.[7]

Antimicrobial susceptibility testing

AMR testing was conducted using Etest for ceftriaxone and cefixime, agar dilution breakpoint method or Etest for azithromycin and ciprofloxacin, and nitrocefin test for detection of penicillinase production.[3,6,21]The minimum inhibitory concentrations (MICs; mg/L) of each antimicrobial were interpreted into resistance, intermediate susceptibility or susceptibility using breakpoints stated by the European Committee on Antimicrobial Susceptibility Testing (EUCAST).[23] Isolates with a ceftriaxone MIC of 0.125 mg/L were

considered to have a decreased susceptibility.Only whole MIC doubling dilutions were analysed.

Epidemiological and clinical variables and statistical analysis

Epidemiological and clinical data analysed included: year of diagnosis, age (<25, 25-44, ≥45 years), area of origin (European Region, EUR [28 EU countries, three EEA countries and 23 non-EU/EEA countries]; Eastern Mediterranean Region, EMR; Region of the Americas, AMRO; African Region, AFR; South-East Asia Region, SEAR; and WPR), sexual orientation (heterosexual females, heterosexual males and men who have sex with men [MSM]), site of infection (ano-rectal, urogenital and pharyngeal), HIV status (positive, negative), previously diagnosed with gonorrhoea (yes, no), and probable country of infection (reporting country, others). AMR isolates from foreign-born patients were compared to those from native patients; and AMR isolates from patients born in EU/EEA were compared to AMR isolates from patients born outside EU/EEA. In our analysis, we excluded countries that had not reported consistently throughout the study period (Estonia, Iceland, Poland and Romania). Statistical significance was determined by Pearson χ^2-test or by Fisher's exact test if cell numbers were less than 5, with two-sided p-values of <0.05 considered as significant. Data from 2010 to 2014 were combined. Among foreign-born patients, the association of gonococcal infection resistant to at least one antimicrobial with epidemiological and clinical characteristics were investigated using univariate and multivariable logistic regression analyses. Results were expressed with crude (cORs) and adjusted odds ratios (aORs) and their 95% confidence interval (CI). Those variables that were associated with the outcome in univariate models at p<0.10 were included in the multivariable model. Using a backward

stepwise approach, those that remained significant ($p<0.05$) were retained in the final model. Statistical analysis was performed in SPSS v.20.

Ethical considerations

All examined gonococcal isolates were cultured and stored as part of routine diagnostics (standard care). Patient data were reported as part of a surveillance program (EU Decisions 2119/98/EC and 1082/2013/EU) with no patient-identifiable information. Accordingly, separate ethical approval for the study was not required.

RESULTS

Study population

Out of the 9529 isolates, the patient's country of birth was known for 4098 (43%) isolates and was reported by 14 (60.8%) of the Euro-GASP countries (Supplementary table 1). Of these isolates (n=4098), 704 (17.2%) were from foreign-born patients. The Netherlands (34.9%), Ireland (13.1%) and the United Kingdom (12.9%) reported 60.9% of the isolates from foreign-born patients (Supplementary Table 1). Among the foreign-born patients, 345 (49%) were from another country in WHO EUR (253 [35.9%] from EU/EEA and 92 [13.1%] from non-EU/EEA countries), 174 (24.7%) from WHO AMRO, 83 (11.8%) from WHO EMR, 55 (7.8%) from WHO AFR, 25 (3.6%) from WHO WPR, and 22 (3.1%) from WHO SEAR. The proportion of isolates reported from foreign-born persons did not vary significantly during the study period (ranging from 13.1% to 18.5%; $p=0.19$).

Antimicrobial resistance and decreased susceptibility to ceftriaxone from persons born outside the reporting country

The proportion of isolates with AMR to at least one antimicrobial was similar for foreign-born persons compared to isolates from native persons (natives: 53.5%; foreign born: 52.0%, p=0.45). Compared to isolates from native persons, isolates from foreign-born had lower level of cefixime resistance (5.7% vs. 3.6%, p=0.02), and similar rates of azithromycin resistance (7.5% vs. 7.2%, p=0.8), ciprofloxacin resistance (50.0% vs. 46.3%, p=0.07) and decreased susceptibility to ceftriaxone (1.9 vs. 2.8, p=0.10). Only the proportion of isolates producing penicillinase was higher among foreign-born persons (8.4% vs. 11.7%, p=0.02). All isolates from foreign-born persons were also susceptible to ceftriaxone; however, four (0.1%) isolates from natives (two MSM and two heterosexual males) were resistant to ceftriaxone(Table 1).

The proportion of isolates with AMR to at least one antimicrobial was significantly higher among those born in non-EU/EEA WHO EUR countries and in WHO EMR countries than in native patients (53.5% vs. 78.3% and 68.7% respectively, p<0.01). Those born in non-EU/EEA WHO EUR countries had the highest rates of resistance to ciprofloxacin (71.7%), azithromycin (11.2%) and cefixime (9.1%), and the second highest rate of decreased susceptibility to ceftriaxone (8.7%). Isolates from patients born in WHO EMR had the highest level of decreased susceptibility to ceftriaxone (9.6%), and additionally the second highest rate of resistance to ciprofloxacin (66.3%) and cefixime (8.9%). The rates of decreased susceptibility to ceftriaxone in those coming from WHO EMR countries and non-EU/EEA WHO EUR were significantly higher than in native patients (1.9% vs. 9.6% and 8.7% respectively, p<0.01) (Table 1). Data including isolates with unknown country of birth is summarised in Supplementary table 2.

Table 1 Antimicrobial resistance and decreased susceptibility to ceftriaxone by region of birth, Euro-GASP isolates 2010-2014

	COUNTRY OF BIRTH OF FOREIGN BORN[a]								NATIVES, No. (%)	p-value[b]
	WHO EUR		WHO EMR, No. (%)	WHO AMRO, No. (%)	WHO AFR, No. (%)	WHO SEAR, No. (%)	WHO WPR, No. (%)	TOTAL foreign born, No. (%)		
	EU/EEA, No. (%)	Non EU/EEA, No. (%)								
CIPROFLOXACIN RESISTANT (n=4088)[c]	103 (40.7)	66 (71.7)	55 (66.3)	54 (31.0)	20 (36.4)	14 (63.6)	14 (56.0)	326 (46.3)	1693 (50.0)	0.07
AZITHROMYCIN RESISTANT (n=4048)	17 (6.7)	10 (11.2)	6 (7.6)	15 (8.6)	0 (0.0)	1 (4.8)	1 (4.0)	50 (7.2)	251 (7.5)	0.8
CEFIXIME RESISTANT (n=4050)	6 (2.4)	8 (9.1)	7 (8.9)	2 (1.1)	1 (1.8)	1 (4.5)	0 (0.0)	25 (3.6)	192 (5.7)	0.02
CEFTRIAXONE RESISTANT (n=4098)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	4 (0.1)	1.0
DECREASED SUSCEPTIBILITY TO CEFTRIAXONE (n=4098)	4 (1.6)	8 (8.7)	8 (9.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	20 (2.8)	63 (1.9)	0.10
PENICILLINASE PRODUCTION (n=3352)	21 (11.6)	9 (11.4)	11 (16.7)	7 (7.4)	4 (10.3)	1 (7.1)	4 (28.6)	57 (11.7)	240 (8.4)	0.02
RESISTANT ISOLATES (n=4098)	118 (46.6)	72 (78.3)	57 (68.7)	68 (39.1)	22 (40.0)	14 (63.6)	15 (60.0)	366 (52.0)	1817 (53.5)	0.45

[a]Divided into WHO regions: EUR, European Region [28 European Union (EU) countries, three European Economic Area (EEA) countries and 23 non-EU/EEA countries]; EMR, Eastern Mediterranean Region; AMRO, Region of the Americas; AFR, African Region; SEAR, South-East Asia Region; and WPR, Western Pacific Region.

[b]p-value(Pearson χ^2-test or by Fisher's exact test if cell numbers were less than 5) between total number of isolates from foreign-born and native patients.

[c]Number of isolates with known country of birth tested for each antimicrobial

Antimicrobial resistance in isolates from persons born outside the EU/EEA

Isolates from patients born outside the EU/EEA when compared to patients born in the EU/EEA had similar levels of resistance to ciprofloxacin (n=1796, 49.4% vs. n=223, 49.4%; p=1.0), azithromycin (n=268, 7.4% vs. n=33, 7.5%; p=1.0), cefixime (n=198, 5.5% vs. n=19, 4.3%; p=0.3), and penicillinase production (n=261, 8.6% vs. n=36, 11.8%; p=0.07). All four ceftriaxone resistant isolates were from patients born in the EU/EEA, however, proportion of decreased susceptibility to ceftriaxone was higher among isolates from patients born outside the EU/EEA (n=67, 1.8% vs. n=16, 3.5%; p=0.02).

Epidemiological and clinical characteristics of antimicrobial resistant isolates from foreign-born patients compared to isolates from native patients

Foreign-born patients with AMR isolates had a mean age of 31.1 years (SD 9.1) and natives of 33.0 years (11.3). Compared to isolates from native persons, foreign-born persons were younger (82.9% vs. 89.6% were <45 years, p<0.01), had higher proportions of ano-rectal (11.0% vs. 18.4%, p<0.01) and lower frequency of urogenital (83.9% vs. 74.7%, p<0.01) infections, as well as higher proportion of infections acquired abroad compared to the reporting country (5.7% vs. 11.0%, p<0.01) (Table 2). Data including isolates with unknown country of birth is summarised in Supplementary Table 3.

257 **Table 2** Epidemiological and clinical characteristics of patients with antimicrobial resistant isolates by country of birth (n=2183), Euro-GAST

258 2010-2014

EPIDEMIOLOGICAL AND CLINICAL CHARACTERISTICS		COUNTRY OF BIRTH		p-value	p-value[a]
		Native No. (%)	Foreign born No. (%)		
YEAR OF DIAGNOSIS	2010	225 (12.4)	31 (8.5)	0.02	0.04
(n=2183)	2011	383 (21.1)	66 (18.0)		0.20
	2012	393 (21.6)	99 (27.0)		0.02
	2013	443 (24.4)	84 (23.0)		0.59
	2014	373 (20.5)	86 (23.5)		0.20
AGE (years)	<25	459 (25.5)	96 (26.3)	<0.01	0.79
(n=2165)	25-44	1033 (57.4)	231 (63.3)		0.04
	≥45	308 (17.1)	38 (10.4)		<0.01
SEXUAL ORIENTATION	Heterosexual females	169 (12.1)	29 (8.5)	0.14	-
(n=1737)	Heterosexual males	637 (45.7)	158 (46.2)		-
	Men who have sex with men	589 (42.2)	155 (45.3)		-
ISOLATION SITE	Ano-rectal	195 (11.0)	66 (18.4)	<0.01	<0.01
(n=2127)	Urogenital	1484 (83.9)	268 (74.7)		<0.01
	Pharyngeal	89 (5.0)	25 (7.0)		0.15
HIV STATUS	Positive	144 (12.7)	42 (15.8)	0.19	-
(n=1396)	Negative	987 (87.3)	223 (84.2)		-

PREVIOUS GONORRHOEA (n=1478)	Yes	181 (14.7)	31 (12.8)	0.48	-
	No	1054 (85.3)	212 (87.2)		-
PROBABLE COUNTRY OF INFECTION (n=1328)	Reporting country	1081 (94.3)	162 (89.0)	<0.01	-
	Other country	65 (5.7)	20 (11.0)		-

p-value[a]Calculated only for those variables with more than two categories and p-value<0.05

Risk factors for antimicrobial resistant isolates among foreign-born patients

Among foreign-born persons, those with *N. gonorrhoeae* isolates resistant to at least one antimicrobial were found to be more likely from non-EU/EEA WHO EUR countries (crude odds ratio [cOR]: 4.1, 95%CI 2.3-7.1) and from WHO EMR (cOR: 2.5, 95%CI 1.4-4.2), heterosexual males (cOR: 2.3, 95%CI 1.6-3.2), HIV negative (cOR: 1.7, 95%CI 1.1-2.7), without a previous gonorrhoea episode (cOR: 1.7, 95%CI 1.0-2.9), and with urogenital site of infection (cOR: 1.9, 95%CI 1.3-2.8). In the multivariable analysis, the associations remained significant for being from non-EU/EEA WHO EUR country (adjusted odds ratio [aOR]: 3.2, 95%CI 1.8-5.8), from EMR (aOR: 1.8, 95%CI 1.1-3.3) and heterosexual male (aOR: 1.8, 95%CI 1.2-2.7) (Table 3). There was no association with age and year of diagnosis.

271 **Table 3** Univariate and multivariate analysis of foreign-born patients with antimicrobial resistant isolates (n=366), Euro-GASP 2010-2014

EPIDEMIOLOGICAL AND CLINICAL CHARACTERISTICS		RESISTANT ISOLATES FROM FOREIGN-BORN PATIENTS				
		No. (%)	Crude OR		Adjusted OR	
			(95% CI)	p-value	(95% CI)	p-value
YEAR OF DIAGNOSIS (n=704)				0. 21	-	-
	2010	31/50 (62.0)	1			
	2011	66/143 (46.2)	0.5 (0.2-1.0)	0.05		
	2012	99/183 (54.1)	0.7 (0.3-1.3)	0.32		
	2013	84/173 (48.6)	0.5 (0.3-1.1)	0.09		
	2014	86/155 (55.5)	0.7 (0.3-1.4)	0.41		
AGE (years) (n=701)				0.25	-	-
	<25	96/177 (54.2)	0.7 (0.4-1.4)	0.40		
	25-44	231/461 (50.1)	0.6 (0.3-1.1)	0.13		
	≥45	38/63 (60.3)	1			
AREA OF ORIGIN (n=704)				<0.01		<0.01
	EU/EEA	118/253 (46.6)	1		1	
	Non-EU/EEA WHO EUR	72/92 (78.3)	4.1 (2.3-7.1)	<0.01	3.2 (1.8-5.8)	<0.01
	WHO EMR	57/83 (68.7)	2.5 (1.4-4.2)	<0.01	1.8 (1.1-3.3)	0.02
	WHO AMRO	68/174 (39.1)	0.7 (0.4-1.0)	0.12	0.7 (0.5-1.1)	0.21
	WHO AFR	22/55 (40.0)	0.7 (0.4-1.3)	0.37	0.6 (0.3-1.2)	0.17
	WHO SEAR		2.0 (0.8-4.9)	0.13	1.9 (0.7-5.0)	0.13

	WHO WPR	14/22 (63.6) 15/25 (60.0)	1.7 (0.7-3.9)	0.20	1.6 (0.7-3.9)	0.23
SEXUAL ORIENTATION (n=677)	Heterosexual females Heterosexual males Men who have sex with men	29/67 (43.3) 158/248 (63.7) 155/362 (42.8)	1.0 (0.6-1.7) 2.3 (1.6-3.2) 1	<0.01 0.94 <0.01	1.0 (0.6-1.8) 1.8 (1.2-2.7) 1	<0.01 0.81 <0.01
ISOLATION SITE (n=694)	Ano-rectal Urogenital Pharyngeal	66/164 (40.2) 268/469 (57.1) 25/61 (41.0)	1 1.9 (1.3-2.8) 1.0 (0.5-1.8)	<0.01 <0.01 0.92	-	-
HIV STATUS (n=555)	Positive Negative	42/115 (36.5) 223/440 (50.7)	1 1.7 (1.1-2.7)	<0.01	-	-
PREVIOUS GONORRHOEA (n=425)	Yes No	31/68 (45.6) 212/357 (59.4)	1 1.7 (1.0-2.9)	0.03	-	-
PROBABLE COUNTRY OF INFECTION (n=319)	Reporting country Other country	162/286 (56.6) 20/33 (60.6)	1 1.1 (0.5-2.4)	0.66	-	-

OR, odds ratio; EU, European Union; EEA, European Economic Area; WHO EMR, WHO Eastern Mediterranean Region; WHO AMRO, WHO Region of the Americas; WHO AFR, WHO African Region; WHO SEAR, WHO South-East Asia Region; and WHO WPR, WHO Western Pacific Region.

DISCUSSION

In our study, the proportion of overall AMR isolates among native and foreign-born patients (53.5%, n=1817, vs. 52.0%, n=366; p=0.45) was similar. However, gonococcal AMR levels for cefixime (more common among native patients) and penicillinase production (more common among foreign-born patients) differed significantly depending on the region of birth of patients. Over the last decade, international transmission of AMR gonococcal strains has been recorded in detail, for example the multi-drug resistant NG-MAST genogroup 1407 clone associated with cefixime and ciprofloxacin resistance, increased MICs of ceftriaxone and azithromycin, and causing the majority of verified cephalosporin treatment failures.[2,8,24] Furthermore, resistance or decreased susceptibility to ceftriaxone and/or resistance to azithromycin has been described in many regions globally.[7] Recently, the first three cases of ceftriaxone resistance combined with high-level resistance to azithromycin[12,13] have been identified, two of them in men who had travelled to southeast Asia and had sexual intercourse with locally resident women. During recent years, in the EU/EEA, the level of cefixime resistance has decreased and appeared to stabilise at around 2%, ceftriaxone resistance has been exceedingly rare, and azithromycin resistance has been stably relatively high (approximately 7-8%).[6]

The role of importation of AMR strains in the transmission and prevalence of AMR in a country or region is difficult to elucidate and is largely unexplored. Global population mobility and international travel including sex tourism are providing additional challenges in the prevention and control of *N. gonorrhoeae* AMR internationally.[25] Recent data from Euro-GASP also showed that the majority (94%) of AMR gonococcal isolates are most likely acquired in the reporting country.[21] In the present study, the higher rate of decreased

susceptibility to ceftriaxone in isolates from persons born outside the EU/EEA (1.8% vs. 3.5%, p=0.02) and particularly in those from WHO EMR countries and non-EU/EEA WHO EUR (1.9% vs. 9.6% and 8.7% respectively, p<0.01), and the higher proportion of foreign-born patients likely infected abroad vs. in the reporting country (5.7% vs. 11.0%, p<0.01) indicate that importation of AMR gonococcal strains, and especially with decreased susceptibility to ceftriaxone, to the EU/EEA by foreign-born persons remains a threat. Despite this, native cases, although more likely to acquire gonorrhoea in the reporting country, are larger in number and therefore may represent a greater risk for importation of gonorrhoea. Further detailed molecular investigations of the international transmission of gonococcal strains with decreased susceptibility or resistance to ESCs and azithromycin are essential.[24]

Although absolute numbers were small, isolates from foreign-born persons from non-EU/EEA WHO EUR countries had the highest rates of resistance to ciprofloxacin (71.7%), azithromycin (11.2%) and cefixime (9.1%), and together with those from WHO EMR, of decreased susceptibility to ceftriaxone (8.7% and 9.6% respectively). The major challenge in the non-EU/EEA part of the WHO EUR Region (former Soviet Union countries in Eastern Europe and Central Asia) is the very limited quality assured surveillance of gonococcal AMR.[4,5,7,26,27] In this region, the burden of gonorrhoea is estimated to be relatively high, and, together with suboptimal laboratory diagnostics, lack of gonococcal culture, scarce surveillance of both gonorrhoea cases and gonococcal AMR, and misuse of antimicrobials of uncertain quality and origin without prescription from a physician predispose for emergence and rapid spread of gonococcal AMR.[7,26-28] Despite that quality assured data are available from Russia and Belarus,[4,5] a quality assured GASP in

the Eastern and Central Asian part of WHO EUR is still needed. As previously stressed,[7] such a GASP is crucial to also develop in the WHO EMR.

In the multivariable analysis, among foreign-born persons, those from non-EU/EEA WHO EUR (aOR: 3.2, CI 1.8-5.8), from WHO EMR (aOR: 1.8, CI 1.1-3.3) and heterosexual males (aOR: 1.8, CI 1.2-2.7) were associated with AMR gonococcal isolates. Most likely, area of origin, country of infection, sexual orientation, and additional epidemiological characteristics can play a major role in the spread of AMR gonococcal strains in many countries. These results are in line with recent data from Euro-GASP, where geometric means were higher for both cefixime and ceftriaxone MICs for heterosexual males compared to MSM ($p<0.001$) and females (cefixime: $p=0.014$, ceftriaxone: $p=0.025$).[29] In England and Wales, a higher rate of decreased susceptibility to ceftriaxone has been reported within MSM compared to heterosexual males.[30] Among heterosexual males, those with older age (especially ≥35 years), rapid partner turnover and sex abroad also had a higher proportion of decreased susceptibility to ceftriaxone.[30] The emergence and spread of gonococcal AMR is such a dynamic phenomenon that transmission of AMR gonococcal strains may spread from heterosexual to MSM networks or vice-versa very quickly. Further studies on the molecular epidemiology of AMR gonococcal strains[24] can contribute to a better understanding of epidemiology and population dynamics in the national and international spread of AMR gonococcal strains.

The present study includes other limitations such as the absence of participation of some countries along with differences in representativeness that limit the generalisability of the findings. In addition, the limited number of isolates resistant to ceftriaxone, cefixime and azithromycin did not allow for analysis by antimicrobial. When considering the AMR all together, the high levels of resistance to ciprofloxacin account for most of the AMR

described. Missing patient data, particularly for country of birth (57%), and the different proportions of reported patient characteristics between different countries may bias the results. The results might also not be representative of all foreign-born cases of gonorrhoea as some categories of foreign-born persons such as refugees, undocumented migrants, trafficked people, migrant MSM, and subgroups of migrant women can face particular challenges in accessing health care services. Male heterosexuals are overrepresented in Euro-GASP, likely because the majority of males with urogenital gonorrhoea are symptomatic and attend for testing, the high sensitivity of culture for these males, but also possibly due to undeclared or misclassified MSM. In some Euro-GASP countries, underreporting of patient data is also due to ethical or juridical restrictions around linking patient and isolate data. The underrepresentation of patients younger than 25 years in Euro-GASP may be due to *Chlamydia trachomatis* screening programs targeting this group and their use of dual *C. trachomatis* and *N. gonorrhoeae* molecular tests instead of culture for diagnosis.

Increasing the number of participating countries and examined isolates, facilitating and promoting culture of *N. gonorrhoeae*, achieving more complete reporting of epidemiological data, particularly data on country of birth, country of infection and sexual orientation, and increasing the representativeness are high priorities for Euro-GASP.[6]

CONCLUSIONS

Importation of AMR gonococcal strains into the EU/EEA from other geographic regions worldwide poses a threat for emergence and subsequent rapid spread of gonococcal AMR in Europe. Effective disease-control measures targeted toward foreign-born originating from countries with higher levels of gonococcal AMR and those returning to their country of birth

to visit friends and relatives could be valuable. These results from Euro-GASP demonstrate the public health value of quality assured surveillance of gonococcal AMR, which is required throughout the WHO European Region. Improving the completeness of demographic and risk factor data in Euro-GASP would provide strengthened information for public health action, as would strengthening the WHO Global GASP,[7] particularly in those regions with the highest rates of AMR. Further research to improve the understanding of sexual networks within foreign-born and sexual tourism populations will help to inform effective tailor-made interventions.

Acknowledgements

We are grateful to the European STI surveillance network for its contribution to the development and implementation of Euro-GASP and the submission of gonococcal isolates and linked epidemiological data. We would also like to acknowledge Kathy Attawell for her review of the manuscript.

Contributors CH, GS and TN designed, initiated and coordinated the study. Euro-GASP network members coordinated and performed the laboratory analyses. Patient data was supplied by the Euro-GASP network members. CH, GS, AM, VG, MC, and MU analysed and interpreted all the data, and wrote a first draft of the paper. MS and JC critically read and commented on the manuscript. All authors read, commented and approved the final manuscript.

Funding None.

Competing interests None.

REFERENCES

1. Bignell C, Unemo M. 2012 European guideline on the diagnosis and treatment of gonorrhoea in adults. *Int J STD AIDS* 2013;24:85-92.
2. Unemo M, Shafer WM. Antimicrobial resistance in *Neisseria gonorrhoeae* in the 21st century: Past, evolution, and future. *Clin Microbiol Rev* 2014;27:587-613.
3. European Centre for Disease Prevention and Control (ECDC). Response plan to control and manage the threat of multidrug-resistant gonorrhoea in Europe. Stockholm; 2012. Available from: *https://ecdc.europa.eu/sites/portal/files/media/en/publications/Publications/1206-ECDC-MDR-gonorrhoea-response-plan.pdf*. (accessed 7November 2018).
4. Lebedzeu F, Golparian D, Titov L, *et al*. Antimicrobial susceptibility/resistance and NG-MAST characterisation of *Neisseria gonorrhoeae* in Belarus, Eastern Europe, 2010-2013. *BMC Infect Dis* 2015;15:29.
5. Kubanova A, Kubanov A, Frigo N, *et al*. Russian gonococcal antimicrobial susceptibility programme (RU-GASP)--resistance in *Neisseria gonorrhoeae* during 2009-2012 and NG-MAST genotypes in 2011 and 2012. *BMC Infect Dis* 2014;14:342.

6. Cole MJ, Spiteri G, Jacobsson S, *et al*. Overall low extended-spectrum cephalosporin resistance but high azithromycin resistance in *Neisseria gonorrhoeae* in 24 European countries, 2015. *BMC Infect Dis* 2017;17:617.
7. Wi T, Lahra MM, Ndowa F, *et al*. Antimicrobial resistance in *Neisseria gonorrhoeae*: Global surveillance and a call for international collaborative action. *PLoS Med* 2017;14:e1002344.
8. Unemo M. Current and future antimicrobial treatment of gonorrhoea - the rapidly evolving *Neisseria gonorrhoeae* continues to challenge. *BMC Infect Dis* 2015;15:364.
9. World Health Organization (WHO). WHO guidelines for the treatment of *Neisseria gonorrhoeae*. Geneva; 2016. Available from: *http://www.who.int/reproductivehealth/publications/rtis/gonorrhoea-treatment-guidelines/en/*. (accessed 7November 2018)
10. Lahra MM, Martin I, Demczuk W, *et al*. Cooperative recognition of internationally disseminated ceftriaxone-resistant *Neisseria gonorrhoeae*strain. *Emerg Infect Dis* 2018;24.
11. Fifer H, Natarajan U, Jones L, *et al*. Failure of dual antimicrobial therapy in treatment of gonorrhea. *N Engl J Med* 2016;374:2504-6.
12. Eyre DW, Sanderson ND, Lord E, *et al.* Gonorrhoea treatment failure caused by a *Neisseria gonorrhoeae* strain with combined ceftriaxone and high-level azithromycin resistance, England, February 2018. *Euro Surveill* 2018;23(27).
13. Whiley DM, Jennison A, Pearson J, Lahra MM. Genetic characterization of *Neisseria gonorrhoeae* resistant to both ceftriaxone and azithromycin. *Lancet Infect Dis* 2018;18:717-8.

14. World Health Organization (WHO). Global action plan to control the spread and impact of antimicrobial resistance in *Neisseria gonorrhoeae*. Geneva; 2012. Available from: *http://apps.who.int/iris/bitstream/handle/10665/44863/9789241503501_eng.pdf;jsessionid=C82AB4530D6132FDDFC15B886BE1EB79?sequence=1*. (accessed 7November 2018).
15. Simon J, Kiss N, Łaszewska A, *et al*. Public health aspects of migrant health: a review of the evidence on health status for labour migrants in the European Region. Copenhagen: WHO Regional Office for Europe; 2015. Available from: *http://www.euro.who.int/__data/assets/pdf_file/0003/289245/WHO-HEN-Report-A5-1-Labour-rev1.pdf?ua=1*. (accessed 7 November2018).
16. EUROSTAT. Your key to European statistics. [Internet].Available from: *http://ec.europa.eu/eurostat/web/population-demography-migration-projections/migration-and-citizenship-data*. (accessed 7 November2018).
17. Suk JE, Semenza JC. Future infectious disease threats to Europe. *Am J Public Health* 2011;101:2068-79.
18. Smith E. [Sexually transmitted infections among immigrants in Denmark. Is it a problem?]. *UgeskrLaeger* 2000;162:6237-40. In Danish.
19. Kyriakis KP, Hadjivassiliou M, Paparizos VA, *et al*. Incidence determinants of gonorrhea, chlamydial genital infection, syphilis and chancroid in attendees at a sexually transmitted disease clinic in Athens, Greece. *Int J Dermatol*2003;42:876-81.
20. European Centre for Disease Prevention and Control (ECDC). Assessing the burden of key infectious diseases affecting migrant populations in the EU/EEA. Stockholm; 2014. Available from:

https://ecdc.europa.eu/sites/portal/files/media/en/publications/Publications/assessing-burden-disease-migrant-populations-summary.pdf. (accessed 7 November2018).

21. European Centre for Disease Prevention and Control (ECDC). Gonococcal antimicrobial susceptibility surveillance in Europe, 2014. Stockholm. 2016. Available from: https://ecdc.europa.eu/sites/portal/files/media/en/publications/Publications/gonococcal-antimicrobial-susceptibility-surveillance-Europe-2014.pdf. (accessed 7 November 2018).
22. IOM. Glossary on migration. International migration law series. Geneva; 2011. Available from: https://publications.iom.int/books/international-migration-law-ndeg25-glossary-migration. (accessed 7 November2018).
23. The European committee on antimicrobial susceptibility testing. Breakpoint tables for interpretation of MICs and zone diameters. Version 8.0; 2018. Available from: http://www.eucast.org/clinical_breakpoints/. (accessed 7 November2018).
24. Harris SR, Cole MJ, Spiteri G, *et al*. Public health surveillance of multidrug-resistant clones of *Neisseria gonorrhoeae* in Europe: a genomic survey. *Lancet Infect Dis* 2018;18:758-68.
25. MacPherson DW, Gushulak BD, Baine WB, *et al*. Population mobility, globalization, and antimicrobial drug resistance. *Emerg Infect Dis* 2009;15:1727-32.
26. Unemo M, Ison CA, Cole M, *et al*. Gonorrhoea and gonococcal antimicrobial resistance surveillance networks in the WHO European Region, including the independent countries of the former Soviet Union. *Sex Transm Infect* 2013;89:iv42-iv46.

27. Unemo M, Shipitsyna E, Domeika M. Gonorrhoea surveillance, laboratory diagnosis and antimicrobial susceptibility testing of *Neisseria gonorrhoeae* in 11 countries of the eastern part of the WHO European region. *APMIS* 2011;119:643-9.
28. Unemo M, Shipitsyna E, Domeika M. Recommended antimicrobial treatment of uncomplicated gonorrhoea in 2009 in 11 east European countries: implementation of a *Neisseria gonorrhoeae* antimicrobial susceptibility programme in this region is crucial. *Sex Transm Infect* 2010;86:442-4.
29. Cole MJ, Spiteri G, Town K, *et al*. Risk factors for antimicrobial-resistant *Neisseria gonorrhoeae* in Europe. *Sex Transm Dis* 2014;41:72-9.
30. Town K, Obi C, Quaye N, *et al*. Drifting towards ceftriaxone treatment failure in gonorrhoea: risk factor analysis of data from the gonococcal resistance to antimicrobials surveillance programme in England and Wales. *Sex Transm Infect* 2017;93:39-45.