Europass Curriculum Vitae

Personal information

Surname(s) / First name(s)	**Luque Fernández, Miguel Ángel**
Address(es)	7A, Highworth Rd. 8005 Sea Point, Cape Town South Africa
Telephone(s)	[+27 825 980 500]
Email(s)	watzilei@hotmail.com miguel.luquefernandez@uct.ac.za
Nationality(-ies)	Spanish
Date of birth	05-04-1972
Gender	Male

Academic and Research

In the last five years, I have contributed to the perinatal epidemiology, in particular to study the impact of changes in reproductive patterns in terms of maternal and foetal-neonatal morbi-mortality in Spain during the period of 1996-2006. This research was part of my European Ph.D dissertation that has obtained the Summa Cum Laude. This dissertation has produced 6 international papers which have had an important impact with the publication of several press releases in different international Medias. Furthermore, I have worked in two important projects in the area of international health changing the operational activities in the field related to the malnutrition and Cholera outbreak activities of the Non Governmental Organization (NGO) Médecins Sans Frontières. Also, this research has produced an oral communication in the congress of the International Association of Epidemiologists of 2009 in Brazil. I have also collaborated as reviewer of the following journals: PAHO journal (World Health Organization -WHO-: Pan-American Journal of Public Health), Gaceta Sanitaria (The most important journal of Public Health in Spain) and WHO Bulletin. Recently with Plos One and the European Journal of Obstetrics Gynecology and Reproductive Biology. My research has been conducted in the populations of Spain, Europe, and Sub-Saharan Africa.

Dates	2006-2010
Title of qualification awarded	European PhD in Public Health and Epidemiology.
Principal subjects/Occupational skills covered	PhD: Maternal Mortality and Perinatal Outcomes in Spain 1996-2006: A change in the reproductive pattern. Qualified as Suma Cum Laude. Published by the university press and Available at: http://hera.ugr.es/tesisugr/18930621.pdf
Name and type of organization providing education and training	Faculty of Medicine. University of Granada; Av. de Madrid, 18012 Granada, Spain.
Level in national or international classification[1]	European PhD, Summa cum laude qualification *PhD certificate*

[1] An European PhD has to be written in two different European languages: English and Spanish

Actualized January 2012.

Dates	2007-2009
Title of qualification awarded	FETP(Msc) Field Epidemiology Training Program.
Principal subjects/Occupational skills covered	Master in field epidemiology applied to public health surveillance in the National Center of Epidemiology in Spain.
Name and type of organization providing education and training	National Centre of Epidemiology and National School of Health. Institute Carlos III (Medical Research), Madrid, Spain. Avd Sinesio Delgado sn. 28001 Madrid.
Level in national or international classification	Master *Certificate*
Dates	2006-2007
Title of qualification awarded	Msc in Epidemiology and Biostatistics.
Principal subjects/Occupational skills covered	Advanced epidemiology and biostatistics, demography, survey methods, sampling methods, quantitative assessment in Public health: multivariate linear models, categorical data analysis, logistic regression, survival analysis, experimentation.
Name and type of organization providing education and training	University Libre Brussels/School of Public Health (ULB/ESP), Route de Lennik 808, Brussels, Belgium.
Level in national or international classification	Master in Science *Academic records*
Dates	2005-2006
Title of qualification awarded	Master in Public Health and Health Management.
Principal subjects/Occupational skills covered	Principles of Public Health, Research methods, health policies and management, health promotion (1300 hours).
Name and type of organization providing education and training	Andalusia School of Public Health (EASP); Cuesta del observatorio 4, 18080 Granada, Spain.
Level in national or international classification	MPH and Health Management *MPH certificate*
Dates	2004-2005
Title of qualification awarded	Diploma in Medical Statistics.
Principal subjects/Occupational skills covered	Biostatistics: Probability Distribution Theory, Statistical Inference, multivariate linear and categorical regressions model, cluster analysis, and studies desing.
Name and type of organization providing education and training	University UNED, Spain.
Level in national or international classification	University Diploma *Dipl certificate*
Dates	2000-2004
Title of qualification awarded	Master in Anthropology.
Principal subjects/Occupational skills covered	Studies of social networks, diffusion, social behavior, kinship patterns, law, politics, ideology, religion, beliefs, patterns of products consumption, exchange, socialization, gender, and other expressions of culture, with strong emphasis on the importance of field work and participant observation.
Name and type of organization providing education and training	University of Granada; Campus Universitario de Cartuja, 18080 Granada, Spain.
Level in national or international classification	MA *MA certificate*
Dates	2003
Title of qualification awarded	Diploma in Tropical Medicine and International Health.
Principal subjects/Occupational skills covered	Introduction in Public Health applied to the tropical medicine, quantitative and qualitative methods, project planning in international cooperation, prevention and control of STI and TB, reproductive health, tropical diseases and non-infectious diseases in developing countries.
Name and type of organization providing education and training	National Health Institute, Carlos III); C/ Sinesio Delgado 6, 28029 Madrid, Spain.

Level in national or international classification	University Diploma *Dipl certificate*
Dates	1997-1999
Title of qualification awarded	Master in perinatal health, obstetrics and gynecology, Midwife.
Principal subjects/Occupational skills covered	Women Health, Perinatal and Neonatal health, Obstetrics and Gynecology.
Name and type of organization providing education and training	University of Granada; Campus Universitario de Cartuja, 18080 Granada, Spain.
Level in national or international classification	National Health Specialization: Master Degree *Certificate*
Dates	1990-1993
Title of qualification awarded	Bachelor in Health Sciences: Public Health.
Principal subjects/Occupational skills covered	Population Health, Demography, health promotion, determinants of health, public health, statistics, infectious diseases, chronic diseases, behavior sciences, etc.
Name and type of organization providing education and training	University of Granada; Campus Universitario de Cartuja, 18080 Granada, Spain.
Level in national or international classification	Bachelor, Bsc.

Work experience

More than 12 years of work experience in Health related activities such as Midwife, Anthropologist, Relief humanitarian worker, Public Health Researcher and Epidemiologist. During the last five years I have done an important number of consultancies as Epidemiologist in Africa (CRA, DRC, Chad, Zimbabwe), Europe and most recently with WHO in Haiti.

Dates	2011-2012
Occupation or position held	Post-doctoral researcher.
Main activities and responsibilities	Research: Impact Evaluation.
Name and address of employer	University of Cape Town, Center of Infectious Disease Epidemiology and Research (CIDER), Cape Town, South Africa. htt://www.cider.uct.ac.za/staff/staff_fernandez.php
Type of business or sector	University.
Dates	12/2010-01/2011
Occupation or position held	Field Epidemiologist GOARN (WHO/PAHO): Cholera Epidemic in Haiti.
Main activities and responsibilities	Surveillance, monitoring and epidemiological analysis of the Cholera epidemic in Jérémie. Support in the GIS analysis and outbreak dynamic mapping representation to the Ministry of Health.
Name and address of employer	Global Outbreak Alert and Response Network (GOARN-WHO).
Type of business or sector	International organization (UN) World Health Organization.
Dates	09/2009-12/2010
Occupation or position held	Epidemiologist: Observatory of Health and Social inequalities of Brussels.
Main activities and responsibilities	Responsible of analysis and management of the Hospitals morbi-mortality database of Brussels (Hospital discharges data base).
Name and address of employer	Observatoire de la Santé et du Social. Service du Services du Collège réuni de la Commission Communautaire Commune de Bruxelles-Capitale, Observatoire de la Santé et du Social, 183 avenue Louise, 1050 Brussels. http://www.observatbru.be/documents/orphan-pages/contact.xml?lang=fr
Type of business or sector	Governmental: Brussels government.

Dates	09/2007-09/2009
Occupation or position held	Epidemiologist at the National Center of Epidemiology in Spain: Public Health Surveillance and Outbreaks alert department.
Main activities and responsibilities	Outbreaks research and national health risk assessment. Morbi-mortality surveillance activities in maternal and perinatal epidemiology.
	Due to a detachment of my position to the Medical Operations Department of EPICENTRE (MSF research international unit) I have had the opportunity to organize, develop and implement in the field two surveys in Africa: Vaccination coverage survey (all antigens) in Lubutu DRC and a Retrospective Mortality Survey in Chad. In 2009 I have had the opportunity to evaluate the intervention of the Cholera Epidemic in Harare Zimbabwe; as a result an article was published showing the effect of the historical social inequalities of the development of the city of Harare and the pattern of Cholera spread in a urban context in a developing country.
Name and address of employer	National Center of Epidemiology, Madrid, Spain
Type of business or sector	Governmental
Dates	09/2004-07/2006
Occupation or position held	Public Health Research Fellow: Midwife and Anthropologist
Main activities and responsibilities	Midwife and Anthropologist: Development of an online tutorial in Research Methods applied to Epidemiology and Public Health addressed to Health workers in Andalusia, Spain. Qualitative approach to understand cultural differences of immigrant pregnant women in Spain. This project was termed: Understanding health seeking behavior and cultural differences at delivery of immigrants' women in Andalusian, Spain. The principal activities during my participation as researcher were related with the direct support to women at delivery such as Midwife documenting though participant observation cultural differences associated with their ethnic origin. The project took place in different Hospitals with the highest rate of immigrant women at delivery in the South of Spain and the North of Africa -Ceuta-. This project was documented with one publication.
Name and address of employer	Andalusian School of Public Health and Andalusian Health System.
Type of business or sector	Governmental.
Dates	01/2003-09/2004
Occupation or position held	International Relief worker: Medical Anthropologist, Public Health and Obstetrics (Midwife)
Main activities and responsibilities	East DRC project (Pweto) from 06-2003 to 09-2004: Exploring women's health seeking behavior, setting up reproductive health program, direct provision of emergency obstetric care and field research. The principal aim of this project was to improve maternal and neonatal care in a rural and isolate setting in east DRC (Pweto). The activities of this project were document with two publications. CRA project (Bangui) from 01-2003-05-2003 : Emergency projet setting up field hospital during coupe détat 2003 in Bangui. Mobile clinics implementation focussing in women health in the villages neighboring the line of conflict. Measles outbreak investigation and response: vaccination campaign.
Name and address of employer	Médecins Sans Frontières Barecelona.
Type of business or sector	NGO.
Dates	06/1997-12/2002
Occupation or position held	Midwife
Main activities and responsibilities	Monitoring the physical, psychological, and social well-being of the mother throughout the childbearing cycle, providing the mother with individualized education, counseling, and prenatal care, continuous hands-on assistance during labor and delivery, and postpartum clinical support.
Name and address of employer	Different Hospitals in Andalusian, Spain.
Type of business or sector	Governmental
Dates	06/1993-10/1995
Occupation or position held	Lieutenant in the Army

Main activities and responsibilities	Supervisor of the sanitarian workers in a Army Hospital in Madrid. Responsible of the salubrity, public health issues and health of the crew in a coastguard in the Canaries Islands during six months.
Name and address of employer	The Army of Spain.
Type of business or sector	Governmental

Statistics postgraduate courses and diplomas

Dates	Summer 2006
Title of qualification awarded	EPISTAT: Multivariate Epidemiological Modeling.
Principal subjects/Occupational skills covered	Less squares estimation, ANOVA and linear models, Maximum Likelihood Estimation and Logistic Regression Models, Modeling Rates, Survival analysis and Cox Regression Models, Poisson Regression and Repeated Measures Modeling.
Name and type of organization providing education and training	University Libre Brussels/School of Public Health (ULB/ESP), Route de Lennik 808, Brussels, Belgium.

Dates	2007
Title of qualification awarded	SAS Programming I, SAS Statistics I and II
Principal subjects/Occupational skills covered	Reading raw data files and SAS data sets and writing the results to SAS data sets; subsetting data; combining multiple SAS files; creating SAS variables and recoding data values; creating listing and summary reports. Intermediate and advanced Statistics with SAS focussing on linear and generalized linear models (experimentation).
Name and type of organization providing education and training	SAS Institute, Training Department; Av. des Minimes 8, 94300 Vincennes (Paris), France.

Dates	2007
Title of qualification awarded	Survey and Complex Sampling.
Principal subjects/Occupational skills covered	Survey design and complex sampling strategies with SAS.
Name and type of organization providing education and training	National Center of Statistics and economic research (INSEE. Paris, France).

Dates	2007
Title of qualification awarded	Experimental designs and generalized linear models.
Principal subjects/Occupational skills covered	Experimental designs and generalized linear models (GLM)
Name and type of organization providing education and training	National Center of Research and Innovation, Madrid, Spain.

Dates	2007
Title of qualification awarded	Time Series analysis
Principal subjects/Occupational skills covered	Time series with SPSS v.17.
Name and type of organization providing education and training	SPSS-Iberica. Madrid, Spain.

Dates	2010
Title of qualification awarded	Multilevel Modeling.
Principal subjects/Occupational skills covered	Hierarchical and Mixed linear and non-liner models with STATA.
Name and type of organization providing education and training	Department of Statistics, Lancaster University (UK)

Dates	2010
Title of qualification awarded	Advanced Epidemiological and Statistical Methods

Principal subjects/Occupational skills covered	Hierarchical models, missing values, clustered data analysis, measurement error, propensity scores analysis, GEE, instrumental variables and Marginal Structural Models.
Name and type of organization providing education and training	Department of Social Medicine, University of Bristol, UK.
Dates	2011
Title of qualification awarded	Graduate Summer Institute of Biostatistics.
Principal subjects/Occupational skills covered	Genetic in Populations and Statistical methods applied to genetics, Survival Analysis, Conditional logistic Regression, Poisson Regression, Bootstrap, Randomization, Longitudinal Analysis, Social Epidemiology and Multilevel Modeling.
Name and type of organization providing education and training	Johns Hopkins University, Bloomberg School of Public Health, Baltimore, USA.
STATA	2009-2012
Title of qualification awarded	STATA NET Courses 101, 151, 152, 461.
Principal subjects/Occupational skills covered	Introduction to STATA, Introduction to STATA programming, Advanced STATA programming, Introduction to Univariate Time Series with STATA.
2012	Currently, I'm doing the net course 152, Advanced STATA programming.
Name and type of organization providing education and training	STATA cop. LP. Texas, USA.

Language skills

Mother tongue(s)	**Spanish**
Other language(s)	Basic command of German
Exams	*DALF(French) and IELTS*

Self-assessment
European level(*)

	Understanding		Speaking		Writing
	Listening	Reading	Spoken interaction	Spoken production	
Language French	C2 Proficient user	C2 Proficient user	C2 Proficient user	C2 Proficient user	C2 Proficient user
Language English	C1 Proficient user	C1 Proficient user	C1 Proficient user	C1 Proficient user	C1 Proficient user

(*) *Common European Framework of Reference (CEF) level*

Social skills and competences

Social skills	Open minded, social person with good team spirit gained through my work in international contexts, very good ability to adapt to multicultural environment gained through my field experience in Africa and within Europe. Good observer and listener.
Organizational skills	Very organized and able to work to deadlines. Good time manager.
Technical skills	Good analytical skills. Ability to do qualitative and quantitative research analysis.

Computer skills

Text editors	Microsoft office, Openoffice and LaTeX.
Data management	EpiData and Access 2010, basic knowledge of Microsoft SQL server and visual basic.
Qualitative analysis	Nudist Vivo.
Bibliography managers	Endnote, Reference Manager, Jabref.
Statistical packages	SPSS v.18 (Excellent skills), SAS v.9 (Good), STATA v.12 (Excellent skills. Actually, STATA is my preferred option), Epiinfo 2000 Csurvey, Ene, R and other multiple epidemiological softwares, R (Good).

GIS packages | ArcView v.9 (Good skills), Healthmapper, Epimap, and Geoda.

Driving licence(s)

Driving license category A and B

References

First reference | Professor Dionisio Herrera Gibert. Director of the international field epidemiology training programs TEPHINET, CDC Atlanta, USA. Email: dherrera@tephinet.org http://www.tephinet.org

Second reference | Professor Andrew Boulle. Director of the Center of Infectious Disease Epidemiology and Research, University of Cape Town, South Africa. Email:andrew.boulle@uct.ac.za

Third reference | Senior Lecturer Dr. Michael Schomaker. Statistician of the Center of Infectious Disease Epidemiology and Research, University of Cape Town, South Africa. Email:michael.schomaker@uct.ac.za

Additional information

Conferences and congress | Epidemiology and Infectious Diseases *conferences*

Press release | Related with my research *Press release*

Reviewer | During 2008/2012 I have participated as reviewer in different Journals: Pan-American Journal of Public Health (PAHO/WHO), Gaceta Sanitaria (The most important journal of Public Health in Spain), WHO Bulletin, EJOGRB European Journal of Obstetrics and Gynaecology and Reproduction Biology, European Journal of Public Health and PLoS-One.

Membership | Member of the Research Standing Committee of the International Confederation of Midwives. Member of the International Association of Epidemiology (IEA). Associate member of the NGO "Médecins sans Frontières".

Publications

BOOKS

[1] Luque Fernández, M.A. Enquete de Couverture Vaccinale Lubutu, 2009. Editions Universitaires Europeennes, 2011.
http://www.amazon.com/enquete-couverture-vaccinale-lubutu-french/dp/6131579792

[2] Luque Fernández, M.A. Tableau de bord de la santé en Région bruxelloise 2010. Ed: Autonomous Government of the City of Brussels.Commission communautaire commune, Brussels, Belgium, 2010.
http://www.observtbru.be/documents/publicatons-sante/tableaux-de-bord-sante.xlm?lang=fr

ARTICLES

http://publicationslist.org/fmiguelangel

[1] M. A. Luque-Fernandez, N. I. Lone, I. Gutierrez-Garitano, and A.12 Bueno-Cavanillas. Stillbirth risk by maternal socio-economic status and country of origin: a population-based observational study in spain, 2007-08.
European journal of public health, 2011 *Article*

[2] M. A. Luque Fernandez, P. R. Mason, H. Gray, A. Bauernfeind, J. F. Fesselet, and P. Maes.
Descriptive spatial analysis of the cholera epidemic 2008-2009 in harare, zimbabwe: a secondary data analysis.
Trans R Soc Trop Med Hyg, 105(1):38–45, 2011 *Article*

[3] M. A. Luque Fernandez, I. Gutierrez Garitano, and A. B. Cavanillas.
Increased risk of maternal deaths associated with foreign origin in spain: a population based case-control study.
European journal of public health, 21(3):292–4, 2011 *Article*

[4] M. A. Luque Fernandez, A. Galmes Truyols, D. Herrera Guibert, G. Arbona Cerda, and F. Sancho Gaya.
Cohort study of an outbreak of viral gastroenteritis in a nursing home for elderly, majorca, spain, february 2008.
Euro surveillance : bulletin europeen sur les maladies transmissibles = European communicable disease bulletin, 13(51), 2008 *Article*

[5] M. A. Luque Fernandez and A. Bueno Cavanillas.
[fertility in spain, 1996-2006: foreign versus spanish women].
Gaceta sanitaria / S.E.S.P.A.S, 23 Suppl 1:67–71, 2009 *Article*

[6] M. A. Luque Fernandez, A. Bueno Cavanillas, and S. de Mateo.
Excess of maternal mortality in foreign nationalities in spain, 1999-2006.
European journal of obstetrics, gynecology, and reproductive biology, 149(1):52–6, 2010 *Article*

[7] M. A. Luque Fernandez, A. Bauernfeind, P. P. Palma Urrutia, and I. Ruiz Perez.
[frequency of sexually transmitted infections and related factors in pweto, democratic republic of congo, 2004].
Gaceta sanitaria / S.E.S.P.A.S, 22(1):29–34, 2008 *Article*

[8] M. A. Luque Fernandez, A. Bauernfeind, J. D. Jimenez, C. L. Gil, N. El Omeiri, and D. H. Guibert.
Influence of temperature and rainfall on the evolution of cholera epidemics in lusaka, zambia, 2003-2006: analysis of a time series.
Trans R Soc Trop Med Hyg, 103(2):137–43, 2009 *Article*

[9] M. A. Luque Fernandez and A. Bauernfeind.
Reply to comment on: Influence of temperature and rainfall on the evolution of cholera epidemics in lusaka, zambia, 2003-2006: analysis of a time series.
Trans R Soc Trop Med Hyg, 2009 *Article*

[10] M. A. Luque Fernandez.
[trends in the risk of late fetal mortality, prematurity and low birth weight associated with advanced maternal age in spain [1996-2005]].
Gaceta sanitaria / S.E.S.P.A.S, 22(5):396–403, 2008 *Article*

[11] M. A. Luque Fernandez.
[epidemiology: discipline or method].
Gaceta sanitaria / S.E.S.P.A.S, 20(5):412–3, 2006 *Article*

[12] J. Gimenez Duran, A. M. Galmes Truyols, D. Herrera Guibert, L. A. Bonilla Vargas, M. A. Luque Fernandez, C. Bosch Isabel, A. Nicolau Riutort, and J. Cayla Buqueras.
[tuberculosis surveillance in the balearic islands and characteristics of unreported cases from 2005 to 2007].
Gaceta sanitaria / S.E.S.P.A.S, 25(1):84–6, 2011 *Article*

[13] M. A. Fernandez, P. Delchevalerie, and M. Van Herp.
Accuracy of muac in the detection of severe wasting with the new who growth standards.
Pediatrics, 126(1):e195–201, 2010 *Article*

[14] M. A. Fernandez, A. B. Cavanillas, M. Dramaix-Wilmet, F. S. Soria, J. de Mata Donado Campos, and D. H. Guibert.
Increase in maternal mortality associated with change in the reproductive pattern in spain: 1996-2005.
J Epidemiol Community Health, 63(6):433–8, 2009 *Article*

[15] J. G. Duran, M. A. Fernandez, J. R. Urrego, C. L. Gil, L. A. Vargas, C. Savulescu, G. Clerger, L. Martinez-Lamas, A. Pousa, M. Donado Jde, D. Herrera, and M. V. Martinez.
[incidence and risk factors for acute gastroenteritis among pilgrims following the french way to santiago de compostela (spain) in summer 2008].
Gaceta sanitaria / S.E.S.P.A.S, 24(6):487–90, 2010 *Article*

[16] M. A. Fernandez, A. B. Cavanillas, and S. de Mateo.
Differences in the reproductive pattern and low birthweight by maternal country of origin in spain, 1996-2006.
European journal of public health, 21(1):104–8, 2011.
Fernandez, Miguel Angel Luque Cavanillas, Aurora Bueno de Mateo, Salvador England Eur J Public Health. 2011 Feb;21(1):104-8. Epub 2010 Apr 12 *Article*

[17] M. A. Luque Fernandez and Oliver Reche M.I.
Culture differences on perceiving and living delivery: the case of immigrant women. index de enfermería 2005.
Index de Enfermería, pages 48–49, 2005 *Article*

[18] M. A. Luque Fernandez and Bauernfeind A.
An action research about the maternal mortality in pweto, drc 2004.
Index de Enfermeria, 57, 2007 *Article*

[19] M. A. Luque Fernandez.
Depuis la confrontation des paradigmes vers lintegration des savoirs le modèle biomédicale face aux sciences sociaux dans la coopération internationale en santé.
Anthrop and H. J, 1:30–34, 2008 *Article*

CERTIFIED TRANSLATION FROM SPANISH INTO ENGLISH

University of Granada
Postgraduate School

Certification of European Doctorate

LUIS CRUZ PIZARRO, DIRECTOR OF THE POSTGRADUATE SCHOOL

Having received the documentation issued by the Panel responsible for judging the Doctoral Thesis presented by MIGUEL ANGEL LUQUE FERNANDEZ, holder of ID document/Passport: 24271499J

CERTIFIES
That on 6 September 2010 *MIGUEL ANGEL LUQUE FERNANDEZ* was awarded the qualification of **"European Doctorate"** by the University of Granada upon completion of the following requirements:

1. Submission of favourable reports from the experts:

   - SÉBASTIEN FIERENS *(CATHOLIC UNIVERSITY OF LOUVAIN – BELGIUM).*
   - JUDITH RACAPE (*BRUSSELS FREE UNIVERSITY – BELGIUM).*

   The said experts belong to the internationally recognised Institution of Higher Education or Investigation, located outside Spain.
2. A member of the Panel, *ALAIN LEVEQUE,* responsible for judging the Doctoral Thesis, who belongs to the *BRUSSELS FREE UNIVERSITY – BELGIUM.*
3. The Thesis was partly written in French, with the candidate having shown evidence of spending at least 3 months *(SCHOOL OF PUBLIC HEALTH AT THE BRUSSELS FREE UNIVERSITY – BELGIUM)* carrying out training and investigations relating to the content of his Doctoral Thesis.

In witness whereof and for the appropriate purposes, I issue this document in Granada on 9 September 2010.

THE DIRECTOR OF THE SCHOOL
[stamp] [signature]
LUIS CRUZ PIZARRO

Translation certified true to the original written in Spanish.
Chastre, 5th October 2010.

Vu par Nous, Premier President de la Cour d'Appel séant à Bruxelles, pour la légalisation de la signature de Eliane Richel

Bruxelles le 07 -10- 2010

p.o.-i.o.
J.P. BAELDE

COUR D'APPEL BRUXELLES

Eliane RICHEL
Traducteur juré près la Cour d'Appel - Bruxelles
(Certified translator to the Brussels Court of Appeal)

7/10/10

ELIANE RICHEL
TRADUCTEUR JURE
53 RUE G. DELVAUX
1450 CHASTRE

UNIVERSIDAD DE GRANADA

COMISION DE DOCTORADO

Referencia T. X / 6024

Curso de 2009 a 2010

ACTA DE GRADO DE DOCTOR

DOCTORANDO D. MIGUEL ÁNGEL LUQUE FERNÁNDEZ

LICENCIADO EN ANTROPOLOGÍA SOCIAL Y CULTURAL por la Universidad de GRANADA

PROGRAMA DE DOCTORADO MEDICINA PREVENTIVA Y SALUD PÚBLICA

DEPARTAMENTO RESPONSABLE MEDICINA PREVENTIVA Y SALUD PÚBLICA

TITULO DE LA TESIS ANÁLISIS EPIDEMIOLÓGICO DEL PATRÓN REPRODUCTIVO EN ESPAÑA, 1996-2005: EVOLUCIÓN Y TENDENCIA DE LA MORBI-MORTALIDAD MATERNA Y FETO-NEONATAL

DIRECTOR / S AURORA BUENO CAVANILLAS
JUAN DE MATA DONADO CAMPOS

TUTOR MICHELE DRAMAIX-WILMET

TRIBUNAL

PRESIDENTE ANTONIO BUENO ESPINAR

VOCAL ALAIN LEVEQUE
JUAN DE DIOS LUNA DEL CASTILLO
SALVADOR DE MATEO ONTAÑÓN

SECRETARIO PABLO LARDELLI CLARET

UNIVERSIDAD DE GRANADA
ESCUELA DE POSGRADO
La presente fotocopia corresponde al original a que se refiere, quedando COMPULSADA Y CONFORME.
Granada 10 de Septiembre de 2010
El Funcionario,

Reunido el día de la fecha el tribunal nombrado para el Grado de Doctor de D. MIGUEL ÁNGEL LUQUE FERNÁNDEZ éste procede al acto de mantenimiento y defensa de la Tesis Doctoral.

Terminado dicho acto y contestadas las objeciones formuladas por el Tribunal, éste le calificó SOBRESALIENTE CUM LAUDE

Granada, 6 de SEPTIEMBRE de 2010

El Secretario del Tribunal,

De todo lo cual como Secretario del Tribunal doy fé, ante el Iltmo. Sr. Secretario General de la Universidad de Granada.

El Secretario General,

El Secretario del Tribunal,

INVESTIDURA { En el Día de la fecha se ha conferido a D.______ el Grado de Doctor en la Facultad de______ conforme a lo previsto en las disposiciones vigentes.

Granada,

El Secretario General,

CERTIFIED TRANSLATION FROM SPANISH INTO ENGLISH

MINISTRY
OF SCIENCE
AND INNOVATION

Instituto de Salud Carlos III [Carlos III *Institute of Health]*

LA ESCUELA NACIONAL DE SALUD
[THE NATIONAL SCHOOL OF HEALTH]

Considering the fact that, in accordance with the provisions established in the Regulations for Academic Affairs,

Miguel Ángel Luque Fernández,

has successfully undertaken the appropriate course of study comprising the Modules which are listed on the reverse of this Certificate, he is therefore granted the title of

MASTER IN APPLIED FIELD EPIDEMIOLOGY

Developed in this National School of Health (ENS), Instituto de Salud Carlos III (ISCIII), in collaboration with the National Centre for Epidemiology (ISCIII).
Madrid, 2nd October 2009

THE DIRECTOR

[SIGNED AND STAMPED
- *MINISTRY OF SCIENCE AND INNOVATION -*
- *INSTITUTO DE SALUD CARLOS III -*
- *NATIONAL SCHOOL OF HEALTH -*
- *BOARD]*

Ferran Martínez Navarro

Registered in the Book of Courses as listed on reverse

Translation certified true to the original written in Spanish.
Chastre, 5th October 2010.

Eliane RICHEL

Traducteur juré près la

Cour d'Appel - Bruxelles (Certified translator to the Brussels Court of Appeal)

Vu par Nous, Premier President de la Cour d'Appel séant à Bruxelles, pour la légalisation de la signature de ......

Bruxelles le 07 -10- 2010

p.o.-i.o.
J.P. BAELDE

COUR D'APPEL BRUXELLES

7/10/10

ELIANE RICHEL
TRADUCTEUR JURE
53 RUE G. DELVAUX
1450 CHASTRE

Université Libre de Bruxelles
Ecole de Santé Publique

2006-2007

DES EN SANTE PUBLIQUE (METHODES STATISTIQUES ET EPIDEMIOLOGIQUES)

M. LUQUE FERNANDEZ Miguel — *matricule* 062654 — juin 2007

Grande distinction — *Moyenne (/100) :* 86,1 — *Totaux :* 155 *sur* 180 — 32 ECTS

			cote /20		pondération	ects
SPUB009	Méthodes épidémiologiques y compris les séminaires	Alain LEVEQUE		15	(2)	8,0
STAT028	Méthodes d'analyse multivariée en santé publique et en médecine	Michèle WILMET DRAMAIX		18	(1)	4,0
STAT081	Méthodes statistiques appliquées en santé publique I	Michèle WILMET DRAMAIX	D		(1)	6,0
STAT082	Méthodes statistiques appliquées en santé publique II	Michèle WILMET DRAMAIX		19	(1)	8,0
STAT083	Méthodes approfondies de statistiques appliquées à la santé publique	Michèle WILMET DRAMAIX		17	(1)	4,0
INFO024	Méthodes de traitement des données: utilisation de logiciels	Christelle SENTERRE		19	(1)	2,0
INFO026	Méthodes de traitement des données: analyse informatique de donné	Michel BOUTSEN	D		(1)	2,0
STAT086	Exercices d'intégration des méthodes quantitatives : statistique	Michèle WILMET DRAMAIX		18	(1)	2,0
SPUB089	Exercices d'intégration des méthodes quantitatives : épidémiologie	Alain LEVEQUE		18	(1)	2,0
SPUB020A	Recherche opérationnelle et planification de la santé	Jean MACQ	D		(1)	2,0
SPUB020B	Recherche opérationnelle et planification de la santé	Bruno DUJARDIN	D		(1)	2,0
SPUB038	Programmation - évaluation	Jean MACQ	D		(2)	6,0
SPUB045A	Collecte des données en santé publique : systèmes d'information sanitaire	Raphaël LAGASSE	D		(1)	2,0
SPUB045B	Collecte des données en santé publique : les enquêtes par questionnaire	Perrine Claire HUMBLET	D		(1)	2,0
SPUB044	Epidémiologie	Philippe DONNEN	D		(1)	4,0
SPUB039	Concepts et méthodes en santé publique	Raphaël LAGASSE	D		(1)	2,0
COMM028A	documentation, publication et communication y compris les exercices	Philippe DONNEN		16	(1)	2,0

A = absent C = certificat médical D = dispense E = étalement M = module N = non inscrit
L = motif légitime P = s'est présenté(e) R = report X = cours non donné Y = cours sans examen

Route de Lennik 808 C.P. 591 Fax: +32-2-555.40.49 Email: Presidence.ESP@ULB.ac.be

UNIVERSIDAD DE GRANADA
ESCUELA ANDALUZA DE SALUD PÚBLICA

El Rector de la Universidad de Granada, considerando que, conforme a las disposiciones y circunstancias prevenidas por la legislación vigente

Escuela Andaluza de Salud Pública
CONSEJERÍA DE SALUD
JUNTA DE ANDALUCIA

Don Miguel Ángel Luque Fernández

nacido el día 5 de abril de 1972 en Granada, de nacionalidad española, ha superado los estudios correspondientes el día 30 de septiembre de 2006, conforme a lo regulado en los Estatutos de la Universidad de Granada, expide el presente TÍTULO de

MÁSTER UNIVERSITARIO EN SALUD PÚBLICA Y GESTIÓN SANITARIA

organizado por la Escuela Andaluza de Salud Pública

con carácter de título propio de la Universidad de Granada, de acuerdo con lo dispuesto en el artículo 34.3 de la Ley Orgánica 6/2001, de 21 de diciembre, de Universidades, que faculta al interesado para disfrutar de los derechos que a este título otorgan las disposiciones vigentes.

Granada, a 30 de septiembre de 2006

El Rector
DAVID AGUILAR PEÑA
RECTOR

El Gerente de la EASP
LUISA LORENZO NOGUEIRAS
Gerente de la EASP

Escuela Andaluza de Salud Pública
JUNTA DE ANDALUCIA
CONSEJERÍA DE SALUD

El Secretario General
Esteban Pérez Alonso
Secretario General

El/la interesado/a

UNIVERSIDAD DE GRANADA
SECCION DE TITULOS
Queda registrado el presente Diploma al folio 231 bajo el Núm. 7834 del libro 7 de los de su clase
Granada, 9-octubre-2007
EL JEFE DE LA SECCION

UNIVERSIDAD DE GRANADA - Servicio de Asuntos Generales - SECRETARIA GENERAL

Francisco Manuel Barrera López
JEFE DE LA SECCIÓN DE TÍTULOS

ESCUELA ANDALUZA DE SALUD PÚBLICA

Queda registrado este Título al folio 52 número 1080 del libro 3

Granada, 25 de Julio de 2007
El Responsable del registro:

MÁSTER UNIVERSITARIO EN SALUD PÚBLICA Y GESTIÓN SANITARIA

Fecha de realización: 17 de octubre de 2005 a 30 de septiembre de 2006

Duración del curso: 1.300 horas

Plan Docente

Módulos

1. Sistemas y políticas de salud y factores de desarrollo sanitario	150 h.
2. Métodos de investigación en salud pública	235 h.
3. Gestión de servicios sanitarios	235 h.
4. Promoción de salud	175 h.
5. Programas opcionales de especialización	75 h.
6. Trabajo de campo individual	430 h.

El Rector de la Universidad Nacional
de Educación a Distancia,

considerando que

Don Miguel Ángel Luque Fernández

nacido en Granada, el día 5 de abril de 1972,
ha superado estudios correspondientes al plan del programa modular

HERRAMIENTAS DE GESTIÓN E INVESTIGACIÓN SANITARIA

y de acuerdo con los módulos que figuran al dorso de este documento,
le expide el presente

TÍTULO DE ESPECIALISTA UNIVERSITARIO EN BIOESTADÍSTICA Y ANÁLISIS DE ESTUDIOS MÉDICOS

Madrid, a 28 de noviembre de 2006

El Jefe de la Sección,

Fdo.: Félix Martínez García

El Rector,

Fdo.: Juan A. Gimeno Ullastres

Nº de créditos: 40/400

Nº de registro: 120702

Este título se otorga como propio de la UNED, según lo dispuesto en el art. 34.3 de la Ley Orgánica 6/2001, de Universidades, y no tiene el carácter oficial establecido en el art. 34.1 de la misma Ley

UNIVERSIDAD NACIONAL
DE EDUCACIÓN A DISTANCIA

Francisco Javier Díez Vegas

Dpto. Inteligencia Artificial
ETSI Informática - UNED
c/ Juan del Rosal, 16 28040 Madrid
Tel.: 91.398.71.61 – Fax: 91.398.88.95
Correo-e: fjdiez@dia.uned.es

Francisco Javier Díez Vegas, Profesor Titular de Universidad del Departamento de Inteligencia Artificial de la UNED y Director del Centro de Investigación sobre Sistemas Inteligentes de Ayuda a la Decisión (CISIAD),

CERTIFICA:

Que durante el curso 2005-06 **D/Dª MIGUEL ANGEL LUQUE FERNÁNDEZ**, con **DNI 24271499J**, ha superado los siguientes módulos del Programa Modular *Herramientas de Gestión e Investigación Sanitaria*:

Módulo	Horas lectivas	Créditos	Calificación
2. Probabilidad y teoría de la decisión	150	15	Notable
3. Diseño de estudios y estadística	150	15	Sobresaliente
4. Interpretación y análisis práctico de estudios médicos	100	10	Sobresaliente

Madrid, 2 de octubre de 2006

Fco. J. Díez

Fdo.: Francisco Javier Díez Vegas
Director del Programa Modular

www.cisiad.uned.es/cursos/modular-medicina

UNIVERSIDAD NACIONAL DE EDUCACIÓN A DISTANCIA
I.U.I.
CENTRO DE INVESTIGACIÓN SOBRE SISTEMAS INTELIGENTES DE AYUDA A LA DECISIÓN

Módulo	Convocatoria	Horas	Créditos
Probabilidad y teoría de la decisión	2005/2006	150	15
Diseño de estudios y estadística	2005/2006	150	15
Interpretación y análisis práctico de estudios médicos	2005/2006	100	10

Juan Carlos I, Rey de España

y en su nombre

El Rector de la Universidad de Granada

Considerando que, conforme a las disposiciones y circunstancias prevenidas por la legislación vigente,

Don Miguel Ángel Luque Fernández

nacido el día 5 de abril de 1972 en Granada, de nacionalidad española,

ha superado los estudios universitarios correspondientes organizados por la Facultad de Filosofía y Letras,
conforme a un plan de estudios homologado por el Consejo de Universidades,
expide el presente título universitario oficial de

Licenciado en Antropología Social y Cultural

con validez en todo el territorio nacional, que faculta al interesado para disfrutar
los derechos que a este título otorgan las disposiciones vigentes.

Dado en Granada, a 28 de enero de 2004

El interesado,	El Rector,	El Jefe de la Secretaría,
	David Aguilar Peña	Francisco Manuel Barrera López

Registro Nacional de Títulos	Código de CENTRO	Registro Universitario de Títulos
2004/130438	18009079	128549

1-BC-198654

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LA ESCUELA NACIONAL DE SANIDAD

Considerando que, conforme a las disposiciones establecidas en el Reglamento de Ordenación Académica,

MIGUEL ÁNGEL LUQUE FERNÁNDEZ

ha cursado y superado los estudios correspondientes al programa que integra los módulos que al dorso se citan, otorga el presente título de:

DIPLOMA SUPERIOR DE SALUD INTERNACIONAL

Desarrollado en esta Escuela Nacional de Sanidad (ENS), Instituto de Salud Carlos III(ISCIII).

Madrid, 12 de diciembre de 2003

LA SUBDIRECTORA GENERAL DE FORMACIÓN Y DIFUSIÓN DE LA INVESTIGACIÓN SANITARIA DEL ISCIII

E. Nelly García-López Hernández

Instituto de Salud Carlos III
Ministerio de Sanidad y Consumo

Registro en el libro de Cursos referido al dorso

SF-S-215/2003

Ministerio de Sanidad y Consumo

ENS Escuela Nacional de Sanidad

Instituto de Salud Carlos III

D. Ricar Gènova, como coordinador del Diploma de Salud Internacional 2003, certifica que:

D. MIGUEL ÁNGEL, LUQUE FERNÁNDEZ ha cursado el 100% de la carga lectiva presencial obligatoria del Diploma en Salud Internacional 2003, habiendo superado las evaluaciones realizadas por módulos y el examen final.

El Diploma en Salud Internacional tiene una carga lectiva de 420 horas (42 créditos), desglosados como sigue:

Diploma Superior en Salud Internacional:		**42 créditos**
Módulo I:	Introducción a la Salud Pública Internacional	2,5
Módulo II:	Metodología Cuantitativa en Salud Internacional	11
Módulo III:	Técnicas Cualitativas en Salud Internacional	3
Módulo IV:	Diseño de proyectos de cooperación y sistemas de salud en países en desarrollo	3
Módulo V:	Prevención y control de las Enfermedades de Transmisión Sexual, SIDA y Tuberculosis en países en desarrollo	6
Módulo VI:	Salud Reproductiva e Infantil	6
Módulo VII:	Enfermedades Tropicales	3
Módullo VIII:	Enfermedades no transmisibles y factores de riesgo asociados	1,5
Tesina		6

Titulo de la Tesina:

"MORTALIDAD MATERNA, TRADICIÓN Y AYUDA HUMANITARIA: UN EJEMPLO DE INTERVENCIÓN (INVESTIGACIÓN-ACCIÓN)"

Y para que así conste, firmo la presente en Madrid a doce de diciembre de dos mil tres.

ESCUELA NACIONAL DE SANIDAD - INSTITUTO DE SALUD CARLOS III - Departamento de Salud Internacional

Ricard Génova

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Juan Carlos I, Rey de España

y en su nombre

La Ministra de Educación, Cultura y Deporte

Considerando que, conforme a las disposiciones y circunstancias previstas por la legislación vigente,

Don Miguel Angel Luque Fernández

nacido el 5 de abril de 1972, en Granada,
de nacionalidad española,

ha justificado que reúne las condiciones determinadas en el Real Decreto 992/1987, de 3 de julio (B.O.E. de 1 de agosto) y en la Orden de 24 de junio de 1998 (B.O.E. del 30), en expediente tramitado por la Dirección General de Enseñanza Superior e Investigación Científica, y tras la residencia efectuada en el Hospital Clínico «San Cecilio» de Granada, durante un periodo de 2 años, que finalizó el 31 de diciembre de 1999, expide el presente

Título de Enfermero
Especialista en Enfermería Obstétrico-Ginecológica (Matrona)

con los derechos que establece el citado Real Decreto.

Madrid, a 19 de julio de 2000

El Interesado,

Por la señora Ministra:
El Secretario de Estado de Educación y Universidades,

La Jefe de Sección de Títulos,

AB - 190449

Número de Registro Nacional de Títulos 2000073215

Personaliza ARTECO

F.N.M.T. Mod. 1-95

MONDAY

09/22

20090207 Session: 04 .4

Track: Surveillance 1

Exhaustivity of the surveillance system for respiratory tuberculosis in Balearic Islands, Spain, 2005-2007: a capture-recapture study

Jaume Giménez-Durán (1), C. Savulescu (2), A. Galmés (3), C. Bosch (3), A. Nicolau (3) L. Bonilla (1), MA Luque (1), JdM. Donado (4), M. Martínez (4), S. de Mateo (4)

1. Field Epidemiology Training Programme (PEAC), C.N.E. - Health Institute Carlos III, Spain
2. EPIET, European Centre of Disease Prevention and Control, Stockholm, Sweden
3. Regional Service of Epidemiology, Balearic Islands, Spain 4 National Centre of Epidemiology (CNE) Health Institute Carlos III, Spain

BACKGROUND

In Balearic Islands, data sources of Tuberculosis (TB) surveillance system include: the Mandatory Notifiable Diseases (MND) system, and the Hospital Basic Data Set (HBDS). We aim to assess the exhaustivity of the TB surveillance system by comparing with another data source: the Electronic Medical Records from Primary Health Care (eSIAP).

METHODS

We conducted a capture-recapture study (C-R) on respiratory TB cases between 2005-2007 in Balearic Islands. TB cases from three databases: MND, HBDS and e.SIAP were included. To assess the dependence between sources, we firstly applied C-R on two by two sources. We used the log-linear regression to determine the likelihood ratio and the Bayesian Information Criterion to select the model that better fits our data sources. We obtained the estimated total number (N) of respiratory TB cases with a confidence interval (C.I.) 95%, and data sources exhaustivity.

RESULTS

We included 681 cases. Of these, 360 (52.9%) appeared in one database, 200 (29.4%) in two databases and 121 (17.7%) in all three. The two-by-two analysis (MND with HBDS and MND with e.SIAP) estimated a lower N. Moreover, the odds ratio of these combinations shows dependency. Using the three databases, the log-linear model estimates a N of 1044 cases (CI 95%: 893 - 1195). The number of cases not recorded by any of sources (X) is 363. The exhaustivity with only two sources is 54.8 %, adding the third source reaches 65.2%.

CONCLUSION

Low exhaustivity cannot be attributed to the limitations of the C-R, neither to the recent computerization of primary health centres. We recommend the reinforcement of TB cases notification in the Hospitals and Primary Care and the characterization of non notified cases.

PRESENTER: GIMÉNEZ-DURÁN

20090257 Session: 04 .5

Track: Surveillance 1

Exhaustivity of the surveillance system for non-respiratory forms of tuberculosis (TB) in Balearic Islands, Spain, 2005-2007: does it have differences with respiratory TB surveillance?

Jaume Giménez-Durán (1), C. Savulescu (2), A. Galmés (3), C. Bosch (3), A. Nicolau (3), L. Bonilla (1), MA Luque (1), S. de Mateo (4)

1. Field Epidemiology Training Programme (PEAC), C.N.E. - Health Institute Carlos III, Spain
2. EPIET, European Centre of Disease Prevention and Control, Stockholm, Sweden
3. Regional Service of Epidemiology, Balearic Islands, Spain 4 National Centre of Epidemiology (CNE) Health Institute Carlos III, Spain

BACKGROUND

In Balearic Islands, the surveillance system for tuberculosis (TB) had two data sources: the Mandatory Notifiable Diseases (MND) system, and the Hospital Basic Data Set (HBDS). We've incorporated recently the Electronic Medical Records from Primary Health Care (eSIAP) and we aim to assess the exhaustivity of the TB surveillance system by comparing with previous years.

METHODS

We conducted a capture-recapture study (C-R) on non-respiratory forms of TB, between 2005-2007. We included TB cases from three databases: MND, HBDS and e.SIAP. To assess the dependence between sources, we firstly applied C-R on two by two sources. We used the log-linear regression to determine the model that better fits our data sources. We obtained the estimated total number (N) of cases with a confidence interval (C.I.) 95%, and data sources exhaustivity.

RESULTS

We included 240 cases. Of these, 182 (75.8%) appeared in one database, 54 (22.5%) in two databases and 4 (1.7%) in all three. In the two-by-two analysis, HBDS with eSIAP estimated a lower N than other combinations. Moreover, the odds ratio of that combination shows dependency. Using the three databases, the log-linear model estimates a N of 450 cases (CI 95%: 361 - 540), and the number of cases not recorded by any of sources (X) is 210. The exhaustivity with only two sources is 52.7%, adding the third source reaches 53.3%.

CONCLUSION

Exhaustivity does not increase with the addition of eSIAP. It seems that non-respiratory forms of TB were an only hospital matter. We need the reinforcement of TB cases notification in the Hospitals and transmit more patients' information to Primary Health Care, using the electronic data transmission system.

PRESENTER: GIMÉNEZ-DURÁN

• What does statistics have to offer epidemiologists?

Room: Sala 100, EXP

Sander Greenland (United States)

• Epidemiology in a changing world

Room: Salão de Convenções, CP/GS

Neil Pearce (New Zealand)

• Chronic diseases in developing countries: more research or more action?

Room: Sala 202, EXP

Shah Ebrahim (United Kingdom)

• The search for causes of disease in an ageing world

Room: Sala 201, EXP

Albert Hofman (Netherlands)

12:45 - 2:15 PM

LUNCH AND POSTERS

2:15 - 3:30 PM

MINI SYMPOSIA: INVITED ABSTRACTS

• Climatic Changes

Room: Sala Carlos Chagas, EXP

Chair: Carlos Corvalan - WHO

Potential Impact of Climate Changes on Spatial Distribution of Schistosomiasis in China (679)

Wen-xiang Peng (Japan)

Influence of temperature and rainfall on the evolution of cholera epidemics in Lusaka, Zambia 2003-2006: a Time Series Analysis (1198)

Miguel Angel Luque Fernandez (Spain)

• Avaliação de tecnologias

Room: Espaço COMPET, CP/GS

Chair: Erno Harzheim (Brazil/RS)

Implantação e avaliação da efetividade de um sistema de telecardiologia em Minas Gerais: Projeto Minas Telecardio (2767)

Clareci Silva Cardoso (Brazil/MG)

Avaliação de tecnologias: aspectos metodológicos

Carisi Polanczyk (Brazil/RS)

Papel da regulação médica na oferta de tecnologia de suporte clínico às equipes de atenção primária

Eno Dias de Castro Filho (Brazil/RS)

Projeto Telessaúde-Brazil em apoio às equipes da Estratégia Saúde da Família

Ana Estela Haddad (Brazil/DF)

2:15 - 03:30 PM

ORAL PRESENTATIONS

(See details at the end of this day's program)

3:30 - 05:30 PM

SYMPOSIA

• Contributions of epidemiology for global health - challenges and opportunities

Room: Teatro do SESI, CP/RS

Chair: Paulo Gadelha (Vice-President of the Abrasco, Brazil/RJ)

1. Contributions of epidemiology for the regional and global health agenda

Mirta Roses Periago (Director, Panamerican Health Organization)

2. The contribution of epidemiology in the structuring of national health systems

Maria Soledad Barria Iroume (Minister of Health, Chile)

3. Social Inequalities in Health: Trends and challenges

Nancy Krieger (Harvard School of Public Health, USA)

• Epidemiologic methods for evaluating primary health care

Room: Sala 100, EXP

Chair: Erno Herzheim (Brazil/RS)

1. Large primary care databases for epidemiological and health services research

James Macinko (United States)

2. Complex interventions based on major intervention trials in primary care

Andy Haines (United Kingdom)

3. Complex interventions in primary care including delivery and organizational interventions

Reference: 20080277

Track: Late Breakers

Methods to determine the prevalence of acute gastroenteritis and associated risk factors in pilgrims doing the French route of Saint James Way, july-september 2008, Spain

Jaume Giménez-Durán(1), M.A. Luque (1), C. Linares (1), J. Rodriguez (1), A. Pousa (2), C Savulescu (1, 3), L. Bonilla (1), G. Clerger (1), J. Donado (4), A. Malvar(2), D. Herrera (4)

1. Field Epidemiology Training Programme (PEAC),C.N.E.- Instituto de Salud Carlos III, Spain
2. Regional Epidemiology Service, Galicia, Spain
3. EPIET, European Centre of Disease Prevention and Control, Stockholm, Sweden
4. Field Epidemiology Training Programme (PEAC) Coordinator's team, C.N.E., I.S.C.III, Spain

BACKGROUND

The pilgrimage to Santiago de Compostela is done every summer by 40,000 pilgrims coming from different countries. In 2010 (Jacobeo year), we expect a significant increase in number of pilgrims. The frequency of acute gastroenteritis (AGE) increases in the summer, but no baseline data is available in Galicia. Therefore, the Galician epidemiology service planed a study aiming at determining the prevalence and associated risk factors of AGE in pilgrims covering the Galician section of Santiago Way.

METHODS

We designed: 1. – A cross-sectional descriptive study, to determine the AGE prevalence, using a self-completed questionnaire filled in by travelers arriving to the 'Monte do Gozo' shelter in Santiago, between July 15-September 15, 2008. 2. – A case-control study with incident AGE cases in the same period of time. We used as concurrent controls, fellow travelers of cases, whenever possible. We identified cases through notification done by doctors, pharmacists, emergency services and people in charge of shelters on the way. Using a self-completed questionnaire, we collected socio-demographic and exposure to risk factors-related data. We also asked cases to provide a stool sample for microbiological study.

RESULTS

For the prevalence study, we received 593 valid questionnaires. For the case-control study, 121 questionnaires were filled-in: 96cases and 25 controls. We received 31 stool samples. Preliminary analysis shows the AGE prevalence rate of 13.83% (n: 593; 95%CI:10.97-16.69). The majority of cases drunk unbottled water from hostels (93.2%) or village fountains (86.7%). The main symptoms were: diarrhoea (51.2%), vomiting (23.2%) or both (25.6%). The microbiological tests and analysis of results are in progress.

CONCLUSIONS

The results of these studies will be the basis of enhanced surveillance of AGE in Galicia for the Jacobeo Year.

14.3 Reference: 20080225

Track: Surveillance

Assessment on exhaustivity of the surveillance system for pulmonary tuberculosis using "capture–recapture" method, Balearic Islands, Spain, 2005

Jaume Giménez-Durán (1), L. Bonilla (1), MA Luque (1), A. Galmés (2), D. Herrera (1), A. Barrasa (3), C. Bosch (2), A. Nicolau (2)

1. Field Epidemiology Training Programme (PEAC), C.N.E.- Instituto de Salud Carlos III, Spain
2. Regional Epidemiology Service, Balearic Islands, Spain
3. E.P.I.E.T. Coordinator, Spain

BACKGROUND

Epidemiologic Surveillance System (ESS) for TB in Balearic Islands includes The Mandatory Notifiable Diseases (MND) and the Hospital Basic Data Set (HBDS). The computerised system of medical records, Primary Health Care (eSIAP), could be used as other source of information. The objective of this study is to assess the exhaustivity of the surveillance system using those three sources of data.

METHODS

We conducted a capture-recapture study (C-R) on pulmonary TB cases during 2005. We have used three sources of data: MND, HBDS and e.SIAP. We applied a log-linear regression using EPIDAT 3.1. We determined the likelihood ratio (G2) and the Bayesian Information Criterion (BIC) to select the model that better fits our data sources. We estimated the total number of tuberculosis cases with a 95% confidence interval (95%CI) and the exhaustivity of data sources.

RESULTS

The most appropriate log-linear model seems to be the one that assumes MND and eSIAP a independent of HBDS. This also is in accordance with our knowledge of these sources. The total estimated number of TB cases is 295 (CI 95%: 260- 330).The exhaustivity of MND is 51.5%, 39.7% for HBDS and 35.6% for e.SIAP. The highest exhaustivity (73.9%) is estimated using both MND and HBDS.

CONCLUSIONS

Results suggest a low exhaustivity of the system. Adding e.SIAP source does not increase the exhaustivity because all tuberculosis cases are reported to MND or referred to hospital (HBDS). We recommend the reinforcement of TB cases monitoring in all sources specially in Hospitals.

20090272 Session: A2.6

Track: Food- and water-borne diseases

First study on incidence and risk factors of acute gastro-enteritis (age) among pilgrims to Santiago de Compostela, Spain, 2008

Jaume Giménez-Durán (1), MA Luque (1), J. Rodríguez-Urrego (1), C. Linares (1), L. Bonilla (1), C. Savulescu (2), G. Clerger (1), L. Martínez Lamas (3), A. Pousa (4), J. Donado (5), D. Herrera (5), MV Martínez (5)

1. Field Epidemiology Training Programme (PEAC),C.N.E.- Instituto de Salud Carlos III, Spain
2. EPIET, European Centre of Disease Prevention and Control, Stockholm, Sweden
3. Microbiology Service, Santiago University Hospital
4. Regional Epidemiology Service, Galicia, Spain
5. National Centre of Epidemiology - Health Institue Carlos III

BACKGROUND

Since the medieval ages, pilgrims are coming to Santiago de Compostela, Spain, from the entire world. Every summer 40,000 persons do the Way and we expect more in 2010. Our objectives were determining incidence of AGE in pilgrims, associated risk factors and microbiological characterization.

METHODS

We realized a cross-sectional study with self-completed questionnaires filled in by pilgrims arriving to Santiago, in the summer of 2008. We calculated the incidence rate of AGE using the days walking for every pilgrim. Simultaneously, we did a case-control study (CCS) to find incident cases of AGE in Galicia. Cases were identified by sanitary services. We asked them a stool sample for microbiology. Controls were asymptomatic pilgrims. We conducted a multivariable analysis by logistic regression.

RESULTS

Cross-sectional study obtained 593 valid questionnaires. Median age was 31.2 years-old. 90.4% drank unbottled water on the Way. 118 (19.9%) From them had have some symptoms, but only 82 (13.8%) were cases. Incidence rate was 23.5 AGE cases / 103 persons-day (CI 95%: 18.9 - 29.4 /103 persons-day). For the CCS, we analysed 175 cases and 478 controls. We found higher risk for AGE in pilgrims under 20 years (OR: 4.72; CI: 2.16 - 10.28). Other important risk factors were: groups of 3 travellers or more (OR: 1.49; CI: 0.98 - 2.28) and to drink unbottled water (OR: 2.09; CI: 0.91 - 4.82). In 31 stool samples analysed, Norovirus was the more frequent etiologic agent (58%).

CONCLUSION

Pilgrims under 20 years, doing the way in group and drink unbottled water, were the three more important risk factors for AGE. We recommend promoting an educational health programme among pilgrims and enhancing AGE's surveillance.

PRESENTER: GIMÉNEZ-DURÁN

20090243 Session: A2.7

Track: Food- and water-borne diseases

Molecular characterization of Salmonella Napoli: a re-emergent serovar in Italy

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Istituto Superiore di Sanità, Rome, Italy

BACKGROUND

An increasing trend of human cases of Salmonella Napoli has been observed in Italy since 2002. This serotype, rarely identified in farm animal, has been frequently isolated from surface water. The aims of this study were to analyse the antimicrobial susceptibility, the genetic relatedness and to study the virulence genes of S. Napoli strains isolated in Italy between 2000 and 2005 from human cases, foods of animal origin and the environment.

METHODS

The antimicrobial susceptibility testing was performed using the disk diffusion method, according to CLSI. Genetic relatedness among the isolates was assessed by pulsed field gel electrophoresis (PFGE). The presence of 11 virulence genes (avrA, ssaQ, mgtC, spi_4D, sopB, spvC, gipA, sopE1, sodC1, bcfC) was investigated by PCR.

RESULTS

All the strains examined were susceptible to the panel of antimicrobial drugs tested. The PFGE grouped 20/44 strains in a major clone while the other strains were distributed among some minor clones. Genes avrA, spvC, gipA, and sodC1, were never found, while ssaQ and sopB were present in all the strains analyzed. Genes mgtC, bcfC, and sopE1 were present in more than 85% of isolates. No specific association between PFGE clones, presence of the genes and isolation source was observed.

CONCLUSION

S. Napoli strains carried an array of virulence genes comparable to that of the major serovar of Salmonella involved in human infections. A major clone appears to circulate in Italy. Environmental isolates belong to the same PFGE clones and "virulotypes" as the human isolates, thus supporting the hypothesis that environment can represent an important risk factor for S. Napoli infection for humans. Further investigations are needed to better understand the epidemiology of this serovar and the possible animal reservoirs.

PRESENTER: GRAZIANI

XXVI Reunión científica anual de la
Sociedad Española de Epidemiología

Girona, 15, 16 y 17 de octubre de 2008

CERTIFICADO DE PARTICIPACIÓN

J Rodríguez, S Jiménez-Jorge, C Guerrier, M Gamarra-Villaverde, J Giménez, L Bonilla, MA Luque, C Linares, A Barrasa

han presentado la comunicación oral titulada:

¿Pesan demasiado las mochilas escolares?. Estudio piloto.

durante la celebración de la XXVI Reunión científica anual de la Sociedad Española de Epidemiología: "Quién es quién frente a las emergencias en salud pública" celebrada en Girona los días 15, 16 y 17 de octubre de 2008.

Neus Camps
Presidenta del Comité Organizador

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J Giménez Durán, A Galmés Truyols, D Herrera Guibert, LA Bonilla Vargas, MA Luque Fernández, C Bosch Isabel, A Nicolau Riutort

han presentado la comunicación oral titulada:

VIGILANCIA DE LA TUBERCULOSIS EN BALEARES: CARACTERIZACIÓN DE CASOS INFRADECLARADOS ENTRE 2005 Y 2007

durante la celebración de la XXVI Reunión científica anual de la Sociedad Española de Epidemiología: "Quién es quién frente a las emergencias en salud pública" celebrada en Girona los días 15, 16 y 17 de octubre de 2008.

Neus Camps
Presidenta del Comité Organizador

Pere Godoy
Presidente del Comité Científico

International Federation of Gynecology and Obstetrics

Spain witnesses rise in maternal mortality

Tuesday, 7th July 2009

A rise in maternal mortality rates has been seen in Spain since 1996, it has been reported.

Research conducted by the Carlos III Health Institute (ISCIII) in Madrid, published in the Journal of Epidemiology and Community Health, indicates that a 17 per cent increase has been witnessed.

Although mortality rates are still lower than in many other European countries, the data shows that they are increasing.

Miguel Angel Luque, lead author of the study, told SINC that the change, linked to the rise in maternal age, "clearly shows" the need for epidemiological monitoring of maternal mortality.

He added: "This is an avoidable phenomenon, and above all because it shows the importance of studying the causes in order to prevent deaths.

"While the role of changing reproductive patterns is obvious in Europe, it is still not clear what other factors, aside from maternal age, are related to the increase in deaths."

Last month, the World Health Organization reported that global maternal mortality levels failed to improve between 1990 and 2007.

Ban Ki-moon, secretary general of the United Nations, expressed his disappointment at the finding.

Related News

Breastfeeding 'reduces risk of diabetes'

Wednesday, 1st September 2010
Mothers who choose not to breastfeed are twice as likely to develop type 2 diabetes later in life.

Breastfeeding helps new mothers shift some of the fat which remains around the abdomen post-pregnancy - one of the factors behind the condition - according to researchers from the US University of Pittsburgh.

Decongestant use linked to lower risk of premature birth

Wednesday, 1st September 2010

Women who take decongestants during pregnancy are less at risk of having their child prematurely.

According to researchers from the Boston University School of Public Health in the US, women who took the over-the-counter remedy during their second or third trimester had a 58 per cent lower risk of pre-term delivery.

http://www.irinnews.org/Report.aspx?ReportId=86487

Cholera, climate change and El Niño

Photo: microbiologybytes

The spread of cholera-causing Vibrio cholerae, the bacterium is accelerating

JOHANNESBURG, 7 October 2009 (IRIN) - Cholera is not only linked to climate change, it also has an El Niño angle. For instance, Papua New Guinea, an island state in the Pacific Ocean, recorded its first cholera cases in 50 years in 2009, which also happens to be an El Niño year.

The periodic flow of warm sea water across the surface of the central and eastern Pacific Ocean, called El Niño, can lead to higher atmospheric temperatures and heavy rains.

When these conditions are coupled with the rise in temperature and heavy rainfalls caused by climate change, ideal conditions are created for the bacterium that causes cholera to multiply, bringing about a global resurgence of the disease.

The Intergovernmental Panel for Climate Change (IPCC), an authoritative global scientific body, cited research in Bangladesh, led by distinguished US scientist Rita Colwell in the late 1990s, which established the link between the cholera bacterium, sea surface temperature and phytoplankton, microscopic plant-like organisms that live in the ocean.

Warmer surface temperatures increase the abundance of phytoplankton, which supports a large population of zooplankton - animal-like micro-organisms - which serves as a reservoir for cholera bacteria, a waterborne disease.

Colwell and her colleagues also traced the source of the cholera bacterium to the plankton in rivers and estuaries.

A World Health Organization (WHO) study found that during the 1997-98 El Niño, a rise in sea surface temperature coupled with excessive flooding emerged as two significant factors in cholera epidemics in Bangladesh, Djibouti, Somalia, Kenya, Tanzania, and Mozambique.

Africa beckons

Most of the research into the links between climate change and cholera has been conducted in Asia, but Africa now accounts for a majority of the world's cases.

The France-based Laboratoire de Génétique et Evolution des Maladies Infectieuses (GEMI), which analyzed data on cholera covering 20 years from five West African countries - Togo, Ivory Coast, Ghana, Benin and Nigeria - obtained results, published in 2007, that were similar to the findings of the Bangladesh study by Colwell and her colleagues.

Colwell told IRIN by email that they were investigating cholera epidemics in East Africa, especially Mozambique, which has an Indian Ocean coastline. Between 1992 and 2004 Mozambique recorded one-third to one-fifth of all cases reported in Africa, and in early 2009 - an El Niño year - experienced one of its worst cholera outbreaks in a long time.

"My hypothesis, which we are in the process of testing, is that climate changes (sea surface temperature, sea surface height, rainfall, etc.) have influenced the cholera epidemics in East Africa, notably Mozambique," Colwell wrote.

Zimbabwe, a landlocked country bordering Mozambique in southern Africa, recorded one of the world's worst cholera outbreaks in 2008, with more than 4,000 deaths.

The "tragic deterioration in the water purification and delivery in Zimbabwe", as a result of the economic implosion and political crisis, were among the main drivers of the epidemic, which could have been prevented, said Colwell. "Nevertheless, there are some climate changes that may well play a role in the Zimbabwe epidemic."

The IPCC cited studies on the incidence of cholera in lakes Tanganyika and Victoria in East Africa and commented: "It is likely that warming in these African lakes may cause conditions that increase the risk of cholera transmission. This is an area that urgently requires research."

Photo: NOAA

Rita Colwell and colleague Anwar Huq display samples of filtered (left) and unfiltered water. Filtering drinking water helps to remove the zooplankton and reduce cholera by 40 to 50 percent

Jane Olwoch, a senior environmental science lecturer at the University of Pretoria, South Africa, pointed out that besides the biological factors, "Floods caused by heavy rains can contaminate drinking water with the bacterium; in droughts, the bacterium can grow more easily in stagnating water in ponds and rivers."

Researchers in Africa, led by Miguel Ángel Luque Fernández from the Institute of Health Carlos III, based in Madrid, Spain, were the first to show a link between higher temperature and rainfall and the incidence of cholera in Zambia in a study published in the Transactions of the Royal Society of Tropical Medicine and Hygiene, in the UK.

Cholera outbreaks between 2003 and 2006 in Zambia showed that a one-degree Celsius rise in temperature six weeks before an outbreak began allowed the bacteria to multiply in enhanced conditions, leading to almost 5 percent more cholera cases, while a 50mm increase in rainfall three weeks ahead of an outbreak pushed up the number of cases by more than 2 percent.

A study in South Africa's coastal province of KwaZulu-Natal in 2008, by researchers from the Environmental Change Institute at the UK-based Oxford University Centre for the Environment, found a similar link between warmer sea water, floods, and cholera outbreaks.

"We know there is an indisputable link between cholera and poverty, poor sanitation, quality of drinking water, but there are biological agents involved in cholera that react to changes in climate," Olwoch said.

"We cannot therefore think that we can solve the cholera problem by ignoring these factors, especially now, when we know very well that our climate is changing."

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Stillbirth risk by maternal socio-economic status and country of origin: a population-based observational study in Spain, 2007–08

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Background: Socio-economic differences are a major determinant of perinatal outcomes. The impact of low socio-economic status on the risk of stillbirth, and the association between socio-economic status and stillbirth by maternal country of origin at a national level in Spain are unknown. We aimed to analyse the effect of maternal socio-economic status on the risk of stillbirth by maternal country of origin in Spain for the years 2007 and 2008. **Methods:** We designed a population-based observational study that included 970 740 live births and 2464 stillbirths from 2007 to 2008. Univariate risk ratios (RRs) of stillbirth were calculated by maternal education, country of origin, age, parity, and gestational age. Adjusted stillbirth RRs were calculated using a generalized linear model with the Poisson family. Then, adjusted attributable risks and aetiological fractions in the population were calculated as measures of impact. **Results:** Stillbirth rate ranged from 1.0 to 4.7 deaths per 1000 births. The stillbirth risk among mothers having secondary or lower education was double than that of mothers with a tertiary education with an adjusted RR of 2.13 [95% confidence interval (CI): 1.74–2.60]. African mothers, compared with mothers from Spain, showed an adjusted stillbirth RR of 1.75 (95% CI: 1.54–2.00). **Discussion:** This study confirms the differences of stillbirth risk by maternal socio-economic status. Regardless of socio-economic status, African mothers had the highest risk of stillbirth. These results point out the necessity to reduce factors related to social and health inequalities in perinatal mortality in Spain, and more specifically, to take into consideration the special vulnerability of African mothers.

Keywords: epidemiology, ethnic groups, foetal mortality, maternal age, socio-economic status, Spain

Introduction

Socio-economic differences are a major determinant of perinatal outcomes. Occupational status, educational achievement, income, poverty and wealth have been utilized as measures of socio-economic status, as determined by rankings in a social hierarchy.[1–4] Internationally, the risk of stillbirth is the highest among socially disadvantaged groups.[5,6] The high risk of stillbirth observed may stem from factors associated with socio-economic status, such as low maternal education attainment, unemployment and immigration.[7,8]

Low-educational maternal attainment has been suggested as a risk factor for stillbirth in a specific region of Spain, although results were inconclusive due to lack of statistical significance.[9] Thus, the impact of socio-economic status on the risk of stillbirth, and the association between socio-economic status and stillbirth risk by maternal country of origin at a national level in Spain are unknown.

This study aimed to analyse whether there was a higher risk of stillbirth among mothers with disadvantaged socio-economic status and whether there were differences in the risk of stillbirth by maternal country of origin in Spain, from 2007 to 2008.

Methods

We designed a national population-based observational study of babies born in 2007 and 2008 in Spain. We excluded multiple births and babies born before the 28th gestational week.

Data were drawn from the National Institute of Statistics in Spain. We used the vital statistics database, for which the official data source is the birth registration form.[10,11] This database contains information about the vital status of the baby at the moment of delivery, which is coded as either dead or alive. Our outcome variable was stillbirth, defined as the death of a foetus with ≥28 completed gestational weeks prior to complete expulsion or extraction from its mother. It should be noted that 'stillbirth' is not a technical term. In this article, 'stillbirth' refers to late foetal deaths to conform to the World Health Organization (WHO) recommendation that late foetal deaths be reported for purposes of international comparison. WHO classifies foetal deaths into late foetal deaths (≥1000 g or after 28 weeks) and early foetal deaths (500–1000 g or 22–27 weeks).[12,13]

We used maternal education attainment as an explanatory variable of stillbirth risk. Maternal education attainment has been used as a proxy of socio-economic status and is referred as the highest academic degree achieved by a woman at the time of delivery, regardless of the time of residence in Spain and using the definitions of the International Standard Classification of Education (ISCE).[14] We classified maternal education attainment into three categories based on ISCE: (i) secondary education or lower, which corresponds with ≤12 years of obligatory school attendance in Spain; (ii) upper secondary education or first stage of tertiary education, which corresponds with >12 to ≤15 years of education; and (iii) tertiary education with >15 years of education.[14]

The following variables were considered as covariates: parity, maternal country of origin, maternal age in years and gestational age in weeks, both at the time of delivery. We dichotomized parity into nulliparous (women that had never given birth) vs. women who had given birth once or more times. Maternal country of origin, defined as the mother's country of birth, was aggregated in five macro regions [Africa, America and the Caribbean, Asia and Oceania, the European Union with 15 Members States (EU15) and other European countries] compared with Spain.[15] Maternal age was categorized into six groups following international recommendations: ≤19, 20–24, 25–29, 30–34 and ≥35 years.[15,16] Finally, we dichotomized gestational age into pre-term births (≥28–36 gestational weeks) and term births with ≥37 gestational weeks.

In the statistical analysis, we first described our population using counts and percentages for categorical data. Then, we calculated stillbirth rates under the assumption of a Poisson distribution. Stillbirth rates were calculated as the rate between the number of stillbirths at or after 28 completed weeks of gestation in a specific period and the total number of births (live births plus stillbirths) in the same period, expressed per 1000 births. Afterwards, we calculated univariate risk ratios (RRs) by each analysed variable. For explanatory variables, the category with the lowest rate was used as the reference.

To control for confounding at the analysis stage, we developed an explicative multivariate generalized linear model with a Poisson assumption, log linear link function and robust standard errors estimation. We built the model with stillbirth as the dependent variable, adjusted by maternal age, country of origin, education attainment, parity and gestational age. From this model, we derived RRs, including their 95% confidence intervals (95% CI). We explored interactions between socio-economic status and maternal country of origin and age, and evaluated the goodness of fit with the deviance statistic. Finally, we developed an analysis of standardized residuals.

Having identified a pattern of missing at random for maternal education, we developed a multivariate imputation using the chained equations method. We independently analysed 10 copies of data, each with suitably imputed missing values, in the multivariate regression analyses. Then, average estimates of the variables and adjusted standard errors were estimated according to Rubin's rules.[17,18] Finally, through a sensitivity analysis, we compared casewise and multiple imputation results.

To estimate population measures of impact, we calculated adjusted attributable fractions (AFs), preventive fractions (PFs) and population AFs (PAFs). Estimated AF 95% CI were based on standard errors of the generalized linear model that was used.[19] To estimate AF, PF and PAF, we used the following formulas: $AR = RR - 1/RR$, $PF = 1 - RR$ and $PAF = Pd \times (RR - 1)/RR$ (where Pd = proportion of cases exposed to RF)

We used the Stata v.11.1 software (StataCorp USA) for statistical analysis.

Results

During the study period, there were 2464 stillbirths (late foetal death) and 970 740 live births. We excluded 36 139 multiple births and 2023 very pre-term births (22–27 gestational weeks). Among the multiple births and very pre-term births excluded, there were 326 cases of early foetal deaths. At the time of delivery, 63.6% of mothers were >30 years of age, 23.0% were of foreign origin and 15.0% had attained tertiary education. The prevalence of pre-term delivery for the period under study was 6.2%. Fifty-six percent of mothers were nulliparous. The stillbirth rate by variables in the analysis ranged from 1.0 to 4.7 deaths per 1000 births. However, in the case of premature births, the rate increased to 21.8 deaths per 1000 births (table 1).

Mothers from the EU15 showed the highest percentage of tertiary education with 20.8% followed by Spanish. On the other hand, African maternal origin presented the highest percentage of mothers with secondary or lower education attainment (94.6%) (Supplementary table S1).

The percentage of pre-term births by maternal age showed the highest prevalence of prematurity among mothers ≥19 years of age, accounting for 9.1% of all pre-term births during 2007 and 2008 (Supplementary table S2).

We found a significant trend between socio-economic status and stillbirth risk. A secondary or lower educational attainment compared with a tertiary educational attainment showed a higher risk of stillbirth (χ^2 for trend 68.0, 1 degree of freedom; $P < 0.001$). The risk of stillbirth among mothers with secondary or lower education attainment was double than that of mothers with tertiary education. In terms of impact, the lowest level of maternal education attainment (secondary or lower) was responsible for more than half (53.0%) of all stillbirths that happened in this group of women (table 2).

It should be noted that, regardless of maternal education attainment, mothers of African origin compared with those of Spanish origin, showed a 75% excess risk of stillbirth with a RR of 1.75 (95% CI: 1.54–2.00). The country of origin of mothers from regions other than Africa was not a risk factor for stillbirth compared with mothers born in Spain (figure 1).

Prematurity and a maternal age of ≥35 years were two factors strongly associated with the risk of stillbirth, with the highest association found for prematurity (table 2).

At a population level, the greatest impact on stillbirth was attributable to prematurity, followed by the lowest level of maternal education attainment (secondary or lower) and maternal age of ≥35 years (table 2).

The combined multiplicative effect of educational-level attainment and maternal country of origin, showed how the linear relationship is identified between education attainment and the risk of late foetal death is applicable to all maternal origins under study. Furthermore, the strength of the measures of association was the highest in the group of African mothers. Therefore, African mothers with secondary or lower educational attainment presented the highest risk of stillbirth (table 3).

Taking as reference Spanish mothers with tertiary education and comparing with mothers with the lowest level of education by maternal country of origin, African mothers with secondary or lower education attainment presented the highest risk of stillbirth with a RR of 3.74 (95% CI: 3.00–4.70) followed by Spanish women with the same level of education, with a RR of 2.13 (95% CI: 1.74–2.60). Moreover, mothers from all other origins with secondary or lower education attainment presented a higher risk of stillbirth compared with Spanish mothers with tertiary education (table 3).

Discussion

We have found that low socio-economic status was associated with an increased risk of stillbirth in singleton pregnancies of ≥28 weeks of gestation in Spain. This association remained significant following adjustment for age, maternal education, country of origin, parity and gestational weeks. In addition, maternal age and country of origin were independently associated with the risk of stillbirth.

Table 1 Stillbirth rate of singleton births with ≥28 gestational weeks by maternal age, country of origin, socio-economic status, parity and gestational age in Spain, during 2007–08 (2464 stillbirths and 973 204 total births)

Variables	Total births (*n*)	Stillbirths (*n*)	Stillbirth rate per 1000 births (95%CI)
Maternal age			
≤19	29 292	88	3.00 (2.41–3.70)
20–24	98 385	275	2.80 (2.47–3.14)
25–29	226 727	547	2.41 (2.21–2.62)
30–34	371 055	834	2.24 (2.10–2.40)
≥35	247 745	720	2.90 (2.70–3.12)
Maternal country of origin			
EU15	20 292	36	1.77 (1.24–2.45)
Other European countries	40 756	96	2.35 (1.90–2.87)
Africa	58 397	277	4.74 (4.20–5.33)
America	89 278	221	2.47 (2.16–2.82)
Asia and Oceania	12 583	28	2.22 (1.47–3.21)
Spain	751 898	1806	2.40 (2.30–2.51)
Maternal education attainment[a]			
Secondary education or lower	559 860	957	1.71 (1.60–1.82)
Upper secondary education or first stage of tertiary education	206 957	215	1.04 (0.90–1.20)
Tertiary education	146 293	106	0.75 (0.60–0.90)
Gestational age in weeks			
Pre-term birth (≥28–36 weeks)	60 103	1312	21.82 (20.66–23.04)
Term birth (≥37 weeks)	913 101	1152	1.26 (1.20–1.34)
Parity			
Nulliparous (first delivery)	547 981	1626	2.96 (1.83–3.11)
Multiparous (≥1 deliveries)	425 223	838	1.97 (1.84–2.11)

a: 6.2% (n: 60 094) missing values for maternal educational attainment

Table 2 Stillbirth risk and attributable fractions by maternal age, country of origin, socio-economic status, parity and gestational age in Spain, during 2007–08 (2464 stillbirths and 973 204 total births)

Variable	Casewise analyse		Multiple imputation		
	Unadjusted RR[a] (95%CI)	Adjusted RR[b] (95%CI)	Adjusted RR[b] (95%CI)	Attributable or preventible fractions (95%CI)	PAF[c]
Maternal age					
20–24	0.93 (0.73–1.20)	1.10 (0.80–1.54)	1.16 (0.91–1.48)	13.80 (1.42–41.82)	0.50
25–29	0.80 (0.64–1.00)	1.24 (0.91–1.70)	1.23 (0.98–1.55)	19.35 (8.68–47.40)	4.30
30–34	0.74 (0.60–0.93)	1.32 (0.96–1.80)	1.42 (1.13–1.78)	29.60 (2.54–61.74)	10.02
≥35	0.96 (0.77–1.20)	1.74 (1.26–2.40)	1.87 (1.48–2.35)	46.52 (5.00–88.10)	13.60
≤19	1	1	1	Ref.	
Maternal country of origin					
EU15	0.74 (0.53–1.03)	0.66 (0.41–1.06)	0.72 (0.52–1.00)	28.00 (4.30–51.80)[d]	
Other European countries	0.98 (0.79–1.20)	0.93 (0.70–1.24)	0.83 (0.67–1.02)	17.00 (−0.05–34.05)[d]	
Africa	2.00 (1.74–2.24)	2.02 (1.70–2.42)	1.75 (1.54–2.00)	42.90 (20.0–65.83)	4.82
America	1.03 (0.90–1.18)	0.75 (0.60–0.94)	0.96 (0.83–1.11)	4.00 (−9.52–17.52)[d]	
Asia and Oceania	0.92 (0.63–1.34)	0.76 (0.42–1.37)	0.82 (0.56–1.20)	14.00 (−16.71–44.7)[d]	
Spain	1	1	1	Ref.	
Maternal education attainment					
Secondary education or lower	2.36 (1.93–2.88)	2.20 (1.77–2.70)	2.13 (1.74–2.60)	53.05 (22.90–83.23)	39.25
Upper secondary education or first stage of tertiary education	1.43 (1.13–1.81)	1.44 (1.14–1.82)	1.40 (1.10–1.72)	28.60 (13.15–70.34)	5.00
Tertiary education	1	1	1	Ref.	
Gestational age in weeks					
Preterm birth (≥28–36 weeks)	17.66 (16.31–19.13)	16.75 (15.00–18.70)	16.60 (15.33–18.00)	94.00 (37.32–225.32)	50.05
Term birth (≥ 37 weeks)	1	1	1	Ref.	
Parity					
Nulliparous (first delivery)	1.50 (1.38–1.64)	1.44 (1.27–1.62)	1.67 (1.53–1.82)	40.12 (25.50–54.50)	26.5
Multiparous (≥1 deliveries)	1	1	1	Ref.	

a: Unadjusted RR
b: Adjusted RRs by maternal age, maternal education, country of origin, parity and gestational age
c: Population attributable fraction
d: Preventive fraction

To our knowledge, at a national level, this is the first study in Spain that shows the higher risk of stillbirth among mothers with low socio-economic status and that identifies a multiplicative effect on stillbirth risk between socio-economic status and maternal country of origin.

Over the past 10 years, Spain has experienced a significant population growth closely related to immigration. In little more than a decade, the population has grown by 13%, from 40 million in 1996 to 46 million in 2007. Eighty-six percent of these 6 million were foreign people. In 2007, 24% of the foreign population in

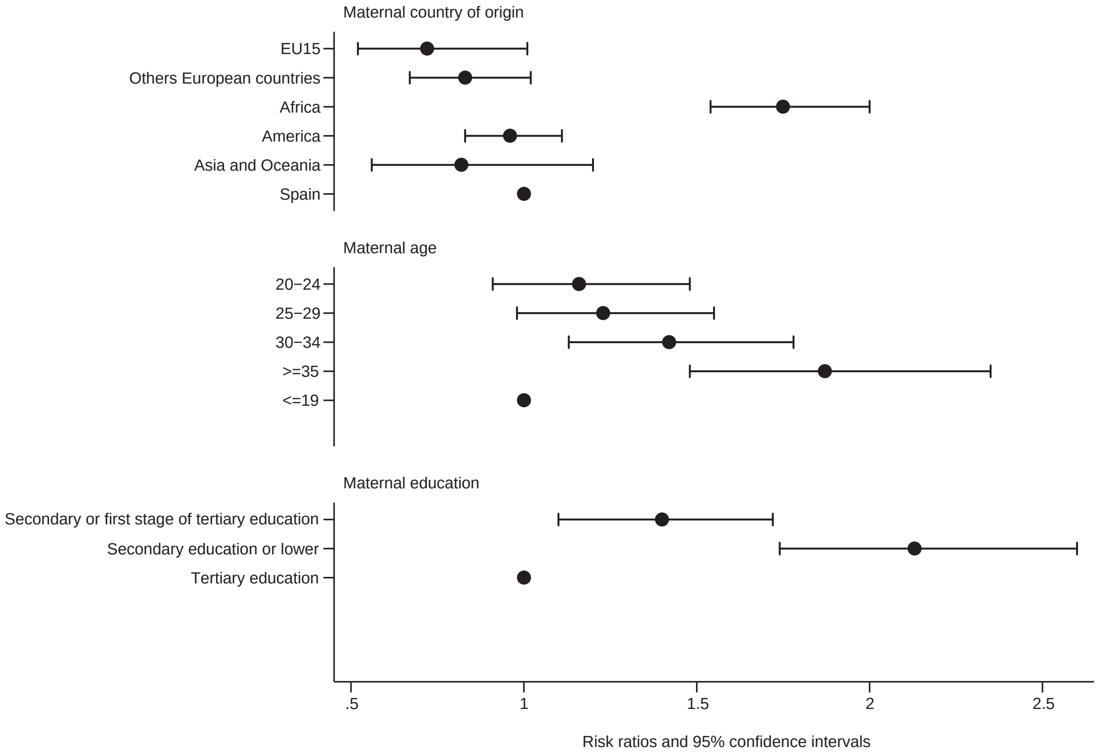

Figure 1 Pattern of stillbirth risk (adjusted RRs) in Spain from 2007 to 2008 by maternal age, country of origin and education attainment (2464 stillbirths and 973 204 total births)

Table 3 Stillbirth RRs by maternal education attainment and country of origin (multiplicative combined effect) in Spain, during 2007–08 (2464 stillbirths and 973 204 total births)

Maternal country of origin	Maternal education attainment		
	Tertiary, RR[a] (95%CI)	Upper secondary or first stage of tertiary, RR (95%CI)	Secondary or lower, RR (95%CI)
Spain	1	1.40 (1.10–1.72)	2.13 (1.74–2.60)
EU15	0.72 (0.52–1.01)	0.99 (0.66–1.48)	1.54 (1.07–2.27)
Other European countries	0.83 (0.67–1.02)	1.13 (0.83–1.54)	1.76 (1.33–2.34)
Asia and Oceania	0.96 (0.83–1.11)	1.32 (1.01–1.72)	2.05 (1.62–2.60)
America	0.82 (0.56–1.20)	1.12 (0.73–1.74)	1.75 (1.15–2.65)
Africa	1.75 (1.54–2.00)	2.41 (1.86–3.12)	3.74 (3.00–4.70)

a: Adjusted risk ratios by maternal age, education, country of origin, parity and gestational age

Spain were women of childbearing age.[20,21] In relation to this, the second important finding of this study is related to the identification of a clear excess in the risk of stillbirth among women of African origin during 2007–08 in Spain.

Recently, the Europeristat report recommended that a late foetal death rate should be used as an indicator to allow international comparisons.[15] Stillbirth risk provides information on avoidable mortality and reveals problems in the quality of perinatal care. Overall, perinatal mortality has been used as a public health indicator, as it is highly sensitive to social and health inequalities.[21,22]

The results of our study agree with international findings showing that risks for stillbirth are higher among older mothers, those with limited education and mothers belonging to ethnic minorities.[7,8,23–25]

In Spain, over the past years, a clear effect of age and period in the trends of stillbirth has been identified. Overall, stillbirth rates declined during 1996–2006, whereas specific stillbirth rates in mothers with advanced maternal age increased steadily during the study period.[26] Our study confirms that advanced maternal age is an independent risk factor of late foetal death, reinforcing national and international findings.

With regard to maternal education, our study is consistent with the results of the monitoring group of perinatal mortality in Canada, whereby women with <12 years of education had an increased risk for foetal death, compared with those with $\geq$14 years of education.[8] In USA, black women had more than twice the rate of stillbirth compared with white women and this increased risk could be attributed both to the access and quality of medical care.[7,27] Recently, a European study showed that in Brussels, perinatal mortality increased in African mothers independently of socio-economic status and maternal characteristics.[28]

Variation in the risk of perinatal mortality by ethnicity has been the subject of research in other countries. African women were found to have an increased risk of hypertension or pre-eclampsia, diabetes and obesity during pregnancy in different studies.[29,30] Medical information was not available in the Spanish birth registration form. Therefore, further studies would be needed to identify additional RF for the increased risk of stillbirth among African mothers in Spain taking into account this information.

Furthermore, to improve our understanding of the underlying causes of higher vulnerability to stillbirth among African women in Spain, more information related to immigrant background and culture, such as communication problems due to language skills, accessibility to the health-care system, acceptance of preventive interventions, use of pre-natal services and quality of health care received, is needed.[31]

Results of our study showed that at a population level, the greatest impact on stillbirth was attributable to prematurity, secondary or lower maternal education attainment and advanced maternal age. The prevention of these risk factors could have an important impact in the reduction of the stillbirth rate in Spain.

Stillbirth is particularly subjected to under-reporting at low gestational ages (20–27 weeks; early foetal death).[32,33] However, the exclusion of infants <28 gestational weeks allowed us to minimize the bias due to under-reporting of foetal deaths. Other restrictions to the study population applied in the study design, such as limiting the study to singleton births, allowed us to deal with confusion introduced by multiplicity.

Another limitation of our study was related to the presence of missing values. It is known that the classical analysis of data with missing values (casewise analysis, i.e. analysis of those cases only with complete data) that do not follow a 'completely at random' pattern, produces a biased estimate of the population of interest and a loss of precision.[17] However, to avoid this bias, we developed a multiple imputation procedure that allows the replacement of missing values by plausible values that differ among multiple copies of the main data set. This ensures that the mean and the variance of variables with imputed missing data reflect the uncertainty of the missing value. This procedure allows an analysis of the full data set to be undertaken, thereby minimizing biased population estimates.[18]

In conclusion, this study confirmed the existence of inequalities in stillbirth by socio-economic status and maternal country of origin in Spain. These results point out the necessity to reduce factors related to social and health inequalities in perinatal mortality, and more specifically, to take into consideration the special vulnerability of African mothers. There is a need for new policies to be developed to make the Spanish health system capable of responding to the special needs of the reproductive health of African women living in Spain.

Supplementary data

Supplementary data are available at *EURPUB* online.

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Conflicts of interest: None declared.

Key points

- Internationally, it is known that stillbirth risk is greatest for pregnant women of advanced age, with limited education, and belonging to ethnic minorities.
- This study confirms this pattern in Spain and identifies a higher risk of stillbirth among African mothers.
- Spain needs to develop a sensitive health-care system that is capable of responding to the special needs of the reproductive health of immigrant women in general and African mothers in particular.

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Descriptive spatial analysis of the cholera epidemic 2008–2009 in Harare, Zimbabwe: a secondary data analysis

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ABSTRACT

This ecological study describes the cholera epidemic in Harare during 2008-2009 and identifies patterns that may explain transmission. Rates ratios of cholera cases by suburb were calculated by a univariate regression Poisson model and then, through an Empirical Bayes modelling, smoothed rate ratios were estimated and represented geographically. Mbare and southwest suburbs of Harare presented higher rate ratios. Suburbs attack rates ranged from 1.2 (95% CI = 0.7–1.6) cases per 1000 people in Tynwald to 90.3 (95% CI = 82.8–98.2) in Hopley. The identification of this spatial pattern in the spread, characterised by low risk in low density residential housing, and a higher risk in high density south west suburbs and Mbare, could be used to advocate for improving water and sanitation conditions and specific preparedness measures in the most affected areas.

1. Introduction

On 20 August 2008 an outbreak of 118 cholera cases was declared in St. Mary's and Zengeza wards of Chitungwiza, a large urban centre on the outskirts of Harare.[1–5] *Vibrio cholerae* El Tor 01 was isolated from 18 (30%) of the 59 specimens collected, thus supporting the clinical evidence for an outbreak.[2] Two months after this initial outbreak, a second wave of cases was reported with numerous suburbs being affected within the city of Harare and within every province of the country. This was the largest and most extensive outbreak of cholera recorded in Zimbabwe and indeed in Africa, affecting rural and urban areas with more than 100 000 cases and 4000 deaths, about half of which occurred in the urban centres of Harare and Chitungwiza.[2–7]

During the 2008–2009 Zimbabwe cholera epidemic the country was in economic crisis and the health care system had become dysfunctional, with most government hospitals unable to provide services or closed due to a lack of essential medical supplies. Many staff in health structures had not been paid, and many were unable to report for duty. Water supplies were irregular and sanitation systems had collapsed. The reason for this was a lack of maintenance of the system, with frequent power interruptions affecting pumping stations.[8–11]

By 2008, Chitungwiza had been without adequate water supply water for more than two years. People had become dependent on shallow wells that were at risk of contamination because of the lack of sewage disposal.[1,9,11] On 1 December 2008, problems with the main pumping station meant that, without prior warning, the water supply was shut off for Harare, leaving large populations without

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Table 1
Distribution of cholera cases by sex and age in the treatment centres during the cholera outbreak in Harare, 2008–2009 (*n* = 19 422 cholera cases)

Variables	*n* (%)
Sex	
Males	10 071 (51.9)
Females	9272 (47.7)
Data missing	79 (0.4)
Age in years	
≤5	3542 (18.2)
6-14	1932 (9.9)
15-24	3811 (19.6)
25-34	4828 (24.9)
35-44	2682 (13.8)
≥45	2627 (13.5)
Children ≤5 years	
0-2	2356 (66.5)
3-5	1186 (33.5)

access to potable water. With no water supply, the limited health structures that continued to operate could not maintain an acceptable level of infection control and many hospitals were closed.[10]

The city of Harare is characterised by lower density affluent suburbs in the north and high density poorer areas in the south.[12] Chitungwiza is a high density dormitory city in the south of Harare, which was established mainly to house workers commuting daily to Harare. The main form of transport in Harare and Chitungwiza is the minibus, a privately-owned small bus that collects passengers from designated bus stops.

Also in Harare and Chitungwiza a large proportion of economic activity is concentrated at informal markets. Markets are particularly common in high density suburbs where they serve the needs of commuters. In the past, city regulations restricted market trading, particularly of food products, to sites with appropriate water and sanitation facilities. At the time of the cholera outbreak, however, implementation of this regulatory framework had already broken down, and most trading was at informal sites with limited or no access to clean water.[12,13] In disadvantaged settings *Vibrio cholerae* is predominantly transmitted by contaminated water and through person to person contact,[14,15] and the risk of transmission is greatest in overcrowded areas, including markets. Markets selling food items, particularly those that lack sanitation or access to clean water, may facilitate the spread of diarrheal disease agents.[16]

Table 2
Age of cholera cases by sex in the treatment centres during the cholera outbreak in Harare, 2008–2009 (*n* = 19 343 cholera cases, 72 missing values of sex variable, listwise analyse)

	Male, n (%)	Female, n (%)	*P*-value[a]
Age by sex			<0.001
≤5	1955 (19.4)	1566 (16.9)	
5-14	1041 (10.3)	879 (9.5)	
15-24	1672 (16.6)	2126 (22.9)	
25-34	2486 (24.7)	2328 (25.1)	
35-44	1587 (15.8)	1088 (11.7)	
≥45	1330 (13.2)	1285 (13.9)	

[a] Pearson $\chi^2{}_{5df} = 177.3$

In line with the above it can be hypothesised that the distribution of cholera cases by suburb in Harare during the epidemic of 2008-2009 followed an identifiable spatial pattern related to the active population movements and high density population areas.

There are currently no published data showing the spatial distribution and spread of cholera cases in Harare. In this paper we describe the spatial distribution of the cholera epidemic in Harare and Chitungwiza and identify factors that influenced the spatial pattern of the outbreak spread that may explain mechanism of transmission, in order to guide future preparedness and control measures.

2. Methods

We developed a population-based ecological study using a secondary data analysis. The study protocol was approved by the Ethical Review Board of Médecins Sans Frontières (MSF).

Data were drawn from the register of cholera treatment centres (CTCs) and oral rehydration points (ORPs) functioning during the cholera epidemic in Harare and Chitungwiza. MSF, in collaboration with the Department of City Health of the Ministry of Health and Child Welfare, implemented and managed three CTCs, in Budiriro Polyclinic, the Beatrice Road Infectious Diseases Hospital and in Chitungwiza. Ten ORPs were functioning in Harare city and one in Chitungwiza.

Population figures by suburb were calculated from the official census of Harare and Chitungwiza, completed in 2002. To estimate the populations' figures at the time of the epidemic we employed an average constant annual growth rate of 3%, as estimated by the Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat.[17]

For the case definition of cholera, we used the definition as listed in the MSF cholera guidelines: in an area where there is a cholera epidemic a cholera case is defined as any patient presenting three or more liquid stools and/or vomiting for the last 24 hours.[18]

In the statistical analysis we describe the outbreak in the classical way, in terms of person, place and time.[19–21] We calculated descriptive statistics for the variables related to person (age, sex). To describe the outbreak by place we calculated the attack rates for each suburb, including 95% exact confidence intervals (CI) under the assumption that the attack rates follow a Poisson distribution.[22] Then, to describe epidemic time evolution, we presented epidemic curves for suburbs with more than fifty cholera cases.

In order to describe the relation between the cholera cases and high density population areas, we computed the Pearson's correlation coefficient (R) between the number of cholera cases and the number of bus stops plus markets by suburbs. Then, we represented a scatter plot, taking out extreme values, to show the relation between cholera cases and the number of bus stops plus markets by suburbs. Both variables were drawn from the Department of the Surveyor-General of the government of Zimbabwe, and have been used as proxies of overcrowded and high mobility areas, where the probability of person to person

Table 3
Rate ratios and attack rates per 1000 people by suburbs in Harare, 2008–2009 (n = 19 422 cholera cases)

Suburbs	Cases	Population	Attack rates per 1000 people (95% CI)	Rate ratios (95% CI)
Waterfalls	548	7 347	74.6 (68.4-81.1)	5.79 (5.32-6.30)
City Centre	123	12 609	9.8 (8.1-11.6)	0.76 (0.63-0.90)
Hatfield	355	28 959	12.3 (11.0-13.6)	0.95 (0.86-1.06)
Epworth	824	130 267	6.3 (5.9-6.7)	0.49 (0.46-0.53)
Borrowdale	63	14 746	4.3 (3.2-5.4)	0.33 (0.26-0.42)
Budiriro	2 536	109 545	23.2 (22.2-24.1)	1.80 (1.72-1.87)
Dzivarasekwa	435	43 302	10.0 (9.1-11.0)	0.78 (0.71-0.86)
Chitungwiza	3 710	321782	11.5 (11.1-12.0)	0.89 (0.86-0.93)
Glen View-Glen Norah	4 583	234 353	19.6 (19.0-20.1)	1.52 (1.47-1.57)
Highfield	824	48 713	16.9 (15.8-18.1)	1.31 (1.22-1.41)
Hopley	541	5 994	90.3 (82.8-98.2)	7.00 (6.43-7.63)
Kambuzuma	183	29 796	6.1 (5.2-7.1)	0.48 (0.41-0.55)
Kuwadzana	759	109 137	7.0 (6.4-7.4)	0.54 (0.50-0.58)
Tafara	712	72 737	9.8 (9.0-10.5)	0.76 (0.70-0.82)
Mbare	2 138	92 219	23.2 (22.2-24.2)	1.80 (1.72-1.88)
Mufakose	568	52 921	10.7 (9.8-11.6)	0.83 (0.77-0.91)
Rugare	61	12 718	4.8 (3.7-6.1)	0.37 (0.29-0.48)
Warren Park	100	57 341	1.7 (1.4-2.1)	0.14 (0.11-0.16)
Mt. Pleasant	32	5 368	6.0 (4.1-8.4)	0.47 (0.33-0.65)
Malbourg	47	9 600	4.9 (3.5-6.5)	0.38 (0.29-0.51)
Milton Park	21	4 405	4.8 (2.9-7.3)	0.37 (0.24-0.57)
Avondale	47	10 613	4.4 (3.2-5.8)	0.34 (0.26-0.46)
Eastlea	29	6 991	4.1 (2.7-5.9)	0.32 (0.22-0.46)
Southerton	42	10 385	4.0 (3.0-5.5)	0.31 (0.23-0.42)
Belvedere	30	10 353	2.9 (1.9-4.1)	0.22 (0.16-0.32)
Mabelreign	16	6 065	2.6 (1.5-4.2)	0.20 (0.13-0.33)
Greendale	31	14 661	2.1 (1.4-3.0)	0.16 (0.12-0.23)
Arcadia	12	5 681	2.1 (1.1-3.7)	0.16 (0.09-0.29)
Highlands	12	6 545	1.8 (0.9-3.2)	0.14 (0.08-0.25)
Hillside	8	4 806	1.7 (0.7-3.2)	0.13 (0.06-0.26)
Tynwald	32	27 398	1.2 (0.7-1.6)	0.09 (0.06-0.13)
All Suburbs	19 422	1507 359	12.9 (12.7-13.1)	1

transmission is higher. After that, we added a linear interpolation computing the linear coefficient of determination (R^2).[23]

In order to control for variance instability resulting from heterogeneity in cholera cases and population data (overdispersion), we estimated smoothed rate ratios (SRR) of cholera by suburb using an Empirical Bayesian Smoothing (EBS) model. The EBS consists of computing a weighted average between the raw rate for each suburb and the regional average, with weights proportional to the underlying population at risk.[24,25] In effect, districts with relatively small populations tend to have their raw rates adjusted considerably, whereas for districts with relatively large populations the raw rates show little change.

In order to explain the relation between the cholera cases and overcrowded and high mobility areas, we introduced the number of bus stops plus markets in the gllamm model used as a fixed effect. Then, we derived the risk ratio and its 95% CI which represented the risk of cholera per one unit increase in the number of bus stops plus markets for each suburb.

Finally, we represented graphically the epidemiological information generated in our analysis in two maps. The absolute number of cholera cases by suburbs and the SRR of cholera by suburb. We used Harare's digital base map, which was developed by the Department of the Surveyor-General of the government of Zimbabwe. The map was digitized based on satellite imagery with Arcview software (Esri, Redlands, CA, USA), including streets, railroads, bus stops, markets and administrative boundaries of suburbs.

We used Stata (StataCorp LP, College Station, TX, USA) for statistical analysis and Arcview to present spatial geographical information.

3. Results

3.1. Epidemic description by person, place and time

During this cholera outbreak, CTCs and ORPs managed by MSF in Harare and Chitungwiza registered and cared for 19 422 persons meeting the case definition. The description of the epidemic by person shows that the population of working age and thus mobile (15 to 44 years old) represented 58.4% of cholera cases during the outbreak in Harare. Children <2 years of age represented 67% of the total cholera cases amongst children <5 years of age (Table 1).

As shown in Table 2, there were gender differences in the proportion of cholera cases by categories of age. There was a higher proportion of men >35 years than women of the same age, although this was not the case with younger men (15-24 years).

The description of the number of cases and attack rates by place (suburb) is presented in Table 3. The suburb with highest attack rate was Hopley with 90.3 cholera cases per 1000 people, 95% CI: 82.8-98.2, followed by Waterfalls, Mbare, Budiriro, Glen View and Glen Norah.

The epidemic curves by suburbs starting from epidemiological week 31 in 2008 (27 July - 2 August) to week 29 in 2009 (19–25 July) showed that the first cholera cases were registered during epidemiological week 34 in 2008

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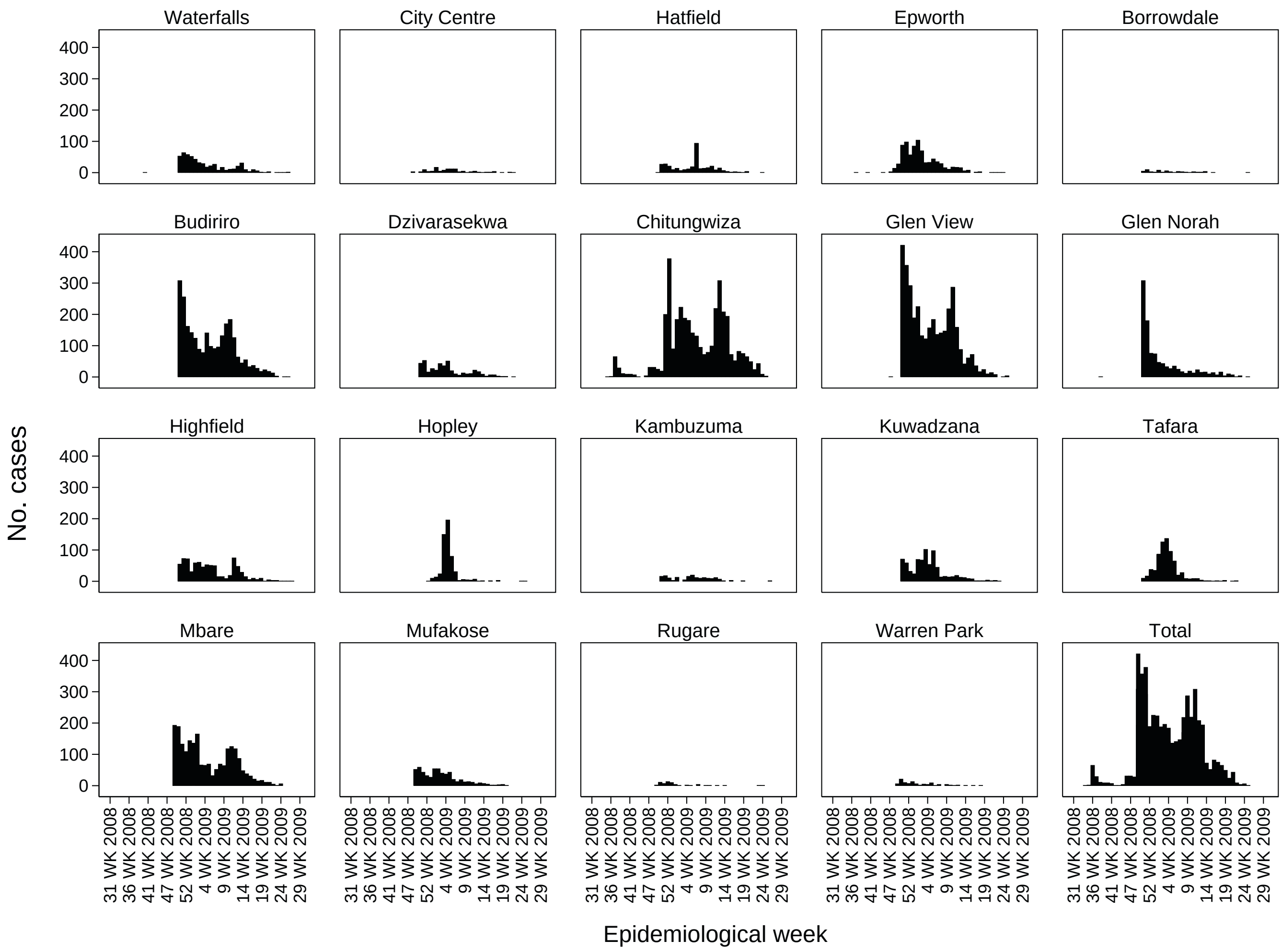

Figure 1. Evolution in time of cholera cases by suburbs in Harare from epidemiological week 31 in 2008 (27 July- 2 August 2008) to epidemiological week 29 in 2009 (19–25 July 2009) (n = 19 422 cases).

in Chitungwiza (17–23 August). The epidemic then rapidly spread to the whole of Harare city starting with Epworth, Waterfalls, Mbare and Glen View. The total duration of the outbreak was 46 weeks. The epidemic presented two peaks; the first one took place in week 50 of 2008 (7-13 December) and the second in week 11 of 2009 (15-21 March[t]) (Figure 1).

3.2. *Spatial distribution of cholera cases and smoothed rate ratios*

The distribution of cholera cases by suburb showed that the south west of Harare and Mbare suburbs were the most affected while industrial areas and north suburbs the least. In Hopley and Waterfalls more than 5% of the population were affected by cholera, and over 2% of the population in Mbare, Budiriro, Glen View and Glen Norah (Figure 2).

The number of cholera cases correlated positively with the number of markets and bus stops by suburb, with an R of 0.52 (P = 0.01). The scatter plot of the rates ratios showed that the increase in number of bus stops plus markets by suburbs augmented the risk of cholera, with an R^2 of 0.31 (P = 0.01) (Figure 3). The increase of one unit in the number of bus stops plus markets by suburbs increased the risk of cholera by 11% (Risk Ratio = 1.11; 95% CI = 0.99–1.23).

The spatial representation of smoothed rate ratios by suburb compared to the whole rate ratio of Harare and Chitungwiza showed a high risk of cholera in Mbare and south west suburbs of Harare (Figure 4).

4. Discussion

This study shows a spatial pattern of the distribution of cholera cases during the epidemic in Harare. This pattern is characterised by a low risk of cholera in the north of Harare, in low density residential areas, and a higher risk in low lying high density south west areas.

This spatial distribution of cases could be linked to the social and historical construction of the city which is characterised by the geographical location of more affluent suburbs, with low densities of population in the north and high density poorer areas in the south. High density population areas and lower socioeconomic status have both been identified as important risk factors in cholera transmission.[12,13] Despite the changes in social and economic conditions since independence, the differences in density of housing persist.[14,15] In the 1990s, two articles warned about the deficit of water supplies in the suburbs of the south of Harare and the problems related with the urban drainage system for resource recovery

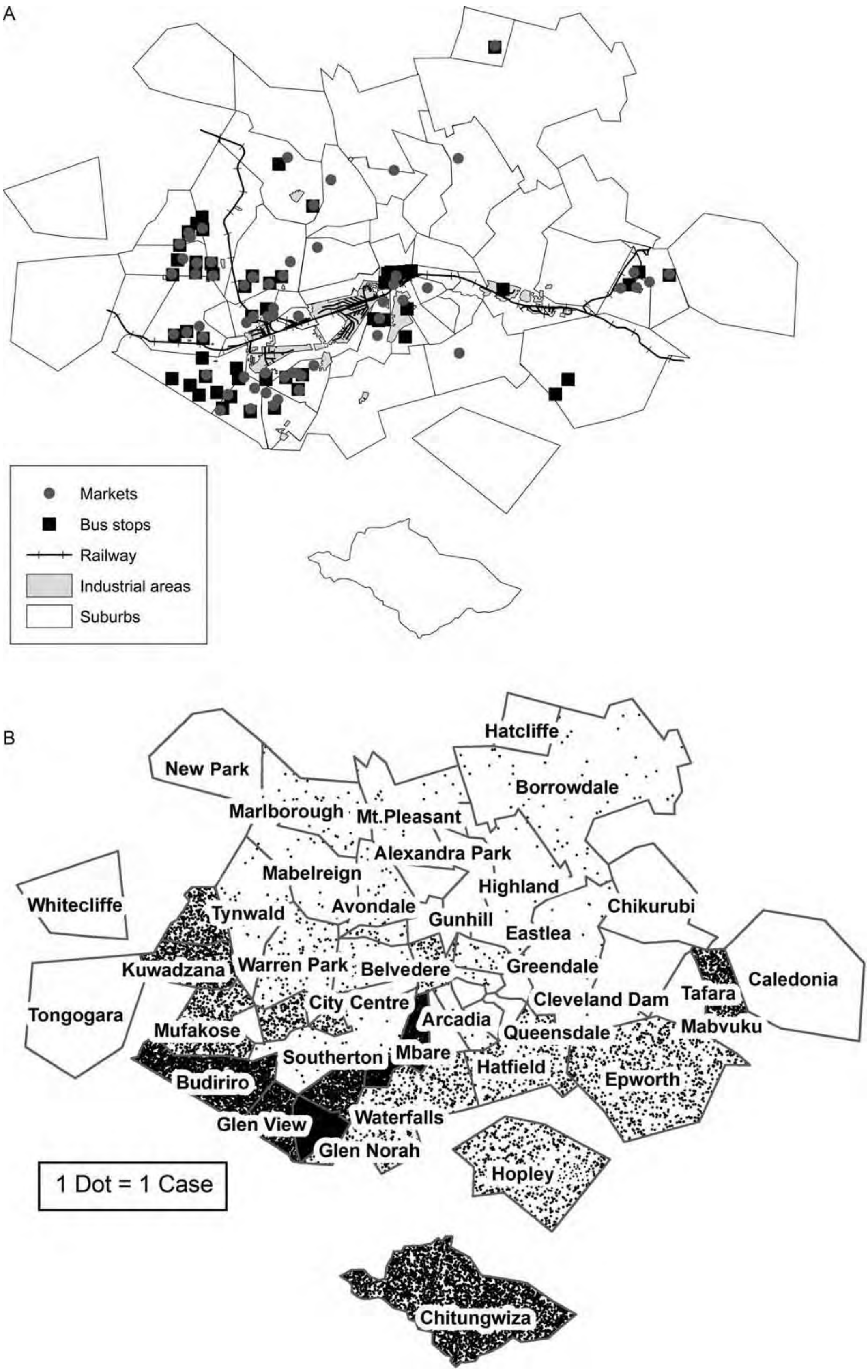

Figure 2. Map of greater Harare, including administrative boundaries, industrial areas, railway, bus stops and markets (2A) in relation to the distribution of cholera cases by suburbs (2B), 2008-2009 ($n = 19\,422$ cases).

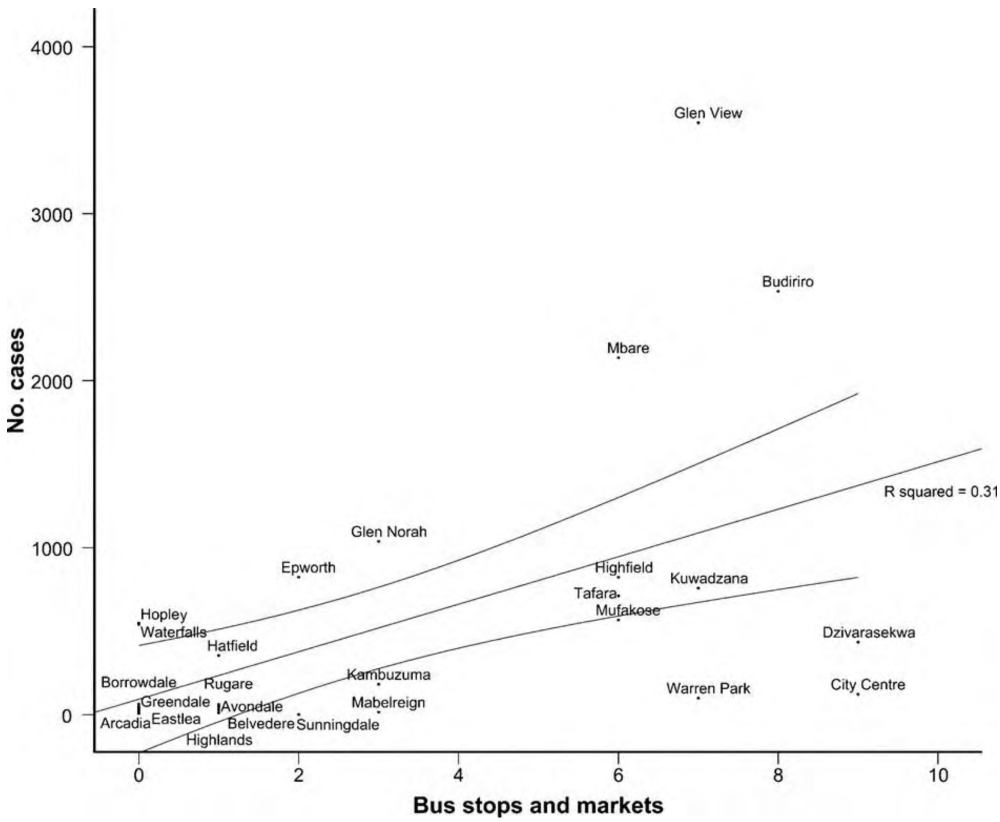

Figure 3. Scatter plot between cholera cases and the number of bus stops plus markets by suburbs in Harare, with a linear interpolation and 95% confidence interval, 2008–2009 (n = 19 422 cholera cases).

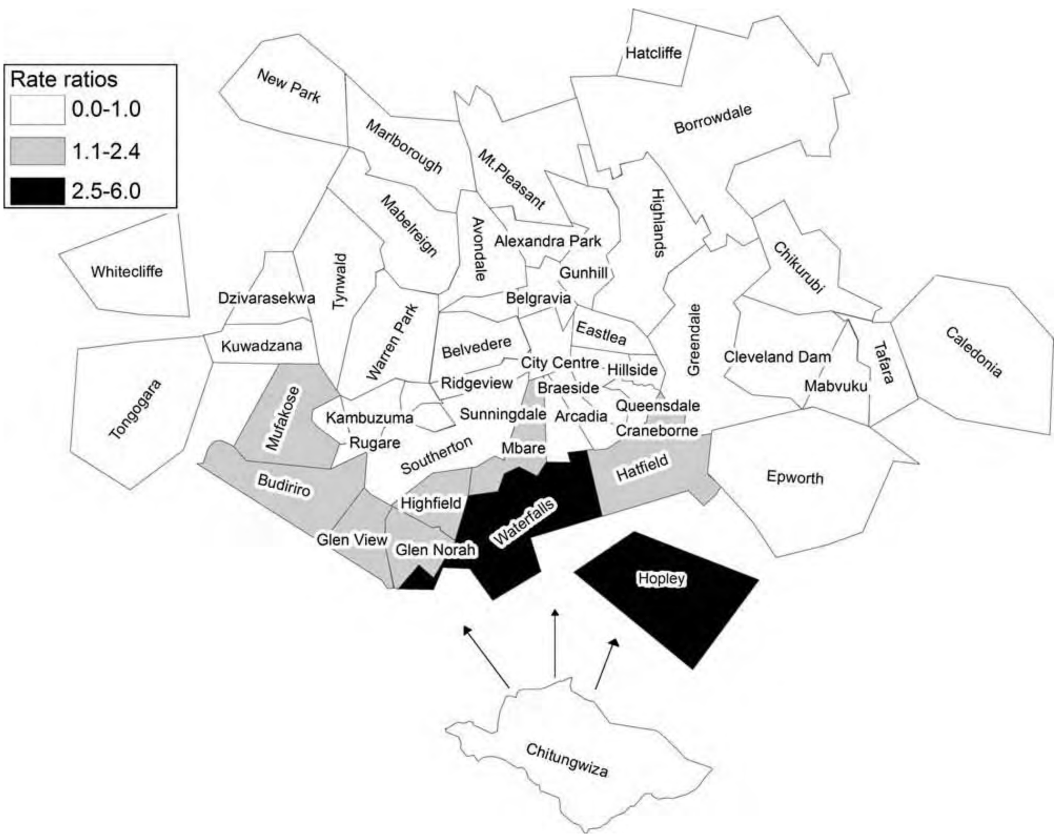

Figure 4. Distribution of smoothed rates ratios by suburbs in Harare 2008–2009 (n = 19 422 cholera cases).

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and protection of drinking water supplies in downstream areas that coincided with south west Harare suburbs and Chitungwiza.[26,27]

Up to now it has been accepted that cholera has become endemic in some rural areas in Zimbabwe but following this outbreak, we can suggest the possibility that there is now a natural reservoir of *Vibrio cholerae* in Harare. In endemic areas cases have been shifting to younger children, with a peak of severe cases at the age of two.[28] By contrast, in epidemic patterns of transmission, such as when *Vibrio cholerae* is introduced into an immunologically naive population, all age groups seem equally susceptible to symptomatic infection.[29] Our study shows that amongst the children five years old or younger, children two years of age or younger were the most affected by the cholera epidemic, suggesting an endemic rather than epidemic epidemiological pattern. Clearly, more in-depth studies of the environment are needed to verify whether an endemic reservoir of *Vibrio cholerae* exists in Harare city or Chitungwiza.

The first cases reported by the CTCs were in Chitungwiza, probably a natural environmental reservoir of *Vibrio cholerae*. Southern suburbs of Harare have numerous bus stops, where people from Chitungwiza arrive in the city for work. Often adjacent to these bus stops are crowded informal markets, popular with commuters, with very poor sanitary conditions.[14,15] Our results show that the mobile working population (15–44 years of age) represented the greatest proportion of cases, strongly suggesting that the combination of a highly mobile infectious working population coming together in the overcrowded and unsanitary conditions found in markets significantly influenced the spread of cholera into the city through person to person transmission.[29–31]

Our data are based on an estimated suburb population and we recognize that the estimates may not reflect the real figures during the epidemic. However we tried to take into account the natural average growth of the population in order to work with most realistic population estimates possible. Waterfalls and Hopley, where there are not bus stops and markets, have a high cholera risk, whereas other suburbs where there are many, as in Dzivarasekwa and Kuwadzana, have a low risk. It may be explained by population figures, with high population density in the former and lower in the later case. However more in-depth analyses are needed in order to understand the dynamic of the epidemic in these suburbs. Another limitation is the impossibility to control the effect of age on the comparison of the rates ratios by suburbs. Though an indirect standardisation of rates by age would be the best option, it was not possible to find figures of population by suburbs stratified by categories of age. Finally, the risk of cholera by suburbs cannot be attributed to one simple individual living in one specific suburb; we need to be aware of the ecological fallacy.

In conclusion, it has been shown that the distribution of cholera cases by suburb in Harare during the outbreak of 2008–2009 followed an identifiable spatial pattern related to the active population movements and high density population areas. The identification of this clear spatial pattern could guide public health action in order to advocate for improving water and sanitation conditions and specific cholera preparedness measures in the most affected areas.

Authors' contributions: MALF and PM developed the concept and design of the study; JF acquired the data; MALF developed analyses; MALF carried out the analyses and all authors interpreted the data; MALF wrote the manuscript. All authors drafted the manuscript, revised critically the content and gave technical support and conceptual advice. Finally, all authors read and approved the final manuscript. MALF is guarantor of the paper.

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Conflicts of interest: None declared.

Ethical approval: The study protocol was approved by the Ethical Review Board of Médecins Sans Frontières.

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Short Report

Increased risk of maternal deaths associated with foreign origin in Spain: a population based case–control study

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In Europe, different studies have identified immigrant women coming from developing countries as a risk group for maternal death. In Spain, an ecological study showed higher maternal mortality rates among foreign mothers compared with Spanish mothers during 2003–04. To examine whether the maternal death risk among foreign mothers in Spain is increased, we performed a population-based matched case–control study. Each case of maternal death during 1999–2006 was matched with four mothers who had given birth during the same year the case occurred. The National Statistics Institute provided the data. The variables in the study were maternal age and country of origin. We used a conditional logistic regression analysis. Adjusted by age, the risk of maternal death was 87% higher among foreign mothers. This study confirms that there is an increased risk of maternal death among foreign mothers in Spain. It would be desirable to analyse the socio-economic and healthcare circumstances surrounding the deaths.

Keywords: epidemiology, ethnic groups, maternal age, maternal mortality

Introduction

From 1930 through the 1980s, the maternal mortality ratio registered a clear decline in most European countries, with it then remaining stable in the following years.[1,2] In the 1990s, different authors forecasted a rise in the maternal mortality ratio by the beginning of the 21st century, specifically in Europe and related to maternal age and immigration.[3,4] A recent ecological study confirmed a change in the maternal mortality pattern in Spain over the decade, 1996–2005, marked by a rising trend and an increased risk at advanced maternal ages.[5] This study detected a cluster of maternal mortality from 2003 to 2004, where 32% of maternal deaths occurred among foreign mothers during the 2-year period.[5] In this respect, other studies have identified women at advanced reproductive age and immigrants coming from developing countries as risk groups for maternal death.[4,6] However, the data yielded in that study do not enable us to specify what percentage of the 32% recorded for deaths among foreign mothers is attributable to mothers from developing countries. Finally, interpreting aggregated data can result in an ecological fallacy.

To test whether there was an increased risk of maternal death among foreign mothers, this study aimed to compare the risk of maternal death between foreign and Spanish mothers from 1999 to 2006 in Spain.

Methods

We performed a population-based matched case–control study. Cases and controls were taken from a source population of mothers who were pregnant or had given birth during the study period. All maternal deaths (cases) were drawn from the National Register of Death Statistics and broken down by cause of death, based on the death certificate. Codes (O00–O99) of the International Classification of Diseases, 10th Revision (ICD-10), were used to identify all of the maternal deaths that occurred during the study period. The definition of maternal death used was the one proposed by the ICD-10. Controls were drawn from the National Register of Live Births portion of the Natural Population Movement Statistics, for which the official data source is the birth

Table 1 Data from a conditional logistic regression of maternal deaths among cases and controls according to maternal age and country of origin, Spain 1999–2006 ($n=665$, 133 matched sets)

Variables	Cases, *n* (%)	Controls, *n* (%)	OR (95% CI)
Maternal age (years)			
≥40	18 (13.5)	21 (4.0)	4.38 (0.82–23.51)
30–39	77 (58.0)	303 (57.0)	1.24 (0.26–5.88)
20–29	36 (27.0)	199 (37.4)	0.81 (0.16–3.87)
≤19	2 (1.5)	9 (1.7)	1
Maternal country of origin			
Foreign countries	21 (15.8)	52 (9.7)	1.87 (1.04–3.34)
Spain	112 (84.2)	480 (90.2)	1

registration form. Both registers are managed by the National Statistics Institute of Spain.[7]

The variables in the study were maternal age at the moment of birth and maternal country of origin, defined as the mother's country of birth.[8] Maternal age was categorized in four groups (≤19, 20–29, 30–39 and ≥40 years), and the maternal country of origin was dichotomized as Spain and foreign country.

To increase the power of the study, four controls were matched to each case (1:4). The controls were randomly selected among the mothers who had given birth during the same year the case had occurred.

For statistical analysis, we conducted a description of cases and controls. Results are expressed as mean ± SD. We then performed a univariate analysis, introducing age as a continuous variable to test the effect of age on the risk of maternal death. Finally, we performed a conditional logistic regression of maternal deaths among cases and controls according to maternal age and country of origin. The reference categories were mothers ≤19 years for maternal age and Spain for maternal country of origin. Adjusted matched odds ratios (ORs) were derived from the model with their respective 95% confidence intervals (CIs), and the attributable risk of maternal death was calculated using the following formula[9]: $100 \times (\mathrm{OR}-1)/\mathrm{OR}$.

The statistical software programme used was Stata v.10 (StataCorp, College Station, TX, USA).

Results

We compared 133 cases with 532 controls matched by year (133 matched sets). The mean ages were 33.1 ± 6.3 and 30.8 ± 5.1 years for cases and controls, respectively.

A total of 15.8% ($n=21$) of cases and 9.7% ($n=52$) of controls were of foreign nationality. Among the cases (mothers who had died), 12 (57%) originated from Central and South America and 5 (24%) from sub-Saharan Africa. The remaining four (19%) were Ukrainian, English, Moroccan and Chinese.

In the univariate analysis for each year of increased age, the OR for maternal death increased by 8%, and the matched OR was 1.08 (95% CI 1.04–1.12).

Table 1 presents the analysis of maternal death risk adjusted for age and country of origin. In Spain, between 1999 and 2006, the OR of maternal death was 87% higher for foreign mothers compared with Spanish mothers, independent of the mother's age. Finally, the attributable risk of maternal death for foreign mothers was 45.3% (95% CI 2.0–88.8).

Conclusions

The results of this study confirm that there is a higher maternal death risk among foreign mothers in Spain. To our knowledge, this is the first study reporting a higher risk of maternal death among foreign mothers in Spain at an individual level. This result coincides with different studies from other countries that have identified women of advanced reproductive age and immigrants from developing countries as risk groups for maternal mortality.[4,6] Two studies conducted in the USA and Europe highlighted the wide disparity between immigrants from developing countries and the native population in terms of access to healthcare.[10,11] Communication problems between health professionals and immigrant patients have been postulated as being a key factor underlying this problem.[12] Whether maternal country of origin and ethnicity are risk factors themselves for maternal deaths is a matter of debate. Rather, they might simply be a social construct that reflects more meaningful factors such as culture, economics and baseline health.[10]

The length of the period studied limits the consistency of the study. This could be addressed by analysing a longer time series; however, maternal nationality was not available in the maternal death statistics, by cause of death before 1999. Nevertheless, we want to highlight the strength of the use of the national registers and the absence of recall bias. Another limitation of the study is the under registration and under-reporting of maternal deaths that authors have highlighted in different European countries.[12,13]

This study shows an increased risk of maternal death among foreign mothers in Spain. Maternal mortality is regarded as a preventable cause of death that is strongly related to the quality of the healthcare system and economic and social factors. The quality of healthcare and maternal care provided to pregnant women is an element that may account for the differences in maternal deaths.[14,15]

In Spain, it would be desirable to implement a maternal mortality active surveillance system and the use of confidential qualitative surveys to allow for the analysis of socio-economic and healthcare circumstances surrounding these deaths. In-depth understanding and characterization of a preventable phenomenon, such as maternal death, would contribute to understanding the differences between the groups and to reducing maternal mortality among foreign and Spanish mothers.

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Conflicts of interest: None declared.

Key points

- In Europe, different studies have identified immigrant women coming from developing countries as a risk group for maternal death. In Spain, an ecological study showed higher maternal mortality rates among foreign mothers compared with Spanish mothers during 2003–04.
- The results of this study confirm, at an individual level, that there was a higher risk of maternal death among foreign mothers in Spain during 1999–2006.
- In Spain, it would be desirable to use qualitative surveys to analyse the socio-economic and healthcare circumstances surrounding these deaths to understand the differences in maternal mortality between the groups.

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Cohort study of an outbreak of viral gastroenteritis in a nursing home for elderly, Majorca, Spain, February 2008

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An outbreak of acute gastroenteritis occurred in a nursing home for elderly in Majorca between 4 and 23 February 2008. To know its aetiology and mechanism of transmission a retrospective cohort study was conducted with a fixed cohort including 146 people (96 residents and 50 employees). The data were collected from clinical histories and through a survey by questionnaire. In total 71 cases were identified (53 residents, 18 employees), corresponding to an overall attack rate (AR) of 48.6%. The consumption of tap water, adjusted by age, sex and consumption of meals provided at the nursing home, presented a relative risk (RR) of 4.03 (95%CI, 1.4-11.4). The microbiological analyses confirmed the presence of norovirus and/or rotavirus in five of the seven stool samples submitted. The slow appearance of cases at the beginning of the outbreak is characteristic of a person to person transmission, while the sudden peak in the middle of the month suggests a common source such as the tap water. We therefore concluded that the outbreak likely originated from two sources: an infected employee of the nursing home and the tap water. The high number of dependent residents most probably facilitated the spread of the outbreak.

Introduction

The progressive aging of the Spanish population increases the demand for residential services. The resulting increase of the numbers of nursing homes and their residents has favoured the emergence of acute gastroenteritis outbreaks in these institutions over the past years [1]. Given the risk characteristics of this particular population, these outbreaks are characterised by high morbidity with high attack rates and long duration [2].

Enteropathogenic viruses, including caliciviruses, are the most common causal agents in these outbreaks [3-5]. Rotaviruses are also responsible for severe diarrhoea, but mainly in children [6,7]. Nevertheless, outbreaks of acute gastroenteritis in nursing homes for elderly caused by rotavirus have been described in the literature [8-10].

In Spain, little information is available on morbidity and mortality associated with norovirus infection, its distribution among the population, and many of its epidemiological characteristics. This is primarily due to the fact that sample collection and laboratory screening for noroviruses is not done routinely [11]. Compared to other EU countries, not many studies of gastroenteritis outbreaks caused by norovirus are described in general and in nursing homes in Spain in particular [4, 12-15].

It is estimated that norovirus is the most common cause of acute gastroenteritis in some European Union countries, with 6% and 11% of all intestinal infectious diseases attributed to norovirus in the United Kingdom and the Netherlands, respectively [16,17].

Noroviruses are transmitted primarily through the faecal-oral route, either by direct person-to-person spread or by faecally contaminated food or water. Secondary and tertiary cases appear quickly through a person-to-person transmission. Noroviruses can also spread via a droplet route from vomits [18,19].

In healthcare facilities, transmission can additionally occur through hand transfer of the virus to the oral mucosa via contact with materials, fomites, and environmental surfaces that have been contaminated with either faeces or vomits. These circumstances make it extremely difficult to control outbreaks in institutional settings [20,21].

Between 4 and 23 February an outbreak of acute gastroenteritis occurred in an elderly nursing home in Majorca, Spain. The outbreak was characterised by a slow start followed by an explosive increase in the number of cases which may be linked to a common source. To contain the outbreak, between 9 and 11 February, the nursing home authorities implemented the following control measures: enteric isolation, cleaning of areas contaminated by vomit, restriction of visitors, suspension of the consumption of tap water, distribution of bottled water, cleaning and chlorination of the water cistern, and stool sampling. The notification of a suspected gastroenteritis outbreak was sent to the health authorities of the Balearic Islands on 13 February. In view of the microbiological confirmation of a mixed viral aetiology (norovirus and rotavirus) and the high attack rate, an epidemiological investigation to determine the causes and transmission routes of the outbreak was launched on 5 March.

Methods

Study design

A retrospective cohort study was conducted including all residents and employees (health workers, cleaning, laundry and maintenance service and administration) who were present in the nursing home in February. The observation period covered 29 days, from 1 to 29 February 2008. Persons who were admitted to or began employment in the nursing home after 29 February or those who were not present for the entire period of 29 days were excluded from the study.

A case of gastroenteritis was defined as any person working or residing in the nursing home during the month of February 2008 who had an episode of acute diarrhoea (defined as three or more liquid stools in 24 hours) or vomiting, or two or more of the following signs: fever, abdominal pain, malaise and nausea.

Data source and epidemiological survey

Two data sources were used. The first one was a computerised database with the medical history of all residents of the nursing home. Information on the employees was obtained through an epidemiological self-administered survey. The questionnaire collected data on the employment position, working shifts and location within the nursing home (ground- or first floor, module A, B or C), as well as consumption of meals and drinking of tap water at the workplace during the month of February and on days 8, 9 and 10 of the same month (these dates were chosen taking into consideration the peak in case numbers on 13 February and the 72-hour incubation period). Finally, questions concerning symptoms experienced during the month of February, history of the disease and information on family members affected.

Microbiological analysis

Stool samples were collected by the medical doctor of the nursing home and sent for routine bacteriological testing to the reference laboratory in the Balearic Islands. Subsequently, as viral origin was suspected in this outbreak, the health authorities of the Balearic Islands sent the available samples to the laboratory of the National Centre of Microbiology in Majadahonda near Madrid where polymerase chain reaction (PCR) was used for identifying norovirus and Elisa test for the identification of rotavirus.

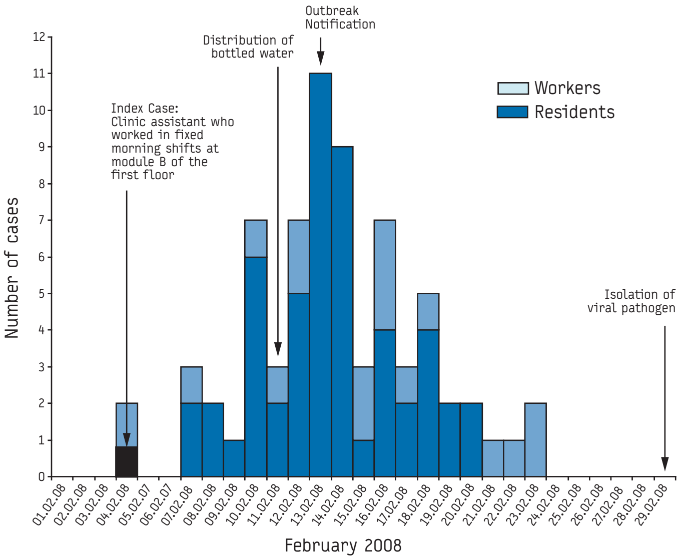
Samples of drinking water could not be taken by the outbreak investigation team because on 26 February cleaning and chlorination of the water cistern of the residence was carried out. Food samples from different meals were collected during the week between 11 and 17 February, i.e. before the arrival of the outbreak investigation team, and were tested for bacteria only.

Statistical analysis:

Common statistical methods were used for describing the variables related to personal data and place of work or residence within the nursing home. A univariate descriptive analysis was done to study the risk factors of employees and residents. The attack rate, the incidence densities, incidence density ratios (IDR) and the aetiological fractions due to exposure were calculated with their respective 95% confidence interval. The incidence densities were expressed in person-days. The differences of rates were analysed through the Fisher's Exact Test [22]. Finally, multivariate analyses using Cox regression with explanatory purpose were done to test the foodborne and the waterborne hypotheses, adjusted for age and sex. The overall significance of the model was verified through a maximum likelihood ratio test and the individual significance using p value of $\chi 2$ (chi square) by Wald's test. The resulting model relative risks (RR) were expressed with their respective 95% CI. The verification of the hypothesis of proportionality of risks was carried out using the graphic method of logarithmic survival curves: $Ln(-Ln\hat{S}(t))$. The study of outliers and influential values was done through the analysis of the residuals. EPIDAT v.3.1 was used for the data collection and Stata v.10 for the data analysis.

Figure 1

Epidemic curve of cases, by date of onset of symptoms, outbreak of gastroenteritis in a nursing home for elderly, Majorca, February 2008 (n=71)



Results

The study population consisted of 168 persons, 96 of them were residents and 72 employees of the nursing home. Information was obtained from 146 people; 100% (n= 96) of the residents and 69% (n=50) of the employees. Among the 50 employees included in the study, 38 (76%) were health workers. Among the 22 employees who did not respond to the questionnaire, nine worked in administration, management or services (laundry, cleaning and cooking) and 13 were health workers.

Descriptive analysis of the residents

The sex ratio (males to females) among residents was 0.2 and the median age was 82 years, with an interquartile range (IQR) of 12. Over 60% of the residents needed help to perform activities of daily living. Dementia was present in 54% and 41% were incontinent. Among the residents, 53 (55%) fulfilled the case definition. The most common symptom was diarrhoea, present in 98% of the cases. All residents ate the meals provided by the nursing home and drank the tap water of the nursing home until distribution and consumption of bottled water was ordered by the director on 11 February.

Descriptive analysis of the employees

Among the employees, the sex ratio (males to females) was 0.06. The median age was 37.7 years (IQR: 17). The median time at workplace was six months. Five (10%) employees drank tap water

Table 1

Attack rates and incidence densities in the cohort, by residents, employees, consumption of meals and drinking of tap water; outbreak of gastroenteritis in a nursing home for elderly, Majorca, February 2008 (n=146)

Variables	Cohort	Cases	Attack rate (%) (95% CI)	Incidence density* (95% CI)	P value**
	146	71	48.6 (38.5-61.3)	2.3 (1.8-2.8)	
Cohort					0.02
Residents	96	53	55.2 (42.1-72.2)	2.7 (2.1-3.6)	
Employees	50	18	36.0 (22.6-57.1)	1.5 (0.9-2.4)	
Employees					0.13
Health workers	37	16	42.1 (25.7-68.7)	1.8 (1.1-2.9)	
Others***	13	2	16.6 (4.2-66.6)	0.6 (0.1-2.5)	
Sex					0.39
Male	23	13	48.7 (37.5-63.2)	2.2 (1.7-2.9)	
Female	123	58	56.5 (32.3-97.3)	2.8 (1.6-4.8)	
Drinking of the nursing home tap water					< 0.05
Yes	102	58	56.8 (43.9-73.5)	2.8 (2.2-3.7)	
No	44	13	29.5 (17.1-50.8)	1.1 (0.6-1.9)	
Diet					0.09
Standard	59	32	54.2 (38.3-76.7)	2.6 (1.9-3.7)	
Diabetic	19	12	63.1 (35.8-111.2)	3.3 (1.8-5.7)	
Soft	13	8	61.5 (30.7-123.0)	3.5 (1.7-6.9)	
Pureed	14	4	28.5 (10.7-76.1)	1.2 (0.4-3.1)	
Do not eat meals at the nursing home	41	15	36.5 (22.0-60.6)	1.5 (0.9-2.5)	

* Incidence density per 100 people and day
** P value of χ^2 of Fisher's exact test
*** Cleaning, laundry and maintenance service and administration

Table 2

Univariate analyses of gastroenteritis cases in residents of the nursing home, outbreak in Majorca, February 2008 (n=96)

Variables	Cohort of residents	Cases	Attack rate (%) (95%CI)	Incidence density* (95%CI)	Incidence density ratio (95%CI)	Attributable fraction (exposed) (95%CI)
Sex						**
Female	76	41	53.9 (39.7-73.2)	2.6 (1.9-3.5)	1	
Male	20	12	60.0 (34.0-105.6)	3.1 (1.7-5.4)	1.2 (0.5-2.2)	15.2 ([-7.7]-5.6)
Age in years						**
≤ 80 years	43	25	58.1 (39.2-86.0)	2.9 (2.0-4.4)	1.2 (0.6-2.1)	15.6 ([-5.1]-52.6)
≥ 81 years	53	28	52.8 (36.4-76.5)	2.5 (1.7-3.6)	1	
Independent in the activities of daily living						**
Yes	38	21	55.1 (39.2-78.0)	2.6 (1.7-4.0)	1	
No	58	32	55.2 (36.0-84.7)	2.8 (1.9-3.9)	1.1 (0.6-1.9)	5.7 ([-6.8]-48.3)
Physical disability* **						**
Yes	36	18	50.0 (31.5-79.3)	2.4 (1.5-3.8)	1	
No	59	35	59.3 (42.5-82.6)	2.9 (2.1-4.1)	1.22 (0.7-2.3)	18.2 ([-48.2]-56.4)
Dementia						**
Yes	52	26	50.0 (34.0-73.4)	2.4 (1.6-3.6)	1	
No	44	27	61.3 (47.1-89.4)	3.0 (2.1-4.5)	1.2 (0.7-2.2)	21.0 ([-40.5]-55.7)
Control sphincters						**
Yes	56	28	50.0 (34.5-72.4)	2.4 (1.7-3.6)	1	
No	40	25	62.5 (42.2-92.4)	3.1 (2.1-4.6)	1.3 (0.7-2.2)	20.0 ([-43.0]-55.0)
Diet						**
Standard	50	29	58.0 (40.3-83.4)	28.8 (20.0-41.5)	2.4 (0.8-9.5)	59.1 ([-16.3]-89.5)
Diabetic	19	12	63.1 (35.8-1112)	32.6 (18.5-57.4)	2.7 (0.8-11.7)	63.8 ([-19.3]-91.4)
Soft	13	8	61.5 (30.7-123.0)	34.6 (17.3-69.2)	2.9 (0.8-13.3)	65.9 ([-27.1]-92.5)
Pureed	14	4	28.5 (10.7-76.1)	11.8 (4.4-31.4)	1	
Type of room						**
Simple	46	23	50.0 (36.1-63.8)	2.3 (1.5-3.5)	1	
Double	50	30	60.0 (46.1-72.4)	3.1(2.1-4.4)	1.3 (0.7-2.7)	24.1 ([-30.6]-55.9)
Floor						**
Ground floor	24	11	45.8 (25.3-82.7)	1.9 (1.0-3.5)	1	
Second floor	72	42	58.3 (43.1-48.0)	3.0 (2.2-4.1)	1.5 (0.8-3.3)	35.8 ([-26.7]-70.2)

* Incidence density per 100 people and day
** P value > 0.05 of χ^2 of Fisher's exact test
*** Information on physical disability was available for 95 of the 96 residents in the cohort (one missing)

Figure 2

Survival function of the tap water adjusted by age, sex and consumption of meals at the nursing home, outbreak of gastroenteritis in Majorca, February 2008 (n=146, 48.6% cases)

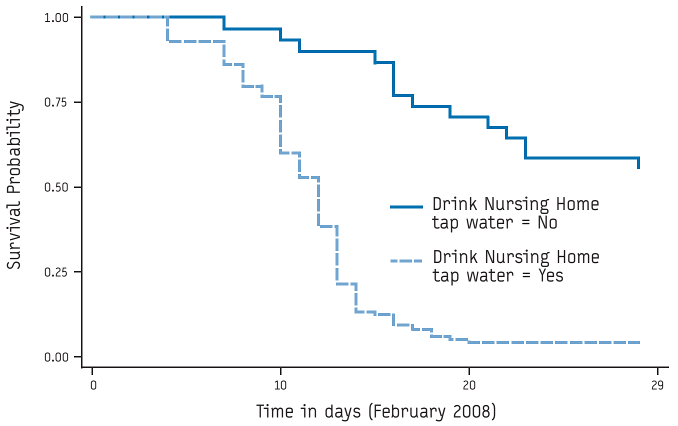


Figure 3

Verification of the hypothesis of proportional risks assumption, logarithmic survival curves, Ln(-LnŜ (t)), outbreak of gastroenteritis in a nursing home for elderly, Majorca, February 2008

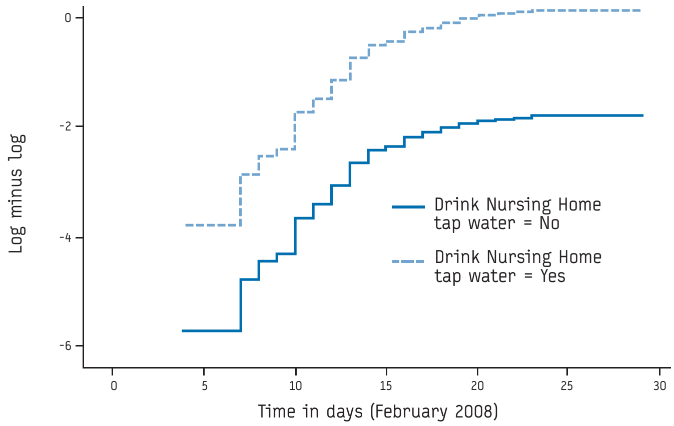


Table 3

Univariate analyses of gastroenteritis cases in employees of the nursing home, outbreak in Majorca, February 2008 (n=50)

Variables	Cohort of employees	Cases	Attack rate (%) (95% CI)	Incidence density* (95% CI)	Incidence density ratio (95% CI)	Attributable fraction (exposed) (95% CI)
Sex						**
Female	47	17	36.1 (22.4-58.1)	1.5 (0.9-2.3)	1.1 (0.2-48.5)	13.9 ([-4.5]-97.9)
Male	3	1	33.3 (4.7-23.6)	1.2 (0.2-9.2)	1	
Age in years* **						
≤ 24	8	3	37.5 (12.116.2)	1.5 (0.5-4.8)	1.5 (0.2-1.7)	36.3 ([-37.5]-91.4)
25-34	12	3	25.0 (8.0-77.5)	0.9 (0.3-3.0)	1	
35-44	12	6	50.0 (22.4-111.2)	2.1 (0.9-4.8)	2.1 (0.4-13.5)	54.2 ([-11.4]-92.6)
≥ 45	15	6	40.0 (17.9-89.0)	1.7 (0.7-3.8)	1.7 (0.4-6.9)	43.2 ([-12.2]-85.5)
Job position						
Health workers	38	16	42.1 (25.7-68.7)	1.8 (1.1-2.9)	2.9 (0.7-2.6)	65.7 ([-45.6]-96.1)
Others****	12	2	16.6 (4.1-66.6)	0.6 (0.1-2.4)	1	
Working hours						
Day shift	16	8	50.0 (25.0-99.9)	2.2 (1.1-4.4)	2.3 (0.5-13.4)	56.5 ([-81.2]-92.5)
Afternoon shift	8	3	37.5 (12.0-116.2)	1.6 (0.5-5.0)	1.6 (0.2-12.5)	40.5 ([-34.3]-92.0)
All shifts	3	1	33.3 (4.6-23.6)	1.4 (0.2-10.1)	1.5 (0.1-18.6)	33.0 ([-342.2]-94.6)
Day/night shift	11	3	27.2 (8.7-84.5)	1.1 (0.3-3.4)	1.1 (0.1-8.6)	13.1 ([-54.8]-88.3)
Day/Afternoon shift	12	3	25.0 (8.0-77.5)	0.9 (0.3-2.9)	1	
Length of employment in months						**
11-14 months	10	5	50.0 (20.8-120.1)	2.3 (9.9-57.4)	2.6 (0.5-13.2)	61.2 ([-76.9]-92.4)
7-10 months	11	5	45.4 (18.9-109.2)	2.0 (8.5-49.4)	2.2 (0.5-11.3)	55.7 ([-105.7]-91.2)
4-6 months	12	4	33.3 (12.5-88.8)	1.2 (4.8-34.0)	1.4 (0.3-7.35)	28.7 ([-282.7]-86.7)
0-3 months	17	4	23.5 (8.8-62.6)	0.9 (3.4-24.2)	1	
Location at the workplace (floor and module) in February						**
Ground floor	10	3	30.0 (9.6-93.0)	1.1 (0.3-3.5)	1.4 (0.2-8.2)	28.0 ([-391.7]-87.8)
Second floor, module A	7	2	28.5 (7.1-114.2)	1.1 (0.2-4.3)	1.3 (0.1-9.1)	23.7 ([-743.3]-89.0)
Second floor, module B	6	4	66.6 (25.0-117.6)	4.5 (1.7-12.1)	5.5 (1.0-29.6)	81.8 (2.5-96.6)
Second floor, module C	8	5	62.5 (26.0-150.1)	2.7 (1.1-6.5)	3.3 (0.7-16.6)	69.6 ([-41.0]-93.9)
Both floors	19	4	21.0 (7.9-56.0)	0.8 (0.3-2.1)	1	
Consumption of the nursing home meals in February						**
Yes	9	3	33.3 (10.7-103.3)	1.4 (0.4-4.3)	1	
No	41	15	36.5 (22.0-60.6)	1.5 (0.9-2.5)	1.1 (0.3-5.8)	7.4 ([-227.0]-82.8)
Drinking of the nursing home tap water in February						**0.01**
Yes	5	4	80.0 (30.0-213.1)	6.5 (2.4-17.4)	**5.3 (1.2-17.0)**	**81.3 (0.2-94.1)**
No	45	14	31.1 (18.4-52.5)	1.2 (7.2-20.7)	1	

*Incidence density per 100 people and day
** P value > 0.05 of χ^2 of Fisher's exact test
*** Information on age was available for 47 of the 50 employees in the cohort (three missing)
**** Cleaning, laundry and maintenance service and administration; (working in administration was not reported by any case)

from the cistern of the nursing home during the month of February, and nine (18%) ate the standard menu during the same time. 18 cases (36%) were identified among the employees. The most common symptom reported by employees was diarrhoea, followed by abdominal discomfort.

Descriptive temporal analysis

The outbreak began on 4 February and lasted until 23 February. The first two cases with onset of symptoms on 4 February were employees of the centre. Both were included in the study but only one provided detailed answers to all questions in the questionnaire. This index case was a nursing assistant who during the month of February worked in fixed morning shifts in the module B on the first floor. This person was diagnosed with acute gastroenteritis by a physician. The relatives of the index case were also affected and began to show symptoms on 6 February (Figure 1).

The outbreak peaked on 13 and 14 February (11 and 9 cases, respectively). The latest reported date of onset of symptoms was 23 February (two cases).

Attack rates, incidence densities

The overall attack rate (AR) was 48.6% (95% confidence interval, CI, 38.5-61.3). The AR among the employees (n=50) was 36% (95%CI, 22.6-57.1). The AR among the residents (n= 96) was 55.2% (95%CI, 42.1-72.2).

There were no significant differences between attack rates and the incidence densities according to sex and consumption of the menu. However, the risk of illness following consumption of tap water from the nursing home was significantly higher among those who drank it compared to those who did not (Table 1).

Univariate analysis

Among residents, women of any age and people of both sexes below 80 years of age were most affected. Being resident of the first floor in a double room, incontinent and dependent on the staff to handle the basic activities of daily living, posed a greater risk of infection. The risk of residents of double rooms was 30% higher (IDR: 1.3 CI95% [0.7-2.2]) than those of single rooms. There were no significant differences between risks related to different diets (i.e. standard, diabetic, pureed, etc.) within the meals consumed in the nursing home (chi square of Fisher's exact test for unequal rates, p= 0.098) (Table 2).

Among employees, health workers between 34 to 44 years of age, with fixed morning shifts attached to the module B of the first floor and more than 10 months at the workplace had a higher risk of acute gastroenteritis. The consumption of tap water during the month of February is the highest risk factor associated with the acute gastroenteritis (Table 3).

Multivariate analysis

The consumption of tap water during the month of February is a clear risk factor for gastroenteritis within employees and residents. The unadjusted risk ratio for drinking tap water was 2.5 95% CI (1.3-4.5). Regardless of age, sex and consumption of the menu, individuals from the cohort, who drank water, were four times more at risk of acute gastroenteritis than those that did not consume (Table 4, Figures 2 and 3).

Laboratory results

On 29 February the results of laboratory analysis of samples taken during the outbreak confirmed the isolation of viral enteropathogenic agents in five of the seven samples submitted: norovirus in three of them, rotavirus in one and both norovirus and rotavirus in the fifth one. The food samples tested during the outbreak were negative for bacteria.

Discussion

The description and the epidemiological analysis of the outbreak allow us to reconstruct the possible source and subsequent transmission of infection in the nursing home. The index case of 4 February was a clinic assistant who worked in fixed morning shifts at module B of the first floor. In this module, where the outbreak began among residents, it is likely that the index case introduced the virus into the residence. This hypothesis is also supported by the fact that the washing and changing clothes of residents is done during the morning shift, the workload is bigger than in the other shifts and the contact between employees and residents is closer.

Regarding the transmission of the outbreak, the epidemic curve with mild start and slow spread until 9 February would support the hypothesis of introduction of rotavirus from outside through the index case. However, on 13 and 14 February an explosive peak, lasting two-days, occurred affecting only residents. Knowing the pathogenesis of norovirus, its epidemiological characteristics and the fact that calicivirus outbreaks have been associated with a common water source [23-27], it is likely that this peak was due to consumption of tap water from the nursing home. All residents and five (10%) of employees in the centre drank tap water until 11 February, when distribution of bottled water was imposed due to the suspicion of an acute gastroenteritis outbreak. Within 72 hours after the closure of the cistern the highest case load per day were reported. In addition, all these cases had drunk tap water before. If we take into consideration the incubation period of these viral agents, the epidemic peak of day 14 and 15 corresponds well to the prohibition to consume tap water and the provision of bottled drinking water. This assumption is further supported by the results of the statistical analysis. The risk of gastroenteritis was four times higher in those individuals of the cohort who had consumed tap water regardless of age, sex and consumption of the nursing home meals. From the qualitative information obtained from staff interviews, we understood that days before the start of the outbreak there were complaints from residents of a bad taste of the tap water.

Table 4

Multivariate analyses by Cox regression model of gastroenteritis cases categorised by age, sex and consumption of meals and tap water at the nursing home, outbreak in Majorca, February 2008 (n=146)

Variables	Beta coeff cient	Standard error	Relative risk (95%CI)	P value*
Age (in years)	-0.01	0.01	0.99 (0.97-1.01)	0.17
Sex (female vs male)	-0.03	0.31	1.03 (0.53-1.79)	0.93
Drinking of tap water (yes vs no)	1.39	0.53	**4.03 (1.42-11.38)**	**0.01**
Consumption of meals (yes vs no)	-0.05	0.25	0.96 (0.58-1.56)	0.85

* P value of χ^2 Wald's test

There were no differences between the risks related to different diets, so the alimentary hypothesis was rejected. The risk of acute gastroenteritis was similar for those who usually ate at the residence as for those who did not, and multivariate analysis confirmed the absence of association between the outbreak and having meals at the nursing home.

Therefore, disregarding the hypothesis of food source, we consider as very likely the coexistence of two routes the outbreak was introduced into the nursing home. The first was infection imported from outside, most likely by the index case we identified, which progressed by a person to person transmission. The second was a common source, most likely the tap water.

The outbreak took place in a closed setting which usually results in high attack rates. However, in this outbreak, the double source could also explain the high virulence and high transmissibility of infection, that affected half of the cohort and a density incidence of 2.3 (95%CI: 1.8-2.8) cases per 100 person-days. The unique dynamics in the transmission of this outbreak makes it markedly different from other outbreaks in nursing homes studied in Spain [4, 10-13].

After the peak on 13 and 14 February, the outbreak adopted a person to person transmission pattern affecting employees and residents. This hypothesis is supported by the high attack rates in both incontinent and dependent residents and health workers in fixed morning shifts of module B of the first floor. In addition, the risk of becoming ill among health workers was greater for those with fixed morning shifts, when as previously commented workers usually have more contact with residents. This phenomenon of spreading the disease by person to person is recurrent in different outbreaks described in nursing homes in Spain and in health care settings in other European countries [4,12-15, 28].

The greatest risk of becoming ill in the group of dependent residents and those with incontinent sphincter may be related to the special care they required. In this group of residents, the health worker per resident ratio is one per 12. As 60.4% of the residents needed assistance in performing activities of daily living, and 41% were incontinent, this might be a factor to take into account when trying to understand the difficulty of controlling the mechanism of person to person transmission in an outbreak in such setting.

Considering the limitations of this study, we must be prudent in interpreting the results where statistically significant associations were not found, since there is a possibility of false negative results in the statistical analyses. We should not overlook the possibility of a classification bias due to the memory at the time of completing the epidemiological questionnaire. Another limitation includes the selection bias introduced with the loss of selective information in the subgroup of employees in our cohort, linked to the non-response of the epidemiological questionnaire. This represents a 21.6% rate of non-response among employees. Therefore, apart from being cautious in extrapolating the results to the subgroup of employees, we should bear in mind that when we report the relative risks in the bivariate analysis of this group, the statistical power of our results is 22%. And finally, the impossibility to confirm by laboratory the presence of viruses in the drinking water of the cistern of the residence can subtract the attribution force of water as the causal hypothesis.

We can conclude that the studied outbreak showed a high attack rate and affected both residents and employees. The aetiology of the outbreak was mixed, with the involvement of norovirus and rotavirus. It is likely, that the high level of dependence of the residents had been a facilitating factor of the spread of the outbreak.

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Original

La fecundidad en España, 1996–2006: mujeres de nacionalidad extranjera frente a españolas

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RESUMEN

Objetivos: Conocer la evolución y la tendencia de la fecundidad en España, así como averiguar si las tasas específicas de fecundidad durante 1996–2006 difieren en función de la edad y la nacionalidad de las mujeres.

Métodos: Estudio transversal de base poblacional. Las tasas de fecundidad se han comparado mediante una estandarización directa; la fecundidad de las mujeres extranjeras frente a la de las españolas, en función de la edad; y el periodo en estudio se ha comparado mediante un modelo lineal generalizado. La tendencia de la serie en función de la nacionalidad se ha descrito mediante gráficos temporales a los cuales se han ajustado modelos de regresión lineal simple.

Resultados: Las mujeres extranjeras han tenido más hijos y a edades más tempranas (índice sintético de fecundidad: 2 frente a 1,2). La creciente tendencia observada en la fecundidad de las mujeres españolas ($p<0{,}001$) se debe sobre todo al aumento de la fecundidad en edades avanzadas ($\geqslant$35 años). La fecundidad de las mujeres extranjeras frente a las españolas de $\leqslant$19 años es seis veces superior (razón de tasas: 6,00; intervalo de confianza del 95%: 2,60–13,86).

Conclusiones: El patrón de fecundidad de las mujeres extranjeras es diferente al de las españolas, caracterizado fundamentalmente por una mayor fecundidad, muy acentuada para el grupo de mujeres de $\leqslant$19 años. Este patrón puede estar asociado a diferencias sociales y culturales. Sería deseable reorientar las políticas de prevención y educación sexual para tener en cuenta las especificidades socioculturales de este grupo de mujeres, y adecuar culturalmente los mensajes de prevención.

Fertility in Spain, 1996–2006: foreign versus spanish women

Keywords:
Population dynamics
Trends
Epidemiology
Pregnancy in adolescence

ABSTRACT

Objectives: To determine fertility trends in Spain and whether women's specific fertility rates differ by age and nationality during the period 1996–2006.

Methods: We performed a population-based, cross-sectional study. Direct standardization was used to compare fertility rates by nationality. Foreign versus Spanish women's fertility rates by age and the period under review were compared by a generalized linear model. The trend by nationality was described by time plots and was analyzed by simple linear regression models.

Results: Foreign women had more children (total fertility rate: 2 versus 1.2) and at younger age. The upward trend observed in the fertility of Spanish women ($p<0.001$) was primarily due to increased fertility in older mothers (35 years and older). The fertility of foreign women aged $\leqslant$19 was six times higher than that of Spanish women (rate ratio: 6.00, 95% CI: 2.60–13.86).

Conclusions: The fertility pattern of foreign women differs from that of Spanish women and is mainly characterized by higher fertility, especially in younger women ($\leqslant$19 years). This pattern may be associated with social and cultural differences. Prevention and sexual educational policies should be reformulated to take into account the specific sociocultural characteristics of this group and to adapt prevention messages to their cultural context.

Introducción

En los últimos diez años, España ha experimentado un importante cambio demográfico como consecuencia de la incorporación de importantes efectivos de población extranjera. En poco más de una década la población ha crecido un 13%, pasando de 40 millones de habitantes en 1996 a 46 millones en 2007[1]. De estos 6 millones de habitantes, el 86% (5,2 millones) han sido ciudadanos de nacionalidad extranjera (2,1 millones originarios de países de la Unión Europea). En 2007, el 24% de la población extranjera residente en España eran mujeres en edad fértil (15 a 49 años)[1]. Otro importante aspecto relacionado con este proceso de cambio demográfico y social es el ligero aumento de la fecundidad experimentado en España. En 2006 se alcanzó la cifra de 1,4 hijos de media por mujer en edad reproductiva[1]. A pesar de este aumento, todavía seguimos manteniendo un nivel por debajo

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del reemplazo poblacional (2,1 hijos de media por mujer)[2]. Si bien es cierto que en el ámbito de la salud pública existen diferentes publicaciones que asocian el incremento de la fecundidad a la incorporación de los hijos nacidos en España de madre extranjera, éstos utilizan datos referidos a comunidades autónomas en particular y no realizan un análisis comparado de la fecundidad de las mujeres extranjeras frente a la de las españolas[3–12]. Sí existen análisis comparados puramente demográficos, sin vínculos a las ciencias de la salud en general ni a la salud pública en particular[13]. Por lo tanto, no disponemos de datos comparativos entre la fecundidad de las mujeres extranjeras frente a las españolas desde una perspectiva epidemiológica nacional. Es por esto que el presente estudio pretende conocer la evolución y la tendencia de la fecundidad en España, así como averiguar si las tasas específicas de fecundidad durante 1996–2006 difieren en función de la edad y la nacionalidad de las mujeres.

Métodos

Diseño, población de estudio y fuentes

Se realizó un estudio transversal de base poblacional. La población de estudio fue el total de los recién nacidos vivos y de las mujeres de 15 a 49 años residentes en España durante 1996–2006. La información se obtuvo de las estadísticas de nacimientos del Movimiento Natural de la Población (recogidas mediante el boletín estadístico del parto) para los datos referidos a todos los recién nacidos vivos, y del Padrón Municipal de Habitantes para las mujeres en edad reproductiva (15–49 años de edad). Ambas fuentes han sido explotadas a través de la página *web* del Instituto Nacional de Estadística[1]. En el padrón se recoge la información, actualizada anualmente desde 1996, de los habitantes empadronados en cada municipio; entre otros datos, constan la nacionalidad y la edad de las personas inscritas[14].

Variables e indicadores

Las variables en estudio son la edad y la nacionalidad. Para el cálculo de las tasas de fecundidad se utilizaron el total de recién nacidos vivos en función de la edad y la nacionalidad de las madres, y el total de mujeres en edad reproductiva (15 a 49 años) en función de la nacionalidad y de diferentes grupos de edad. La nacionalidad se dicotomizó en mujeres extranjeras y españolas, y la edad se categorizó en seis grupos: $\leqslant$19, 20–24, 25–29, 30–34, 35–39 y $\geqslant$40 años.

Análisis estadístico

Para la descripción de la fecundidad en España durante el periodo 1996–2006 se calcularon las tasas de fecundidad general y las específicas por edad y nacionalidad. Las tasas se calcularon para cada año y para la totalidad del periodo en estudio. Para el cálculo de las tasas de fecundidad general para los años estudiados se tomó como denominador la suma del total de mujeres en edad reproductiva de cada año. A continuación se calculó el índice sintético de fecundidad a partir de las tasas específicas por edad y grupo de nacionalidad de la totalidad del periodo en estudio[2]. Dada la ausencia de datos para el año 1997 referidos al total de madres en edad reproductiva, se utilizó una imputación mediante el método de la media de orden 1 de los puntos adyacentes (la media de la suma de los años 1996 y 1998)[15]. Posteriormente se calcularon las razones de tasas de fecundidad para la totalidad del periodo en función de la edad de la madre, tomando como grupo de referencia a las madres de nacionalidad española. Para la comparación de la tasa de fecundidad general de las mujeres extranjeras frente a la de las españolas se utilizó una estandarización directa tomando como población de referencia la suma de ambos grupos de nacionalidad. Seguidamente se calculó la razón de tasas ajustada por la edad tomando como referencia a las mujeres de nacionalidad española[16].

Para el análisis comparado de la fecundidad ajustada por la edad, la nacionalidad y el periodo en estudio, se utilizó un modelo lineal generalizado con *link log* y familia binomial negativa, y la sobredispersión fue verificada mediante un test basado en la regresión[17]. La capacidad de ajuste de los diferentes modelos utilizados se comparó mediante el valor del estadístico de *deviance* y el test de máxima verosimilitud. El modelo con la *deviance* más pequeña fue el que presentó los efectos del periodo, la edad, la nacionalidad de la madre y la interacción significativa entre la edad y la nacionalidad. Las razones de tasas de fecundidad de las mujeres de nacionalidad extranjera frente a las españolas se derivaron de este modelo. La adecuación final del modelo se comprobó mediante el análisis gráfico de los residuos de Anscombe en función de los valores pronosticados y un QQ *plot* de los residuos[17,18]. Finalmente se representó un gráfico de las tasas de fecundidad estimadas por el modelo por grupos de edad y nacionalidad.

Confirmada la interacción de edad y nacionalidad, el análisis de la evolución y la tendencia de la fecundidad se estratificaron en función de la nacionalidad utilizando dos gráficos de tiempo para representar las tasas de fecundidad general para cada año en estudio y cada grupo de edad. La tendencia se analizó utilizado ajustes lineales calculando la pendiente, el intercepto, el coeficiente de determinación y la significación del ajuste. Para el grupo de mujeres españolas se utilizó una escala logarítmica de base 10 para apreciar con mayor facilidad la diferencia entre las tasas de los diferentes grupos de edad. Para el grupo de mujeres de nacionalidad extranjera, la tendencia de la fecundidad general se calculó a partir del año 2000. El programa utilizado en los análisis fue el Stata v.10.

Resultados

Descripción de la fecundidad (tabla 1)

El 9,4% (428.845) de los recién nacidos en España durante el periodo en estudio eran de madres extranjeras. Este porcentaje no ha dejado de aumentar desde 1996, con un crecimiento ajustado a un modelo exponencial ($Y = 2{,}71e^{0{,}19x}$; $R^2 = 0{,}96$). De un 3,4% de recién nacidos vivos de madre extranjera en 1996 se pasó a un 16,6% en 2006. La fecundidad general de las mujeres de nacionalidad extranjera frente a las españolas es un 80% superior para la totalidad del periodo. Las tasas específicas de fecundidad de las madres extranjeras son también superiores para cada categoría de edad, excepto para el grupo de madres de 30 a 34 años, donde la relación se invierte. Globalmente, las extranjeras en edad reproductiva tienen dos hijos de media por mujer, mientras que las españolas tienen uno. La media de hijos por mujer en edad reproductiva en España durante el periodo en estudio era de 1,2.

La fecundidad de las madres extranjeras, ajustada por el efecto de la edad mediante una estandarización directa, sigue siendo superior, pero pasa de ser un 80% superior a un 62% (razón de tasas estandarizada en función de la edad = 1,62; intervalo de confianza del 95% [IC95%]: 1,61–1,63).

Las razones de tasas de fecundidad para cada grupo de edad de las madres de nacionalidad extranjera frente a la de las madres españolas ajustadas por el periodo en estudio, la edad, la nacionalidad y la interacción cualitativa de edad y nacionalidad,

Tabla 1
Tasas de fecundidad general, razón de tasas brutas y ajustadas de las mujeres de nacionalidad extranjera frente a las españolas e índice sintético de fecundidad en 1996–2006 en España

Grupo de edad, años	Nacidos vivos de madre extranjera, n (%)	Extranjeras de 15 a 49 años, n	Tasa de fecundidad general en extranjeras ‰	Nacidos vivos de madre española, n	Españolas de 15 a 49 años, n	Tasa de fecundidad general en españolas, ‰	Razón bruta de tasas de fecundidad: extranjeras frente a españolas (IC95%)	Razón ajustada de tasas: extranjeras frente a españolas[a] (IC95%)
⩽19	24.065 (18,3)	503.293	47,8	107.556	13.734.787	7,8	5,87 (5,79–5,95)	6,00 (2,60–13,86)
20–24	99.271 (21,4)	948.502	104,6	365.452	16.408.053	22,3	4,35 (4,32–4,38)	5,53 (2,40–12,80)
25–29	131.666 (10,5)	1.339.555	98,3	1.126.139	17.551.527	64,2	1,53 (1,52–1,54)	1,82 (0,87–4,21)
30–34	107.639 (6,1)	1.277.110	84,3	1.651.943	17.472.026	94,5	0,90 (0,89–0,91)	1,00 (0,43–2,32)
35–39	53.403 (6,7)	1.056.925	51,5	749.39	16.988.252	44,1	1,14 (1,13–1,15)	1,24 (0,54–2,86)
⩾40	12.801 (9,9)	1.382.701	9,3	116.317	29.913.775	3,9	2,37 (2,33–2,41)	2,45 (1,6–5,67)
Total	428.845 (9,4)	6.508.086	65,9	4.116.797	112.068.419	36,7	1,79 (1,78–1,80)	–
	Índice sintético de fecundidad		2,0	Índice sintético de fecundidad		1,2		

IC95%: intervalo de confianza del 95%.
Fuente: INE. Elaboración propia.
[a] Ajustadas por el periodo en estudio, la nacionalidad, la edad y la interacción de edad y nacionalidad.

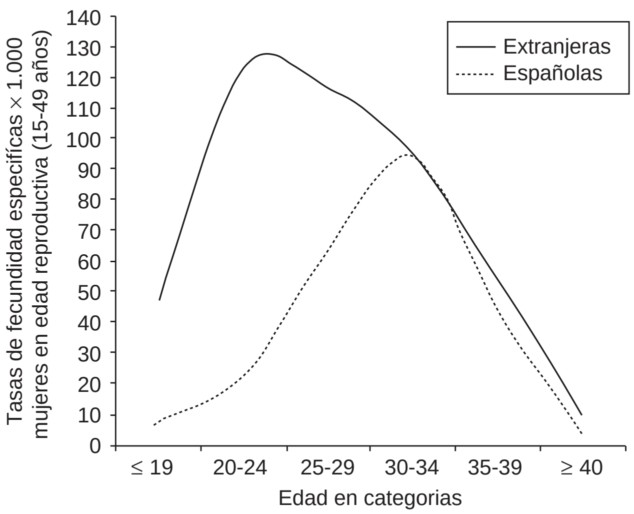

Figura 1. Tasas de fecundidad pronosticadas por el modelo lineal generalizado en función de la edad y la nacionalidad durante 1996–2006. Fuente: INE. Elaboración propia.

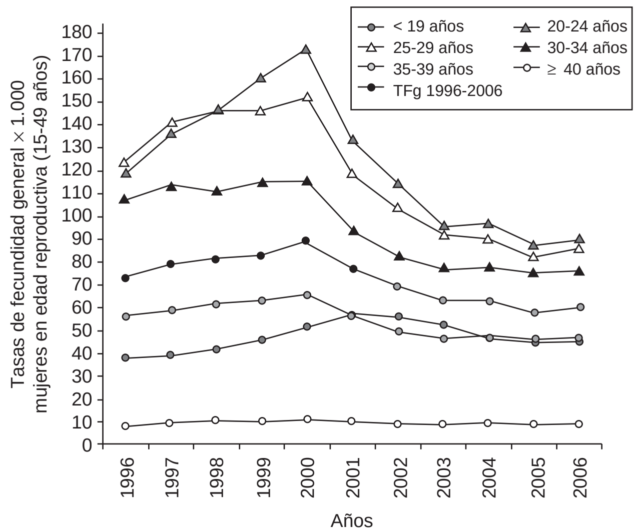

Figura 2. Evolución de las tasas específicas de fecundidad por grupos de edad de las mujeres extranjeras durante el periodo 1996–2006. Fuente: INE. Elaboración propia.

muestran una fecundidad notablemente mayor para las mujeres extranjeras. Las diferencias son marcadamente superiores y significativas para los grupos de edad de 19 y menos años y de 20 a 24 años, y la diferencia también es significativa, pero no tan acentuada, para el grupo de ⩾40 años. La fecundidad del grupo de ⩽19 años de edad es seis veces mayor en las mujeres de nacionalidad extranjera en comparación con la de las españolas del mismo grupo de edad.

Las tasas de fecundidad general estimadas por el modelo lineal generalizado representadas en la figura 1 nos muestran cómo la fecundidad se comporta de manera diferente en función de la edad y la nacionalidad para el periodo en estudio. El patrón de fecundidad de las mujeres extranjeras es mayor que el de las españolas para todo el periodo, y la diferencia es notablemente superior para las mujeres < 30 años de edad. La fecundidad más alta para las mujeres españolas se debe a las mujeres del grupo de edad de 30 a 34 años, mientras que la fecundidad más alta para las extranjeras en comparación con las españolas se produce en las madres 10 años menores (20 a 24 años).

Análisis de la evolución y tendencia

En la figura 2 puede apreciarse cómo en el grupo de mujeres extranjeras la tasa de fecundidad general, desde 2000 a 2006, presenta una tendencia negativa significativa (χ^2 de tendencia: 4046,4; 1 g.l, $p<0{,}001$). La evolución de la fecundidad por grupos de edad se caracteriza por una fecundidad notablemente superior a la tasa de fecundidad general para los grupos de edad de 20 a 24, 25 a 29 y 30 a 34 años, mientras que están por debajo de la media de la fecundidad general los grupos de ⩽19 años, 35 a 39 y ⩾40 años. Todas las tasas específicas de fecundidad presentan una tendencia decreciente a partir del año 2000, excepto las de las mujeres de ⩾40 años, que permanece estable a lo largo del tiempo.

En la figura 3 puede apreciarse que la fecundidad de las mujeres españolas, al contrario que la de las extranjeras, presenta una ligera tendencia de crecimiento lineal positivo para la totalidad del periodo en estudio (tasa de fecundidad general = 0,6x+33,3; $R^2 = 0{,}9$; χ^2 de tendencia: 8419,8; 1 g.l,

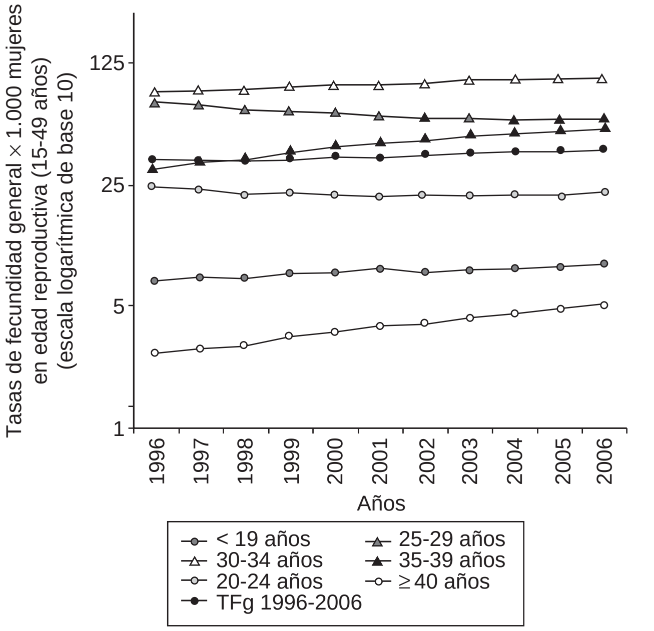

Figura 3. Evolución de las tasas específicas de fecundidad por grupos de edad para las mujeres de nacionalidad española durante el periodo 1996–2006. Fuente: INE. Elaboración propia.

$p < 0{,}001$). Este patrón de crecimiento se encuentra en todas las categorías de edad y para todo el periodo, excepto para los grupos de edad de 20 a 24 años (tasa de fecundidad general $= -0{,}13x+23$; $R^2 = 0{,}2$) y de 25 a 29 años (tasa de fecundidad general $= -1{,}62x+74$; $R^2 = 0{,}9$), que presentan una tendencia decreciente. A diferencia del grupo de mujeres extranjeras, el grupo de edad de 35 a 39 años presenta unas tasas de fecundidad superiores a la tasa de fecundidad general para todo el periodo en estudio, y la tasa de fecundidad de las mujeres $\geqslant$40 años presenta un crecimiento lineal positivo (tasas de fecundidad general $= 0{,}2x+2{,}3$; $R^2 = 0{,}9$), mientras que el grupo de mujeres extranjeras se mantenía estable.

Discusión

Entre los resultados de nuestro estudio cabe destacar la fecundidad observada en los grupos de edad extremos. En concreto, se ha puesto de manifiesto la elevada fecundidad de las mujeres extranjeras $\leqslant$19 años en España. Dado que el embarazo de las adolescentes es un importante problema de salud pública, este resultado puede ser de gran valor de cara a la planificación de políticas de salud pública nacionales. Diversos estudios internacionales han puesto de manifiesto este hecho[19,20]. En general, la elevada tasa de fecundidad en las adolescentes se ha asociado a diferencias socioeconómicas de los grupos implicados[21,22]. La prevención requiere información adecuada y adaptada a la edad, el sexo, la cultura y las experiencias sexuales del grupo implicado. Resolver el problema de los embarazos en las adolescentes precisa un gran esfuerzo coordinado y dirigido no sólo a los adolescentes, sino también a las esferas política, económica, médica y educativa[23]. En este sentido, llamamos la atención sobre las campañas de salud pública encaminadas a la prevención de los embarazos en adolescentes, puesto que deberían de ser compatibles con el origen cultural y social de las mujeres.

El segundo importante resultado a comentar está relacionado con la fecundidad de las mujeres en edades avanzadas. Nuestro estudio confirma una tendencia creciente de la fecundidad de las mujeres españolas en este grupo de edad. La edad materna avanzada en España se ha asociado a un mayor riesgo de mortalidad fetal tardía, prematuridad y bajo peso al nacer[24]. En los últimos años se ha puesto de manifiesto un problema de infertilidad en la población española[25], y son muchas las explicaciones propuestas. Sin embargo, cabe destacar el retraso de la maternidad y la edad materna avanzada como una de las principales causas[26–28]. El hecho de que la fecundidad de las mujeres extranjeras $\geqslant$40 años de edad sea dos veces superior a la de las mujeres españolas nos lleva a preguntarnos cuáles son los factores que se asocian a ello. Las hipótesis que surgen de la interpretación de los resultados de este estudio nos plantean la necesidad de nuevos estudios observacionales que nos permitan identificar qué grupos de nacionalidades (mujeres europeas o de países relacionados con la inmigración económica) explican esta diferencia, así como de estudios cualitativos que nos permitirían profundizar en el conocimiento de los factores asociados a las diferencias de fecundidad por nacionalidades.

A pesar de la baja fecundidad observada en España durante el periodo en estudio, con un índice sintético de fecundidad de 1,2, en 2006 se apreció un ligero aumento (hasta 1,4)[1] motivado por el continuado incremento, durante los 11 años anteriores, de la fecundidad de las mujeres españolas de 35 y más años, y por la incorporación de los recién nacidos de las mujeres de nacionalidad extranjera.

Varios estudios han puesto de manifiesto una mayor fecundidad de las mujeres de nacionalidad extranjera en determinadas comunidades autónomas[3–12]. Sin embargo, éste es el primer estudio que analiza el impacto de la fecundidad de las mujeres extranjeras en toda España. Además de analizar el efecto de la edad y el periodo para las tasas de fecundidad de las mujeres en función de la nacionalidad, se ha descrito un patrón de fecundidad manifiestamente diferente, caracterizado por una fecundidad en las extranjeras notablemente superior comparada con la de las mujeres españolas, y por estar fuertemente influenciado por los grupos de edad de menos de 30 años, mientras que en el grupo de mujeres españolas el patrón de fecundidad está fuertemente influenciado por las de más de 30 años. La fecundidad de las mujeres españolas presenta una tendencia creciente, fundamentalmente por el aumento continuado en el tiempo de las tasas de fecundidad de las mujeres de 35 y más años, mientras que la fecundidad de las extranjeras a lo largo del periodo en estudio tiende a disminuir y estabilizarse. Este fenómeno de adaptación de los patrones reproductivos a los patrones de la población de acogida ya se ha puesto de manifiesto en Cataluña[29].

Entre las limitaciones del estudio hay que tener en cuenta que el proceso masivo de regularización de inmigrantes acontecido en el año 2000 puede estar sesgando la interpretación del descenso de la fecundidad de las mujeres de nacionalidad extranjera. La regularización supuso la inscripción en los registros municipales del padrón municipal de habitantes de cientos de miles de inmigrantes irregulares, con lo cual aumentó el denominador en el cálculo de las tasas. Por lo tanto, el descenso brusco de la fecundidad de las mujeres extranjeras observado en el año 2000 puede estar relacionado con este fenómeno[30,31]. Puesto que todos los nacimientos acontecidos en territorio español, ya sean de madre extranjera en situación legal o irregular, tienen la obligación legal de ser inscritos en el registro civil para que el recién nacido adquiera sus derechos civiles y de filiación, el numerador de las tasas de fecundidad no ha resultado afectado por este proceso, con lo cual las tasas anteriores al año 2000 podrían estar sobrestimadas. Teniendo en cuenta esta limitación, la tendencia de la serie de las tasas anuales de fecundidad general para el grupo de mujeres de nacionalidad extranjera se ha calculado a partir del año 2000, considerando que a partir de ese año las tasas son más fiables. Otra limitación es la falta de información para el año 1997 referida al total de mujeres en edad reproductiva, como consecuencia de la entrada en vigor de la Ley 4/1996. De cualquier modo, consideramos que la imputación para el año 1997 del total de mujeres de 15 a 49 años obtenida con la información del año 1996 y 1998, es una buena aproximación a los datos reales.

En definitiva, podemos concluir que durante 1996–2006 el patrón de fecundidad de las mujeres extranjeras es marcadamente diferente al de las españolas. Las mujeres extranjeras han tenido más hijos (una media de dos hijos por mujer en edad reproductiva frente a uno para las españolas) y a edades más tempranas. La tendencia creciente observada en la fecundidad de las mujeres españolas se debe sobre todo al aumento de la fecundidad de las mujeres de edad avanzada (35 y más años). Este patrón de fecundidad de las mujeres extranjeras, caracterizado fundamentalmente por una mayor tasa, muy acentuada para el grupo de mujeres $\leqslant$19 años, puede estar asociado a diferencias sociales y culturales. Sería deseable reorientar las políticas de prevención y educación sexual para considerar las especificidades socioculturales de las mujeres adolescentes extranjeras y adecuar culturalmente los mensajes de prevención.

Conflicto de intereses

Los autores declaran que no existen conflictos de intereses.

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Contribuciones de autoría

M.A. Luque y A. Bueno concibieron el estudio. M.A. Luque obtuvo y analizó los datos. M.A. Luque y A. Bueno interpretaron los resultados. M.A. Luque redactó el texto. Ambos autores aportaron ideas, interpretaron los hallazgos, revisaron los borradores y aprobaron la versión final.

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Excess of maternal mortality in foreign nationalities in Spain, 1999–2006

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ABSTRACT

Objective: This study aimed to compare maternal mortality by province, autonomous region and mother's country of birth in Spain during 1999–2006.
Study design: A cross-sectional ecological study with all live births and maternal mortality cases occurring during 1999–2006 in Spain was done. Data were drawn from the National Statistics Institute (INE) and we used the Movement of Natural Persons (MNP) and death statistics broken down by cause of death. Maternal mortality rates by province, autonomous region and mother's country of birth were calculated. To compare maternal mortality by province, standardised mortality ratios were calculated using an indirect standardisation. The risk of maternal death by autonomous region, age and mother's country of birth was calculated by a Poisson regression.
Results: Sub-Saharan nationalities present the highest maternal mortality rates. Adjusted by age and autonomous region, foreign nationalities had 67% higher risk of maternal mortality (RR = 1.67; 95%CI = 1.22–2.33). Adjusted by mother's country of birth and age, two autonomous regions had a significant mortality excess: Andalusia (RR = 1.84; 95%CI = 1.32–2.57) and Asturias (RR = 2.78 95%CI = 1.24–6.24).
Conclusion: This study shows inequalities in maternal mortality by province, autonomous region and mother's country of birth in Spain. It would be desirable to implement a maternal mortality active surveillance system and the use of confidential qualitative surveys for analysis of socio-economic and healthcare circumstances surrounding deaths. These measures would be invaluable for in-depth understanding and characterisation of a preventable phenomenon such as maternal death.

1. Introduction

In 2006, with a mean of 1.3 children per woman of reproductive age, Spain ranked among the group of countries with the lowest total fertility rates in the world, only ahead of the Ukraine and Greece (among others) with 1.1 and 1.2 children per woman respectively. In the last 20 years, despite the low fertility, the number of pregnancies among women aged over 35 years has been rising progressively, accounting for 21.2% of births in 2006 [1]. This important increase in fertility among women aged over 35 years has been accompanied by a higher fetal and neonatal morbidity and mortality, becoming extremely marked from age 40 years onwards [1–3]. Similarly, the delay in maternity and the progressive rise in maternal age at date of birth have also resulted in higher female morbidity and mortality. Advanced maternal age has been associated with a higher risk of death and an increased risk of delivery by caesarean section during the birth process [4–8]. Maternal mortality is regarded as a preventable cause of death, strongly related to the quality of the healthcare system and economic and social factors [9–11]. The quality of healthcare and maternal care furnished to pregnant women is an element that may account for the differences between rates [12,13].

In Spain, a study conducted into the maternal mortality trend for the period 1980–1992 reported a certain stabilisation in the maternal mortality ratio, but even so the authors of this study forecast an increase in maternal mortality for the year 2000, associated with advanced maternal age and delay in maternity [14]. This increase has also been forecast for France and England for 2005 [15]. A recent study confirmed the increase of maternal mortality associated with advanced maternal age in Spain during 1996–2005. In addition, it has demonstrated an excess mortality during 2003–04 in one province and in foreign mothers [16]. Accordingly, this study aims to confirm these results with a longer time period. The objective is to compare maternal mortality by province,

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autonomous region and mother's country of birth in Spain during 1999–2006.

2. Materials and methods

2.1. Study design and population

A cross-sectional ecological study with all live births and maternal mortality cases occurring during 1999–2006 in Spain was done.

2.2. Data source

Data for this population analysis were drawn from the National Statistics Institute (INE) in Spain; we used the Movement of Natural Persons (MNP) and death statistics broken down by cause of death [17].

2.3. Description of variables

The data obtained from INE were aggregate by autonomous region of maternal death, mother's age and country of birth. We obtained the data of live births from the MNP and data of maternal deaths from deaths statistics broken down by cause of death. The variables under study were: mother's age, mother's country of birth, province and autonomous region and the cause of death by the International Classification of Diseases, 10th Revision (ICD-10). Maternal age was categorized into four groups (≤19, 20–29, 30–39 and ≥40). Mothers' country of birth for descriptive analyses were aggregated into macro-regions (Sub-Saharan Africa, Latin America & the Caribbean, Asia, North Africa and Europe included Spanish mothers) [18] and for multivariable analysis of the data have been dichotomized into foreign and Spanish mothers. The definition of maternal mortality used was that proposed by the ICD-10, i.e., "*the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes*" [19].

2.4. Statistical analysis

Maternal mortality ratios (MMRs) were calculated as the rate between maternal deaths observed for the period and total live

Table 1
Descriptive analyses of maternal mortality rate by age, nationality, autonomous region and ICD-10 cause, Spain 1999–2006 (n = 133 deaths).

Variables		Deaths, n (%)	Total live births (n)	per 105 live births (95% CI)[a]
Age (years)	≤19	2 (1.5)	98,282	2.03 (0.24–7.35)
	20–29	36 (27.1)	1,250,968	2.88 (2.00–3.98)
	30–39	77 (57.9)	1,992,902	3.86 (3.05–4.83)
	≥40	18 (13.5)	106,636	16.88 (10.00–26.68)
Mothers' country of birth aggregated by regions				
	Sub-Saharan Africa	5 (3.7)	11,490	43.52 (14.13–101.60)
	Latin America & The Caribbean	12 (9.0)	107,271	11.20 (5.80–19.54)
	Asia	2 (1.5)	18,597	10.75 (1.30–38.85)
	Europe	113 (85.0)	3,071,121	3.68 (3.03–4.42)
	North Africa	1 (0.7)	83,026	1.20 (0.03–6.71)
	Other countries[b]	0	157,283	–
Autonomous region				
	Ceuta	1 (0.7)	9300	10.75 (0.27–59.91)
	Asturias	6 (4.5)	56,979	10.53 (3.86–22.92)
	Andalucía	46 (34.6)	688,098	6.70 (4.90–8.91)
	Canarias	9 (6.8)	154,873	5.81 (2.65–11.03)
	Baleares	4 (3.0)	82,322	4.86 (1.32–12.44)
	Aragón	4 (3.0)	86,902	4.60 (1.25–11.78)
	Extremadura	3 (2.2)	79,820	3.76 (0.77–11.00)
	Cataluña	20 (15.0)	571,138	3.50 (2.14–5.40)
	Castilla y León	5 (3.7)	147,736	3.38 (1.10–7.89)
	Murcia	4 (3.0)	126,669	3.16 (0.86–8.08)
	Valencia	10 (7.5)	365,889	2.73 (1.31–5.02)
	Madrid	14 (10.5)	513,792	2.72 (1.50–4.57)
	Cantabria	1 (0.7)	37,120	2.69 (0.06–15.01)
	Navarra	1 (0.7)	47,378	2.11 (0.05–11.76)
	Galicia	3 (2.2)	160,926	1.86 (0.38–5.49)
	Castilla La Mancha	1 (0.7)	138,555	0.72 (0.02–4.02)
	País Vasco	1 (0.7)	150,071	0.66 (0.01–3.71)
	Rioja	0	21,283	–
	Melilla	0	9937	–
ICD-10 cause				
Pregnancy with abortive outcome	O00–O08	13 (9.8)	3,448,788	0.37 (0.20–0.64)
Oedema, proteinuria and hypertensive disorders in pregnancy, childbirth and the puerperium	O10–O16	30 (22.6)	3448788	0.87 (0.58–1.24)
Other maternal disorders predominantly related to pregnancy	O20–O29	1 (0.8)	3,448,788	0.02 (0.00–0.16)
Maternal care related to the foetus and amniotic cavity and possible delivery problems	O30–O48	18 (13.5)	3448788	0.52 (0.30–0.82)
Complications of labour and delivery	O60–O75	29 (21.8)	3,448,788	0.84 (0.56–1.21)
Delivery	O80–O84	–	–	–
Complications predominantly related to the puerperium	O85–O92	31 (23.3)	3,448,788	0.90 (0.61–1.28)
Other obstetric conditions, not classified elsewhere	O95–O99	11 (8.3)	3,448,788	0.32 (0.16–0.57)

Source: INE, in-house.
[a] Fisher's exact test.
[b] 170 nationalities without maternal death cases.

births for this same period, expressed per 100,000 live births; the MMR thus represents the risk of maternal death with respect to the number of live births. The number of live births used in the denominator is an approximation of the population of pregnant women who are at risk of a maternal death [20]. MMRs follow a Poisson distribution and were calculated together with their respective 95% exact confidence intervals (95%CI).

To compare maternal mortality by province, standardised mortality ratios (SMRs) were calculated using the indirect method. SMRs were estimated as the ratio of observed deaths to those expected. Expected numbers of deaths in each province were obtained by multiplying each age group stratum's population by the age-specific MMR for the whole of Spain [21]. In order to determine the statistical significance of the SMR and compute the 95%CI, exact methods were applied. A map with SMRs by province was presented.

The risk of maternal death by autonomous region, age and dichotomized mothers' country of birth were calculated by a generalized linear model with family Poisson and link log [22]. For autonomous regions a deviance contrast was used in order to compare each autonomous region to the whole country. Relative risks were derived from the models with their exact 95%CI. To compensate for over-dispersion, standard errors were scaled using the square root of the Pearson χ^2 dispersion. The goodness-of-fit was evaluated using the test based on deviance and a graphical analysis of Anscombe residuals by predicts probabilities [23].

The model used was:

$$\textit{Maternal deaths} = \ln(\textit{live births}) + \textit{Age} \times \beta_1 + \textit{Nationality} \times \beta_2 + \textit{Autonomous regions} \times \beta_3$$

Finally a caterpillar plot by autonomous regions with relative risk of maternal mortality adjusted by age and mother's country of birth was presented. The statistical software used was Stata v.10 (StataCorp., College Station, TX, USA).

3. Results

A descriptive analysis of MMRs by age, autonomous region, mothers' country of birth (aggregated by macro-regions) and cause of death (ICD-10) was done. For country of birth, it is important to highlight that mothers born in Sub-Saharan countries present the highest MMR. With respect to the causes of death, the most frequent cause, with 31 cases (23.3%), was complications of the puerperium (O85–O99) followed by gestational hypertension (O10–O16) with 30 cases (22.6%) and complications of labour and delivery (O60–O75) with 29 cases (21.8%) (Table 1).

Following the recommendations of the Europeristat report to present the distribution of maternal deaths according to obstetric causes, in Spain during 1996–2006 the causes of maternal deaths were: 13 cases (9.7%) of amniotic fluid embolism, 9 (6.7%) of other thromboembolism causes, 30 (22.5%) of complications of hypertension, 11 (8.2%) of haemorrhage, 14 (10.5%) choriamnionitis/sepsis, 13 (9.7%) abortion/ectopic pregnancy, 3 (2.2%) anaesthesia, 3 (2.2%) uterine rupture, 25 (18.8%) other direct causes, 10 (8.2%) indirect cause and 2 (1.5%) unknown.

Fig. 1 shows an unequal distribution of SMRs by provinces in Spain. Maternal death analysis shows a higher risk of mortality among foreign mothers versus Spanish and in women ≥40 years old versus ≤19 years old. Adjusted by age and autonomous region, foreign nationalities had a 67% higher risk of maternal mortality (Table 2). Adjusted by mother's country of birth and age, two autonomous regions had a significant mortality excess: Andalusia (RR = 1.84; 95%CI = 1.32–2.57) and Asturias (RR = 2.78 95%CI = 1.24–6.24) (Fig. 2). In Andalusia, only two provinces (Huelva and Cordoba) out of seven did not have a mortality excess and two provinces (Almeria and Malaga) had a significant

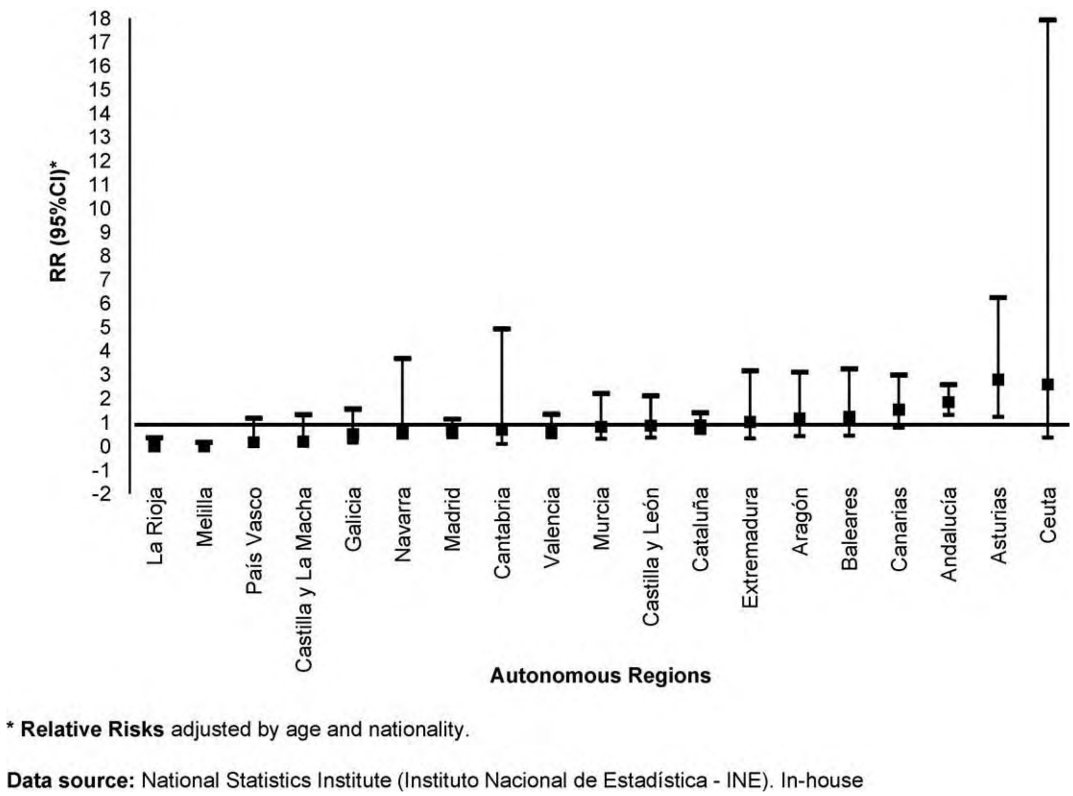

Fig. 1. Standardised maternal mortality ratios by province in Spain, 1999–2006 (maternal deaths, n: 133).

Table 2
Maternal mortality risk ratios by maternal age and nationality adjusted by autonomous region, Spain, 1999–2006 (*n*: 133 maternal deaths).

	Coefficient (standard error)[a]	RR (95% CI)[b]	*P*-value
Foreign versus Spanish mothers	0.51 (0.17)	1.67 (1.20–2.33)	0.002
Maternal age			
20–29 versus ≤19	0.77 (0.50)	1.60 (0.60–4.32)	>0.05
30–39 versus ≤19	0.47 (0.50)	2.20 (0.81–5.78)	>0.05
≥40 versus ≤19	2.25 (0.52)	9.50 (3.43–26.31)	<0.001

Goodness-of-fit χ^2: 131.8, $p = 0.969$. Deviance: 82.2.
[a] Standard errors scaled using square root of Pearson χ^2-based dispersion.
[b] Relative risks adjusted by autonomous regions.

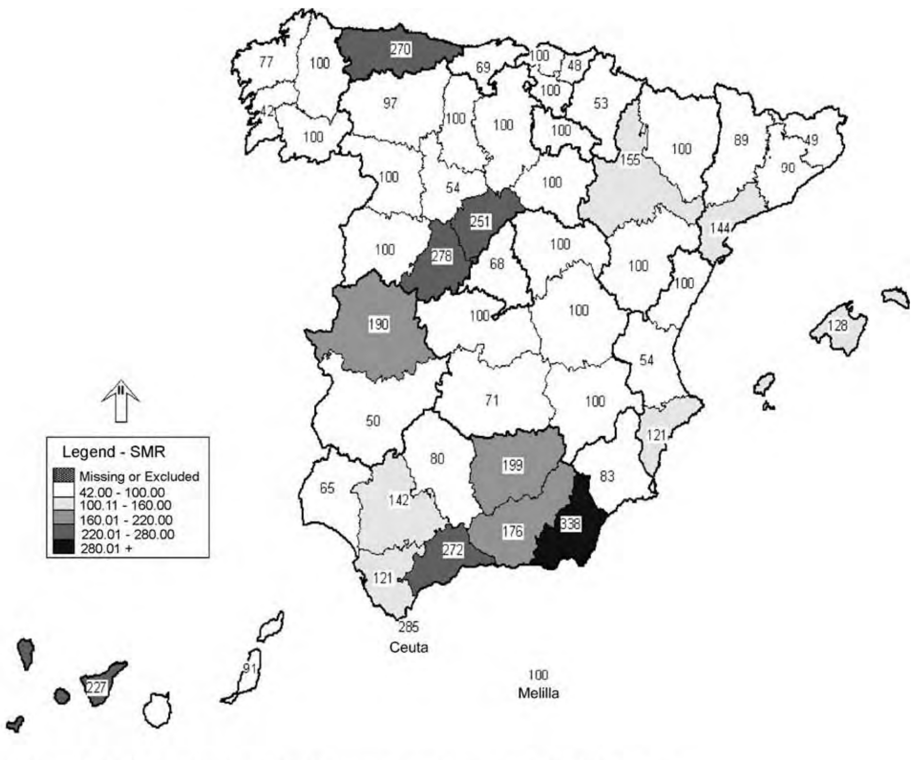

Fig. 2. Risk ratios of maternal mortality by autonomous region adjusted by age and nationality in Spain, 1999–2006 (maternal deaths, *n*: 133).

mortality excess compared to the whole country. With respect to SMR, Almeria presents 3.38 (95%CI = 1.38–6.97) and Malaga 2.72 (95%CI = 1.45–4.66). All the mothers who died in Asturias were Spanish. Thirteen percent (6/46) of the deaths in Andalusia were foreign mothers.

4. Comment

This study shows inequalities in maternal mortality by province, autonomous region and mothers' country of birth. To our knowledge, this is the first study reporting an excess in maternal mortality among foreign nationalities in Spain. This result coincides with different studies in others countries that have identified women of advanced reproductive age and immigrants from developing countries as risk groups for maternal mortality [15,13]. Two studies in United States and Europe highlighted the fact that there is a wide disparity between immigrants from developing countries and the native population in terms of access to health [24,25]. Communication problems between health professionals and immigrant patients have been postulated as being a key factor underlying this problem [26]. Whether mother's nationalities and ethnicity are risk factors themselves for maternal mortality is a matter of debate. Rather, they might simply be societal constructs that reflect more meaningful factors such as culture, economics and baseline health [24].

With respect to the maternal mortality inequalities by province and autonomous region, confidential surveys conducted in France, the United Kingdom and Holland in the 1990s estimated that the proportion of maternal deaths that did not benefit from an optimal level of care accounted for 50–80% of the cases reviewed [27–29]. Accordingly, this is a factor that might explain the differences in maternal mortality between regions. This is why confidential investigations into maternal death are indispensable for furnishing a more reliable picture of what is in fact happening. Such research requires every effort to be made to gather comprehensive data on all the possible variables underlying the event. Individualised nation-wide studies on maternal deaths started being conducted in the United Kingdom in 1952 and in The Netherlands shortly thereafter [13,30].

Insofar as the limitations of this study are concerned, it must be stressed that when one talks of risk of maternal mortality associated with mothers' country of birth, this is not interpretable at an individual level (ecological fallacy). Probability distributions for infrequent events increase the risk of type I error and, at times, yield *p*-values that are difficult to interpret. For a correct interpretation, one would have to access a longer time series but before 1999 the statistics broken down by cause of death did not specify mother's country of birth. Similarly, it is highly likely that most of the spatial clusters of adverse results in reproductive health are random events: only a very small proportion are caused by environmental agents, which could be identified by exhaustive epidemiological research [31,32]. And finally, different authors have highlighted problems of under-registration and under-reporting of maternal deaths in different European countries and Spain: in consequence the SMR estimates in our study could be underestimated [33].

This study shows an excess of maternal mortality in specific provinces and autonomous regions and among foreign mothers in Spain. Maternal mortality is regarded as a preventable cause of death, strongly related to the quality of the healthcare system and economic and social factors. The quality of healthcare and maternal care furnished to pregnant women is an element that may account for the differences between ratios [12,13]. This situation justifies the need for more intense and detailed epidemiological surveillance of a preventable phenomenon in Spain. In the United States, a pregnancy related mortality surveillance system has been in place since 1987 [25]. In some European countries confidential surveys are carried out to analyse factors related to maternal mortality [12,13,28,30].

In Spain, it would be desirable to implement a maternal mortality active surveillance system and the use of confidential qualitative surveys for analysis of socio-economic and healthcare circumstances surrounding deaths. These measures would be invaluable for in-depth understanding and characterisation of such a preventable phenomenon as maternal death.

Conflicts of interest

None declared.

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Frecuencia de infecciones de transmisión sexual y factores relacionados en Pweto, República Democrática del Congo, 2004

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(Frequency of sexually transmitted infections and related factors in Pweto, Democratic Republic of Congo, 2004)

Resumen

Objetivos: Estimar la prevalencia de ulceración genital y exudado uretral en Pweto, República Democrática del Congo, así como analizar la asociación de las prevalencias estimadas, con la edad, el estado civil, la profesión y el número de parejas sexuales.

Métodos: Estudio descriptivo y transversal mediante encuesta, realizada a una muestra representativa de 106 varones de Pweto, de entre 15 y 65 años de edad, en mayo de 2004, con una precisión del 9,5%. Las preguntas sobre la presencia actual o antecedentes de ulceración y exudado fueron autoinformadas y referidas al último año a partir del día de la encuesta. Para el estudio de las asociaciones, se calculó la *odds ratio* (OR) cruda y posteriormente la OR ajustada mediante una regresión logística multivariante.

Resultados: La prevalencia fue del 39,6% (intervalo de confianza [IC] del 95%, 30-49) para el exudado uretral y del 33% (IC del 95%, 24-42) para la ulceración genital. Independientemente de la edad, el número de parejas sexuales durante el último año y el estado civil, los militares fueron identificados como un grupo de riesgo. El análisis multivariante nos muestra una OR ajustada de 3,25 (IC del 95%, 1,10-9,95; $p < 0,05$) para la frecuencia del exudado uretral de los militares frente a otras profesiones.

Conclusiones: La alta prevalencia de infecciones de transmisión sexual (ITS) en Pweto y las asociaciones encontradas desencadenaron la instauración de un programa de donación supervisada de preservativos para los militares. En situaciones de conflicto, con alta prevalencia de ITS y los servicios sanitarios deficientes, las organizaciones de ayuda humanitaria deberían implementar actividades de prevención focalizadas en los grupos de riesgo.

Palabras clave: Salud pública. Prevalencia. República Democrática del Congo. Infecciones de transmisión sexual. Virus de la inmunodeficiencia humana.

Abstract

Objectives: To estimate the prevalence of genital ulcer and urethral discharge in Pweto, Democratic Republic of Congo, and to analyze the association between the estimated prevalence and age, marital status, profession, and number of sexual partners.

Methods: We performed a descriptive cross-sectional study through a survey conducted in May 2004 in a representative sample of 106 men in Pweto aged between 15 and 65 years old, with a precision of 9.5%. Questionnaire items about current or previous ulceration and urethral discharge where self-reported and referred to the previous year as of the date of the survey. To study the associations, crude and adjusted odds ratios (OR) were calculated using multivariate logistic regression.

Results: The prevalence was 39.6% (95% confidence interval [CI], 30-49) for urethral discharge and 33% (95%CI, 24-42) for genital ulcer. Soldiers were identified as a risk group independently of age, the number of sexual partners during the previous year, and marital status. The multivariate analysis showed an adjusted OR of 3.25 (95%CI, 1.10-9.95) ($p < 0.05$) for the frequency of urethral discharge in soldiers compared with other professions.

Conclusions: The high prevalence of sexually transmitted infections in Pweto and the associated factors identified prompted the initiation of a controlled condom donation program for soldiers. In conflict situations with a high prevalence of sexually transmitted infections and lack of health services, humanitarian aid organizations should implement prevention activities focused on risk groups.

Keys words: Public health. Prevalence. Democratic Republic of the Congo. Sexually transmitted infections. Human immunodeficiency virus.

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Introducción

Las infecciones de transmisión sexual (ITS) representan un importante problema de salud pública internacional[1,2]. Una ITS que no recibe tratamiento puede acrecentar hasta 10 veces el riesgo de infección y transmisión del virus de la inmunodeficiencia humana (VIH)[3]. Un estudio prospectivo sobre trabajadoras del sexo en Kenia demostró un riesgo relativo de 4,7 en la seroconversión para el VIH si se tenían antecedentes de ulceración genital[4], y otro, realizado en Kinshasa, República Democrática del Congo (RDC), demostró un riesgo relativo de 3,5 al tener antecedentes de gonorrea y otras ITS[5]. Cada año se registran unos 340 millones de nuevos casos de ITS en personas de entre 15 y 49 años de edad. El mayor número de nuevas infecciones se detectan en la región asiática y en el África subsahariana, con 69 millones de nuevos casos al año[3,6].

Entre las medidas de salud pública para el control y la prevención de las ITS, incluido el VIH, se incluyen la distribución de condones y el manejo sindrómico de los casos de ITS, lo que implica el agrupamiento de síntomas y signos que presentan las infecciones en «síndromes»[7]. Un ensayo clínico llevado a cabo en Mwanza demostró una menor susceptibilidad al VIH y una menor infectividad con la mejora del manejo sindrómico de las ITS[8]. Las sinergias entre las ITS y la infección por el VIH hacen que su control se integre en los programas de prevención del VIH[9-12]. Los mejores servicios para el tratamiento de ITS y hacer hincapié en los subgrupos de población con mayor riesgo permiten reducir la incidencia del VIH en lugares donde los servicios de tratamiento de las ITS son deficientes y éstas son muy prevalentes[13]. El uso del preservativo en todas las relaciones sexuales con penetración vaginal reduce un 86% la incidencia del VIH y de las ITS[14-16]. Las situaciones donde concurre una crisis crónica ligada a la pobreza con otra crisis aguda generada por un conflicto armado suponen un mayor riesgo de violencia sexual. La violación perpetrada por militares infectados expone directamente a las mujeres a las ITS y el VIH[17,18]. Si bien escasean los datos sobre su prevalencia en ámbitos de poblaciones desplazadas a causa de conflictos armados, se cree que éstas corren mayor riesgo de contraer ITS e infección por el VIH durante el desplazamiento y después de éste[19,20].

Los militares de los países en conflicto en el África subsahariana son un grupo de riesgo con acceso limitado a los preservativos. Sus comportamientos se han asociado con el uso abusivo del alcohol antes de las relaciones sexuales y una tendencia a tener múltiples parejas sexuales[21,22]. En la RDC se ha reportado hasta un 50% más de riesgo (riesgo relativo [RR] = 1,5) para la seroprevalencia positiva del VIH en las poblaciones de militares[23]. Un estudio reciente reclama la inclusión de medidas de educación sanitaria y prevención centradas en los militares como estrategia de control del VIH y de las ITS en situaciones de emergencias complejas[24]. La información sobre las ITS y el VIH/sida, proporcionar preservativos, la búsqueda activa de casos y el tratamiento de las ITS se han postulado como posibles soluciones para el control y la prevención de la transmisibilidad de las ITS y el VIH en los militares[25]. Este estudio fue realizado durante el mes de mayo de 2004 en Pweto, RDC. Sus objetivos eran estimar la prevalencia de ulceración genital y exudado uretral entre los varones de Pweto de entre 15 y 65 años de edad, así como analizar la asociación de las prevalencias estimadas con la edad, el estado civil, la profesión y el número de parejas sexuales, y probar la hipótesis de la mayor frecuencia de ulceración genital y exudado uretral en los militares de Pweto, frente a otras profesiones.

Métodos

Se realizó un estudio epidemiológico descriptivo y transversal. La población diana de estudio fue de 6.972 hombres de Pweto, con edades comprendidas entre los 15 y los 65 años para el año 2004[26]. Se llevó a cabo un muestreo aleatorio simple, en el que el criterio de inclusión fue ser varón, cabeza de familia de Pweto, mayor de 15 y menor de 65 años, entendiendo por cabeza de familia a los varones que, localizados en su domicilio, eran los adscritos culturalmente a la figura del representante de la familia extensa, aun habiendo más varones cohabitando en la casa. Con el objetivo de realizar la estimación de una prevalencia con una precisión del 9,5%, mediante un intervalo de confianza (IC) asintótico normal y bilateral del 95%, asumiendo que la proporción era del 50%, se determinó un tamaño de muestra de 106 unidades de estudio. Aprovechando la elaboración de un censo poblacional por una organización no gubernamental presente en Pweto, se procedió a contar y numerar las casas existentes en cada barrio. Posteriormente, mediante un muestreo aleatorio simple se identificaron las casas en las que localizar al cabeza de familia. Para la obtención de los números aleatorios se utilizó la función «RAN» de una calculadora científica.

Los datos fueron recogidos mediante un cuestionario estructurado de preguntas cerradas y codificado con el objetivo de guardar el anonimato del entrevistado, elaborado en francés (lengua oficial de la RDC) y validado mediante un pilotaje previo. Un agente de salud (bilingüe) preguntaba en la lengua vernácula (chibemba/bemba) y rellenaba el cuestionario elaborado con las respuestas de los entrevistados. Las preguntas sobre la presencia y los antecedentes de ulceración genital, exudado uretral y número de parejas sexuales fueron de declaración autoinformada y referida a los últimos 12 meses anteriores al día de la entrevista. A todos los sujetos incluidos en el estudio se les aseguró la confidencialidad y se les pidió su consentimiento. De igual forma, se facilitó gratuitamente, a todos los individuos que declaraban antecedentes de ulceración genital, exudado uretral o ambos, el tratamiento según criterios del manejo sindrómico de las ITS en las estructuras de salud de Pweto.

Se realizó el análisis estadístico de la base de datos mediante el paquete estadístico SPSS v.13.0. En primer lugar, se realizó un análisis univariante y después un análisis bivariante mediante tablas de contingencia y el estadístico χ^2, para probar la existencia de asociación entre la presencia o ausencia de ulceración y/o exudado uretral y la edad, el estado civil, el número de parejas sexuales y la profesión. Una vez testada la asociación, se calculó la OR. Para el cálculo de las asociaciones, se dicotomizaron las variables cuantitativas edad y número de parejas sexuales. Asumidas las asociaciones, se llevó a cabo un análisis multivariante de regresión logística con 4 predictores (edad, estado civil, profesión y número de parejas sexuales). Se utilizó un método de entrada progresivo paso a paso, basado en el test de *likelihood ratio* (Forward: LR) para la obtención del modelo, dado nuestro pequeño tamaño muestral. La adecuación final del modelo se comprobó mediante el test de Hosmer-Lemeshow y, finalmente, un análisis de residuos para detectar los casos extremos. A partir del modelo final, se calcularon las OR ajustadas (ORa), así como sus respectivos IC del 95%. El valor de p de la χ^2 de Wald se presenta en el apartado de resultados.

Resultados

La edad media de nuestros encuestados fue de 31,5 años. El 30,2% eran militares, el 41,5% estaban sin trabajo y en el 28,3% restante se repartían agricultores, pescadores y comerciantes. El 49,1% estaban solteros. El 56,6% de los varones declaró tener o haber tenido dos o más parejas sexuales. Entre los militares la edad media es de 30,8 años, el 68,8% declaraba estar soltero y el 62% declaró tener o haber tenido dos o más parejas sexuales durante el último año (tabla 1).

La prevalencia de ulceración genital de los varones de Pweto en 2004 es del 33% (IC del 95%, 24,2-42,8), y para el exudado uretral es del 39,6% (IC del 95%, 30,3-49,6). Entre los militares la frecuencia de ulceración genital y de exudado uretral es del 37,7 y del 56,3%, respectivamente.

Los resultados del análisis bivariante muestran la asociación existente entre la edad y el número de parejas con respecto a la ulceración genital. Los varones menores de 30 años tienen 2,30 más probabilidades de padecer una ulceración genital que los mayores de 30 años, y los varones con dos o más parejas tienen 4,87 más probabilidades de presentar una ulceración genital que los varones con una pareja. De igual forma, se observa una mayor probabilidad de padecer una ulceración genital en los solteros y los militares, asociación esta última en el límite de la significación (tabla 2).

Para el exudado uretral, el análisis bivariante señala que el estado civil, la profesión y el número de parejas sexuales estaban asociados a la presencia de exudado uretral. En este sentido, los valores de las OR crudas (ORc) nos muestran que los varones solteros, los militares y los varones con dos o más parejas sexuales tienen una mayor probabilidad de padecer exudado uretral (tabla 3).

Tabla 1. Descripción de la muestra de varones seleccionada en Pweto, durante el mes de mayo de 2004 (n = 106)

Variables	%	Mediana (intervalo intercuartílico)
Edad (años)		
15-30	53,8	30 (11)
31-65	46,2	
Estado civil		
Soltero	49,1	
Casado	50,9	
Profesión		
Militar	30,2	
Agricultor	5,7	
Pescador	5,7	
Comerciante	17,0	
Sin trabajo	41,5	
Parejas		
Una	43,4	2 (1)
≥ Dos	56,6	

Tabla 2. Análisis de la asociación entre la ulceración genital en función de la edad, el estado civil, la profesión y el número de parejas sexuales

Variables	n, ulceración genital (%)	ORc	IC del 95%	p
Edad (años)				
15-30	46 (3,5)	2,30	1,01-5,26	0,04
31-65	60 (25,0)	1,0		
Estado civil				
Soltero	52 (40,4)	1,93	0,85-4,40	0,11
Casado	54 (25,9)	1,0		
Profesión				
Militar	32 (37,5)	1,33	0,55-3,17	0,51
Otros[a]	74 (31,1)	1,0		
Parejas				
Una	46 (15,2)	1,0		
≥ Dos	60 (46,7)	4,87	1,88-12,61	0,001

n = 106; ulceración genital: 33%.
[a]Parados, agricultores, pescadores y comerciantes.
IC: intervalo de confianza; ORc: *odds ratio* cruda.

Tabla 3. Análisis de la asociación entre exudado uretral en función de la edad, el estado civil, la profesión y el número de parejas sexuales

Variables	n, exudado uretral (%)	ORc	IC del 95%	p
Edad				
< 30	46 (47,8)	1,83	0,83-4,03	0,131
≥ 30	60 (33,3)	1,0		
Estado civil				
Soltero	52 (53,8)	3,33	1,47-7,54	0,03
Casado	54 (25,9)	1,0		
Profesión				
Militar	32 (56,3)	2,68	1,14-6,27	0,02
Otros[a]	74 (32,4)	1,0		
Parejas				
Una	46 (8,7)	1,0		
≥ Dos	60 (63,3)	18,13	5,73-57,40	< 0,001

n = 106; exudado uretral: 39,6%.
[a]Parados, agricultores, pescadores y comerciantes.
IC: intervalo de confianza; ORc: *odds ratio* cruda.

Tabla 4. Ulceración genital y exudado uretral en función de la profesión y el número de parejas sexuales. Análisis multivariante

Variables	ORa	IC del 95%	p
Ulceración genital			
Parejas			
Una	1,0		
≥ Dos	4,87	1,88-12,69	0,001
Exudado uretral			
Profesión			
Otros[a]	1,0		
Militar	3,25	1,10-9,55	0,03
Parejas			
Una	1,0		
≥ Dos	19,73	5,95-65,43	< 0,001

n: 106; 35 varones con antecedentes de úlcera genital y 42 con antecedentes de exudado uretral.
[a]Parados, agricultores, pescadores y comerciantes.
IC: intervalo de confianza; ORa: *odds ratio* ajustada.
No incluidas, por no ser significativas, las variables: edad, sexo y estado civil.
R^2 (úlcera genital): 0,19; R^2 (exudado uretral): 0,43.

Las ORa de padecer una ulceración genital, controlando por el resto de las variables independientes en estudio, es 4,87 si se tienen dos o más parejas sexuales frente a una pareja. Las restantes variables no influyen significativamente en el modelo. Para el exudado uretral la ORa se incrementa a 19,73 veces si se tienen más de dos parejas sexuales, respecto a los varones que sólo tienen una pareja, y a 3,25 si se es militar de profesión frente a otras ocupaciones laborales. Por tanto, el perfil de riesgo queda ajustado a ser militar y tener dos o más parejas sexuales en el último año (tabla 4).

Discusión

Los datos obtenidos para la estimación de la prevalencia de exudado uretral y úlcera genital, del 33 y el 39,6% en este estudio, respectivamente, son similares a los datos de otras publicaciones referidas a áreas rurales del África subsahariana.

Así, podemos hablar de una prevalencia del 36% para la úlcera genital durante 1999 en un área rural de Uganda o de un 28,9% en Etiopía para el año 2002, y de un 25% para el exudado uretral en las áreas rurales de Zimbabwe para el año 2005[27-29]. Las cifras autodeclaras para el exudado uretral y la ulceración genital nos proporcionan evidencias sobre una alta prevalencia de gonococia y clamidiasis en el caso del exudado uretral, y de chancro blando y sífilis primaria para el caso de la ulceración genital[7,10].

Diferentes estudios han puesto de manifiesto la asociación entre la frecuencia de ITS con la infección del VIH, el virus de la hepatitis C (VHC), la edad, el inicio de las relaciones sexuales, el número de parejas sexuales y la pertenencia a determinados grupos de riesgo, entre los que se encuentran los militares[30-35].

Con pocos recursos, una muestra reducida y con las limitaciones propias del trabajo de campo allí donde no hay datos previos, este estudio pone de manifiesto la asociación entre la alta frecuencia de las ITS y los militares residentes en Pweto durante un contexto de posconflicto armado y de violencia, como el que vivía la RDC durante su realización. Sin embargo, este estudio presenta importantes limitaciones relacionadas con el tipo de diseño aplicado y el tamaño muestral empleado.

Dado que se trata de un estudio transversal, a pesar de su intencionalidad analítica, las asociaciones encontradas no tienen significación causal. Los datos fueron recogidos durante el mes de mayo de 2004 y están referidos a un período de recuerdo de un año, por lo que se pudo incurrir en sesgos de clasificación no diferencial hacia la no asociación relacionados con la memoria. Asimismo, asumimos la existencia de sesgos de clasificación no diferencial por parte del entrevistado al responder positivamente, y la presencia de úlceras y/o exudado fue negativa, al tratarse de prevalencias autodeclaras y ofrecerse el tratamiento con posterioridad. Podemos afirmar subjetivamente, después de la experiencia sobre el terreno, que la autodeclaración de problemas de salud en Pweto no supone un problema culturalmente asociado a la estigmatización para las personas entrevistadas. La validez externa de los resultados y su generalización son limitadas y dependerán en todo caso del contexto hoy por hoy en Pweto, dónde quizás la población de militares no ha permanecido estable y los movimientos migratorios han modificado la situación sociodemográfica.

A pesar de las importantes limitaciones, queremos resaltar el valor de los resultados de este estudio, teniendo en cuenta las dificultades para su obtención y la ausencia de recursos en contextos como los de Pweto y las zonas rurales del África subsahariana. Gracias a los datos que generó esta investigación y a la relación entre la prevalencia, la densidad de incidencia y la duración media de la clínica de las infecciones que el exudado uretral y la ulceración genital representan, se pudieron inferir las necesidades de antibióticos para el tratamiento de las ITS en Pweto a partir de un dato objetivo, y se pudo justificar la pertinencia de la instauración de un programa de donación bajo supervisión y educación sanitaria de preservativos.

Demostrada la mayor frecuencia de ulceración genital entre los militares, y conociendo la efectividad de la disminución de la transmisibilidad del VIH con la incorporación de la prevención de las ITS como estrategia de control centrada en grupos de riesgo[23-27], se recomienda incorporar las estrategias preventivas contra la transmisibilidad del VIH centradas en los militares, en los proyectos de las organizaciones médicas de cooperación internacional. Así, dotar de mejores servicios para el tratamiento de ITS y hacer hincapié en los subgrupos de población con mayor riesgo permiten reducir la incidencia del VIH en lugares donde los servicios de tratamiento de las ITS son deficientes y las ITS son muy prevalentes[13,36-38], como es el caso de Pweto.

Agradecimientos

En memoria de «Papa Kishimba» y «Mama Sophie» que nos enseñaron a entregarse a su prójimo sin pedir nada a cambio, aun sabiendo que sus vidas eran igual de frágiles que las de las personas a quienes ayudaban. A la organización humanitaria Médicos Sin Fronteras, sin la que este trabajo no hubiera podido realizarse.

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Influence of temperature and rainfall on the evolution of cholera epidemics in Lusaka, Zambia, 2003—2006: analysis of a time series

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Summary In this study, we aimed to describe the evolution of three cholera epidemics that occurred in Lusaka, Zambia, between 2003 and 2006 and to analyse the association between the increase in number of cases and climatic factors. A Poisson autoregressive model controlling for seasonality and trend was built to estimate the association between the increase in the weekly number of cases and weekly means of daily maximum temperature and rainfall. All epidemics showed a seasonal trend coinciding with the rainy season (November to March). A 1 °C rise in temperature 6 weeks before the onset of the outbreak explained 5.2% [relative risk (RR) 1.05, 95% CI 1.04—1.06] of the increase in the number of cholera cases (2003—2006). In addition, a 50 mm increase in rainfall 3 weeks before explained an increase of 2.5% (RR 1.02, 95% CI 1.01—1.04). The attributable risks were 4.9% for temperature and 2.4% for rainfall. If 6 weeks prior to the beginning of the rainy season an increase in temperature is observed followed by an increase in rainfall 3 weeks later, both exceeding expected levels, an increase in the number of cases of cholera within the following 3 weeks could be expected. Our explicative model could contribute to developing a warning signal to reduce the impact of a presumed cholera epidemic.

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1. Introduction

The turn of the century has been marked by a worrisome emergence and re-emergence of infectious diseases worldwide. In fact, the number of cholera cases reported to the WHO between 2003 and 2006 has dramatically increased, reaching its highest values in more than a decade. In 2006, a total rise of 79% was observed compared with the previous year; 87% of cholera cases occurred in Africa.[1]

It is well established that environmental factors, through seasonal variations or as a consequence of global climate change, play an important role in the resurgence and dynamics of infectious diseases.[2–6] On the other hand, in addition to being linked to climate[7], cholera is closely related to poor environmental status and lack of basic infrastructure in developing countries. In this manner, high population densities as well as poor access to safe water and proper sanitation along with other environmental conditions contribute to the spread of cholera in Africa.[8,9]

Vibrio cholerae requires optimal temperature and physicochemical conditions (salinity, pH, humidity etc.) to survive. Nevertheless, it has also been shown to resist suboptimal conditions through specific associations of the bacterium with aquatic plants[10] or animals such as oysters, crabs and copepods.[11–14] As a result, the pathogen can persist for longer periods in aquatic habitats. Weather conditions such as an increase in environmental or sea surface temperatures favour plankton bloom. This link with temperature could explain the surge of cholera in endemic zones in cycles of 3–6 years, its expansion and its re-emergence after an absence of several years. In line with this observation, theoretical models were developed that included environmental variables as causal factors for cholera re-emergence in an attempt to describe its dynamics.[15] In real-life conditions, positive correlations were shown to exist between an upsurge in the number of cholera cases during an outbreak and the increase in sea surface temperature 8 weeks earlier.[16,17] Hence, upon describing epidemiological variables of outbreaks and analysing related climate variables, mathematical models can be built providing necessary information to predict the evolution of cholera epidemics.[18]

In Zambia, cholera is endemic and cases appear all year round. Certain regions of the country are more prone to epidemics, among which is Lusaka, the capital of Zambia. For 2003 it was estimated that 36% of the total country population lived in urban areas and only 55% had access to drinking water.[19] The last outbreak recorded occurred in 1999 and affected 7569 individuals. From 2003, epidemics re-emerged repeatedly, occurring during 3 consecutive years.[1]

The objectives of this study were to describe the evolution of the three cholera epidemics that took place in Lusaka during the period 2003–2006 and to explain the association between the increase in the number of cholera cases on the one hand and daily maximum temperature and rainfall recorded during the period under consideration on the other.

2. Methods

2.1. Study design

A descriptive and ecological study was carried out. The evolution and the impact of the three epidemics that occurred in Lusaka between 2003 and 2006 are described. Through an explicative model using time series analysis, an analytical component examined the influence of environmental factors, namely rainfall and temperature, on the appearance and increase in the number of cases of cholera.

2.2. Data source and collection

Epidemiological data were collected by the non-governmental organisation Médecins Sans Frontières, which intervened in all three outbreaks in Lusaka. The main data source was medical registries at cholera isolation centres that the organisation put in place in collaboration with the Zambian Ministry of Health. Environmental data were taken at the meteorological station of the international airport of Lusaka (FLLS-676650), whose geographical coordinates are -15.31° latitude, 28.45° longitude and 1152 m altitude. Data were available through the website TuTiempo.net (http://www.tutiempo.net), which compiles and stores data from meteorological stations around the world.

Sociodemographic data regarding the inhabitants of Lusaka (capital of Zambia) were obtained from the UNFPA.[19]

2.3. Variables considered

The WHO case definition for cholera was used.[20] Cases were aggregated by epidemiological week. Deaths attributable to cholera and recorded at the isolation centres were also grouped by epidemiological week. Weekly arithmetic means of maximum temperature were calculated for the epidemiological weeks based on daily maximum temperature (maximum value in 24 h) and were expressed in °C. Rainfall (in mm) was the total daily precipitation recorded, summed up weekly in the same manner as for temperature. The period considered for analysis extended from the eighth epidemiological week of 2003 until the eighth week of 2006.

2.4. Statistical analysis

A descriptive analysis of the variables under study was performed using time plots. The outbreaks were described presenting epidemic curves, the total weekly number of cases, weekly incidence rate, attack rate, case fatality rate (CFR), duration of outbreak and strains isolated along with their serotype. A spectral analysis was then performed with a Fast Fourier transform procedure for detecting significant trend and periodicity in the univariate analysis of the weekly number of cholera cases. Then, to examine the association between the increase in the weekly number of cholera cases (the dependent variable) and climate factors (independent variables), a Poisson autoregressive model was used through a generalised linear model with family Poisson and link log controlling for seasonality. Akaike's information cri-

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terion (AIC) was used to find the best model. The variables were entered and omitted manually from the model in a stepwise manner, with the criterion for elimination being a *P*-value >0.05. In the case of overdispersion of the data, adjusted standard errors of coefficients were presented. Sin and cos functions were used in the model for building the independent variables that explain the seasonal component of the series. An autoregressive term at order 1 was incorporated into the model to control for the autocorrelation of cases of cholera of a current week with a previous week.[21] Based on our review of the literature, lags of up to 8 weeks for temperature were introduced to analyse the association between the occurrence and increase in the number of cholera cases and the mean maximum temperature 6 weeks before the onset of the outbreak.

Goodness of fit was assessed through the standard Poisson regression models by looking for the model that minimised the residual autocorrelation, graphically through examining the simple autocorrelation function (ACF) plot and the partial autocorrelation function (PACF) plot. In addition, the plot of standardised deviance residuals against the observed cases of cholera from the final model and the simulation approach for evaluating the goodness of fit of sparse data by Boyle et al.[22] was used.

Relative risks (RR) were derived from the determination coefficients and were presented with their 95% CI. Assuming that the whole population was exposed to the environmental factors, the attributable risk (AR) was calculated using the formula AR = RR—1/RR, applicable when RR is derived from Poisson regression models.[23] Analysis was performed using Stata v.10 (StataCorp., College Station, TX, USA).

3. Results

Outbreaks were confirmed and *V. cholerae* was isolated in all three situations; the strain identified was O1 El Tor Ogawa.

Epidemiological descriptions of the three outbreaks revealed many similarities. All three took place during the rainy season coinciding with epidemiological Weeks 47—15 and were of similar duration. Table 1 gives the attack rates and other characteristics. The epidemic curves show a high CFR at the beginning of the outbreak of 2003, which then drops and remains stable for 21 weeks. No mortality data were available for 2004. During the outbreak of 2005, the CFR was smaller in magnitude and duration. The number of cases was significantly lower in the second epidemic (Figures 1—3).

The Poisson distribution of the number of cholera cases as the dependent variable was verified. The weekly numbers of cases for the period 2003—2006 varied between a minimum of 2 and a maximum of 911 cases, with a median of 89 and an interquartile range of 304 weekly cases. The weekly daily maximum temperature per epidemiological week had a minimum of 21.9 °C and a maximum of 36 °C. Rainfall had a minimum of 0 mm and a maximum of 307.1 mm. In the time plots, an increase in temperature and rainfall was observed in the weeks prior to the appearance of the epidemics (Figures 4 and 5). Univariate analysis of cholera cases for the 3 years showed a seasonal pattern that corresponded to the months from December through April, confirmed using spectral analysis and periodograms (Supplementary Figure 1), but no trend. Analysis of the association between the weekly number of cases and climate factors using a Poisson autoregressive model controlling for seasonality showed a statistically significant association between the increase in the number of cases and the increase in temperature 6 weeks earlier and the increase in rainfall 3 weeks earlier.

The final model was overdispersed. To compensate for overdispersion, standard errors were scaled using the square root of the Pearson χ^2 dispersion. The final model was adjusted for sin and cos variables to control for seasonality (sin 365°, 120°, 60° and cos 365°, 180°), and autoregressive term at order 1 of cholera cases for controlling autocorrelation. Among all models examined, the following model showed the lowest AIC value:

Weekly number of cholera cases=$\beta_0 + \beta_1$ seasonality + β_2 autoregressive component order at 1+β_3°Temp 6 weeks earlier + β_4 rainfall 3 weeks earlier

Table 1 Characterisation of three cholera outbreaks in Lusaka, Zambia, 2003—2006 (Médecins Sans Frontières, unpublished data)

	2003—2004	2004—2005	2005—2006
Population	1 234 600	1 283 984	1 335 343
Isolated strain	Ogawa	Ogawa	Ogawa
Year of last epidemic	1999	2003	2004
Years without epidemics	4	0	0
Epidemiological weeks affected	47—15	43—14	46—14
Duration in weeks	23	24	21
Total no. of cases	6471	888	5710
Maximum no. of cases per week	911	92	581
Absolute no. of deaths	205	ND	87
Case fatality rate (%)	3.2	ND	1.5
Attack rate (epidemic) (%)	0.5	0.1	0.4
Duration (weeks) of the peak	3	6	2
Epidemiological week of 1st peak	14	10	11

ND: no data available.

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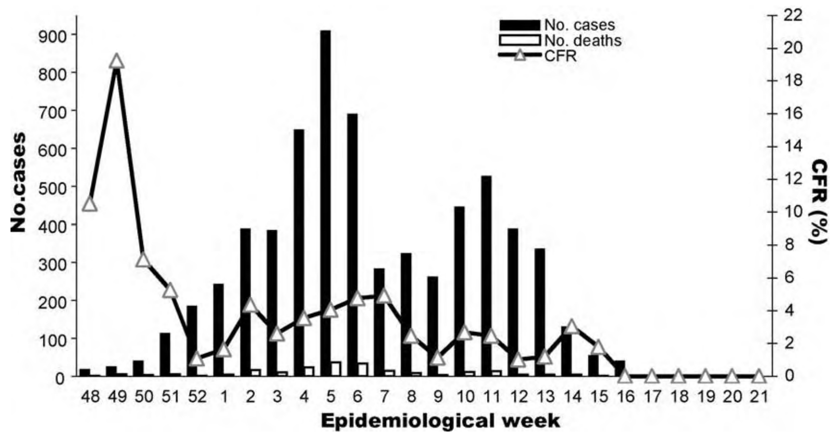

Figure 1 Distribution of cholera cases, deaths and case fatality rate (CFR) per epidemiological week ($n = 6471$ cases and 205 deaths) in the 2003—2004 outbreak in Lusaka, Zambia (Médecins Sans Frontières, unpublished data).

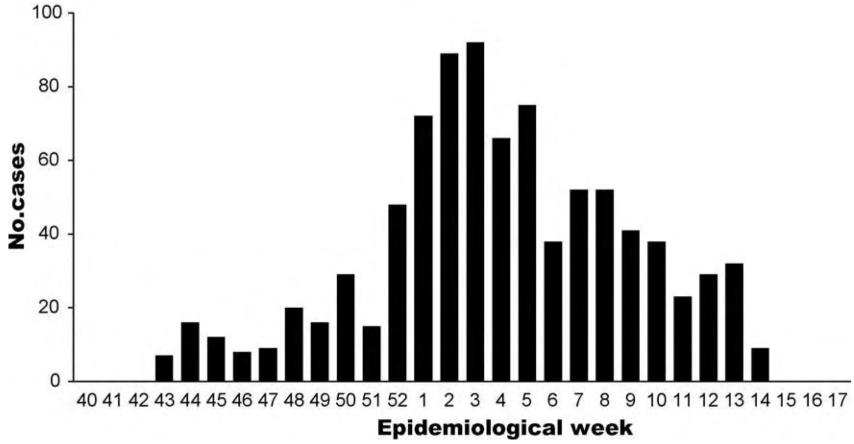

Figure 2 Distribution of cholera cases per epidemiological week ($n = 888$ cases) in the 2004—2005 outbreak in Lusaka, Zambia (Médecins Sans Frontières, unpublished data).

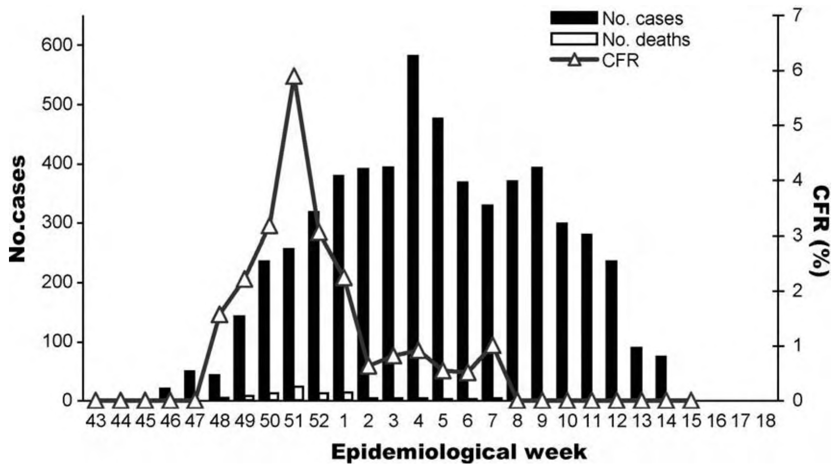

Figure 3 Distribution of cholera cases, deaths and case fatality rate (CFR) per epidemiological week ($n = 5710$ cases and 87 deaths) in the 2005—2006 outbreak in Lusaka, Zambia (Médecins Sans Frontières, unpublished data).

Examining the functions of PACF and ACF of residuals confirmed their random distribution, indicating proper adjustment of the model. The plot of standardised deviance residuals against expected cases of cholera from the model also showed a good fit of the data. The line plot of the predicted cases of cholera from the model and observed cases showed a good fit with a correlation coefficient of 0.9 ($P < 0.001$) (Supplementary Figure 2). As the overdispersion

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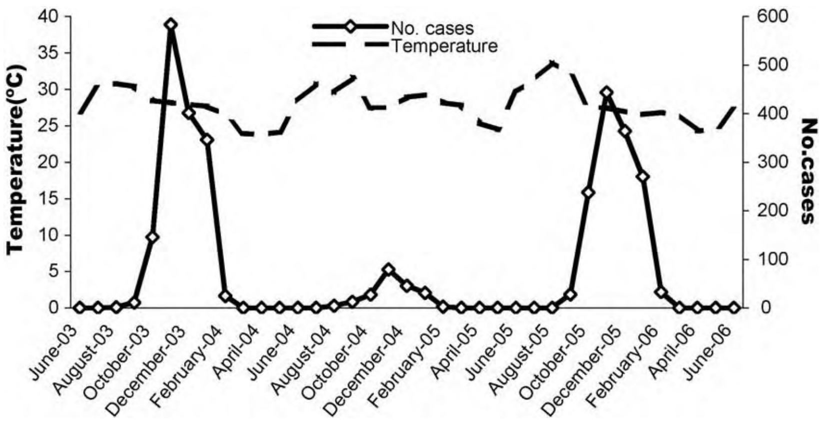

Figure 4 Time plots of number of cholera cases per month and monthly mean temperature (°C) in Lusaka, Zambia, 2003—2006 (Médecins Sans Frontières, unpublished data).

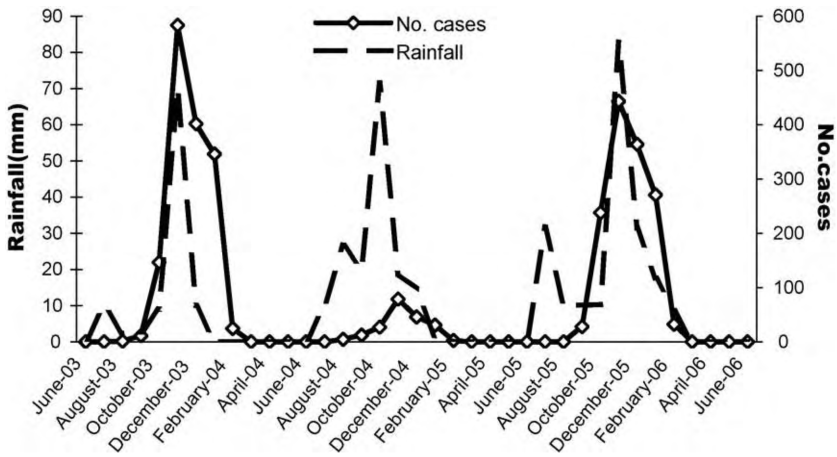

Figure 5 Time plots of number of cholera cases per month and monthly mean rainfall (mm) in Lusaka, Zambia, 2003—2006 (Médecins Sans Frontières, unpublished data).

of the data is due to the high number of null values, the interpretation of the deviance χ^2 is unreliable. Thus, using the simulation approach for evaluating the goodness of fit of sparse data by Boyle et al.[22], the deviance was 5.3 with 142 d.f., the test of goodness of fit of deviance >0.05 and AIC 3.4.

Hence, an ambient temperature increase of 1 °C 6 weeks before the beginning of the outbreaks explained 5.2% of the weekly augmentation of cholera cases observed, and an increase of 50 mm in rainfall 3 weeks earlier explained another 2.5% (Table 2).

4. Discussion

A recent review of WHO cholera incidence and mortality data (1960—2005) raised the question of Africa as a 'new homeland' for cholera.[24] Our results showed recurrent cholera outbreaks in Lusaka, Zambia, within a period of 3 years and characterised by high incidence and CFRs.

The seasonal trend for cholera incidence observed in our time series and coinciding with the rainy season is consistent with what is known for the region.[25,26]

Table 2 Association between the number of cholera cases and climate variables: final autoregressive Poisson model including lags of weekly mean temperature and rainfall (Médecins Sans Frontières, unpublished data)[a]

	Coefficient (SE)[b]	RR (95% CI)	% change[c]	AR (%)	*P*-value
Temperature (6 weeks earlier)	0.05 (0.006)	1.05 (1.04—1.06)	5.2	4.7	<0.001
Rainfall (3 weeks earlier)	0.02 (0.01)	1.02 (1.01—1.04)	2.5	1.9	0.011

RR: relative risk; AR: attributable risk.
[a] Adjusted for seasonality.
[b] Standard errors (SE) scaled using square root of Pearson χ^2 based dispersion.
[c] Percent change in expected count for 1 °C increase in temperature and 50 mm in rainfall.

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In recent years, numerous studies have demonstrated the association between the re-emergence and dynamics of infectious diseases and environmental factors.[7,27] We identified such an association between temperature and rainfall and the increase in the number of cholera cases in three outbreaks occurring in Lusaka (2003—2006), which is in concordance with suggested environmental theories for re-emergence of infectious diseases. It is worth noting that most studies relating climate to cholera describe coastal regions.

In the model presented, a 1 °C rise in temperature 6 weeks before the beginning of the outbreaks explained 5.2% of the increase in cholera cases. It could be that in continental zones, the increase in environmental temperature affects water temperature and salinity and favours growth of copepods, zooplankton, phytoplankton[16,17,28] or algal blooms, to which *V. cholerae* attaches and gains survival advantages.[10] Thus, the disease cholera can no longer be considered a simple equation of bacteria and human host, but represents a complex network that includes global weather patterns, aquatic reservoirs, phages, zooplankton and collective behaviour of surface-attached cells.[29] A rise of 50 mm in rainfall 3 weeks earlier explained 2.5% of case augmentation. For proper comparison, we would ideally refer to studies from the same region with comparable parameters of population, environment etc., but such results are not available.

To our knowledge, this is the first study reporting an association between cholera and climate factors in sub-Saharan Africa. In Peru, an association was found between environmental temperature and an increase in diarrhoea cases. A 1 °C increase in temperature corresponded to an 8% increase in hospital admissions due to diarrhoea in Lima.[30]

In Bangladesh, positive correlations existed between the increase in cholera cases during an outbreak and rising sea surface temperature 8 weeks before. A recent study carried out in South Africa reports the association between cholera incidence and increased sea surface temperature and precipitation.[31]

One of the limitations of our study was the unavailability of data on cholera cases between epidemics, which did not allow for analysis using autoregressive integrated moving average (ARIMA) predictive models that would have represented a valuable tool for forecasting future cholera outbreaks in Lusaka.

Regarding the magnitude of cholera outbreaks, cases included in the study were patients in isolation centres thus probably presenting more severe symptoms, which suggests the overall number of affected individuals might have been underestimated. Nevertheless, this selection bias does not discredit our chronological analysis since all centres recruited and operated comparably throughout the three outbreaks.

Furthermore, ecological fallacy cannot be excluded when extrapolating results to individual risks through presenting attributable risks.

We recognise that in our analysis only temperature and precipitation as explicative variables intervened whilst other factors not targeted here play an important role in the rise in the incidence of cholera.

Examining the evolution of the outbreaks permitted a clear seasonal pattern associated with the beginning of the rainy season and specific prior increases in temperature and rainfall to be established. These observations could be useful for developing a warning signal aiming to facilitate public health authority interventions in the region with the arrival of the rainy season. In fact, the second outbreak had a lower burden and attack rate, possibly due to acquired immunity as is often observed following large outbreaks whereby the following ones are shorter and less severe.[18] Moreover, intervention teams were present long after the first outbreak and substantial efforts were put into implementing prevention and control measures. Therefore, public sensitisation to the problem, resource mobilisation and lessons learned from the previous outbreak could have played a role.

Our results suggest that towards the end of August and beginning of September, an increase in the average maximum temperature above expected (pre-established based on historical data) followed by an increase in rainfall 3 weeks later could be indicators of a potential increase in cholera cases during October to November.

As pointed out by Pascual et al.[18], climate factors are not enough to understand the size and timing of cholera outbreaks. To improve our insight into cholera epidemics, immunity levels of the population in the region should be taken into account.

According to experts, global warming is likely to increase the severity and frequency of extreme weather events in the future. Considering this threat and the cholera burden in sub-Saharan Africa, we recommend characterising cholera outbreaks further, linking their occurrence to factors other than rises in temperature or precipitation. To develop an early warning system for outbreaks, forecasting methods would be interesting, although a comprehensive understanding of the disease dynamics and all parameters involved is necessary. The model for environmental cholera transmission proposed in the literature[15] would be helpful.

In conclusion, our results show an association between an increase in the number of cholera cases and climate variables. If 6 weeks prior to the beginning of the rainy season an increase in temperature is observed followed by an increase in rainfall 3 weeks later, both exceeding expected levels, we may be confronted with an increase in the number of cases of cholera within the following 3 weeks. Our explicative model could contribute to developing a warning signal to reduce the impact of a presumed cholera epidemic.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.trstmh.2008.07.017.

Authors' contributions: MALF, AB, NEO and DHG developed the concept and design for the study; AB acquired the data; JDJ and CLG developed the model and supervised the analyses; MALF, JDJ and CLG analysed and interpreted the data; MALF drafted the manuscript. All authors revised the manuscript critically for intellectual content and read and approved the final version. MALF is guarantor of the paper.

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CORRESPONDENCE

Reply to comment on: Influence of temperature and rainfall on the evolution of cholera epidemics in Lusaka, Zambia, 2003—2006: analysis of a time series

When researchers from wealthy countries undertake research in less-developed countries, they should strive to seek collaboration with local actors and build capacity through training and mentorship. Indeed, the requirement for local collaboration has been put forward as a benchmark for ethical research in developing countries.[1]

In June 2003 Médecins Sans Frontières (MSF) established an independent ethics review board for the assessment of research conducted in settings where it works. This independent ethics review board developed a set of practical benchmarks for the ethical conduct of research, among which collaborative research is a core principle. In practice, this means that research protocols submitted to the ethics review board have to demonstrate, or justify the absence of, the following activities: partnership with national and/or international research institutions; collaboration with local and national researchers and health; involvement Involve the community in which the study takes place; a contribution to developing the capacity for researchers and health policymakers to become full and equal partners in the research enterprise; and a fair sharing of financial and other rewards of the research.

One of the grey areas for the MSF ethics review board has been to determine the line between research and routine programme monitoring. MSF has previously undertaken prospective research in Zambia, and this has rightly involved local investigators.[2] The paper reporting temperature and rainfall trends in relation to cholera epidemics published in the *Transactions*[3] was a retrospective analysis of routinely collected data. The MSF ethics board considers that the analysis of routinely collected data is outside of the purview of ethics review. In this instance, the analysis was done almost 2 years after the data was collected, long after MSF's cholera programme in Zambia had closed.

Collaboration and capacity building can take many forms, from the training of data capturers to the engagement of local principal investigators. The danger of using authorship as a proxy for collaboration is that it could encourage token authorship — a practice that is rightly shunned in the West — in place of true capacity building.[4] It would be more appropriate to encourage capacity building at the beginning of the study, during the process of ethics and scientific review.

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ORIGINAL

Evolución del riesgo de mortalidad fetal tardía, prematuridad y bajo peso al nacer, asociado a la edad materna avanzada, en España (1996-2005)

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(Trends in the risk of late fetal mortality, prematurity and low birth weight associated with advanced maternal age in Spain [1996-2005])

Resumen

Objetivos: Describir la evolución de la fecundidad, la mortalidad fetal tardía, la prematuridad y el bajo peso al nacer, así como su asociación con la edad materna avanzada, en España, durante el período 1996-2005.

Métodos: Estudio ecológico. La prematuridad y el bajo peso en función de la edad materna se analizan mediante tablas de contingencia. La evolución de las tasas de mortalidad fetal tardía se analiza mediante una estandarización directa. El riesgo de mortalidad fetal tardía, ajustado por la edad materna y la prematuridad, se analiza mediante una regresión de Poisson.

Resultados: Las tasas de mortalidad fetal tardía y de fecundidad han aumentado en las mujeres de más de 35 años de edad, sobre todo en las mayores de 45 años. El riesgo de mortalidad fetal tardía es 2,7 veces superior para las mujeres a partir de los 45 años (razón de tasas: 2,7; intervalo de confianza del 95% [IC95%]: 1,8-3,0), con una fracción etiológica de la exposición del 69% (IC95%: 55,2-78,6). La prevalencia de prematuridad y de bajo peso para este mismo grupo es 3 veces superior, con una razón de prevalencias de prematuridad de 2,9 (IC95%: 2,7-3,1) y de bajo peso de 3,1 (IC95%: 2,9-3,3).

Conclusiones: El elevado riesgo de las mujeres de 45 o más años de edad se explica por el aumento de la proporción de embarazos en este grupo de edad. Se requieren nuevos estudios, en el ámbito de la epidemiología perinatal, que analicen el impacto de las técnicas de reproducción asistida en los embarazos a edades avanzadas, así como la dinamización de la puesta en marcha del registro nacional de técnicas de reproducción asistida.

Palabras clave: Edad materna. Mortalidad fetal tardía. Recién nacido de bajo peso. Recién nacido prematuro. Técnicas de reproducción asistida.

Abstract

Objectives: To describe trends in fertility, fetal death rate, prematurity and low birth weight, as well as their association with advanced maternal age, in Spain from 1996 to 2005.

Methods: We performed an ecological study. The association between low birth weight and prematurity with maternal age was analyzed through contingency tables. The pattern of fetal mortality rate was analyzed through direct standardization. To study the risk of late fetal mortality, adjusted by age and prematurity, a Poisson regression model was used.

Results: The rates of fertility and late fetal mortality increased in women aged more than 35 years, especially in women aged more than 45 years. The risk of late fetal mortality was 2.7 times higher in women aged 45 years and above (rate ratio, 2.7; 95%CI: 1.8-3), with an etiological fraction of exposure of 69% (95%CI: 55.2-78.6). The prevalence rate of prematurity and low birth weight was three times higher in this age group, with a prevalence rate of prematurity of 2.9 (95%CI: 2.7-3.1) and of low birth weight of 3.1 (95%CI: 2.9-3.3).

Conclusions: The high risk found in women aged more than 45 years is explained by the increase in the proportion of pregnancies within this age group during the period analyzed. Further studies in perinatal epidemiology that analyze the impact of assisted reproduction techniques in pregnancies in older women are required, as well as a national registry of assisted reproduction techniques.

Key words: Maternal age. Fetal death rate. Low birth weight infant. Premature infant. Assisted reproduction techniques.

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Introducción

En la década de los ochenta se inició en España un progresivo descenso de la natalidad. En 2006, con 1,3 hijos de media por mujer en edad reproductiva, se situaba en el grupo de países con el índice sintético de fecundidad más bajo del mundo, por encima de Ucrania y Grecia (entre otros), con 1,1 y 1,2 hijos por mujer, respectivamente[1]. El descenso de la fecundidad experimentado se produce sobre todo en las mujeres menores de 35 años, ya que en los últimos 20 años ha aumentado el número de embarazos en mujeres de más de 35 años, que representan el 21,2% de los embarazos del año 2006[2]. Los determinantes sociales de esta modificación del patrón reproductivo pueden explicarse por los cambios culturales, sociales y económicos acontecidos en nuestra sociedad durante el último tercio del siglo XX. La incompatibilidad de la conciliación entre la vida familiar y laboral, la ausencia durante años de políticas protectoras de la maternidad, y la progresiva medicalización del embarazo y el parto, se han propuesto como determinantes del descenso de la natalidad y del aumento de la edad media para el primer embarazo[2,3]. Las técnicas de reproducción asistida comenzaron a desarrollarse en España en la década de los setenta. En 1984 nacía el primer niño fecundado *in vitro*[4]. La probabilidad de conseguir un embarazo disminuye con la edad, y a partir de los 35 años esta disminución es más marcada[5]. Las técnicas de reproducción asistida, entre otras muchas indicaciones, están utilizándose en los casos de disminución de la fertilidad debida a la edad materna avanzada y, por tanto, están contribuyendo al aumento del número de embarazos en mujeres mayores de 35 años. En los países desarrollados, se estima que alrededor del 1% de los nacimientos son fruto de la reproducción asistida[6]. En España, actualmente se desconoce el número exacto de niños nacidos mediante estas técnicas. La ley 14/06, de la que cabe destacar la creación del «Registro de actividad» de los centros de reproducción asistida, nos abre la posibilidad de controlar en un futuro este estadístico[7]. Son muchos los trabajos que han puesto de manifiesto la asociación entre la edad materna avanzada y el aumento de la mortalidad fetal tardía, la prematuridad y el bajo peso al nacer[8-14]. El presente estudio describe la evolución de la fecundidad, la mortalidad fetal tardía, la prematuridad y el bajo peso al nacer, así como su asociación con la edad materna avanzada, en España, para el período 1996-2005.

Métodos

Diseño

Estudio ecológico de tendencias para el análisis de la evolución de las tasas de fecundidad y de mortalidad fetal tardía, y transversal para la estimación de la prevalencia de prematuridad y de bajo peso al nacer.

Población de estudio

Nacimientos de hijos de mujeres residentes en España durante el período 1996-2005.

Descripción de las variables

Los datos agregados de este estudio se obtuvieron de las estadísticas de la base de datos del Movimiento Natural de la Población, y del padrón municipal de habitantes del Instituto Nacional de Estadística (INE) de España[2]. Las tasas de fecundidad y de mortalidad fetal tardía se calcularon como sigue:

$$\text{Tasa de fecundidad general} = \frac{\Sigma \text{ Nacidos vivos}}{\Sigma \text{ Mujeres de 15-49 años}} \times 1.000$$

Tasa de fecundidad específica por edad =

$$\frac{\Sigma \text{ Nacidos vivos de madres de «X» años}}{\Sigma \text{ Mujeres de «X» años de edad}} \times 1.000$$

Tasa de mortalidad fetal tardía =

$$\frac{\Sigma \text{ Muertes fetales}}{\quad} \times 1.000$$

Desde 1975, el INE define como «nacimiento» todo recién nacido con vida, y como «muerte fetal tardía» todo feto muerto con 6 o más meses de gestación, antes de su completa expulsión o extracción del cuerpo de la madre. De igual forma, el INE define la «prematuridad» como el recién nacido de menos de 37 semanas, y el «bajo peso al nacer» como menos de 2.500 g[15]. Estos dos parámetros se calcularon como proporciones en las cuales el numerador lo componía el total de recién nacidos de bajo peso o de prematuros para ese año, y el denominador el total de nacidos vivos para el mismo año o período. La edad materna fue categorizada en 4 grupos: < 35, 35-39, 40-44 y ≥ 45 años. El grupo de menores de 35 años se tomó como referencia.

Análisis estadístico

En primer lugar, se realizó un análisis descriptivo de las tasas de mortalidad fetal tardía, de fecundidad, de la proporción de prematuridad y del bajo peso al nacer. Para el análisis de la evolución de las tasas de mortalidad fetal tardía se llevó a cabo una estandarización directa. Como nos interesaba valorar la evolución temporal de la mortalidad, se tomó como referencia el año 1996, obteniendo las tasas de mortalidad estandarizadas de los años siguientes. Las tasas ajustadas así obtenidas se interpretaron como la mortalidad de la población, en el tiempo t, de no haber cambiado la estructura de edades de dicha población a lo largo del tiempo considerado[16]. En segundo lugar, se analizaron las tasas de fecundidad y de mortalidad fetal tardía en función de la edad materna para cada uno de los años del estudio, y para el total de los 10 años, calculando la razón de tasas (RT) como medida de asociación y la fracción etiológica debida a la exposición (FEE) como medida de impacto en la población. La FEE se calculó como la RT expresada en términos relativos (RT – 1/RT), con su respectivo intervalo de confianza del 95% (IC95%), interpretada como el porcentaje de riesgo de mortalidad fetal tardía atribuible a la edad materna. Para el cálculo de la RT de la mortalidad fetal tardía ajustada en función de la edad materna, para el período total de 10 años, se utilizó un primer modelo de regresión binomial negativa. La prematuridad se asocia con la mortalidad fetal tardía y, a su vez, con la edad materna, y no es un factor intermedio de la asociación entre la mortalidad fetal tardía y la edad materna. Por tanto, se controló el efecto de la prematuridad introduciéndola como covariable en un segundo modelo de regresión de Poisson. Los dos modelos empleados fueron:

– Tasa de mortalidad fetal tardía = $\beta_0 + \beta_1 \times$ edad materna.
– Tasa de mortalidad fetal tardía = $\beta_0 + \beta_1 \times$ edad materna + $\beta_2 \times$ prematuridad.

De este modo obtuvimos la RT de mortalidad fetal tardía en función de la edad materna, ajustada por la prematuridad, con sus respectivos IC95%, para el conjunto de los 10 años en estudio. La bondad del ajuste de los modelos fue verificada mediante el estadístico de desviación y el contraste de verosimilitud. Finalmente, para el análisis de la proporción de recién nacidos prematuros y de bajo peso en función de la edad materna, se llevó a cabo un análisis de tablas de contingencia, calculando como medida de la fuerza de la asociación la razón de prevalencias (RP)[17,18]. El programa estadístico utilizado para el análisis de los datos fue el Stata v.10.0[19].

Resultados

Se observa una disminución progresiva de la tasa de mortalidad fetal tardía en España durante el período 1996-2005, a la vez que un aumento de la tasa de fecundidad general, debido a los nacidos vivos de madres de $\geq$ 35 años (tablas 1 y 2). Cabe destacar el in-

Tabla 1. Análisis descriptivo: número absoluto de recién nacidos vivos en función de la edad materna, porcentaje de recién nacidos de madres mayores de 35 años, número absoluto de mujeres en edad fértil, número absoluto de muertes fetales tardías, TMFT, TME, TFG, prevalencia de recién nacidos de menos de 37 semanas de gestación y de recién nacidos de menos de 2.500 g, en el período 1996-2005, en España

	Recién nacidos por grupos de edad materna (n):											
Año	< 35 años	35-39 años	40-44 años	≥ 45 años	> 35 años (%)	Mujeres en edad fértil[a] (n)	MTF (n)	TMFT (‰)	TME (‰)	TFG (‰)	Prematuros n (%)	Bajo peso n (%)
1996	324.160	34.402	3.932	132	10,6	10.306,679	1.423	3,9	Ref.	35,2	17.923 (4,9)	20.721 (5,7)
1997	326.720	37.964	4.217	134	11,5	SD	1.531	4,2	4,2	SD	24.889 (6,7)	21.829 (5,9)
1998	319.976	40.624	4.445	148	12,4	10.386.132	1.416	3,8	3,9	35,1	25.839 (7,1)	22.522 (6,2)
1999	329.496	45.245	5.201	188	13,3	10.418.963	1.463	3,8	3,7	36,5	27.578 (7,2)	24.423 (6,4)
2000	341.483	50.353	5.588	208	14,1	10.516.807	1.479	3,7	3,4	37,8	29.380 (7,4)	25.999 (6,5)
2001	345.262	54.473	6.395	250	15,0	10.677.807	1.541	3,8	3,4	38,0	29.710 (7,3)	27.760 (6,8)
2002	353.159	58.447	6.968	272	15,7	10.872.784	1.470	3,5	3,1	38,5	32.400 (7,7)	29.917 (7,1)
2003	369.423	64.364	7.793	301	16,4	11.075.129	1.494	3,4	2,7	39,9	34.278 (7,8)	31.649 (7,2)
2004	377.348	68.611	8.281	351	17,0	11.167.478	1.438	3,2	2,5	40,7	35.279 (7,8)	32.365 (7,1)
2005	384.681	71.874	9.422	394	17,5	11.358.283	1.538	3,3	2,6	41,0	34.620 (7,4)	33.658 (7,2)

MFT: muertes fetales tardías; TMFT: tasa de mortalidad fetal tardía; TME: tasa de mortalidad estandarizada; TFG: tasa de fecundidad general; SD: sin datos.
[a]Mujeres en edad fértil: de 15-49 años.
Fuente: INE (elaboración propia).

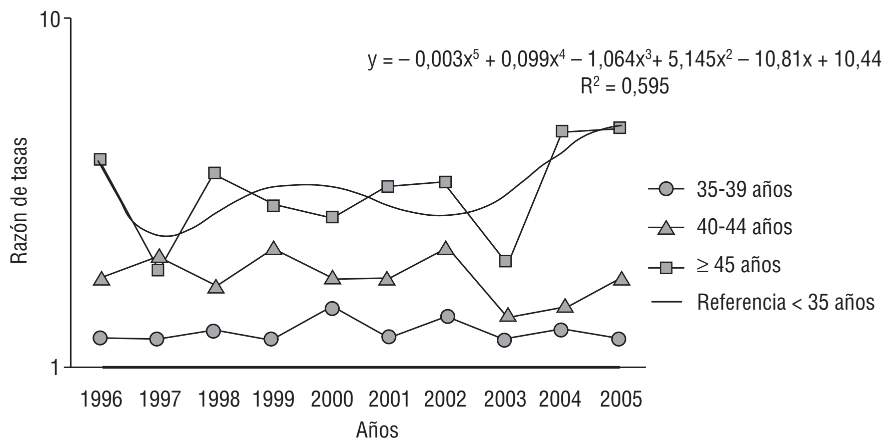
Tabla 2. Evolución anual de las tasas de fecundidad específicas y de mortalidad fetal tardía en función del grupo de edad materna. Razón de tasas de mortalidad fetal tardía y fracción etiológica debida a la exposición, durante el período 1996-2005, en España

Año	Edad (años)	TFE, $^0/_{00}$ (IC95%)	TMFT, $^0/_{00}$ (IC95%)	RT (IC95%)	FEE (IC95%)
1996	< 35	51,1 (50,9-51,3)	3,8 (3,6-4)	Ref.	Ref.
	35-39	23,4 (23,2)	4,7 (3,9-5,3)	1,2 (1-1,4)	16,3 (1-29)
	40-44	3,1 (3-3,2)	6,9 (4,5-9,9)	1,8 (1,2-2,6)	44,2 (18,5-61,9)
	≥ 45	0,10 (0,09-0,12)	15,2 (1,8-54,7)	3,9 (0,9-15,5)	74,5 (–0,1 a 93,6)
1997	< 35	ND	4 (3,8-4,2)	Ref.	Ref.
	35-39	ND	5 (4,3-573)	1,2 (1,1-1,4)	19,6 (6,4-31)
	40-44	ND	8,5 (5,9-11,8)	2,1 (1,5-2,9)	53 (34,6-66,1)
	≥ 45	ND	7,5 (1,9-4,2)	1,9 (0,3-1,3)	46,2 (–2,8 a 92,3)
1998	< 35	50,1 (50,7-51,1)	3,8 (3,6-4)	Ref.	Ref.
	35-39	26,9 (26,6-27,1)	4,7 (3,9-5,3)	1,3 (1,1-1,5)	24,6 (12,5-35,1)
	40-44	3,7 (3,6-3,8)	6,9 (4,5-9,9)	1,7 (1,2-2,5)	43,1 (0,17-60,5)
	≥ 45	0,15 (0,12-0,17)	15,2 (1,8-54,7)	3,6 (0,9-14,3)	72,3 (–0,1 a 93)
1999	< 35	52,8 (52,6-53,0)	3,7 (3,5-3,8)	Ref.	Ref.
	35-39	29,4 (29,0-29,6)	4,6 (4,0-5,3)	1,2 (1,0-1,4)	20,0 (7,4-30,1)
	40-44	3,7 (3,6-3,8)	8,3 (6,0-11,1)	2,2 (1,6-3,0)	55,3 (34,6-67,0)
	≥ 45	0,13 (0,11-0,15)	10,6 (1,3-38,4)	2,9 (0,7-11,4)	62,5 ([-0,4]-91,2)
2000	< 35	54,8 (54,6-55)	3,5 (3,3-3,7)	Ref.	Ref.
	35-39	31,7 (31,5-32)	5,1 (4,5-5,7)	1,5 (1,3-1,7)	31,9 (22,1-40,5)
	40-44	3,9 (3,7-4)	6,3 (4,4-8,7)	1,8 (1,3-2,5)	44,4 (22,3-60,3)
	≥ 45	0,16 (0,14-0,18)	9,6 (1,2-34,7)	2,7 (0,7-10,1)	63,7 (–0,4 a 91)
2001	< 35	55,3 (55,1-55,5)	3,6 (3,4-3,8)	Ref.	Ref.
	35-39	33,4 (33-33,6)	4,5 (4-5,2)	1,2 (1,1-1,4)	20 (8-30,2)
	40-44	4,2 (4,1-4,3)	6,4 (4,6-8,7)	1,8 (1,3-2,4)	43,4 (22,8-58,5)
	≥ 45	0,19 (0,16-0,21)	12 (2,5-35,1)	3,3 (1,1-10,1)	70 (0,6-90,1)
2002	< 35	56,2 (56-56,4)	3,2 (3-3,4)	Ref.	Ref.
	35-39	34,7 (34,4-35)	4,6 (4,1-5,2)	1,4 (1,2-1,6)	29,9 (20-38,6)
	40-44	4,5 (4,4-4,6)	7,2 (5,3-9,4)	2,2 (1,6-2,9)	54,6 (39,8-65,7)
	≥ 45	0,2 (0,17-0,22)	11 (2,3-32,2)	3,4 (1,1-10,4)	70,3 (0,8-90,4)
2003	< 35	58,3 (58,2-58,5)	3,2 (3-3,4)	Ref.	Ref.
	35-39	36,9 (36,6-37,2)	4 (3,6-4,6)	1,2 (1,1-1,4)	20,2 (9-30,1)
	40-44	4,8 (4,7-4,9)	4,6 (3,2-6,4)	1,4 (1-1,9)	29,8 (2,4-49,6)
	≥ 45	0,21 (0,19-0,24)	6,6 (0,8-24)	2,0 (0,5-8,1)	51,1 (–0,9 a 87,7)
2004	< 35	59,8 (54,6-59,9)	2,9 (2,8-3,1)	Ref.	Ref.
	35-39	38,8 (38,5-39,1)	4 (3,5-4,5)	1,3 (1,2-1,5)	25,4 (14,9-34,6)
	40-44	5 (4,9-5,1)	4,3 (3-6)	1,5 (1-2)	31,4 (4,5-50,7)
	≥ 45	0,24 (0,21-0,27)	14,2 (4,6-33,2)	4,7 (1,9-11,3)	78,8 (49,4-91,2)
2005	< 35	60,6 (60,4-60,8)	3,1 (3-3,3)	Ref.	Ref.
	35-39	40 (39,7-40,3)	3,7 (3,3-4,2)	1,2 (1-1,3)	15,6 (3,7-26,1)
	40-44	5,5 (5,4-5,6)	5,8 (4,4-7,6)	1,8 (1,4-2,4)	46 (29,3-58,7)
	≥ 45	0,25 (0,23-0,28)	15,2 (5,6-33,1)	4,8 (2,2-10,6)	79,1 (53,7-90,6)

IC95%: intervalo de confianza del 95%; FEE: fracción etiológica debida a la exposición; ND: no disponible; RT: razón de tasas de mortalidad fetal tardía; TFE: tasa de fecundidad específica; TMFT: tasa de mortalidad fetal tardía.
Fuente: INE (elaboración propia).

cremento del 60% de la tasa específica de fecundidad para las mujeres de ≥ 45 años en el año 2005 con respecto a 1996 (tabla 2). Si tomamos como población de referencia los recién nacidos del año 1996 y comparamos los siguientes años con éste mediante una estandarización directa de las tasas de mortalidad fetal tardía, se observa una clara y progresiva disminución de las tasas estandarizadas (tabla 1). Por el contrario, podemos destacar un aumento progresivo de la prevalencia de prematuridad y de bajo peso al nacer durante los años del estudio. Desde 1996 a 2005, el incremento de la prematuridad y del bajo peso al nacer ha sido de un 20,8 y un 31%, respectivamente (tabla 1). El riesgo de mortalidad fetal tardía para cada año

Figura 1. Evolución anual de la razón de tasas de la mortalidad fetal tardía en función de la edad materna, tomando como referencia el grupo de edad de menores de 35 años, durante el período 1996-2006 en España.



Fuente: INE (elaboración propia).

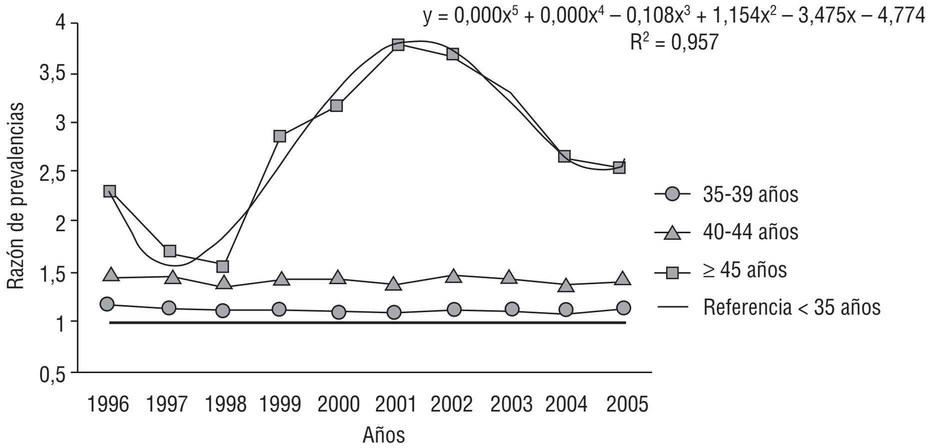
del estudio se concentra en el grupo de mujeres de ≥ 45 años; en 5 de los 10 años nos encontramos con más de un 70% del riesgo de mortalidad fetal tardía atribuible a este grupo de edad. Así, la disminución global de las muertes fetales tardías que se produce durante este período no se acompaña de una distribución homogénea en función de la edad materna. Si bien disminuye en el grupo de menos de 35 años, sucede lo contrario para las mayores de esta edad y muy particularmente para las de ≥ 40 años (tabla 2 y fig. 1). Debido a la dispersión de las muertes fetales tardías, el modelo empleado para el cálculo de las razones de las tasas de mortalidad fetal tardía en función de la edad materna para el conjunto de los 10 años fue una regresión binomial negativa. Mediante el test de la razón de verosimilitud (χ^2 = 11,28; p < 0,001) se comprobó que este modelo era equivalente a una regresión de Poisson. El modelo nos muestra que, a pesar de la clara disminución de las tasas de mortalidad fetal tardía durante el período 1996-2005, el riesgo de muerte fetal tardía se concentra en las mujeres mayores de 40 años, y muy particularmente por encima de los 45 años. En un segundo modelo de regresión de Poisson se introdujo la prematuridad controlando el efecto confusor descrito en la bibliografía para esta última variable[8-14]. De una RT en el primer modelo de 3,1 (IC95%: 2,1-4,5) para el grupo de edad de ≥ 45 años, pasamos a una RT ajustada de 2,7 (IC95%: 1,8-3), con una disminución global del efecto de la edad materna sobre la mortalidad de un 12,9% (tabla 3). La prevalencia de recién nacidos con bajo peso es significativamente mayor en las mujeres mayores de 35 años, y muy notable para las mujeres de ≥ 45 años. Se observa que a mayor edad materna mayor es la RP, lo cual apoya el criterio de consistencia causal de «gradiente biológico». Cabe destacar las RP de las mujeres mayores de 45 años a partir de 1999, con valores > 3 (figs. 2 y 3). El grupo de mujeres mayores de 45 años tiene una RP 3,10 veces superior

Tabla 3. Modelos de regresión binomial negativa y de Poisson: TMFT en función de la edad materna y la prematuridad, para el total del período 1996-2005 en España (n = 14.793)

Período	Edad materna (años)	TMFT, ‰ (IC95%)	RT[a] (IC95%)	RT[b] (IC95%)	FEE[c] (IC95%)
1996-2005	< 35	3,8 (3,7-3,9)	Ref.	Ref.	Ref.
	35-39	4,8 (4,6-4,9)	1,2 (1,1-1,3)	1,2 (1,1-1,3)	19,7 (16,1-23,2)
	40-44	6,9 (6-7,4)	1,7 (1,5-1,9)	1,5 (1,4-1,7)	42,5 (36,5-48,1)
	≥ 45	12,5 (8,3-18)	3,1 (2,1-4,5)	2,7 (1,8-3)	69 (55,2-78,6)
TMFT período		4,0 (3,9-4,1)			

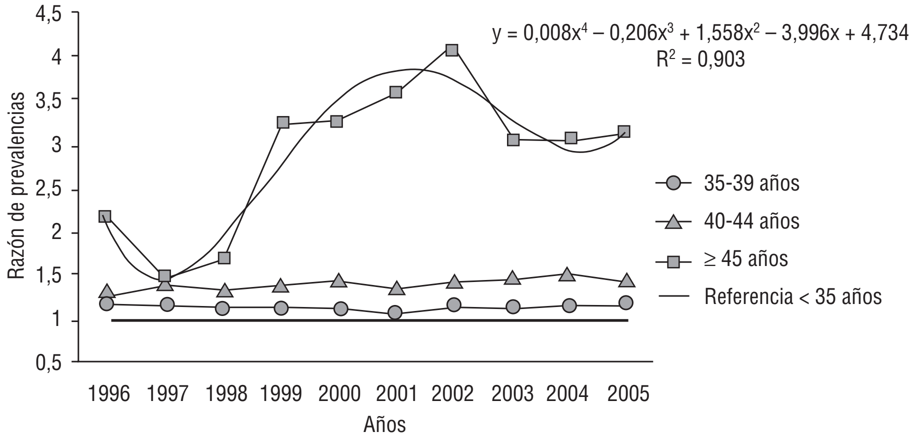
IC95%: intervalo de confianza del 95%; FEE: fracción etiológica debida a la exposición; RT: razón de tasas de mortalidad fetal tardía; TMFT: tasa de mortalidad fetal tardía.
[a]RT en función de la edad materna obtenidas mediante un modelo de regresión binomial negativa.
[b]RT ajustadas por la edad materna y la prematuridad mediante un modelo de regresión de Poisson.
[c]Fracción etiológica debida a la exposición.

Figura 2. Evolución anual de la razón de prevalencias de la prematuridad en función de la edad materna, tomando como referencia el grupo de edad de menores de 35 años, durante el período de 1996-2006 en España.



Fuente: INE (elaboración propia).

Figura 3. Evolución anual de la razón de prevalencias de bajo peso al nacer en función de la edad materna, tomando como referencia el grupo de edad de menores de 35 años, durante el período 1996-2006 en España.



Fuente: INE (elaboración propia).

(IC95%: 2,86-3,33) de tener un recién nacido de bajo peso, frente al grupo de menores de 35 años, en el período 1996-2005 (tabla 4). La proporción de recién nacidos de menos de 37 semanas de gestación se comporta de manera semejante a la de bajo peso al nacer, con tan sólo pequeñas variaciones en los valores de RP. Cabe destacar las RP de las mujeres mayores de 45 años, que para el conjunto de los 10 años en estudio presentan una RP de prematuridad 2,92 veces superior (IC95%: 2,71-3,14) a la del conjunto de las mujeres menores de 35 años. La prevalencia de prematuridad para el total de los 10 años del estudio en este grupo de edad es destacablemente superior a la del resto de las edades, con cifras cercanas al 20% (tabla 4).

Discusión

La asociación entre la edad materna avanzada, el riesgo de mortalidad fetal tardía y la morbilidad neonatal es un hallazgo esperado que no difiere de los encontrados en la bibliografía revisada[8-14]. La disminución de la mortalidad fetal tardía se relaciona clásicamente con los avances sociales, económicos y de salud pública

Tabla 4. Razón de prevalencias de la proporción de recién nacidos prematuros (n = 4.062.685 nacidos vivos, un 7,1% prematuros) y de bajo peso en función de la edad materna (n = 3.856.664 nacidos vivos; un 6,6% con bajo peso y un 5,07% sin peso declarado) para el período 1996-2005, en España

Período	Edad materna (años)	Prematuro < 37 SG, n (%)	A término ≥ 37 SG (n)	RP (IC95%)
1996-2005	< 35	223.569 (6,9)	3.025.622	Ref.
	35-39	57.006 (8,1)	645.617	1,15 (1,14-1,16)
	40-44	10.459 (9,9)	95.567	1,46 (1,43-1,49)
	≥ 45	862 (17,8)	3.983	2,92 (2,71-3,14)
Período	Edad materna (años)	Bajo peso < 2.500 g, n (%)	Normopeso ≥ 2.500 g (n)	RP (IC95%)
1996-2005	< 35	207.770 (6,7)	2.874.227	Ref.
	35-39	52.781 (7,8)	617.237	1,14 (1,13-1,15)
	40-44	9.472 (9,4)	90.692	1,42 (1,40-1,45)
	≥ 45	820 (18,3)	3.665	3,10 (2,86-3,33)

IC95%: intervalo de confianza del 95%; RP: razón de prevalencias; SG: semanas de gestación.
Fuente: INE (elaboración propia).

acontecidos durante el pasado siglo, entre los que cabe destacar la universalización y la gratuidad de los cuidados prenatales y los cambios estructurales, diagnósticos y terapéuticos que la perinatología experimentó en el último tercio del siglo XX[20]. Sin embargo, gracias a los resultados de este estudio se demuestra que la disminución global de las muertes fetales tardías para este período no se acompaña de una distribución homogénea en función de la edad materna: si bien disminuye en el grupo de edad de menos de 35 años, sucede lo contrario para las mayores de 35, y muy particularmente para las de ≥ 45 años. Entre las limitaciones de este estudio hay que destacar el infrarregistro de la mortalidad perinatal en las estadísticas oficiales de España[21,22], circunstancia que puede haber desplazado los resultados hacia la no asociación. Otra limitación que hay que tener en cuenta, relacionada con el tipo de estudio realizado, es que las medidas de asociación y de impacto encontradas no pueden expresarse como el riesgo individual de una mujer de determinada edad, ya que incurriríamos en el principal sesgo de este tipo de estudios: la falacia ecológica. Los resultados de las medidas del riesgo expresadas en razones de tasas y fracciones etiológicas debidas a la exposición pueden estar confundidas con otros múltiples factores no controlados en este estudio, como las técnicas de reproducción asistida, los antecedentes obstétricos, los datos antropométricos, la enfermedad materna, la paridad, las gestaciones múltiples[22,23], etc. De todos estos factores, la prematuridad y la edad materna fueron los únicos que se pudieron controlar en este estudio. Como consecuencia de la modificación de la normativa padronal de 1996, que establecía un nuevo sistema de gestión continua e informatizada de los padrones municipales, no disponemos de los datos de la población referidos a 1997 para el cálculo de la tasa de fecundidad. Finalmente, nos encontramos con un 5% de pesos no declarados para los 10 años en estudio. A pesar de las limitaciones, el estudio nos ha mostrado un cambio en el patrón epidemiológico de la fecundidad y de las tasas de mortalidad fetal tardía para el período 1996-2005 en España. La relación entre la edad materna avanzada y el mayor riesgo de morbimortalidad fetal y neonatal, muy notable a partir de los 45 años de edad, está asociada con el incremento de la fertilidad de las mujeres mayores de 35 años. Por tanto, hay que preguntarse qué impacto están teniendo las técnicas de reproducción asistida en el aumento de la fertilidad de estos grupos de edad y si, independientemente de cualquier otro factor, aumenta el riesgo de morbimortalidad fetal y neonatal. En este sentido, una reciente revisión sistemática de la literatura médica y 3 metaanálisis encuentran un mayor riesgo de morbimortalidad fetal y neonatal en los recién nacidos concebidos mediante técnicas de reproducción asistida[6,24-29]. Estas técnicas se están utilizando, entre otras muchas indicaciones, para el caso de la fertilidad natural disminuida en las mujeres de edad avanzada. Sería importante establecer los riesgos de mortalidad fetal tardía y de morbilidad neonatal asociados a las técnicas de reproducción asistida, ajustados por la edad materna. Así, podríamos obtener el riesgo atribuible a ellas independientemente de la edad materna, y viceversa. El importante incremento del número de embarazos en las mujeres mayores de 35 años se está manifestando con un aumento de la morbimortalidad fetal y neonatal para este grupo de edad. En términos de impacto sobre la salud pública, esta situación se manifiesta con elevadas fracciones etiológicas de mortalidad fetal y altas prevalencias de prematuridad y bajo peso, para la edad materna avanzada, con el consiguiente efecto económico que supone la atención hospitalaria de la morbimortalidad fetal y neonatal[30,31]. En el aspecto político, se debería incidir en la génesis de los determinantes sociales del aumento de la proporción de embarazos en edades muy avanzadas. Así, el Parlamento Europeo insta a tomar las medidas necesarias que faciliten y apoyen la toma de la decisión de tener hijos a edades más tempranas[32].

El mayor riesgo de las mujeres mayores de 35 años, muy acentuado a partir de los 45 años, se explica por el aumento de la proporción de embarazos en este grupo de edad durante el período de estudio. Se requieren nuevos estudios, en el ámbito de la epidemiología perinatal, que nos proporcionen el porcentaje de embarazos en edades avanzadas atribuible a las técnicas de reproducción asistida, así como sus resultados. Es necesaria la dinamización de la puesta en marcha del registro nacional de técnicas de reproducción asistida, como elemento básico de vigilancia epidemiológica en el ámbito de la salud reproductiva.

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Epidemiología: disciplina o método

Estimados/as lectores/as, permítanme preguntarme si la epidemiología es ciencia o método. Quisiera obtener respuestas, iniciar un debate, y es por ello que escribo. A mi humilde parecer, si hablamos de epidemiología como disciplina científica, presumimos un cuerpo de conocimientos, una práctica profesional, y un método exclusivo y propio de ésta. De igual forma que para otros determinados campos del conocimiento identificamos profesiones (físico/a para la física, psicólogo/a para la psicología o filósofo/a para la filosofía, etc.), para la epidemiología debemos proceder a identificar al epidemiólogo/a. Y es aquí donde incurrimos en el primer sesgo en la definición de este campo del conocimiento catalogado como disciplina científica: ¿quién es el epidemiólogo/a? ¿Cómo se forma el epidemiólogo/a? ¿Quién puede ejercer de epidemiólogo/a? ¿Está reglada la formación de epidemiología en el ámbito estatal (en España)? ¿Hay un cuerpo profesional propio regulado por ley? Ahora bien, si partimos de estas premisas dialógicas, la presunción de la epidemiología como disciplina científica queda desmerecido de manera consistente. Posiblemente sea más prudente denotarla *método científico positivista* del que se valen la medicina en la clínica y la salud pública en la investigación para generar conocimiento. Pero si tenemos en cuenta la definición clásica y las posteriores, así como su origen etimológico, en el que «demos» toma mucho peso, podemos concluir que la población no es un objeto de estudio puramente epidemiológico, sino también demográfico, sociológico, filosófico, antropológico e incluso ético. Por lo tanto, de una asunción un tanto acaparadora de una disciplina, la medicina, que quiere universalizar su método hacedor de ciencia, la epidemiología, pasamos a comprender que, dado el objeto de estudio compartido por otras disciplinas, la epidemiología, más que disciplina, pasa a ser método. De igual forma, como método hacedor de ciencia ha demostrado su inconsistencia al intentar dar respuesta o soluciones a problemas complejos de índole social y poblacional. Una de estas inconsistencias radica en las limitaciones de la estadística utilizada para dar respuesta a problemas sociales complejos. Cuán conocidos son los debates sobre «n», su tamaño y la significación. Y es aquí dónde se presenta uno de los principales inconvenientes; la epidemiología como método para caracterizar la frecuencia y la distribución de los fenómenos de la vida ha demostrado ser ampliamente válida. Pero en el momento en el que intenta interpretar, analizar y responder a fenómenos poblacionales empieza a denotar sus limitaciones. Y es que para la descripción, la categorización y la intervención de fenómenos complejos, como lo son los de la vida y la muerte, la salud y la enfermedad en poblaciones humanas, se requiere la conjunción del saber de diferentes disciplinas y la unión de sus métodos, tanto positivistas como no positivistas para llegar a una comprensión integral del problema que genere la intervención más adecuada, acertada. *The Lancet* inauguró en abril de 1991 su apartado «Medicina y Cultura» motivado por las numerosas publicaciones surgidas relacionadas con la antropología médica. En el editorial se afirmaba: «Los médicos no deben sorprenderse cuando sus conocimientos de medicina occidental no provocan los resultados esperados en otras sociedades»[1].

Para obtener resultados positivos en materia de salud pública es necesaria una aproximación multidisciplinaria e intersectorial, es decir, una cooperación entre diferentes disciplinas y sectores de la sociedad en la búsqueda conjunta de soluciones a los problemas de salud. Es así como en Uganda, la tasa de prevalencia del virus de la inmunodeficiencia humana (VIH) descendió del 15 al 5% en la década de los años noventa[2]. La comunidad internacional apoya esta evidencia como una de las mejores aproximaciones para prevenir el VIH[3]. Las intervenciones costosas, la tecnología punta y las investigaciones sobre biología molecular o genómica tan bien financiadas no son la única solución.

Para terminar, definiré la epidemiología como el método científico positivista de las ciencias biomédicas que ayuda a caracterizar en términos de frecuencia y distribución los fenómenos de la vida y la muerte, la salud y la enfermedad de las poblaciones humanas. Que junto a otros métodos de otras disciplinas sociales aporta una visión y no la única, para poder generar intervenciones en las poblaciones que mejoren los estados de salud y enfermedad, así como para dotar de criterios las decisiones de los planificadores de las cuestiones relacionadas con la salud de las poblaciones humanas.

Espero con la impaciencia del novel, los nervios del iniciado y desde la honestidad y la humildad, haber generado la reflexión necesaria en el lector, para que ávidamente pueda responderme sobre si la epidemiología es ciencia o método.

Muchas gracias.

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Nota de campo

Vigilancia de la tuberculosis en las Islas Baleares y caracterización de los casos infradeclarados entre los años 2005 y 2007

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RESUMEN

Estudio descriptivo de los casos de tuberculosis detectados por el Sistema de Vigilancia Epidemiológica en Baleares, en el trienio de 2005 a 2007. El objetivo fue caracterizar los casos infradeclarados en términos sociodemográficos y de su contacto con la atención primaria de salud. Globalmente, la infradeclaración de la tuberculosis se sitúa en torno al 20%. Las características que resultan significativas en el análisis multivariado son la marginalidad social (alcoholismo, usuarios de drogas por vía parenteral o indigencia) (odds ratio ajustada [ORa] : 2,6 [1,2-5,3]), el contacto con la atención primaria (ORa : 3,2 [1,4-7,1]) y la tuberculosis extrapulmonar (ORa : 5,5 [3,2-9,6]). Se recomienda reforzar la notificación de los especialistas hospitalarios mediante la adecuación informática de la historia clínica hospitalaria, y se observa que la información obtenida desde la informatización de la historia en atención primaria resulta de utilidad para mejorar la vigilancia epidemiológica de la tuberculosis.

Tuberculosis surveillance in the Balearic Islands and characteristics of unreported cases from 2005 to 2007

Keywords:
Tuberculosis
Epidemiologic surveillance
Disease notification
Underreporting
Logistic regression

ABSTRACT

We performed a descriptive study of tuberculosis cases detected by the Epidemiological Surveillance System in the Balearic Islands in the triennium 2005-2007. Our goal was to characterize underreported cases in sociodemographic terms and their contact with primary care. Overall, underreporting of tuberculosis was approximately 20%. Significant factors in multivariate analysis were social marginality (consisting of alcoholism, intravenous drug use or indigence) (aOR: 2.6 [1.2 to 5.3]), contact with primary care (aOR: 3.2 [1.4 to 7.1]), and extrapulmonary tuberculosis (aOR: 5.5[3.2-9.6]). We recommend strengthening notification by hospital specialists through the use of hospital electronic records. Our findings show that the information obtained from the primary care computerized history is helpful in improving the epidemiological surveillance of tuberculosis.

Antecedentes y objetivos

La vigilancia epidemiológica de la tuberculosis en las Islas Baleares se ha reforzado en los últimos años añadiendo a la información pasiva del sistema de enfermedades de declaración obligatoria (EDO) la búsqueda activa de casos con los datos del archivo del conjunto mínimo básico de datos hospitalarios (CMBD) y la información de algunos laboratorios clínicos de la red asistencial pública y privada[1]. Desde 2005, la informatización completa de las consultas de atención primaria de salud ofrece nuevas posibilidades de investigación. El programa de historia clínica informatizada en atención primaria podría ser así otra fuente en el proceso de vigilancia activa de la tuberculosis. El objetivo de este trabajo es caracterizar los casos infradeclarados en términos sociodemográficos[2,3] y de su contacto con la atención primaria, así como determinar los factores de riesgo asociados a la infradeclaración.

Métodos

Se realizó un estudio descriptivo de la tuberculosis en las Islas Baleares durante el periodo comprendido entre el 1 de enero de 2005 y el 31 de diciembre de 2007, con información del sistema de vigilancia epidemiológica (SVE) y del sistema informático de atención primaria. Se definen los casos infradeclarados[4] como aquellos encontrados por búsqueda activa entre todos los detectados y que no figuraban en el sistema EDO. Describimos mediante análisis

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Tabla 1
Factores asociados a la ausencia de declaración de los casos de tuberculosis.

Variable	Total (543)	Infradeclarados(102)	Asociación			
	n (%)	n (%)	ORc	(IC95%)	OR_A	(IC95%)
Hospitales Públicos:						
Mallorca (A)	174 (32)	30 (29,4)	0,9	n.s.	–	
Mallorca (B)	130 (23,9)	29 (28,4)	1,3	n.s.	–	
Mallorca (C)	50 (9,2)	26 (25,5)	**5,9**	**(3,2-10,9)**	–	
Eivissa	76 (14)	15 (14,7)	1,1	n.s.	–	
Menorca	21 (3,9)	1 (1)	0,2	n.s.	–	
Edad (años)	μ: 40,9; mediana: 37,3	μ: 43,l; mediana:39,7	1,0	n.s.	1,0	n.s.
Sexo						
Hombre	346 (63,7)	66 (64,7)	1,1	n.s.	0,9	n.s.
Mujer	197 (36,3)	36 (35,3)	1,0	–		
Inmigración	162 (29,8)	26 (25,5)	0,8	n.s.		
VIH	58 (10,7)	20 (19,6)	**2,7**	**(1,5 - 5,0)**	1,9	n.s.
Alcoholismo[a]	67 (12,3)	13 (12,8)	1,3	n.s.	*1	
UDVP[a]	23 (4,2)	13 (12,8)	**7,4**	**(3,1 -17,6)**	*2	
Indigencia[a]	10 (1,8)	2 (2)	1,4	n.s.	*3	
Marginalidad Social[b]	*#83 (15,3)	23 (22,6)	**1,9**	**(1,1 - 3,2)**	**2,6**	**(1,2 - 5,3)**
Tuberculosis extrapulmonar	137 (25,2)	53 (52)	**4,6**	**(2,9 - 7,3)**	**5,5**	**(3,2 - 9,6)**
Contacto Atención Primaria	414 (76,2)	89 (87,3)	**2,4**	**(1,3 - 4,5)**	**3,2**	**(1,4 - 7,1)**

[a,] Componentes de la variable: «Marginalidad Social»'.
[b] Sumatorio de casos totales, algunos con más de un factor de marginalidad.

bivariado las características de los casos y ajustamos mediante un test de regresión logística multivariada los factores de riesgo tales como el sexo, la edad, la nacionalidad[5], la infección por el virus de la inmunodeficiencia humana (VIH)[6] y otras variables que pudieran estar asociadas a la infradeclaración. Por la baja frecuencia de algunas variables relacionadas con el ámbito de la exclusión social construimos la variable «marginalidad social» incluyendo los sujetos alcohólicos, usuarios de drogas por vía parenteral (UDVP) e indigentes.

Resultados

A efectos del SVE, el total de casos de tuberculosis detectados en el trienio 2005-2007 fueron 543. La fuente de la detección fue el sistema EDO en 441 (81,2%) notificados y la vigilancia activa en 102 (18,8%) infradeclarados. En cuanto a estos últimos, 28 (27,5%) se detectaron por el CMBD, 20 (19,6%) por laboratorios y 54 (52,9%) por ambos sistemas. Respecto al origen de los diagnósticos de tuberculosis en el periodo del estudio, 465 fueron en hospitales públicos, 53 en atención primaria, 18 en clínicas privadas, 3 en prisiones y 4 en otras comunidades autónomas.

La tasa bruta de incidencia global de la tuberculosis en la comunidad autónoma fue de 18,5/100.000 habitantes en 2005, 16,9 en 2006 y 18,6 en 2007. La distribución por islas indica las tasas más altas en Ibiza-Formentera: $28/10^5$ de media en el periodo, 17 en Mallorca y 10,6 en Menorca.

De los 543 enfermos de tuberculosis, el 74,5% eran españoles. En inmigrantes, la enfermedad aumentó del 26,2% en 2005 hasta el 36,5% en 2007. El 64,7% eran hombres y el 46,1% tenían entre 25 y 44 años. La edad media era de 40,9 años y la mediana de 37,3 años. No se halló asociación entre la edad y la infradeclaración.

El 74,6% (intervalo de confianza del 95% [IC95%]: 70,8-78,3) fueron formas pulmonares y la infradeclaración fue del 11,9% (IC95%: 8,6-15,1). Las formas extrapulmonares representaron el 25,4% (IC95%: 21,7-29,2) y fueron infradeclaradas en un 38,4% (IC95%: 29,9-46,9). La infradeclaración global por años fue del 21,3% (IC95%: 15,1-27,5) en 2005, del 16,0% (IC95%: 10,2-21,8) en 2006 y del 18,8% (IC95%: 13,0-24,5) en 2007.

Respecto a los casos infradeclarados, el análisis bivariado (tabla 1) destaca el ser UDVP como una característica muy asociada con la infradeclaración, aunque era poco frecuente. La variable «marginalidad social» incluyó 83 enfermos de tuberculosis, algunos de ellos con varios factores, representó un 22,6% del total de casos no declarados y se asoció a casi dos veces una mayor probabilidad de no ser declarados. Los coinfectados por el VIH eran el 19,6% (respecto de los que tenían este dato registrado) y su *odds ratio* fue de 2,7, con significación estadística. Las formas de tuberculosis extrapulmonares y el contacto con la atención primaria también fueron características personales asociadas positivamente a la infradeclaración. Otro resultado reseñable fue la falta de notificaciones de un hospital de Mallorca, destacado respecto a los otros.

Al ajustar por el resto de los factores de riesgo significativos, las formas de tuberculosis extrapulmonares presentaron 5,5 veces más probabilidades de no ser declaradas que la tuberculosis pulmonar (IC95%: 3,2-9,6). También observamos que la variable de marginalidad social otorgaba 2,6 veces más probabilidades de que no se declarara el caso (IC95%: 1,2-5,3), y que los pacientes que habían tenido contacto con atención primaria tenían 3,2 veces más posibilidades de ser casos no declarados (IC95%: 1,4-7,1).

Respecto al contacto con atención primaria de los casos de tuberculosis, el 26,3% (IC95%: 22,1-30,5) de los notificados no tiene ninguna consulta registrada, mientras que esta proporción es del 12,8% (IC95%: 5,8-19,7) entre los no declarados, con una diferencia significativa. En cambio, no hubo diferencias en el número de visitas de seguimiento.

Discusión

Los casos infradeclarados corresponden a pacientes de mayor edad, de sexo masculino y de origen español. Las formas extrapulmonares tienen el mayor riesgo de ser infradeclaradas[7], y también los pacientes que presentan algún factor de marginalidad social (alcoholismo, UDVP, indigencia). Probablemente este perfil teórico de paciente infradeclarado se correspondería con las características de riesgo de exclusión social y la poca continuidad en el seguimiento clínico.

El predominio de la enfermedad tuberculosa en Ibiza es un hecho conocido que merecería una valoración aparte en términos sociológicos y nosológicos.

El contacto con la atención primaria de los pacientes con tuberculosis es escaso. Sorprendentemente, los casos de tuberculosis que acudieron en alguna ocasión a los centros de salud tuvieron más posibilidades de no ser declarados. Parece que haya cambiado la relación de la atención primaria con la tuberculosis en nuestro medio, de manera que el diagnóstico se hace más en el hospital y únicamente en el seguimiento puede tener un peso relativo destacable la atención primaria. El aspecto positivo de este hallazgo es que la información de atención primaria se demuestra como fuente útil para la búsqueda activa de casos infradeclarados, de manera que aumentaría la exhaustividad del SVE.

En cuanto a las limitaciones del estudio, podemos señalar dos cuestiones principales. En primer lugar, la mayor dificultad para la vigilancia activa de la tuberculosis en las Islas Baleares fue la falta de información procedente de atención primaria durante el trienio 2005-2007, lo que requirió una estrategia de búsqueda informática específica que actualmente está incorporada en el sistema EDO. La segunda limitación radica en que no se dispone de archivos de información equivalente a los archivos del CMBD en las clínicas privadas, circunstancia que impide conocer el porcentaje de infradeclaración de éstas y compararlo con el sistema sanitario público.

Recomendaciones

Debería promoverse la mejora de la cumplimentación de la notificación de las EDO[8] por parte de los clínicos hospitalarios y de atención primaria, sobre todo para las formas de tuberculosis extrapulmonares y entre los especialistas quirúrgicos[9]. Una posibilidad sería utilizar los recursos informáticos que ofrece la historia clínica electrónica, de manera que se genere un código de aviso para declarar una EDO cuando un médico introduce un diagnóstico. En este aspecto, la informatización de las consultas médicas ha sido una ayuda en atención primaria, pero todavía no es así en las consultas hospitalarias.

Finalmente, se pone de manifiesto la utilidad de la historia clínica informatizada de atención primaria como fuente de vigilancia activa de la tuberculosis.

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Contribuciones de autoría

J. Giménez, A.M. Galmés y D. Herrera participaron en la idea inicial, diseñaron el estudio, organizaron el trabajo de campo y revisaron los borradores del manuscrito. L.A. Bonilla, M.A. Luque y C. Bosch participaron en el trabajo de campo, elaboraron la base de datos y revisaron el análisis estadístico y los borradores. A. Nicolau y J. Caylà hicieron aportaciones críticas al diseño del estudio, revisaron los resultados del análisis estadístico y revisaron los borradores del manuscrito. Todos los autores dieron su aprobación al texto final.

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Accuracy of MUAC in the Detection of Severe Wasting With the New WHO Growth Standards

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Accuracy of MUAC in the Detection of Severe Wasting With the New WHO Growth Standards

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KEY WORDS

malnutrition, anthropometry, mid-upper-arm circumference, diagnostic errors, epidemiology

ABBREVIATIONS

MUAC—mid-upper-arm circumference
NCHS—National Center for Health Statistics
WHO—World Health Organization
CI—confidence interval

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WHAT'S KNOWN ON THIS SUBJECT: MUAC measurements are used to screen rapidly for malnutrition among children 6 to 59 months of age. With the introduction of a new growth curve for children by the WHO in 2006, an evaluation of MUAC diagnostic accuracy is needed.

WHAT THIS STUDY ADDS: This study confirms the need to change the MUAC cutoff value from <110 mm to <115 mm. This change is needed to maintain the same diagnostic accuracy and to identify children at greatest risk of death resulting from severe wasting.

abstract

OBJECTIVES: The objectives of this study were to estimate the accuracy of using mid-upper-arm circumference (MUAC) measurements to diagnose severe wasting by comparing the new standards from the World Health Organization (WHO) with those from the US National Center for Health Statistics (NCHS) and to analyze the age independence of the MUAC cutoff values for both curves.

METHODS: We used cross-sectional anthropometric data for 34 937 children between the ages of 6 and 59 months, from 39 nutritional surveys conducted by Doctors Without Borders. Receiver operating characteristic curves were used to examine the accuracy of MUAC diagnoses. MUAC age independence was analyzed with logistic regression models.

RESULTS: With the new WHO curve, the performance of MUAC measurements, in terms of sensitivity and specificity, deteriorated. With different cutoff values, however, the WHO standards significantly improved the predictive value of MUAC measurements over the NCHS standards. The sensitivity and specificity of MUAC measurements were the most age independent when the WHO curve, rather than the NCHS curve, was used.

CONCLUSIONS: This study confirms the need to change the MUAC cutoff value from <110 mm to <115 mm. This increase of 5 mm produces a large change in sensitivity (from 16% to 25%) with little loss in specificity, improves the probability of diagnosing severe wasting, and reduces false-negative results by 12%. This change is needed to maintain the same diagnostic accuracy as the old curve and to identify the children at greatest risk of death resulting from severe wasting. *Pediatrics* 2010;126:e195–e201

Human arms contain subcutaneous fat and muscle mass. Under conditions of reduced food intake, lower levels of subcutaneous fat and muscle mass tend to correspond to a decrease in the mid-upper-arm circumference (MUAC). This measurement can be used to diagnose malnutrition.[1–3] MUAC is easy to measure and is relatively independent of gender and age.[4] Because of the simplicity and low cost of measuring MUAC, it is used to screen rapidly for malnutrition among children 6 to 59 months of age.[5,6] MUAC cutoff points of 125 mm (indicating global malnutrition) and 110 mm (indicating severe wasting) have been proposed for all children <5 years of age.[7]

Weight for height, expressed as a *z* score, is used to define severe wasting. A weight-for-height level less than a *z* score cutoff value of −3 is internationally recognized as severe wasting. In 2006, a new curve growth standard for assessing the growth of children throughout the world was introduced by the World Health Organization (WHO). A study comparing curves offered by the WHO and the US National Center for Health Statistics (NCHS) for diagnosis of severe wasting concluded that the WHO curve would identify more children with a high risk of death and would increase the number of children classified as experiencing severe wasting.[8] Therefore, it is also important to compare the accuracy of the current MUAC cutoff point for severe wasting (110 mm) against the standard measures, that is, the 1977 child growth standards of the US NCHS[9] and the 2006 WHO reference curve.[10] The objectives of this study were to estimate the accuracy of using MUAC measurements to diagnose severe wasting, defined as a weight-for-height *z* score less than −3 without bipedal edema, by comparing the new WHO curve with the NCHS curve and to analyze the age independence of the MUAC cutoff values of both curves.

METHODS

Data were obtained from 39 nutritional surveys conducted by Doctors Without Border in 10 countries, that is, Angola, Burundi, Malawi, Sierra Leona, Ethiopia, Niger, Burkina Faso, Chad (Darfur), India, and Afghanistan. Gender, weight, height, and MUAC were recorded for all children. The weight-for-length ratio was calculated for children who were <24 months of age. A total of 34 937 children between 65 and 110 cm in height without bipedal edema were included in our analyses. The device used to measure the MUAC of children was a plastic, colored, insertion tape (incapable of stretching and unresponsive to temperatures) marked in millimeters, with cutoff points from red to yellow at 110 mm and from yellow to green at 125 mm (more information about measurers and the MUAC device is provided in the Appendix).[11]

For the statistical analyses, we first calculated the nutritional indicators of severe wasting (more information is available in the Appendix), weight-for-height *z* scores less than −3 for all children, according to the NCHS and WHO curves. We then compared the diagnostic accuracy of the 2 curves by using 2 × 2 tables to determine the sensitivity, specificity, positive predictive value, and Youden index (more information about Youden index estimation is available in the Appendix)[12] of various MUAC cutoff points (110, 115, 125, 135, 140, and 145 mm). The proportion of children with severe wasting who would be missed with the MUAC measure also was calculated. We used receiver operating characteristic curves to estimate the area under the curve[13] for different MUAC cutoff values, to compare the discriminatory capacity of the WHO and NCHS curves for severe wasting.

To analyze the age and gender independence of the sensitivity and specificity of MUAC measurements in the diagnosis of severe wasting with the new curve, 2 logistic regression models were used to build receiver operating characteristic curves (more information about the models is available in the Appendix). The areas under both curves (unadjusted and adjusted for gender and height, as a proxy of age) were compared by using the test described by Hanley and McNeil.[14]

Finally, the age independence of the sensitivity and specificity of MUAC measurements in the diagnosis of severe wasting with the WHO and NCHS curves was assessed. Height was used as a proxy for age according to the following categories: 60.0 to 73.9 cm, 6 to 11 months; 74.0 to 84.9 cm, 12 to 23 months; 85.0 to 93.9 cm, 24 to 35 months; 94.0 to 101.9 cm, 36 to 47 months; 102.0 to 110.0 cm, 48 to 59 months.[15]

RESULTS

According to the old NCHS reference curve, the prevalence of severe wasting (defined as the proportion of children 6 to 59 months of age with weight-for-height *z* scores below −3, without edema) was 1.5% (548 children). According to the new WHO curve, however, the prevalence was 3.9% (1419 children). The prevalence of severe wasting diagnosed with the new WHO reference curve increased by 2.4% (95% confidence interval [CI]: 2.2%–2.6%).

Table 1 shows the accuracy of various MUAC cutoff points according to both the NCHS and WHO reference curves. The best cutoff point for the diagnosis of severe wasting according to the NCHS curve was 130 mm (Youden index: 0.63), and that according to the WHO curve was 135 mm (Youden index: 0.61). The predictive capacity of MUAC measurements with these cutoff points improved remarkably when the WHO curve was used instead of the NCHS curve (NCHS curve, positive predictive value: 7.0% [95% CI: 6.3%–7.6%]; WHO curve, positive predictive value: 13.0% [95% CI: 12.2%–13.6%]). In addition, the proportion of false-negative results with a 135-mm MUAC cutoff value was 15.5% with the WHO standards and increased to 20.4% when the NCHS standards were used. However, it should be noted that the highest Youden index value was obtained when cases were defined by using the NCHS reference and a MUAC cutoff value of 130 mm, rather than the WHO curve. On the basis of area-under-the-curve values, MUAC measurements performed better against the NCHS reference at cutoff values up to 140 mm; it was only at 140 and 145 mm that such measurements performed better against the WHO curve. This difference was statistically significant (Hanley-McNeil test, MUAC cutoff value of 140 mm, NCHS versus WHO curve, $z = 2.5$; $P = .01$; MUAC cutoff value of 145 mm, NCHS versus WHO curve, $z = 2.2$; $P = .02$). Graphically, the best MUAC cutoff point with the NCHS curve was confirmed to be 130 mm (area under the curve: 0.82 [95% CI: 0.79–0.83]), and the best cutoff point with the WHO curve was 135 mm (area under the curve: 0.80 [95% CI: 0.79–0.82]) (Fig 1).

The predicted values of both logistic regression models (unadjusted and adjusted for height and gender) were used to build 2 receiver operating characteristic curves to analyze the age and gender independence of the sensitivity and specificity of MUAC measurements for the diagnosis of severe wasting by using the WHO standards. The areas under the curve, compared with the Hanley-McNeil test, did not differ statistically ($z = 0.48$; $P > .05$). The area under the curve for the unadjusted curve was 0.89 (95% CI:

TABLE 1 Comparison of Different MUAC Cutoff Points Among 34 937 Children Between 60 and 110 cm of Height Through Weight-for-Height *z* Scores Below −3

MUAC Cutoff Value, mm	Below Cutoff Value, *n* (%)	Sensitivity, Estimate (95% CI), %		Specificity, Estimate (95% CI), %		Youden Index		Area Under Curve, Estimate (95% CI)		Positive Predictive Value, Estimate (95% CI), %		Proportion of Children With Low Weight-for-Height Values Missed With MUAC Measurements, %	
		NCHS	WHO	NCHS	WHO	NCHS	WHO	NCHS	WHO	NCHS	WHO	NCHS	WHO
110	322 (0.9)	23.9 (20.2–27.6)	16.0 (14.0–17.9)	99.4 (99.4–99.5)	99.7 (99.6–99.7)	0.23	0.16	0.62 (0.59–0.64)	0.58 (0.56–0.59)	40.0 (34.5–45.6)	69.2 (64.0–74.4)	76.1	84.0
115	626 (1.8)	34.7 (30.6–38.8)	25.0 (22.6–27.2)	98.7 (98.6–98.8)	99.1 (99.0–99.2)	0.33	0.24	0.67 (0.64–0.69)	0.62 (0.60–0.64)	29.9 (26.2–33.5)	55.6 (51.6–59.5)	65.3	75.0
120	1621 (4.6)	50.8 (46.5–55.1)	42.3 (39.6–44.9)	96.1 (95.8–96.3)	96.9 (96.7–97.1)	0.47	0.39	0.73 (0.71–0.76)	0.70 (0.68–0.71)	16.9 (15.0–18.7)	36.4 (34.0–38.8)	49.2	57.7
125	2914 (8.3)	63.8 (59.6–67.9)	55.2 (52.5–57.8)	92.5 (92.2–92.8)	93.6 (93.3–93.8)	0.56	0.49	0.78 (0.76–0.81)	0.74 (0.73–0.76)	11.8 (10.6–13.0)	26.5 (24.9–28.1)	36.2	44.8
130	6123 (17.5)	79.6 (76.1–83.0)	74.1 (71.7–76.4)	83.5 (83.0–83.8)	84.8 (84.4–85.2)	0.63	0.59	0.82 (0.79–0.83)	0.79 (0.78–0.81)	7.0 (6.3–7.6)	17.0 (15.9–17.8)	20.4	25.9
135	9141 (26.2)	87.4 (84.5–90.3)	84.5 (82.5–86.4)	74.8 (74.3–75.2)	76.2 (75.8–76.7)	0.62	0.61	0.81 (0.79–0.82)	0.80 (0.79–0.82)	5.2 (4.7–5.6)	13.0 (12.2–13.6)	12.6	15.5
140	14 684 (42.0)	92.4 (90.0–94.7)	93.2 (91.8–94.5)	58.7 (58.2–59.2)	60.1 (59.6–60.6)	0.51	0.53	0.76 (0.74–0.77)	0.77 (0.75–0.77)	3.4 (3.1–3.7)	8.9 (8.4–9.3)	7.6	6.8
145	18 744 (53.7)	94.0 (91.7–96.0)	95.3 (94.1–96.4)	47.0 (46.4–47.5)	48.1 (47.5–48.6)	0.41	0.43	0.74 (0.68–0.72)	0.71 (0.70–0.72)	2.7 (2.5–2.9)	7.1 (6.7–7.5)	6.0	4.7

The standard for screening for severe wasting was NCHS or WHO values. Compared with NCHS and WHO weight-for-height *z* scores below −3, the prevalence of severe wasting according to NCHS values was 1.5% and that according to WHO values was 3.9%.

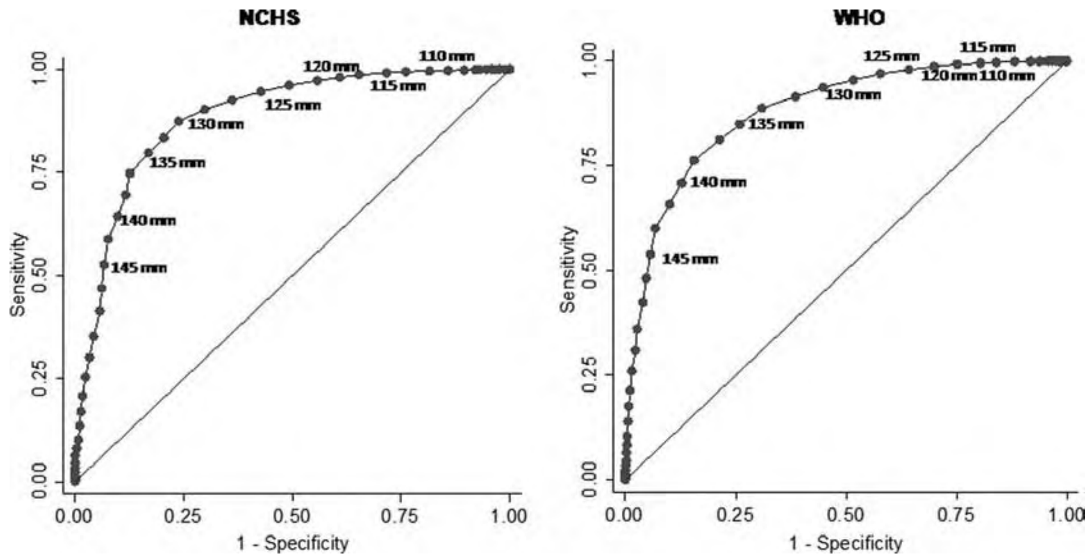

FIGURE 1
Receiver operating characteristic curves for severe wasting, defined as weight-for-height *z* scores below −3, with NCHS (area under the curve: 0.82 [95% CI: 0.79−0.83]) and WHO (area under the curve: 0.80 [95% CI: 0.79−0.82]) standards and different MUAC cutoff values.

0.88−0.90), and the area under the curve for the curve adjusted for gender and height was 0.90 (95% CI: 0.89−0.92).

The results in Table 2 confirm this relative height (as a proxy for age) independence of the sensitivity and specificity of MUAC measurements for children between the ages of 6 and 59 months. For children 24 to 59 months of age, the sensitivity and specificity of MUAC measurements were independent of age; for children <24 months of age, however, the sensitivity and specificity of MUAC measurements were relatively independent of age.

DISCUSSION

Our results showed an increase in the number of children classified as having severe wasting when the new WHO curve was compared with older standards. This finding confirms the results of other studies.[16,17] This increased prevalence of severe wasting should have an impact on the planning of nutritional support programs in sub-Saharan Africa, because of the more-inclusive nature of the WHO standard-based case definition. During a famine, unstable conditions may make it difficult to determine the height and weight of children, and the use of MUAC measurements for children 6 to 59 months of age might overestimate severe wasting. With a higher cutoff point, false-positive results increase and malnutrition is therefore overestimated; however, false-negative results decrease.

MUAC was found to be the best indicator for screening and detection of malnutrition in a community.[7] Screening methods based on comparisons with growth curves or weight gain are not likely to be predictive of mortality risk; arm circumference measurements, even without corrections for age or height, are substantially better than weight-for-age, height-for-age, or weight-for-height measurements.[18] A MUAC cutoff point of <110 mm was most related to mortality risk and therefore is suitable for use in malnutrition screening and detection efforts among children between 6 and 59 months of age.[7,19–23] However, with the new WHO reference curve, an increase of 5 mm (from 110 mm to 115 mm) in the MUAC cutoff value is necessary to maintain a level of diagnostic accuracy equal to that of the old curve.

With the new WHO curve, the overall performance of MUAC measurements, in terms of sensitivity and specificity, has deteriorated; therefore, to maintain the same diagnostic accuracy as the old curve and to identify the children at greatest risk of death resulting from severe wasting, a change in the cutoff value is needed. Our major findings are related to the need to change the MUAC cutoff point used to diagnose severe wasting from <110 mm to <115 mm. This increase of 5 mm produces a large change in sensitivity (from 16% to 25%), with little loss in specificity. In addition, this increase improves the probability of diagnosing severe wasting, compared with the NCHS curve, and reduces false-negative results by 12% because of the more-inclusive nature of the WHO curve-based case definition.

The relative age and gender independence of the sensitivity and specificity of MUAC measurements and the ease of use are some of their most important characteristics.[4–7] The results of our study also revealed that the age independence of the sensitivity and specificity of MUAC measurements improves with the switch from the NCHS standards

TABLE 2 Sensitivity, Specificity, and Youden Index for MUAC Indicators in Identifying Severe Wasting (Weight-for-Height *z* Scores Below −3) Among 34 937 Children 6 to 59 Months of Age, According to Height

Height (Age Proxy)	MUAC Cutoff Value, mm	WHO			NCHS		
		Sensitivity, %	Specificity, %	Youden Index	Sensitivity, %	Specificity, %	Youden Index
60.0–73.9 cm (6–11 mo)	110	32.0	99.0	0.31	48.1	97.6	0.46
	115	47.8	97.4	0.45	68.8	95.3	0.64
	120	71.8	90.4	0.62	89.6	87.4	0.77
	125	84.6	81.6	0.66	92.2	78.2	0.70
	130	93.2	62.9	0.56	97.4	59.9	0.57
	135	95.3	50.4	0.46	98.7	48.0	0.47
	140	98.5	29.7	0.28	100	28.2	0.28
	145	99.4	19.3	0.19	100	18.3	0.18
74.0–84.9 cm (12–23 mo)	110	18.9	99.6	0.19	28.1	99.4	0.28
	115	32.2	98.8	0.31	44.8	98.5	0.43
	120	54.4	95.8	0.50	65.1	95.1	0.60
	125	67.2	91.2	0.58	79.2	90.4	0.70
	130	82.5	78.8	0.61	89.6	77.8	0.67
	135	87.8	67.2	0.55	92.2	66.3	0.59
	140	92.8	47.7	0.41	94.3	47.0	0.41
	145	95.8	34.8	0.31	96.4	34.3	0.31
85.0–93.9 cm (24–35 mo)	110	12.7	99.9	0.13	25.0	99.8	0.25
	115	17.8	99.7	0.18	28.3	99.6	0.28
	120	34.7	98.6	0.33	43.5	98.2	0.42
	125	51.2	96.7	0.48	63.0	96.1	0.59
	130	73.7	90.7	0.64	79.3	89.7	0.69
	135	83.1	83.8	0.67	88.0	82.8	0.71
	140	92.0	68.6	0.61	92.4	67.7	0.60
	145	94.4	56.2	0.51	93.5	55.4	0.49
94.0–101.9 cm (36–47 mo)	110	5.8	99.9	0.06	10.0	99.9	0.10
	115	9.0	99.7	0.09	13.3	99.6	0.13
	120	24.7	98.8	0.24	27.8	98.4	0.26
	125	38.1	97.2	0.35	40.0	96.5	0.37
	130	61.9	92.3	0.54	65.6	91.3	0.57
	135	76.7	86.0	0.63	78.9	84.7	0.64
	140	89.7	72.8	0.63	88.9	71.6	0.61
	145	91.0	61.3	0.52	90.0	60.2	0.50
102.0–110.0 cm (48–59 mo)	110	2.7	100	0.03	7.0	100.0	0.07
	115	4.9	99.9	0.05	11.6	99.9	0.12
	120	9.1	99.7	0.09	17.4	99.5	0.17
	125	19.4	98.9	0.18	31.4	98.5	0.30
	130	49.0	95.7	0.45	57.0	94.5	0.52
	135	74.1	90.2	0.64	75.6	88.3	0.64
	140	91.3	78.2	0.63	86.0	76.1	0.62
	145	93.9	66.3	0.60	88.4	64.5	0.53

to the new WHO curve. When the NCHS reference curve is used, the sensitivity and specificity of MUAC measurements are at their most age dependent and the MUAC cutoff value increases by 1.5 cm between the ages of 6 and 59 months. With the new curve, an increase of only 1 cm is targeted among children between the ages of 6 and 59 months.

Other researchers also found that the MUAC cutoff points increase by 1.5 cm between the ages of 6 and 59 months according to the NCHS curve.[24–26] This reinforces the validity of our finding that the relative age independence of the sensitivity and specificity of MUAC measurements improves with the new curve. The improved predictive capacity and the relative age independence of the sensitivity and specificity of MUAC measurements indicate that the standards of the new WHO curve are better able to screen for severe wasting.[27]

Our study may contain a classification bias, because the surveys were conducted in 10 different countries at different times and by different staff members. Similarly, we think that there might have been a selection bias related to the ethnicity of the children. Anthropometric nutritional surveys from Ethiopia and Somalia found that *z* scores and MUAC case definitions returned different estimates of the prevalence of acute malnutrition in pastoralist livelihood zones but similar estimates of the prevalence of severe wasting in agrarian livelihood zones.[28] Nevertheless, the new WHO curve uses a pooled sample from the 6 participating countries and provides a tool that is timely and appropriate for contemporary ethnic diversity and the development of increasingly multiracial societies. The WHO curve also demonstrates that healthy children from around the world who are raised in healthy environments, according to recommended feeding practices, have strikingly similar patterns of growth.[29]

CONCLUSIONS

With the new WHO curve, the performance of MUAC measurements has deteriorated. This poorer performance, in terms of sensitivity and specificity, confirms the need to change the MUAC cutoff value from <110 mm to <115 mm. This increase of 5 mm produces a large change in sensitivity (16% to 25%) with little loss in specificity, improves the probability of diagnosing severe wasting, and reduces false-negative results by 12%. This change is needed to maintain the same diagnostic accuracy as the old curve and to identify the children at greatest risk of death resulting from severe wasting.

APPENDIX

MUAC Measurers

The measurers were people already working in nutritional programs. The measurers were supervised by a person who was responsible for proper application of the sampling procedures and was responsible for a team with respect to the measurements and other procedures defined in the survey guidelines. All measurers were trained by a nutritional nurse regarding the proper gathering of anthropometric measurements. A pretest was conducted to test the teams and the reliability of primary measurements. At the end of the pretest, the quality of the anthropometric measurements taken by the measurers was reviewed.

Device Used to Measure MUAC

The device used was a plastic, colored, insertion tape (incapable of stretching and unresponsive to temperatures) marked in millimeters, with cutoff points from red to yellow at 110 mm and from yellow to green at 125 mm.

Calculation of Indicator of Severe Wasting (Weight-for-Height *z* Score)

Severe wasting, defined as weight-for-height *z* scores below −3 for all children according to the NCHS curve, were calculated with Epi Info 6 (Centers for Disease Control and Prevention, Atlanta, GA). The *z* scores for the new WHO standards were calculated with the igrowup macro package (available at www.who.int/childgrowth/software/en).

Estimation of Age and Gender Independence of Sensitivity and Specificity of MUAC Cutoff Values From WHO Curve

Two logistic regression models were used to analyze the age and gender independence of the sensitivity and specificity of MUAC measurements in the diagnosis of severe wasting according to the WHO curve. The first model was built by using the WHO dichotomous indicator (yes/no) of severe wasting as a dependent variable and MUAC as an independent variable. The second model was adjusted for gender and height (as a proxy for age). The models were as follows: unadjusted model: log(severe wasting) $= \beta_0 + (\beta_1 \times \text{MUAC})$; adjusted model: log(severe wasting) $= \beta_0 + (\beta_1 \times \text{MUAC}) + (\beta_2 \times \text{height}) + (\beta_3 \times \text{gender})$. The predicted values of both models were used to build 2 receiver operating characteristic curves. The areas under the curves were compared with the Hanley-McNeil test.

Youden Index

The Youden index represents an attempt to summarize test accuracy into a single numeric value, that is, Youden index = sensitivity + specificity − 1 = $S - (1 - E)$. The minimum value is −1 and the maximum value is +1. A perfect test would have a Youden index value of +1.

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Increase in maternal mortality associated with change in the reproductive pattern in Spain: 1996–2005

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ABSTRACT

Background: In Europe, different studies forecast an increase in maternal mortality in the coming years, associated with advanced maternal age and delay in maternity. This study aims to analyse the age-related trend in the maternal mortality ratio among mothers in Spain for the decade 1996–2005, and to describe the causes of death and associated sociodemographic factors for the years with highest mortality.

Methods: An ecological study on trends, for the age-related trend in the maternal mortality ratio; an indirect standardisation and Poisson regression model was used. For the description of the causes of death, a cross-sectional study was used.

Results: Prevalence of live births among mothers aged 35 years and over was 15% higher in Spain than in Europe. The maternal mortality rate increased by 20% (standardised mortality ratio of 1.2, 95% CI 0.9 to 1.4) in 2005 with respect to 1996. The age-related risk of maternal mortality was three times higher (relative risk of 2.90, 95% CI 2.01 to 4.06) among mothers aged 35–44 years versus those aged under 35 years. The highest mortality was detected during 2003–2004. The risk of maternal mortality was higher in foreign mothers.

Conclusion: This study confirms that there was a change in the maternal mortality trend characterised by an increase in deaths, associated with advanced maternal age, as well as an increase in the prevalence of live births among mothers aged 35 years and over. This change in pattern identifies the need to intensify maternal mortality surveillance by collecting the necessary set of variables that allows investigation of the causes and determinant factors underlying deaths.

In 2006, with a mean of 1.3 children per woman of reproductive age, Spain ranked among the group of countries with the lowest total fertility rates in the world, only ahead of the Ukraine and Greece (among others) with 1.1 and 1.2 children per woman respectively. In the last 20 years, despite the low fertility, the number of pregnancies among women aged over 35 years has been rising progressively, accounting for 21.2% of births in 2006.[1] This important increase in fertility among women aged over 35 years has been accompanied by higher feto-neonatal morbidity and mortality, which becomes extremely marked from age 40 years onwards.[1–3] Similarly, the delay in maternity and the progressive rise in maternal age at date of birth have also resulted in higher female morbidity and mortality. Advanced maternal age has been associated with a higher risk of death[4 5] and an increased risk of delivery by caesarean section during the birth process.[6 8] 1 Maternal mortality is regarded as a preventable cause of death, strongly related to the quality of the healthcare system and economic and social factors.[9–11] The quality of healthcare and maternal care furnished to pregnant women is an element that may account for the differences between rates.[12 13] In Spain, a study into the maternal mortality trend for the period 1980–1992 reported a certain stabilisation in the maternal mortality ratio; even so, the authors of this study forecast an increase in maternal mortality for the year 2000, associated with advanced maternal age and delay in maternity.[14] Although this increase has also been forecast for France and England for 2005,[15] there are no comparative analysis data available for the prevalence of pregnancies among women aged 35 years and over in Spain versus Europe, and the maternal mortality trend in Spain needs to be reassessed, as does the impact of advanced age on this trend. Accordingly, this study sought to: compare the prevalence of live births among mothers aged 35 years and over in Spain versus Europe during the last 5 years of the study period, 2000–2005; analyse the age-related trend in the maternal mortality ratio among mothers in Spain for the decade 1996–2005; and describe the causes of death and associated sociodemographic factors for the years with highest mortality. 2

METHODS

An ecological study on trends, using aggregate data for the maternal mortality trend during the period 1996–2005; and cross-sectional analysis using individual data to ascertain causes of maternal death and associated sociodemographic factors during 2003–2004.

Data source

Data on Europe were drawn from the European Statistics Office (Eurostat). Eurostat calculates the European aggregates on the basis of the data collected from the National Statistical Offices.[16] Data on Spain were drawn from the National Statistics Institute (INE); we used the movement of natural persons (MNP) and death statistics broken down by cause of death.[17]

Description of variables

The total births by mother's age in Europe, for 2000 to 2005 obtained from Eurostat, were used to

Table 1 Prevalence of live births among women aged 35 years and over for 15 European countries (EU15), 2000–2005

Countries (EU15)	LBMA ⩾35 years (n)	Total live births (N)	Prevalence % (P)	Difference in P	Prevalence ratio
Italy	750 190	3 176 749	23.6	4.6	1.24*
Ireland	83 441	355 940	23.4	4.4	1.23*
Spain	566 354	2 585 701	21.9	2.9	1.15*
Sweden	110 412	579 153	19.1	0.1	1.01**
Netherlands	228 506	1 193 527	19.1	0.1	1.01**
Luxembourg	6103	32 616	18.7	−0.3	0.98*
Germany	797 526	4 318 210	18.5	−0.5	0.97*
Finland	62 703	340 619	18.4	−0.6	0.97*
United Kingdom	757 974	4 150 737	18.3	−0.7	0.97*
Austria	72 212	404 309	17.8	−1.2	0.94*
France	786 333	4 807 827	16.3	−2.7	0.86*
Greece	101 912	626 738	16.2	−2.8	0.85*
Denmark	62 301	390 264	16.0	−3.0	0.84*
Portugal	100 083	678 359	14.8	−4.2	0.78*
Belgium†	–	–	–	–	–
Total (EU15) (Reference)	4 486 050	23 640 749	19.0	Reference	Reference

LBMA, live births with maternal age ⩾35 years old.
*p-Value <0.01.
†No data.
Source: Eurostat, in-house.

3

describe the prevalence of births among women aged 35 years and over for 15 European countries. The variables used to

describe the maternal mortality trend in Spain were the total number of births and maternal deaths by mother's age at the date of birth for each year of the study period, obtained from the MNP. The definition of maternal mortality used was that proposed by the International Classification of Diseases, 10th Revision (ICD-10), that is "the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes".[18] The maternal mortality ratio was calculated as the rate between maternal deaths observed for any given year and total live births for this same year expressed per 100 000 newborns; it thus represents the risk of maternal death with respect to the number of newborns. The number of live births used in the denominator is an approximation of the population of pregnant women who are at risk of a maternal death.[19] For the individual description of sociodemographic factors related to maternal deaths, the following variables were used: age; province of birth and death registration; and finally, the ICD-10 diagnostic code of cause of death, obtained from the register of deaths statistics broken down by cause of death.

Statistical analysis

The median, the interquartile range and the 5th and 95th percentiles were used for the description of maternal deaths. Considering maternal death as a rare event, and assuming that the maternal mortality ratio follows a Poisson distribution, maternal mortality ratios were calculated together with their respective 95% confidence intervals.

The trend in observed *vis-à-vis* expected deaths for each year of study was represented graphically in accordance with a Poisson distribution. The trend in mortality ratios was also represented graphically. A χ^2 test for trend was applied to the ratios and, using linear adjustment by the least squares method, a trend line was added to the figure, accompanied by the formula of the equation of the straight line and the coefficient of determination (R^2).

To confirm the trend in the series, standardised mortality ratios were calculated using the indirect method and taking 1996 as reference. Subsequently, in view of the small number of events that occur annually, the mortality ratios of the two quinquennia of the series were calculated in order to give more consistency to the analysis of the series. Using indirect standardisation and taking the 5-year period from 1996 to 2000 as reference, the standardised mortality ratio for the 5-year period 2001–2005 was then calculated.[20]

To analyse risk of death in terms of maternal age, the age-related mortality rates categorised in three groups (⩽34, 35–44 and ⩾45 years) were graphically represented (for the whole study period). A χ^2 test for trend was applied to the ratios and, lastly, a model with an exponential fit was depicted in the figure with its respective equation and coefficient of determination.

An exact Poisson regression was used to estimate the maternal age-related risk of death, adjusted for the study period. The explanatory model used was as follows:

$$\text{MMR} = \beta_0 + \beta_1{*}\text{Period (continuous variable)} + \beta_2{*}\text{Age (categorical variable)}$$

The statistical test of deviance was used to estimate goodness-of-fit, and an analysis of standardised Pearson residuals was performed.

Finally, after identifying the years with highest mortality, the sociodemographic factors related to maternal deaths were described individually. The statistical software program used was Stata v.10 (StataCorp, College Station, TX, USA).

RESULTS

The prevalence of live births among women aged 35 years and over in Spain was 15% higher than in the European Union (EU15) over the 5-year period 2000–2005. Along with Ireland and Italy, Spain registered the highest prevalence; Portugal was the country with the lowest prevalence (table 1).

During the period 1996–2005, there were 148 maternal deaths in Spain. The descriptive analysis revealed an annual median of 15 deaths for the study period, with an interquartile range of 7,

Table 2 Maternal mortality ratios and standardized mortality ratios in Spain (n: 148 maternal deaths; n = 4 062 685 live births), 1996–2005

Years/period	OMD	NLB	MMR (95% CI)	EMD	SMR	p-Value
1996	11	362 626	3.0 (1.7 to 5.5)	Reference	Reference	0.079*
1997	8	369 035	2.2 (1.1 to 4.3)	11	0.7 (0.5 to 1.1)	
1998	10	365 193	2.7 (1.5 to 5.1)	11	0.9 (0.6 to 1.3)	
1999	15	380 130	4.0 (2.4 to 6.5)	11	1.3 (0.9 to 1.7)	
2000	14	397 632	3.5 (2.1 to 5.9)	12	1.2 (0.9 to 1.6)	
2001	17	406 380	4.2 (2.6 to 6.7)	12	1.4 (0.9 to 1.8)	
2002	14	418 846	3.3 (2.0 to 5.6)	13	1.1 (0.8 to 1.5)	
2003	20	441 881	4.5 (2.9 to 7.0)	13	1.5 (1.2 to 1.9)	
2004	21	454 591	4.6 (3.0 to 7.1)	14	1.5 (1.2 to 2.0)	
2005	18	466 371	3.9 (2.4 to 6.1)	14	1.3 (0.9 to 1.7)	
1996–2000	58	1 874 616	3.1 (2.4 to 4.0)	Reference	Reference	0.089**
2001–2005	90	2 188 069	4.1 (3.3 to 5.1)	77	1.2 (0.9 to 1.4)	

EMD, expected maternal deaths; MMR, maternal mortality ratio; NLB, number of live births; OMD, observed maternal deaths; SMR, standardised mortality ratio.
*Trend χ^2.
**χ^2 for unequal rates.
Source: INE, in-house.

and 5th and 95th percentile of 8 and 21 deaths respectively. The maternal mortality ratio for the period was 3.6 (95% CI 3.1 to 4.3) women per 100 000 live births. Taking 1996 as reference, the standardised mortality ratio displayed an upward trend at the limit of significance ($p = 0.079$). Maternal deaths increased by 55% in the period 2001–2005 compared with 1996–2000 (table 2).

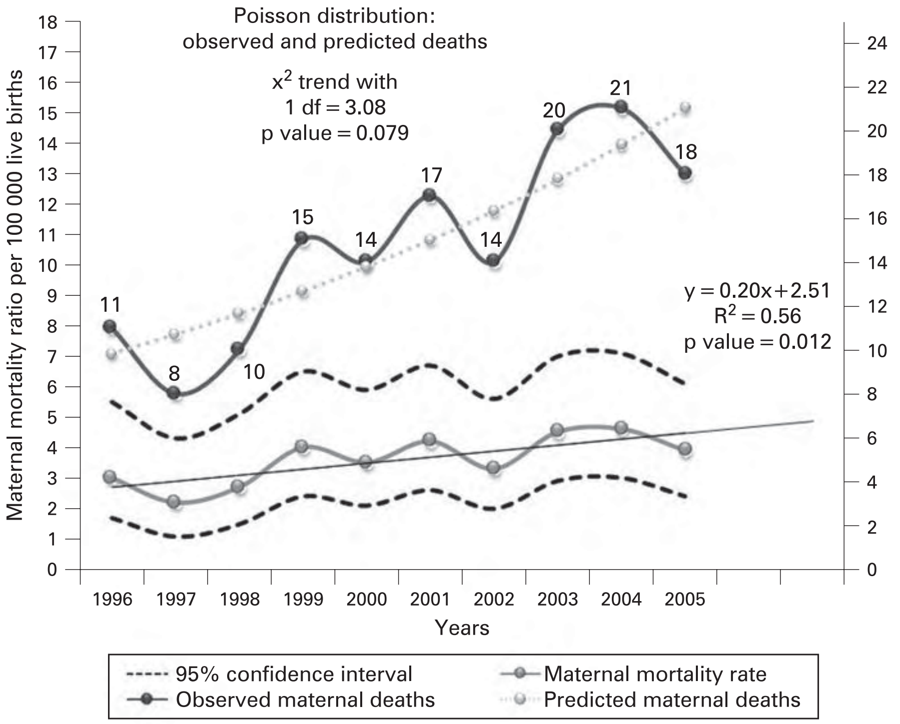
The maternal mortality ratio for the study period reflected linear growth ($p = 0.012$) (fig 1) and indicated 2 years with highest mortality. The maternal mortality represented a 50% increase mortality in 2003 and 2004, taking 1996 as reference (table 2).

Across the entire study period, the curve that best explained the trend in maternal age-related mortality ratios was that which depicted exponential growth (fig 2).

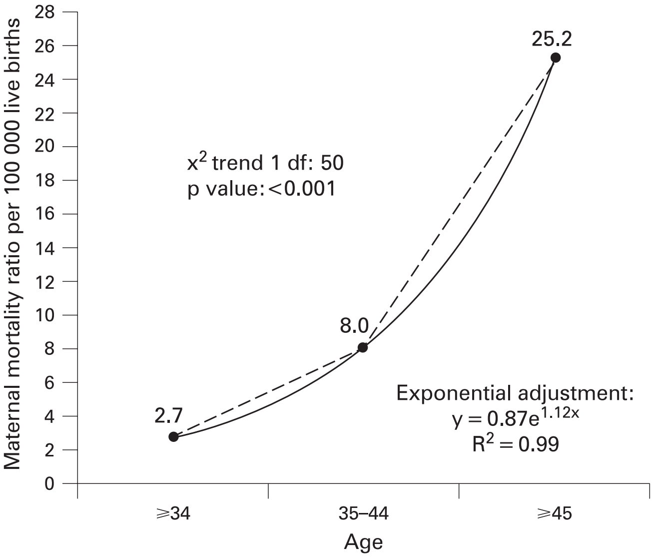
Adjusted for the study period, the maternal age group ranging from 35 to 44 years displayed a 2.9-fold higher risk of death compared with the 34 years and under age group. This higher risk rose to as much as 89.2-fold in the case of the 45 years and over age group (table 3).

Age-related sociodemographic characteristics, nationality (Spanish versus foreign), province of death and cause of death in respect of the 41 mothers who died in the 2 years that registered the highest mortality (2003–2004) are summarised in table 4. It should be stressed here that 32% of deaths were of foreign origin, 57% were aged 35 years and over, and 20% of deaths occurred in only one province (Málaga). The mortality risk in Málaga, taking the maternal mortality ratio of other provinces as reference was 6 times higher (rate ratio 6.4, 95% CI 2.6 to 14.2), and the mortality risk of death for foreign mothers, taking national mothers as reference, was 3.1 times higher (rate

Figure 1 Annual trend in the absolute number of deaths and maternal mortality ratios for the period 1996–2005 (n = 148).



Data source: national statistics institute (instituto nacional de Estadística-INE). In-house



Data source: national statistics institute (instituto nacional de Estadística-INE). In-house

Figure 2 Age-related maternal mortality ratio for the period 1996–2005 (n = 148).

ratio 3.1, 95% CI 1.5 to 6.1). The number of maternal deaths by provinces in Spain for the period 2003–2004 were: Alicante (3), Almeria (1), Asturias (3), Badajoz (1), Balearic Isles (1), Barcelona (5), Cadiz (1), Ceuta (1), Jaén (2), Las Palmas (1), Lleida (1), Madrid (5), Málaga (8), Murcia (1), Santa Cruz de Tenerife (2), Seville (1), Pontevedra (1), Valladolid (1), Zaragoza (1) (fig 3). The groups O10–O16 and O85–O92 constitute 48.7% of all deaths in the years 2003 and 2004. In the first group, pre-eclampsia/eclampsia accounts for 90% (9 deaths) of the deaths and embolism (amniotic fluid (4 deaths), the blood clot in obstetrics (3 deaths) and other obstetric embolism (1 death)) accounts for 80% of deaths in the second group.

CONCLUSIONS

From 1930 to the 1980s, the maternal mortality ratio registered a clear decline in most European countries, with it then remaining stable in the following years.[21 22] In the 1990s, different authors forecast a rise in the maternal mortality ratio by the beginning of the 21st century, specifically in Spain, France and the United Kingdom.[14 15] In line with these forecasts, the results of this study confirm a change in the maternal mortality trend in Spain over the decade 1996–2005.

In Spain, the risk of maternal mortality grew exponentially with mothers' age over the decade 1996–2005. This is the first time that a study has drawn attention to the high percentage of maternal deaths among the foreign population in Spain (32% of total deaths during the 2-year period from 2003 to 2004). In this respect, other studies have identified women of advanced reproductive age and immigrants from developing countries as risk groups for maternal mortality.[13 15] However, the data yielded by our study do not enable us to specify what percentage of the figure of 32% recorded for deaths among foreign mothers is attributable to mothers from developing countries. In this connection, a study on maternal mortality in Europe highlights the fact that there is a wide disparity between migrants from developing countries and the native population in terms of access to health. Communication problems between health professionals and immigrant patients have been postulated as being a key factor underlying this problem.[23]

Table 3 Maternal mortality ratios according to maternal age and study period (n = 148 maternal deaths), 1996–2005

	Coefficient (standard error)	RR (95% CI)*	p-Value
Period 1996–2005	0.04 (0.03)	1.04 (0.98 to 1.10)	0.181
Maternal age (years)			<0.001
35–44 vs ⩽34	1.05 (0.18)	2.90 (2.01 to 4.06)	
⩾45 vs ⩽34	4.50 (0.42)	89.2 (39.04 to 203.85)	

*Relative risk. Goodness-of-fit χ^2 26.7, p = 0.421.

According to Eurostat data, the mean age of first pregnancy in most European countries is rising.[16] The determinants of this process can be explained by the social, economic and cultural changes that took place in western societies in the last third of the 20th century. Specifically, here in Spain, the lack of conciliation between professional and family life, absence of protective policies during years of maternity and the progressive medicalisation of pregnancy and birth have been suggested as determinants of the increase in the mean age of mothers at first pregnancy.[24] Furthermore, the development of assisted reproduction techniques, different prenatal diagnostic tests, legal termination of pregnancy after prenatal diagnosis of congenital defects[25] and delivery by caesarean section with enhanced safety for mother and fetus have brought greater guarantees of safety for couples who can now delay maternity with a certain degree of tranquillity.[26]

This would account for the fact that Spain and Italy, with some of the lowest total fertility rates in Europe (a mean of 1.2–1.3 children per woman of reproductive age),[16] are the two countries that have the highest number of assisted reproduction clinics (115 and 182 respectively) and register the highest prevalence of births among women aged 35 years and over in Europe.[27] This change in the fertility pattern has led some authors to forecast future rises in maternal mortality.[15 22]

The individual descriptive analysis of maternal deaths that occurred during the 2-year period with the highest mortality (2003–2004) has enabled a cluster of deaths to be located in one Spanish province. Confidential surveys conducted in France, the United Kingdom and Holland in the 1990s estimated that the proportion of maternal deaths that did not benefit from an optimal level of care accounted for 50–80% of the cases reviewed.[28–30] Accordingly, this is a factor that might well explain the difference in maternal mortality between regions.

This is why confidential investigations into maternal death are indispensable in furnishing a more reliable image of what is in fact happening. Such research requires every effort to be made to gather comprehensive data on all the possible variables underlying the event. Individualised nationwide studies on maternal deaths started being conducted in the United Kingdom in 1952 and in The Netherlands shortly thereafter.[13 31]

Insofar as the limitations of this study are concerned, it must be stressed that, when one talks of risk of maternal mortality associated with age, this is not interpretable at an individual level: to do so, would be to fall foul of an ecological fallacy. Different authors have highlighted problems of under-registration and under-reporting of maternal deaths in different European countries and Spain,[32] and so the results of our study could be underestimated. One must be prudent when it comes to interpreting the results in view of the fact that probability distributions for infrequent events increase the risk of type 1 error and, at times, yield p-values that are difficult to interpret. To solve this problem when analysing the data, we therefore

Figure 3 Maternal mortality by province of death in Spain (n = 41), 2003–2004.

endeavoured to lend the results greater consistency by adding maternal deaths for periods of 5 years in order to perform 5-yearly comparisons. Prudence is also called for when it comes to interpreting the mortality cluster detected. For a correct interpretation, one would have to have access to a longer time series. Similarly, it is highly likely that most of the clusters of adverse results in reproductive health are random events: only a very small proportion are caused by environmental agents, which could be identified by exhaustive epidemiological research.[33 34]

The change in the maternal mortality pattern detected marked by a rising trend and increased risk at advanced maternal ages, the detection of a cluster with geographical excess mortality plus the high prevalence of pregnancies among women aged 35 years and over in Spain versus other European countries justify the need for more intense and detailed epidemiological surveillance of a preventable phenomenon. It would be desirable to conduct an assessment of under-registration and under-reporting, implement active surveillance to put a halt to geographical clusters, use qualitative surveys for analysis of the socioeconomic and healthcare circumstances surrounding deaths and perform comparative quantitative analyses in the European sphere, both national and regional. These measures would be invaluable for in-depth understanding and characterisation of a preventable phenomenon such as maternal death.

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Table 4 Maternal mortality ratios, sociodemographic characteristics and causes of death as per ICD-10 in Spain (n = 41 maternal deaths; n = 896 472 live births), 2003–2004

Variables	N (%)	TLB (n)	MMR (95% CI)
Province of death			
Málaga	8 (19.5)	32 450	24.6 (10.6 to 48.6)
Others*	33 (80.5)	864 022	3.8 (2.6 to 5.3)
Age (years)			
⩽34	18 (43.9)	746 771	2.4 (1.4 to 3.8)
35–44	21 (51.2)	149 049	14.1 (0.9 to 21.5)
⩾45	2 (4.9)	652	306.7 (34.4 to 1170.0)
Nationality			
Foreign nationals	13 (31.7)	116 661	10.1 (0.6 to 1.9)
Spanish nationals	28 (68.3)	779 811	3.6 (2.4 to 5.2)
ICD-10 cause			
Pregnancy with abortive outcome (O00–O08)	4 (9.7)	896 472	0.4 (0.1 to 1.1)
Oedema, proteinuria and hypertensive disorders in pregnancy, childbirth and the puerperium (O10–O16)	10 (24.4)	896 472	1.1 (0.5 to 2.0)
Maternal care related to the fetus and amniotic cavity and possible delivery problems (O30–O48)	5 (12.2)	896 472	0.5 (0.2 to 1.3)
Complications of labour and delivery (O60–O75)	7 (17.1)	896 472	0.7 (0.3 to 1.6)
Complications predominantly related to the puerperium (O85–O92)	10 (24.4)	896 472	1.1 (0.5 to 2.0)
Other obstetric conditions, not classified elsewhere (O95–O99)	5 (12.2)	896 472	0.5 (0.2 to 1.3)

TLB, total live births.
*Other province deaths: Alicante, Almeria, Asturias, Badajoz, Balearic Isles, Barcelona, Cadiz, Ceuta, Jaén, Las Palmas, Lleida, Madrid, Murcia, Santa Cruz de Tenerife, Seville, Pontevedra, Valladolid, Zaragoza.
Source: INE, in-house.

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What is already known on this subject

- The delay in maternity and the progressive rise in maternal age at date of birth have resulted in higher female morbidity and mortality. Maternal mortality is regarded as a preventable cause of death, strongly related to the quality of the healthcare system and economic and social factors.
- Different studies forecast an increase in maternal mortality, associated with advanced maternal age and delay in maternity in the coming years. The maternal mortality trend in Spain needs to be reassessed, as does the impact of advanced age on this trend.

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What this study adds

- A change in the maternal mortality pattern in Spain marked by a rising trend and an increased risk at advanced maternal ages, the detection of a cluster with geographical excess mortality plus the high prevalence of pregnancies among women aged 35 years and over in Spain versus other European countries.
- This pattern change poses the need to intensify maternal mortality surveillance in Spain by collecting the necessary set of variables that allows investigation of the causes and determinant factors underlying deaths. Active surveillance should be implemented to put a halt to geographical clusters, qualitative surveys used for analysis of the socioeconomic and healthcare circumstances surrounding deaths, and comparative quantitative analyses performed in the European sphere, both national and regional. These measures would be invaluable for in-depth understanding and characterisation of a preventable phenomenon such as maternal death.

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Original breve

Incidencia y factores de riesgo de gastroenteritis en los peregrinos del Camino de Santiago durante el verano de 2008 en el camino francés

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RESUMEN

Objetivos: Conocer la incidencia de gastroenteritis aguda en los peregrinos del Camino de Santiago, los factores de riesgo asociados y su caracterización microbiológica.
Métodos: Se diseñaron dos estudios simultáneos, uno transversal mediante encuestas autocumplimentadas de peregrinos llegados a Santiago y otro de casos y controles a los peregrinos en el camino. Se hizo un análisis multivariado mediante regresión logística.
Resultados: En el estudio transversal la densidad de incidencia fue de 23,5 episodios de gastroenteritis aguda por 1.000 peregrinos-día (intervalo de confianza del 95% [IC95%]: 18,9–29,4/10^3). En el estudio de casos y controles los factores de mayor riesgo fueron la edad <20 años (*odds ratio* [OR]=4,72; IC95%: 2,16–10,28), viajar en grupo (tres personas o más) (OR=1,49; IC95%: 0,98–2,28) y consumir agua no embotellada (OR=2,09; IC95%: 0,91–4,82). Norovirus fue el microorganismo aislado con más frecuencia (56%).
Conclusiones: Ser peregrino menor de 20 años, realizar el camino en grupo y consumir agua no embotellada se asocian con un mayor riesgo de presentar gastroenteritis aguda.

Incidence and risk factors for acute gastroenteritis among pilgrims following the French way to Santiago de Compostela (Spain) in summer 2008

Keywords:
Gastroenteritis
Cross-sectional study
Case-control study
Disease outbreaks
Traveling
Santiago de Compostela

ABSTRACT

Objectives: To determine the incidence of acute gastroenteritis in pilgrims on St. James' Way, as well as associated risk factors and microbiological characteristics.
Methods: Two studies were designed simultaneously: a cross-sectional study through self-completed questionnaires among pilgrims reaching Santiago, and a case-control study of pilgrims traveling along the Way. Multivariate analysis was performed using logistic regression.
Results: In the cross-sectional study, the incidence rate was 23.5 episodes of acute gastroenteritis/10^3 pilgrims-day (95% CI: 18.9–2.4/10^3). In the case-control study, the major risk factors were age <20 years (OR=4.72; 95% CI: 2.16–10.28), traveling in groups (three or more) (OR=1.49; 95% CI: 0.98–2.28), and drinking unbottled water (OR=2.09; 95% CI: 0.91–4.82). The most frequent etiologic agent was norovirus (56%).
Conclusions: Age less than 20 years, traveling in groups and drinking unbottled water were important risk factors for acute gastroenteritis.

Introducción

Las gastroenteritis agudas infecciosas constituyen procesos patológicos muy frecuentes, que en general aparecen como casos esporádicos de curso benigno y autolimitado. Aunque con menos frecuencia, también se dan casos graves, de etiología viral o bacteriana, que suelen afectar principalmente a niños[1] y ancianos[2,3]. En verano son numerosas las gastroenteritis agudas bacterianas por las altas temperaturas, por problemas de conservación de los alimentos y por el cambio de hábitos vacacional.

El Camino de Santiago es una importante ruta turística, cultural y religiosa, frecuentada por unos 40.000 peregrinos durante el verano[4]. Al no haber registros de gastroenteritis aguda en esta población, ni datos específicos de incidencia por cuadros diarreicos, se planteó este trabajo de campo en el cual colaboraron la Consellería de Sanidade de Galicia y el Programa de Epidemiología Aplicada de Campo (PEAC) del Centro Nacional de Epidemiología. Con él se pretendía estimar la incidencia de casos de gastroenteritis aguda que se producen en el Camino de Santiago, en previsión de los riesgos que se puedan dar en el presente Año Santo Compostelano 2010.

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Objetivos

El objetivo general fue conocer la incidencia de gastroenteritis aguda, y los factores de riesgo asociados, en los peregrinos que realizaban el Camino de Santiago en el tramo gallego del camino francés (trayecto desde la entrada en Galicia por O Cebreiro, en Lugo, hacia Sarria y finalmente Santiago). Los objetivos específicos fueron:

- Describir el perfil de los peregrinos y de los casos incidentes de gastroenteritis aguda durante el estudio.
- Determinar la densidad de incidencia (DI) como estimador de frecuencia más adecuado para una población dinámica e inestable.
- Caracterizar microbiológicamente los cuadros diarreicos.
- Analizar el riesgo de gastroenteritis aguda en función de las características de los peregrinos y de otros factores de riesgo relacionados con el camino, los albergues y el origen del agua y los alimentos consumidos en las 72 h previas a la gastroenteritis aguda[5].

Métodos

Se realizó un estudio transversal de los casos de gastroenteritis aguda informados por los peregrinos que realizaron la ruta francesa del Camino de Santiago entre el 15 de julio y el 15 de septiembre de 2008, mediante encuestas autocumplimentadas en el albergue del Monte do Gozo, localizado al final del camino.

Se diseñaron encuestas en cuatro idiomas (español, gallego, francés e inglés), que incluían mapas de las cinco etapas consideradas clásicas[6], para ayudar a evitar sesgos de memoria: O Cebreiro - Sarria - Portomarín - Palas de Rei - Arzúa - Santiago de Compostela. La información se recogió y se trató confidencialmente.

La incidencia se estimó con una precisión del 5% y un grado de confianza del 95%, calculando un tamaño de muestra de al menos 385 peregrinos[7]. Éstos se seleccionaron de forma consecutiva a su llegada al albergue, hasta completar una cuota diaria de encuestas. Se calcularon las DI utilizando como denominador las sumas de los tiempos en riesgo de cada individuo, a partir de los días que cada persona estuvo haciendo el tramo de estudio en Galicia antes de padecer diarrea.

Se realizó simultáneamente un estudio de casos incidentes utilizando como fuente de información los reportes a un teléfono móvil de los hospitaleros (denominación habitual de las personas a cargo de los albergues), los centros de salud, los servicios de urgencias y las farmacias de alrededor del camino. De esta manera se identificó a los afectados con celeridad para poder entrevistarlos por teléfono, recogiendo información sobre factores de riesgo asociados y solicitarles una muestra de heces que se repartió en sendos frascos para bacteriología (general y tipificación de *Escherichia coli* enteropatógénica), virología (ELISA para adenovirus/rotavirus y RT-PCR para Norovirus) y parásitos. También se solicitó la identificación de un acompañante sin síntomas como control concurrente[8] cuando fue posible. La definición de caso fue «peregrino con dos o más deposiciones blandas/día y/o vómitos en el tramo gallego del camino francés durante el periodo del 15-7-08 al 15-9-08».

Se realizó un análisis de casos y controles conjunto utilizando los no-casos del estudio transversal, para tener más de dos controles por caso y así aumentar la potencia estadística para evaluar posibles factores asociados al riesgo de presentar gastroenteritis aguda. Se realizó un análisis multivariado mediante regresión logística.

Resultados

El estudio transversal recogió información de 531 peregrinos, en su mayoría mujeres, viajando solas o en pareja (53,2%), de nacionalidad española (60%) y que habían hecho el camino anteriormente al menos en una ocasión (25%). La mediana de edad fue de 31,2 años, con un rango intercuartílico (IQ) de 23,7 a 43,8. La mediana del número de días invertidos en el camino fue de 5 (IQ: 4-7). La estancia mediana en territorio gallego fue de 6 días (IQ: 5-8). El 90,4% consumió agua no embotellada en algún momento durante el camino (intervalo de confianza del 95% [IC95%]: 87,9%-92,9%).

Presentaron gastroenteritis aguda o síntomas relacionados 118 peregrinos (19,9%). De éstos, sólo 82 (13,8%) cumplió la definición de caso y dos no dejaron datos de registro temporal. La DI fue de 23,5 episodios de gastroenteritis aguda por cada mil peregrinos-día (IC95%: 18,9–29,4/10^3) (tabla 1).

En el estudio de casos incidentes, de las cinco etapas en que se dividió el camino en el tramo de estudio, la primera y la última son las que acumulan un porcentaje mayor de inicio de gastroenteritis aguda (28% y 25%).

Caracterización microbiológica

Se obtuvieron muestras de heces en 32 casos, y en nueve no se detectaron patógenos. De los 23 positivos, en 12 se identificó Norovirus, en dos *E. coli* eae, en uno *Salmonella*, en uno *Hafnia* y en uno *Cryptosporidium*. En cinco casos hubo doble identificación: Norovirus+*E. coli* (2 eae, 1 enteropatogénica, 1 enterotoxigénica) y *Hafnia alvei* (1), y un caso con triple aislamiento con Norovirus, *E.coli* eae y *Campylobacter*.

Análisis de los posibles factores de riesgo

En el análisis de casos y controles conjunto se identificaron 175 casos, 95 procedentes del estudio de casos incidentes y 80 del estudio transversal. Los controles fueron 27 del estudio de casos incidentes y 451 del transversal; en total, 653 peregrinos. En el análisis univariado no se asociaron de forma significativa con los cuadros de gastroenteritis aguda el lugar de inicio del camino, el modo de peregrinaje (a pie/bicicleta), los días de estancia en el camino, la procedencia de los alimentos (albergues, tiendas, bares, restaurantes, hoteles) ni el origen del agua consumidos en las 72 h previas.

Después de ajustar por la edad, el sexo, el país de procedencia y el número de acompañantes, el consumo de agua no embotellada resulta ser un factor de riesgo que multiplica por dos la presencia de un cuadro de gastroenteritis aguda (*odds ratio* ajustada [ORa]=2,09), con una significación estadística al límite (IC95%: 0,91–4,82). También el hecho de hacer el camino en compañía de más de tres personas aumenta el riesgo de gastroenteritis aguda, rozando la significación estadística (ORa=1,49; IC95%: 0,98–2,28). El único factor claramente asociado a la incidencia de gastroenteritis aguda fue la edad (ORa=4,72; IC95%: 2,16–10,28), para los menores de 20 años respecto a los mayores de 50 años (tabla 2).

Discusión

Al parecer, el prototipo de peregrino candidato a presentar una gastroenteritis aguda es de nacionalidad española, menor de 20 años, que va con al menos tres acompañantes y que consume agua no embotellada, pues el agua de fuentes es más fácil de obtener en

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Tabla 1
Analisis descriptivo de los casos de gastrointeritis aguda y densidades de incidencia (n=653)

Variables	N	Casos, n (%)	Personas-día en riesgo	Densidad de incidencia por 1.000 personas-día
Edad en años				
< 20	78	48 (61,5)	405	118,5 (88,4–155,8)
20–29	205	60 (29,3)	1.116	53,8 (41,4–68,7)
30–39	134	23 (17,2)	655	35,1 (22,8–51,9)
40–49	85	23 (27,1)	410	56,1 (36–83)
> 50	95	16 (16,8)	607	26,4 (15,6–42)
Sexo				
Mujer	294	85 (28,9)	1.648	51,6 (41,7–63,8)
Hombre	359	90 (25,1)	1.869	48,2 (39,2–59,2)
País de procedencia				
España	409	123 (30,1)	2.130	57,7 (48,4–68,9)
Otros	244	52 (21,3)	1.387	37,5 (28,6–49,2)
Acompañante				
En grupo (≥ 3)	320	108 (33,8)	1.768	61,0 (50,6–73,8)
Solo o en pareja	319	56 (17,6)	1.741	32,2 (24,8–41,8)
Consumo de agua no embotellada				
Sí	591	167 (28,3)	3.171	52,6 (45,3–61,3)
No	60	8 (13,3)	336	23,8 (11,9–47,6)
Veces que ha hecho el camino				
1.ª vez	478	129 (27)	2.696	47,9 (40,1–56,7)
2.ª vez	105	18 (17,1)	611	29,5 (18–45,7)
3 o más	38	7 (18,4)	210	33,3 (14,6–65,9)
Modo de hacer el camino				
Andando	592	155 (26,2)	3.361	46,1 (39,3–53,8)
Bicicleta	59	18 (30,5)	156	115,4 (70,5–178,8)
Lugar de inicio				
Galicia	214	49 (22,9)	1.226	40 (29,9–52,4)
Otras comunidades autónomas	316	87 (27,5)	1.672	52 (41,9–63,9)
Francia	100	22 (22)	561	39,2 (25,2–58,4)
Origen del agua no embotellada				
Fuente de pueblo	487	111 (22,8)	2.640	42,1 (34,8–50,4)
Fuente del camino	434	111 (25,6)	2.290	48,5 (40,1–58,2)
Bares y restaurantes	401	117 (29,2)	2.095	55,9 (46,4–66,7)
Albergues	471	135 (28,7)	2.554	52,9 (44,5–62,4)
Otros	109	24 (22)	617	38,9 (25,5–57)

Tabla 2
Análisis de los factores de riesgo de gastrointeritis aguda (n=653)

Variables		Casos, n (%)	Controles, n (%)	ORc (IC95%)	ORa (IC95%)
Edad en años	< 20	48 (61,5)	30 (38,5)	7,90 (3,90–15,90)	4,72 (2,16–10,28)
	20–29	60 (29,3)	145 (70,7)	2,04 (1,10–3,78)	1,71 (0,89–3,30)
	30–39	23 (17,2)	111 (82,8)	1,02 (0,51–2,06)	0,89 (0,43–1,86)
	40–49	23 (27,1)	62 (72,9)	1,83 (0,89–3,76)	1,57 (0,74–3,36)
	> 50	16 (16,8)	79 (83,2)	1	1
Sexo	Mujer	85 (28,9)	209 (71,1)	1,22 (0,86–1,72)	0,97 (0,66–1,43)
	Hombre	90 (25,1)	269 (74,9)	1	1
País de procedencia	España	123 (30,1)	286 (69,9)	1,59 (1,10–2,30)	1,43 (0,92–2,25)
	Otros	52 (21,3)	192 (78,7)	1	1
Acompañante	En grupo (≥ 3)	108 (33,8)	212 (66,3)	2,39 (1,63–3,52)	1,49 (0,98–2,28)
	Solo o en pareja	56 (17,6)	263 (82,4)	1	1
Consumo de agua no embotellada	Sí	167 (28,3)	424 (71,7)	2,56 (1,19–5,50)	2,09 (0,91–4,82)
	No	8 (13,3)	52 (86,7)	1	1

ORc: odds ratio cruda; ORa: odds ratio ajustada; IC95%: intervalo de confianza del 95.

el camino y este hábito es una conducta de riesgo generalizada y posiblemente fácil de imitar cuando se camina en grupo.

La mayor densidad de incidencia de gastroenteritis aguda en grupos de peregrinos y el aislamiento de Norovirus, de muy fácil transmisión, en un 56% de los casos, nos hace pensar que pudo haber contagio persona-persona[9,10].

La potencia final del estudio de casos y controles es del 70%, tomando como asociación principal el consumo de agua no embotellada y teniendo en cuenta una prevalencia de exposición entre los controles del 89,1% (424) y entre los casos del 95,4% (167).

La variabilidad clínica y la tolerancia individual a los síntomas de la gastroenteritis aguda hace pensar que hubo casos no detectados a pesar del sistema de vigilancia establecido en este tramo del camino, en Galicia, escogido por razones operativas del estudio.

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No hay estudios previos publicados sobre este tema. Al ser el primero, no se dispuso de una población de referencia de peregrinos en el momento de diseñar el trabajo de campo, pues los datos de la Archidiócesis de Santiago de Compostela sólo informan del número de peregrinos que acuden a recoger la Compostela (certificado eclesiástico). La sociedad anónima que gestiona los albergues del Plan Xacobeo registra pernoctaciones, no personas, y por tanto no hay información de los peregrinos que no se alojan en los albergues oficiales y que no recogen la Compostela.

Se sugirió a la Consellería de Sanidade que en el año 2010, dada la elevada afluencia de peregrinos, se implementara un plan de educación sanitaria con informaciones en páginas web y otros medios para los peregrinos, excursionistas, asociaciones deportivas y de otro tipo, orientadas al consumo de agua potable o embotellada, y la notificación inmediata a la autoridad sanitaria de cualquier cuadro de gastroenteritis aguda. Así mismo, se propuso una campaña publicitaria de respeto a las indicaciones de potabilidad, y la mejora del acceso al agua potable allí donde sea necesaria.

Contribuciones de autoría

A. Pousa tuvo la idea original, buscó financiación, organizó el trabajo de campo, referenció las fuentes y los albergues del camino francés, participó en el diseño del estudio, el análisis de los datos y las revisiones de los borradores. J. Giménez, M.A. Luque, C. Linares y J. Rodríguez participaron en el diseño del estudio, realizaron el trabajo de campo, analizaron los datos y realizaron revisiones críticas de los borradores del trabajo. L. Bonilla, C. Savulescu y G. Clerger participaron en el diseño del estudio, construyeron las bases de datos y las encuestas, y participaron en el análisis estadístico. L. Martínez, J.M. Donado, D. Herrera y M.V. Martínez participaron críticamente en el diseño del trabajo, ayudaron en la obtención de los datos, revisaron el análisis estadístico y realizaron la revisión crítica de los borradores. Todos los autores dieron su aprobación al borrador final.

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Conflicto de intereses

Los autores declaran no tener ningún conflicto de intereses.

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Differences in the reproductive pattern and low birthweight by maternal country of origin in Spain, 1996–2006

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Background: Numerous studies have highlighted poorer reproductive and perinatal health outcomes among migrant mothers in developed countries. Due to the fact that no conclusive data is currently available at national level in Spain, this study aimed to explore potential differences by comparing the prevalence of low and multiple live births and the proportion of live births by maternal age and country of origin during 1996–2006.
Methods: A cross-sectional study was conducted using data from the National Statistics Institute. Low birthweight (LBW) was compared by mothers' country of origin using a logistic regression model. Odds ratios (ORs) and their respective 95% confidence intervals (CIs) are stratified by multiplicity and maternal age.
Results: LBW was associated with a combination of older maternal age and multiple pregnancies in the case of women who had been born in Europe (EU15). However, this association was not found in women who originated from outside the EU15, mostly from countries who have shown significant emigration to Spain during the last decade. LBW was present among all age groups, in both singleton and multiple births, and in particular Romanian mothers showed the highest OR 2.34 (95% CI 1.20–4.80).
Conclusion: This study confirms differences in the reproductive pattern and LBW depending on maternal country of origin. These results allow a better understanding of the reproductive pattern and the implications of mothers' country of origin in LBW. Thus, helping health decisions makers to plan future health interventions aimed at reducing the LBW prevalence in Spain.

Keywords: maternal age, low birthweight, ethnic groups, reproductive health, epidemiology

Introduction

In less than a decade, population of Spain has grown by 13%, climbing from 40 million inhabitants in 1996 to 46 million in 2007; 86% (5.2 million) of this increase is attributable to migration. In 2007, 24% of the foreign population residing in Spain were women of fertile age.[1] These demographic and social shifts have led to a slight increase in overall fertility associated with increased live births prevalence among foreign mothers.[2–4] At international level, several studies have highlighted the worse perinatal and reproductive health outcomes observed in migrant women,[5–8] and specifically the higher prevalence of pregnancies, prematurity and low birthweight (LBW) among adolescent mothers.[9–13] In Spain, only a few studies have addressed this subject from a comparative approach producing contradictory results and based on regional data.[14–17] After arrival to the host country, migrant women undergo a process of adaptation and change which can generate stress. In addition, there are numerous difficulties related to the access to health care services.[9,18,19]

Maternal country of origin, defined as the country of birth of the mother giving birth, is considered by various studies as an indicator for comparative outcomes analysis of perinatal and reproductive health.[20,21]

The LBW prevalence in Spain has increased by 31% during the period 1996–2005, with a prevalence of 7.2% in 2005. This increase has been related to the change of reproductive patterns in Spain, characterized by a higher prevalence of live births among older women.[22] However, the prevalence of LBW by maternal country of origin remained unknown.

Hence, the objectives of this study were to compare the proportion of live births, the prevalence of LBW and multiple live births depending on maternal country of origin and maternal age, as well as to analyse the differences found in Spain during 1996–2006.

Methods

We performed a cross-sectional study. The population in study represented 98.7% (4 484 414 live births) of the total of live births registered in Spain from 1996 to 2006.

Study data were drawn from the National Register of Live Births, part of the Natural Population Movement Statistics

(Estadísticas del Movimiento Natural de la Población – MNP), that obtains official data from the mandatory birth registration form. Registration form data from all civil registries around the country are centralized, processed and analysed by the National Statistics Institute (Instituto Nacional de Estadística – INE).[1]

The following variables were selected according to the designated study objectives: maternal age on the date of giving birth, birth multiplicity, birth weight and the mothers' country of origin. The maternal country of origin variable comprised of 21 categories. Twenty of these corresponding to different countries, and one category was made up of 41 Sub-Saharan African countries that shared homogeneous development, socio-economic indicators and Human Development Index[23] $\leq$0.6. Maternal age was classified into four groups ($\leq$19, 20–29, 30–39 and $\geq$40 years), multiplicity was dichotomized into singleton live birth and multiple live births (two or more), and birth weight was categorized as <2500 or $\geq$2500 g.[24]

Initially, a descriptive analysis of data was performed. The total live births, LBW prevalence, mean birthweight, multiplicity and maternal age were examined by maternal country of origin. Odds ratios (ORs) derived from a logistic regression model were considered a good approximation of the prevalence ratios because LWB prevalence for all nationalities was less than 10%.[25] Hence, LBW was compared by maternal country of origin using a logistic regression model. Dichotomized LBW was included as the dependent variable and maternal country of origin as the independent one. Spanish mothers were considered the reference group. Maternal age (categorized) and multiplicity (dichotomized) were introduced as covariables by means of a manual stepwise method. Various multivariate logistic regression models were conducted in order to control for the confounding effect of age and multiplicity. The best model selected (based on the deviance statistic and the goodness-of-fit) showed a significant interaction between maternal age and multiplicity:

$$\text{Log (OR)} = \beta_0 + \beta_1 \times \text{Maternal country of origin} + \beta_2 \times \text{Multiplicity} + \beta_3 \times \text{Maternal Age} + \beta_4 \times \text{Maternal Age} \times \text{Multiplicity}$$

ORs and their respective 95% confidence intervals (CIs) were presented by multiplicity and maternal age, which was recorded as a dichotomic variable with two categories, mothers aged $\leq$ 35 and >35 years.

The statistical software programme used was Stata v.10 (StataCorp. College Station, TX, USA).[26]

Results

Table 1 ranks the absolute number of live births by maternal country of origin. The greatest number of live births during the study period was found among Spanish, Moroccan, Ecuadorian, Colombian, Romanian and the group of African Sub-Saharan women.

Regarding maternal age, mothers who had been born outside from the former European Union comprised by 15 states members—EU15—in countries linked to a migration process to Spain during the last decade, registered higher prevalence of live births among mothers aged $\leq$19 years. Romanian mothers registered the highest prevalence with 11.1% of live births. In contrast, it was mothers from EU15 that registered a

Table 1 Distribution of maternal age, multiple births, mean birthweight and LBW by maternal country of origin: Spain, 1996–2006 (n = 4 484 414)

Total live births by maternal country of origin		Maternal age (%) ≤19	20–29	30–39	≥40	≥35	Multiple births (%)	Birthweight in grams[a] Mean birthweight	LBW (%) < 2500 g
Spanish	4 116 797	2.6	36.2	58.3	2.8	15.0	3.3	3210	7.2
Moroccan	93 311	6.3	53.5	35.8	4.4	14.0	2.6	3341	5.4
Ecuadorian	59 075	9.2	60.2	28.4	2.1	8.5	1.5	3281	5.7
Colombian	31 149	6.0	52.1	38.8	3.1	13.0	2.0	3288	5.9
Romanian	28 530	11.1	67.1	21.2	0.6	4.0	1.8	3226	7.9
Sub-Saharan Africa[b]	22 635	5.0	59.9	32.8	2.3	9.0	3.2	3185	8.7
Chinese	15 918	1.7	64.7	32.1	1.5	7.6	1.6	3304	4.5
Argentine	12 449	2.4	47.9	46.8	2.9	13.0	2.5	3273	6.1
English	12 385	2.4	33.1	59.3	5.2	23.0	3.2	3263	7.8
Bolivian	10 867	6.9	65.0	26.5	1.5	6.8	1.6	3408	4.6
Peruvian	10 317	2.4	41.8	51.4	4.4	18.0	2.3	3350	5.3
French	9463	1.4	37.5	58.7	2.4	15.0	3.7	3222	7.2
Brazilian	8660	3.4	57.2	37.0	2.4	10.0	2.3	3261	6.8
Dominican	8644	9.5	52.3	35.7	2.4	10.0	2.5	3228	7.9
Portuguese	8262	7.9	49.8	39.3	2.9	12.0	3.2	3199	8.4
German	7837	1.8	27.1	66.1	5.0	24.0	3.3	3252	7.2
Cuban	6255	3.0	53.9	41.6	1.4	9.3	2.5	3334	5.6
Italian	5738	1.2	34.1	60.2	4.5	20.0	3.1	3261	5.7
Polish	5674	2.5	66.4	30.0	1.1	5.3	1.8	3290	5.7
Algerian	5283	2.1	54.6	40.9	2.4	11.0	2.7	3321	5.5
Bulgarian	5165	7.0	65.4	26.5	1.0	5.2	2.2	3234	6.7
All countries	4 484 414	2.9	37.7	56.5	2.8	15.0	3.2	3216	7.1

[a] 226 309 (5.0%) missing birthweight values: Spanish (4.7%), Moroccan (12.6%), Ecuadorian (6.4%), Colombian (5.0%), Romanian (7.5%), Saharan Africa (12.0%), Chinese (11.7%), Argentine (4.2%), English (6.7%), Bolivian (6.7%), Peruvian (7.0%), French (5.4%), Portuguese (7.1%), German (6.6%), Cuban (6.0%), Italian (5.9%), Polish (7.1%), Algerian (7.6%) and Bulgarian (6.2%).
[b] Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central Africa Republic, Chad, Comoros, Democratic Republic of Congo, Republic of Congo, Djibouti, Equatorial Guinea, Ethiopia, Gabon, Gambia, Ghana, Guinea Conakry, Guinea Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Sierra Leone, Somalia, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia and Zimbabwe.
Data source: National Statistics Institute (Instituto Nacional de Estadística-INE), In-house.

Table 2 Comparative analysis of risk of LBW according to maternal country of origin, stratified by age and multiplicity in Spain, 1996–2006 ($n = 4\,484\,414$)

	Singleton births		Multiple births	
Maternal country of origin	Age ≤ 35 years OR (95% CI)	Age > 35 years OR (95% CI)	Age ≤ 35 years OR (95% CI)	Age > 35 years OR (95% CI)
Moroccan	0.78 (0.75–0.81)	0.79 (0.72–0.86)	0.67 (0.61–0.74)	0.65 (0.54–0.79)
Ecuadorian	0.91 (0.87–0.95)	1.06 (0.94–1.19)	0.77 (0.66–0.89)	0.74 (0.50–1.11)
Colombian	0.87 (0.82–0.92)	1.00 (0.87–1.15)	1.14 (0.94–1.37)	1.21 (0.58–1.76)
Romanian	1.34 (1.28–1.40)	1.83 (1.50–2.24)	0.92 (0.76–1.12)	2.34 (1.20–4.80)
Sub-Saharan Africa	1.36 (1.28–1.44)	1.60 (1.34–1.88)	0.81 (0.68–0.96)	1.06 (0.68–1.53)
Chinese	0.68 (0.62–0.75)	0.88 (0.66–1.16)	0.78 (0.59–1.03)	0.66 (0.29–1.47)
Argentine	0.86 (0.78–0.95)	1.06 (0.86–1.32)	1.15 (0.87–1.51)	0.62 (0.37–1.02)
English	1.13 (1.03–1.24)	1.20 (1.02–1.39)	0.98 (0.76–1.26)	1.02 (0.70–1.45)
Bolivian	0.71 (0.64–0.80)	0.78 (0.54–1.20)	0.80 (0.57–1.11)	0.51 (0.19–1.38)
Peruvian	0.76 (0.68–0.86)	0.99 (0.80–1.22)	0.52 (0.38–0.71)	0.94 (0.55–1.61)
French	1.00 (0.90–1.11)	0.89 (0.69–1.14)	0.90 (0.70–1.15)	0.97 (0.60–1.60)
Brazilian	1.00 (0.91–1.12)	1.13 (0.85–1.50)	1.32 (0.92–1.87)	1.51 (0.80–2.83)
Dominican	1.22 (1.11–1.35)	1.65 (1.30–2.11)	0.83 (0.61–1.12)	0.75 (0.37–1.50)
Portuguese	1.24 (1.12–1.34)	1.34 (1.04–1.71)	1.27 (0.95–1.71)	0.58 (0.32–1.03)
German	1.06 (0.95–1.20)	1.05 (0.86–1.23)	0.72 (0.53–0.98)	0.87 (0.53–1.43)
Cuban	0.74 (0.65–0.86)	0.90 (0.61–1.32)	1.02 (0.71–1.45)	1.54 (0.60–4.01)
Italian	0.73 (0.62–0.85)	0.80 (0.60–1.07)	1.09 (0.75–1.60)	1.13 (0.58–1.59)
Polish	0.89 (0.78–1.01)	1.05 (0.63–1.74)	0.95 (0.62–1.48)	0.66 (0.21–2.05)
Algerian	0.77 (0.66–0.90)	1.01 (0.70–1.46)	0.68 (0.47–0.99)	0.33 (0.12–0.88)
Bulgarian	1.02 (0.90–1.17)	0.83 (0.46–1.48)	1.33 (0.87–2.04)	1.54 (0.40–6.00)
Spanish	1	1	1	1

Data source: National Statistics Institute (Instituto Nacional de Estadística-INE), In-house.

higher prevalence of live births among mothers aged ≥35 years, with the highest prevalence in older live births in German mothers, followed by English and Italian mothers.

Overall, the distribution of live births by maternal age showed a clear pattern. This was characterized by a prevalence of >50% in the 20–29-year age group in mothers born outside EU15 and a prevalence of >50% in the 30–39-year age group among mothers from EU15. Similarly, with the exception of African Sub-Saharan mothers (with prevalence exceeding 3%), it was EU15 mothers that registered a higher absolute number of multiple births (table 1).

When mean birthweight in grams was analysed, the live births of Bolivian mothers had the highest mean while mothers in the African Sub-Saharan group, presented the lowest figures. The absolute difference between these two extreme groups was 223 g. Among the remaining maternal countries of origin, no major absolute differences were found, with mean weights ranging from 3200 to 3300 g. The mean weight across all groups was 3216 g. The highest prevalence of LBW (<2500 g), live births was seen in African Sub-Saharan mothers with a prevalence of 8.7% (table 1).

Analysis of the association of LBW by maternal country of origin highlighted higher odds of LBW from mothers born outside EU15 compared with Spanish mothers. Romanian mothers, registered the highest ORs (>2) in both maternal age groups for singleton births and in the group of mothers aged >35 years for multiple births. Among the European mothers, weaker measures of association (<1.5) were found with live births of English and German mothers registering higher odds of LBW if compared with live births of Spanish mothers (table 2).

Discussion

Our study confirms differences in the reproductive pattern and LBW depending on maternal country of origin in Spain during 1996–2006. Different authors have highlighted the suitability and importance of comparative analyses of perinatal and reproductive health indicators by maternal country of origin.[20,21] Research has shown that looking at outcome by 'migrant' versus 'non-migrants' is not informative because 'migrants' are an extremely heterogeneous group. It is thus difficult to interpret the results obtained from conducting such comparisons, in order to determine their relevance for policy and practice. Our study has attempted to compare homogeneous groups by using an internationally known 'label', proposed by EUROPERISTAT report such as maternal country of origin,[20] and has avoided using ambiguous and heterogeneous concepts such as 'migrant'.

The associations observed by our study highlight two differentiated patterns of LBW, namely: one linked to a higher prevalence of newborns among adolescent mothers born outside EU15; and the other linked to higher prevalence, both of live births among mothers of advanced age and of multiplicity, in the case of EU15 mothers.

Our results do not differ from those of other studies which also report a higher prevalence of pregnancies among adolescent immigrant mothers.[9,10] In addition, this higher prevalence is related to social inequalities in health.[27]

As far as the interpretation of risk of LBW is concerned, a number of studies estimate that ∼5% of all live births in Europe are attributable to assisted reproductive therapies (generally among mothers of advanced age), which entail a higher likelihood of LBW.[20,28] Looking at live births of EU15 mothers, they registered the highest prevalence of multiplicity and of pregnancies in mothers of advanced age (≥40 years). This finding is best exemplified by live births of English mothers, who, moreover, have the highest risk of LBW of the various EU15 mothers that were studied. Accordingly, among EU15 mothers, the odds of LBW could well be associated with the combination of higher maternal age and multiplicity (with the latter being possibly favoured by assisted reproduction techniques). Among the mothers born outside EU15, however, LBW is distributed across all age groups and applies to both single and multiple births, with Romanian mothers best representing this risk pattern. It can therefore be presumed that in the pattern shown by mothers born outside EU15, there may be other factors of a social nature, not controlled for by this study. In this connection, many authors have reported migrant mothers as having worse perinatal and reproductive health outcomes, associated with social inequalities.[9–14]

One limitation of our study is the lack of data on the biological, behavioural, socio-economic and environmental determinants of LBW.[29] This information could not be used, either because it was not given on the birth registration form, or because screening and analysis of the database showed it as not being biologically plausible (by comparing the percentage of incongruencies from a biological stance on cross-tabulation of variables categorized by contingency tables, e.g. weeks of gestation and birthweight). However, we were able to describe what occurred in terms of reproductive health patterns and LBW depending on maternal country of origin during 1996–2006. The magnitude of data managed (all live births during a 10-year period) gives an added value to this study. As has previously been recognized, monitoring trends and identify patterns with information on the demographic characteristics of individuals is the most important objective of public health surveillance systems.[30] In line with this, this study has demonstrated a differentiated pattern in the prevalence of LBW in Spain by maternal country of origin, contributing to a better knowledge of the birth pattern and serving as a tool for decision makers and other stakeholders to better plan and implement future health interventions.

Another limitation of the study has been the possible presence of selection bias due to the percentage of missing weight values, i.e. 5%, the highest proportion of which was, in general, accounted for live births from mothers born outside EU15. Despite this, the large size of our sample endows our associations in our results with a high power. Even if the missing values pertained to normal-weight live births, the probability of committing type II error would still be low, and if, in contrast, such values pertained to low-weight live births, the strength of the associations might possibly be even more evident for certain groups of nationalities.

The results of this study could serve as an important decision-making tool for managers and policy-makers in the field of public health. We identified that mothers born outside EU15 had higher odds of having LBW infants and a higher prevalence of pregnancies in adolescent, as well as certain EU15 mothers, including Spanish, having a higher prevalence of multiplicity and pregnancy at advanced ages.

Accordingly, with the different patterns identified, it would be appropriate for the health authorities to become actively involved in promoting a wide spectrum of measures targeted at reducing the higher prevalence of pregnancies among adolescent mothers born outside EU15, and in fostering compatibility between professional and family life in an effort to ensure that pregnancies occur at earlier ages among Spanish and other European mothers in order to reduce the impact of high prevalence of LBW in Spain.

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Conflicts of interest: None declared.

Key points

- We observed differences in the prevalence of live births among adolescent and older women as well as in the prevalence of LBW and multiple births by maternal country of origin, in Spain during 1996–2006.
- We observed two differentiated patterns of LBW, namely: one linked to a higher prevalence of newborns among adolescent mothers born outside EU15; and the other linked to higher prevalence, both of live births among mothers of advanced age and of multiplicity, in the case of mothers from the former European Union comprised by 15 states members.
- These results allow a better understanding of this pattern and the implications of maternal country of origin in LBW and could help decisions makers in reproductive health to better plan future interventions aimed to reduce the prevalence of LBW in Spain.

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In English

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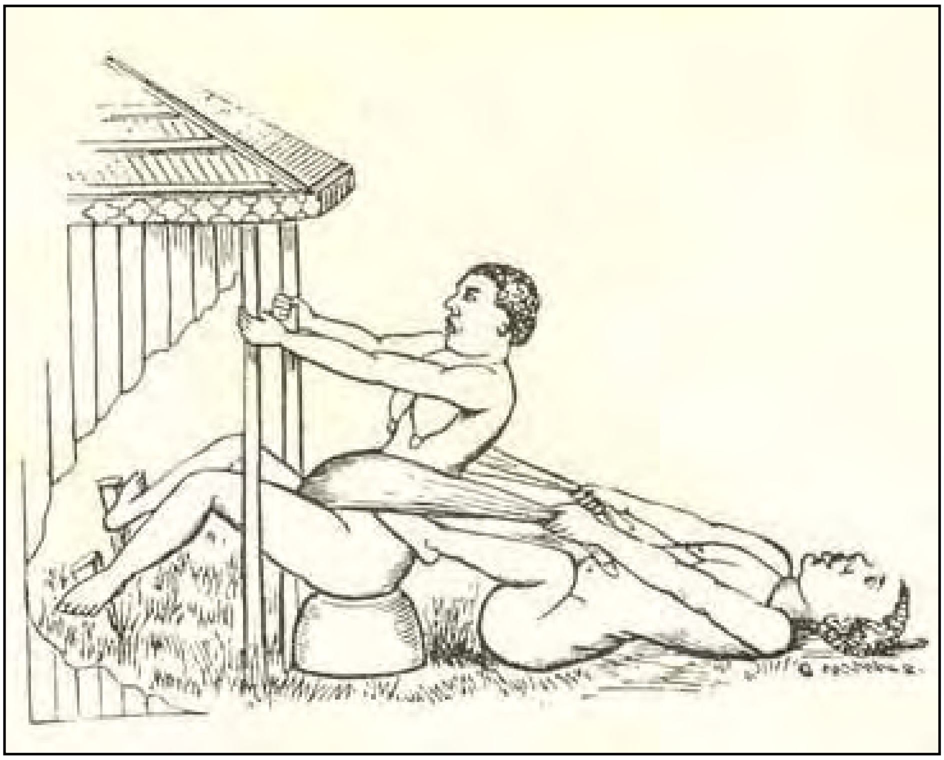

Culture differences on perceiving and living delivery: the case of immigrant women

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Abstract

Target: To wathc behavioural patterns of cultural origin during delivery in inmigrant women which could haverd health assistance.
Material and methods: Qualitative investigation based upon participating observation and twenty semi-structured interviews to inmigrant women.
Results: Cultural sensitivities regarding sense of prudeness and the preference for female obstetric assistance have been found, also in perception of attitude towards labour pain, in company preferences during labour, in their experience and perception (position during third stage, acceptance of medicalised labour, etc.), as well as in patterns of inmediate interaction with the newborn.
Conclusions: The differences found, which can not be generalised towards the whole of women from the same geographical origin, occasionally are misunderstood by the health profesionals, and may help us understand that our model of performance is not the only one, or the best, or the most "natural", allowing to establish a health assistance sensitive to every woman's needs.

Introduction

Over the past two decades, a lot of immigrants from developing countries have come to Spain. Immigrant women represent a young population and as a consequence, most of them are of reproductive age[1], so that attendance at birth is a main priority.

Health assistance/care can be influenced by both cultural and linguistic barriers[2] because reproduction and maternity are bio-cultural phenomena where values, feelings and beliefs are reflected[3,4].

There is a great diversity of experiences concerning delivery. In some traditional areas, empirical midwives take part in the delivery process which takes place at home. They have special traditions when assisting the newborn[5] and the post-natal mother. Nevertheless, in the west, birth takes place in hospital and medication levels are high.

Even if for immigrant women, Spanish health improvements result in a decrease in maternal and neonatal morbid-mortality rates, socio-cultural differences between both countries may lead to a clash of habits in health assistance during delivery. It is by that, related to the delivery care, that may occurs conflicts between the origin and reception customs.

Cultural aspects play an important role in the perception and acceptance of the health services and they have been studied in the case of fertility, contraception[6] and puerperium[7]. It has been considered the reproductive behaviour of immigrant women influenced by socio-cultural and health concepts of their home countries but also by the habits of the countries in which they are living right now. It is not common for people to get used to new rules and values and to forget about their habits, they just try to combine values of both cultures by changing some traditions and holding up some others[8].

Whatever the influence of the culture in reproductive behaviour, health professionals do not always understand these differences in the health assistance and from an ethnocentric attitude, we often judge people based on our prejudices and lack of understanding. This may lead to unfairness in the health care. However, cause-effect relation is not always stablished between stereotypes, prejudices and discrimination. Sometimes and because of these differences people are not treated equally and it usually happens in the health field, where prejudices are not normally the cause of discriminatory attitudes because according to professional principles, we should act with fairness9. Nevertheless, we may show subtle[10] signs of prejudice towards them, shown by a minor expression of feelings of affection and warmness in the assistance and a lack of recognizement of the cultural specifities of those women, either because we do not know about their cultural patterns or because of ethnocentric attitudes. This last aspect responds to a defense of traditional or "normal" values when giving birth. We are talking about criteria which determine whether the attitudes are acceptable (adjusted to this values) or not (not adjusted).

That is the reason why the aim of our research has been to study the behavioural patterns of immigrant women during delivery that can have a cultural origin, and result in some difficulties in the relation, in intercultural clash and in prejudices showed by health professionals assisting them.

Methodology

Qualitative investigation based upon participating observation has been carried out. It includes informal conversations and twenty semi-structured interviews. Observations have been carried out between January and May 2002 in the areas of obstetrics and in the delivery room of a public hospital in Andalusia, taking advantage of all the interactions and the professional attention of the investigators with women inmigrants.

It has been explained the aim of the semi-structured interviews to women and we have promised them not to reveal their names. The selection criteria was their linguistic competence of Spanish and their willingness to collaborate with us. They told us about the way they lived the delivery at the hospital, their preferences for assistance and their attitude towards labour pain, as well as the difficulties concerning assistance. All the information compiled after every observation and interviews were first written in a field journal and it was later codified and analysed qualitatively.

The sample consisted of immigrant women who have given birth in this hospital, their relatives and all those accompanying them. The hospital is located in an area with a diversified population with a high percentage of immigrants, so that 20% of the deliveries where foreign women deliveries. Most of them came from Africa, followed by eastern European and women from Latin America.

Results and Discussion

Sense of decency. In our culture, assistance to women is provided by professionals of both sexes, but it does not happen in other countries. We realized that just some women, mainly from Africa, are unwillingly to be examined by a male gynaecologist. It does not happen only with male health professionals but with men in general. In most cases, their husbands prefer to leave their wives alone during examination. This situation has been described in literature with Muslim women[11] that consider their body as a symbol of custody of the honour of their family. This attitude also has to do with the sexual segregation of traditional Muslim societies.

Nevertheless, even if the sense of decency and the preference for female assistance is higher for Muslim women, it is often overestimated. A lot of women are not reluctant to be examined by male doctors. Furthermore, even if cultural factors play an important role, they get over these differences after they are explained the reason for the examination and after they realize that they are being kindly treated.

Perception and attitude towards labour pain. The perception and expression of pain have a lot to do with socio-cultural[12,13] differences. In some cultures, women are asked to be quiet during delivery, while in some others it is assumed that they shout as a way to express their pain[14]. The vast majority of women from East Europe and sub-Saharan Africa have stoical behaviour. African women make grimaces of pain with facial muscles and the body movements are minimum. When they are in great pain, they make guttural sounds of difficult description. Their faces express pain and there are usually problems concerning verbal communication.

On the contrary and although it is not general to the whole colective, it is common for North African women to have fewer inhibitions, expressing their pain more clearly and they become even exasperated. Sometimes they complain noisily, making active corporal movements even if they are not in the active phase of labour. They usually repeat a litany in their language or they call their mothers.' It is even verified women who ask for epidural, continue to express their pain. Nevertheless, just a few of these women ask for epidural analgesia, in most cases, because they do not know anything about it. On the contrary, South American women or women from Eastern Europe know about this kind of anaesthetic and they often ask for it.

Apart from cultural aspects, the perception of pain can be influenced by information previous to birth, and psycho-social conditions of immigrant women: finding themselves in a different context makes it possible for them to feel afraid about the delivery. The fact that they feel alone and the lack of emotional support may decrease the tolerance of pain.

Whatever the reason for the perception of pain, they are not always understood by health professionals participating in the delivery process. We do not want women, whatever their country, to express their pain and we consider negatively those who complain "too much" because they demand more health assistance.

Company during labour. Cultural aspects also play an important role when talking about company preferences during labour although there are enormous differences between women from the same culture. In general, Muslim men are more reluctant to accompany their wives during delivery. Some of them accompany their wives during dilation but they are physically far from them without stroking or encouraging them, they just go in and out the delivery room. Some health professionals consider this attitude to be "indifferent" to the pain endured by women. Even if sometimes they accompany their wives during dilation with a loving attitude, they prefer not to be with them during third stage. Some men, who have been previously convinced to enter the delivery room have then expressed their gratitude and satisfaction after witnessing the birth of their child.

But it is not just an attitude typical of men. Some African women express their wish not to be accompanied by their husbands for a number of reasons: linguistic incompetence, occupations or just because "labour is only for women". Here we have an example:

"A Moroccan woman entered the delivery room. She told me that her husband wanted to be with her during delivery. Her husband, who spoke fluent Spanish, acted as an interpreter to complete the clinical history. The woman complained but her husband did not approach her to support her. When I went to examined her I realized that she did not want to take her clothes off in front of her husband. During delivery she pronounced repeatedly the name of her mother. Suddenly she gestured to her husband to ask him to get out of the room. After the child was born, the woman covered her genital area with green cloths and she did not let us examine the area. When there were just the two of us in the room, she removed the cloths and said to me that I could begin".

This story suggests that the woman asked her husband to be there just because her insecurity was stronger than her embarrassment. This is a common situation, but it does not always happen. There are also some cases in which husbands express their feelings before and after the birth to their wife and newborn.

Immigrant women from any country who enjoy social and familiar support sometimes prefer to be accompanied by a friend or a female relative. However, when they do not have relatives, a friend can witness the delivery process. They are usually compatriots who have been living here for a long time and who speak our language and who know the way our health system works, that is why they sometimes act as translators and speak to health professionals. This is a social and gender phenomenon very common for North African and eastern European women; however, it does not happen with sub-Saharan women who very often give birth alone. Sometimes they are accompanied by Spanish women who are their friends or with whom they have a work relationship. Sometimes they are accompanied by women just because their husbands give priority to work or because they prefer to wait in the waiting room.

When women are not able not speak Spanish, it is very useful for health professionals to count on husbands or friends that come in the dilatation or delivery rooms who act as translators when they ask them about clinical information or just when they want to say something to the woman in labour. Besides, relatives or friends should take care of the woman and the baby during the two hours after the birth, that is why when they are reluctant to do it, health professionals might get angry and say that "they should get used to Spanish habits".

It is understandable that some foreign men do not feel comfortable when they are asked to take part in the delivery process. In some cultures and traditional societies, the delivery takes place at home and just women take part in it. In Spain, from halfway through the 20th century - when deliveries started to take place in health facilities- families did not take part in the delivery process and they had to wait in the waiting room until the baby was born[15]. However, the father's role has been promoted through the last years as a result of new cultural values.

With the birth rate on the decrease, the concepts of maternity and paternity have been redefined. According to the new cultural concept of paternity, to look after the children is considered to be a very important factor. The father's role[16] starts by supporting the woman and taking care of the newborn. In fact, for most non-immigrant women it is important to be accompanied by their husbands during the delivery process. They do not feel that it is necessary to be accompanied by anyone else[17].

However, there are some exceptions to this rule which have to do with cultural differences and historical changes that have taken place in our society over the last decades that are not taken in consideration. It would be necessary for professionals to question the belief that the person who accompanies the woman during childbirth should always be the husband. They should also ask immigrants and non-immigrant women about their preferences, so that husbands only accompany their wives because they are willing to do so but not because that is what most people do[18].

Experience and perception during labour. In our culture, acceptance of medicalised labour is largely widespread, whereas in some other cultures it is not. We expect women to obey all rules, to accept all care provided and to do as health professionals tell them to do but it is not always the case for women from different geographical origins. Here we have a revealing example:

"A woman from Ecuador pregnant with her fourth child came to Accident and Emergency on her own. She had arrived in Spain just two months before. After being examined, we realized that she was in her final phase of pregnancy, so we decided to start with the ordinary protocol: to shave the perineum, bedding her, to monitor the heartbeat of the foetus and to find a venous access. As we carried on with all these things, we realized that she did not feel comfortable and that it was all very strange to her. She repeatedly insisted that we removed the "straps". She wanted to walk. We said to her that she could not get out of bed. While artificial amniorrhexis she asked: why are you doing that? Rapidly she reach the complete dilatation. However, even if contractions became more frequent, she did not push. We decided to take her to the delivery room. When we told her to push, she asked: "Let me squat". She squatted and the baby was born".

This is also a common situation for African women and it gets on the nerves of health professionals, who are used to acting quick and to forcing the delivery. Although most women from different cultures give birth in a vertical position, in Spain as well as in other countries, they give birth lying down because it makes things easier for professionals. However, we know about the advantages of the freedom of movement[19] during labour.

Interaction with the newborn. Even if the way of expressing feelings differs from one person to another, after the baby is born the mother is expected to remain calmly and peacefully. Sometimes they express their feeling of happiness and affection by kissing or saying lovely words to the newborn[20]. However they are some women that do not show any interest during immediate postpartum even though they had desirable pregnancies. They do not show their feelings towards the newborn. After childbirth, the baby is placed on the belly of his mother but some women do not touch them or they do not even look at them. The attitude of these women could be defined as "emotionally deprived", which means that they do not express their feelings in a "natural" and "common" way.

Instead of making an effort to understand the reasons for this attitude, health professionals say things like that: "I don't understand that, they don't love their children", "It would have been better not to have had children.", "What a shame!" We say that because we only think of our culture and the way mothers express their love to their children when they are born[21].

What are the reasons for this attitude? We may think that the personal situation of these women makes them not to express their feelings. However, some authors state that we should make a difference between natural and social affections. They say that we should have in mind that these attitudes, as well as some other attitudes which have to do with feelings, are not natural and depend on the socio-cultural and economic context in which they take place. In some places where perinatal and child birth and mortality rates are high, the bond between the mother and the newborn[22] is not immediate. In fact, we have realized that in our postpartum rooms, women that were considered to be "unaffectionate" towards their babies while they were in the delivery room, show their affection some minutes afterwards, so that they express their motherly love but at different times.

Conclusions

This study highlights difference in behavioural and attitudes patterns of cultural origin during delivery. However, even if some differences have been found between women from different groups, they cannot be generalised: individual variability is an important premise.

Because of the increasing amount of immigrants, health professionals face a wide range of new cultural situations in health assistance. In order to overcome difficult situations when dealing with these patients, some strategies considering a broad range of socio-cultural and economic contexts should be adopted.

The differences found in those minorities, which cannot be generalised to all women from the same geographical origin, are occasionally misunderstood by the health professionals, and may help us understand that our model of performance is not the only one, or the best, or the most "natural", allowing to establish a health assistance sensitive to every woman's needs.

In order to face up to this challenge, a cognitive change in health professionals and a better anthropological education are needed. It should be promoted attitudes of respect to the otherness and differences in behavioural patterns of cultural origins should be relativized provided that they respect human dignity and human rights.

It is also important for professionals to work on interculturality in order to improve "cultural sensitivity" and mutual respect. The biomedical model is considered as the hegemonic, to be the best one, although there is a lack of reflection about the cultural bias of the system. It is a fact that the ideology of the western biomedical system offers to our professional praxis some rules of behaviour which are not supported by the scientific evidence and that there are a lot of ritual and symbolic aspects concerning health professions and institutions and that the intrahospital space also creates cultural ways of assistance which change through the years[23].

In order to become sensitive to cultural diversity, it would be really important for professionals to think about it and to become aware of the implicit culture of our health institutions. Adopting a political attitude towards our own praxis, influenced by cultural values, and understanding that expressions and habits concerning health and illness change from one culture to another and even within the same cultural system is the first step to understand the women we deal with, either if they are immigrants or not.

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Prevención de la mortalidad materna

UN EJEMPLO DE INTERVENCIÓN COMUNITARIA EN SALUD EN EL CONGO

Miguel Angel Luque Fernández,[1] Ariane Bauernfeind[2]

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Resumen Abstract

Introducción: En el año 2005, la Organización Mundial de la Salud llamó la atención de la comunidad médica internacional sobre la crisis sanitaria invisible que provocan las muertes maternas en los países más pobres del mundo. Tras el lema "Cada madre y cada niño contarán" del informe mundial de la salud, se reconoce la mortalidad materna como un gran problema de salud pública internacional y de derechos humanos.
Objetivo: Aumentar el número de partos institucionalizados mediante una investigación-acción con el objetivo de disminuir indirectamente la mortalidad materna.
Métodos: Un ensayo comunitario, de metodología cualitativa-cuantitativa, realizada en Pweto (República Democrática del Congo) entre 2002 y 2004. Mediante un abordaje etnográfico se obtuvieron las claves determinantes de la baja proporción de partos instititucionalizados desde la perspectiva de las mujeres y se instauró un programa de intervención. La efectividad del programa se mensuró mediante el test de la T de student, comparando los partos atendidos en las estructuras sanitarias antes y después de la intervención.
Resultados: La diferencias observadas tras la intervención, con un aumento de 1279 partos, son estadísticamente significativas (T:-12,062 con 28 g.l., p<0,01), demostrándose que existe una fuerte asociación lineal positiva entre el número de partos y la intervención (R^2:0,81 p<0,01).
Discusión: Los proyectos de cooperación internacional en salud deberían considerar la mortalidad materna como un problema transversal al que dar solución. Intervenciones sencillas centradas en dar respuesta a los problemas tal y como los perciben las mujeres, pueden aumentar el número de partos institucionalizado en regiones receptoras de ayuda humanitaria como en Pweto.

PREVENCION OF MATERNAL MORTALITY: AN EXAMPLE ON COMMUNITY INTERVENTION IN CONGO
Introduction: The WHO "World Health Report 2005" calls attention to the international medical community about the invisible health crisis causing the maternal deaths in the poorest countries of the world. Under the slogan "Make every mother and child count", the maternal mortality was recognised as a huge international public health and human rights problem.
Objective: Increase the number of institutional deliveries trough an action research, with the objective to reduce indirectly maternal mortality.
Methods: A qualitative-quantitative community trial was conducted in Pweto (Democratic Republic of Congo) from 2002 to 2004. An intensive ethnographic research was done to obtain the key determinants of the low proportion of institutional deliveries from the mother's perspective and an intervention was started. The program's efficiency was measured through a T student test comparing the number of deliveries attended in the institution before and after the intervention.
Results: The increase of 1279 deliveries observed after the intervention has statistically significance (T:-12,062 with 28 grade of liberty, p<0,01) demonstrating a strong positive lineal association between the number of institutional deliveries and the intervention carried out (R^2:0,81 p<0,01).

Discussion: International health cooperation projects have to consider maternal mortality as a crosscutting problem which needs to be addressed in all their interventions. Simple intervention, focusing on answering to the problems perceived by the women, could increase the number of institutional deliveries in regions of humanitarian aid such as Pweto.

Introducción

El fallecimiento de una madre es más que una tragedia personal. Puede tener graves consecuencias no sólo para su familia, sino también para la comunidad y la economía local. La mujer en los hogares de bajos ingresos desempeña no solamente un papel reproductivo, sino también productivo, participa en el trabajo agrícola, en la obtención de ingresos adicionales y provee a la comunidad de servicios básicos.[1] Cuando mueren las madres, sus hijos de corta edad también tienen mayores probabilidades de morir.[2] La mortalidad materna se define como la muerte de una mujer ocurrida en el curso del embarazo o en los 42 días posteriores después del parto, independientemente de la duración o la localización, debida a cualquier causa determinada o agravada por el embarazo o los cuidados que el mismo motiva, pero ni accidental ni fortuita. La tasa de mortalidad materna debe ser calculada por mil nacidos vivos.[3] Las complicaciones relacionadas con el embarazo, parto y puerperio son la principal causa de muerte para las mujeres en los países en vías de desarrollo.[4] Las mujeres que quedan embarazadas en países en desarrollo se enfrentan a un riesgo de muerte entre 80 y 600 veces superior al de las mujeres en países desarrollados.[5] Estas complicaciones relacionadas con el embarazo parto y puerperio (EPP) han sido evidenciadas ya hace tiempo por la comunidad internacional como un problema significativo concerniente a la salud pública y a la declaración universal de los derechos humanos. Mientras que las estrategias de salud pública tienen en cuenta este problema, a menudo no es considerado como prioritario. La comunidad médica internacional ha estado lenta en identificar una aproximación de salud pública para las complicaciones relacionadas con el EPP.[6] Hay que esperar hasta la década de los noventa del siglo XX para encontrar declaraciones de compromisos concretas que intentan llamar la atención de la comunidad internacional hacia la mortalidad materna y sus causas, así como para considerarla como una prioridad de salud pública. En 1994 se establecieron compromisos de acción específicos para intentar dar solución a la mortalidad materna. Estos se recogieron en el Plan de Acción de la Conferencia Internacional de la Población y del Desarrollo (ICPD) de El Cairo[7] y en 1995 la Plataforma de Acción de la Cuarta Conferencia Mundial sobre la Mujer[8], en Beijing. A pesar de las declaraciones y de los compromisos de acción, el 64% de la población mundial estimada de adultos analfabetos son mujeres.[9,10] Y cada año siguen muriendo 700.000 mujeres como consecuencia directa del EPP. En el Africa Sub-Sahariana la posibilidad de que una mujer muera a lo largo de su EPP es de 1 sobre 13 partos, mientras que en los países de la Organisation for Economic Co-opertion and Development (OCDE), es de 1 sobre 4.085 partos. En Europa la mortalidad materna ha descendido hasta cifras de 5-7 mujeres por cada 100.000 partos, mientras que en algunos países africanos hay una mortalidad materna de 1000 a 2000 mujeres por cada 100.000 partos,[11] pudiendo llegar incluso a cifras como las que el Internacional Rescue Committee (IRC) reporta de hasta 3.000 mujeres muertas por cada 100.000 partos en casos de emergencias complejas[12-14] (crisis crónica o aguda con violencia, desplazamiento de población, inseguridad alimentaria y aumento de las tasas de malnutrición y mortalidad general). Más de 1600 mujeres mueren cada día en el curso de un parto[15] y sin embargo la magnitud real del problema es difícil de evaluar por falta de estadísticas confiables. El peso de la mortalidad materna recae sobre países pobres que no tienen desarrollados sistemas de información sanitaria, por lo tanto aún podría ser que las cifras fueran superiores a las reportadas.[16,17] Los problemas de salud de las mujeres y la mortalidad materna han sido descuidados o considerados como una fatalidad, y por lo tanto no han sido puestos en relieve para ser abordados como un problema prioritario en las políticas de desarrollo de las grandes agencias internacionales.[18] En el informe sobre la salud en el mundo de la Organización Mundial de la Salud (OMS) de 2005, se evidencia la crisis sanitaria invisible que provocan las muertes maternas.[19] La mortalidad materna depende del nivel de riqueza o pobreza que un determinado país pueda alcanzar y de determinantes socio-culturales. En numerosas culturas la morbi-mortalidad ligada al EPP, es interpretada como un hecho natural asociado al rol de las mujeres en la sociedad, y no como un problema de salud que necesite una atención particular. La OMS, en una declaración conjunta con otras organizaciones internacionales sobre la mortalidad materna en el año 1999, declaró que las principales causas de muerte materna son atribuidas a la esfera de lo biológico, en concreto un 80% de la causalidad es atribuida a factores médicos. Sin embargo, solamente un 20% es atribuido a otras causas llamadas indirectas.[20] No podemos obviar la importancia de los determinantes socioculturales en la génesis de las causas de muerte materna en los países menos desarrollados. La adecuación sociocultural de un proyecto de intervención es una variable crucial que suele tener una incidencia directa sobre su éxito.[21] Los políticos y la sociedad en general se deben convencer de que la mortalidad materna se puede y se debe prevenir.[22] Y para llegar a adquirir este compromiso político, las sociedades deben de reconocer que la solución a la mortalidad materna pasa por comprender que en su génesis, son causa fundamental la pobreza y la desigualdad de género.[23,24] Este trabajo evalúa la implementación de una serie de actividades encaminadas a incentivar el parto institucionalizado con el objetivo de reducir la mortalidad materna en una población en situación de emergencia compleja con medidas poco costosas y en un pequeño período de tiempo. Todas las intervenciones en el ámbito de la salud pública, la ayuda humanitaria y la antropología médica, destinadas a incentivar el parto institucionalizado a escala local en una población dada, generarán una disminución secundaria de la tasa de mortalidad materna.[24]

El proyecto tiene lugar en Pweto, República Democrática del Congo. Un país que ocupa el puesto 167 de 175 en el Indice de Desarrollo Humano, según el informe del Programa de las Naciones Unidas para el Desarrollo de 2005.[25] El bajo umbral socio-económico, consecuencia directa del subdesarrollo y de la guerra, la carencia de bienes de consumo y las dificultades orográficas y climáticas que imposibilitan la permanencia de las rutas, hacen de Pweto una población cerrada con múltiples dificultades para el desplazamiento de personas y mercancías. El grupo étnico imperante en la región es el "Bemba", son agricultores y el peso de las tareas agrícolas recae, generalmente, sobre las mujeres. El dialecto más hablado es el Bemba, encontrando personas que por influjo colonial hablan el francés, los menos, y otros tantos que hablan el "Chibemba", que es una mezcolanza entre Bemba y Swahili. Es una sociedad patrilineal y su religión se basa en el individuo y el culto de los antepasados, aunque por influjo colonial se produce un sincretismo entre cristianismo y tradición religiosa popular.[26]

Después de la última campaña nacional de vacunación contra la polio del Fondo de las Naciones Unidas para la Infancia (UNICEF) en 2002, sabemos que la población de Pweto es de 257.190 habitantes. La tasa de natalidad de la RDC, es de 44 por 1000 habitantes, la tasa global de fecundidad de 6,7 hijos por mujer, y el 22,3% de la población está representada por mujeres en edad reproductiva.[27] Con estos datos podemos estimar que para el área de salud de Pweto el número aproximado de partos para un año cualquiera es de 2523. Sin embargo, en el 2002 el número de partos atendidos en el hospital fue solamente de 249. Por lo tanto la gran mayoría de los partos tuvieron lugar en el domicilio. La tasa de mortalidad materna, es un dato subestimado que no denota la magnitud real del problema.[28] Las estadísticas del año 2002 para el área de salud de Pweto, solamente reflejaban la muerte de dos mujeres embarazadas. Nuestro proyecto se centró en analizar las razones del bajo número de mujeres que vinieron a parir a las estructuras de salud durante el año 2002, para generar las claves de compresión del fenómeno, y así, implementar una serie de actividades encaminadas a aumentar el número de partos institucionalizados. Posteriormente se evaluó el impacto de nuestra intervención.

Metodología

Se diseñó un proyecto de intervención comunitario basado en una investigación-acción. La metodología empleada fue cuali-cuantitativa. La estrategia de tipo etnográfico caracterizó los determinantes sociales y culturales relacionados con la baja proporción de partos institucionalizados observada en Pweto. Las técnicas cualitativas empleadas fueron la observación participante, el análisis de las notas y diario de campo, las entrevistas en profundidad a informantes clave y grupos de discusión. Del análisis de la información obtenido se pudo generar la intervención consistente en un conjunto de actividades destinadas a conseguir un aumento del número de partos institucionalizados: la construcción de una nueva maternidad, seminarios de formación de las parteras locales e incorporación de un sistema de alerta rápido para el traslado de las urgencias obstétricas a la maternidad, entre otras. El criterio para considerar la evaluación de la intervención como exitosa, consistió en alcanzar al menos un 25% del total de partos esperados en Pweto para el año 2003 y al menos un 50% para el año 2004. El método utilizado para evidenciar si las diferencias entre el número de partos antes de la intervención y después de la misma, consistió en la aplicación de un test de hipótesis para la comparación de medias en dos muestras independientes. El estadístico elegido fue la T de Student para la variable dependiente número de partos y la variable independiente dicotómica, presencia o ausencia de intervención con un nivel de confianza del 99%. El período de tiempo a comparar fue de 36 meses, comprendido entre el mes de enero de 2002 hasta el mes de junio de 2003 (18 meses) sin intervención y el período de tiempo con intervención, comprendido entre el mes de junio de 2003 y el mes de diciembre de 2004 (18 meses). Esta combinación complementaria de metodología fue necesaria ya que para caracterizar un problema de salud en una comunidad y tratar de comprender sus necesidades de salud, las obvias y las más ocultas, se requiere de métodos cualitativos sensibles[29]. En especial si el problema involucra cuestiones que no se manifiestan fácilmente, como es el caso de las creencias ligadas a la maternidad.[30] La investigación etnográfica nos brindó una situación privilegiada para recoger ciertos datos a los que no hubiéramos accedido mediante técnicas de encuestas formales, estructuradas y cerradas.[31]

Para la parte cualitativa, se optó por utilizar un muestreo no probabilístico e intencional que se realizó durante los meses de abril, mayo y junio de 2003. Se seleccionaron 40 mujeres embarazadas en las estructuras de salud, intentando que fueran lo más heterogéneas posible en cuanto a edad y lugar de procedencia. Se constituyeron cuatro grupos de discusión con diez mujeres cada uno. De forma paralela, mediante muestreo no probabilístico e intencional, basado en procedimientos de bola de nieve, se entrevistó a 6 parteras tradicionales de las poblaciones atendidas por las estructuras de salud. Y por último, se seleccionaron intencionadamente los 8 profesionales sanitarios directamente implicados en la salud materna. Para la parte del diseño cuantitativo asumimos que trabajamos con la población total, que son todas las mujeres que parieron institucionalmente durante el período de observación de 36 meses comprendidos entre el mes de enero de 2002 y el mes de diciembre de 2004.

La información fue agrupada en las siguientes categorías de análisis: creencias sobre EPP, limitantes de acceso a las estructuras sanitarias y sus determinantes y las propuestas de cambio aportadas por la comunidad. Del análisis discursivo de la información generada, se obtuvieron las áreas prioritarias de actuación con el fin de aumentar el número de partos institucionalizados. El número de partos atendidos en el hospital, fue la variable cuantitativa de base para evaluar los resultados de nuestras intervenciones. Para los datos cuantitativos, se ha llevado a cabo un análisis mediante SPSS.[12]

Resultados

El criterio preestablecido para evaluar la intervención como exitosa se logró (ver tabla 1), llegando a sobrepasar, incluso, los límites prefijados de los partos esperados en Pweto, para los años 2003 y 2004.

Así, durante el año 2002 atendimos 249 partos institucionalizadamente [Media (Md): 20,7-Desviación Típica (Dt): 5,4], es decir, el 9,87% de los 2523 partos estimados para Pweto. En 2003 alcanzamos el 29,13%, es decir 735 partos (Md: 61,2-Dt: 19,5) y en 2004 llegamos al 52,67% con 1329 partos (Md: 110,7-Dt: 15,9).

Para el test de hipótesis se utilizó la T de Student para la diferencia de medias en dos muestras independientes. Se consideró como período comparable el comprendido entre enero de 2002 hasta junio de 2003, meses durante los cuales no hubo intervención y desde el mes de julio de 2003 hasta el mes de diciembre de 2004, meses durante los cuales hubo intervención. Asumida la normalidad mediante un test de Shapiro-Wilk: 0,902 (p: 0,061), pero no la homogeneidad de varianzas mediante el estadístico de Levene: 6,483 (p: 0,016), se utilizó una T de Student para las varianzas desiguales mediante la aproximación de Welch. Los resultados descriptivos del test pueden verse en la tabla 2.

Podemos asumir que la diferencia entre las medias de partos entre el período en el que no hubo intervención y en el que sí la hubo, no es debida al azar. Este resultado aporta la evidencia estadística necesaria para apoyar nuestra hipótesis de que el aumento en el número de partos durante el período de intervención y los meses posteriores es debido a nuestras actividades con una confianza del 99% (ver tabla 3). Para proporcionar un dato sobre la fuerza de la asociación entre el número de partos y la presencia de intervención se realizó una regresión lineal simple, en la que se consideró como variable dependiente el número de partos desagregada por mes y como variable independiente la presencia o ausencia de intervención (ver tabla 4). Existe una fuerte asociación lineal positiva entre el número de partos y la intervención que explica el 80% de la variabilidad del número de partos con un nivel de confianza del 99%. La presencia de intervención incrementa en 71 el número de partos por mes.

Existe una fuerte asociación lineal positiva entre el número de partos y la intervención que explica el 80% de la variabilidad del número de partos con un nivel de confianza del 99%. La presencia de intervención incrementa en 71 el número de partos por mes.

Discusión

La aplicabilidad y transferabilidad de este proyecto dependerán de una red multifactorial de circunstancias que no podrían extrapolarse a contextos distintos de manera idéntica. Sin embargo, la metodología y las estrategias llevadas a cabo, así como la descripción de los procesos que hemos realizado, pueden considerarse como criterios a poder transferir a otros contextos de cooperación y en otras regiones. Una limitación muy importante de nuestro trabajo fue que las notas de campo y las entrevistas no se pudieron transcribir para ser compiladas en una base de datos por carencia de tiempo y recursos materiales. Las actividades llevadas a cabo fueron simples, sin embargo supusieron la participación de la comunidad, las mujeres embarazadas, no embarazadas, parteras tradicionales y enfermeras obstétricas. Las mujeres participaron en la toma de decisiones. Esto supuso una movilización de la comunidad en torno a la nueva maternidad. Con la información obtenida y la triangulación de la misma, evidenciamos que la percepción positiva por parte de la población de las medidas adoptadas, junto a la solución brindada a los problemas de salud que surgían, y la franca intención de involucrar a toda la comunidad en la solución de las altas tasas de mortalidad materna, provocaron un aumento significativo del número de partos institucionalizados. La fiabilidad y objetividad de los resultados pueden tener limitaciones, pero sin embargo la detallada descripción de todo el proceso de investigación-acción enriquece la consistencia y la neutralidad de la investigación. La triangulación de la información y el aumento estadísticamente significativo del número de partos tras nuestra intervención en las estructuras sanitarias son los criterios en los que se sustenta la credibilidad de nuestro proyecto de investigación-acción. Investigaciones similares en las que se pone énfasis desde la perspectiva de las mujeres han demostrado logros similares en cuanto al incremento de los partos institucionalizados y por consiguiente de la reducción de las altas tasas de mortalidad materna que asolan a los países más pobres.[32-34]

Conclusiones

Los problemas de las mujeres en materia de salud genésica deben ser prioritarios y no una fatalidad o un problema complejo de difícil solución. Si nos servimos de métodos que nos ayuden a comprender el problema "desde dentro", tal y como lo perciben quienes están involucrados en él, y si además involucramos a los mismos actores del estudio en la resolución del mismo, las posibilidades de que cualquier proyecto de investigación-acción tenga éxito es bastante alta. Los trabajadores humanitarios pensamos a menudo que los programas de salud materna en los países más pobres del mundo son difíciles de implementar ya que tocan problemas vinculados con la tradición y las prácticas ligadas a las creencias populares sobre la maternidad. Estas son cuestiones que desde un punto de vista social y cultural están muy relacionadas con el rol que la sociedad adscribe a la mujer. La desigualdad de género aparece como uno de los principales obstáculos para que las mujeres accedan a la salud. Por lo tanto, hace falta desterrar la idea de que las cuestiones culturales en relación muy estrecha con la maternidad y las creencias populares son el principal freno para que las mujeres no vengan a parir a las estructuras de salud. Con esta investigación, desde un punto de vista local, hemos demostrado que la institucionalización de los partos y la consiguiente disminución de la mortalidad materna dentro de una comunidad, tiene menos consecuencias sociales que el hecho de modificar determinadas prácticas tradicionales. Las muertes maternas que hemos evitado han hecho que en contra de las tradiciones y creencias populares, las mujeres vengan a parir a las estructuras sanitarias.

Tabla 1. Criterios de evaluación de la intervención

Año	% Partos Institucionalizados	Criterio de Evaluación Prefijado	Logro del Objetivo de Evaluación Prefijado
2002	9,8% (249)	-	-
2003	29,1%(735)	25%	SI
2004	52,6%(1239)	50%	SI

Tabla 2. Descriptivo de la comparación de medias

Año	Meses sin intervención (Ene-02 hasta Jun-03)	Meses con intervención (Jul-03 hasta dic-04)
Número de partos	517	1796
Media	28,72	99,78
Mínimo	12	61
Máximo	57	133
Desviación Típica	13,407	21,092

Tabla 3. Estadístico de la T de Student (aproximación de Welch)

T de student	Diferencia de Medias	Nivel de Significación
-12,062 con 28,809 gl	71,06	P < 0,01

Tabla 4. Análisis de regresión lineal

Variable dependiente	R^2	B_1	p
Número de partos por mes	0,81	71	<0,001

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INFORMACION PARA LOS AUTORES

-Se suprime el gráfico 1 por ser incompatible con el formato de gráfico en la revista (esta compuesto en colores y no es modificable), de todas formas reitera los datos contenidos en la tabla.

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Depuis la Confrontation des Paradigmes Vers L'intégration des Savoirs: Le Modèle Biomédicale Face aux Sciences Sociaux dans la Coopération Internationale en Santé.

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ABSTRACT

Facing complex social system problems, such as health systems, needs to look at integral solutions. Projects of international health cooperation (IHC) require a reorientation towards a multidisciplinary approach. This reorientation goes through the change of the paradigm of health workers responsible for the design, implementation, management and follow up of those projects. This article, through a dialog opening up a discussion and descriptive examples of the confrontation of the paradigm, offers a possible solution for the success of IHC: The incorporation of a more holistic and integrated vision to the biomedical vision of health workers. Copyright © 2008 Anthropology & Heath Journal & Syllaba Press. All rights reserved.

Keywords: Public Health, Epidemiology, International Cooperation.

RÉSUMÉ

Face aux problèmes des systèmes sociaux complexes, comme les systèmes de santé, devient nécessaire la quête des solutions intégraux. Les projets de coopération internationale en santé (PCIS) ont besoin d'une nouvelle réorientation multidisciplinaire. Cette réorientation, passe par un changement de paradigme des professionnels de santé responsables de la création, gestion, implémentation et suivi des projets. Cet article moyennant un discours dialogique et l'exemple descriptif de la confrontation des paradigmes, offre comme une des possibles solutions à la quête du succès des PCIS : L'incorporation des visions plus holistes et complémentaires, a la vision biomédicale des professionnels de la santé. Copyright © 2008 Anthropology & Heath Journal & Syllaba Press. All rights reserved.

Mots clés: Santé Publique, Épidémiologie, Coopération Internationale.

Introduction

Les déterminants sociaux et culturels des maladies mettent en évidence la relation entre santé et société. Les sciences sociales comme l´Anthropologie médicale se sont développées dans des nombreux départements universitaires de Santé Publique du monde anglo-saxon et francophone. Au Royaume Uni, la revue The Lancet a lancé en avril 1991 une chronique sur la relation entre médicine et culture, motivée par le nombre de publications apparues sur des sujets anthropologiques. Son éditorial affirmait: "Les médecins ne doivent pas se surprendre quand leurs connaissances de médicine occidentale ne fonctionnent pas ou provoquent des résultats inattendus dans des sociétés différentes" (Herman, 1991) (Littlewood, 1991) Il y a très souvent dans la littérature du monde de la coopération internationale descriptions des projets en santé qui ont eu des forts échecs dans le cadre du développement qui n'en finit pas de poser question (Kottak, 1985). Une nouvelle approche vers la nouvelle santé publique est nécessaire pour tenir en compte dans le partenariat nord sud en matière de santé et développement. On sait qu'une révolution scientifique intervient quand un ancien paradigme cède la place à un nouveau paradigme. L'émergence d'un nouveau paradigme constitue la rupture d'une vision du monde. Par exemple le passage de l'Univers newtonien à l'Univers einsteinien constitue la rupture d'une vision du monde, donc l'émergence d'une nouvelle vision (Morin, 1990). Dans le domaine de la coopération international en santé un changement de paradigme1 doit être conçu pour passer des approches biomédicales axes sur le risque et la recherche de causalité vers des approches holistes et sensibles aux attentes du bénéficières des projets. Pour cette changement il faut confronter les paradigmes[1] en vue de donner la possibilité des futures professionnels responsables de la coopération et développement en matière de santé

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une alternative à la vision biomédicale, héritière de la force symbolique du Pasteur et ses postulats (Dujardin, 2003) Ce travail moyennent un discours dialogique, essai de provoquer la réflexion du lecteur de la nécessité d'un changement de paradigme dans le monde de la coopération internationale en santé.

Problematique

Le savoir biomédical soutenu par le paradigme pasteurien refuse le rapport de la maladie au social et à l'histoire, ainsi qu'à tout ce qui échappe à la mesure et notamment la subjectivité non seulement du malade mais aussi du médecin (Laplantine, 2003). Les projets de développement en santé nés en occident ne correspondent ni aux attentes ni aux besoins des bénéficiaires, car ils ont étés conçus, le plus part de fois, pour des professionnels de la santé sous la base du paradigme pasteurien. Des professionnels qui ont une vision du monde qui n'a rien à voir avec celle des cultures locales de pays cibles des projets de coopération. Dû au pouvoir d'une profession qui a vu naître la médicalisation croissante de la société occidentale, les médecins ont la responsabilité d'être là où on parle de santé. Cette situation fait qu'ils soient engagés comme responsables des projets de santé dans n'importe quel pays en développement. Or, ils ont la responsabilité de donner réponses à des questions dont le paradigme pasteurien n'est pas valable. Pour obtenir des résultats positifs en matière de Santé Publique, il est nécessaire une approche multidisciplinaire, c´est à dire, une coopération des différentes disciplines dans la recherche des solutions aux problèmes complexes (Luque, 2006). Il y a des exemples positifs comme la lutte contre le SIDA dans certains pays de l´Afrique. Dans ces pays, les actions ne se sont pas limitées à la distribution de préservatifs. On a essayé d´aller plus loin, de faire un effort pour éduquer avec compréhension et respect la population afin qu´elle change ses comportements. Ainsi en Ouganda, le taux de prévalence de VIH est tombé de 15% à 5% aux années 90 (Halperin, 2004) La communauté internationale appuie cette approche pour prévenir le SIDA (Alonso, 2004). Par contre, les interventions coûteuses, la technologie de pointe et les recherches sur la biologie moléculaire ou génomique ne sont pas toujours nécessaires, même si elles sont à la mode et bien financées par les institutions. Or, qu'est-ce qu'on peut faire pour mener projets avec succès ? La confrontation des paradigmes pasteurien et systémique chez les scientifiques et futurs médecins, a été invoquée comme une des plusieurs et possibles solutions. Ça veut dire, s'attaquer à la cosmovision du monde des futurs médecins responsables des projets de coopération en matière de santé. Pour passer des projets conçus depuis une approche biomédicale et qui recherchent la solution miracle, à des projets systémiques et holistes qui appellent à la l'approche intersectorielle, il faut tenir en compte de la multidisciplinarité. Cette solution miracle qui répond bien aux caractéristiques socioculturelles et économiques des sociétés occidentales n'existe que dans l'esprit du chercheur pasteurien (Dujardin, 2003).

Analyse des Paradigmes Confrontes

Aujourd'hui, l'épidémiologie utilisée prioritairement pour la clinique en médicine, continue à être vue comme une science, malgré les nombreuses publications qui ont prouvé son inconsistance. Les débats sur « n », ses dimensions et sa signification sont extrêmement connus (Freiman, 1978 ; Moher, 1994 ; Carné, 1989 ; Lemeshow, 1995) Pour la nouvelle santé publique, l'épidémiologie est vue comme un méthode avec limitations qui provient principalement de la limitation des statistiques utilisées pour offrir une solution à des problèmes sociaux complexes (Krieger, 2000 ; Berkman, 2000 ; Parodi, 2006 ; Muntaner , 2003) Pour montrer la force du paradigme pasteurien, il ne faut que aller chez « pubmed » et essayer de faire un petit expriment. On peut y aller au thésaurus (MeSH) pour chercher le mot « épidémiologie » : Et on trouve que la médicine était la mère de l'épidémiologie. On continu en faisant une petite recherche sur l'histoire de l'épidémiologie « épidémiologie AND Historie » et on trouve 193 articles. Parmi lesquels un échantillon aléatoire pour le calcule d'une proportion avec une précision du 0,2% et un niveau de signification du 95% a été faite avec une taille de 22 articles. Et on trouve que parmi le 22 articles, 12 ne spécifiaient aucune définition de l'épidémiologie, mais parmi les 10 autres, avec un intervalle de confiance au 95% (57,04-92,96) le 80% des articles appelaient l'épidémiologie comme étant une science. Pour démarrer le débat sur la confrontation des paradigmes on choisi l'épidémiologie tout d'abord comme exemple, mais on aura pu choisir n'importe qu'elle autre sujet dans l'actualité de la conformation du savoir de la santé publique et la coopération au développement en matière de santé : Comme le débat sur le quantitative versus qualitative, les programmes sectorielles versus les spécifiques, l'approche projet vertical versus horizontal etc. Dans ce point du débat il faut se demander si l'épidémiologie est-elle une science ou bien une méthode. Si nous traitons l'épidémiologie comme une discipline scientifique, nous serons en train de présumer l'existence d'un ensemble de connaissances, d'une pratique professionnelle, ainsi qu'une méthode exclusive et propre de cette discipline. Dans certains domaines du savoir, les différentes professions sont déjà identifiées (un

1. Un paradigme est une construction théorique (ou un schéma conceptuel) qui oriente le discours, la recherche ou la vision du monde d'une époque ou d'une société dans tel ou tel sens. Ou encore l'ensemble de principes d'association / exclusion fondamentaux qui commandent toute pensée, toute théorie, toute vision du monde.

physicien ou une physicienne pour la physique, un ou une psychologue pour la psychologie, ou bien un ou une philosophe pour la philosophie) ; par conséquent, il est grand temps d'identifier le ou la épidémiologiste en Espagne. Cependant, voici le premier biais de la définition de ce domaine du savoir catalogué comme discipline scientifique: Qui est l'épidémiologiste? Comment le former? Qui peut exercer en tant qu'épidémiologiste? La formation comme épidémiologiste est-elle réglementée par l'État? Existe-t-il un groupe professionnel défini par les lois? Donc, si nous prenons ces prémisses dialogiques, la présomption d'épidémiologie en tant que discipline scientifique est totalement déméritée. Il est, donc, plus prudent de la classifier en tant que méthode scientifique positiviste utilisée par la médicine en clinique et par la santé publique dans les recherches, afin d'augmenter les connaissances. Cependant, si nous prenons en considération la définition classique, tout comme les ultérieures, nous observons que l'origine étymologique est très importante, une origine où « demos » est indispensable. Nous pouvons donc en déduire que la population n'est point un objet d'étude purement épidémiologique mais démographique, sociologique, philosophique, anthropologique et éthique. Par conséquent, d'une assomption d'une discipline un peu accaparatrice telle que la médecine, qui a pour objectif d'universaliser sa méthode génératrice de savoir, l'épidémiologie; et en tenant compte de l'objet d'étude partagé par de différentes disciplines, nous pouvons en déduire que l'épidémiologie plus qu'une discipline est une méthode. La conjonction de différents domaines du savoir, de différentes disciplines, ainsi que l'union de ces méthodes, quelles soient positivistes ou non positivistes, sont nécessaires pour pouvoir mener à bien les interventions des phénomènes complexes tels que la vie ou la mort, la santé ou la maladie, dans les populations humaines. Cette conjonction permet la compréhension intégrale du problème et l'intervention la plus adéquate. L'épidémiologie est le méthode positiviste des sciences biomédicales qui permet la caractérisation des phénomènes de la vie et de la mort, de la santé et de la maladie, des populations humaines en termes de fréquence et de distribution. L'épidémiologie associée aux méthodes d'autres disciplines sociales permet une vision, non unique, afin de générer des interventions sur les populations pour améliorer la santé, ainsi que de doter de critères les décisions des planificateurs en ce qui concerne la santé des populations. Un autre exemple de confrontation de paradigmes dans les dernières années se trouve dans le débat qui confronte la recherche dite qualitative versus la quantitative. Les pasteuriens déméritent la recherche qualitative, grosso modo par le manque de représentativité de leurs résultats. Mais la recherche qualitative venant de l'anthropologie est nécessaire pour générer hypothèses là où il n'y avait pas et pour faire comprendre aux pasteuriens que la compatibilité culturelle, la participation communautaire et l'appropriation symbolique des projets de coopération en santé pour les bénéficiaires est un pre requis (Muntaner, 2003) Historiquement, le problème vient de la relation entre la pratique des sciences biologiques et celle des sciences sociales de la santé, relations qui sont encore essentiellement caractérisées, pourquoi nous le dissimuler, par le malentendu et l'ignorance réciproque. Une fois plus de la confrontation entre le paradigme biomédical ou pasteurien et le symbolique ou holiste nous mènent aux refus pour la plupart de ceux qui ont été formes dans l'apprentissage du modèle biomédical de toute approche non naturaliste de la maladie et de la guérison, surtout si celle-ci n'est pas fondée sur un protocole expérimental et ne fait pas intervenir des instruments de mesure. La tendance est à appréhender la recherche qualitative avec un certain scepticisme. Mais, inversement pour un grand nombre de chercheurs en sciences sociales, la médicine en tant que science de la nature appliquée est souvent considérée comme intrinsèquement impérialiste (Laplantine, 2003) En dehors de la confrontation, il faut reconnaître que la recherche qualitative découvre ce qui se rend invisible pour la quantitative et fait que la population où l'étude se déroule ait la sensation de participer dans la recherche des solutions, ce qu'on a appelé la recherche action. C'est surtout depuis 1975 que l'on observe l'exigence d'interdisciplinarité conduisant à une ouverture vers les sciences sociales. Il ne s'agit plus seulement d'introduire de nouvelles approches dans tel ou tel secteur du développement, car cet appel aux sciences humaines est l'indice d'un changement dans le dispositif institutionnel de la recherche, entendu comme le rapport entre lieu d'observation (ou d'expérimentation) et secteur d'intervention (ou d'application). Dans le domaine institutionnel, alors même que l'hôpital ou le dispensaire devenaient à leur tour objets d'investigation pour les sociologues, les organisations internationales, et en particulier l'OMS et l'UNICEF, préconisaient la "sortie" de la médecine des institutions biomédicales en revalorisant les guérisseurs, métamorphosés en "tradi praticiens", ou en formant des travailleurs paramédicaux villageois. Ce fut lors de la conférence internationale d'Alma Ata, dans le Kazakhstan soviétique en 1978, organisée conjointement par l'OMS et l'UNICEF, que, par une déclaration solennelle, fut affirmée le lien indissociable entre santé et développement dans le cadre des "soins de santé primaires" regroupant l'éducation, l'alimentation et la nutrition, les problèmes d'approvisionnement et d'assainissement de l'eau, les soins maternels et infantiles. Ainsi, pendant un moment, a t on pu penser que s'effectuait une transition d'une approche verticale étude de telle ou telle maladie tropicale et ethnomédecine-vers une approche plus "horizontale" soins de santé primaires et anthropologie des "itinéraires thérapeutiques" (le malade s'adresse aussi bien au guérisseur traditionnel qu'à l'institution médicale : dispensaire, hôpital, et c'est cette succession qui a un sens) comme solution aux problèmes de santé à l'égard des populations sous développées. Mais la réalité ce que cet approche n'a pas réussi non plus et que les problèmes de santé des populations moins développés restent les mêmes. Pourquoi, il n'y a pas de solution miracle? Est-ce que, peut être, faudra-t-il partager l'envie de vouloir changer les choses depuis toutes les disciplines du savoir, impliquées dans le domaine du développement?

Discussion

Est-ce qu'il est logique voir comme à ton entourage les gens meurent de malaria, infections, malnutrition sans pouvoir rien faire parce que ton projet touche seulement la trypanosomiase? Encore aujourd'hui, le débat sur l'approche vertical ou horizontal des projets de coopération en santé continue active malgré les 28 années qui se sont écoulés depuis Alma Ata. Pourquoi est-il si difficile de changer l'opinion et la culture de ceux qui ont le pouvoir de prendre les décisions? La médicine est devenu la science tout puissante de la société du XX^{éme} et XXI^{éme} siècle. Nous voulons rester jeunes, ne pas mourir est jamais tomber malades. Les médecins pasteuriens ont le pouvoir. Ils sont devenus les protagonistes des films à la télévision, les personnages principaux de best-sellers et la source incontournable des espoirs d'une société fortement médicalisée. Cette médicalisation croissante de la société est la cause de que les petits ennuis de la vie quotidienne comme la calvitie, être trop petit, trop gros, trop maigre, avoir des petits seins, etc. aient devenues maladies qu'il faut soigner. La ligne de démarcation que séparent les comportements morbides des comportements normaux a aujourd'hui tendance à se déplacer vers la pathologisation. Derrière tout cela se trouve la mauvaise face de la globalisation où le néolibéralisme a pris des dimensions épouvantables. A nos jours presque toute dimension humaine peut avoir valeur monétaire dans le marché, même la santé. Tout est valable afin de que soit rentable et les entreprises biomédicaux et pharmaceutiques sont des plus en plus fortes. Ainsi la connaissance du phénomène morbide, comme le traitement sont biens du marché et ils doivent être mensures. Il n`y a pas connaissance scientifique que du mensurable, et cette obsession pour la quantification s'exprime notamment dans les domaines de l'épidémiologie et du diagnostique. Que l'épidémiologie cherche à mesurer les fréquences significatives de la distribution de la maladie dans un groupe donné ou à dégager les facteurs responsables de la maladie afin de permettre un prévention raisonnée, est tout entière fondée sur le méthode statistique et a notamment pour effet de renfoncer dans la public la pensée étiologique, dans sa conviction de pouvoir détecter, isoler, nommer et supprimer des causes. Ainsi les vrais médecins doivent êtres bien formés dans le savoir hospitalo-universitaire pour l'application intégrale du diagnostique et traitement des processus morbides pour sauver les vies humaines. Donc hors de question nier le pouvoir du médecin dans notre société. Pourquoi s'étonner d'entendre dire au chef coutumier d'un petit village en Afrique subsaharienne que le besoin en matière de santé que les villageois ont c'est un ballon en cuir et que ils ne veulent pas aller au poste de santé où se mène à bien notre projet? C'est peut-être, car les projets de santé qui sont étés développés ne avaient pas pris en compte les attentes de la population ? Pourquoi pas les études de médicine, d'infirmerie n'ont pas étés modifies comme autres formations depuis si longtemps? Peut-être car les entreprises pharmaceutique et de biotechnologie ont besoin des inversions dans l'avenir? Pourquoi les médecins du tiers monde formés selon les critères du premier monde sont l'élite des sociétés pauvres et ne veulent pas aller en brousse pour soigner sa population? Pourquoi les jeunes médecins qui partent en mission dans le monde de la coopération s'étonnent de voir comme les médicaments qui ont données pour guérir la maladie sont vendus pour les malades dans le marché? Il est prioritaire recentrer la formation professionnelle médicale et paramédicale. Il faut modifier les structures des universités et les faire prendre partie de l'envie de nouveaux défis pour mieux atteindre les attentes des patients. Dans les pays du tiers monde où la formation des médecins est encore plus élitiste et cartésienne ont a besoins des professionnels bien formés dans le domaine de la santé publique, les master en développement et coopération et tout autre opportunité de formation qui donne la possibilité de ouvrir le regard vers autres réalités doivent être encouragés, même exiges aux professionnelles de la santé. Et bien sur, tout professionnel de la santé engagé dans la coopération, devrait avoir voulu connaître les approches non quantitatives de la santé en vue de pouvoir analyser les phénomènes complexes qui opèrent dans le domaine de la coopération et le développement.

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