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Health inequalities by sexual orientation and their association with discrimination

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Doctoral Thesis - 2021

Department of Paediatrics, Obstetrics and
Gynaecology, and Preventive Medicine



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Under the direction of doctor

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Barcelona, December 2021

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CERTIFIES:

Marcos Marti Pastor has carried out under my supervision the thesis entitled “Health inequalities by sexual orientation and their association with discrimination”, which meets the necessary conditions for its presentation as a doctoral thesis.

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During my training as a specialist doctor in Preventive Medicine and Public Health in the Teaching Unit of the 'Parc de Salut Mar', I had the opportunity to perform different rotations through different institutions (Barcelona Public Health Agency, Hospital del Mar, Johns Hopkins Bloomberg School of Public Health and IMIM) and participate in numerous community health, prevention and health promotion projects. This training period allowed me to know the importance of reducing social inequalities to improve the persons' health, as well as the usefulness of measuring health to be able to detect differences between vulnerable population groups.

That is why, after completing the specialty of Preventive Medicine, I decided to start my doctoral thesis in the field of social inequalities and health measurement with a Jordi Gras grant from Hospital del Mar (2015) and, later with a Rio contract Ortega (2016-2018).

During this research stage I was lucky enough to be able to join the Health Services Research group of the Hospital del Mar Medical Research Institute, specialized in public health research, such as the measurement of Health-Related Quality of Life and the interpretation of its scores as health results.

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Abstract

The general aim of this doctoral thesis was to evaluate the health inequalities by sexual orientation and to explore their association with discrimination, health-related behaviors, chronic conditions, and socio-demographic characteristics.

Data from the 2011 Barcelona Health Survey (3,277 adults) and from Baltimore's 2011 and 2014 National HIV Behavioral Surveillance surveys (men who have sex with men: 671 gay and 331 bisexual) were used to assess health inequalities by sexual orientation in Barcelona and Baltimore, respectively. The outcomes measured were Health-Related Quality of Life (HRQL), through the EuroQol-Five Dimensions (EQ-5D); mental health, assessed with the 10-item Centre for Epidemiological Studies Depression Scale (CES-D-10); and enacted stigma, which covered three dimensions: verbal harassment, discrimination, and physical assault.

In Barcelona, the lesbian, gay and bisexual (LGB) persons presented in 2011 a significantly lower EQ-5D index than the heterosexual ones, and higher prevalence ratios of problems in the EQ-5D dimensions of mobility and usual activities among both genders, after adjusting by socio-demographic variables. In Baltimore, bisexual men reported stigma experiences less frequently than gay men (verbal harassment 22.7% vs. 32.3%, and discrimination 15.7% vs. 23.0%), but presented depressive symptoms more frequently (43.1% vs 34.2%), and the three enacted stigma dimensions were significantly associated with depressive symptoms.

The LGB persons in Barcelona presented worse HRQL than the heterosexual ones, and chronic conditions, health-related behaviors and gender played a major role in explaining health differences by sexual orientation. Baltimore's study of men who have sex with men confirms the association between enacted stigma and depressive symptoms among gay and bisexual men. The bisexual men could present other psychosocial stressors that explain their higher prevalence of depressive symptoms. Findings of both studies indicate the need of developing new effective public health strategies to avoid the consequences of homophobic and biphobic culture, and of including sexual orientation into the global agenda of health inequities.

Resumen

El objetivo general de esta tesis doctoral fue evaluar las desigualdades en salud por orientación sexual y explorar su asociación con la discriminación, los comportamientos relacionados con la salud, las condiciones crónicas y las características sociodemográficas.

Para evaluar las desigualdades en salud por orientación sexual en Barcelona y Baltimore, respectivamente, se utilizaron datos de la Encuesta de salud de Barcelona del 2011 (3277 adultos) y de las encuestas del sistema nacional de vigilancia del comportamiento del VIH de 2011 y 2014 de Baltimore (hombres que tienen sexo con hombres: 671 gais y 331 bisexuales). Los resultados medidos fueron la Calidad de Vida Relacionada con la Salud (CVRS), a través del EuroQol de cinco dimensiones (EQ-5D); la salud mental, evaluada con la Escala de depresión de 10 ítems del Centro de Estudios Epidemiológicos (CES-D-10); y el estigma confirmado, que incluía tres dimensiones: acoso verbal, discriminación y agresión física.

En Barcelona, las personas lesbianas, gais y bisexuales (LGB) presentaron en 2011 un índice EQ-5D significativamente más bajo que las heterosexuales, y una mayor razón de prevalencia de problemas en las dimensiones de movilidad y actividades habituales del EQ-5D en ambos sexos, tras ajustar por las variables sociodemográficas. En Baltimore, los hombres bisexuales informaron de experiencias de estigma con menos frecuencia que los hombres gais (acoso verbal 22,7% frente a 32,3% y discriminación 15,7% frente a 23,0%), pero presentaron síntomas depresivos con mayor frecuencia (43,1% frente a 34,2%), y las tres dimensiones de estigma confirmado se asociaron significativamente con síntomas depresivos.

Las personas LGB de Barcelona presentaron una peor CVRS que las heterosexuales, y las condiciones crónicas, los comportamientos relacionados con la salud y el género tuvieron un papel importante en la explicación de las diferencias de salud por orientación sexual. El estudio de Baltimore de hombres que tienen sexo con hombres confirma la asociación entre el estigma confirmado y los síntomas depresivos entre hombres gais y bisexuales. Los hombres bisexuales podrían presentar otros estresores psicosociales que explicaran su mayor prevalencia de síntomas depresivos. Los hallazgos de ambos estudios indican la necesidad de desarrollar nuevas estrategias de salud pública efectivas para evitar las consecuencias de la cultura homofóbica y bifóbica, e incluir la orientación sexual en la agenda global de inequidades en salud.

Resum

L'objectiu general d'aquesta tesi doctoral va ser avaluar les desigualtats en salut per orientació sexual i explorar-ne l'associació amb la discriminació, els comportaments relacionats amb la salut, les condicions cròniques i les característiques sociodemogràfiques.

Per avaluar les desigualtats en salut per orientació sexual a Barcelona i Baltimore, respectivament, es van utilitzar dades de l'Enquesta de salut de Barcelona del 2011 (3277 adults) i de les enquestes del sistema nacional de vigilància del comportament del VIH del 2011 i del 2014 de Baltimore (homes que tenen sexe amb homes: 671 gais i 331 bisexuals). Els resultats mesurats van ser la Qualitat de Vida Relacionada amb la Salut (QVRS), mitjançant l'EuroQol de cinc dimensions (EQ-5D); la salut mental, avaluada amb l'Escala de depressió de 10 ítems del Centre d'Estudis Epidemiològics (CES-D-10); i l'estigma confirmat, que incloïa tres dimensions: assetjament verbal, discriminació i agressió física.

A Barcelona, les persones lesbianes, gais i bisexuals (LGB) van presentar el 2011 un índex EQ-5D significativament més baix que les heterosexuals, i una raó de prevalença més gran de problemes en les dimensions de mobilitat i activitats habituals de l'EQ-5D en ambdós sexes, després d'ajustar per les variables sociodemogràfiques. A Baltimore, els homes bisexuals van informar d'experiències d'estigma amb menys freqüència que els homes gais (assetjament verbal 22,7% davant de 32,3% i discriminació 15,7% davant de 23,0%), però van presentar símptomes depressius amb més freqüència (43,1% davant del 34,2%), i les tres dimensions d'estigma confirmat es van associar significativament amb símptomes depressius.

Les persones LGB de Barcelona van presentar una pitjor QVRS que les heterosexuals, i les condicions cròniques, els comportaments relacionats amb la salut i el gènere van tenir un paper important en l'explicació de les diferències de salut per orientació sexual. L'estudi de Baltimore d'homes que tenen sexe amb homes confirma l'associació entre l'estigma confirmat i els símptomes depressius entre homes gais i bisexuals. Els homes bisexuals podrien presentar altres estressors psicosocials que expliquessin la seva major prevalença de símptomes depressius. Les troballes dels dos estudis indiquen la necessitat de desenvolupar noves estratègies de salut pública efectives per evitar les conseqüències de la cultura homofòbia i bifòbica, i d'incloure l'orientació sexual a l'agenda global d'inequitats en salut.

Preface

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The thesis, presented as a compendium of publications, comprises three published articles. The first article is methodological, centered on the EQ-5D, the instrument used to measure health-related quality of life. The other two articles were focused on assessing health inequalities according to sexual orientation and perceived discrimination in two cities, Barcelona and Baltimore.

- 1) **Marti-Pastor M**, Pont A, Ávila M, Garin O, Vilagut G, Forero CG, Pardo Y, Tresserras R, Medina-Bustos A, Garcia-Codina O, Cabasés J, Rajmil L, Alonso J, Ferrer M. *Head-to-head comparison between the EQ-5D-5L and the EQ-5D-3L in general population health surveys*. Popul Health Metr. 2018 Aug 16;16(1):14. IF: 2.786; Q1 (77 of 376. SSCI, Public, Environmental & Occupational Health).
- 2) **Marti-Pastor M**, Perez G, German D, Pont A, Garin O, Alonso J, Gotsens M, Ferrer M. *Health-related quality of life inequalities by sexual orientation: Results from the Barcelona Health Interview Survey*. PLoS One. 2018 Jan 24;13(1):e0191334. IF: 3.240; Q2 (26 of 72. SCIE, Multidisciplinary Sciences).
- 3) **Marti-Pastor M**, Ferrer M, Alonso J, Garin O, Pont A, Flynn C, German D. *Association of Enacted Stigma with Depressive Symptoms Among Gay and Bisexual Men Who Have Sex with Men: Baltimore, 2011 and 2014*. LGBT Health. 2020 Jan;7(1):47-59. IF: 4.190; Q1 (47 of 203. SCIE, Public, Environmental & Occupational Health).

The **first article** focuses on the measurement of the metric characteristics of the two EQ-5D versions, with the intention of knowing their descriptive richness and discriminatory capacity in the general population.

The **second article** assesses sexual orientation-related inequalities in Barcelona, using data of the 2011 Barcelona Health Interview Survey. It evaluates if the differences observed between lesbian, gay and bisexual (LGB) persons and heterosexual ones could be considered avoidable inequities, which could be reduced through taking social action.

Given that our hypothesis is that discrimination based on sexual orientation is the main factor in producing health inequalities affecting sexual minorities, the **third article** addresses evaluating the effect of discrimination on mental health and health-related behaviors among men who have sex with men. It measures enacted stigma (institutional discrimination, interpersonal discrimination and violence) and how the association between enacted stigma and depressive symptoms may vary according to the sexual orientation identity of men who have sex with men in Baltimore during 2011 and 2014.

Finally, following our previous hypothesis about the relationship between discrimination based on sexual orientation and health inequalities, a fourth unpublished manuscript (included as an annex) was prepared to assess health-related quality of life inequalities by sexual orientation and their association with discrimination in the 2016-2017 Barcelona Health Interview Survey, stratifying by sex:

Marti-Pastor M, German D, Perez G, Bartoll X, Diez E, Pont A, Garín O, Alonso J, Hernandez G, Mayoral K, Zamora V, Vilagut G, Ferrer M. *Health inequalities by sexual orientation: results from the 2016-2017 Barcelona Health Survey*. (Under review).

Table of contents

| | |
|--|------------|
| 1. INTRODUCTION | 1 |
| 1.1 BRIEF HISTORY OF LESBIAN, GAY, BISEXUAL AND TRANSGENDER (LGBT) POPULATION | 2 |
| 1.2 THEORIES ON SEXUAL ORIENTATION | 5 |
| 1.3 LEGAL SITUATION OF SEXUAL DIVERSITY WORLDWIDE | 7 |
| 1.4 SOCIAL DETERMINANTS OF HEALTH | 13 |
| 1.5 DIFFERENCES BY SEXUAL ORIENTATION ON MENTAL AND PHYSICAL HEALTH | 18 |
| 1.6 DIFFERENCES BY SEXUAL ORIENTATION ON HEALTH-RELATED QUALITY OF LIFE | 20 |
| 1.7 DISCRIMINATION BY SEXUAL ORIENTATION | 24 |
| 2. THESIS RATIONALE..... | 27 |
| 3. OBJECTIVES OF THE DOCTORAL THESIS | 29 |
| GENERAL OBJECTIVE | 29 |
| METHODOLOGICAL OBJECTIVE | 29 |
| SPECIFIC OBJECTIVES | 29 |
| 4. HYPOTHESES | 30 |
| 5. PUBLICATIONS..... | 33 |
| 5.1 ARTICLE 1 | 33 |
| Marti-Pastor M, Pont A, Ávila M, Garin O, Vilagut G, Forero CG, Pardo Y, Tresserras R, Medina-Bustos A, Garcia-Codina O, Cabasés J, Rajmil L, Alonso J, Ferrer M. Head-to-head comparison between the EQ-5D-5L and the EQ-5D-3L in general population health surveys. <i>Popul Health Metr.</i> 2018 Aug 16;16(1):14. | 33 |
| 5.2 ARTICLE 2 | 47 |
| Marti-Pastor M, Perez G, German D, Pont A, Garin O, Alonso J, Gotsens M, Ferrer M. Health-related quality of life inequalities by sexual orientation: Results from the Barcelona Health Interview Survey. <i>PLoS One.</i> 2018 Jan 24;13(1):e0191334. | 47 |
| 5.3 ARTICLE 3 | 65 |
| Marti-Pastor M, Ferrer M, Alonso J, Garin O, Pont A, Flynn C, German D. Association of Enacted Stigma with Depressive Symptoms Among Gay and Bisexual Men Who Have Sex with Men: Baltimore, 2011 and 2014. <i>LGBT Health.</i> 2020 Jan;7(1):47-59. | 65 |
| 6. DISCUSSION..... | 81 |
| 6.1 THE EVOLUTION OF HEALTH INEQUALITIES BY SEXUAL ORIENTATION IN BARCELONA | 81 |
| 6.2 THE EVOLUTION OF HEALTH INEQUALITIES BY SEXUAL ORIENTATION IN EUROPE | 83 |
| 6.3 THE EVOLUTION OF HEALTH INEQUALITIES BY SEXUAL ORIENTATION IN UNITED STATES | 84 |
| 7. SOCIAL IMPLICATION AND FUTURE RESEARCH LINE..... | 87 |
| 8. CONCLUSIONS..... | 89 |
| 9. BIBLIOGRAPHY..... | 91 |
| 10. ANNEX: NON-PUBLISHED ARTICLE | 107 |

Abbreviations

95% CI: 95% Confidence Interval

aPR: adjusted Prevalence Ratio

BHIS: Barcelona Health Interview Survey

BMI: Body Mass Index

CES-D-10: 10-item Centre for Epidemiological Studies Depression Scale

CHIS: Catalan Health Interview Survey

DCE: Discrete Choice Experiment

DIF: Differential Item functioning

EQ-5D: EuroQol-Five Dimensions

EQ-5D-3L: EuroQol-Five Dimensions-Three Levels

EQ-5D-5L: EuroQol-Five Dimensions-Five Levels

GEE: Generalized Estimating Equation

HRQL: Health-Related Quality of Life

ILGA: International Lesbian, Gay, Bisexual, Trans and Intersex Association

IRB: Institutional Review Board

INAH3: Third interstitial nucleus of the anterior hypothalamus

LGB: Lesbian, Gay, and Bisexual

LGBT: Lesbian, Gay, Bisexual and Transsexual

MSM: Men who have Sex with Men

NHBS: National HIV Behavioral Surveillance

OR: Odds Ratio

QALYs: Quality-Adjusted Life Years

RR: Risk Ratio

SF-12: Short Form Health Survey - 12 items

SF-36: Short Form Health Survey - 36 items

TTO: Time Trade Off

UN: United Nations

USSR: Union of Soviet Socialist Republics

VAS: Visual Analogue Scale

WSW: Women who have Sex with Women

1. INTRODUCTION

Sexual orientation is a complex, multidimensional construct for which definition and measurement can vary across studies and settings. However, there is a growing consensus that sexual orientation includes cognitive, affective, and behavioral dimensions.

Sexual identity, the cognitive dimension of sexual orientation, is the term typically used to refer to a person's own identification as lesbian, gay, or bisexual (LGB). In contrast, sexual behavior focuses on the sex of the person's sexual partners. Behavioral research sometimes refers to people as MSM (men who have sex with men) or WSW (women who have sex with women). Sexual attraction is the affective component of sexual orientation. People may be emotionally and sexually attracted to men, women, or both. Although these three dimensions of sexual orientation are related, there is not a complete overlap among them.^{1,2}

Sexual attraction covers some of the gaps left out by behavior or identity measures, including people not reporting same-sex sexuality and/or LGB identity,³ and it is more predictive than sexual identity to detect inequalities according to sexual orientation.⁴

It is difficult to define the size and distribution of the lesbian, gay or bisexual population. This is due to several factors, including: the heterogeneity of LGB groups; the incomplete overlap between identity, behavior, and desire; the lack of research about LGB persons; and the reluctance of some people to answer survey questions about stigmatized identities and behaviors.⁵

Over the last few decades, surveys conducted in Western countries have shown an increasing proportion of persons reporting an LGB sexual orientation worldwide. For example, it increased from 2.7% in 2008 to 5.4% in 2016 in United States,⁶ and from 1.6% in 2012 to 2.2% in 2018 in United Kingdom.⁷ In our context, we observed an increase of six times higher proportion of persons reporting any same sex attraction in Barcelona (from 2.2% in 2011-2012 to 12.5% in 2016-2017). These increasing proportions has been observed especially among younger persons, probably because the progressively higher acceptance and lower discrimination among LGB persons in the last two decades.

1.1 BRIEF HISTORY OF LESBIAN, GAY, BISEXUAL AND TRANSGENDER (LGBT) POPULATION

The LGBT population has not had a uniform situation and it has had to adapt in each era to the prevailing ideas and conditions.

The earliest explicit references to homosexuality were around 3000 B.C, with the Egyptian myths of Seth and Horus and descriptions of homosexual practices in the Sumerian civilizations.^{8,9} As to gender, in many American indigenous groups there were non-binary persons such as the ‘two-spirit’, ‘muxes’ or ‘quariwarmi’, with records prior to the colonization process started in 1492.¹⁰⁻¹²

In China, during Han, Song and Ming dynasties, same-sex attraction was considered normal and it remained unchanged until the Qing dynasty. Since the 17th century, the understanding of homosexuality changed due to the influence of Western countries, and the penalties applied to homosexuality ranged from physical punishment or imprisonment to death.¹³ This situation will remain until 1997 and 2001 when homosexuality was withdrawn from the Chinese penal code and the Chinese list of mental disorders, respectively.

In India there are historical records (the ‘Rig-veda’ -second millennium BC- and, the ‘Sushruta-shamitá’ -around 600 BC) that mention the existence of a “third gender”.¹⁴ In Japan, during the Heian period there were references to homosexual relationships and, during the Middle Ages, the practice of homosexuality in Japanese armies (‘shudō’) was common.¹⁵

Although Islam condemns sodomy, in Muslim countries, the practice of homosexuality was common during the Abbasid Caliphate. However, since the 17th century, the medieval tolerance was abandoned, becoming prosecuted as a crime and applying the sharia. Sentences ranged from a simple penalty of lashing to prison or death.¹⁶

In Ancient Greece, male homosexual practices were mainly an aristocratic custom through which the upper classes transmitted their values, and it did not replace heterosexual marriage.¹⁷

In the Ancient Rome, homosexuality was restricted by the lex Scantinia during the republic. Later, in the first half of the Roman Empire, homosexuality became totally accepted.

However, during the second half of the Empire homosexuality acceptance declined and, at the beginning of the Christian era, Theodosius I punished homosexuality with the death penalty in 390 AC.¹⁸ With the fall of the Western Roman Empire, homosexuality was tolerated,¹⁹ but Visigothic Hispania punished male homosexual practices with castration and exile, and Justinian I continued to apply the death penalty to homosexuals.²⁰ Since the 12th century, throughout Europe, intolerance of homosexuality grew based on interpretations of the New Testament, and the medieval Inquisition tortured homosexuals and sentenced them to death.²¹

In Europe, during the Renaissance (1492-1789), there were some of the greatest homosexual persecutions by ecclesiastical and civil authorities: the Spanish Inquisition sentenced around 120 persons to death and around 1000 to jail,²² and the Portuguese Inquisition sentenced around 30 persons to death and around 500 to jail.²³ The French Revolution, following Napoleon's penal code, abolished in 1791 the criminalization of homosexual practices.²⁴ Napoleon's conquests and French cultural influence spread this decriminalization throughout southern Europe and some Latin-American countries.²⁵ However, there were Protestant countries in northern Europe where homosexuality was still a crime and the United States, after independence, inherited the United Kingdom's laws and its death penalty.

The legal treatment of homosexuality in Latin America varies between regions and over time. Several countries joined the Napoleonic penal code and decriminalized homosexual practices in the 19th century, such as Brazil (1830), Mexico (1871), Guatemala (1871) and Argentina (1886). Other countries decriminalized it along the 20th century, such as Peru (1924), while some waited until the 21st century, such as Puerto Rico (2005), Panama (2008) and Nicaragua (2008). It is important to remark the case of Venezuela, where homosexuality was never penalized.

During the Liberation Movement in Germany (1890-1934), a homosexual rights movement began, becoming the most active in the world during the Weimar Republic, although Germany's legislation punished homosexuality (article 175).²⁶ In 1897, the first gay organization (Scientific Humanitarian Committee) was created in Berlin.²⁷ In 1929, the Scientific Humanitarian Committee convinced the Parliament to remove Article 175. However, the financial crisis and Austria's annexation conditions prevented its removal.²⁸ In

1930, the first sex reassignment took place: the Danish painter Einar Mogens Wegener took the name Lili Elbe (1882-1931).

After the emergence of psychoanalysis (1890s), homosexuality began to be treated as a psychiatric disorder and homosexuals were subjected to sexual reorientation therapy, which included electroshock, aversion therapy, and even lobotomy.²⁹

In the Nazi Germany (1933-1945), homosexuality was considered an inferiority trait and a genetic defect that prevented the perpetuation of the Aryan race. An estimated 100,000 men were arrested: 50,000 were jailed and 10,000-15,000 were sent to concentration camps (of which only 4,000 survived).²⁸ Lesbians were not arrested, although the lesbian and feminist movement was prohibited. All women were relegated to cheap labor and lesbians, without the help of a husband's salary, were especially vulnerable to survive.³⁰ After the Second World War, the Article 175 remained in force until 1968 (East Germany) and 1969 (West Germany).^{31,32} In the 1940s, the fascist dictatorship of Benito Mussolini in Italy sent homosexuals to internal exile (tiny Italian islands)^{33,34} and the Vichy regime introduced laws against homosexuals in France.³⁵

In 1933, Joseph Stalin added to the criminal code of the Union of Soviet Socialist Republics (USSR) the Article 121, which considered homosexuality a defect linked to fascists and corrupt bourgeoisie. Homosexuality was not only an activity against nature, but also against socialist society. It made male homosexuality a crime punishable by up to five years in prison, and hundreds of thousands of persons were interned in gulags, many of which never returned.³⁴

In Spain, the Franco dictatorship (1939-1975) modified the Law of Vagrants and Crooks to include homosexuals in 1954 and confine them into work camps, such the one in Tefia (Fuerteventura Island).³⁶ This law was replaced in 1970 by the law on dangerousness and social rehabilitation, which includes penalties of up to five years of confinement in jails or mental hospitals.³⁷ Although this law was not applied during the democratic period, it continued in force until its total repeal in 1995.

The Universal Declaration of Human Rights (10 December 1948) claimed that all human beings are born free and equal in dignity and rights, without any distinction of race, color, sex, language, religion, political opinion or of any other nature, national or social origin, economic position, birth or any other condition.^{38,39} Despite this formulation, these equal rights were not respected for LGBT population in most countries.

On June 28, 1969, the Stonewall riots became the starting point of the global LGBT liberation movement, commemorated by making this date the International LGBT Pride Day. On May 17, 1990, the World Health Organization removed homosexuality from the international classification of diseases. This exclusion was followed by: the United Kingdom (1994), followed by the Ministry of Health of the Russian Federation (1999) and the Chinese Society of Psychiatry (2001).

The signing of two high-profile documents, the Declaration of Montreal (International Conference on LGBT Human Rights 2006)⁴⁰ and the Yogyakarta Principles in Relation to Sexual Orientation and Gender Identity (2007)⁴¹, derives from and symbolizes a significant acceleration and intensification of international struggles lead by LGBT movements. LGBT non-governmental organizations are achieving substantial and secure representation in global forums, recently even at the United Nations (UN), and ‘sexual orientation’ and ‘gender identity’ issues are finally finding a place on international human rights, law and policy agendas.

1.2 THEORIES ON SEXUAL ORIENTATION

The widespread belief that experiences during childhood, development, and the influence and relationship with parents can explain homosexual orientation is as controversial as the explanation based on biological causes.

Some evidence supports a role for prenatal testosterone exposure in the development of core gender identity in childhood,⁴² as well as in sexual orientation in later life, at least in some cases.⁴³ The Prenatal Neuroendocrine Theory has been experimentally demonstrated in non-human mammals.⁴³

There could also be other biological mechanisms, such as the fraternal birth order effect, which describes an increased incidence of homosexuality in males with older brothers due to a progressive immunization of the mother against a male-specific cell-adhesion protein (Neurologin 4 Y-linked).⁴⁴

In 1991, Simon LeVay published that the third interstitial nucleus of the anterior hypothalamus (INAH3) was twice as big in heterosexual men than in heterosexual women. In homosexual men, the INAH3 was similar to heterosexual women. However, LeVay's work did not achieve the required degree of consensus for a deeper scientific investigation.⁴⁵

Contrary to biological causes, psychoanalytic theory proposed by Freud asserts that homosexuality is the result of unresolved childhood conflicts experienced during the Oedipal and pre-Oedipal periods.⁴⁶ The Oedipus complex is seen to lie at the source of deep psychological tensions within male and female gender identities that conform to patriarchal definitions of “normal” adult heterosexuality.⁴⁷ Critics argue that the theory was established with minimal evidence, making it difficult to justify as a universal phenomenon without consideration for differing cultural and social factors.⁴⁶

In addition to childhood predispositions, the various developmental tasks of adolescence influence the degree and course of homosexuality.⁴⁸ Many aspects of the Oedipus complex have been criticized.

Queer theory is a pluridisciplinary field which emerged in the 1990s and had a major role in third-wave feminism.⁴⁹ Butler became the non-official ‘leader’ of queer theory through her academic work, most notably *Gender Trouble*. Butler’s theory showed that people’s identities are far more complex than the binary standards imposed on them. Sex is not the biological meaning of gender and is already socially constructed by norms, just as gender is an ongoing performance. Conversely, a person’s particularities should be valued and complexified with queer contributions to point to the multiplicity of gender identities.⁵⁰

Roughgarden’s Social Selection is one of the latest proposed theories for homosexuality (2006). Biology Professor Joan Roughgarden denies the reduction of sexual diversity to two sexes, one male and aggressive and the other female and self-conscious. She affirms that the existence of homosexual, transsexual and intersexual persons is nothing more than a natural variation that is perfectly integrated into the diversity shown by other animals.⁵¹

1.3 LEGAL SITUATION OF SEXUAL DIVERSITY WORLDWIDE

There are currently 67 United Nations (UN) Member States (31 from Africa, 9 from Latin America and the Caribbean, 21 from Asia and 6 from Oceania) with provisions criminalizing consensual same-sex conduct, with two additional UN Member States (Egypt and Iraq) having de facto criminalization, according to official data in December 2020 (**Table 1**).

Among those countries which criminalize it, there is full legal certainty that death penalty is the legally prescribed punishment for consensual same-sex sexual acts in six UN Member States, namely: Brunei, Iran, Mauritania, Nigeria (12 Northern states only), Saudi Arabia and Yemen. There are also five additional UN Member States where certain sources indicate that death penalty may be imposed for consensual same-sex conduct. These countries are: Afghanistan, Pakistan, Qatar, Somalia (including Somaliland) and the United Arab Emirates.⁵²

Table 1. Countries criminalizing consensual same-sex conduct in December 2020:⁵²

| | |
|--|---|
| Africa | Algeria, Burundi, Cameroon, Chad, Comoros, Egypt, Eritrea, Eswatini, Ethiopia, Gambia, Ghana, Guinea, Kenya, Liberia, Libya, Malawi, Mauritania, Mauritius, Morocco, Namibia, Nigeria, Senegal, Sierra Leone, Somalia, South Sudan, Sudan, Tanzania, Togo, Tunisia, Uganda, Zambia and Zimbabwe |
| Latin America and the Caribbean | Antigua and Barbuda, Barbados, Dominica, Grenada, Guyana, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines. |
| Asia | Afghanistan, Bangladesh, Bhutan, Brunei, Iraq, Iran, Indonesia, Kuwait, Lebanon, Malaysia, Maldives, Myanmar, Oman, Pakistan, Palestine (Gaza only), Saudi Arabia, Singapore, Sri Lanka, Syria, Turkmenistan, United Arab Emirates, Uzbekistan, Yemen. |
| Oceania | Kiribati, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, Cook Islands. |

On the opposite side, there are 57 UN Member States, 1 non-UN Member State, and 28 non-independent jurisdictions with provisions that confer broad protection against discrimination based on sexual orientation (**Table 2**). There are also 81 UN Member States, 2 non-UN

Member States, and 33 non-independent jurisdictions with provisions protecting against employment discrimination based on sexual orientation.⁵²

Table 2. Countries with broad protection against discrimination based on sexual orientation in December 2020.⁵²

| | |
|--|--|
| Africa | Angola, Mauritius, South Africa. |
| Latin America and the Caribbean | Bolivia, Brazil, Chile, Colombia, Cuba, Ecuador, Honduras, Mexico, Peru, Suriname, Uruguay. |
| North America | Canada, 29 states in United States. |
| Asia | Israel, Mongolia, Nepal, Taiwan, several provinces in Philippines. |
| Europe | Albania, Andorra, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Finland, France, Georgia, Germany, Hungary, Iceland, Ireland, Kosovo, Liechtenstein, Lithuania, Luxembourg, Malta, Montenegro, Netherlands, North Macedonia, Norway, Portugal, Romania, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, United Kingdom. |
| Oceania | Australia, Fiji, Marshall Islands, Micronesia, New Zealand. |

There are 28 UN Member States that allow same-sex marriage in 2020, with one additional non-UN Member State (Taiwan) and 30 non-independent territories also having marriage equality.⁵²

The first state in the world to legalize homosexual marriages was the Netherlands in 2001, followed by Belgium (2003), Spain and Canada (2005), South Africa (2006), Norway and Sweden (2009), Portugal, Iceland, Argentina (2010), Denmark (2012), Brazil, France, New Zealand and Uruguay (2013), United Kingdom (2014), Ireland, Luxembourg and United States (2015), Colombia (2016), Australia, Germany, Finland and Malta (2017), Austria, Taiwan and Ecuador (2019), Costa Rica and 19 jurisdictions of Mexico (2020), and Switzerland (2022).⁵²

Furthermore, 28 UN Member States and 25 non-independent jurisdictions recognize joint adoption by same-sex couples, and 31 UN Member States, 1 non-UN Member State, and 25 non-independent jurisdictions recognize second parent adoption (**Table 3**).⁵²

Table 3. Countries recognizing adoption by same-sex couples in December 2020:⁵²

| | |
|--|---|
| Africa | South Africa |
| Latin America and the Caribbean | Argentina, Brazil, Colombia, Costa Rica, Uruguay |
| North America | Canada, United States |
| Asia | Israel |
| Europe | Andorra, Austria, Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, United Kingdom |
| Oceania | Australia, New Zealand |

The **Figure 1** represents in the world map the previously commented legal situation of sexual diversity worldwide, as reported by the International Lesbian, Gay, Bisexual, Trans and Intersex Association (ILGA) in their World's State-Sponsored Homophobia report published in December 2020.⁵²

Figure 1. World Map of legal situation of sexual diversity. ILGA World's State-Sponsored Homophobia report. Published in December 2020.⁵²

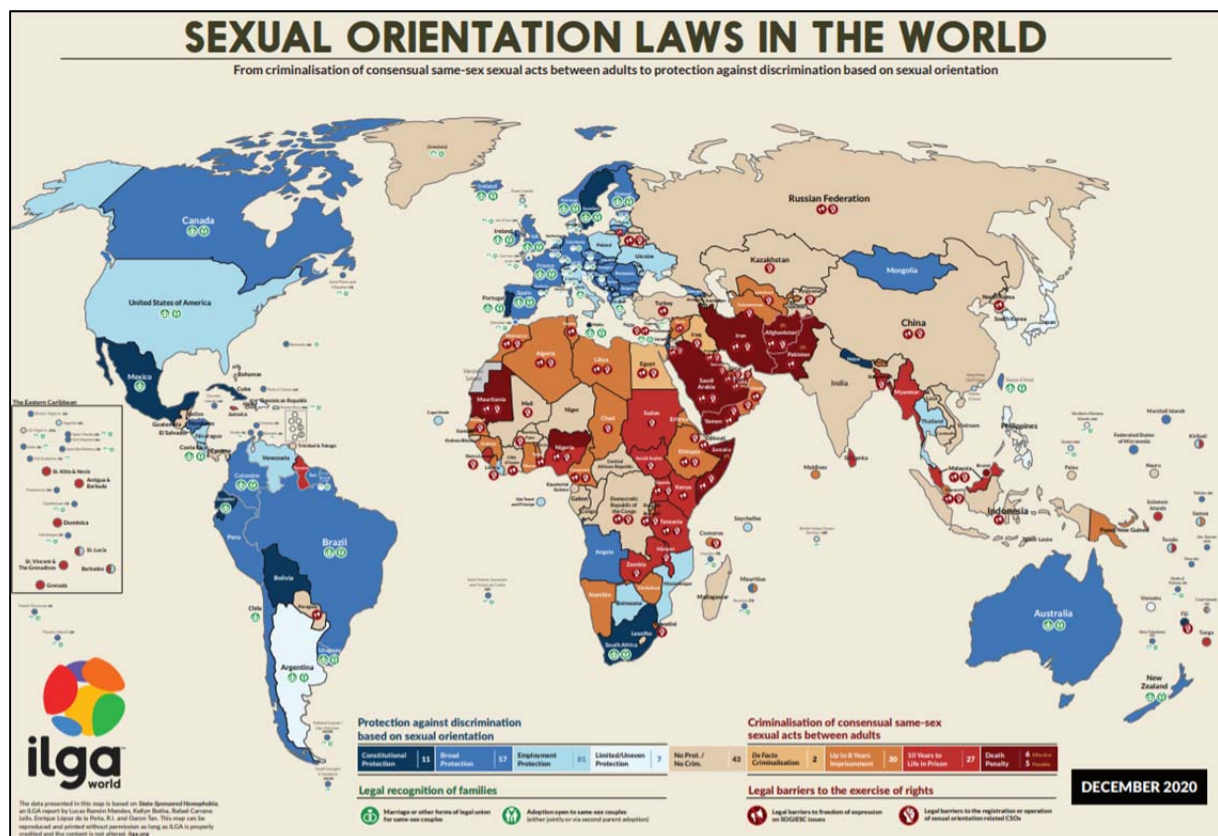
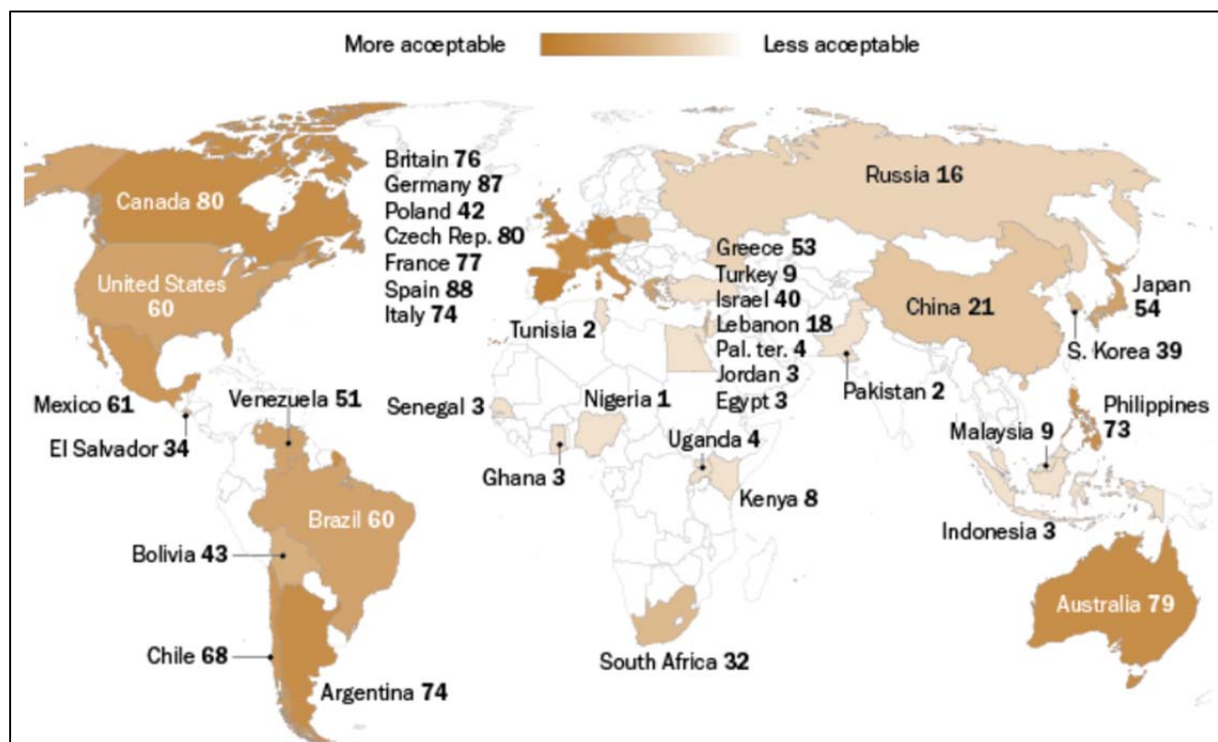


Figure 2 shows results of the 2013 Pew Research Center Survey of the LGBT Population.⁵³ Views of homosexuality were particularly positive in Spain (88% persons say it should be accepted by society), Germany (87%), Czech Republic (80%), Canada (80%), Australia (79%), France (77%), Britain (76%), Argentina (74%), Italy (74%) and Philippines (73%). Conversely, acceptance was extremely low in Nigeria (1%), Tunisia (2%), Ghana (3%), Senegal (3%), Egypt (3%), Jordan (3%), Indonesia (3%), Uganda (4%), Palestinian territories (4%) and Kenya (8%).

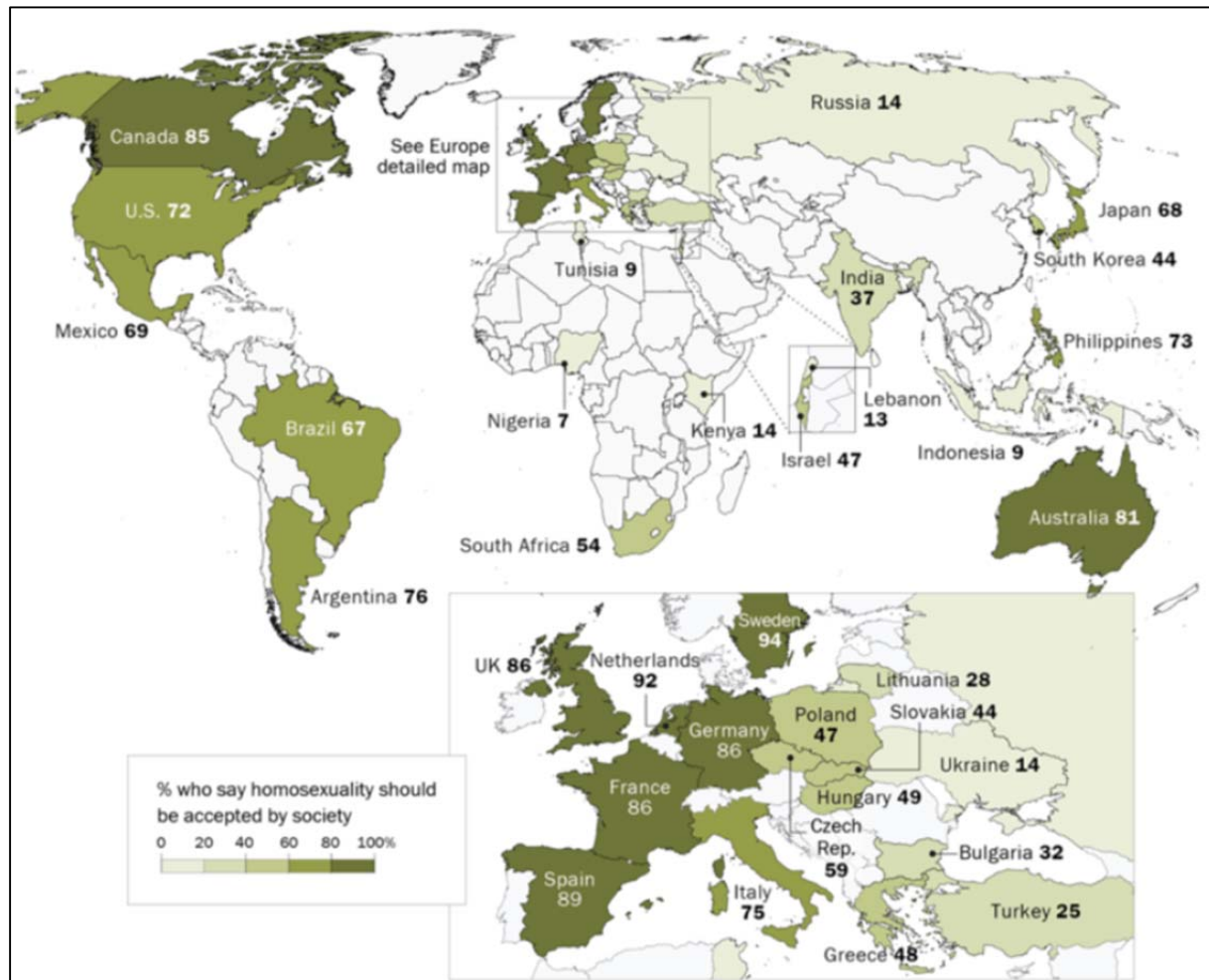
Figure 2. World Map of Social Acceptance of Homosexuality: percent who say homosexuality should be accepted by society. Pew Research Center. 2013 Spring Pew Global Attitudes Survey.⁵³



Views of homosexuality in 2019⁵⁴ (**Figure 3**) were particularly positive in Sweden (94%), The Netherlands (92%), Spain (89%), France (86%), Germany (86%), United Kingdom (86%), Canada (85%), Australia (81%), Argentina (76%), Italy (75%), Philippines (73%), United States (72%), Mexico (69%), Japan (68%) and Brazil (67%). Conversely, low proportion of persons in Nigeria (7%), Tunisia (9%), Indonesia (9%), Lebanon (13%), Kenya

(14%), Russia (14%) and Ukraine (14%) say that homosexuality should be accepted by society. But in South Africa (54%) and Israel (47%) do more than a quarter hold this view.

Figure 3. World Map of Social Acceptance of Homosexuality: percent who say homosexuality should be accepted by society. Pew Research Center. Spring 2019 Global Attitudes Survey.⁵⁴



On a regional basis, acceptance of homosexuality is higher in Western Europe and North America. Central and Eastern Europeans, however, are more divided on the subject, with a median of 46% who say homosexuality should be accepted and 44% saying it should not be.

Many of the countries surveyed between 2013 and 2019 have seen a double-digit increase in acceptance of homosexuality. This includes a 22-point increase in South Africa (from 32% in 2013 to 54% in 2019) and India (from 15% in 2013 to 37% in 2019), 16-point increase in

Turkey (from 9% in 2013 to 25% in 2019), 14-point increase in Japan (from 54% in 2013 to 68% in 2019), 12-point increase in United States (from 60% in 2013 to 72% in 2019) and 10-point increase in United Kingdom (from 76% in 2013 to 86% in 2019).

Countries with a lower increased include France (9-point increase, from 77% in 2013 to 86% in 2019), Mexico (8-point increase, from 61% in 2013 to 69% in 2019), Brazil (7-point increase, from 60% in 2013 to 67% in 2019), Israel (7-point increase, from 40% in 2013 to 47% in 2019), Tunisia (7-point increase, from 2% in 2013 to 9% in 2019), Kenya (6-point increase, from 8% in 2013 to 14% in 2019), Indonesia (6-point increase, from 3% in 2013 to 9% in 2019), Nigeria (6-point increase, from 1% in 2013 to 7% in 2019), Canada (5-point increase, from 80% in 2013 to 85% in 2019), Poland (5-point increase, from 42% in 2013 to 47% in 2019) and South Korea (5-point increase, from 39% in 2013 to 44% in 2019).

The percentages remain very similar between 2013 and 2019 in Australia, Argentina, Spain, Italy, Philippines, Germany and Russia, possibly explained by the ceiling effect (high level of acceptance, over 70% in 2013), except in Russia, that went from 16% in 2013 to 14% in 2019.

Finally, there were a few countries where a reduction in acceptance of homosexuality was observed: Greece (5-point reduction, from 53% in 2013 to 48% in 2019), Lebanon (5-point reduction, from 18% in 2013 to 13% in 2019) and Czech Republic 21-point reduction, from 80% in 2013 to 59% in 2019. However, there might have been some bias introduced in the latter, as the 2013 Czech Republic survey was carried out by telephone interviews, while the 2019 survey was face-to-face. Attitudes on this issue are correlated with country's wealth. In general, people in wealthier and more developed economies are more accepting of homosexuality than are those in less wealthy and developed economies.⁵⁴

There also are differences on acceptance of homosexuality within countries by age, education, income and, in some instances, or gender strata – and in several cases, these differences are substantial. In addition, religion and its importance in people's lives shape opinions in many countries.⁵⁴

Political ideology also plays a role in acceptance of homosexuality. In many countries, those on the political right are less accepting of homosexuality than those on the left, and supporters of several right-wing populist parties in Europe are also less likely to see homosexuality as acceptable.⁵⁴

1.4 SOCIAL DETERMINANTS OF HEALTH

‘Social determinants of health’ is a term used to describe the social and environmental conditions in which persons are born, grow, live, work, and age, which shape and drive health outcomes. Factors that determine how the social determinants of health are experienced across societies include the distribution of power, money and resources. Unfair distribution creates avoidable health inequalities, known as ‘health inequities’. Therefore, social, economic, and environmental factors, as well as political and cultural factors, constitute the ‘social determinants of health’.⁵⁵

The conceptual framework for action on the social determinants of health developed by the Commission on Social Determinants of Health (**Figure 4**) includes:⁵⁶ 1) structural determinants (based on socioeconomic and political context and the resultant socioeconomic position of individuals); 2) intermediary determinants (based on exposures, vulnerabilities and consequences that people experience differently based on their social position); 3) social cohesion and social capital; and 4) impact on equity of health and well-being.

Socioeconomic and political context can be understood as the main characteristics of a country that generate, configure and maintain social hierarchies, including: the labor market; the educational system, political institutions and other cultural and societal values. Among the contextual factors that most powerfully affect health are the welfare state and its redistributive policies (or their absence).

The socioeconomic position of individuals identifies key dimensions of social stratification, such as income, education, occupation, social class, gender, and race/ethnicity. However, this framework did not consider sexual orientation.

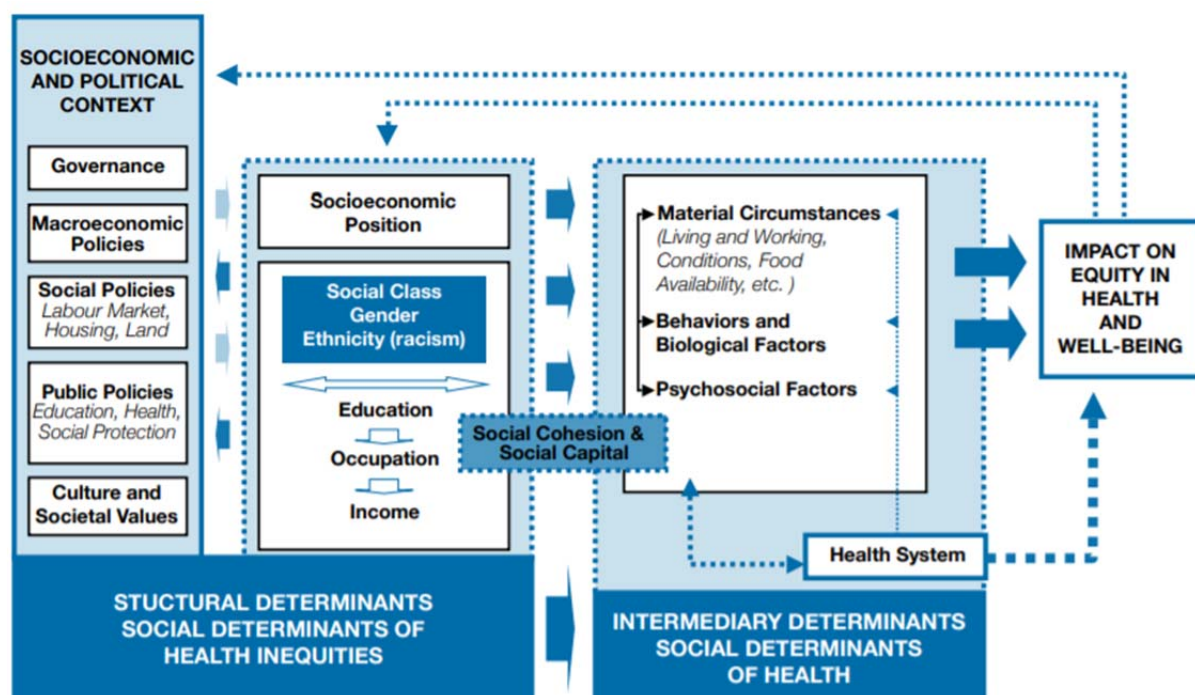
The intermediary determinants list includes the material circumstances, and behavioral, biological and psychological factors. ‘Material circumstances’ means those such as housing and neighborhood quality, consumption potential, and the physical work environment. Psychosocial circumstances may be psychosocial stressors, stressful living circumstances and relationships, and social support and coping styles. Behavioral factors include nutrition, physical activity, tobacco consumption and alcohol consumption. Biological factors consider

genetic factors. The health system becomes particularly relevant through enabling access to the health services citizens need, when and where they need them.

Social capital cuts across the structural and intermediary dimensions, with features that link it to both. Focusing on social capital, however, risks interpretations that reinforce depoliticized approaches to public health and the social determinants of health, when the political nature of the endeavor needs to be an explicit part of any strategy to tackle them.

Health inequities are systematic differences in the health status of different population groups. Where health inequalities are considered to be avoidable by reasonable means, yet are not avoided, they are inequitable, and taking action to reduce them is a matter of social justice, as these inequities have significant social and economic costs both to individuals and societies. Finally, inequities can be identified in health and well-being.⁵⁷⁻⁵⁹

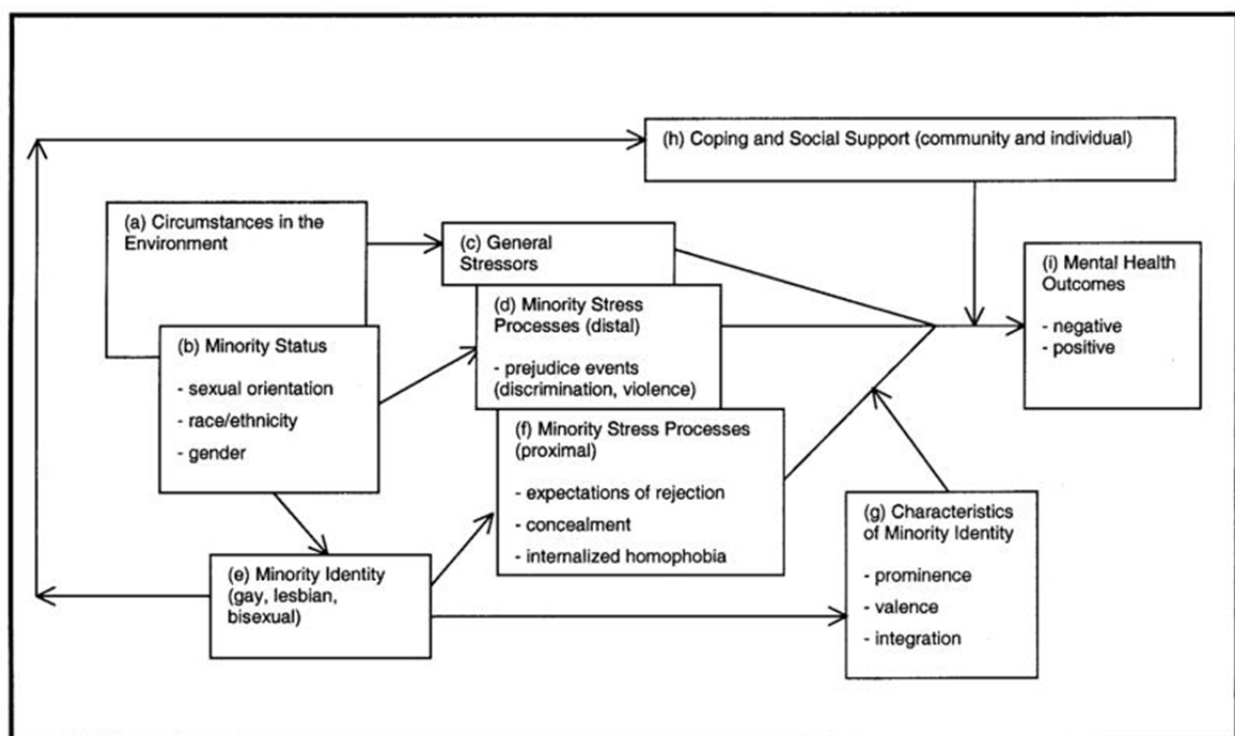
Figure 4. A conceptual framework for action on the social determinants of health. The Commission on Social Determinants of Health, lead by Orielle Solar and Alec Irwin.⁵⁶



Sexual orientation is a well-known axis of health inequities:^{60,61} worse health outcomes are consistently reported for LGB persons in mental health,^{62–67} chronic conditions,^{68–70} health-related behaviors,^{62,66} and perceived health.^{62,64,68}

In 2003, Meyer proposed a conceptual framework⁷¹ for understanding the excess in prevalence of mental disorders in terms of minority stress—explaining that stigma, prejudice, and discrimination create a hostile and stressful social environment that causes mental health problems. The model describes stress processes, including the experience of prejudice events, expectations of rejection, hiding and concealing, internalized homophobia, and ameliorative coping processes.

Figure 5. Minority stress processes in lesbian, gay, and bisexual populations proposed by Meyer IH. 2003.⁷¹



Meyer's framework⁷¹ (**Figure 5**) depicts stress and coping, and their impact, on mental health outcomes (box i). Minority stress is situated within general environmental circumstances (box a), which may include advantages and disadvantages related to factors such as socioeconomic status. An important aspect of these circumstances in the environment is the person's minority status, for example being gay or lesbian (box b). These are depicted as overlapping

boxes in the figure to indicate close relationship to other circumstances in the person's environment. For example, minority stressors for a gay man who is poor would undoubtedly be related to his poverty; together these characteristics would determine his exposure to stress and coping resources.⁷²

Circumstances in the environment lead to exposure to stressors, including general stressors, such as a job loss or death of an intimate (box c), and minority stressors unique to minority group members, such as discrimination in employment (box d). Similar to their source circumstances, the stressors are depicted as overlapping as well, representing their interdependency.⁷³ For example, an experience of antigay violence (box d) is likely to increase vigilance and expectations of rejection (box f). Often, minority status leads to personal identification with one's minority status (box e). In turn, such minority identity leads to additional stressors related to the individual's perception of the self as a stigmatized and devalued minority.⁷⁴ Because they involve self-perceptions and appraisals, these minority stress processes are more proximal to the individual, including, as described above for LGB individuals, expectations of rejection, concealment, and internalized homophobia (box f).

In 2009, Mule et al. proposed a new framework⁷⁵ arguing the importance of including gender and sexually diverse populations in policy development towards a more inclusive form of health promotion. They emphasized the need to address the broad health and wellbeing issues and needs of LGBT persons.

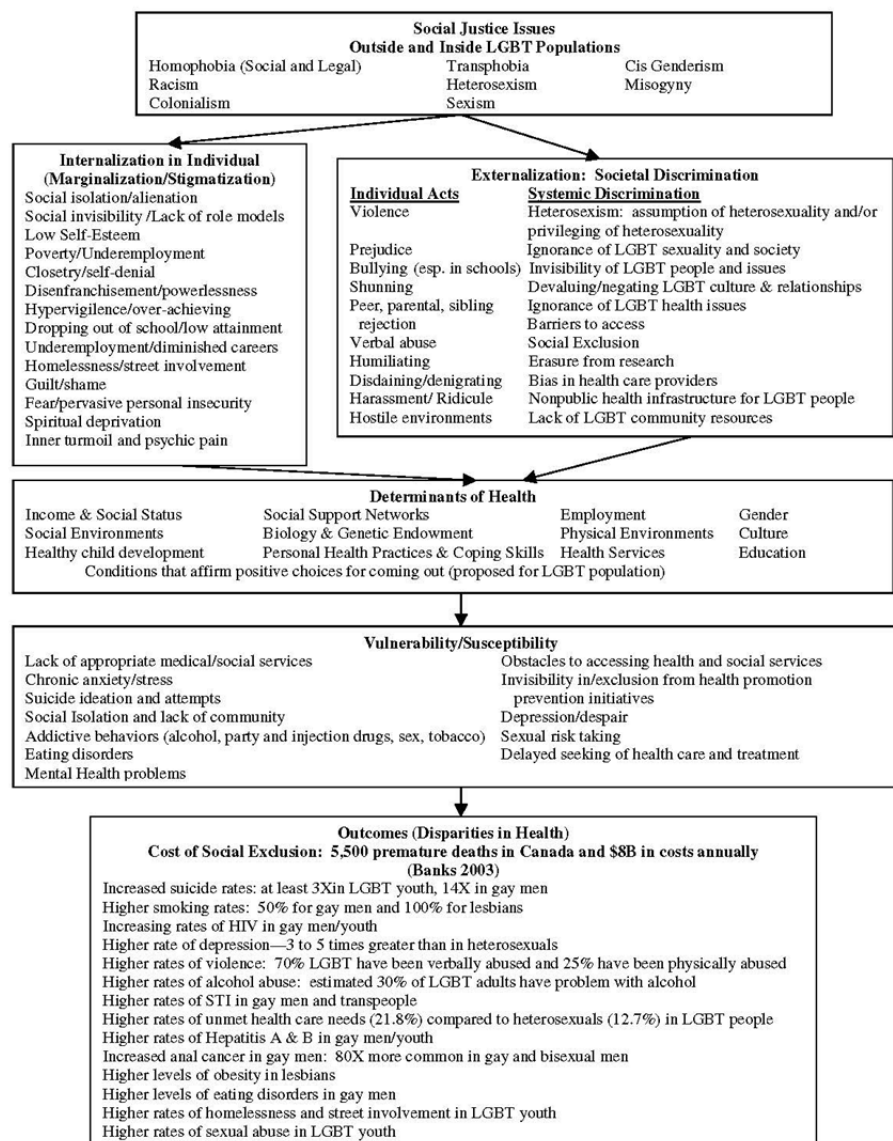
Figure 6 shows the framework proposed by Mule et al.,⁷⁵ which illustrates, from a structural perspective, the health and wellbeing inequities experienced by gender and sexually diverse populations. From the outset, at the top of the framework, social justice issues are framed within an intersectional discourse acknowledging the multiple social locations and power relationships that LGBT individuals and communities inhabit. These varying social locations intersect with one's gender identity and/or sexuality, and the resulting effects on health and wellbeing. The next two boxes respectively outline internalized and externalized forms of oppression. The former lists affected individualized responses; the latter lists both individually targeted and systemic forms of discrimination with stigmatizing effects.

The interaction of individual acts and/or systemic discrimination in the latter has a direct impact on the health and wellbeing of the individual in the former. Further down the framework, specified vulnerabilities and susceptibilities are outlined on individual and

systemic levels, indicating repercussions on health and wellbeing for these populations. The box at the bottom of the framework provides the known health disparities for gender and sexually diverse populations. The determinants of health are located at the center of the framework, midstream between that which ails and the resulting impacts.

This framework illustrates the down streaming structural effects that health and wellness inequities have on gender and sexually diverse populations, shifting the focus from individualized pathology to systemic oppression.

Figure 6. Structural Framework for Gender and Sexually Diverse Health and Wellbeing Inequities proposed by Mule NJ et al. 2009.⁷⁵



Numerous scientific studies show that sexual orientation-related health inequalities are huge, and in many cases cause an excess of mortality and morbidity, higher than those of most known risk factors for disease.^{76–79} It is also important to have in mind that scientific evidence indicates that health inequalities can be reduced if the appropriate health and social interventions and public policies are applied.⁸⁰

1.5 DIFFERENCES BY SEXUAL ORIENTATION ON MENTAL AND PHYSICAL HEALTH

Even in western countries, where supposedly views on homosexuality are particularly positive, the legal situation is favorable and there are less barriers to reporting sexual orientation, which has allowed to study the health differences by sexual orientation in general population through population health surveys, LGB people have shown worse health outcomes in mental health,^{62–67} chronic conditions,^{68–70} health-related behaviors,^{62,66} and perceived health.^{62,64,68}

Several studies have suggested worse mental health, and higher rates of depression and anxiety among gay, lesbian, and bisexual persons.^{62–65,81} A systematic review with 476 selected studies published between 1966 and 2005⁶³ revealed a 1.5-fold excess in risk for depression and anxiety disorders (over a period of 12 months or a lifetime).

A combined meta-analysis of 12 United Kingdom population health surveys,⁶⁴ after adjusting for a range of covariates, also showed that lesbian and gay persons had higher prevalence of common mental disorder when compared to heterosexuals, but with a different association through age groups: intermediate for those under 35 (Odds Ratio (OR) = 1.78; 95% CI = 1.40–2.26), weaker at age 35–54.9 (OR = 1.42; 95% CI = 1.10–1.84), but strongest at age 55+ (OR = 2.06; 95% CI = 1.29–3.31). This association was stronger for bisexual adults with a similar pattern through age groups, adjusting for a range of covariates in relation to symptoms of common mental disorder.

A Swedish nationwide population-based health survey conducted yearly from 2008 to 2013⁶⁹ showed that LGB participants were more likely to report worse self-rated health, more physical health symptoms and conditions (e.g., pain, insomnia, dermatitis, tinnitus, intestinal

problems, diabetes, asthma, high blood pressure) compared to heterosexuals. Disparities were largest among adolescents and young adults and generally smallest in older age groups. Health behaviors and elevated reports of exposure to perceived discrimination, victimization, and threats of violence among sexual minorities partially explained the sexual orientation disparities in physical health.

The 2013-2014 United States National Health Interview Survey⁷⁰ showed that lesbians had a higher prevalence of obesity, stroke, and functional limitation than heterosexual women. Gay men were more likely to have hypertension and heart disease, compared to heterosexual men.

The 2014-2015 Behavioral Risk Factor Surveillance System⁶⁶ showed that, after controlling for demographic and socioeconomic status, gay and bisexual men reported higher odds of frequent mental distress and depression, compared with heterosexual men. Lesbian and bisexual women also had higher odds of frequent mental distress compared to heterosexual women. Lesbian and (particularly) bisexual women consistently reported worse physical health outcomes (e.g. activity limitations, arthritis, asthma, and COPD) and worse health risks (e.g. obesity, current smoking, and recent binge drinking) compared to heterosexual women. However, this study found inconsistent evidence that gay and bisexual men endure worse physical and functional health outcomes compared to heterosexual men.

A population-based study conducted in four United States eastern cities (Baltimore, New York City, Philadelphia, and Washington D.C.) between March and April 2016,⁶⁷ showed that only bisexual participants had significantly higher psychological distress than heterosexual ones, even after adjusting for age and income. The associations were consistent across gender and race/ethnicity. No significant differences between homosexual and heterosexual persons were found.

The American Cancer Society⁸² estimates that the LGBT population are disproportionately affected by specific cancers, such as anal cancer in gay and bisexual men, breast cancer in lesbian women, and viral infection–induced cancers in LGB and transgender persons. The drivers of these cancer disparities include risk factors that are often more common among LGBT people, such as tobacco use, nulliparity, and HIV.

Accumulating evidence shows that having a minority sexual orientation could be related to higher prevalence of alcohol consumption, cigarette smoking and psychoactive drug

consumption. The prevalence of tobacco, alcohol and psychoactive drug consumption is around 2-fold higher than that of their heterosexual counterparts.^{62,83–87} For example, in Massachusetts,⁸⁵ the probability of current smoking and any 30-day drug use was at least 2 times greater among LGB than heterosexuals; in England,⁸⁶ the LGB group reported almost 2 times higher significant alcohol and drug dependence; and in United States,⁸⁷ the sexual minority group showed a probability of past year tobacco and alcohol use disorder around 2 times greater than the heterosexual counterparts.

This pattern of worse health-related behaviors has been related to discrimination and stigma,⁸⁸ which may lead to a reduction of self-control in those who feel threatened by their social identity. According to the minority stress theory underlying LGB health inequities, ‘when an individual perceives that one of their social identities is discriminated against, feelings of anguish and stress are generated that have negative effects’ on health and health-related behaviors.

1.6 DIFFERENCES BY SEXUAL ORIENTATION ON HEALTH-RELATED QUALITY OF LIFE

Health-related quality of life (HRQL) is a broad and multidimensional concept. Some authors describe HRQL as the outcome of the interaction of variables across four levels: biological and psychological factors, symptoms, functioning (psychologically and socially), and general health perception. It is considered an ultimate and comprehensive outcome on the conceptual model of health.⁸⁹

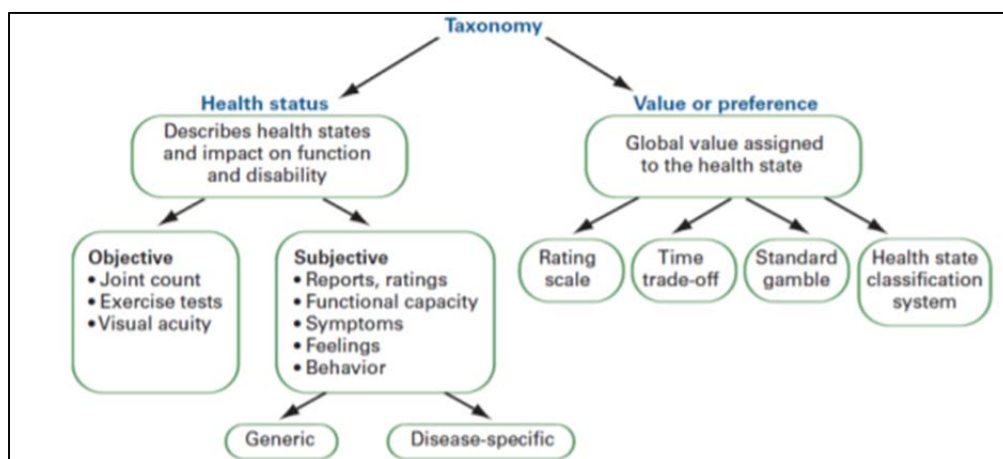
There is a lack of consensus in the definition of HRQL,^{90,91} but a general agreement that it is subjective, multidimensional (including physical, psychological, social and spiritual domains) and covers both positive and negative dimensions.⁹² The growing interest in HRQL resulted in the development of many instruments.

HRQL measures are classified as generic or specific according to the target population (**Figure 7**). Generic measures are applicable to multiple diseases, patients, and populations⁹³ due to their coverage of the complete spectrum of function, disability and distress. Specific measures are those designed to assess specific populations. Disease-specific instruments

focus on how a dysfunction in a single disease affects HRQL. Other instruments may be specific to a patient population, to a certain function, or to a given condition or problem.⁹⁴ The disadvantages of specific measures are that they are not comprehensive and cannot be used to compare across sub-populations or conditions.

HRQL measures can be also classified as health status and value/preference (**Figure 7**). In general, health status measures provide information on several concepts describing a person's functioning by a profile of interrelated scores or domains. In contrast, health value, preference or utility measures assess the value or desirability of a health state against an external metric and summarize HRQL as a single index value (utility).⁹⁵ Econometric instruments incorporate social preferences (utilities) on health states, which allows to measure quality adjusted life years (QALYs).⁹⁶

Figure 7. Health-Related Quality of Life Taxonomy.⁹⁵



One of the most popular generic health status profiles is the 36-Item Short Form Health Survey questionnaire (SF-36)⁹⁷ or 12-Item Short Form Health Survey questionnaire (SF-12).⁹⁸ Both measure 8 health domains (physical functioning, social functioning, mental health, role limitations due to physical problems, role limitations due to emotional problems, vitality, bodily pain, and general health perception), which can be summarized into physical and mental component summary scores.

Probably, the EuroQol-Five Dimensions (EQ-5D) is the most used preference-based utility measure worldwide.⁹⁹ It is composed of a descriptive system (**Figure 8**), and a visual

analogue scale (**Figure 9**).¹⁰⁰ The descriptive system covers five dimensions of health (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression), and response options include three (EQ-5D-3L) or five levels (EQ-5D-5L) of severity according to the version. The instrument therefore defines 243 (EQ-5D-3L: 3^5) or 3125 (EQ-5D-5L: 5^5) distinct health states from all the possible combinations of dimensions and levels of severity (55).¹⁰¹

Figure 8. Descriptive system of two versions of the EQ-5D: with three and five levels of response.

| EQ-5D-3L | EQ-5D-5L |
|---|---|
| Under each heading, please tick the ONE box that best describes your health TODAY. | |
| MOBILITY | MOBILITY |
| I have no problems in walking about <input type="checkbox"/> | I have no problems in walking about <input type="checkbox"/> |
| I have some problems in walking about <input type="checkbox"/> | I have slight problems in walking about <input type="checkbox"/> |
| I am confined to bed <input type="checkbox"/> | I have moderate problems in walking about <input type="checkbox"/> |
| | I have severe problems in walking about <input type="checkbox"/> |
| | I am unable to walk about <input type="checkbox"/> |
| SELF-CARE | SELF-CARE |
| I have no problems with self-care <input type="checkbox"/> | I have no problems washing or dressing myself <input type="checkbox"/> |
| I have some problems washing or dressing myself <input type="checkbox"/> | I have slight problems washing or dressing myself <input type="checkbox"/> |
| I am unable to wash or dress myself <input type="checkbox"/> | I have moderate problems washing or dressing myself <input type="checkbox"/> |
| | I have severe problems washing or dressing myself <input type="checkbox"/> |
| | I am unable to wash or dress myself <input type="checkbox"/> |
| USUAL ACTIVITIES (e.g. work, study, housework, family or leisure activities) | USUAL ACTIVITIES (e.g. work, study, housework, family or leisure activities) |
| I have no problems with performing my usual activities <input type="checkbox"/> | I have no problems doing my usual activities <input type="checkbox"/> |
| I have some problems with performing my usual activities <input type="checkbox"/> | I have slight problems doing my usual activities <input type="checkbox"/> |
| I am unable to perform my usual activities <input type="checkbox"/> | I have moderate problems doing my usual activities <input type="checkbox"/> |
| | I have severe problems doing my usual activities <input type="checkbox"/> |
| | I am unable to do my usual activities <input type="checkbox"/> |
| PAIN / DISCOMFORT | PAIN / DISCOMFORT |
| I have no pain or discomfort <input type="checkbox"/> | I have no pain or discomfort <input type="checkbox"/> |
| I have moderate pain or discomfort <input type="checkbox"/> | I have slight pain or discomfort <input type="checkbox"/> |
| I have extreme pain or discomfort <input type="checkbox"/> | I have moderate pain or discomfort <input type="checkbox"/> |
| | I have severe pain or discomfort <input type="checkbox"/> |
| | I have extreme pain or discomfort <input type="checkbox"/> |
| ANXIETY / DEPRESSION | ANXIETY / DEPRESSION |
| I am not anxious or depressed <input type="checkbox"/> | I am not anxious or depressed <input type="checkbox"/> |
| I am moderately anxious or depressed <input type="checkbox"/> | I am slightly anxious or depressed <input type="checkbox"/> |
| I am extremely anxious or depressed <input type="checkbox"/> | I am moderately anxious or depressed <input type="checkbox"/> |
| | I am severely anxious or depressed <input type="checkbox"/> |
| | I am extremely anxious or depressed <input type="checkbox"/> |

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Figure 9. The general health Visual Analogue Scale (VAS), which is the same for both versions of the EQ-5D.

EQ-5D-3L AND EQ-5D-5L VISUAL ANALOGUE SCALE (VAS)

- We would like to know how good or bad your health is TODAY.
- This scale is numbered from 0 to 100.
- 100 means the best health you can imagine.
0 means the worst health you can imagine.
- Please mark an X on the scale to indicate how your health is TODAY.
- Now, write the number you marked on the scale in the box below.

YOUR HEALTH TODAY =

The best health you can imagine

100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0

The worst health you can imagine

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A major feature of the EQ-5D instrument lies in its single index (based on societal preference utilities), which allows the calculation of QALYs.¹⁰⁰ Societal preferences for each health state can be expressed quantitatively as a utility, which allows cost-utility analyses and to calculate quality-adjusted life years. The EQ-5D-3L societal preferences were elicited with Time Trade Off (TTO) to construct the EQ-5D-3L index,¹⁰² while the EQ-5D-5L index was elicited by combining the techniques of time trade-off and discrete choice.¹⁰³

Furthermore, it is important to highlight that the EQ-5D has proven its usefulness as a measure of population health,¹⁰⁴ being able to show the differences between communities or population groups with different socioeconomic characteristics.^{105–107}

Few studies on sexual orientation inequalities in general population have considered HRQL as a whole,^{68,108,109} while others^{64,65} just included selected HRQL dimensions. The California Quality of Life Survey⁶⁵ only reported the physical component of the Short Form-12 Health

Survey (SF-12), and the combined meta-analysis of health surveys from United Kingdom only reported anxiety/depression from the EQ-5D.⁶⁴ The Dutch National Survey of General Practice assessed both the physical and the mental health components covered by the SF-36,⁶⁸ and the United States Growing Up Today Study reported the EQ-5D index in one study,¹⁰⁸ and the five EQ-5D-5L dimensions in another study.¹⁰⁹

The California Quality of Life Survey⁶⁵ only showed a higher risk of poor SF-12 physical health for bisexual women and homosexually experienced heterosexual men compared to heterosexuals.

The combined meta-analysis from United Kingdom⁶⁴ showed that adults who identify as lesbian, gay, bisexual and other non-heterosexual identities were around twice as likely to report symptoms of mental health or problems of anxiety/depression than heterosexual persons.

The Dutch National Survey of General Practice⁶⁸ showed that, compared with heterosexual respondents, gay and lesbian participants scored lower on the SF-36 mental component summary, indicating poorer mental health. However, no SF-36 physical component summary differences were reported.

The United States Growing Up Today Study showed sexual orientation differences in the EQ-5D single utility index¹⁰⁸ and the five EQ-5D-5L dimensions (mobility, self-care, usual activities, pain/discomfort and anxiety/depression).¹⁰⁹

1.7 DISCRIMINATION BY SEXUAL ORIENTATION

Discrimination is defined as the unequal treatment of persons on the basis of an identifying characteristic such as age, sex, race, national origin, sexual orientation, and gender identity.^{88,110} Stigma is defined as the negative and usually unfair beliefs on the basis of an identifying characteristic.¹¹¹ So, sexual orientation stigma refers to stereotyping, prejudice, and discrimination directed towards persons perceived to be non-heterosexual.¹¹² Herek, Gillis, and Cogan asserted that sexual minorities may experience this stigma in three unique ways.¹¹³

First, individuals may be subject to “enacted stigma”, which represents a relatively overt discrimination that may manifest in the form of hate crimes, social ostracism, and the use of homophobic epithets. Second, individuals may experience “felt stigma,” which denotes awareness that persons and institutions are homo- and bi-negative, and consequently engage in strategies designed to hide one’s sexual minority status (e.g., being closeted). Third, and finally, individuals may suffer from “internalized stigma,” which refers to “negative and distressing thoughts and feelings” about one’s sexuality “which are attributed to experiences of cultural heterosexism and victimization”.¹¹⁴

Even in those countries where homosexuality is more accepted, LGB persons are more likely to suffer discrimination or stigma,¹¹⁵ which could influence the intensity of stressors that negatively affect physical and mental health, as well as the increase in health risk behaviors.⁸⁸ This effect is motivated by the existence of unfair relationships based on institutional and interpersonal practices where members of a dominant group acquire privileges with respect to others.¹¹⁶

The impact of LGB discrimination on health and risk behaviors has been observed in three recent studies. The first one found that LGB persons who reported discrimination in the previous year presented more than 4 times higher use of harmful substances, compared to LGB adults who reported no discrimination.¹¹⁷ The second one concluded that, in communities with high levels of homosexual prejudice, the LGB population had 12 years less life expectancy.⁶¹ This life expectancy reduction is higher than that produced by the most important risk factors in western countries, such as hypertension, hypercholesterolemia, obesity or tobacco and alcohol consumption, which are associated with reductions in life expectancy of 5, 6, 8, 9 and 10 years,^{76–79} respectively. The third article, which measured a homophobic climate index in 158 different countries, showed that a 10% increase in the level of homophobia at country level is associated with a 1.7-year loss in life expectancy for males.¹¹⁸

It is also important to highlight that LGB discrimination not only affects sexual minority populations. A national US study published in 2014 showed that heterosexuals who reported higher levels of antigay prejudice had a life expectancy difference of approximately 2.5 years (95% CI = 1.0, 4.0 years) compared to persons with low levels of antigay prejudice.

Furthermore, antigay prejudice was specifically associated with increased risk of cardiovascular-related causes of death in fully adjusted models.¹¹⁹

There are several scales to measure discrimination and stigma. However, a systematic review of these instruments which involved 162 articles revealed that most have suboptimal psychometric properties.¹²⁰ Specifically, questionable content validity; items are not created in collaboration with sexual minorities; measures possess a small number of items and, thus, may not sufficiently represent the domain of interest; and scales are “adapted” from measures designed to examine race and gender-based discrimination.

2. THESIS RATIONALE

Available scientific evidence shows that the lesbian, gay and bisexual (LGB) persons have worse mental and physical health than their heterosexual peers. However, there are still very few studies assessing the impact of sexual orientation on such a comprehensive outcome as health-related quality of life (HRQL), and they showed contradictory results. Studies on health inequalities by sexual orientation, usually based on health surveys, have been carried out in Western and Northern European countries (the Netherlands, the United Kingdom, France, Sweden and Iceland), the United States and Australia, but there is hardly any data available in Eastern and Southern European countries, except a single cross-sectional study in Serbia.

Around the world, approximately 234,000 million adults (using 3% as the relative number of LGB persons in the whole population, though most recent studies place the number at 3-5%) identify as being lesbian, gay or bisexual. They have a higher risk for physical and mental chronic conditions, and are more likely to present risky behaviors due to LGB stigma and discrimination. This unfavorable health situation has been observed in Western countries, where a small percentage of the worldwide population lives, the views of homosexuality are particularly positive and legal situation is favorable. However, most of the estimated 234,000 LGB million persons around the world live in countries with high levels of discrimination.

There is initial scientific evidence on the impact of LGB discrimination on health and health-related behaviors. In communities with high levels of homosexual prejudice, life-expectancy reduction for LGB population is greater than most well-known health risk factors. Discrimination based on sexual orientation is therefore a risk factor that is associated with excess mortality and morbidity.

Although some studies have evaluated discrimination reported by LGB persons in health surveys, none of them have evaluated the effect of discrimination based on sexual orientation as a mediator in the production of inequalities in HRQL: When a person perceives that one of their social identities is discriminated, feelings of anguish and stress that are generated may create negative health effects.

Given this public health problem, the purpose of this thesis is to assess the health inequalities between LGB persons and heterosexual ones; to analyze the extent to which

sociodemographic characteristics, health-related behaviors, and chronic conditions could explain such inequalities, and to understand if they are sexual orientation-based inequities.

Since our hypothesis is that discrimination based on sexual orientation is the main factor in producing health inequalities due to sexual orientation, we will also focus on evaluating the effect of discrimination on HRQL, mental health and health-related behaviors.

The knowledge of inequities and their underlying mechanisms is fundamental to create and implement policies that could improve LGB health, and reduce the health gap for this vulnerable population.

3. OBJECTIVES OF THE DOCTORAL THESIS

GENERAL OBJECTIVE

To evaluate the health inequalities by sexual orientation and to explore their association with discrimination, health-related behaviors, chronic conditions, and socio-demographic characteristics.

METHODOLOGICAL OBJECTIVE

1. Head-to-head comparison to assess to what extent expanding the number of levels in the EQ-5D from three to five has improved discriminatory power and validity to measure health-related quality of life in the general population.

SPECIFIC OBJECTIVES

2. To assess health-related quality of life inequalities between lesbian, gay, and bisexual persons and heterosexuals in the 2011 Barcelona population, to describe the extent to which sociodemographic characteristics, health-related behaviors, and chronic conditions could explain such inequalities, and to understand if they are sexual orientation inequities.

3. To assess health inequalities by sexual attraction in the 2016-2017 Barcelona population in order to examine the evolution since 2011.

4. To assess differences between gay and bisexual men in enacted stigma, and how the association between stigma and depressive symptoms may vary according to sexual orientation identity, using data collected in Baltimore in 2011 and 2014.

4. HYPOTHESES

The following hypotheses correspond to the methodological and specific objectives above:

1. Our hypothesis is that the new EQ-5D version, developed by the EuroQol Research Foundation by increasing the number of response options from three (EQ-5D-3L) to five levels (EQ-5D-5L), reduces its ceiling effects, and improves its discriminative capacity and validity to measure health-related quality of life in the general population.
- 2.1 We hypothesize worse health-related quality of life in lesbian, gay and bisexual persons than their heterosexual counterparts in the 2011 Barcelona population. Health determinants such as age, education level, country of birth, partnership status, and social support can be potential confounders when assessing health inequalities by sexual orientation. Furthermore, age and gender can modify the effect of sexual orientation in health.
- 2.2 Despite the favorable social climate of Barcelona in 2011 toward sexual minorities in the world, our hypothesis is that discrimination by sexual orientation may lead to increased vulnerabilities, such as distress and worse health-related behaviors, which result in higher prevalence of chronic conditions and, finally, worse health-related quality of life.
3. We hypothesize that health inequities by sexual orientation have been reduced in Barcelona from 2011 to 2016, but this reduction could be attenuated by social backlash reacting to the higher visibility of LGB population.

4. We hypothesize that sexual orientation-related identity can affect stigma experiences and modify their effect on depressive symptoms, producing different patterns for gay and bisexual men in Baltimore in 2011 and 2014.

Our specific hypotheses were:

- 4.1 Higher prevalence of depressive symptoms in men reporting more sexual orientation-related enacted stigma experiences.
- 4.2 Race/ethnicity may modify the association of sexual orientation-related stigma with mental health; stigma and other minority stressors are within general environmental circumstances.
- 4.3 Differences in socioeconomic status between bisexual and gay men may confound the association between stigma and depressive symptoms.
- 4.4 Being open about one's sexual orientation and being in a relationship can have negative consequences for bisexual persons in ways that differ from gay or heterosexual men, thus modifying the impact of stigma on depressive symptoms.

5. PUBLICATIONS

5.1 ARTICLE 1

Marti-Pastor M, Pont A, Ávila M, Garin O, Vilagut G, Forero CG, Pardo Y, Tresserras R, Medina-Bustos A, Garcia-Codina O, Cabasés J, Rajmil L, Alonso J, Ferrer M. *Head-to-head comparison between the EQ-5D-5L and the EQ-5D-3L in general population health surveys*. Popul Health Metr. 2018 Aug 16;16(1):14.


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RESEARCH

Open Access



Head-to-head comparison between the EQ-5D-5L and the EQ-5D-3L in general population health surveys

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Abstract

Background: The EQ-5D has been frequently used in national health surveys. This study is a head-to-head comparison to assess how expanding the number of levels from three (EQ-5D-3L) to five in the new EQ-5D-5L version has improved its distribution, discriminatory power, and validity in the general population.

Methods: A representative sample ($N = 7554$) from the Catalan Health Interview Survey 2011–2012, aged ≥ 18 , answered both EQ-5D versions, and we evaluated the response redistribution and inconsistencies between them. To assess validity of this redistribution, we calculated the mean of the Visual Analogue Scale (VAS), which measures perceived health. The discriminatory power was examined with Shannon Indices, calculated for each dimension separately. Spanish preference value sets were applied to obtain utility indices, examining their distribution with statistics of central tendency and dispersion. We estimated the proportion of individuals reporting the best health state in EQ-5D-5L and EQ-5D-3L within groups of specific chronic conditions and their VAS mean.

Results: A very small reduction in the percentage of individuals with the best health state was observed, from 61.8% in EQ-5D-3L to 60.8% in EQ-5D-5L. In contrast, a large proportion of individuals reporting extreme problems in the 3 L version moved to severe problems (level 4) in the 5 L version, particularly for pain/discomfort (75.5%) and anxiety/depression (66.4%). The average proportion of inconsistencies was 0.9%. The pattern of the perceived health VAS mean confirmed the hypothesis established a priori, supporting the validity of the observed redistribution. Shannon index showed that absolute informativity was higher in the 5 L version for all dimensions. The means (SD) of the Spanish EQ-5D-3L and EQ-5D-5L indices were 0.87 (0.25) and 0.89 (0.22). The proportion of individuals with the best health state within each specific chronic condition was very similar, regardless of the EQ-5D version ($\leq 30\%$ in half of the 28 chronic conditions).

Conclusion: Although the proportion of individuals with the best possible health state is still very high, our findings support that the increase of levels provided by the EQ-5D-5L contributed to the validity and discriminatory power of this new version to measure health in general population, as in the national health surveys.

Keywords: Quality of life, Health survey, Validity and reliability, Perceived health

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Background

Health-related quality of life has been gaining importance in research, clinical practice and health planning [1, 2] by providing complementary information to health indicators based on morbidity and mortality. This is especially relevant to describe health in developed countries, where life expectancy has been increasing steadily after their epidemiological transition. Evaluating the general population's health is one of the specific applications proposed for health-related quality of life instruments [3].

The EQ-5D has been frequently selected for national health surveys [4–10], given its low respondent burden and its consistently proven metric properties [6, 11, 12]. However, the high percentage of individuals with the best health state in the EQ-5D [13, 14] has been repeatedly highlighted as a limitation, since this may reduce its capacity to discriminate within good health [6, 15, 16], and its responsiveness in some health areas [17–19]. The traditional EQ-5D descriptive system, composed of five dimensions (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression) with three levels of severity, defines 243 distinct health states [20] resulting from all the possible combinations (i.e., 3^5). This is a very low number compared with other instruments, such as the Health Utilities Index [21] with 972,000 or the SF-6D [22] with 18,000 possible combinations.

To improve its discriminative capacity and sensitivity to change, and to reduce ceiling effects, the EuroQol Research Foundation decided to develop a new EQ-5D version increasing the number of response options from three (EQ-5D-3L) to five levels (EQ-5D-5L), resulting in 3125 health states (i.e., 5^5). Face and content validity of the new EQ-5D-5L were demonstrated for both the English and Spanish versions through focus group research [23]. Studies performed in cancer [24, 25], hepatitis B [26], or hip arthroplasty [27] patients showed improvements for discriminative capacity [24, 26], construct validity [24–26], and responsiveness, without diminishing its reliability [25], as well as a large decrease in the percentage of individuals with the best health state.

Given the recent development of the EQ-5D-5L, there are still few head-to-head studies in general population comparing its metric properties with the traditional 3 L version. Studies carried out in South Korea [28], Alberta (Canada) [29], England [30] and Lombardy (Italy) [31], mainly based on national health surveys, examined both versions of EQ-5D in general population. Yet the South Korean study published in 2013 [28] was performed only in a small sample ($n = 600$), neither the Canadian [29] nor the English health surveys [30] administered both versions together, while the Italian survey did, but without comparing them. The decrease in the percentage of individuals with the best health state varied in these studies, from 42.1 to 32.3% in Alberta [29], from 56.2 to 47.6% in

England [30], from 43.9 to 38% in Lombardy [31], and from 65.7 to 61.2% in South Korea [28]. The aim of this study is a head-to-head comparison to assess to what extent expanding the number of levels in the EQ-5D from three to five has improved its distribution, discriminatory power, and validity in the general population.

Methods

Study population

Data used in this study came from the Catalan Health Interview Survey (CHIS), a continuous cross-sectional study carried out since 2010 in Catalonia [32], an Autonomous Community in the northeast of Spain with about seven million inhabitants. A representative sample of Catalonia's non-institutionalized population, without any age limit, is surveyed through computer-assisted personal interviews administered by an accredited team of interviewers in the respondent's home. The CHIS was approved by the Consultants' Committee of Confidential Information Management at the Catalan Health Department, according to the 2000 revision of the Helsinki Declaration.

Information collection is based on an uninterrupted random sampling strategy divided into waves with 6 months of duration. Each wave has an independent subsample of around 2500 individuals of all ages (representative of the Autonomous Community population), and a complete cycle is composed of eight waves with around 20,000 participants interviewed over 4 years (representative of the healthcare-governing districts).

Study design

The CHIS complex sampling process was designed to ensure the territorial representativeness of the sample in every wave, taking into account the distribution of the Catalan population. In a first stage, health care-governing districts were systematically selected. At a second stage, municipalities were chosen at random after stratifying by number of inhabitants. In a third stage, participants from each municipality were selected by simple random sampling from the Catalan census register, after stratifying by age and gender.

The two EQ-5D versions (3 L and 5 L) were included in four waves (2nd to 5th) of the CHIS, conducted from January 2011 to December 2012 ($N = 9658$). Both versions of EQ-5D were face-to-face, computer-assisted interviews, always administered in the same order: first the EQ-5D-3L and next the EQ-5D-5L, followed by the visual analogue scale. Furthermore, to assess the effect of administering the two versions of EQ-5D together, we used data from the 6th wave (the first one where EQ-5D-5L was administered alone) to compare with the 5th wave (the last one where the two EQ-5D versions were administered together).

To correct the effect of non-response, 49% of selected sampling units needed to be replaced by others with the

same characteristics in terms of age group, sex, and neighborhood. Reasons for replacement were: refusal to participate (25.9%), change of address (34.7%), prolonged absence (17.8%), inaccessible dwelling (12.6%), wrong address (4.0%), language skills (0.6%), death (1.4%), or other reasons (3.0%).

Study variables

The EQ-5D is a generic, multi-attribute health status measure composed of a descriptive system, and a visual analogue scale (VAS) asking individuals to rate their own health from 0 to 100 (the worst and best imaginable health, respectively). The descriptive system covers five dimensions of health, and response options include three or five levels of severity according to the version. In general, the grading terms for level 1 (no problems), and 5 (extreme problems/unable to) on the EQ-5D-5L are consistent with the extreme levels of the EQ-5D-3L, except for “confined to bed” (EQ-5D-3L) vs. “unable to walk about” (EQ-5D-5L). Label description on EQ-5D-5L is “slight” for level 2 and “severe” for level 4 (except for anxiety/depression, with “slightly” and “severely”). The Spanish value set of preferences elicited with Time Trade Off (TTO) was applied to construct the EQ-5D-3L index [33], while the EQ-5D-5L index was calculated with the crosswalk 3 L–5 L value set [34], derived from the original EQ-5D-3L preference weights [33]. This crosswalk 3 L–5 L value set was obtained using a non-parametric indirect model [34] to generate values for the 5 L by estimating the probabilities of being in each of the 3 L levels. Thus, the theoretical ranges of the EQ-5D-5L index calculated with the crosswalk value set matched exactly with the 3 L index: from 1 (the best health state) to –0.65 (negative values in health states valued as worse than death), where 0 is equal to death.

Sociodemographic variables recorded in the survey included gender, age, level of education, and social class. Social class was assigned according to the respondent’s most recent occupation (or the head of the household’s occupation in the case of those who were looking after the home), using an adapted version of the British Registrar General Social Classes: classes I and II (managerial and freelance professionals), class III (skilled non-manual occupations), class IV (skilled manual workers), and class V (non-skilled manual workers) [35].

Health indicators collected in the CHIS included general perceived health (rated as excellent, very good, good, fair or poor), limitation of daily activities due to any health problem during the previous 6 months, and a checklist of 28 common chronic conditions. Respondents were asked, “Do you suffer from or have you suffered from any of the following chronic conditions?” and had to answer “Yes” or “No” for each condition. A summary indicator was derived from the checklist, based on the number of reported chronic conditions. This discrete variable was categorized

according to sample distribution into five groups: none, 1, 2, 3–4, and 5 or more chronic conditions.

Statistical analysis

The sample size of CHIS allows calculating the proportion of individuals with the best health state among those reporting stroke (the least prevalent condition among the Catalan population) for an estimated percentage of 20% with a 95% confidence interval of ± 5 .

To restore the representativeness of the Catalan population, taking into account the complex sampling process followed (considering age, gender, and municipality), a weighting factor was applied. In addition, design-based standard errors and significance tests were estimated with the Taylor series linearization method implemented in SAS software, which account for the correlation structure among individuals induced by the stratified and clustered sampling design [36]. In order to determine the effect of the sampling in the estimations, the design effects were obtained as the ratio between two variances: the variance of the estimator under the actual sample design to that under simple random sampling of the same size.

Sample characteristics were described by calculating unweighted frequencies and weighted percentages. To evaluate the response redistribution between the classical EQ-5D and the new five level version, we first calculated weighted percentages in each level of the EQ-5D-5L after stratifying by responses to the EQ-5D-3L and, second, we assessed the inconsistencies according to the method described by Janssen et al. [37]. Briefly, from the 15 potential 3 L–5 L response pairs in each dimension, those skipping the adjacent categories of the 5 L were defined as inconsistencies. To assess validity of the response redistribution between three and five levels, we calculated the mean of the perceived health VAS in each of these 15 subgroups of potential pairs. Our hypothesis is that, except for inconsistencies, the perceived health (VAS) in subgroups of individuals selecting an EQ-5D-5L category with more severe problems is worse than in subgroups remaining in the same category of response to the EQ-5D-3L (or vice versa, better perceived health in milder problems).

The discriminatory power was examined with Shannon Indices, which were calculated for each dimension separately. The Shannon index is defined as:

$$H' = - \sum_{i=1}^L p_i \log_2 p_i$$

where H' represents the absolute amount of informativity captured, L is the number of levels, and $p_i = n_i/N$, the proportion of observations in the i th level ($i = 1, \dots, L$), n_i being the observed number of responses in level i and N the total sample size [38]. H' reaches its maximum (H'_{\max}) when distribution is uniform (rectangular) and it

equals to $\log_2 L$. Shannon's Evenness index ($J' = H'/H'\max$) reflects the evenness (spread) of a distribution, regardless of the number of levels. The 95% confidence intervals were calculated according to the variance of the Shannon index:

$$\text{var } H' = \frac{\sum_{i=1}^L p_i (\log_2 p_i)^2 - (\sum_{i=1}^L p_i \log_2 p_i)^2}{N}$$

As previously reported [37, 39, 40], we hypothesized that the 5 L has more discriminatory power (larger H' values) than the 3 L version, but lower Shannon Evenness index J' , reflecting that populations need a larger spread to cover five levels than for three. Therefore, we expected the H' to increase (higher absolute levels of information) and J' to stay equal or marginally decrease in the 5 L version.

A plot between EQ-5D-3L index (y -axis) and EQ-5D-5L index (x -axis) was constructed to graphically compare the distribution of both indices. We also calculated the statistics describing the distribution of EQ-5D indices: the theoretical and observed ranges, the weighted proportion and 95% confidence intervals (95% CI) of individuals with the best and worst health state, and parameters of central tendency and dispersion. Furthermore, a sensitivity analysis was performed to examine the consistency of results when the EQ-5D-5L index is estimated with 3 L–5 L crosswalk value set or with the newly developed Spanish value set obtained through a common composite method of TTO and discrete choice experiments (DCE) [41]. We calculated the statistics describing the distribution of the EQ-5D-5L index constructed with this value set in the entire sample; as well as after excluding participants with negative values in any index, because the theoretical range of this new EQ-5D-5L index (−0.416 to 1) was not exactly coincident with the EQ-5D-3L index (−0.653 to 1) for values < 0.

To explore the distribution of EQ-5D indices in persons with chronic conditions, the weighted proportion (95% CI) of individuals reporting the best possible health state (11111) in EQ-5D-3L and EQ-5D-5L within each of the 28 specific chronic conditions' groups was estimated. Furthermore, the mean (95% CI) of the perceived health VAS for this subgroup of individuals reporting the best possible health state within each specific chronic condition was calculated. Since we expected a lower proportion of individuals reporting the best health state (11111) with EQ-5D-5L than with EQ-5D-3L, we hypothesized a better perceived health (VAS) when this subgroup of individuals is defined by the EQ-5D-5L.

Finally, to assess the effect of administering the EQ-5D-5L after the 3 L version, we compared the responses to the dimensions in the EQ-5D-5L between the samples of the 5th (3 L and 5 L versions administered together) and 6th waves (EQ-5D-5L administered alone) using a Chi-squared test.

Results

Of the 9658 participants in the CHIS between January 2011 and December 2012, 7554 individuals aged 18 to 102 years old were analyzed after excluding 2104 people younger than 18. Mean age of participants was 47.1 (SD = 18.9), and 50.9% were female (Table 1). More than half had completed secondary studies, 40% belonged to social class IV, and 48.5% suffered three or more chronic conditions. Only 15% of the individuals reported some limitation of activities in the previous 6 months, and 34.3% claimed to have either excellent or very good perceived health (Table 1).

Cross tabulations of responses to both EQ-5D versions (Table 2) showed that most of the participants reporting no problems in the 3L version remained at Level 1 in the 5L version, and only 1–2% moved to slight problems. In contrast, a large proportion of individuals reporting extreme problems in the 3L version had moved to severe problems (Level 4) in the 5L version. This proportion was particularly marked for pain/discomfort (75.5%) and anxiety/depression (66.4%). Grey cells show the pairs previously defined as inconsistencies. The number of inconsistencies was highest in the pain/discomfort domain ($n = 189$; 2.4%) and lowest in the self-care one ($n = 54$; 0.6%). The average proportion of inconsistencies by dimension was 0.9%.

Regarding the validity of the redistribution between three and five levels, the mean of the perceived health VAS was over 75 in the subgroup of individuals reporting no problems in both versions for all dimensions (range 75.4–79.7). Confirming the hypothesis established a priori, the perceived health VAS mean in subgroups of individuals selecting an EQ-5D-5L category of more severe problems is worse than in those remaining in the same category as in the EQ-5D-3L. Similarly, those moving to milder problems in the EQ-5D-5L presented better perceived health. For example, in the last row of Table 2 (extremely anxious or depressed in the EQ-5D-3L), the 66.4% who moved to a milder level in the 5 L (severe problems) presented better perceived health than those who remained at the extreme level (11.5%); mean VAS of 41.7 vs. 29.5.

Figure 1 shows Shannon indices of EQ-5D-3L and EQ-5D-5L. The maximum information captured by the system ($H'\max$ in light bars), and also the absolute informativity (H' in dark bars) is higher in 5 L than in 3 L version. However, when H' is compared with the $H'\max$, the relative information area captured (J') is significantly lower in EQ-5D-5L than in 3 L for all dimensions except self-care. This difference is especially marked in pain/discomfort ($J' = 0.59$ vs. 0.68) and anxiety/depression ($J' = 0.42$ vs. 0.50).

Figure 2 shows the plot between EQ-5D-3L and EQ-5D-5L indices. The cloud of points and the biggest clusters of individuals were concentrated around the perfect agreement diagonal, indicating a high correlation

Table 1 Sample characteristics of the Catalan Health Interview Survey (2011–2012)

| | <i>n</i> (%) Unweighted | <i>n</i> (%) Weighted | SE ^a | Design effect |
|--|-------------------------|-----------------------|-----------------|---------------|
| Gender | | | | |
| Male | 3791 (50.2%) | 3877 (49.1%) | 0.20 | 0.19 |
| Female | 3763 (49.8%) | 4014 (50.9%) | 0.20 | 0.19 |
| Age group | | | | |
| 18–44 years | 3527 (46.7%) | 3801 (48.2%) | 0.45 | 0.62 |
| 45–64 years | 2259 (29.9%) | 2436 (30.9%) | 0.76 | 2.08 |
| 65–74 years | 753 (10.0%) | 784 (9.9%) | 0.33 | 0.92 |
| 75 years and over | 1015 (13.4%) | 870 (11.0%) | 0.29 | 0.53 |
| Studies level | | | | |
| Primary or less | 2015 (26.7%) | 1993 (25.3%) | 2.19 | 18.52 |
| Secondary | 4179 (55.4%) | 4345 (55.1%) | 1.65 | 8.31 |
| University or more | 1356 (18.0%) | 1548 (19.6%) | 3.44 | 60.70 |
| Social class | | | | |
| I-II (managerial and free-lance professionals) | 1312 (18.0%) | 1485 (19.5%) | 2.83 | 40.90 |
| III (skilled non-manual occupations) | 2226 (30.6%) | 2390 (31.3%) | 2.36 | 19.84 |
| IV (skilled manual workers) | 3067 (42.2%) | 3052 (40.0%) | 4.71 | 68.95 |
| V (non-skilled manual workers) | 671 (9.2%) | 701 (9.2%) | 0.59 | 3.18 |
| Perceived health | | | | |
| Excellent | 564 (7.5%) | 636 (8.1%) | 0.82 | 7.41 |
| Very good | 1895 (25.1%) | 2067 (26.2%) | 1.64 | 10.84 |
| Good | 3388 (44.9%) | 3452 (43.7%) | 2.08 | 13.25 |
| Fair | 1356 (18.0%) | 1374 (17.4%) | 0.48 | 1.20 |
| Poor | 351 (4.7%) | 362 (4.6%) | 0.41 | 2.82 |
| Activity limitation | | | | |
| Yes, seriously affected | 398 (5.3%) | 397 (5.0%) | 0.33 | 1.60 |
| Yes, limited but not seriously | 762 (10.1%) | 786 (10.0%) | 0.63 | 3.33 |
| No | 6394 (84.6%) | 6708 (85.0%) | 0.85 | 4.19 |
| Number of chronic physical conditions | | | | |
| None | 1690 (22.4%) | 1783 (22.6%) | 1.60 | 11.21 |
| 1 condition | 1183 (15.7%) | 1256 (15.9%) | 0.55 | 1.75 |
| 2 conditions | 981 (13.0%) | 1017 (12.9%) | 0.50 | 1.66 |
| 3 or 4 conditions | 1432 (19.0%) | 1526 (19.3%) | 0.47 | 1.07 |
| 5 or more conditions | 2268 (30.0%) | 2308 (29.2%) | 1.36 | 6.68 |
| VAS (mean, SD) | 7554 | 73.19 (19.21) | 0.42 | 5.21 |

^aStandard error was estimated by the Taylor series method

between both indices. A slight deviation to higher values with the EQ-5D-5L than the EQ-5D-3L is also observable.

Table 3 shows the statistics describing distribution of the EQ-5D indices. Ranges observed in our sample matched exactly with the theoretical ranges (from −0.65 to 1). The proportion of individuals with the worst health state was negligible (< 0.15%), while the proportion with the best health state was 61.8% with EQ-5D-3L and 60.8% with EQ-5D-5L. Means (SD) were 0.87 (0.25) and 0.89

(0.22) for EQ-5D-3L and EQ-5D-5L. Sensitivity analysis performed with the EQ-5D-5L index constructed with the newly developed Spanish value set [41] (see Additional file 1) showed consistent results: mean 0.90 (SD = 0.19) in the entire sample, and mean 0.92 (SD = 0.14) after excluding the 249 subjects with negative values. Differences between EQ-5D-3L and EQ-5D-5L indices remained quite stable regardless the value set used.

Figure 3 shows results by each specific chronic condition: the proportion of individuals with the best

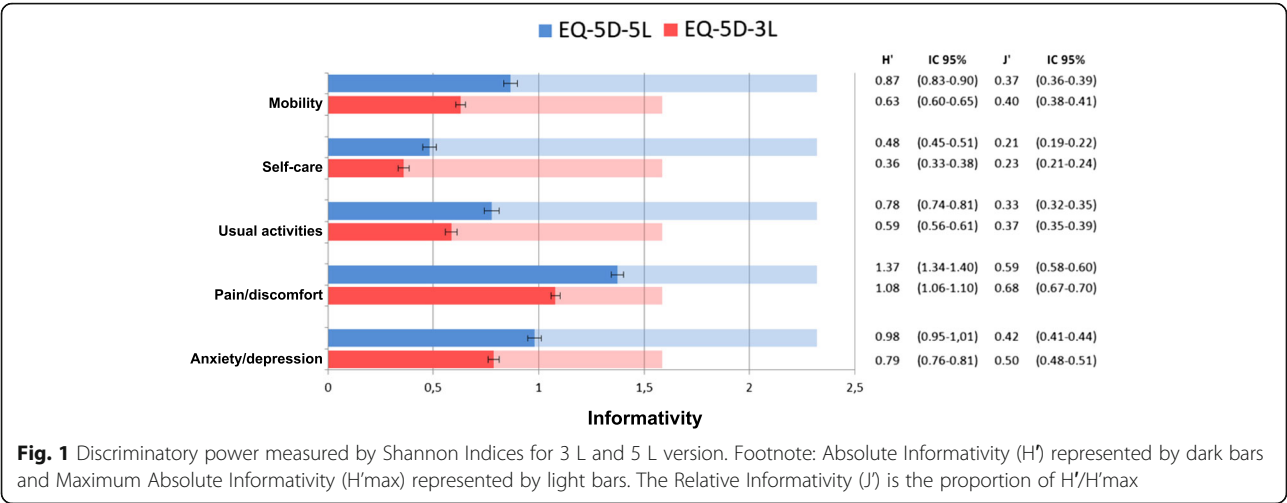
Table 2 Comparison between EQ-5D-5L and EQ-5D-3L responses, and mean of perceived health VAS

| EQ-5D-3L | EQ-5D-5L | | | | |
|--|-----------------------------------|----------------------------------|------------------------------------|----------------------------------|-----------------------------------|
| | No problems 1 | Slight problems 2 | Moderate problems 3 | Severe problems 4 | Unable/ extreme 5 |
| Mobility | | | | | |
| No problems in walking about (n = 6390) | 6287 (98.6%) [77.4] | 86 (1.2%) [58.5] | 16 (0.2%) [53.5] | 1 (0.0%) [15.0] | 0 (0.0%) - |
| Some problems in walking about (n = 1104) | 36 (3.2%) [60.7] | 392 (34.8%) [57.0] | 436 (41.1%) [48.9] | 221 (19.8%) [38.2] | 19 (1.1%) [52.2] |
| Confined to bed (n = 60) | 3 (4.4%) [74.5] | 1 (0.2%) [40.0] | 3 (7.9%) [37.3] | 15 (26.5%) [35.2] | 38 (60.9%) [35.5] |
| Self-care | | | | | |
| No problems with self-care (n = 7057) | 6956 (98.6%) [75.4] | 88 (1.2%) [46.8] | 12 (0.2%) [32.5] | 1 (0.0%) [40.0] | (0.0%) - |
| Some problems washing or dressing myself (n = 345) | 27 (6.3%) [61.8] | 109 (29.1%) [49.9] | 154 (48.9%) [43.7] | 51 (14.9%) [30.6] | 4 (0.8%) [24.9] |
| Unable to wash or dress myself (n = 152) | 2 (1.5%) [76.9] | 3 (1.7%) [52.3] | 5 (3.6%) [55.4] | 29 (18.4%) [44.7] | 113 (74.9%) [36.5] |
| Usual activities | | | | | |
| No problems with performing my usual activities (n = 6677) | 6526 (97.8%) [77.0] | 105 (1.6%) [58.2] | 37 (0.5%) [56.5] | 8 (0.1%) [36.3] | 1 (0.0%) [70.0] |
| Some problems with performing my usual activities (n = 600) | 31 (4.3%) [59.0] | 197 (31.3%) [53.8] | 269 (46.3%) [46.0] | 92 (16.3%) [40.0] | 11 (1.7%) [47.1] |
| Unable to perform my usual activities (n = 277) | 1 (0.6%) [70.0] | 2 (0.5%) [69.1] | 20 (7.7%) [48.8] | 81 (30.0%) [42.2] | 173 (61.3%) [35.0] |
| Pain/discomfort | | | | | |
| No pain or discomfort (n = 5275) | 5124 (97.3%) [79.7] | 113 (2.0%) [68.1] | 34 (0.6%) [65.5] | 4 (0.1%) [65.9] | 0 (0%) - |
| Moderate pain or discomfort (n = 1846) | 73 (3.7%) [68.7] | 790 (41.9%) [67.6] | 875 (47.9%) [59.4] | 107 (6.6%) [49.4] | 1 (0.0%) [40.0] |
| Extreme pain or discomfort (n = 433) | 0 (0%) - | 7 (1.8%) [55.8] | 70 (15.7%) [47.9] | 324 (75.5%) [40.1] | 32 (7.0%) [34.2] |
| Anxiety/depression | | | | | |
| Not anxious or depressed (n = 6226) | 6098 (98.1%) [77.4] | 100 (1.5%) [61.0] | 21 (0.3%) [65.8] | 6 (0.0%) [43.9] | 1 (0.0%) [50.0] |
| Moderately anxious or depressed (n = 1111) | 52 (4.5%) [58.0] | 526 (47.0%) [62.1] | 474 (43.6%) [54.8] | 56 (4.6%) [46.1] | 3 (0.3%) [22.3] |
| Extremely anxious or depressed (n = 217) | 3 (1.5%) [49.6] | 6 (2.4%) [51.5] | 37 (18.2%) [46.5] | 147 (66.4%) [41.7] | 24 (11.5%) [29.5] |

N unweighted, (weighted % by response to EQ-5D-3L) and [mean VAS]. Inconsistencies are marked in bold

health state (11111) in the EQ-5D-3L (blue bars) and EQ-5D-5L (green bars), and also the mean (95% CI) of perceived health VAS in subgroups with and without the best health state. In both indices, chronic allergies presented the highest proportion of subjects with the best health state (50.6 and 50.1%), and urinary incontinence the lowest (13.1 and 12.0%). Regardless of the index used, the proportion of individuals with the best health state was $\leq 30\%$ in half of the chronic conditions from the checklist (cervical pain, tumors, arthrosis, arthritis or rheumatism, peptic ulcer, poor circulation, other health illnesses, cataracts, myocardial infarction, chronic

constipation, anxiety or depression, other mental disorders, stroke, osteoporosis, and urinary incontinence). The mean of the VAS for the subgroup with the best possible health state defined by EQ-5D-3L and EQ-5D-5L (in dark blue and green lines, respectively) was over 70 within all specific chronic condition groups, ranging 71.3–79.8 and 72.6–81.3, respectively. Perceived health VAS means in the subgroups defined by the EQ-5D-3L were very similar to those obtained in the subgroups defined by EQ-5D-5L. For the subgroup with some health problem (not 11111), mean of VAS was always lower than 60 (light blue and green lines).



Discussion

This head-to-head comparison of EQ-5D-5L with EQ-5D-3L in the general population of Catalonia shows that redistribution of levels is mostly in individuals reporting extreme problems on the EQ-5D-3L, which moved to level 4 on the EQ-5D-5L, but not for those reporting no problem, who remained at the top. This explains the very small reduction in the percentage of individuals with the best health state, from 61.8% with EQ-5D-3L to 60.8% with EQ-5D-5L, and the increment of the index mean (from 0.87 to 0.89) in our sample.

One of the original contributions of this study is that, as far as we are aware, this is the first time that distribution and validity of the EQ-5D-5L have been compared head-to-head to those of the EQ-5D-3L in a health survey on general population.

In the Lombardy study both versions were also administered, but they were not compared since the publication was focused on reference norms [31].

Our study has some limitations. Firstly, the two versions of the EQ-5D were always administered in the same order: first the 3 L and then the 5 L. This proximity might have affected the EQ-5D-5L, which was always administered second. However, the comparison with the 6th wave (see Additional file 2), where only the EQ-5D-5L was administered, showed no differences in EQ-5D-5L dimensions, except for pain/discomfort (72.4% versus 67.6% of individuals reporting no problem, $p = 0.003$). This finding indicates that the fact of administering the two versions together did not modify the response to the EQ-5D-5L when administered alone (as in the 6th wave). Furthermore, results from the 2011 National Health Survey of

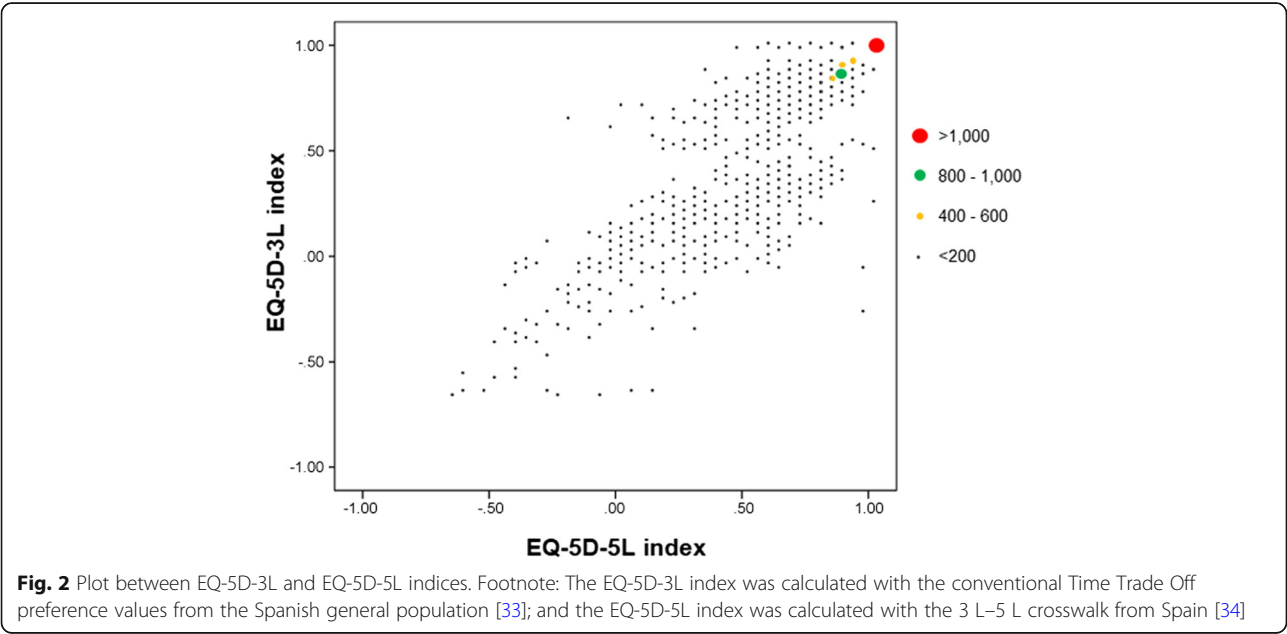


Table 3 Distribution of the EQ-5D-3L and EQ-5D-5L indices (total sample and positive values subsample^a)

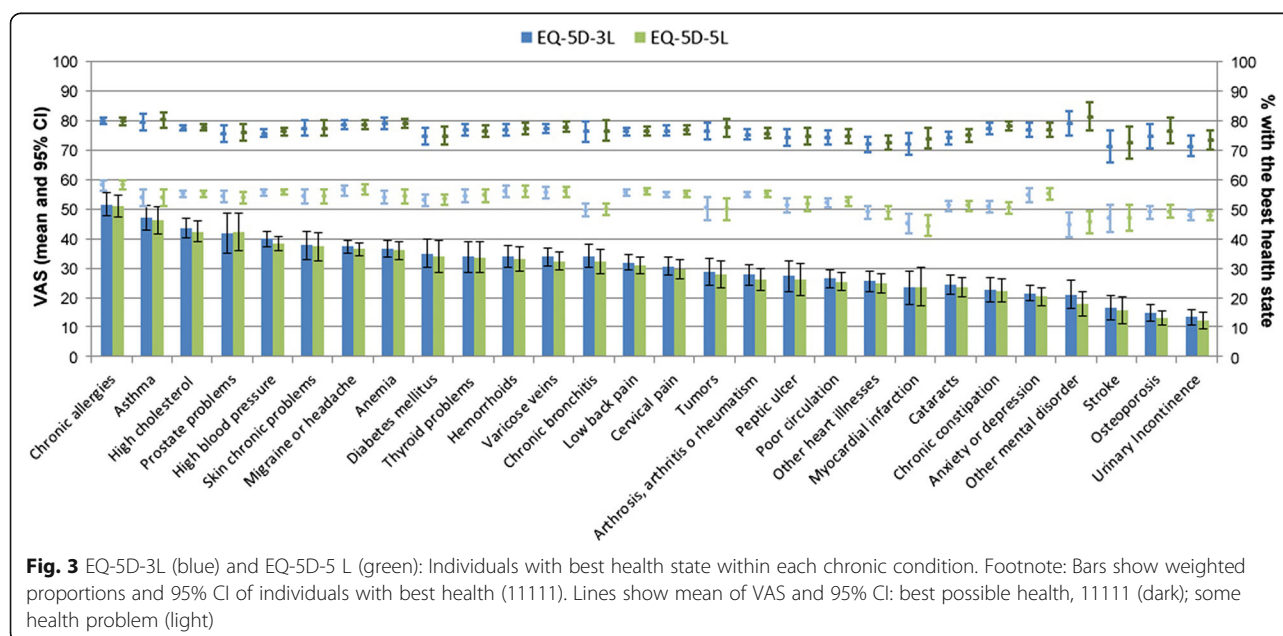
| | EQ-5D-3L | EQ-5D-5L |
|------------------------------------|------------------------------|------------------------------|
| Total sample | N = 7554 | N = 7554 |
| Theoretical range | −0.653, 1 | −0.654, 1 |
| Observed range | −0.653, 1 | −0.654, 1 |
| % with worst health state (95% CI) | 0.14% (0.04, 0.24) | 0.03% (0, 0.08) |
| % with best health (95% CI) | 61.82% (59.38, 64.26) | 60.82% (58.36, 63.28) |
| Mean, SD (95% CI) | 0.87, SD = 0.25 (0.86, 0.88) | 0.89, SD = 0.22 (0.88, 0.90) |
| Median [IQR] | 0.93 [0.87, 0.96] | 0.94 [0.88, 0.97] |

^aAfter excluding participants with negative values in any index. The EQ-5D-3L index was calculated with the conventional Time Trade Off preference values from the Spanish general population [33]; and the EQ-5D-5L index was calculated with the 3 L–5 L crosswalk from Spain [34].

Spain (62.4% of individuals with the best health state) where only the 5 L version was administered [42] also support our EQ-5D-5 L findings in Catalonia. Secondly, an interviewer bias may have played a role, and this could be differential for those dimensions where the wording of the response option had been modified in the EQ-5D-5L. For example, in the extreme of mobility (“confined to bed” for the EQ-5D-3L versus “unable to walk about” for the EQ-5D-5L), interviewers might have attenuated the severity. Finally, our sample is only representative of Catalonia. However, given the similarities in national indicators such as life expectancy or healthy life years in the general population of Catalonia, Spain, and other European regions [43], it is likely that our results will be generalizable to similar developed countries.

The small reduction observed in the percentage of individuals with the best health state, from 61.8% with EQ-5D-3L to 60.8% with EQ-5D-5L, is due to the negligible movement from level 1 out of 3 (“no problem”) to level 2 out of 5 (“slight problems”) in all dimensions. This absolute reduction of 1% (relative reduction of 1.6%) in the proportion of individuals with the best health state was lower than that reported in the population of South Korea and Lombardy (absolute reductions of 4.5, and 5.9%, respectively) [28, 31]. The Canadian and English studies [29, 30] reported greater differences of 9.8 and 8.6%; but as previously remarked, they were not head-to-head comparisons, so this could be explained by other reasons related to the study design, rather than to differences between EQ-5D versions.

This is the first time that redistribution of a large proportion of individuals from extreme to severe problems has been reported in a general population. Depending on the dimension, between 18.3 and 75.7% of individuals reporting extreme problems in the 3 L version moved to level 4 (severe problems) in the 5 L one. The better perceived health in this latter subgroup (VAS mean over 40 in most domains), compared with the subgroup remaining in extreme problems (VAS mean ranging from 29.5 in anxiety/depression to 36.5 in self-care), supports the validity of the redistribution phenomenon observed in the side of the EQ-5D descriptive system indicating poor health. This may indicate that the EQ-5D-5L can measure the health state of individuals with severe (but not extreme) health problems in the Catalan general population better than the EQ-5D-3L. This partly explains why the index mean of the new version was higher (0.89) than that obtained with the traditional version with three levels (0.87).



Due to its small sample size ($N = 600$), the South Korean study could not observe this redistribution because there were too few participants on level 3 of EQ-5D-3L (0–6 individuals) [28], while the Italian study did not assess the redistribution [31]. It is important to highlight the low average proportion of inconsistencies between both EQ-5D versions in our study (0.9%), which was comparable to the South Korean general population (1.1%) [28], and lower than that reported among patients with cancer (3.5%) [25] or with chronic conditions (2.9%) [39].

As expected, extending the EQ-5D descriptive system from three to five levels resulted in significantly higher absolute, but slightly lower relative (evenness) discriminatory power. J' values have also been found slightly lower in some dimensions of EQ-5D-5L in previous comparative studies [37, 39, 40]. The absolute and relative informativity of both EQ-5D versions in our study (0.36–1.37 and 0.21–0.68, respectively) were similar to those reported by Pattanaphesaj et al. [40] (0.12–1.40 and 0.08–0.63), but lower than those observed in others [37, 39]. The relatively good health of people from the Catalan general population could partly explain the lower absolute informativity observed in our study.

The difference observed between EQ-5D-3L and EQ-5D-5L indices for medians and means (SD) merits a comment. The EQ-5D-5L index presented a slightly higher median and mean, but a reduced SD compared with the EQ-5D-3L index. Since the crosswalk 3 L–5 L value set applied to calculate the EQ-5D-5L index had been derived from that originally developed for the 3 L version, these differences may be mainly explained by the increment in the number of levels. For this reason, it is recommendable that national health surveys using the EQ-5D-3L that decide to replace it with the EQ-5D-5L maintain both versions, at least in a random subsample, for a temporary period. Results in these subsamples will allow anchoring results of the two versions, in order to take into account the version effect and correctly monitor the evolution of health along time. Otherwise, changes observed when monitoring populations could be mistakenly attributed to health worsening/improvement instead of measurement differences between versions.

The most prevalent chronic conditions in this sample were low back pain (30%), arthrosis, arthritis or rheumatism (27.8%), and high blood pressure (25.6%), while stroke was the least prevalent with a rate of 2.4% (data not shown). Contrarily to the a priori hypothesis, both EQ-5D versions had an almost identical validity measuring health in individuals who self-reported chronic conditions and with the best health state. This unexpected result is probably explained by the very similar percentage of individuals with the best health state within each specific chronic condition, regardless of the EQ-5D version. Although larger reductions in this percentage were

reported in studies of specific conditions such as hepatitis B (21.6 to 16.7%) [26] and surgery patients (30 to 18%) [27], the decline observed in the groups with specific chronic conditions within our sample was $\leq 3\%$ in all cases. This difference could be due to self-reporting instead of clinical diagnoses.

Conclusions

The increase of levels provided by the EQ-5D-5L contributed to the validity and discriminatory power of this new version. The group of individuals with poor health was redistributed into different severity levels, while in the EQ-5D-3L they were stuck in the category of extreme problems. The proportion of individuals with the best health state is still very high in the EQ-5D-5L. Nonetheless, results of perceived health VAS support validity of the observed redistribution. Furthermore, consistency between both EQ-5D versions and with results from the 2011 Spanish National Health Survey enhance the reliability of responses from this subset of general population in good health.

Our findings support the validity and discriminatory power of the new EQ-5D-5L for health measurement of the general population. However, it would be advisable to maintain both versions in parallel for a temporary period when introducing the new EQ-5D-5L to a national health survey currently using the EQ-5D-3L version in order to establish an anchor.

Additional files

Additional file 1: Sensitivity analysis performed with the newly developed Spanish value set obtained through a common composite method of Time Trade Off (TTO) and discrete choice experiments (DCE): Distribution of the EQ-5D-3L and EQ-5D-5L indices (total sample and positive values subsample). (DOCX 15 kb)

Additional file 2: EQ-5D-5L comparison between 5th and 6th waves to assess effect of administering it after EQ-5D-3L. (DOCX 19 kb)

Abbreviations

CHIS: Catalan Health Interview Survey; IQR: Interquartile range; SD: Standard deviation; TTO: Time Trade Off

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Availability of data and materials

The Catalan Health Interview Survey is an official statistic in the current Statistical Plan of Catalonia which carries a guarantee of data confidentiality (Catalonia statistic law 23/1998, 30th December). The anonymous microdata of the Catalan Health Interview Survey can be requested for purposes of scientific research (contact e-mail: dgpr.salut@gencat.cat).

Transparency

The lead authors (MMP and MF) affirm that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.

Authors' contributions

MMP analysed and interpreted the data, drafted and critically revised the manuscript and did the statistical analysis. AP analyzed and interpreted the data, and did the statistical analysis. MA interpreted the data, and critically revised the manuscript. OG conceived and designed the study, interpreted the data, and critically revised the manuscript. GV analyzed and interpreted the data, and critically revised the manuscript. CGF interpreted the data, and critically revised the manuscript. YP interpreted the data, and critically revised the manuscript. RT interpreted the data and critically revised the manuscript. OGC interpreted the data and critically revised the manuscript. JC interpreted the data and critically revised the manuscript. LR interpreted the data and critically revised the manuscript. JA provided supervision, conceived and designed the study, interpreted the data, drafting, and critically revised the manuscript. MF obtained funding, provided supervision, conceived and designed the study, interpreted the data, drafting, and critically revised the manuscript. All authors read and approved the final manuscript.

Ethics approval and consent to participate

The Catalan Health interview survey was approved by the Consultants' Committee of Confidential Information Management (CATIC) from the Catalan Health Department, according to the 2000 revision of the Helsinki Declaration.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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5.2 ARTICLE 2

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RESEARCH ARTICLE

Health-related quality of life inequalities by sexual orientation: Results from the Barcelona Health Interview Survey

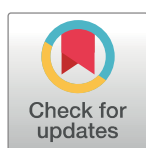
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Abstract

Background

Studies on health-related quality of life (HRQoL) inequalities according to sexual orientation are scarce. The aim of this study was to assess HRQoL inequalities between lesbian, gay, and bisexual (LGB) people and heterosexuals in the 2011 Barcelona population, to describe the extent to which sociodemographic characteristics, health-related behaviors, and chronic conditions could explain such inequalities, and to understand if they are sexual orientation inequities.

Methods

In the 2011 Barcelona Health Interview Survey 3277 adults answered the EQ-5D, which measures five dimensions of HRQoL summarized into a single utility index (1 = perfect health, 0 = death). To assess HRQoL differences by sexual orientation we constructed Tobit models for the EQ-5D index, and Poisson regression models for the EQ-5D dimensions. In both cases, nested models were constructed to assess the mediator role of selected variables.

Results

After adjusting by socio-demographic variables, the LGB group presented a significantly lower EQ-5D index than heterosexuals, and higher prevalence ratios of problems in physical EQ-5D dimensions among both genders: adjusted prevalence ratio (aPR) = 1.70 for mobility ($p = 0.046$) and 2.11 for usual activities ($p = 0.019$). Differences in mental dimensions were only observed among men: aPR = 3.15 for pain/discomfort ($p = 0.003$) and 2.49 for anxiety/

depression ($p = 0.030$). All these differences by sexual orientation disappeared after adding chronic conditions and health-related behaviors in the models.

Conclusion

The LGB population presented worse HRQoL than heterosexuals in the EQ-5D index and most dimensions. Chronic conditions, health-related behaviors and gender play a major role in explaining HRQoL differences by sexual orientation. These findings support the need of including sexual orientation into the global agenda of health inequities.

Introduction

Sexual orientation is a social determinant of health inequities which influences different morbidity and mortality outcomes [1,2]. Even in western countries, where progress in social rights has been large and rapidly implemented from the end of the 20th century, the lesbian, gay, and bisexual (LGB) population presented worse health than the heterosexual one [3–6]. Health inequalities among the LGB population have been reported for mental health [4,6,7], chronic conditions [3], and health-related behaviors [7,8]; but very few studies have assessed health-related quality of life (HRQoL) [3,4,6,9].

HRQoL is a broad and multidimensional concept which describes the physical, social, and psychological aspects of well-being and functioning [10]. It is considered an ultimate and comprehensive outcome on the conceptual model of health [11]. However, only two studies on sexual orientation inequalities have considered HRQoL as a whole [3, 9], while others [4,6] just included selected HRQoL dimensions. The California Quality of Life Survey [4] only reported the physical component of the Short Form-12 Health Survey (SF-12), and the combined meta-analysis of health surveys from United Kingdom (UK) only reported anxiety/depression from the EuroQol-5 Dimensions (EQ-5D) [6]. The Dutch National Survey of General Practice assessed both the physical and the mental health components covered by the Short Form-36 Health Survey (SF-36), [3] and the United States Growing Up Today Study [9] reported the EQ-5D index. A major feature of the EQ-5D instrument lies on its single index (based on societal preference utilities), which allows the calculation of quality-adjusted life years (QALYs) [12].

It is important to distinguish between inequality and inequity in health among population groups [13]. Inequity refers to inequalities which are avoidable and unfair, since they are consequence of the different opportunities and resources that people have due to their social position [14]. The aim of our study was to assess HRQoL inequalities between LGB and heterosexuals in the 2011 Barcelona population, to describe the extent to which sociodemographic characteristics, health-related behaviors, and chronic conditions could explain such inequalities, and to understand if they are sexual orientation inequities.

Following the structural framework proposed by Mule et al. [15], we hypothesize worse HRQoL in LGB than their heterosexual counterparts. Health determinants such as age, education level, country of birth, partnership status, and social support can be potential confounders when assessing health inequalities by sexual orientation [16]. Furthermore, age [17] and gender [4,18] can modify the effect of sexual orientation in health. Despite the favorable social climate of Barcelona toward sexual minorities in the world [19], our hypothesis is that discrimination by sexual orientation may lead to increased vulnerabilities, such as distress and

worse health-related behaviors, which result in higher prevalence of chronic conditions and, finally, worse HRQoL.

Material and methods

Study population

Data used in this study came from the Barcelona Health Interview Survey (BHIS) 2011 edition. It is a cross-sectional study periodically performed in Barcelona [20], a city in the north-east of Spain with about 1.5 million inhabitants. A representative sample of the non-institutionalized population, older than 15 years, was surveyed through computer-assisted personal interviews administered face to face by accredited interviewers in the respondent's home.

To ensure territorial representativeness, the sample was stratified by municipal districts. A random sampling strategy was applied, using a simple extraction system from the municipal census, between January 2011 and January 2012 taking into account gender and age distribution. The sample size was estimated at 4,000 individuals (relative error margin of 1.55% with a confidence level of 95.5%). The BHIS is an official statistical activity, and data confidentiality is guaranteed by the Spanish Law Number 23/1998.

Variables and measurement instruments

The EQ-5D. The EQ-5D covers five dimensions of health (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression) with three levels of severity, from none to extreme problems. Its validity and reliability have been demonstrated in general population health surveys [21,22]. We used the conventional Time Trade Off preference values from the Spanish general population [23] which produced a single preference-based index ranging from 1 (best health state) to negative values, where 0 is equal to death.

Sexual orientation. Sexual orientation (1) was assessed from responses to the question of the National Survey of Sexual Attitudes and Lifestyles of United Kingdom [24]: “Which of the following statements do you feel more identified with?”, with six response options considering attraction only to the opposite sex, usually to the opposite sex, equally to the same and opposite, usually to the same, only to the same sex, or rather not answering. These were dichotomized into heterosexual for those responding the first option, and LGB for the other four sexual attraction combinations stated.

Health-related behaviors. Information about lifetime use of the following psychoactive drugs was gathered through five groups of substances: tranquilizers, hashish or marihuana, cocaine or by-products, amphetamines or similar, and heroine.

Alcohol consumption during the past year on working days and weekends separately was collected, and weekly consumption was calculated with the formula: Standard drink units (1 unit = 10 g alcohol) * Number of drinks * frequency weekly [25]. Alcohol consumption was categorized into non-drinker, moderate, or risk drinker (>17 or >28 alcohol units/week for women and men, respectively).

Body mass index (BMI) was also considered, since the LGB population has consistently been shown to have weight differences with respect to heterosexuals [26]. BMI was divided into low/normal and overweight/obesity applying the cut-off point of 25.

Socio-demographic variables. Participants in 2011-BHIS were asked about their gender (women or men), age, country of birth, education level, social class, social support, and whether they were living with a partner. The maximum aggregation of categories for each variable was used to avoid cells with zero individuals because the number of LGB participants was small (n = 77).

Social class (manual and non-manual workers) was based on the Spanish National Classification of Occupations 2011 using a neo-Weberian approach [27]. Country of birth was categorized into low vs high income countries according to the GNI per capita (World Bank Atlas Method for the 2011 fiscal year) [28]. Social support was assessed with the Duke-UNC Functional Social Support Questionnaire composed of eight-items, using the recommended percentile 15 [29] as the cut-off to define low social support.

Chronic conditions. Participants in the 2011-BHIS were asked about 15 chronic conditions. A summary indicator based on the number of reported chronic conditions was categorized according to sample distribution into 5 groups: none, 1, 2, 3–4, and 5 or more chronic conditions.

Statistical analysis

The 2011-BHIS sample size allows the detection of differences of 0.07 points on the EQ-5D index mean (estimated as the minimal important difference [30]) between LGB ($N = 77$) and heterosexual ($N = 3,200$) groups with alpha risk 0.05 and beta of 0.2. To restore the representativeness of the Barcelona population, a weighting factor was applied for age, gender, and municipal district. Unweighted frequencies and weighted percentages were calculated. Differences between participants with and without information on sexual orientation, and differences between LGB respondents and heterosexual counterparts were tested using χ^2 . Due to the imbalance mainly in age between LGB and heterosexual groups, the percentages of chronic conditions and health-related behaviors were adjusted by age and gender using logistic regression models.

To assess differences by sexual orientation on HRQoL, we built censored linear regression models (Tobit) with EQ-5D index, and Poisson regression models with EQ-5D dimensions. Censored linear regression models (Tobit) were used due to the right-skewed distribution of EQ-5D index (dependent variable). Marginal effects were obtained from the Tobit model as averaged individual marginal effects [31] to restore the original range of the EQ-5D index. The original three-level response scale of EQ-5D dimensions was dichotomized into “no problems” versus “moderate/extreme problems”, and it was included as the dependent variable in Poisson regression models with robust error variance. These models were used to estimate the prevalence ratio [32], which is more interpretable and easier to communicate than an odds ratio (obtained with logistic regression models) in cross-sectional studies.

In all cases, nested models were constructed to assess the mediator role of selected variables: first including only sexual orientation, which is the principal explanatory variable (Model 1), then adding sequentially gender and age (Model 2), socio-demographic variables (education level, country of birth, and married or in sentimental partnership in Model 3), number of chronic conditions (Model 4), and health-related behaviors (smoking status, alcohol consumption, and psychoactive drug consumption in Model 5). These nested models were compared with the immediately previous one using the log-likelihood ratio test. Interactions of sexual orientation with gender and age were tested.

Finally, a sensitivity analysis was performed by excluding participants that reported being attracted to the same sex only sometimes, to test validity of sexual orientation definition (S1 File). A sensitivity analysis was also carried out for comparison purposes by matching LGB and heterosexual individuals with propensity score. The primary objective of this analysis was to maximize the balance in the distribution of possible confounders between LGB and heterosexual groups. A logistic regression model was constructed to estimate the conditional probability of belonging to each group (propensity score) by including socio-demographic characteristics as independent variables. Quartiles of this conditional probability were used to

define four propensity score categories. LGB individuals were matched with heterosexual counterparts (ratio 1:5) according to propensity score quartile, age group, and gender. The five heterosexual participants for each LGB individual were randomly selected, giving priority to individuals with less potential pairs. In this sensitivity analysis, conditional logistic regression was used to estimate odds ratio of reporting EQ-5D problems to take into account the matching, instead of the Poisson regression with robust error variance used in the main analysis strategy (S2 File).

Results

Of the 3,524 participants, 247 (7%) did not state their sexual orientation. The non-respondents were older ($p < 0.001$), with a lower education level ($p = 0.021$), less frequently married or in a sentimental partnership ($p < 0.001$), and with lower social support ($p = 0.011$) than participants who responded (Table 1).

Of 3,277 respondents, 3,200 only felt attracted to the opposite sex and 77 (2.3%) became attracted to the same sex with varying frequency. This latter group was composed of: 34 who only felt attracted to the same sex, 8 only sometimes to the opposite sex; 13 felt equally attracted to both sexes; and 22 only sometimes to the same sex. Characteristics of the heterosexual and LGB groups are shown in Table 2. Differences by sexual orientation were not

Table 1. Socio-demographic differences between participants with and without information on sexual orientation. Unweighted frequencies and weighted percentages.

| | Data on sexual orientation N = 3277 | No data on sexual orientation N = 247 | p-value |
|--|--|--|----------|
| Sex | | | |
| Men | 1559 (46.9%) | 126 (49.2%) | 0.461 |
| Women | 1718 (53.1%) | 121 (50.8%) | |
| Age group | | | |
| 15–34 years | 929 (29.0%) | 56 (25.7%) | <0.001** |
| 35–64 years | 1597 (48.3%) | 95 (37.2%) | |
| 65 years and over | 751 (22.7%) | 96 (37.2%) | |
| Education level | | | |
| Primary or less | 1346 (42.2%) | 120 (51.2%) | 0.021* |
| Secondary | 833 (25.6%) | 47 (21.0%) | |
| University or more | 1080 (32.3%) | 69 (27.8%) | |
| Social class | | | |
| Non manual | 1708 (56.1%) | 120 (56.7%) | 0.870 |
| Manual | 1325 (43.9%) | 92 (43.3%) | |
| Married or in sentimental partnership | | | |
| Yes | 1904 (57.2%) | 104 (41.2%) | <0.001** |
| No | 1373 (42.8%) | 143 (58.8%) | |
| Country of birth | | | |
| High income countries | 2820 (87.1%) | 222 (90.0%) | 0.189 |
| Low income countries | 445 (12.9%) | 24 (10.0%) | |
| Social support | | | |
| Social support (>P15) | 2752 (84.5%) | 222 (90.4%) | 0.011* |
| Low social support (≤P15) | 525 (15.5%) | 25 (9.6%) | |

Bold: significant p-value (*p-value<0.05; **p-value<0.01).

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Table 2. Unweighted frequencies and weighted percentages of socio-demographic characteristics, chronic conditions and health-related behaviors of LGB individuals and heterosexual counterparts in the 2011 Barcelona Health Interview Survey.

| | Unadjusted % | | | Adjusted % by gender and age | | |
|--|----------------------------|-----------------|----------|------------------------------|-------|----------|
| | Heterosexual (n = 3200) | LGB (n = 77) | p-value | Heterosexual | LGB | p-value |
| SOCIODEMOGRAPHIC | n (%) | n (%) | | % | % | |
| Gender | | | | | | |
| Men | 1528 (47.0%) | 31 (42.1%) | 0.401 | | | |
| Women | 1672 (53.0%) | 46 (57.9%) | | | | |
| Age group | | | | | | |
| 15–34 years | 886 (28.4%) | 43 (56.6%) | <0.001** | | | |
| 35–64 years | 1571 (48.7%) | 26 (30.3%) | | | | |
| 65 years and over | 743 (22.9%) | 8 (13.2%) | | | | |
| Education level | | | | | | |
| Primary or less | 1328 (42.5%) | 18 (26.3%) | 0.013* | 29.1% | 17.7% | 0.052 |
| Secondary | 812 (25.5%) | 21 (28.9%) | | 32.7% | 31.5% | |
| University or more | 1042 (32.0%) | 38 (44.7%) | | 38.3% | 50.8% | |
| Social class | | | | | | |
| Non manual | 1666 (56.1%) | 42 (57.4%) | 0.833 | 53.5% | 55.9% | 0.696 |
| Manual | 1297 (43.9%) | 28 (42.6%) | | 46.5% | 44.1% | |
| Married or in sentimental partnership | | | | | | |
| Yes | 1881 (58.0%) | 23 (25.0%) | <0.001** | 31.3% | 15.8% | 0.001** |
| No | 1319 (42.0%) | 54 (75.0%) | | 68.7% | 84.2% | |
| Country of birth | | | | | | |
| High income countries | 2760 (87.3%) | 60 (78.9%) | 0.031* | 82.2% | 75.4% | 0.163 |
| Low income countries | 428 (12.7%) | 17 (21.1%) | | 17.8% | 24.6% | |
| Social support | | | | | | |
| Social support (>P15) | 2690 (84.6%) | 62 (77.6%) | 0.095 | 92.0% | 87.4% | 0.103 |
| Low social support (≤P15) | 510 (15.4%) | 15 (22.4%) | | 8.0% | 12.6% | |
| NUMBER OF CHRONIC CONDITIONS | | | | | | |
| None | 1297 (42.0%) | 34 (42.1%) | 0.187 | 68.9% | 63.7% | 0.018* |
| One | 639 (19.4%) | 9 (11.8%) | | 19.5% | 13.0% | |
| Two | 401 (12.0%) | 13 (18.4%) | | 7.7% | 14.6% | |
| Three or four | 427 (13.1%) | 13 (17.1%) | | 3.0% | 7.1% | |
| Five or more | 436 (13.6%) | 8 (10.5%) | | 0.9% | 1.6% | |
| HEALTH-RELATED BEHAVIORS | | | | | | |
| Body mass index (BMI) | | | | | | |
| Low weight or normal weight | 2103 (65.8%) | 60 (75.0%) | 0.093 | 86.8% | 89.6% | 0.344 |
| Overweight or obesity | 1069 (34.2%) | 17 (25.0%) | | 13.2% | 10.4% | |
| Smoking | | | | | | |
| Never smoker | 1748 (57.3%) | 23 (25.7%) | <0.001** | 51.8% | 24.0% | <0.001** |
| Current or former smoker | 1380 (42.7%) | 52 (74.3%) | | 48.2% | 76.0% | |
| Alcohol consumption | | | | | | |
| Non-drinker | 616 (26.9%) | 9 (14.5%) | 0.012* | 13.7% | 7.1% | 0.051 |
| Moderate drinker | 1731 (68.3%) | 48 (74.2%) | | 74.2% | 72.2% | |
| Risk drinker | 132 (4.8%) | 8 (11.3%) | | 12.1% | 20.7% | |
| Psychoactive drug consumption | | | | | | |
| Yes | 710 (9.6%) | 44 (43.4%) | <0.001** | 18.8% | 52.3% | <0.001** |
| No | 2490 (90.4%) | 33 (56.6%) | | 81.2% | 47.7% | |

The first three columns show the unadjusted percentages, and the last three columns the adjusted percentages by gender and age. LGB: Lesbian, gay or bisexual. **Bold:** significant p-value (* p-value<0.05; **p-value<0.01).

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significant regarding gender and social class, but they were significant for several other variables. The LGB group was younger (56.6 vs 28.4% <35 years old; $p < 0.001$), with higher education level (44.7% vs 32.0% university; $p = 0.013$), was less frequently married or in a sentimental partnership (25.0% vs 58.0%; $p = 0.001$), and came more frequently from low-income countries (22.1% vs 12.7%; $p = 0.031$). Adjusted percentages of most health-related variables presented statistically significant differences: the LGB group reported chronic conditions more frequently ($p = 0.018$), higher consumption of tobacco (76.0% vs 48.2%; $p < 0.001$), and psychoactive substances (52.3% vs 18.8%; $p < 0.001$).

[Table 3](#) presents nested Tobit models with the EQ-5D index as the dependent variable. Model 1 shows that there is no significant crude difference on EQ-5D index by sexual orientation. After adjusting by gender and age (Model 2), the difference is statistically significant (-0.052, $p = 0.04$). Model 3 with all the sociodemographic variables shows a very similar difference (-0.055; $p = 0.029$). Once number of chronic conditions was considered (model 4), the difference on EQ-5D index by sexual orientation is no longer significant (-0.031; $p = 0.145$). After adding health-related behaviors (model 5), this difference was -0.003 ($p = 0.899$).

Nested models constructed with each of the three physical dimensions of the EQ-5D as dependent variables are shown in [Fig 1](#). The crude prevalence ratio (Model 1) was not significant for any dimension. However, mobility and usual activities dimensions showed statistically significant differences by sexual orientation after adjusting for age and gender (Model 2), for all sociodemographic variables (Model 3), and for number of chronic conditions (Model 4). These differences were no longer statistically significant after adding health-related behaviors in model 5.

Since models of the EQ-5D's two mental dimensions presented statistically significant interactions with gender, further models were constructed for men and women separately ([Fig 2](#)). Among men, nested models showed statistically significant adjusted prevalence ratios in models 2 and 3: for pain/discomfort aPR was 2.88 and 3.15; and for anxiety/depression aPR was 2.85 and 2.49. These differences ceased to be significant in model 5 for pain/discomfort, and in model 4 for anxiety/depression. However, no differences by sexual orientation were observed among women.

Sensitivity analysis performed after excluding the 22 participants who reported only sometimes becoming attracted to the same sex is shown in [S1 File](#). Results of nested models with the EQ-5D index and its dimensions as dependent variables were consistent with the results obtained from the 77 individuals primarily considered in the LGB group. Also, results of the sensitivity analysis done with LGB individuals and matched heterosexual counterparts (ratio 1:5) were consistent with findings obtained through the main analysis strategy, showed in the tables and figures within the article ([S2 File](#)).

Discussion

In our study, the LGB group clearly showed worse HRQoL than the heterosexuals. This health inequality was consistently observed in the EQ-5D index and most EQ-5D dimensions. Such pattern is common among men and women for physical health dimensions (mobility and usual activities), but differs by sex for mental health dimensions (pain/discomfort and anxiety/depression). It is important to highlight that HRQoL differences by sexual orientation disappeared when we considered chronic conditions and health-related behaviors, suggesting that these played a major mediator role.

These results support our hypotheses of worse HRQoL in the LGB population, and that the effect of sexual orientation on mental health is modified by gender. After adjusting by age,

Table 3. Censored linear regression models (Tobit model) with the EQ-5D index as the dependent variable.

| | MODEL 1 | | MODEL 2 | | MODEL 3 | | MODEL 4 | | MODEL 5 | |
|--|----------|----------|----------|---------------|----------|---------------|----------|----------------|----------|----------------|
| | Estimate | p-value | Estimate | p-value | Estimate | p-value | Estimate | p-value | Estimate | p-value |
| Intercept | 0.4752 | <0.001** | 0.5956 | <0.001** | 0.5482 | <0.001** | 0.5358 | <0.001** | 0.5114 | <0.001** |
| Sexual orientation | | | | | | | | | | |
| <i>Heterosexual</i> | - | | - | | - | | - | | - | |
| <i>LGB</i> | 0.0003 | 0.990 | -0.052 | 0.040* | -0.055 | 0.029* | -0.0311 | 0.145 | -0.003 | 0.899 |
| Gender | | | | | | | | | | |
| <i>Men</i> | | | - | | - | | - | | - | |
| <i>Women</i> | | | -0.062 | <0.001** | -0.058 | <0.001** | -0.0298 | <0.001** | -0.023 | 0.002* |
| Age | | | | | | | | | | |
| <i>15–34 years old</i> | | | - | | - | | - | | - | |
| <i>35–64 years old</i> | | | -0.116 | <0.001** | -0.12 | <0.001** | -0.0546 | <0.001** | -0.046 | <0.001** |
| <i>≥ 65 years old</i> | | | -0.238 | <0.001** | -0.22 | <0.001** | -0.0824 | <0.001** | -0.072 | <0.001** |
| Education level | | | | | | | | | | |
| <i>Primary or less</i> | | | | | - | | - | | - | |
| <i>Secondary</i> | | | | | 0.037 | <0.001** | 0.0243 | 0.005** | 0.025 | 0.010* |
| <i>University or more</i> | | | | | 0.053 | <0.001** | 0.0280 | 0.001** | 0.026 | 0.005* |
| Country of birth | | | | | | | | | | |
| <i>High income countries</i> | | | | | - | | - | | - | |
| <i>Low income countries</i> | | | | | 0.029 | 0.024* | 0.0088 | 0.423 | 0.001 | 0.928 |
| Married or in sentimental partnership | | | | | | | | | | |
| <i>No</i> | | | | | - | | - | | - | |
| <i>Yes</i> | | | | | 0.016 | 0.052 | 0.0192 | 0.007** | 0.014 | 0.078 |
| Number of chronic conditions | | | | | | | | | | |
| <i>None</i> | | | | | | | - | | - | |
| <i>One</i> | | | | | | | -0.0932 | <0.001** | -0.074 | <0.001** |
| <i>Two</i> | | | | | | | -0.0925 | <0.001** | -0.072 | <0.001** |
| <i>Three or four</i> | | | | | | | -0.1452 | <0.001** | -0.126 | <0.001** |
| <i>Five or more</i> | | | | | | | -0.2495 | <0.001** | -0.223 | <0.001** |
| Smoking status | | | | | | | | | | |
| <i>Never smoker</i> | | | | | | | | | - | |
| <i>Current or former smoker</i> | | | | | | | | | 0.001 | 0.890 |
| Alcohol consumption | | | | | | | | | | |
| <i>Non-drinker</i> | | | | | | | | | - | |
| <i>Moderate drinker</i> | | | | | | | | | 0.013 | 0.108 |
| <i>Risk drinker</i> | | | | | | | | | 0.028 | 0.153 |
| Psychoactive drug consumption | | | | | | | | | | |
| <i>Yes</i> | | | | | | | | | - | |
| <i>No</i> | | | | | | | | | -0.025 | 0.002** |
| Log-likelihood | -1648 | | -1393 | | -1362 | | -1079 | | -802.4 | |
| df | 3 | | 6 | | 10 | | 14 | | 18 | |
| p-value | | | < 0.001 | | < 0.001 | | < 0.001 | | < 0.001 | |

Estimate: EQ-5D index difference. **Bold:** significant p-value (*p-value<0.05; **p-value<0.01)

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gender, and socio-demographic variables, the magnitude of the EQ-5D index difference (-0.055) is very close to the minimal important difference, estimated previously at ± 0.07 for this instrument [30]. Translating this adjusted mean difference to QALYs, -0.055 is interpretable as 20 fewer days of full health per year experienced by each LGB individual. Considering

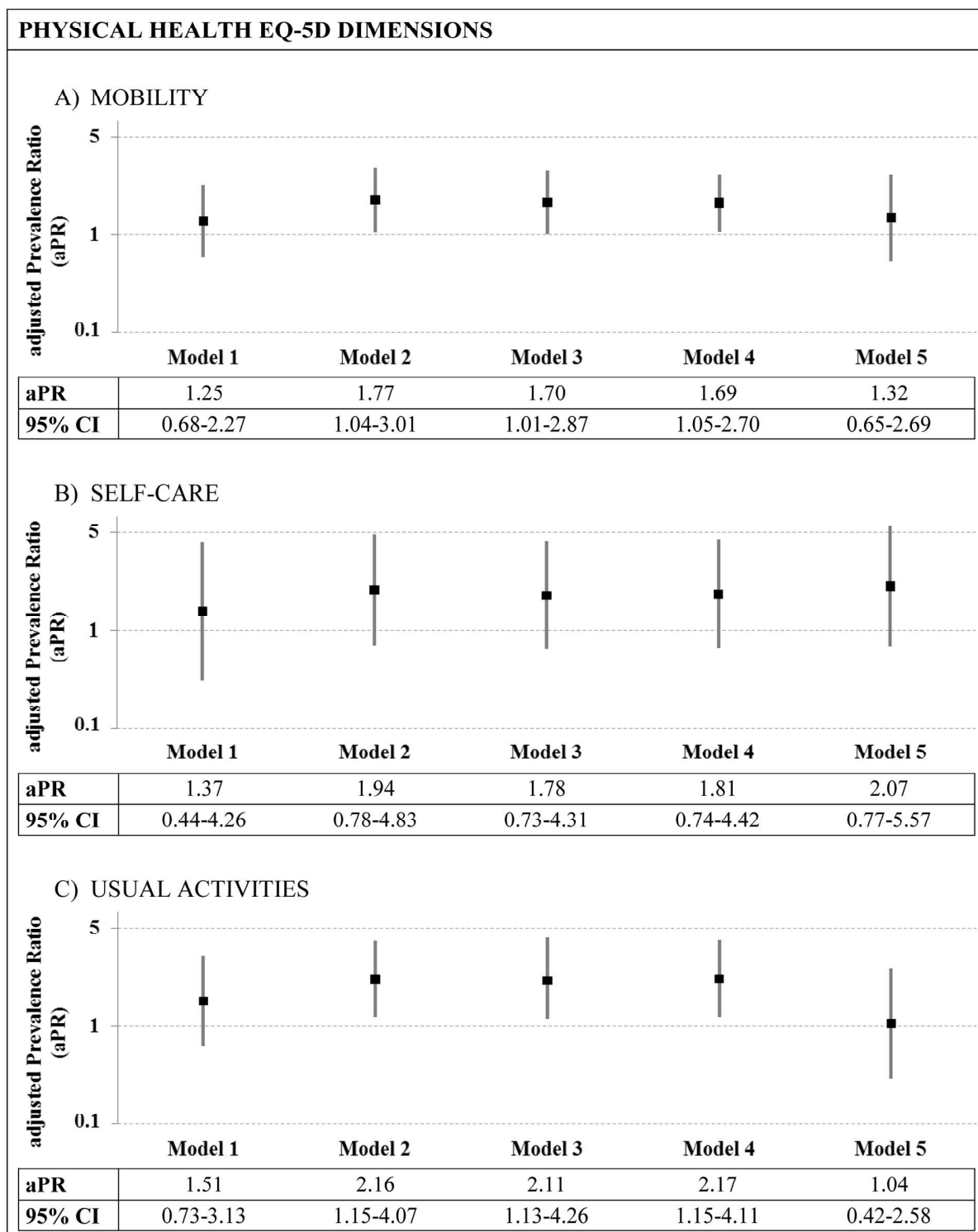


Fig 1. Prevalence ratios and 95% Confidence Intervals (95%CI) by sexual orientation for each physical EQ-5D dimension, considering different adjustment variables. The EQ-5D dimension (dependent variable) was dichotomized into: no problems vs moderate/extreme problems. **Model 1:** Crude prevalence ratio. **Model 2:** Adjusted by age and gender. **Model 3:** Adjusted by age and gender + sociodemographic variables (education level, country of birth, and married or in sentimental partnership). **Model 4:** Adjusted by age and gender + sociodemographic variables + number of chronic conditions. **Model 5:** Adjusted by age and gender + sociodemographic variables + number of chronic conditions + health-related behaviors (smoking status, alcohol consumption, and psychoactive drug consumption).

<https://doi.org/10.1371/journal.pone.0191334.g001>

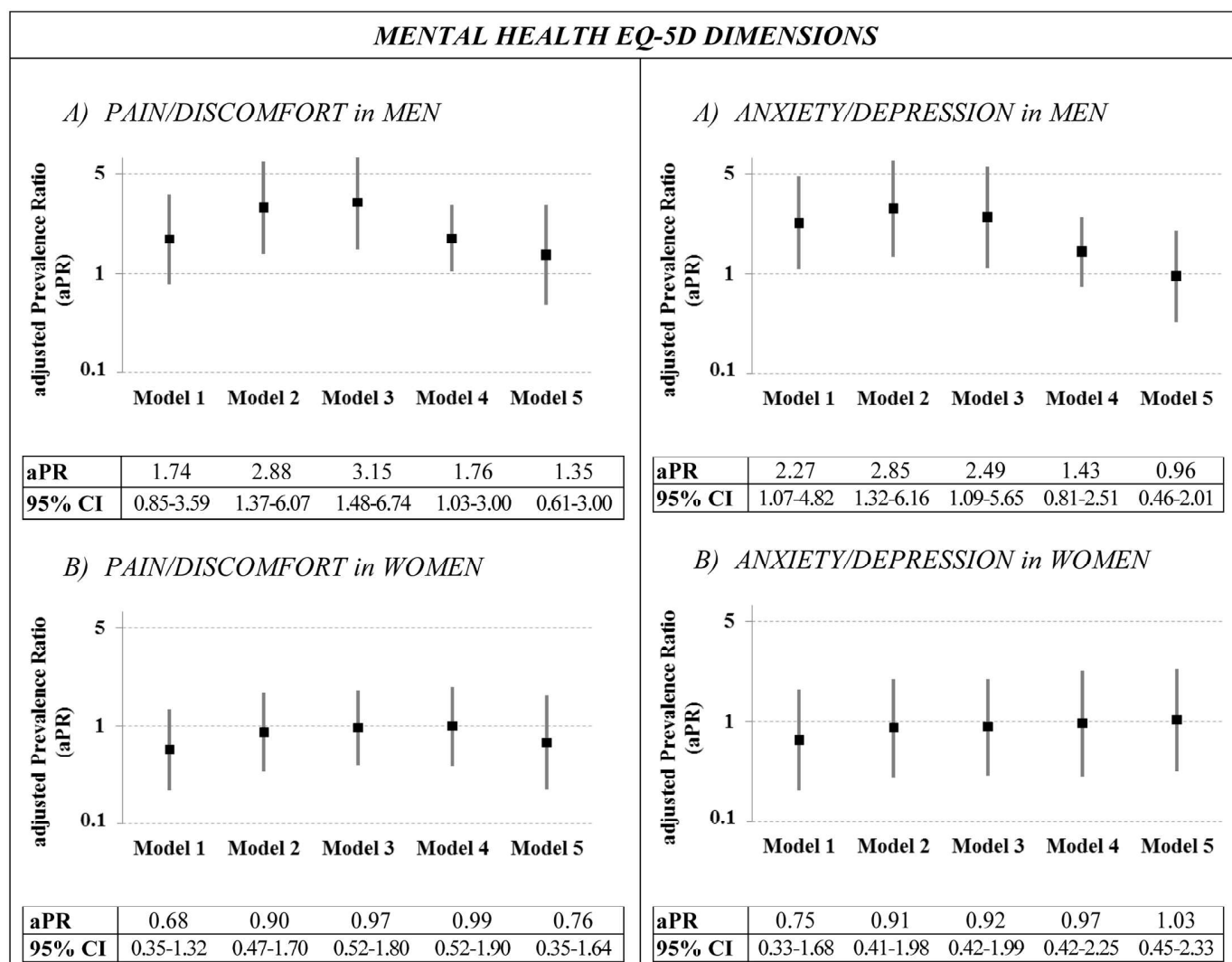


Fig 2. Prevalence ratios and 95% Confidence Intervals (65%CI) by sexual orientation for each mental EQ-5D dimension stratified by gender, considering different adjustment variables. The EQ-5D dimension (dependent variable) was dichotomized into: no problems vs moderate/extreme problems. **Model 1:** Crude prevalence ratio. **Model 2:** Adjusted by age and gender. **Model 3:** Adjusted by age and gender + sociodemographic variables (education level, country of birth, and married or in sentimental partnership). **Model 4:** Adjusted by age and gender + sociodemographic variables + number of chronic conditions. **Model 5:** Adjusted by age and gender + sociodemographic variables + number of chronic conditions + health-related behaviors (smoking status, alcohol consumption, and psychoactive drug consumption).

<https://doi.org/10.1371/journal.pone.0191334.g002>

the 2.3% proportion of LGB among the 1.6 million inhabitants, the total number of full health days lost each year would be higher than 700,000 in Barcelona.

Results of the previous health surveys which have explored HRQoL inequalities by sexual orientation consistently showed worse mental [3,6], but not physical [4] health for the LGB group. The United States Growing Up Today Study showed sexual orientation differences in the EQ-5D single index, without reporting mental and physical EQ-5D dimensions [9]. No SF-36 physical component differences were reported in the Dutch survey [3]. The California Quality of Life Survey [4] only showed a higher risk of poor SF-12 physical health for bisexual women and homosexually-experienced heterosexuals. In our study, in contrast to these previous findings, two of the main physical dimensions of EQ-5D, mobility and usual activities,

showed consistent health inequalities in both genders by sexual orientation. The prevalence ratios indicate a 110% and 77% higher probability of having problems in usual activities and mobility, respectively, for LGB people.

Regarding mental health, the prevalence ratio for anxiety/depression in our study indicates a 185% higher probability of having problems among gay/bisexual men but not among women. Similarly, pain/discomfort dimension also presented a 188% higher probability of problems for gay/bisexual men compared to heterosexuals. Our results for men are consistent with the SF-36 mental component in the Dutch survey [3], and also with the meta-analysis of UK [6]. The latter additionally found that interaction with gender was statistically significant indicating stronger effects for men.

In our study, the LGB group was considerably younger than its heterosexual counterpart (mean 39.6 vs 48.6 years; $p < 0.001$). Response and survival biases are two possible reasons for this age difference. First, older LGB individuals may be less likely than the younger ones to report their true sexual orientation, because during the Spanish dictatorship homosexuality was punishable with prison under the “Law of Vagrants and Crooks”. This theory is consistent with the results of our analysis comparing participants with and without information on sexual orientation, as people who did not answer the question on sexual attraction were significantly older than those who responded it. Second, there is considerable evidence of higher mortality for the LGB population [2,33], leading possibly to a survival bias. The 2001–2010 National Health and Nutrition Examination Surveys reported greater all-cause mortality for LGB than for heterosexuals (adjusted hazard ratio = 2) [33]. Another USA study [2] showing a 12-year shorter life expectancy for LGB individuals from communities with high anti-gay prejudice levels versus low ones [2] revealed suicide, homicide/violence, and cardiovascular diseases as the underlying specific mortality causes.

Results from nested models support our hypothesis regarding the effect of sexual orientation through the continuum from vulnerabilities to outcomes. Chronic conditions and risk behaviors are the principal factors explaining the HRQoL differences by sexual orientation in these models, suggesting their principal mediator role in LGB health inequalities. Statistical significance of sexual orientation disappeared after including them in the models. The Californian survey showed higher prevalence in LGB than in heterosexual participants for certain chronic conditions, especially for those related with tobacco, alcohol and drug consumption, such as asthma, heart disease, and cancer [4]. The prevalence of tobacco, alcohol and psychoactive drug consumption in our LGB subsample is around 2-fold higher than that of their heterosexual counterparts, even after adjusting by age and gender, which is consistent with evidence [5,7,17,18]. For example, in Massachusetts [18], the probability of current smoking and any 30-day drug use was also at least 2 times greater among LGB than heterosexuals; and in England [8], the LGB group reported almost 2 times higher significant alcohol and drug dependence. This pattern of worse health-related behaviors has been related to discrimination and stigma [34], which may lead to a reduction of self-control in those who feel threatened by their social identity. Minority stress theory proposes that stressors induced by homophobic culture require an individual to adapt and may affect physical and mental health [3,35], which should be considered an unfair and avoidable inequity. However, further than chronic conditions related with discrimination and substance abuse, other risk behaviors, such as unsafe sexual practices and their associated conditions should be considered as potential causes of the worse HRQoL experienced by LGB individuals.

Since data of this study came from the health survey of a large European city, results are representative of an urban setting. We have to highlight that the EQ-5D is a generic and standardized instrument which provides a simple descriptive profile and a robust single preference-based index [21,22]. In addition, the EQ-5D has proved its usefulness as a HRQoL

measure for the general population [22], and detecting socioeconomic health inequalities [36]. This is the first study to have explored the mediator role of socio-demographic characteristics, health-related behaviors, and chronic conditions in health inequalities by sexual orientation.

The main limitation is that the LGB group was constructed based only on sexual attraction, without considering self-identification and sexual behavior [37]. However, sexual attraction covers some of the gaps left out by behavior or identity measures, and it has been argued that identity-based conceptualizations of sexual orientation may not adequately account for the possible variations in the population's sexuality [37]. In addition, recent studies have shown that sexual attraction measures are more predictive than sexual identity ones to detect inequalities by sexual orientation [38]. Second, the proportion of individuals not answering the question on sexual attraction was high (7%) and part of them could be LGB. Taking into account the low number of LGB participants in the sample (2.3%), biases of non-response and social desirability affecting the sexual orientation question may have produced an infra-estimation of this group. However, the LGB percentage was similar to other developed country population surveys [3,4]. As showed previously, a sizable proportion of LGB people are unwilling to disclose their sexual orientation in surveys [39]. Consistently with our results, willingness is influenced by age, living environment (social support), education and partnership status, suggesting that general population surveys may not be fully representative of gay and bisexual populations. Third, the Barcelona Health Interview Survey design is cross-sectional, which constrains causality assessment. However, it is more plausible that sexual orientation has a negative effect on health than the inverse relationship (poor health affecting sexual orientation). Finally, the small proportion of LGB participants did not allow stratifying for age, but its interaction with sexual orientation was not significant.

Conclusions

The LGB population presented worse HRQoL than the heterosexual one; and gender, chronic conditions, and health-related behaviors play a major role in explaining such differences. These findings support the need of including sexual orientation into the global agenda of health inequities, and provide helpful information for developing new effective public health strategies from promotion to tertiary prevention including: education based on sexual diversity, evidence-based public health interventions on general population to reduce external/social and internalized homophobia, and recommendations for health professionals to improve the LGB population's health.

Supporting information

S1 File. Sensitivity analysis performed to test validity of sexual orientation definition by excluding participants that reported being attracted to the same sex only sometimes. (PDF)

S2 File. Sensitivity analysis with LGB individuals and matched heterosexual counterparts (ratio 1:5). (PDF)

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5.3 ARTICLE 3

Marti-Pastor M, Ferrer M, Alonso J, Garin O, Pont A, Flynn C, German D. *Association of Enacted Stigma with Depressive Symptoms Among Gay and Bisexual Men Who Have Sex with Men: Baltimore, 2011 and 2014*. *LGBT Health*. 2020 Jan;7(1):47-59.

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Association of Enacted Stigma with Depressive Symptoms Among Gay and Bisexual Men Who Have Sex with Men: Baltimore, 2011 and 2014

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Abstract

Purpose: We assessed differences between gay and bisexual men in enacted stigma, and how the association between stigma and depressive symptoms may vary according to sexual orientation identity.

Methods: Participants (671 gay and 331 bisexual men who have sex with men) in Baltimore's 2011 and 2014 National HIV Behavioral Surveillance completed an anonymous survey, including 3 enacted stigma dimensions and the Center for Epidemiologic Studies Depression Scale. Adjusted prevalence ratios were calculated through Generalized Estimating Equation models adjusting for theorized confounders (demographic, socioeconomic, and relational factors).

Results: Bisexual men reported stigma experiences less frequently than did gay men (verbal harassment 22.7% vs. 32.3%, and discrimination 15.7% vs. 23.0%). Relevant depressive symptoms were reported by 43.1% of bisexual men and 34.2% of gay men ($p < 0.001$). Statistically significant differences in depressive symptoms between bisexual and gay men disappeared after adjusting for socioeconomic factors. The three enacted stigma dimensions were significantly associated with depressive symptoms, but their interaction with sexual orientation identity was not.

Conclusion: This study confirms the association between enacted stigma and depressive symptoms among gay and bisexual men. However, sexual orientation identity did not modify this association as hypothesized. The bisexual men presented other psychosocial stressors that may explain their higher prevalence of depressive symptoms. The high levels of verbal harassment, discrimination, and physical assault reported by gay and bisexual men and their negative effect on mental health indicate the need to develop new effective public health strategies to avoid these consequences of homophobic and biphobic culture.

Keywords: bisexual men, discrimination, gay men, mental health, stigma

Introduction

DESPITE MAJOR CHANGES over the past two decades, gay and bisexual men remain stigmatized in many countries worldwide due to their sexual orientation.^{1,2} Stigma has been defined as the social discrediting of a marginalized individual or group by others due to perceived negative attributes.³ Stigma is a complex and broad concept, which may include perceived, internalized, and enacted stigma.⁴⁻⁶

Compared to bisexual individuals, gay men report higher rates of enacted stigma (verbal harassment, discrimination, and physical violence),^{7,8} which has been attributed to their greater visibility.⁹ On the other hand, bisexual individuals may experience pressure to conform to a binary sexual orientation,¹⁰ and prejudice due to specific stereotypes associated with bisexuality such as confusion, promiscuity,^{11,12} or being a "bridge" population for HIV.¹³ Bisexual men may also confront prejudicial behaviors and attitudes within the LGBT community.¹⁴⁻¹⁷

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Both gay and bisexual men are at increased risk for adverse mental health outcomes in comparison to their heterosexual counterparts, but bisexual men have been found to present higher rates of adverse outcomes than gay men.¹⁰ These mental health disparities have been attributed to numerous factors, such as stigma^{10,18} and socioeconomic position^{19–21} as well as their interrelation.^{7,10} Several studies have evaluated the association between mental health and sexual orientation-related stigma,^{16,22–29} but without evaluating if this association differs between gay and bisexual men.

Are mental health disparities between gay and bisexual men explained mostly by differences in demographic, socioeconomic, and relational factors? Or is enacted stigma related to depression differently for gay versus bisexual men? For example, experiencing frequent enacted stigma could facilitate the development of tools, strategies, or mechanisms to cope with their negative effects on mental health among gay men. In contrast, among bisexual men, the differential stress of not disclosing their sexual orientation and internalizing negative attitudes toward effeminacy could modify the effect of enacted stigma on their mental health.³⁰

The aim of our study was to assess differences between gay and bisexual men in enacted stigma, and how the association between stigma and depressive symptoms may vary according to sexual orientation identity, using data collected in Baltimore in 2011 and 2014. Our general hypothesis was that sexual orientation identity can affect stigma experiences and modify their effect on depressive symptoms, producing different patterns for gay and bisexual men.^{7,22–24} Following the structural framework proposed by Mulé et al.³¹ and the minority stress model,¹⁸ our specific hypotheses were as follows: (1) we expect higher prevalence of depressive symptoms in men reporting more enacted stigma experiences; (2) race/ethnicity⁷ may modify the association of stigma with mental health; (3) stigma and other minority stressors^{18,27,32} are situated within general environmental circumstances; as bisexual men may have a lower socioeconomic status compared with gay men,^{19–21} this can confound the association between stigma and depressive symptoms³³; and (4) being open about one's sexual orientation and being in a relationship can have negative consequences for bisexual people^{34,35} in ways that differ from gay or heterosexual men, thus modifying the impact of stigma on depressive symptoms.

Methods

Sampling and recruitment

The National HIV Behavioral Surveillance (NHBS) is conducted in rotating annual cycles to monitor HIV prevalence and sociobehavioral characteristics among men who have sex with men (MSM), injection drug users, and those with a heightened risk through heterosexual sex, in ~20 cities in the United States.^{36,37} NHBS procedures have been published previously.^{38,39}

For this study, we focused on the MSM sample recruited in the Baltimore metropolitan area in 2011 and 2014. The study was approved by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board (IRB) and the Maryland Department of Health IRB (H.34.03.07.02.A1). MSM were recruited using venue-based, time-space sam-

pling methods described elsewhere.³⁶ Eligible participants were males 18 years of age or older who were residents of the Baltimore metropolitan region, reported oral or anal sex with another man in the past 12 months, and were able to complete the survey in English or Spanish.³⁸ After completing the informed consent procedures, eligible participants responded to a structured computerized interview administered anonymously by trained interviewers.

Measures

Health determinants. Sociodemographic characteristics included age, race/ethnicity, education level, employment status, household annual income, homelessness (past 12 months), and marital status. Race/ethnicity was classified according to the racial group or groups with which the men identified, and a further question for those with Hispanic or Latin-American origin. Household annual income before taxes was dichotomized applying the cutoff point of \$20,000 (average poverty threshold for a family of three in 2014, as defined by the United States Census Bureau)⁴⁰ to be consistent with previous research.^{7,41}

Sexual orientation-related variables. Respondents were asked to identify which category best described them (heterosexual or “straight,” homosexual or gay, and bisexual) and a question on sexual orientation disclosure regarding same-sex attraction: “have you told anyone that you are attracted to or have sex with men?” (Yes/No).

Enacted stigma. The enacted stigma scale included in NHBS was adapted from previously published surveys,^{42–45} and assessed discrimination based on perceived same-sex attraction. Specifically, men were asked if they had experienced any situation (out of a list of five) as a result of someone knowing or assuming they were attracted to men. These five items covered three enacted stigma dimensions⁴⁵: verbal harassment (being called names or insulted), discrimination (receiving poorer services in restaurants, stores, or other businesses; been treated unfairly at work or school; and been denied or given lower quality health care), and physical assault (physically attacked or injured).

Depressive symptoms. Depressive symptoms were measured with the 10-question version of the Center for Epidemiologic Studies Depression (CES-D-10) Scale,⁴⁶ which was included only in the Baltimore local survey. The revised CES-D-10 measured with a four-point scale the frequency with which each mood or symptom had occurred “during the past week”⁴⁶: scores range from 0 to 30, and a cutoff point of 10 or higher indicates the presence of clinically relevant depressive symptoms.

Statistical analysis

The statistical power, calculated retrospectively for the bisexual group due to its smaller sample size ($n = 331$), allowed the detection of prevalence ratios of 1.5 on relevant depressive symptoms between men who had experienced enacted stigma and those who had not, with alpha risk of 0.05 and beta of 0.1. The χ^2 was used to test differences between gay, bisexual, and heterosexual groups, between waves, between participants who did or did not complete the CES-D-10

Scale, and between individuals who did or did not report depressive symptoms.

To evaluate differential item functioning (DIF)⁴⁷ of the enacted stigma scale by sexual orientation identity, three nested models were constructed with logistic regression for each item (dependent variable): Model 1 only included the total stigma score (number of experiences endorsed); Model 2 added sexual orientation identity; and Model 3 also included the interaction between the total stigma score and sexual orientation identity. McFadden's pseudo $R^2 > 0.02$ between Model 1 and Model 2 and between Model 2 and Model 3 indicate, respectively, uniform and nonuniform DIF.

We built Generalized Estimating Equation (GEE) models using a Poisson distribution to assess differences by sexual orientation identity, first in stigma and second in depressive symptoms. In both cases, to examine the hypothesis, four nested models were constructed: adjusting for study wave and age (Model 1); then adding race/ethnicity (Model 2); introducing education level, household annual income, employment status, and homelessness as socioeconomic factors (Model 3); and finally adding sexual orientation disclosure and marital status as relational factors (Model 4). These nested models were compared using the quasi-likelihood under the Independence model Criterion.⁴⁸ GEE models were constructed to account for clustering⁴⁹ by venue and date. Poisson regression distribution was selected to estimate the prevalence ratio,⁵⁰ which is easier to interpret and communicate in cross-sectional studies than an odds ratio.

To assess differences in enacted stigma between gay and bisexual men, models were constructed for any experience of enacted stigma, and also for each specific dimension of enacted stigma (dependent variable). To study the relationship between stigma and relevant depressive symptoms (dependent variable), the models tested interactions between sexual orientation identity and stigma, among stigma dimensions, and of stigma with race/ethnicity, sexual orientation disclosure, and marital status. Analyses were conducted using STATA 12.0 (StataCorp. 2011; StataCorp LP, College Station, TX) and SAS 9.4 (SAS Institute Inc., Cary, NC).

Results

Sample characteristics

Most of the participants identified as gay ($n=671$), followed by bisexual ($n=331$) and heterosexual men ($n=57$). Table 1 shows that gay men were significantly younger, more frequently living with a partner, employed, with a higher level of education and household annual income, less frequently homeless, and had a lower prevalence of relevant depressive symptoms (34.2% vs. 43.1% and 59.3%; $p < 0.001$) than bisexual and heterosexual men. As the sexual orientation-related stigma scale was not administered to the heterosexual participants, this group was excluded from the analysis. Compared with bisexual men, gay men reported more frequently being non-Hispanic White, having disclosed their sexual orientation, and having experienced verbal harassment (32.3% vs. 22.7%; $p=0.002$) and discrimination (23.0% vs. 15.7%; $p=0.008$).

There were significant differences in age, race/ethnicity, education level, household annual income, and employment

status between men in the 2011 and 2014 waves. The comparison between participants who did and those who did not complete the CES-D-10 scale (Supplementary Table S1) only showed differences in age ($p=0.017$) and household annual income ($p=0.009$). No DIF between gay and bisexual men was observed for any of the enacted stigma questions (Table 2).

Depressive symptoms by enacted stigma

Figure 1 shows that the prevalence of depressive symptoms was statistically higher among gay men who reported experiencing enacted stigma than among gay men who did not: verbal harassment (43.78% vs. 29.77%, $p=0.001$), discrimination (46.21% vs. 30.60%, $p=0.001$), and physical assault (51.67% vs. 32.34%, $p=0.003$). However, among bisexual men, statistically significant differences were only detected in discrimination ($p=0.031$).

Enacted stigma by sexual orientation identity and socioeconomic factors

Table 3 shows nested models examining which characteristics were independently associated with reporting any enacted stigma experience. Prevalence of enacted stigma experience was statistically lower among bisexual men, the oldest group (≥ 40 years), and non-Hispanic Black men. Participants who were unable to work for health reasons and those who reported past 12-month homelessness presented statistically higher prevalence of enacted stigma experiences. Supplementary Table S2 shows models constructed separately for each dimension.

Association of depressive symptoms with enacted stigma

Table 4 shows adjusted prevalence ratios (aPR) for depressive symptoms. As the interactions between sexual orientation identity and enacted stigma were not statistically significant, they were not included in the final model: aPR of the interaction with verbal harassment was 0.80 (95% confidence interval [CI] 0.54–1.16), with discrimination it was 1.06 (95% CI 0.71–1.58), and with physical assault it was 0.86 (95% CI 0.44–1.68). Statistically significant higher prevalence of depressive symptoms in bisexual men compared with gay men (reference category) in Models 1 and 2 disappeared after adding socioeconomic factors in Model 3 (aPR 1.10, 95% CI 0.91–1.32) and relational factors in Model 4 (aPR 1.06, 95% CI 0.87–1.30). The three enacted stigma dimensions, as well as the interactions between the dimensions, were significantly associated with depressive symptoms. Significantly higher aPR were seen for nonemployed men (1.30 for those who were unemployed or retired and 1.78 for those unable to work for health reasons) as well as for full-time students (1.51) and those who indicated "other" for employment status (1.60), also for men who were neither married nor cohabiting (1.35). No statistically significant interactions were found between the three dimensions of enacted stigma and race/ethnicity ($p=0.42$, 0.46, and 0.08), sexual orientation disclosure ($p=0.19$, 0.83, and 0.68), or marital status ($p=0.77$, 0.27, and 0.61).

TABLE 1. HEALTH DETERMINANTS, DEPRESSIVE SYMPTOMS, AND SEXUAL MINORITY-RELATED ENACTED STIGMA IN MEN WHO HAVE SEX WITH MEN BY STUDY WAVE AND SEXUAL ORIENTATION IDENTITY IN THE BALTIMORE-TOWSON-COLUMBIA METROPOLITAN STATISTICAL AREA, 2011 AND 2014

| | Gay (n=671), n (%) | Bisexual (n=331), n (%) | Heterosexual (n=57), n (%) | p* | Gay and bisexual MSM (n=1002), n (%) | 2011 (n=468), n (%) | 2014 (n=534), n (%) | p |
|---|--------------------------|----------------------------|-------------------------------|----|---|---------------------------|---------------------------|------------------|
| Health determinants | | | | | | | | |
| Sexual orientation identity | | | | | | | | |
| Gay | | | | | | | | |
| Bisexual | | | | | | | | |
| Age groups | | | | | | | | |
| 18–24 | 202 (30.1) | 70 (21.1) | 8 (14.0) | | 671 (67.0) | 306 (65.4) | 365 (68.4) | 0.319 |
| 25–39 | 283 (42.2) | 113 (34.1) | 21 (36.8) | | 331 (33.0) | 162 (34.6) | 169 (31.6) | |
| ≥40 | 186 (27.7) | 148 (44.7) | 28 (49.1) | | | | | |
| Race/ethnicity | | | | | | | | |
| Non-Hispanic White | 151 (22.6) | 35 (10.6) | 12 (21.1) | | 272 (27.1) | 155 (33.1) | 117 (21.9) | <0.001 |
| Non-Hispanic Black | 442 (66.3) | 264 (79.8) | 40 (70.2) | | 396 (39.5) | 153 (32.7) | 243 (45.5) | |
| Hispanic | 25 (3.7) | 7 (2.1) | 2 (3.5) | | 334 (33.3) | 160 (34.2) | 174 (32.6) | |
| Multiracial | 37 (5.5) | 20 (6.0) | 2 (3.5) | | | | | |
| Other | 12 (1.8) | 5 (1.5) | 1 (1.8) | | | | | |
| Missing | 4 (0.1) | 0 (0.0) | 0 (0.0) | | | | | |
| Education level | | | | | | | | |
| Grades 1–8 | 5 (0.7) | 6 (1.8) | 2 (3.5) | | 186 (18.6) | 65 (13.9) | 121 (22.7) | <0.001 |
| Grades 9–11 | 28 (4.2) | 62 (18.7) | 14 (24.6) | | 706 (70.7) | 360 (77.1) | 346 (65.2) | |
| Grade 12 or GED | 228 (34.0) | 138 (41.7) | 22 (38.6) | | 32 (3.2) | 11 (2.4) | 21 (3.9) | |
| College, Associate's or Technical degree | 213 (31.7) | 86 (26.0) | 13 (22.8) | | 57 (5.7) | 26 (5.6) | 31 (5.8) | |
| Bachelor's degree | 127 (18.9) | 30 (9.1) | 4 (7.0) | | 17 (1.7) | 5 (1.1) | 12 (2.3) | |
| Any postgraduate studies | 70 (10.4) | 9 (2.7) | 2 (3.5) | | 4 (0.4) | 1 (0.2) | 3 (0.6) | |
| Household annual income | | | | | | | | |
| \$0 to \$19,999 | 264 (41.6) | 202 (63.3) | 39 (73.6) | | 11 (1.1) | 5 (1.1) | 6 (1.1) | <0.001 |
| ≥ \$20,000 | 370 (58.4) | 117 (36.7) | 14 (26.4) | | 90 (9.0) | 58 (12.4) | 32 (6.0) | |
| Missing | 37 (5.5) | 12 (3.6) | 4 (7.0) | | 366 (36.5) | 195 (41.7) | 171 (32.0) | |
| Employment status | | | | | 299 (29.8) | 144 (30.8) | 155 (29.0) | |
| Employed | 423 (63.0) | 154 (46.5) | 27 (47.4) | | 157 (15.7) | 45 (9.6) | 112 (21.0) | |
| Full-time student | 51 (7.6) | 15 (4.5) | 0 (0.0) | | 79 (7.9) | 21 (4.5) | 58 (10.9) | |
| Unemployed or retired | 139 (20.7) | 121 (36.6) | 22 (38.6) | | 466 (48.9) | 243 (54.4) | 223 (44.1) | 0.002 |
| Unable to work for health reasons | 33 (4.9) | 25 (7.6) | 6 (10.5) | | 487 (51.1) | 204 (45.6) | 283 (55.9) | |
| Other | 25 (3.7) | 16 (4.8) | 2 (3.5) | | 49 (4.9) | 21 (4.5) | 28 (5.2) | |
| Homelessness in the past 12 months | | | | | | | | |
| No | 620 (92.4) | 243 (73.9) | 39 (68.4) | | 577 (57.6) | 243 (51.9) | 334 (62.5) | 0.001 |
| Yes | 51 (7.6) | 86 (26.1) | 18 (31.6) | | 66 (6.6) | 28 (6.0) | 38 (7.1) | |
| Missing | 0 (0.0) | 2 (0.6) | 0 (0.0) | | 260 (25.9) | 149 (31.8) | 111 (20.8) | |
| | | | | | 58 (5.8) | 23 (4.9) | 35 (6.6) | |
| | | | | | 41 (4.1) | 25 (5.3) | 16 (3.0) | |
| | | | | | 863 (86.3) | 392 (84.1) | 471 (88.2) | 0.061 |
| | | | | | 137 (13.7) | 74 (15.9) | 63 (11.8) | |
| | | | | | 2 (0.2) | 2 (0.4) | 0 (0.0) | |

(continued)

TABLE 1. (CONTINUED)

| | Gay (n=671), n (%) | Bisexual (n=331), n (%) | Heterosexual (n=57), n (%) | p* | Gay and bisexual MSM (n=1002), n (%) | 2011 (n=468), n (%) | 2014 (n=534), n (%) | p |
|------------------------------------|--------------------------|----------------------------|-------------------------------|-------------------------|---|---------------------------|---------------------------|-------|
| Marital status | | | | | | | | |
| Married or cohabiting with a man | 206 (32.3) | 38 (11.8) | 0 (0.0) | <0.001 ^{a,b,c} | 244 (25.4) | 109 (23.9) | 135 (26.8) | 0.412 |
| Married or cohabiting with a woman | 0 (0.0) | 40 (12.4) | 15 (27.8) | | 40 (4.2) | 22 (4.8) | 18 (3.6) | |
| Not married or cohabiting | 432 (67.7) | 244 (75.8) | 39 (72.2) | | 676 (70.4) | 325 (71.3) | 351 (69.6) | |
| Missing | 33 (4.9) | 9 (2.7) | 3 (5.3) | | 42 (4.2) | 12 (2.6) | 30 (5.6) | |
| Sexual orientation disclosure | | | | | | | | |
| No | 28 (4.2) | 109 (32.9) | — | <0.001 | 137 (13.7) | 71 (15.2) | 66 (12.4) | 0.196 |
| Yes | 643 (95.8) | 222 (67.1) | — | | 865 (86.3) | 397 (84.8) | 468 (87.6) | |
| Missing | 0 (0.0) | 0 (0.0) | 57 (100.0) | | 0 (0.0) | 0 (0.0) | 0 (0.0) | |
| Depressive symptoms (score ≥10) | | | | | | | | |
| No | 416 (65.8) | 181 (56.9) | 22 (40.7) | <0.001 ^{a,b,c} | 597 (62.8) | 276 (61.7) | 321 (63.8) | 0.509 |
| Yes | 216 (34.2) | 137 (43.1) | 32 (59.3) | | 353 (37.2) | 171 (38.3) | 182 (36.2) | |
| Missing | 39 (5.8) | 13 (3.9) | 3 (5.3) | | 52 (5.2) | 21 (4.5) | 31 (5.8) | |
| Verbal harassment | | | | | | | | |
| No | 453 (67.7) | 256 (77.3) | — | 0.002 | 709 (70.9) | 332 (71.1) | 377 (70.7) | 0.900 |
| Yes | 216 (32.3) | 75 (22.7) | — | | 291 (29.1) | 135 (28.9) | 156 (29.3) | |
| Missing | 2 (0.3) | 0 (0.0) | 57 (100.0) | | 2 (0.2) | 1 (0.2) | 1 (0.2) | |
| Service discrimination | | | | | | | | |
| No | 580 (86.4) | 296 (89.4) | — | 0.180 | 876 (87.4) | 404 (86.3) | 472 (88.4) | 0.325 |
| Yes | 91 (13.6) | 35 (10.6) | — | | 126 (12.6) | 64 (13.7) | 62 (11.6) | |
| Missing | 0 (0.0) | 0 (0.0) | 57 (100.0) | | 0 (0.0) | 0 (0.0) | 0 (0.0) | |
| Work/school discrimination | | | | | | | | |
| No | 579 (86.4) | 303 (92.1) | — | 0.009 | 882 (88.3) | 406 (86.9) | 476 (89.5) | 0.214 |
| Yes | 91 (13.6) | 26 (7.9) | — | | 117 (11.7) | 61 (13.1) | 56 (10.5) | |
| Missing | 1 (0.1) | 2 (0.6) | 57 (100.0) | | 3 (0.3) | 1 (0.2) | 2 (0.4) | |
| Health care discrimination | | | | | | | | |
| No | 657 (97.9) | 320 (97.0) | — | 0.359 | 977 (97.6) | 456 (97.4) | 521 (97.7) | 0.747 |
| Yes | 14 (2.1) | 10 (3.0) | — | | 24 (2.4) | 12 (2.6) | 12 (2.3) | |
| Missing | 0 (0.0) | 1 (0.3) | 57 (100.0) | | 1 (0.1) | 0 (0.0) | 1 (0.2) | |
| Any discrimination | | | | | | | | |
| No | 517 (77.0) | 279 (84.3) | — | 0.008 | 796 (79.4) | 364 (77.8) | 432 (80.9) | 0.223 |
| Yes | 154 (23.0) | 52 (15.7) | — | | 206 (20.6) | 104 (22.2) | 102 (19.1) | |
| Missing | 0 (0.0) | 0 (0.0) | 57 (100.0) | | 0 (0.0) | 0 (0.0) | 0 (0.0) | |
| Physical assault | | | | | | | | |
| No | 610 (90.9) | 312 (94.3) | — | 0.066 | 922 (92.0) | 424 (90.6) | 498 (93.3) | 0.121 |
| Yes | 61 (9.1) | 19 (5.7) | — | | 80 (8.0) | 44 (9.4) | 36 (6.7) | |
| Missing | 0 (0.0) | 0 (0.0) | 57 (100.0) | | 0 (0.0) | 0 (0.0) | 0 (0.0) | |

Bold denotes significance at a level of $p < 0.05$.*Statistically significant differences ($p < 0.05$) between sexual orientation identity groups are specified in superscript letters: ^aGay versus bisexual; ^bgay versus heterosexual; ^cbisexual versus heterosexual.

GED, General Educational Development; MSM, men who have sex with men.

TABLE 2. DIFFERENTIAL ITEM FUNCTIONING OF THE ENACTED STIGMA SCALE BY SEXUAL ORIENTATION IDENTITY

| Item | Pseudo R^2 change | | | Relative β change |
|---|---------------------|----------------|-------------|-------------------------|
| | Uniform DIF | Nonuniform DIF | Overall DIF | |
| “You were called names or insulted” | <0.01 | 0.004 | 0.004 | 0.003 |
| “You received poorer services than other people in restaurants, stores, other businesses or agencies” | 0.001 | 0.003 | 0.004 | 0.003 |
| “You were treated unfairly at work or school” | 0.003 | <0.01 | 0.003 | <0.001 |
| “You were denied or given lower quality health care” | 0.017 | <0.01 | 0.017 | 0.029 |
| “You were physically attacked or injured” | 0.002 | <0.01 | 0.002 | <0.001 |

Pseudo R^2 and relative change of coefficient statistics for DIF analyses by sexual orientation identity (gay vs. bisexual men). DIF, differential item functioning.

Discussion

Bisexual men reported enacted stigma experiences less frequently than did gay men even after adjustment. In contrast, our results indicated that socioeconomic and relational factors explain differences between gay and bisexual men in prevalence of depressive symptoms. As expected, men who reported enacted stigma experiences presented higher prevalence of clinically relevant depressive symptoms than those who did not, but the effect of these experiences was not cumulative. Against our a priori hypothesis, sexual orientation identity did not modify the association of enacted stigma with depressive symptoms, neither did race/ethnicity, sexual orientation disclosure, or being in a relationship.

Prevalence of enacted stigma experiences and depressive symptoms

The large proportion of men reporting enacted stigma related to their sexual minority status in the Baltimore NHBS sample analyzed in this article was very similar to U.S. na-

tional estimates obtained in 20 cities in 2011⁴¹: one-third reported verbal harassment, one quarter reported discrimination, and 8% reported physical assault as a result of perceived same-sex attraction.⁴¹ The NHBS national report did not provide information on enacted stigma separately for gay and bisexual men, but other studies have found a higher enacted stigma prevalence among gay men compared with bisexual men,^{7,9,29} as in our study. We found that these differences were not attenuated after adjusting for demographic variables, and socioeconomic and relational factors.

It is worth highlighting that more than one-third of the men in our sample had clinically relevant depressive symptoms, 59.3% among heterosexual MSM, 43.1% among bisexual respondents, and 34.2% among gay men. This result is consistent with a Californian study showing that 25.1% of homosexually experienced heterosexual men, 14.6% of bisexual men, and 11.9% of gay men reported high levels of psychological distress in the last 30 days.⁵¹ Furthermore, it adds weight to hypotheses of added social strain among heterosexual and bisexual MSM.⁵¹

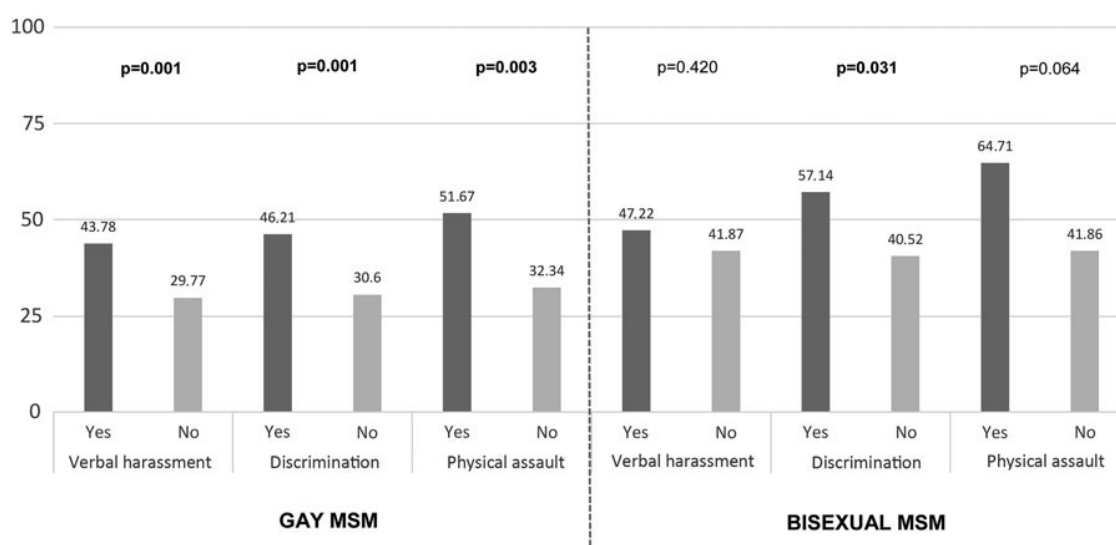


FIG. 1. Percentages of participants presenting relevant depressive symptoms among those who reported (darkest gray) or not (lighter gray) sexual minority-related enacted stigma, separately for gay and bisexual men in Baltimore, 2011 and 2014. Bold denotes significance at the level of $p < 0.05$.

TABLE 3. GENERALIZED ESTIMATING EQUATION MODELS USING A POISSON DISTRIBUTION TO ASSESS THE ASSOCIATION OF SEXUAL ORIENTATION IDENTITY AND OTHER CHARACTERISTICS WITH ANY ENACTED STIGMA EXPERIENCE (DEPENDENT VARIABLE) AMONG GAY AND BISEXUAL MEN IN THE BALTIMORE-TOWSON-COLUMBIA METROPOLITAN STATISTICAL AREA, 2011 AND 2014

| | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
|--|---------------------------|----------------|---------------------------|----------------|---------------------------|----------------|---------------------------|----------------|
| | Estimate, aPR (95% CI) | p | Estimate, aPR (95% CI) | p | Estimate, aPR (95% CI) | p | Estimate, aPR (95% CI) | p |
| Intercept | 0.49 (0.43–0.57) | < 0.001 | 0.57 (0.46–0.71) | < 0.001 | 0.61 (0.42–0.89) | 0.010 | 0.60 (0.40–0.88) | 0.010 |
| Sexual orientation identity | | | | | | | | |
| Gay | Ref. | | Ref. | | Ref. | | Ref. | |
| Bisexual | 0.75 (0.61–0.92) | 0.005 | 0.77 (0.63–0.95) | 0.012 | 0.69 (0.56–0.85) | 0.001 | 0.74 (0.58–0.93) | 0.011 |
| Wave | | | | | | | | |
| 2011 | Ref. | | Ref. | | Ref. | | Ref. | |
| 2014 | 0.94 (0.80–1.10) | 0.447 | 0.92 (0.78–1.08) | 0.283 | 0.93 (0.78–1.09) | 0.365 | 0.94 (0.79–1.11) | 0.449 |
| Age groups, years | | | | | | | | |
| 18–24 | Ref. | | Ref. | | Ref. | | Ref. | |
| 25–39 | 0.92 (0.77–1.11) | 0.378 | 0.89 (0.74–1.06) | 0.191 | 0.86 (0.71–1.03) | 0.096 | 0.87 (0.71–1.06) | 0.155 |
| ≥40 | 0.73 (0.59–0.91) | 0.004 | 0.71 (0.58–0.88) | 0.002 | 0.63 (0.50–0.80) | < 0.001 | 0.66 (0.52–0.85) | 0.001 |
| Race/ethnicity | | | | | | | | |
| Non-Hispanic White | Ref. | | Ref. | | Ref. | | Ref. | |
| Non-Hispanic Black | 0.83 (0.68–1.01) | 0.062 | 0.83 (0.68–1.01) | 0.062 | 0.79 (0.64–0.98) | 0.029 | 0.75 (0.60–0.93) | 0.009 |
| Hispanic | 1.18 (0.83–1.69) | 0.360 | 1.18 (0.83–1.69) | 0.360 | 1.11 (0.75–1.64) | 0.607 | 1.08 (0.70–1.67) | 0.735 |
| Multiracial | 1.01 (0.70–1.44) | 0.975 | 1.01 (0.70–1.44) | 0.975 | 0.92 (0.64–1.32) | 0.650 | 0.99 (0.70–1.39) | 0.935 |
| Other | 0.92 (0.51–1.68) | 0.792 | 0.92 (0.51–1.68) | 0.792 | 0.82 (0.40–1.66) | 0.575 | 0.72 (0.31–1.67) | 0.440 |
| Education level | | | | | | | | |
| Grades 1–11 | Ref. | | Ref. | | Ref. | | Ref. | |
| Grade 12 or GED | 0.95 (0.70–1.28) | 0.730 | 0.95 (0.70–1.28) | 0.730 | 0.91 (0.68–1.23) | 0.538 | 0.91 (0.68–1.23) | 0.538 |
| College, Associate's or Technical degree | 1.07 (0.78–1.48) | 0.672 | 1.07 (0.78–1.48) | 0.672 | 0.97 (0.70–1.35) | 0.876 | 0.97 (0.70–1.35) | 0.876 |
| Bachelor's degree | 0.85 (0.57–1.27) | 0.430 | 0.85 (0.57–1.27) | 0.430 | 0.79 (0.53–1.17) | 0.242 | 0.79 (0.53–1.17) | 0.242 |
| Any postgraduate studies | 0.98 (0.62–1.57) | 0.945 | 0.98 (0.62–1.57) | 0.945 | 0.81 (0.49–1.34) | 0.412 | 0.81 (0.49–1.34) | 0.412 |
| Household annual income | | | | | | | | |
| ≥ \$20,000 | Ref. | | Ref. | | Ref. | | Ref. | |
| \$0 to \$19,999 | 0.99 (0.83–1.19) | 0.942 | 0.99 (0.83–1.19) | 0.942 | 1.02 (0.85–1.23) | 0.800 | 1.02 (0.85–1.23) | 0.800 |
| Employment status | | | | | | | | |
| Employed | Ref. | | Ref. | | Ref. | | Ref. | |
| Full-time student | 0.79 (0.56–1.12) | 0.192 | 0.79 (0.56–1.12) | 0.192 | 0.74 (0.51–1.07) | 0.113 | 0.74 (0.51–1.07) | 0.113 |
| Unemployed or retired | 1.01 (0.84–1.22) | 0.931 | 1.01 (0.84–1.22) | 0.931 | 1.00 (0.83–1.21) | 0.991 | 1.00 (0.83–1.21) | 0.991 |
| Unable to work for health reasons | 1.45 (1.07–1.97) | 0.017 | 1.45 (1.07–1.97) | 0.017 | 1.49 (1.10–2.01) | 0.009 | 1.49 (1.10–2.01) | 0.009 |
| Other | 1.12 (0.75–1.69) | 0.576 | 1.12 (0.75–1.69) | 0.576 | 1.17 (0.77–1.77) | 0.468 | 1.17 (0.77–1.77) | 0.468 |
| Homelessness in the past 12 months | | | | | | | | |
| No | Ref. | | Ref. | | Ref. | | Ref. | |
| Yes | 1.54 (1.23–1.92) | < 0.001 | 1.54 (1.23–1.92) | < 0.001 | 1.50 (1.20–1.88) | < 0.001 | 1.50 (1.20–1.88) | < 0.001 |

(continued)

TABLE 3. (CONTINUED)

| | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
|------------------------------------|---------------------------|---|---------------------------|---|---------------------------|---|---------------------------|-------|
| | Estimate, aPR (95% CI) | p | Estimate, aPR (95% CI) | p | Estimate, aPR (95% CI) | p | Estimate, aPR (95% CI) | p |
| Sexual orientation disclosure | | | | | | | | |
| Yes | | | | | | | | |
| No | | | | | | | Ref. 0.74 (0.53–1.04) | 0.080 |
| Marital status | | | | | | | | |
| Married or cohabiting with a man | | | | | | | Ref. | |
| Married or cohabiting with a woman | | | | | | | 0.66 (0.33–1.29) | 0.222 |
| Not married or cohabiting | | | | | | | 1.18 (0.97–1.42) | 0.095 |
| QICu | 2403.5 | | 2382.8 | | 2254.2 | | 2126.3 | |

Bold denotes significance at a level of $p < 0.05$.

Nested models: first, adjusting by study wave and age (Model 1); then adding race/ethnicity (Model 2); next adding socioeconomic factors, including education level, household annual income, employment status, and homelessness (Model 3); and finally adding sexual orientation disclosure and marital status as relational factors (Model 4).

aPR, adjusted prevalence ratio; CI, confidence interval; QICu: quasi-likelihood under the Independence model Criterion.

Effect of stigma on depressive symptoms by sexual orientation identity

Within the context of the minority stress model,^{18,32} one might expect that those reporting enacted stigma experiences would more frequently show depressive symptoms. Our findings confirm the association between stigma and prevalence of depressive symptoms, but not the cumulative effect of stigma experiences or our general hypothesis about different patterns of association for gay and bisexual men. Physical assault was the enacted stigma dimension most strongly associated with depressive symptoms, followed by discrimination and verbal harassment.

Interactions among enacted stigma dimensions were all statistically significant. The aPR of the interactions between two enacted stigma dimensions did not increase the risk of presenting depressive symptoms. This pattern was similar for individuals who reported experiences in all of the three enacted stigma dimensions (aPR 2.03; not tabulated), very close to the aPR of individuals reporting only physical assault experiences. This suggests a saturation phenomenon instead of a cumulative effect of stigma experiences on depressive symptoms. In the case of men who experienced physical assault, for example, additionally experiencing discrimination and/or verbal harassment did not increase the strength of the association between stigma experiences and depressive symptoms.

Stigma measurement

No DIF on the enacted stigma scale indicated that gay and bisexual men answered similarly. However, as this scale focuses on experiences that only happen if someone knows or assumes same-sex attraction, it does not capture the unique challenges related to the disclosure of a bisexual orientation or identity. To address this limitation, specific instruments to assess bisexual stigma have been developed, such as the Anti-Bisexual Experiences Scale⁵² and the Bisexual Identity Inventory,⁵³ covering dimensions related to internalized stigma. A systematic review⁵⁴ has found that internalized stigma could be more important than enacted stigma experiences when considering mental health outcomes. Internalized stigma in the current context refers to the internalization of anti-LGB social attitudes by sexual minority individuals.⁵⁵ Further research measuring both enacted and internalized stigma is needed to understand the effect of stigma on poor mental health.

Demographic and social characteristics of gay, bisexual, and heterosexual participants

Similar to Baltimore's general population, the majority of the participants in this study identified as non-Hispanic Black, but this proportion was significantly higher among bisexual than among gay men (79.8% vs. 66.3%, $p < 0.001$). Previous research proposed a dynamic ecological model in which race/ethnicity was an important factor in terms of how men organize, interpret, and share their sexual identities.⁵⁶ The intersection of race/ethnicity and sexual and masculine identities influences sexual behavior, as it limits (and expands) men's options for what may be considered acceptable sexual behavior.^{56,57} Gay men were younger than

TABLE 4. GENERALIZED ESTIMATING EQUATION USING A POISSON DISTRIBUTION TO ASSESS THE ASSOCIATION OF SEXUAL ORIENTATION IDENTITY, ENACTED STIGMA, AND OTHER CHARACTERISTICS WITH CLINICALLY RELEVANT DEPRESSIVE SYMPTOMS (DEPENDENT VARIABLE) AMONG GAY AND BISEXUAL MEN IN THE BALTIMORE-TOWSON-COLUMBIA METROPOLITAN STATISTICAL AREA, 2011 AND 2014

| | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
|--|----------------------------------|--------|----------------------------------|--------|----------------------------------|--------|----------------------------------|--------|
| | Estimate, <i>aPR</i> (95% CI) | p | Estimate, <i>aPR</i> (95% CI) | p | Estimate, <i>aPR</i> (95% CI) | p | Estimate, <i>aPR</i> (95% CI) | p |
| Intercept | 0.27 (0.21–0.34) | <0.001 | 0.26 (0.19–0.35) | <0.001 | 0.26 (0.18–0.38) | <0.001 | 0.22 (0.14–0.33) | <0.001 |
| Sexual orientation identity | | | | | | | | |
| Gay | Ref. | | Ref. | | Ref. | | Ref. | |
| Bisexual | 1.28 (1.08–1.52) | 0.005 | 1.27 (1.06–1.51) | 0.008 | 1.10 (0.91–1.32) | 0.335 | 1.06 (0.87–1.30) | 0.551 |
| Enacted stigma dimensions and their interactions | | | | | | | | |
| Verbal harassment | | | | | | | | |
| No | Ref. | | Ref. | | Ref. | | Ref. | |
| Yes | 1.52 (1.19–1.93) | 0.001 | 1.51 (1.19–1.93) | 0.001 | 1.42 (1.12–1.80) | 0.004 | 1.39 (1.09–1.77) | 0.008 |
| Discrimination | | | | | | | | |
| No | Ref. | | Ref. | | Ref. | | Ref. | |
| Yes | 1.79 (1.38–2.32) | <0.001 | 1.78 (1.37–2.31) | <0.001 | 1.83 (1.40–2.37) | <0.001 | 1.76 (1.35–2.29) | <0.001 |
| Physical assault | | | | | | | | |
| No | Ref. | | Ref. | | Ref. | | Ref. | |
| Yes | 2.14 (1.39–3.30) | 0.001 | 2.13 (1.39–3.28) | 0.001 | 2.00 (1.28–3.13) | 0.003 | 2.04 (1.29–3.22) | 0.002 |
| Verbal × Discrimination | | | | | | | | |
| No | Ref. | | Ref. | | Ref. | | Ref. | |
| Yes | 0.49 (0.33–0.75) | 0.001 | 0.50 (0.33–0.76) | 0.001 | 0.45 (0.30–0.69) | <0.001 | 0.48 (0.31–0.75) | 0.001 |
| Verbal × Physical | | | | | | | | |
| No | Ref. | | Ref. | | Ref. | | Ref. | |
| Yes | 0.35 (0.17–0.72) | 0.005 | 0.36 (0.17–0.73) | 0.005 | 0.39 (0.19–0.81) | 0.011 | 0.41 (0.20–0.82) | 0.012 |
| Discrimination × Physical | | | | | | | | |
| No | Ref. | | Ref. | | Ref. | | Ref. | |
| Yes | 0.39 (0.18–0.84) | 0.016 | 0.39 (0.18–0.84) | 0.016 | 0.29 (0.12–0.70) | 0.006 | 0.29 (0.11–0.73) | 0.009 |
| Verbal × Discrimination × Physical | | | | | | | | |
| No | Ref. | | Ref. | | Ref. | | Ref. | |
| Yes | 6.26 (2.19–17.91) | 0.001 | 6.26 (2.19–17.92) | 0.001 | 7.80 (2.52–24.16) | <0.001 | 7.23 (2.30–22.77) | 0.001 |
| Wave | | | | | | | | |
| 2011 | Ref. | | Ref. | | Ref. | | Ref. | |
| 2014 | 0.97 (0.82–1.14) | 0.693 | 0.97 (0.82–1.15) | 0.728 | 1.02 (0.87–1.21) | 0.782 | 1.02 (0.87–1.21) | 0.777 |
| Age groups, years | | | | | | | | |
| 18–24 | Ref. | | Ref. | | Ref. | | Ref. | |
| 25–39 | 0.96 (0.79–1.17) | 0.695 | 0.96 (0.79–1.18) | 0.718 | 0.96 (0.78–1.19) | 0.738 | 0.97 (0.79–1.20) | 0.806 |
| ≥40 | 1.19 (0.96–1.47) | 0.112 | 1.19 (0.96–1.48) | 0.107 | 1.11 (0.88–1.40) | 0.358 | 1.11 (0.89–1.40) | 0.354 |
| Race/ethnicity | | | | | | | | |
| Non-Hispanic White | Ref. | | Ref. | | Ref. | | Ref. | |
| Non-Hispanic Black | 1.04 (0.82–1.30) | 0.758 | 1.04 (0.82–1.30) | 0.758 | 0.86 (0.69–1.08) | 0.193 | 0.84 (0.67–1.06) | 0.140 |
| Hispanic | 0.99 (0.58–1.67) | 0.960 | 0.99 (0.58–1.67) | 0.960 | 1.01 (0.61–1.67) | 0.978 | 1.02 (0.61–1.71) | 0.931 |

(continued)

TABLE 4. (CONTINUED)

| | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
|--|----------------------------------|---|----------------------------------|-------|----------------------------------|------------------|----------------------------------|------------------|
| | Estimate, <i>aPR</i> (95% CI) | p | Estimate, <i>aPR</i> (95% CI) | p | Estimate, <i>aPR</i> (95% CI) | p | Estimate, <i>aPR</i> (95% CI) | p |
| Multiracial | | | 1.06 (0.72–1.54) | 0.779 | 0.96 (0.66–1.40) | 0.827 | 0.95 (0.65–1.40) | 0.812 |
| Other | | | 1.08 (0.63–1.84) | 0.790 | 0.97 (0.53–1.79) | 0.923 | 0.98 (0.51–1.86) | 0.944 |
| Education level | | | | | | | | |
| Grades 1–11 | | | | | Ref. | | Ref. | |
| Grade 12 or GED | | | | | 0.94 (0.74–1.20) | 0.634 | 0.95 (0.74–1.20) | 0.647 |
| College, Associate's or Technical degree | | | | | 0.96 (0.74–1.24) | 0.757 | 0.95 (0.74–1.24) | 0.717 |
| Bachelor's degree | | | | | 0.72 (0.51–1.02) | 0.068 | 0.73 (0.52–1.03) | 0.071 |
| Any postgraduate studies | | | | | 0.81 (0.51–1.27) | 0.356 | 0.82 (0.52–1.28) | 0.385 |
| Household annual income | | | | | | | | |
| ≥ \$20,000 | | | | | Ref. | | Ref. | |
| \$0 to \$19,999 | | | | | 1.26 (1.03–1.55) | 0.026 | 1.21 (0.98–1.49) | 0.079 |
| Employment status | | | | | | | | |
| Employed | | | | | Ref. | | Ref. | |
| Full-time student | | | | | 1.51 (1.02–2.24) | 0.042 | 1.51 (1.03–2.23) | 0.037 |
| Unemployed or retired | | | | | 1.32 (1.07–1.63) | 0.010 | 1.30 (1.05–1.61) | 0.015 |
| Unable to work for health reasons | | | | | 1.78 (1.36–2.33) | <0.001 | 1.78 (1.36–2.34) | <0.001 |
| Other | | | | | 1.65 (1.20–2.27) | 0.002 | 1.60 (1.15–2.22) | 0.005 |
| Homelessness in the past 12 months | | | | | | | | |
| No | | | | | Ref. | | Ref. | |
| Yes | | | | | 1.10 (0.87–1.38) | 0.417 | 1.08 (0.86–1.36) | 0.488 |
| Sexual orientation disclosure | | | | | | | | |
| Yes | | | | | Ref. | | Ref. | |
| No | | | | | 1.10 (0.88–1.38) | | 1.10 (0.88–1.38) | 0.411 |
| Marital status | | | | | | | | |
| Married or cohabiting with a man | | | | | Ref. | | Ref. | |
| Married or cohabiting with a woman | | | | | 0.99 (0.56–1.78) | | 0.99 (0.56–1.78) | 0.984 |
| Not married or cohabiting | | | | | 1.35 (1.08–1.68) | | 1.35 (1.08–1.68) | 0.008 |
| QICu | 2187.3 | | 2180.2 | | 2076.6 | | 2095.9 | |

Bold denotes significance at a level of $p < 0.05$.

Nested models: first, adjusting by study wave and age (Model 1); then adding race/ethnicity (Model 2); next adding socioeconomic factors, including education level, household annual income, employment status, and homelessness (Model 3); and finally adding sexual orientation disclosure and marital status as relational factors (Model 4).

bisexual men, and heterosexual men were the oldest group (27.7%, 44.7%, and 49.1% ≥ 40 years old). Some evidence has suggested that a stronger internal dilemma of violating male gender role expectations⁵⁸ and nonconformity of same-sex attraction⁵⁹ among older generations may underlie some of these differences.

In this study, men who identified as gay had the highest socioeconomic position, measured by higher education level, employment rates, and household income, and less homelessness, followed by bisexual and heterosexual MSM, the latter presenting the most disadvantaged position. Other studies have also reported socioeconomic differences in this direction between gay and bisexual men.⁷ The mechanisms underlying these associations would benefit from further study. Our findings suggest that this worse socioeconomic position exacerbates depressive symptoms among bisexual men showing that social instability (e.g., in housing, employment, income, criminal justice, and social relationships) can exacerbate stress and contribute to poor mental health outcomes among these men. Socioeconomic disadvantages may also partly explain the high prevalence of depressive symptoms among heterosexual MSM in our sample. Together, these findings suggest a need to better understand the intersectional relationship between sexual orientation and socioeconomic position.

Limitations and strengths

First, it is important to note the high prevalence of relevant depressive symptoms reported by heterosexual men (59.3%), to whom the enacted stigma scale was not administered. Second, since the sample only included venue-based MSM, participants may not be representative of gay and bisexual men who do not socialize in MSM-identified spaces and suburban or rural men, where stigma is likely to be higher.^{60–62} It is also important to note that our sample of MSM did not include bisexual men who were not sexually active with men. Third, although GEE models were constructed to account for correlations among individuals recruited in each venue and date, it is possible that some clustering remains unaccounted for, thus either underestimating or overestimating variability. Fourth, as data were collected at two time points, differences found between the 2011 and 2014 waves could be due to either recruitment processes or societal changes. To take this into account, the source wave was included in the models for adjustment. Fifth, enacted stigma and CES-D-10 scales being administered by interviewers, and the difference in time frames (no specific time vs. the past week), may have biased answers and modified results. Finally, the survey design was cross-sectional, which constrains the assessment of causality.

One of the strengths of this study is the large sample size of bisexual ($n=331$) and gay men ($n=671$). In addition, it is the first study from the NHBS which included use of the CES-D-10 to measure depressive symptoms. This allowed us to understand in further detail the relationship between mental health and enacted stigma among gay and bisexual men.

Conclusion

This study confirms the association between enacted stigma and depressive symptoms among gay and bisexual

men, but, contrary to our a priori hypothesis, sexual orientation did not modify this association. The bisexual group presented other psychosocial stressors, which may explain their higher prevalence of depressive symptoms.

The high levels of verbal harassment, discrimination, and physical assault reported by gay and bisexual men, and their negative effect on mental health, indicate the need to develop new effective public health strategies to avoid these mental health consequences of homophobic and biphobic culture. Strategies may include advocating for education on sexual diversity, developing community-building or empowerment interventions to prevent stigma, and designing educational interventions for confronting and coping with mistreatment that consider the specific characteristics of gay and bisexual men.

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Supplementary Material

Supplementary Table S1
Supplementary Table S2

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6. DISCUSSION

6.1 THE EVOLUTION OF HEALTH INEQUALITIES BY SEXUAL ORIENTATION IN BARCELONA

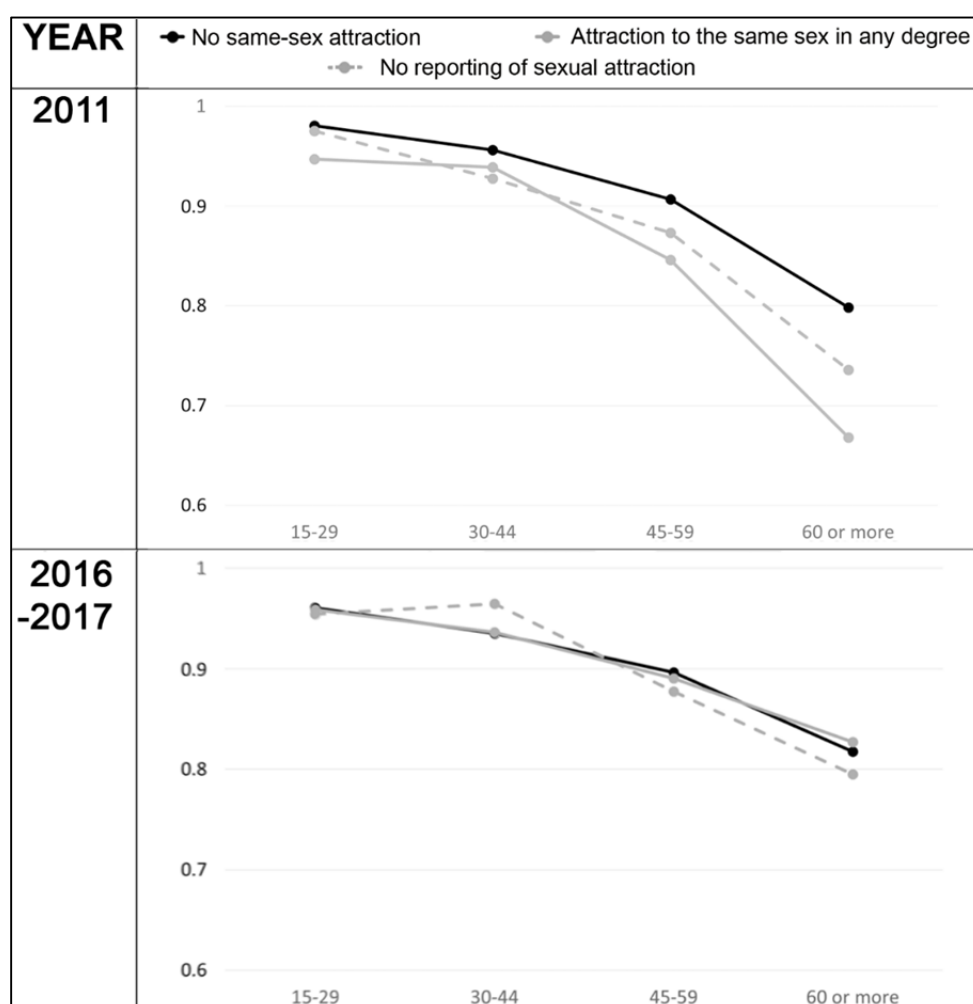
Over the last few decades, surveys have shown an increasing proportion of persons reporting an LGB sexual orientation worldwide.^{6,7} In our context, we observed a six-fold increase (from 2.2% in 2011 to 12.5% in 2016-2017) of persons reporting any same-sex attraction in the Barcelona Health Surveys. This relevant change in such a short period suggests that disclosure has increased as a result of a higher social acceptance and lower discrimination.

Our hypothesis of less health inequities by sexual orientation in the 2016-2017 than the 2011 Barcelona Health Survey could be related to the increment of persons reporting same-sex attraction as consequence of a higher social acceptance.

Figure 10 shows the EQ-5D mean index per age group according to sexual attraction in 2011 and 2016-2017. In 2011, differences between persons attracted to their same sex in any degree (grey continuous line) and those with ‘no same-sex attraction’ (black continuous line) were observed in most age groups, and it was higher than the minimal important difference previously established for the EQ-5D utility index as 0.045 ± 0.009 .¹²¹ However, the 2016-2017 figure is totally different compared to the 2011 figure: here the grey and black continuous lines are practically overlapping, showing that the results of these two groups are very similar.

The discontinuous grey line shows the EQ-5D mean index of the participants that did not report sexual attraction: in the 2011 Barcelona Health Survey, results of this group (7% of the total) are between those with and without same-sex attraction, suggesting that it is composed by a mix of both. In the 2016-2017 Barcelona Health Survey it was very similar, 311 (9.3%) did not answer the question on sexual attraction and they are very close to both continuous lines.

Figure 10. Mean of EuroQol index by sexual attraction according to age groups in the 2011 and 2016-2017 Barcelona Health Surveys.



The proportion of persons who did not report sexual attraction in both Barcelona Health Surveys is low, considering that 30% of gay and bisexual men in a 2011-2012 study¹²² about willingness to reveal sexual orientation in national population surveys indicated unwillingness to disclose it.

The Barcelona Health Survey design is cross-sectional, which prevents measuring longitudinal changes from 2011 to 2016-2017 (which was not our objective), and constrains causality assessment. However, the observed reduction of sexual orientation-related health inequities comparing the 2011 and the 2016-2017 Barcelona Health Surveys suggest a probable improvement of supportive environment in Barcelona city.

6.2 THE EVOLUTION OF HEALTH INEQUALITIES BY SEXUAL ORIENTATION IN EUROPE

There are few studies on health inequalities related to sexual orientation in Europe, most of them were carried out in the United Kingdom. A systematic review focused on persons aged 50 or older¹²³ showed that gay and bisexual men have an increased risk of reporting long-term illness and health-related limitations, and lesbian and bisexual women have an increased risk of worse self-rated health as well as risky health behaviors. A combined meta-analysis of 12 population health surveys in United Kingdom⁶⁴ showed that lesbian and gay participants had higher prevalence of common mental health disorders, but with a different association through age groups.

An English longitudinal study among adults aged 50 and older (ELSA)¹²⁴ showed that LGB participants reported significantly lower health-related quality of life, lower life satisfaction and higher prevalence of depressive symptoms.

The Adult Psychiatric Morbidity Survey carried out in England in 2007⁸⁶ showed that self-reported identification as non-heterosexual was associated with unhappiness, neurotic disorders, depressive episodes, generalized anxiety disorder, obsessive-compulsive disorder, phobic disorder, probable psychosis, suicidal thoughts and acts, self-harm and alcohol and drug dependence. A comparison between the 2007 and 2014 Adult Psychiatric Morbidity Surveys in England¹²⁵ showed that inequalities in risks of common mental disorder or substance misuse did not change between both surveys, seven years apart. LGB participants were more likely to have common mental disorder (particularly bisexual persons), and to report alcohol and drug misuse.

We have found three other studies from Western Europe. A national Dutch Survey⁶⁸ that showed that gay and lesbian persons reported on average more chronic conditions; a cohort study of Dutch adolescents¹²⁶ where LGB participants reported more internalizing problems, smoked more cigarettes, and used more marijuana; and a national French population survey¹²⁷ showing that sexual minority adults were more likely to have experienced current depressive symptoms and a major depressive episode in last year.

We have found three studies in Sweden. A population-based health survey conducted between 2008 and 2013⁶⁹ showed that LGB persons were more likely to report worse self-rated health, as well as more physical health symptoms and conditions (e.g., pain, insomnia, dermatitis, tinnitus, intestinal problems, diabetes, asthma, high blood pressure), compared to their heterosexual counterparts, but disparities were smaller in older age groups. A population-based sample cohort recruited between 2010 and 2014¹²⁸ showed higher mental health outcomes in LGB participants. Finally, a 2011 national cohort study¹²⁹ showed that gay and lesbian participants were more likely to receive treatment for anxiety disorders and to use antidepressant medication, and bisexuals were more likely to receive treatment for mood, anxiety and substance use disorders, and to use antidepressant medication.

An Iceland study¹³⁰ that surveyed the whole population of 10-year-old students in 2006, 2010, and 2014 showed that LGB students presented worse psychosocial measures across the three surveys, as compared with non-LGB students. However, the gap between LGB and non-LGB adolescents appears to be closing, at least between 2010 and 2014. Social support, liking school, classmate friendliness and acceptance, being bullied, and physical and mental health all seem to play an important part in life satisfaction and general wellbeing.

A Serbian cross-sectional study¹³¹ showed the highest average score of depressive symptoms in bisexual, followed by homosexual and then heterosexual participants. To our knowledge, no other studies on inequalities by sexual orientation have been published in countries from Eastern and Southern Europe, besides our own study present in this thesis.

Finally, the 2010 European Social Survey¹³² conducted in 26 countries showed that the acceptance of LGB persons varies significantly among countries and it is significantly related to better self-rated health and well-being.

6.3 THE EVOLUTION OF HEALTH INEQUALITIES BY SEXUAL ORIENTATION IN UNITED STATES

According to sexual minority stress⁷¹ and life course theories, increased legal rights and social acceptance of sexual minority identities will decrease stigma and, in turn, reduce health disadvantages associated with the sexual minority status. However, a nonlinear progression

toward LGB rights has been observed in United States, wherein LGB people have experienced uneven progression and sometimes a reduction in protections.^{133,134} It is also important to highlight that minority sexual stressors regarding individual, interpersonal, and institutional factors change in the different social and legal contexts of LGB status, translating into different health outcomes.¹³⁵

On the other hand, social, cultural, economic, and demographic shifts may not affect all LGB people equally. Persons who identify as bisexual, in particular, appear to suffer greater marginalization in both heterosexual and gay/lesbian communities.^{136–138} In addition, despite increasingly positive attitudes toward same-sex sexual behavior, research has not found growing positivity toward bisexual persons.¹³⁹ Perceptions and policies that are more favorable to sexual minorities may not address the stigma and stereotyping of non-monosexual people that persist among both heterosexual and sexual minority communities.^{140–142}

The LGB health status differs over time and among minority sexual subgroups (lesbian, gay and bisexual). A Minnesota student survey,¹⁴³ collected from 9th and 12th graders in three time frames (1998, 2004, 2010), showed that young people with partners with more than one sex reported more emotional distress compared to their peers who only have partners from a different sex. With a few exceptions, gaps in disparities between heterosexual persons and those who are members of some sexual minority have not changed from 2004 to 2010. A study which used data from the pooled 2013–2018 United States Integrated National Health Interview Surveys¹³⁵ showed no evidence of reduced health disparities (psychological distress, depression, anxiety, self-rated physical health, and activity limitation) by sexual orientation across cohorts. Instead, regarding exclusively heterosexual-identified participants, the health disadvantages of gay, lesbian, and—most strikingly— bisexual-identified persons have increased across cohorts.

When considering specifically mental health, data from the National Epidemiologic Survey of Alcohol and Related Conditions–III,⁸⁷ a nationally representative sample collected in United States in 2012-2013 showed a varying effect through time between sexual minority status and major depressive symptoms, being strongest at younger ages, and declining with age. At age 18, sexual minority status was associated with approximately 3 times greater

adjusted odds of having major depressive symptoms in the past year, compared to 1.5 times greater odds at age 25 through 40, and no longer being significant by age 52.

In the Epidemiologic Study of Health Risk in Women (ESTHER), carried out in Pittsburgh between 2003 and 2006 with a follow-up between 2015 and 2016,¹⁴⁴ lesbian participants reported higher rates of depression at baseline compared to heterosexual women. However, by the time of the follow-up survey 10 years later, this disparity in depression had resolved.¹⁴⁴ Some authors have posited that improvements in legal protections, including the right to marriage, and increased societal acceptance for sexual minority adults may contribute to improving their health.¹⁴⁵ These findings are also congruent with research that suggests that the healthy development of the self is related to resilience, an ability to bounce back following the effect of social stigma or traumatic experiences and enhanced by resources that can be activated in times of stress.^{146–149} Another possible explanation could be a selection bias; it is especially relevant in aging research because biased estimation of the effect of an exposure within lifetime can occur when mortality is a common effect of such exposure and an unmeasured determinant in similar settings.¹⁵⁰

Data from the Local National Youth Risk Behavior Survey¹⁵¹ conducted biennially from 2007 to 2017¹⁵¹ showed that overall alcohol use is decreasing among 9th to 12th graders. The largest decreases were seen in current alcohol use among young lesbian women, which fell from a prevalence of 56.1% in 2007 to 38.9% in 2017, and among bisexual women from 64.3% in 2007 to 41.1% in 2017. Despite this, alcohol use behaviors (lifetime alcohol use, age at first drink, current alcohol use and binge drinking) were still elevated among lesbian and bisexual female youth compared to their heterosexual counterparts. Heterosexual male students presented decreases in alcohol use, while most alcohol use behaviors among sexual minority males did not decrease to a significant degree, with the exception of binge drinking among gay (2007: 36.0% to 2017: 12.6%) and bisexual (2007: 24.7% to 2017: 11.6%).

A 20-year follow-up study from United States¹⁴⁷ showed that LGB participants reported a higher number of chronic conditions (OR= 1.48; 95% CI = 1.24–1.76) at baseline and there was an increase in the number of chronic conditions over time (OR = 1.22, 95% CI = 1.14–1.31). However, chronic conditions for LGB participants increased less over time than for heterosexual participants. The results of this study suggest that LGB individuals may become resilient to the negative health effects of minority stressors over time.^{146–149}

7. SOCIAL IMPLICATION AND FUTURE RESEARCH LINE

Due to the scarce research in health inequalities related to sexual orientation, the usefulness of this thesis is especially relevant considering one of the principles of action of the WHO Commission on Social Determinants of Health: measuring the magnitude of the problem, expanding the knowledge, and sensitizing public opinion in this regard.

Even in western countries, where supposedly views on homosexuality are particularly positive, the legal situation is favorable and there are fewer barriers to reporting sexual orientation, the LGB population has presented worse health outcomes. Since recent research has showed the relationship between life expectancy reduction and the level of homophobia at a country level, we could hypothesize that in those countries with negative views on homosexuality the LGB persons have much worse health outcomes than their heterosexual counterparts. Therefore, it is necessary to provide information about the effect of LGB discrimination in countries with lower LGB acceptance, and also implement humanitarian programs to help LGB persons in those countries.

United States is the country with more scientific evidence on LGB-related health inequalities, most European research has been conducted in Western and Northern countries, and there is hardly any data available in Eastern and Southern countries. Moreover, very few studies in Europe and United States provide information on the evolution of LGB health inequalities. Therefore, further research is necessary for monitoring the LGB health inequities through time and for delving deeper into the social and individual factors that produce these LGB health inequalities, in order to develop the appropriate health policies, health interventions, education-based programs and recommendations for reducing external and internalized homophobia.

In last decade, some studies showed a reduction in health inequities related to sexual orientation in England, Iceland and United States. This reduction was consistent with our findings in Barcelona, and may be explained in part by the increase on social acceptance and lower discrimination in the last years. However, recent events of verbal harassment and physical assault towards LGB persons showed that this trend could be attenuated by social backlash reacting to the higher visibility of the LGB population.

On the other hand, the improvement of health outcomes among LGB people in recent years could also be consequence of their resilience, according to some social theorists: LGB persons may become resilient to the negative health effects of minority stressors over time. Thus, continue monitoring of inequities is needed to detect a possible social backlash to the current visibility of the LGB population, and it is essential to implement interventions at younger ages on improving the health of LGB persons when they are at a higher risk of negative health outcomes.

It is also important to extend research on the effects of LGB discrimination beyond sexual minority populations, assessing also its impact on heterosexual persons. Demonstrating that the benefits of reducing homophobic and biphobic stigma for the whole population could not only improve health globally, but also increase the social acceptance of policies addressed to health inequalities related to sexual orientation.

To advance in the process of achieving health equity, our results showed the need of:

- 1) Including sexual orientation in the global agenda of health inequities in all countries and monitoring LGB-related health inequities systematically;
- 2) Developing and evaluating the effectiveness of new public health strategies to avoid the mental health consequences of homophobic and biphobic culture, such as education based on sexual diversity, community building or empowerment interventions to prevent stigma, and educational interventions for confronting and coping with mistreatment that consider the specific characteristics of lesbian, gay and bisexual persons;
- 3) Designing public health strategies addressed to lesbian and bisexual women that consider the intersection of gender and sexual identities;
- 4) Training health professionals about the LGB-related health inequalities and this population's specific needs.

8. CONCLUSIONS

- The increase in levels provided by the new version of the EQ-5D with 5 levels, the EQ-5D-5L, contributed to its validity and discriminatory power to measure health-related quality of life. The group of individuals with poor health was redistributed into different severity levels, while in the EQ-5D-3L they were stuck in the category of extreme problems.
- The proportion of individuals with the best health state is still very high in the EQ-5D-5L. Nonetheless, results of perceived health support the validity of the observed redistribution. Furthermore, the consistency between both EQ-5D versions and with results from the 2011 Spanish National Health Survey enhances the reliability of responses from this subset of general population in good health.
- Our findings support the validity and discriminatory power of the new EQ-5D-5L for health measurement of the general population. However, it would be advisable to maintain both versions in parallel for a temporary period when introducing the new EQ-5D-5L to a national health survey currently using the EQ-5D-3L version, in order to establish an anchor.
- The lesbian, gay and bisexual persons in the 2011 Barcelona population presented worse health-related quality of life than the heterosexual ones, and gender, chronic conditions, and health-related behaviors play a major role in explaining such differences.
- Health inequities by sexual orientation observed in the 2011 Barcelona population support the need of including sexual orientation into the global agenda of health inequities, and provide helpful information for developing new effective public health strategies from promotion to tertiary prevention, including: education based on sexual diversity, evidence-based public health interventions on general population to reduce external and internalized homophobia, and recommendations for health professionals to improve the LGB population's health.

- Health inequities by sexual orientation observed in the 2016-2017 Barcelona population were only observed among women who felt any same-sex attraction, suggesting a supportive environment for men with any same-sex attraction in Barcelona. Although this seems promising, as only five years before these results were considerably worse, it is important to continue monitoring inequities to detect a possible social backlash to the current visibility of the LGB persons.
- Our findings in Baltimore's 2011 and 2014 National HIV Behavioral Surveillance confirm the association between enacted stigma and depressive symptoms among gay and bisexual men but, contrary to our a priori hypothesis, sexual orientation did not modify this association. The bisexual group presented other psychosocial stressors, which may explain their higher prevalence of depressive symptoms.
- The high levels of verbal harassment, discrimination, and physical assault reported by gay and bisexual men in Baltimore (2011 and 2014) and their negative effect on mental health indicate the need to develop new effective public health strategies to avoid these mental health consequences of homophobic and biphobic culture. Strategies may include advocating for education on sexual diversity, developing community-building or empowerment interventions to prevent stigma, and designing educational interventions for confronting and coping with mistreatment that consider the specific characteristics of gay and bisexual men.

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10. ANNEX: NON-PUBLISHED ARTICLE

Marti-Pastor M, German D, Perez G, Bartoll X, Diez E, Pont A, Garín O, Alonso J, Hernandez G, Mayoral K, Zamora V, Vilagut G, Ferrer M. *Health inequalities by sexual orientation: results from the 2016-2017 Barcelona Health Survey*.

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Title:

Health inequalities by sexual orientation: results from the 2016-2017 Barcelona Health Survey

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Running head: Health inequalities by sexual orientation 2016-2017

Keywords: LGB people; Inequalities; Quality of life; Health survey; Health behaviors.

ABSTRACT

Purpose

The aim of this study was to assess health inequalities by sexual attraction in the 2016-2017 Barcelona population, stratifying by sex and assuming cisgenderness.

Methods

Data came from the 2016-2017 Barcelona Health Survey, where 3,362 adults answered among other instruments the EuroQol (EQ-5D-5L), which measures 5 health dimensions and summarizes health-related quality of life into a single utility index. To assess health differences by sexual attraction, we constructed Tobit models for the EQ-5D index and Poisson regression models for the EQ-5D dimensions. Nested models were constructed to examine the mediator role of discrimination and health-related variables.

Results

After adjusting for socio-demographic variables, women feeling attraction to more than one sex showed lower EQ-5D index (-0.042, $p=0.012$) than those with no same-sex attraction, and higher prevalence of mobility, usual activities, and anxiety/depression with the following adjusted prevalence ratios (aPR) and confidence intervals (CI): 1.79 (95%CI 1.05-3.05); 1.84 (95%CI 1.05-3.21); and 1.76 (95%CI 1.27-2.43). Women feeling attraction to same sex only also presented higher aPR of anxiety/depression (1.46, 95%CI 1.10-1.92). In contrast, differences were not observed in men.

Conclusion

The women feeling ‘attraction to more than one sex’ and ‘only same-sex attraction’ in Barcelona in 2016-2017 presented worse health than those feeling ‘no same-sex attraction’, with discrimination likely playing a mediator role in explaining such inequalities. Health differences according to sexual

attraction were not observed among men. These worse results among women indicate the need to develop public health strategies in Barcelona addressed to lesbian and bisexual women considering the intersection of gender and sexual identities.

INTRODUCTION

Sexual orientation is a well-known axis of health inequities:^{1,2} worse health outcomes are consistently reported for lesbian, gay and bisexual (LGB) populations in mental health,³⁻⁷ chronic conditions,^{8,9} health-related behaviors,^{3,8} and perceived health.^{3,6,9} Health inequity refers to health inequalities which “are avoidable, yet are not avoided, they are inequitable”.¹⁰ Despite the United Nations Human Rights Council’s resolution recognizing LGBT rights in 2011,¹¹ their application varies substantially across countries. Same-sex sexual activity is still criminalized in more than 70 countries,¹² while same-sex marriage is legal in 30 countries.¹³ The Netherlands was the first country where it was legalized (2001), followed between 2003 and 2005 by Belgium, Canada, Spain, and Massachusetts (US), the first US state to approve same-sex marriage.

Social acceptance of sexual diversity in 2019 varied from the high numbers in some parts of Europe (Sweden 94%, The Netherlands 92%, and Spain 89%) to countries with less than 10% of acceptance, such as Nigeria (7%), Tunisia (9%) and Indonesia (9%).¹⁴ In this world context, Spain could be considered one of the countries with a higher respect of LGBT rights. Although Barcelona was the first Spanish city to fight for the LGBT rights with the historic demonstration on 26th June 1977,¹⁵ in 2011 persons attracted to their same sex still presented worse results in physical and mental health dimensions than those with no same-sex attraction.⁸

Over the last few decades, surveys have shown an increasing proportion of persons reporting an LGB sexual orientation worldwide.¹⁶ In our context, we observed a six-fold increase (from 2.2% in 2011 to 12.5% in 2016-2017) of participants reporting any same-sex attraction in the Barcelona Health Surveys. This relevant change in such a short period suggests that disclosure has increased as a result of a higher social acceptance and lower discrimination. Thus, we hypothesized that health inequities by

sexual orientation have been reduced in Barcelona in the last decade, but this reduction could be attenuated by social backlash reacting to higher visibility of LGB population.

Health inequities according to sexual orientation were assessed in the 2011 Barcelona Health Survey,¹⁷ though the small number of participants reporting any same-sex attraction prevented carrying out disaggregate analyses in subgroups. Our hypothesis is that inequities vary between men and women, and between persons feeling ‘attraction to more than one sex’ and ‘only same-sex attraction’. There is consistent scientific evidence about differences by sex in the impact of mediator factors on sexual orientation-related health inequities, such as socioeconomic position and health-related behavior^{7, 18, 19}. There are also studies showing differences between persons feeling attraction to same sex only and to more than one sex: the first group can suffer more enacted stigma,^{7, 8} which has been attributed to their greater visibility;⁹ while the latter may experience pressure to conform to a binary sexual orientation,²⁰ and prejudice due to specific stereotypes associated with bisexuality, such as confusion and promiscuity,^{21, 22} within the LGB community.^{23–26}

The aim of our study was to assess health inequalities by sexual attraction in the 2016-2017 Barcelona population, stratifying by sex; to analyze the extent to which sociodemographic characteristics, discrimination, health-related behaviors, and chronic conditions could explain such inequalities; and to understand whether they are inequities.

METHODS

Study population

Data used in this study came from the Barcelona Health Survey (BHS) 2016-2017 edition. It is a cross-sectional study periodically performed in Barcelona,¹⁷ a city in the north-east of Spain with about 1.6 million inhabitants. A representative sample of the non-institutionalized population aged 15 years or

older was surveyed through computer-assisted personal interviews administered face to face by accredited interviewers in the respondent's home between March 2016 and May 2017. The sample size was estimated at 3,600 individuals aged 15 years or older (relative error margin of 1.55% with a confidence level of 95.5%).

To ensure territorial representativeness, the sample was stratified by municipal districts. A random sampling strategy was applied using a simple extraction system from the municipal census, taking into account sex and age distribution. The sample size was estimated at 3,600 individuals aged 15 years or older (relative error margin of 1.55% with a confidence level of 95.5%). Post-stratification weights were calculated to restore the representativeness of the Barcelona population. To correct the effect of non-response, 66.5% of selected sampling units needed to be replaced by others with the same characteristics in terms of age group, sex, and neighborhood. Reasons for replacement were: refusal to participate (46.0%), change of address (29.3%), unreachable (11.1%), prolonged absence (6.9%), wrong address (2.6%), death (0.9%), local language skills (0.5%), or other reasons (2.8%).

The 2016-2017 BHS is an official statistic within the 2016 Statistical Action Plan of Catalonia, with an ethics review performed by the Catalan statistical authority in order to comply with the Spanish 15/1999 and European 2016/679 data protection laws. Citizens were asked for their explicit informed consent to participate in the survey. Our study was reviewed and approved by the Barcelona Public Health Agency (ASPB), which is the public health provider responsible for public health in Barcelona.

Variables and measurement instruments

The EuroQol - 5 Dimensions – 5 levels (EQ-5D-5L)

The EQ-5D-5L covers five dimensions of health (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression) with one item per dimension, and each item has five levels of

severity, from none to extreme problems. The instrument therefore defines 3125 distinct health states from all the possible combinations of dimensions and levels of severity (5⁵).

Societal preferences for each health state can be expressed quantitatively as a utility, which allows cost-utility analyses and to calculate quality-adjusted life years. The EQ-5D-5L societal preferences were elicited following a common protocol for all the countries, by combining the techniques of time trade-off and discrete choice.²⁷ In this study, the Spanish version of the EQ-5D-5L and preference values elicited from a representative sample of the Spanish general population²⁸ were used to construct the preference-based utility index. The EQ-5D-5L index in Spain ranges from 1 (perfect health) to -0.416, 0 being the value assigned to death. Negative values indicate health states valued by the Spanish society as worse than death.²⁸ For example, a person reporting being unable to walk about, unable to wash or dress themselves, several problems doing usual activities, several pains or discomfort, and being extremely anxious or depressed has an utility of -0.261870. The minimal important difference for the EQ-5D-5L index was estimated as 0.045 ± 0.009 .²⁹ EQ-5D-5L validity and reliability have been demonstrated for its use in general population health surveys,³⁰ and it has been used previously in health inequity studies.^{8,31}

Sexual orientation

Sexual orientation was assessed from responses to the question based on the National Survey of Sexual Attitudes and Lifestyles of United Kingdom³² “*Which of the following statements do you feel more identified with?*”, offering five response options considering attraction: only to the other sex, usually to the other sex, equally to the same and the other sex, usually to the same, or only to the same sex. This variable was categorized into ‘no same-sex attraction’ for the first option, ‘only same-sex attraction’ for the last one, and ‘attraction to more than one sex’ for the three responses in between. Furthermore, sexual identity was collected through the question “*From the sexual identity perspective,*

do you consider yourself heterosexual or 'straight' (informal); homosexual, gay or lesbian; bisexual; or some other option?".

Socio-demographic variables

Participants in 2016-2017 BHS were asked about their current sex (women or men, without specifying whether cis or transgender), age, education level, social class, marital status, country of birth, and social support.

Social class was based on the Spanish National Classification of Occupations 2011, using a neo-Weberian approach.³³ Country of birth was categorized into low vs high income countries according to the GNI per capita (World Bank Atlas Method for the 2016 fiscal year).³⁴

Discrimination

Discrimination was assessed through the question: *"In the last year, have you experienced any type of discrimination because of ...?"* for sex, ethnicity, and sexual orientation. Response options ('never', 'sometimes', 'many times', 'constantly', and 'not applicable') were dichotomized into 'no' for those responding the first option, and 'yes' for the following three options.

Health-related behaviors

Tobacco consumption was divided into four categories: never, former, occasional and current smoker. Alcohol consumption during the previous year was collected considering working days and weekends separately, and calculated with the formula: Standard drink units (1 unit = 10 g alcohol) * Number of drinks * weekly frequency.³⁵ Information about the use of psychoactive drugs in the last 30 days was collected through five groups of substances: tranquilizers, hashish or marihuana, cocaine or by-products, amphetamines or similar, and heroine.

Physical activity was assessed with two questions, asking separately about activities related to their work and their leisure time.

An adaptation of the International Physical Activity Questionnaire (IPAQ),³⁶ proposed by the EUROHIS group, was used to measure leisure-time physical activity. Participants were classified as having a low, moderate, or intense physical activity in leisure time according to total metabolic equivalent of task (MET) in minutes per week: ≤ 499 , 500-999, or ≥ 1000 , respectively.

Chronic conditions

Participants in the 2016-2017 BHS were asked about 28 chronic conditions, and a summary indicator based on the number of reported chronic conditions was categorized according to sample distribution into 5 groups: none, 1, 2, 3-4, and 5 or more chronic conditions.

Statistical analysis

We calculated the statistical power of the 2016-2017 BHS sample size to detect mean differences of 0.045 points (SD=0.2) on the EQ-5D-5L index, which has been estimated as the minimal important difference,²⁹ with an alpha risk of 0.05. The statistical power is 0.8 when comparing women or men feeling ‘only same-sex attraction’ (N = 140 or 146, respectively) with those feeling ‘no same-sex attraction’ (N = 1,369 or 1,261, respectively).

All the analyses were stratified by sex. Differences by sexual orientation were tested using χ^2 . Due to the imbalance among sexual attraction groups, mainly in socio-demographic variables, the percentages of chronic conditions and health-related behaviors were adjusted for age, education level, social class and country of birth using logistic regression models. Furthermore, the analyses were performed with and without post-stratification weights for age, sex and municipal district.

To assess differences in health by sexual orientation, we built censored linear regression models (Tobit) with EQ-5D-5L index, and Poisson regression models with EQ-5D-5L dimensions. Censored linear regression models (Tobit) were used due to the right-skewed distribution of the EQ-5D-5L index (dependent variable). Marginal effects were obtained from the Tobit model as averaged individual

marginal effects to restore the original range of the EQ-5D-5L index.³⁷ The five-level response scale of EQ-5D-5L dimensions was dichotomized into “no problems” versus “any problem” (slight, moderate, severe, or extreme problems), and it was included as the dependent variable in Poisson regression models with robust error variance to estimate the prevalence ratio. Prevalence ratio (PR) is more suitable than odds ratio in cross-sectional studies, especially when the outcome is frequent. PR >1 indicates higher likelihood than reference category, <1 indicating lower likelihood.

In all cases, nested models were constructed to assess the role of selected variables: first including sexual attraction, which is the main explanatory variable following the structural framework proposed by Mule et al.³⁸, and socio-demographic variables that can be potential confounders (Model 1); then adding discrimination (Model 2), because it can have a mediator role in health inequities; and, finally, behaviors and the number of chronic conditions (Model 3) were added as health-related factors. Each of these nested models was compared with the immediately previous one using the log-likelihood ratio test. Interaction of discrimination with sexual attraction variables and among the three sources of discrimination were tested, but none was statistically significant. A sensitivity analysis with the variable sexual identity as main explanatory variable was performed. The level of statistical significance was set to $\alpha = 0.05$.

RESULTS

Of the 3,362 participants in the BHS, 3,051 answered the question on sexual attraction (Supplementary **Table S1**), and 3028 the question on sexual identity. Among women (n=1,597), 1,369 (85.7%) reported feeling ‘no same-sex attraction’, 88 (5.5%) ‘attraction to more than one sex’, and 140 (8.8%) ‘only same-sex attraction’. Among men (n=1,454), 1,261 (86.7%) felt ‘no same-sex attraction’, 47 (3.2%) ‘attraction to more than one sex’, and 146 (10%) ‘only same-sex attraction’.

Characteristics of women and men according to sexual attraction are shown in **Table 1 and 2**.

We found statistically significant differences by sexual attraction on most socio-demographic variables, discrimination, and some health-related behaviors. After adjusting for age, education level, social class and country of birth, differences in health-related behaviors disappeared, differences in discrimination remained significant, and differences in the prevalence of problems were found in two EQ-5D-5L dimensions (mobility, $p=0.013$ and anxiety/depression, $p=0.001$).

Table 3 shows the difference in EQ-5D-5L index per sexual attraction among women, which was only statistically significant between women feeling ‘attraction to more than one sex’ and those with ‘no same-sex attraction’ in model 1 (-0.042 , $p=0.012$ after adjusting for socio-demographic variables). Table 4 shows that the difference in EQ-5D-5L index per sexual attraction among men was not statistically significant in any model.

Figures 1 and 2 show adjusted prevalence ratios (aPR) and 95% confidence intervals (95%CI) of problems in each EQ-5D-5L dimension. Women feeling ‘attraction to more than one sex’ presented significant differences in three EQ-5D-5L dimensions (model 1): mobility (aPR = 1.79; 95%CI 1.05-3.05), usual activities (aPR = 1.84; 95%CI 1.05-3.21), and anxiety/depression (aPR = 1.76; 95%CI 1.27-2.43), which remains very similar after adjusting also for discrimination by sex, ethnicity and sexual orientation (model 2). Women feeling ‘only same-sex attraction’ showed statistically significant differences only in anxiety/depression (aPR = 1.76; 95%CI 1.27-2.43, model 1). Among men, no EQ-5D-5L dimension presented statistically significant differences by sexual attraction. Sensitivity analyses with sexual identity showed the same pattern of results except for pain, with statistically significant differences between bisexual and heterosexual women (Supplementary Figures S1 and S2 and Tables S2 and S3).

DISCUSSION

In our study, women feeling attraction to ‘more than one sex’ and ‘only same sex’ showed worse health, measured with the EQ-5D-5L, than women with ‘no same-sex attraction’ after adjusting for sociodemographic variables. However, these differences were not observed in men, supporting our hypothesis that the effect of sexual attraction on health is modified by sex. Furthermore, it is important to highlight that physical health differences per sexual attraction among women disappeared when we considered variables hypothesized as mediators, such as discrimination and/or chronic conditions, while mental health differences were only attenuated.

The magnitude of the EQ-5D-5L utility index difference (-0.042) between women feeling ‘attraction to more than one sex’ and those with ‘no same-sex attraction’ after adjusting for socio-demographic variables is close to the minimal important difference, estimated previously at ± 0.045 for this instrument.²⁹ Translating this utility index difference to QALYs, -0.042 is interpretable as 15 fewer days of full health per year experienced by each woman attracted to more than one sex (5.5% of Barcelona’s 0.8 million adult female inhabitants)¹⁷, which means 660,000 full health days lost each year in total. On the other hand, the higher prevalence of mobility, usual activities and anxiety/depression dimensions (aPR of 1.79, 1.84 and 1.76) indicates that physical and mental health are affected in women feeling ‘attraction to more than one sex’, while only mental health is affected in women feeling ‘only same-sex attraction’ (aPR of 1.46 for anxiety/depression).

Although sexual orientation-related health inequalities have been usually observed both among women and men,⁵ there are studies reporting them only in men or only in women, as in our case. Similarly to our findings, a US study showed higher relative risk (RR) of mood and anxiety disorders in the previous 12 months in women with any same-sex partner, compared to those with a different sex partner (RR=2.74 95%CI 1.86-4.03); but not among men (RR=1.5 95%CI 0.77-2.94).³⁹ Also, another

US study showed that lesbian women and bisexual persons of any sex are more likely to present depression and anxiety than gay men and heterosexual individuals.⁴⁰

In the 2012 European LGBT survey,⁴¹ 38% reported discrimination or harassment in the previous 12 months on the grounds of sexual orientation in Spain. Compared to this figure, the percentage of persons reporting sexual orientation-related discrimination in the last year in our study (around 5%) is extremely low. The difference could be explained by the survey year (2012 vs 2016-2017) and how discrimination was measured, as we only included a single question on sexual orientation-related discrimination, while this European survey asked about six experiences/settings (hate crime, harassment, aggression, at work or when looking for a job, in education or in healthcare and social services).

It is important to highlight, however, that using a similar single question to measure sex-related and ethnicity-related discrimination, a substantial proportion of women reported experiencing them: 22.8% and 31.5%, respectively, among those feeling ‘attraction to more than one sex’, 10.6% and 7.3% among those with ‘only same-sex attraction’, and 7.8% and 6.8% among those with ‘no same-sex attraction’. The additive effect of these discriminations to the sexual orientation-related discrimination could explain the health inequities among women in our study. Furthermore, discrimination on the basis of intersecting identities (gender, ethnicity and sexual orientation) may play a role in explaining differences between women and men in sexual orientation-related health inequities in our study, as they can exacerbate the harms of discrimination. Carrying multiple socially underprivileged identities (i.e., being a lesbian, being a racial or ethnic minority, and being a woman) may suppose a risk for stress-induced depression, as suggested by a study showing that lesbians and bisexual women exhibited higher levels of distress than gay men, except for those with HIV infection.⁴²

Our hypothesis of less health inequities by sexual orientation in the 2016-2017 than the 2011 BHS was based on interpreting the increment of participants reporting same-sex attraction (from 2.2% in 2011 to 12.5% in 2016-2017) as a reflection of a higher social acceptance. **Figure 3** shows the EQ-5D mean index per age group according to sexual attraction in 2011 and 2016-2017. In 2011, differences between participants attracted to their same sex in any degree (grey continuous line) and those with 'no same-sex attraction' (black continuous line) were observed in most age groups, and it was higher than the minimal important difference of 0.045 in participants aged 45 years or older.²⁹ The 2016-2017 figure is totally different: here the grey and black continuous lines are practically overlapping, showing that the results of these two groups are very similar. The discontinuous grey line shows the EQ-5D mean index of the participants that did not report sexual attraction: in the 2011 BHS, results of this group (7% of the total) are between those of participants with and without same-sex attraction, suggesting that it is composed by a mix of both; in the 2016-2017 BHS it is very close to both continuous lines. These similar EQ-5D index outcomes between participants reporting and not reporting sexual attraction dismisses having selected healthier individuals in the study.

Of the 3,362 participants in the 2016-2017 BHS, only 311 (9.3%) did not answer the question on sexual attraction. This proportion is low, especially considering that 30% of gay and bisexual men in a 2011-2012 study⁴³ about willingness to reveal sexual orientation in national population surveys indicated unwillingness to disclose it. Non-respondents in our study were significantly older, with lower education and social class, and reported less risky health-related behaviors but more sedentarism and a higher number of chronic conditions (Supplementary **Table S1**). However, this difference in chronic conditions is explained by their older age (mean of 58.5 vs 48.5 years) and it disappeared after adjusting for age (data not shown). An unsupportive environment to sexual orientation disclosure among older persons⁴⁴ and disadvantaged social class⁴⁵ could be reasons underlying this differential distribution.

Limitations

Our study has some limitations. The main one is the selection bias derived from the individuals refusing to participate in the BHS or not answering the question on sexual attraction, which has been widely commented in the paragraph above. The risk of a participation bias towards a healthy segment of same-sex attracted persons explaining the skewed findings is unlikely, considering that 56.6% of the 2016-2017 BHS interviews were conducted on persons from the first or second selection rounds. Second, social desirability biases may have produced an infra-estimation of health inequity, since persons suffering more discrimination and stigma are more likely to report the most socially accepted sexual orientation. Third, the Barcelona Health Survey design is cross-sectional, which prevents measuring longitudinal changes from 2011 to 2016-2017 (which was not our objective), and constrains causality assessment.

Fourth, the groups compared were defined based on sexual attraction, which was selected as the main explanatory variable because it covers some of the gaps left out by behavior or identity measures,⁴⁶ providing the largest estimate of population size including people not reporting same-sex sex and/or LGB identity,⁴⁷ and is more predictive than sexual identity ones to detect inequalities according to sexual orientation.⁴⁸ Furthermore, results of the sensitivity analysis performed with the sexual identity variable are consistent with those obtained with sexual attraction, but certain estimations were impossible to calculate due to the insufficient individuals in some categories (Supplementary Figures S1 and S2 and Tables S2 and S3). Finally, the 2016-2017 BHS did not collect gender identities, asked about sex in a binary way, and did not consider whether respondents are cis or transgender persons.

CONCLUSION

The women feeling ‘attraction to more than one sex’ and ‘only same-sex attraction’ in Barcelona in 2016 presented worse health than those feeling ‘no same-sex attraction’; with discrimination likely playing a mediator role in explaining such inequalities. These health inequities by sexual orientation among women indicate the need to develop public health strategies in Barcelona addressed to lesbian and bisexual women considering the intersection of gender and sexual identities. In contrast, finding no sexual orientation-related health inequities and low proportion of reported discrimination in men suggests a supportive environment in Barcelona city in 2016-2017. Although this seems promising, as only five years before these results were considerably worse, it is important to continue monitoring inequities to detect a possible social backlash to the current visibility of this population.

Authors’ Contributions

MMP analyzed and interpreted the data, drafted and critically revised the manuscript and did the statistical analysis. DG interpreted the data, and critically revised the manuscript. GP interpreted the data, and critically revised the manuscript. XB interpreted the data, and critically revised the manuscript. ED interpreted the data, and critically revised the manuscript. AP interpreted the data, and did the statistical analysis. OG interpreted the data, and critically revised the manuscript. JA interpreted the data, and critically revised the manuscript. GH interpreted the data, and critically revised the manuscript. KM interpreted the data, and critically revised the manuscript. VZ interpreted the data, and critically revised the manuscript. GV interpreted the data, and critically revised the manuscript. MF analyzed and interpreted the data, and critically revised the manuscript.

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Disclaimer

The 2016-2017 Barcelona Health Interview Survey is an official statistic activity, and data confidentiality of the participants is guaranteed in accordance of the Spanish 15/1999 and European 2016/679 data protection laws. Our study was reviewed and approved by the Barcelona Public Health Agency (ASPB), which is the public health provider responsible for public health in Barcelona.

Author Disclosure Statement

No competing financial interests exist.

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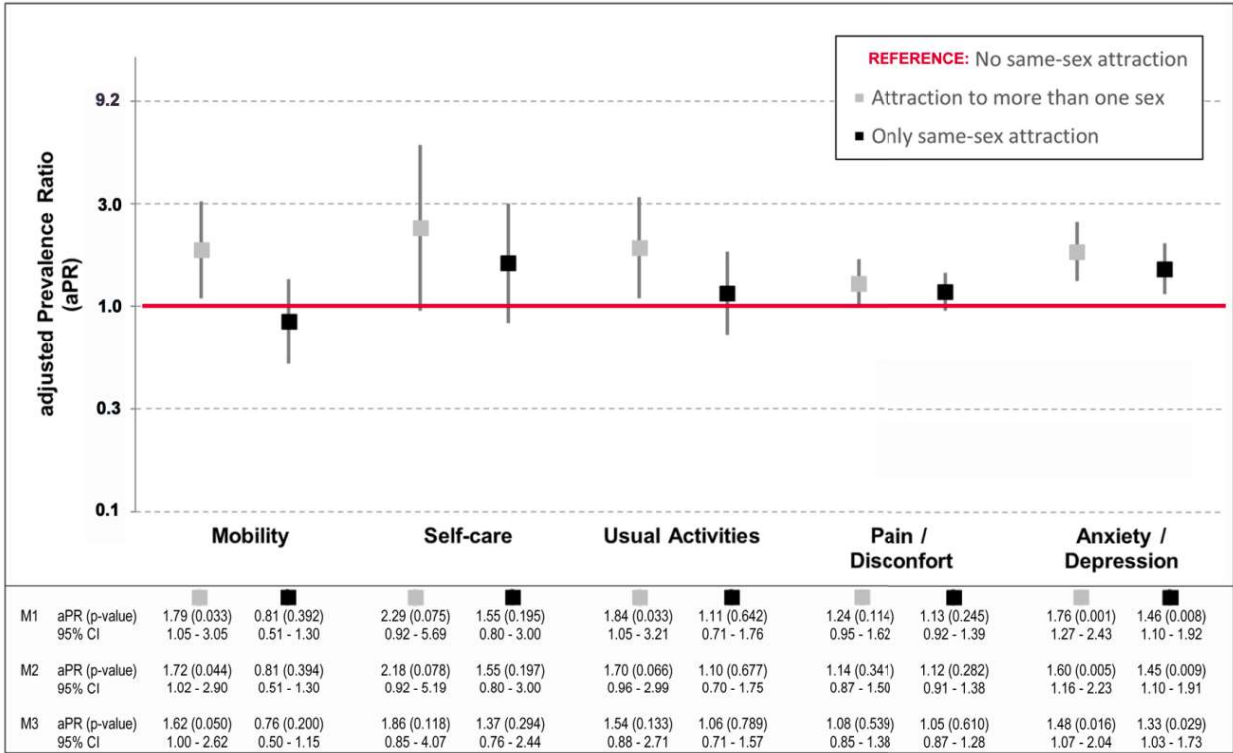
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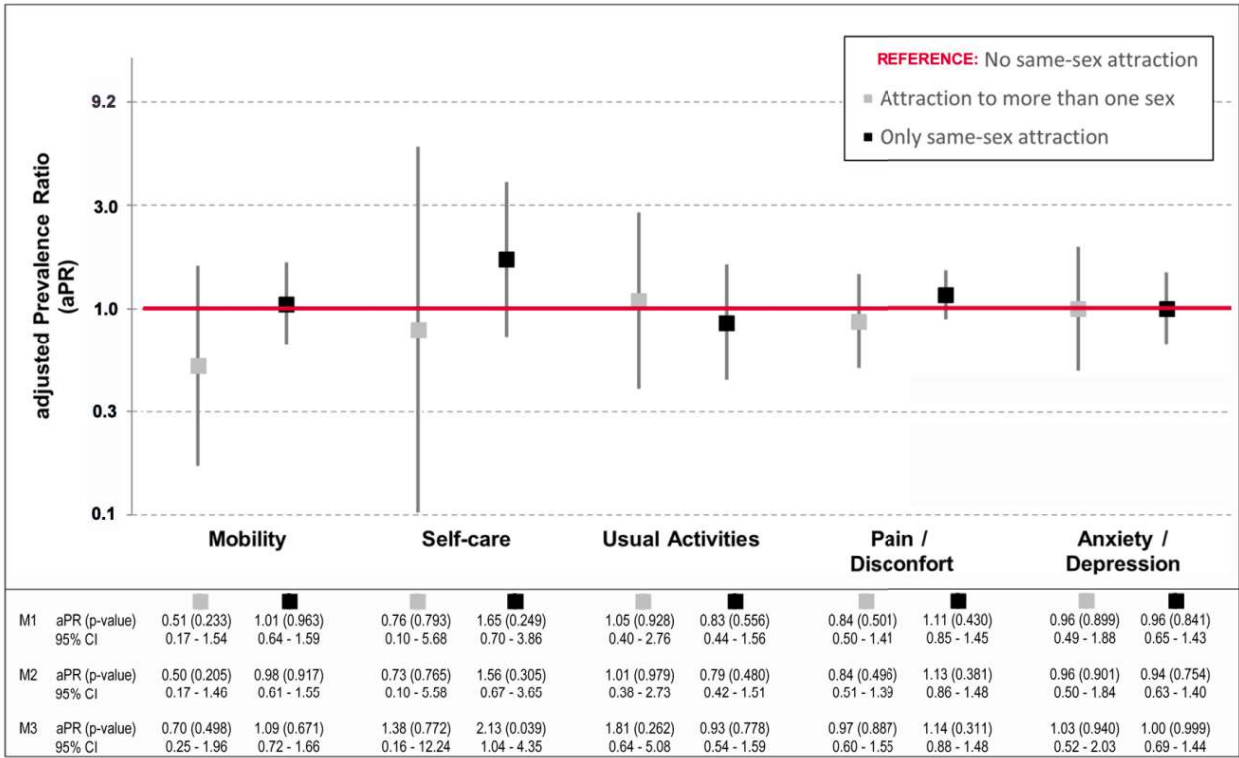
FIGURES

Figure 1. Prevalence Ratio and 95% Confidence Intervals of problems reported on each EuroQol dimension by sexual attraction among women in the 2016-2017 Barcelona Health Survey: graphic shows adjusted Prevalence Ratios (aPR) obtained in model 1.



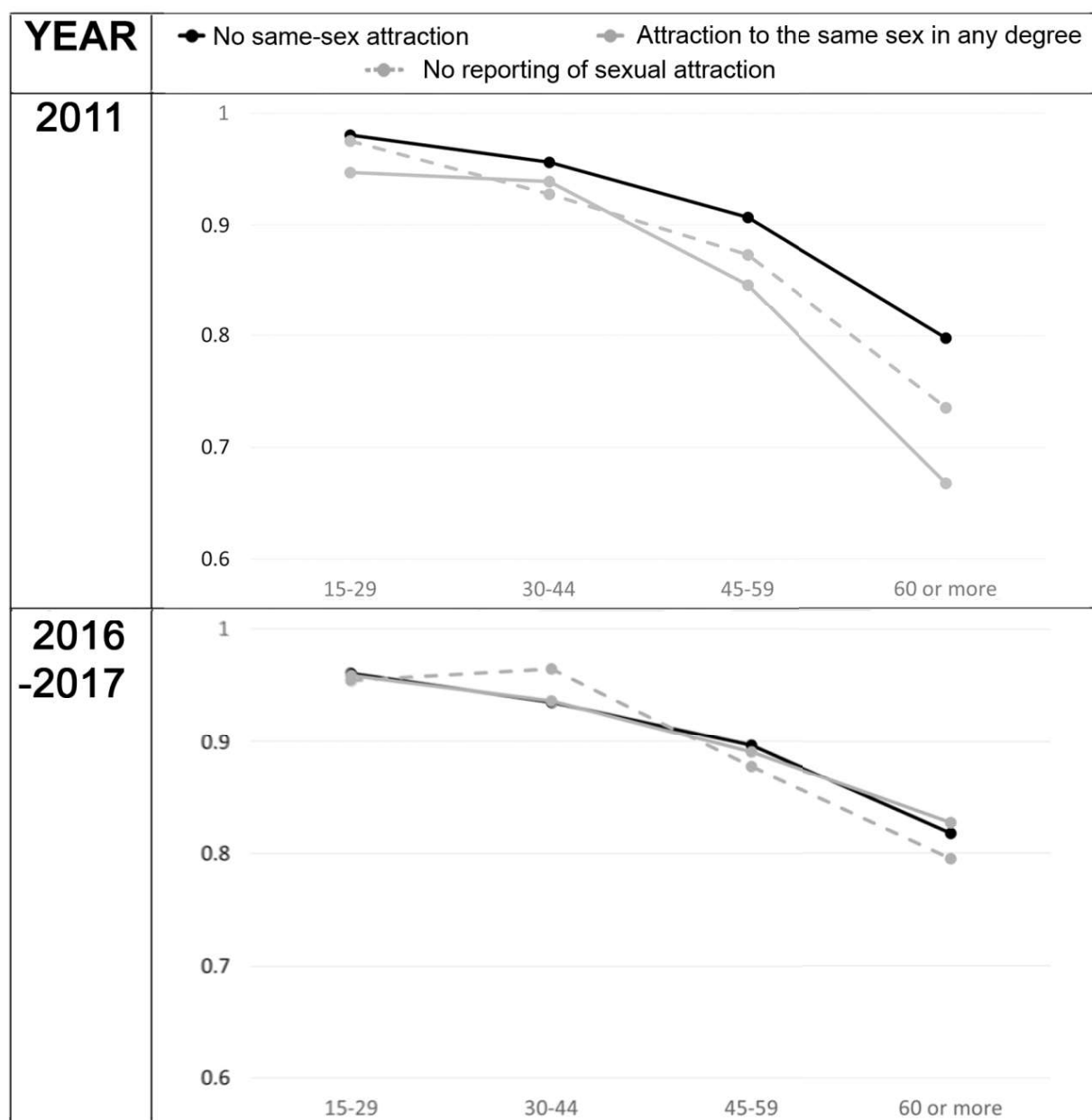
Model 1: Adjusted for Sociodemographic variables (age, education level, social class, and country of birth). Model 2: Adjusted for Sociodemographic variables + Discrimination (Sexual orientation-related discrimination, Sex-related discrimination, and Ethnicity-related discrimination). Model 3: Adjusted for Sociodemographic variables + Discrimination + Health-related behaviors + Number of chronic conditions.

Figure 2. Prevalence Ratio and 95% Confidence Intervals of problems reported on each EuroQol dimension by sexual attraction among men in the 2016-2017 Barcelona Health Survey: graphic shows adjusted Prevalence Ratios (aPR) obtained in model 1.

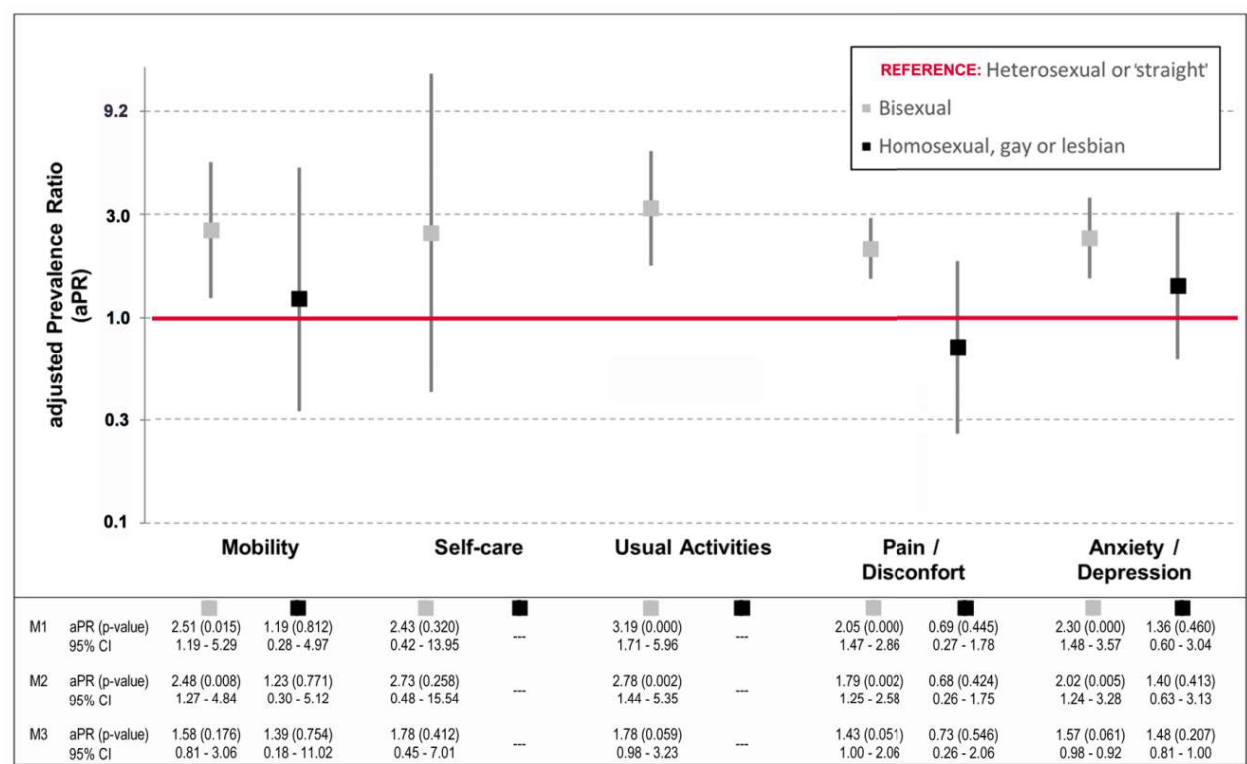


Model 1: Adjusted for Sociodemographic variables (age, education level, social class, and country of birth). Model 2: Adjusted for Sociodemographic variables + Discrimination (Sexual orientation-related discrimination, Sex-related discrimination, and Ethnicity-related discrimination). Model 3: Adjusted for Sociodemographic variables + Discrimination + Health-related behaviors + Number of chronic conditions.

Figure 3. Mean of EuroQol index by sexual attraction according to age groups in the 2011 and 2016-2017 Barcelona Health Surveys.

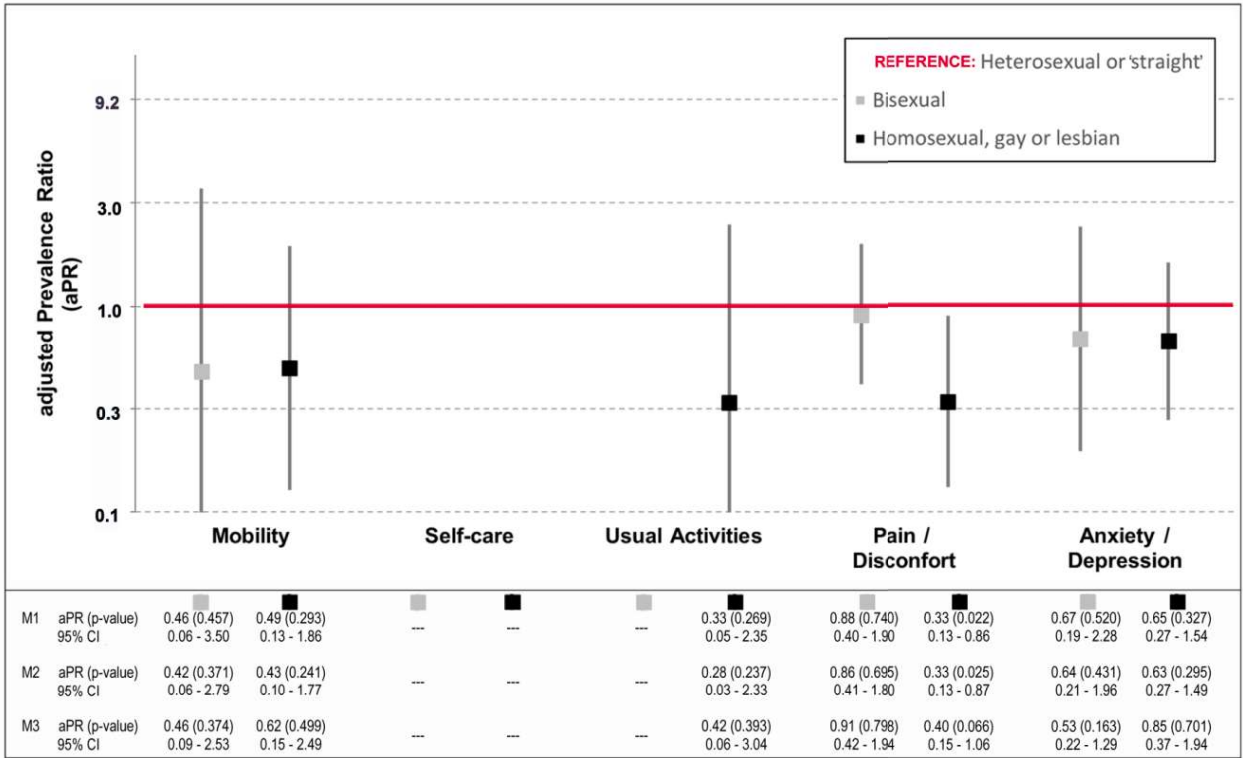


Supplementary Figure S1. Prevalence Ratio and 95% Confidence Intervals of problems reported on each EuroQol dimension **by sexual identity among WOMEN** in the 2016-2017 Barcelona Health Survey: graphic shows adjusted Prevalence Ratios (aPR) obtained in model 1.



Model 1: Adjusted for Sociodemographic variables (age, education level, social class, and country of birth). **Model 2:** Adjusted for Sociodemographic variables + Discrimination (Sexual orientation-related discrimination, Sex-related discrimination, and Ethnicity-related discrimination). **Model 3:** Adjusted for Sociodemographic variables + Discrimination + Health-related behaviors + Number of chronic conditions.

Supplementary Figure S2. Prevalence Ratio and 95% Confidence Intervals of problems reported on each EuroQol dimension **by sexual identity among MEN** in the 2016-2017 Barcelona Health Survey: graphic shows adjusted Prevalence Ratios (aPR) obtained in model 1.



Model 1: Adjusted for Sociodemographic variables (age, education level, social class, and country of birth). **Model 2:** Adjusted for Sociodemographic variables + Discrimination (Sexual orientation-related discrimination, Sex-related discrimination, and Ethnicity-related discrimination). **Model 3:** Adjusted for Sociodemographic variables + Discrimination + Health-related behaviors + Number of chronic conditions.

TABLES

Table 1. Socio-demographic characteristics, health-related behaviors, and chronic conditions by sexual attraction among women in the 2016-2017 Barcelona Health Survey. Unweighted frequencies and weighted percentages.

| SOCIODEMOGRAPHIC | | | | | | | | | |
|---|--------------------------------------|---|---------------------------------------|----------------------------------|------------------------|---------------------------------|--------------------------|----------------------------------|--|
| Unadjusted | | | | | Adjusted | | | | |
| | No same-sex attraction (n = 1369) | Attraction to more than one sex (n = 88) | Only same-sex attraction (n = 140) | p-value weighted (unweighted) | No same-sex attraction | Attraction to more than one sex | Only same-sex attraction | p-value weighted (unweighted) | |
| Age group | | | | | | | | | |
| 15-29 | 184 (14.1%) | 37 (41.8%) | 39 (28.4%) | < 0.001 | | | | | |
| 30-44 | 365 (27.6%) | 27 (30.8%) | 43 (31.2%) | (< 0.001) | | | | | |
| 45 - 59 | 353 (25.0%) | 17 (18.7%) | 30 (20.6%) | | | | | | |
| 60 or more | 467 (33.3%) | 7 (8.8%) | 28 (19.9%) | | | | | | |
| Education level | | | | | | | | | |
| Primary or less | 507 (36.2%) | 15 (15.6%) | 34 (23.4%) | 0.005 | | | | | |
| Secondary | 339 (25.3%) | 33 (38.9%) | 32 (23.4%) | (0.005) | | | | | |
| University or more | 520 (38.5%) | 40 (45.6%) | 74 (53.2%) | | | | | | |
| Social Class ^a | | | | | | | | | |
| Social Class I | 246 (19.0%) | 25 (28.1%) | 28 (20.3%) | 0.001 | | | | | |
| Social Class II | 167 (12.8%) | 12 (16.9%) | 25 (18.8%) | (0.002) | | | | | |
| Social Class III | 301 (23.1%) | 21 (23.6%) | 38 (27.5%) | | | | | | |
| Social Class IV | 28 (2.1%) | 2 (2.2%) | 0 (0.0%) | | | | | | |
| Social Class V | 74 (5.6%) | 6 (6.7%) | 5 (3.6%) | | | | | | |
| Social Class VI | 296 (22.3%) | 17 (19.1%) | 30 (22.5%) | | | | | | |
| Social Class VII | 199 (15.1%) | 3 (3.4%) | 10 (7.2%) | | | | | | |
| Country of birth | | | | | | | | | |
| Low-middle income countries | 266 (19.7%) | 10 (11.1%) | 19 (14.8%) | 0.138 | | | | | |
| High income countries | 1086 (80.3%) | 78 (88.9%) | 121 (85.2%) | (0.114) | | | | | |
| Marital status | | | | | | | | | |
| Single | 427 (32.1%) | 51 (57.8%) | 60 (43.3%) | 0.001 | 83.4% | 83.2% | 80.3% | 0.948 | |
| Married / Cohabiting | 661 (48.1%) | 28 (32.2%) | 62 (44.0%) | (< 0.001) | 14.0% | 13.2% | 16.9% | (0.963) | |
| Widow | 147 (10.3%) | 2 (2.2%) | 9 (6.4%) | | 0.0% | 0.0% | 0.0% | | |
| Divorced / Separated | 132 (9.5%) | 7 (7.8%) | 9 (6.4%) | | 2.7% | 3.6% | 2.8% | | |
| DISCRIMINATION ^b | | | | | | | | | |
| Sexual orientation-related discrimination | 2 (0.1%) | 6 (6.7%) | 3 (2.1%) | < 0.001 (< 0.001) | 0.1% | 4.0% | 1.7% | < 0.001 (< 0.001) | |
| Sex-related discrimination | 124 (9.3%) | 32 (35.6%) | 22 (15.7%) | < 0.001 (< 0.001) | 7.8% | 22.8% | 10.6% | < 0.001 (< 0.001) | |
| Ethnicity-related discrimination | 44 (3.2%) | 6 (6.7%) | 3 (2.1%) | 0.171 (0.153) | 6.9% | 31.5% | 7.3% | 0.011 (0.009) | |

| HEALTH RELATED BEHAVIORS | | | | | | | | |
|---|--------------|------------|-------------|---------|-------|-------|-------|---------|
| Smoking | | | | | | | | |
| Never smoker | 800 (58.1%) | 35 (42.0%) | 75 (54.9%) | 0.127 | 81.9% | 72.3% | 82.1% | 0.454 |
| Former smoker | 298 (21.9%) | 24 (27.3%) | 32 (22.5%) | (0.041) | 11.7% | 18.1% | 11.5% | (0.378) |
| Occasional smoker | 38 (2.8%) | 6 (6.8%) | 5 (3.5%) | | 1.2% | 2.2% | 1.2% | |
| Current smoker | 229 (17.2%) | 21 (23.9%) | 28 (19.0%) | | 5.2% | 7.3% | 5.2% | |
| Alcohol Consumptions | | | | | | | | |
| Non-drinker | 388 (28.2%) | 13 (14.4%) | 33 (23.2%) | 0.013 | 29.1% | 20.2% | 28.9% | 0.578 |
| Moderate drinker | 923 (67.8%) | 67 (76.7%) | 97 (69.7%) | (0.011) | 67.1% | 74.9% | 66.5% | (0.667) |
| Risk drinker | 54 (4.0%) | 7 (8.9%) | 10 (7.0%) | | 3.8% | 5.0% | 4.6% | |
| Psychoactive drug consumption (30 days) | | | | | | | | |
| No | 1274 (93.4%) | 75 (85.6%) | 128 (91.5%) | 0.025 | 95.6% | 90.0% | 93.6% | 0.052 |
| Yes | 95 (6.6%) | 13 (14.4%) | 12 (8.5%) | (0.017) | 4.4% | 10.0% | 6.4% | (0.057) |
| Work-related physical activity | | | | | | | | |
| None | 534 (39.1%) | 32 (36.0%) | 65 (47.5%) | 0.382 | 38.5% | 31.4% | 44.5% | 0.300 |
| Low | 150 (11.3%) | 9 (10.1%) | 10 (7.2%) | (0.437) | 4.3% | 3.3% | 2.8% | (0.411) |
| Moderate | 583 (43.8%) | 41 (48.3%) | 52 (37.4%) | | 55.2% | 62.9% | 49.8% | |
| Intense | 78 (5.8%) | 5 (5.6%) | 11 (7.9%) | | 2.0% | 2.4% | 3.0% | |
| Physical activity in leisure time c | | | | | | | | |
| Low (≤499 MET-minutes / week) | 73 (5.0%) | 3 (3.3%) | 5 (3.5%) | 0.039 | 4.4% | 4.4% | 3.6% | 0.988 |
| Moderate (500-999 MET-minutes / week) | 776 (57.1%) | 40 (44.4%) | 71 (50.7%) | (0.081) | 46.0% | 43.8% | 46.5% | (0.993) |
| Intense (≥1000 MET-minutes / week) | 520 (37.9%) | 45 (52.2%) | 64 (45.8%) | | 49.6% | 51.8% | 49.9% | |
| NUMBER OF CHRONIC CONDITIONS | | | | | | | | |
| 0 | 280 (20.8%) | 26 (28.6%) | 41 (29.8%) | 0.064 | 49.5% | 47.6% | 56.3% | 0.251 |
| 1 | 248 (18.3%) | 16 (17.6%) | 19 (13.5%) | (0.073) | 26.6% | 20.6% | 16.6% | (0.316) |
| 2 | 168 (12.2%) | 11 (13.2%) | 20 (14.2%) | | 8.0% | 7.8% | 8.8% | |
| 3 or 4 | 262 (19.2%) | 18 (23.1%) | 26 (18.4%) | | 10.7% | 16.5% | 11.6% | |
| 5 or more | 411 (29.5%) | 17 (17.6%) | 34 (24.1%) | | 5.1% | 7.5% | 6.6% | |
| EQ-5D-5L (any problem) | | | | | | | | |
| Mobility | 290 (20.5%) | 14 (15.6%) | 14 (9.9%) | 0.001 | 2.6% | 7.0% | 1.9% | 0.013 |
| | | | | (0.001) | | | | (0.008) |
| Self-care | 97 (6.6%) | 4 (4.4%) | 9 (6.4%) | 0.618 | 0.1% | 0.2% | 0.2% | 0.253 |
| | | | | (0.516) | | | | (0.185) |
| Activity | 218 (15.4%) | 12 (13.3%) | 15 (10.6%) | 0.142 | 1.9% | 4.3% | 2.0% | 0.081 |
| | | | | (0.128) | | | | (0.052) |
| Pain / Discomfort | 611 (44.3%) | 31 (36.7%) | 55 (39.0%) | 0.551 | 17.0% | 24.7% | 20.3% | 0.120 |
| | | | | (0.479) | | | | (0.200) |
| Anxiety / Depression | 345 (24.7%) | 27 (30.0%) | 40 (28.4%) | 0.070 | 16.8% | 30.9% | 25.5% | 0.001 |
| | | | | (0.071) | | | | (0.001) |

^a Social class: D) Large employers (≥10 employees) & higher grade professionals or managers; II) Small employers, lower grade professionals or managers, higher grade technicians & sports professionals and artists; III) Intermediate occupations (white collar workers); IV) Self-employed occupations; V) Lower supervisory & lower technician occupations; VI) Skilled primary workers & semi-skilled workers; VII) Unskilled workers.

^b Discrimination response options were dichotomized into 'yes' for those responding 'sometimes', 'many times', or 'constantly'; and 'no' for those responding 'never'.

^c Metabolic Equivalent of Task (MET)

Table 2. Socio-demographic characteristics, health-related behaviors, and chronic conditions by sexual attraction among men in the 2016-2017 Barcelona health survey. Unweighted frequencies and weighted percentages.

| SOCIODEMOGRAPHIC | | | | | | | | | |
|---|--|--------------------------------------|---|---------------------------------------|----------------------------------|------------------------|---------------------------------|--------------------------|----------------------------------|
| Age group | | Unadjusted | | | | Adjusted | | | |
| | | No same-sex attraction (n = 1261) | Attraction to more than one sex (n = 47) | Only same-sex attraction (n = 146) | p-value weighted (unweighted) | No same-sex attraction | Attraction to more than one sex | Only same-sex attraction | p-value weighted (unweighted) |
| SOCIODEMOGRAPHIC | | | | | | | | | |
| Age group | | | | | | | | | |
| 15-29 | | 227 (18.9%) | 16 (35.4%) | 22 (15.1%) | 0.043 | | | | |
| 30-44 | | 388 (31.0%) | 11 (22.9%) | 64 (44.5%) | (0.058) | | | | |
| 45 - 59 | | 310 (24.4%) | 9 (20.8%) | 34 (22.6%) | | | | | |
| 60 or more | | 336 (25.7%) | 11 (20.8%) | 26 (17.8%) | | | | | |
| Education level | | | | | | | | | |
| Primary or less | | 448 (35.2%) | 17 (37.5%) | 31 (21.4%) | 0.005 | | | | |
| Secondary | | 365 (29.4%) | 13 (27.1%) | 49 (33.1%) | (0.004) | | | | |
| University or more | | 445 (35.4%) | 17 (35.4%) | 65 (45.5%) | | | | | |
| Social Class ^a | | | | | | | | | |
| Social Class I | | 224 (17.7%) | 9 (16.7%) | 35 (25.7%) | 0.027 | | | | |
| Social Class II | | 171 (13.9%) | 8 (16.7%) | 24 (16.4%) | (0.040) | | | | |
| Social Class III | | 242 (19.8%) | 13 (29.2%) | 33 (23.6%) | | | | | |
| Social Class IV | | 43 (3.4%) | 0 (0.0%) | 2 (1.4%) | | | | | |
| Social Class V | | 161 (12.7%) | 3 (6.3%) | 11 (7.9%) | | | | | |
| Social Class VI | | 285 (23.0%) | 7 (16.7%) | 27 (18.6%) | | | | | |
| Social Class VII | | 117 (9.4%) | 6 (14.6%) | 9 (6.4%) | | | | | |
| Country of birth | | | | | | | | | |
| Low-middle income countries | | 234 (18.8%) | 10 (22.9%) | 22 (15.4%) | 0.505 | | | | |
| High income countries | | 1011 (81.2%) | 37 (77.1%) | 122 (84.6%) | (0.399) | | | | |
| Marital status | | | | | | | | | |
| Single | | 503 (40.8%) | 27 (58.3%) | 73 (49.3%) | 0.015 | 90.0% | 94.9% | 92.4% | 0.411 |
| Married / Cohabiting | | 636 (49.6%) | 16 (31.3%) | 62 (42.5%) | (0.014) | 10.0% | 5.1% | 7.6% | (0.482) |
| Widow | | 43 (3.4%) | 1 (2.1%) | 2 (1.4%) | | 0.0% | 0.0% | 0.0% | |
| Divorced / Separated | | 79 (6.2%) | 3 (8.3%) | 9 (6.8%) | | 0.0% | 0.0% | 0.0% | |
| DISCRIMINATION ^b | | | | | | | | | |
| Sexual orientation-related discrimination | | 5 (0.4%) | 3 (6.4%) | 7 (4.8%) | < 0.001 (< 0.001) | 0.1% | 2.2% | 1.8% | < 0.001 (< 0.001) |
| Sex-related discrimination | | 32 (2.6%) | 2 (4.3%) | 4 (2.7%) | 0.841 (0.831) | 5.0% | 7.2% | 4.5% | 0.870 (0.837) |
| Ethnicity-related discrimination | | 42 (3.4%) | 0 (0.0%) | 5 (3.4%) | 0.753 (0.763) | 6.9% | 0.0% | 9.2% | 0.129 (0.161) |
| HEALTH RELATED BEHAVIORS | | | | | | | | | |
| Smoking | | | | | | | | | |
| Never smoker | | 491 (39.0%) | 19 (41.7%) | 57 (39.7%) | 0.576 | 57.9% | 57.0% | 54.7% | 0.954 |
| Former smoker | | 414 (32.5%) | 17 (33.3%) | 43 (28.8%) | (0.648) | 18.5% | 19.8% | 17.5% | (0.921) |
| | | | | | | 14.5% | 16.5% | 18.8% | |

| | | | | | | |
|---|--------------|------------|-------------|---------|-------|-----------|
| Occasional smoker | 59 (4.7%) | 3 (6.3%) | 11 (7.5%) | 9.2% | 6.6% | 9.0% |
| Current smoker | 295 (23.8%) | 8 (18.8%) | 35 (24.0%) | | | |
| Alcohol Consumption | | | | 35.5% | 35.0% | 23.7% |
| Non-drinker | 255 (20.0%) | 9 (17.8%) | 16 (11.0%) | 0.024 | 54.6% | 66.4% |
| Moderate drinker | 886 (70.4%) | 33 (73.3%) | 117 (80.7%) | (0.023) | 9.9% | 9.9% |
| Risk drinker | 116 (9.5%) | 3 (8.9%) | 13 (8.3%) | | 8.2% | (0.187) |
| Psychoactive drug consumption (30 days) | | | | | | |
| No | 1132 (89.8%) | 44 (93.8%) | 125 (86.1%) | 0.318 | 94.1% | 84.4% |
| Yes | 126 (10.2%) | 3 (6.3%) | 20 (13.9%) | (0.273) | 5.9% | 15.6% |
| Work-related physical activity | | | | | | |
| None | 531 (42.1%) | 22 (50.0%) | 61 (41.7%) | 0.959 | 54.0% | 48.0% |
| Low | 92 (7.6%) | 1 (2.2%) | 12 (8.3%) | (0.950) | 1.6% | 6.1% |
| Moderate | 489 (39.3%) | 21 (43.5%) | 51 (36.1%) | | 42.3% | 38.6% |
| Intense | 135 (11.1%) | 2 (4.3%) | 20 (13.9%) | 4.7% | 2.1% | 7.3% |
| Physical activity in leisure time ^c | | | | | | |
| Low (≤499 MET-minutes / week) | 47 (3.6%) | 1 (2.1%) | 3 (2.1%) | 0.048 | 0.4% | 0.909 |
| Moderate (500-999 MET-minutes / week) | 611 (48.1%) | 20 (40.4%) | 57 (39.7%) | (0.035) | 20.2% | 19.4% |
| Intense (≥1000 MET-minutes / week) | 603 (48.3%) | 26 (57.4%) | 86 (58.2%) | 77.8% | 79.4% | 80.2% |
| NUMBER OF CHRONIC CONDITIONS | | | | | | |
| 0 | 421 (33.8%) | 22 (47.9%) | 53 (36.3%) | 0.556 | 63.2% | 52.6% |
| 1 | 242 (19.1%) | 9 (18.8%) | 26 (18.5%) | (0.473) | 23.7% | 25.0% |
| 2 | 182 (14.6%) | 3 (6.3%) | 25 (17.1%) | | 2.5% | 8.6% |
| 3 or 4 | 217 (17.1%) | 8 (16.7%) | 25 (17.1%) | 10.5% | 8.5% | 11.5% |
| 5 or more | 199 (15.4%) | 5 (10.4%) | 17 (11.0%) | 2.8% | 2.1% | 2.3% |
| EQ-5D-5L (any problem) | | | | | | |
| Mobility | 195 (14.9%) | 3 (6.4%) | 17 (11.0%) | 0.072 | 7.7% | 8.3% |
| | | | | (0.074) | | (0.313) |
| Self-care | 49 (3.6%) | 1 (2.1%) | 7 (4.8%) | 0.802 | 0.2% | 0.292 |
| | | | | (0.954) | | (< 0.001) |
| Activity | 130 (10.0%) | 4 (8.3%) | 10 (6.8%) | 0.073 | 2.9% | 2.6% |
| | | | | (0.088) | | (1.000) |
| Pain / Discomfort | 384 (29.9%) | 10 (20.8%) | 43 (29.0%) | 0.502 | 18.0% | 27.4% |
| | | | | (0.419) | | (0.443) |
| Anxiety / Depression | 232 (18.1%) | 7 (14.9%) | 24 (15.9%) | 0.374 | 9.7% | 9.6% |
| | | | | (0.330) | | (0.968) |

^a Social class: I) Large employers (≥10 employees) & higher grade professionals or managers; II) Small employers, lower grade professionals or managers, higher grade technicians & sports professionals and artists; III) Intermediate occupations (white collar workers); IV) Self-employed occupations; V) Lower supervisory & lower technician occupations; VI) Skilled primary workers & semi-skilled workers; VII) Unskilled workers.

^b Discrimination response options were dichotomized into 'yes' for those responding 'sometimes', 'many times', or 'constantly'; and 'no' for those responding 'never'."

^c Metabolic Equivalent of Task (MET)

Table 3. Differences on EuroQol index by sexual attraction among women in the 2016-2017 Barcelona Health Survey. Tobit Models.

| Model 1 | | | Model 2 | | Model 3 | |
|---|----------|----------------------------------|----------|----------------------------------|----------|----------------------------------|
| Attraction to more than one sex | Estimate | p-value (unweighted analysis) | Estimate | p-value (unweighted analysis) | Estimate | p-value (unweighted analysis) |
| Intercept | 0.5838 | (< 0.001) | 0.5914 | (< 0.001) | 0.5002 | (< 0.001) |
| Sexual Attraction | | | | | | |
| No same-sex attraction | Ref. | | Ref. | | Ref. | |
| Attraction to more than one sex | -0.0416 | (0.012) | -0.0284 | (0.093) | -0.0229 | (0.111) |
| Only same-sex attraction | -0.0166 | (0.206) | -0.0140 | (0.288) | -0.0065 | (0.556) |
| Age | | | | | | |
| 15-29 | Ref. | | Ref. | | Ref. | |
| 30-44 | -0.0438 | (0.001) | -0.0466 | (< 0.001) | -0.0171 | (0.128) |
| 45 - 59 | -0.0862 | (< 0.001) | -0.0915 | (< 0.001) | -0.0321 | (0.005) |
| 60 or more | -0.1576 | (< 0.001) | -0.1648 | (< 0.001) | -0.0607 | (< 0.001) |
| Education level | | | | | | |
| Primary or less | Ref. | | Ref. | | Ref. | |
| Secondary | 0.0179 | (0.079) | 0.0210 | (0.040) | 0.0092 | (0.289) |
| University or more | 0.0403 | (0.001) | 0.0430 | (< 0.001) | 0.0156 | (0.123) |
| Social class ^a | | | | | | |
| Managers, professionals | Ref. | | Ref. | | Ref. | |
| Intermediate occupations | -0.0173 | (0.126) | -0.0204 | (0.070) | -0.0205 | (0.032) |
| Lower and manual workers | -0.0466 | (< 0.001) | -0.0466 | (< 0.001) | -0.0308 | (0.003) |
| Country of birth | | | | | | |
| High income countries | Ref. | | Ref. | | Ref. | |
| Low-middle income countries | -0.0106 | (0.309) | -0.0123 | (0.254) | -0.0165 | (0.075) |
| Sexual orientation-related discrimination | | | | | | |
| No | | | Ref. | | Ref. | |
| Yes | | | -0.0436 | (< 0.001) | -0.0206 | (0.051) |
| Sex-related discrimination | | | | | | |
| No | | | Ref. | | Ref. | |
| Yes | | | -0.0134 | (0.559) | 0.0066 | (0.731) |
| Ethnicity-related discrimination | | | | | | |
| No | | | Ref. | | Ref. | |
| Yes | | | -0.0353 | (0.438) | -0.0189 | (0.618) |
| Smoking | | | | | | |
| Never smoker | | | | | Ref. | |
| Former smoker | | | | | -0.0080 | (0.301) |
| Occasional / Current smoker | | | | | 0.0007 | (0.931) |
| Alcohol Consumption | | | | | | |
| Non-drinker | | | | | Ref. | |
| Moderate drinker | | | | | 0.0191 | (0.007) |
| Risk drinker | | | | | 0.0256 | (0.112) |
| Psychoactive drug consumption (30 days) | | | | | | |
| No | | | | | Ref. | |
| Yes | | | | | -0.0636 | (< 0.001) |
| Work-related physical activity | | | | | | |
| None | | | | | Ref. | |
| Low | | | | | 0.0259 | (< 0.001) |
| Moderate or Intense | | | | | 0.0181 | (0.175) |
| Physical activity in leisure time ^b | | | | | | |
| Low (≤499 METmin/week) | | | | | Ref. | |
| Moderate (500-999 METmin/w) | | | | | 0.1017 | (< 0.001) |
| Intense (≥1000 METmin/week) | | | | | 0.1146 | (< 0.001) |
| Number of chronic conditions | | | | | | |
| 0 | | | | | Ref. | |
| 1 | | | | | -0.0355 | (0.003) |
| 2 | | | | | -0.0778 | (< 0.001) |
| 3 or 4 | | | | | -0.0928 | (< 0.001) |
| 5 or more | | | | | -0.1739 | (< 0.001) |
| Log-likelihood | -444.4 | | -436.7 | | -174.3 | |
| df | 12 | | 15 | | 28 | |
| p-value | | | 0.001 | | < 0.001 | |

^a Social class categories: Managers, professionals (Social class I, II); Intermediate occupations (Social class III, IV); Lower and manual workers (Social class V, VI, VII). ^b Metabolic Equivalent of Task (MET)

Table 4. Differences on EuroQol index by sexual attraction among men in the 2016 - 2017 Barcelona Health Survey. Tobit Models.

| Model 1 | | | Model 2 | | Model 3 | |
|---|----------|----------------------------------|----------|----------------------------------|----------|----------------------------------|
| | Estimate | p-value (unweighted analysis) | Estimate | p-value (unweighted analysis) | Estimate | p-value (unweighted analysis) |
| Intercept | 0.5397 | (< 0.001) | 0.5409 | (< 0.001) | 0.4313 | (< 0.001) |
| Sexual Attraction | 0.0330 | (0.186) | 0.0350 | (0.164) | 0.0087 | (0.650) |
| No same-sex attraction | Ref. | | Ref. | | Ref. | |
| Attraction to more than one sex | 0.0330 | (0.186) | 0.0350 | (0.164) | 0.0087 | (0.650) |
| Only same-sex attraction | -0.0040 | (0.768) | -0.0025 | (0.857) | -0.0053 | (0.604) |
| Age | | | | | | |
| 15-29 | Ref. | | Ref. | | Ref. | |
| 30-44 | -0.0506 | (< 0.001) | -0.0524 | (< 0.001) | -0.0177 | (0.080) |
| 45 - 59 | -0.0754 | (< 0.001) | -0.0781 | (< 0.001) | -0.0196 | (0.071) |
| 60 or more | -0.1116 | (< 0.001) | -0.1146 | (< 0.001) | -0.0097 | (0.406) |
| Education level | | | | | | |
| Primary or less | Ref. | | Ref. | | Ref. | |
| Secondary | 0.0432 | (< 0.001) | 0.0451 | (< 0.001) | 0.0200 | (0.012) |
| University or more | 0.0481 | (< 0.001) | 0.0497 | (< 0.001) | 0.0223 | (0.013) |
| Social class ^a | | | | | | |
| Managers, professionals | Ref. | | Ref. | | Ref. | |
| Intermediate occupations | -0.0124 | (0.300) | -0.0129 | (0.281) | -0.0109 | (0.228) |
| Lower and manual workers | -0.0262 | (0.027) | -0.0254 | (0.032) | -0.0188 | (0.039) |
| Country of birth | | | | | | |
| High income countries | Ref. | | Ref. | | Ref. | |
| Low-middle income countries | -0.0190 | (0.084) | -0.0128 | (0.257) | -0.0209 | (0.017) |
| Sexual orientation-related discrimination | | | | | | |
| No | | | Ref. | | Ref. | |
| Yes | | | -0.0513 | (0.032) | 0.0055 | (0.768) |
| Sex-related discrimination | | | | | | |
| No | | | Ref. | | Ref. | |
| Yes | | | -0.0376 | (0.089) | -0.0032 | (0.848) |
| Ethnicity-related discrimination | | | | | | |
| No | | | Ref. | | Ref. | |
| Yes | | | -0.0219 | (0.579) | -0.0091 | (0.773) |
| Smoking | | | | | | |
| Never smoker | | | | | Ref. | |
| Former smoker | | | | | -0.0046 | (0.538) |
| Occasional / Current smoker | | | | | 0.0025 | (0.753) |
| Alcohol Consumption | | | | | | |
| Non-drinker | | | | | Ref. | |
| Moderate drinker | | | | | 0.0127 | (0.108) |
| Risk drinker | | | | | 0.0251 | (0.050) |
| Psychoactive drug consumption (30 days) | | | | | | |
| No | | | | | Ref. | |
| Yes | | | | | -0.0523 | (< 0.001) |
| Work-related physical activity | | | | | | |
| None | | | | | Ref. | |
| Low | | | | | 0.0207 | (0.002) |
| Moderate or Intense | | | | | 0.0212 | (0.047) |
| Physical activity in leisure time ^b | | | | | | |
| Low (≤ 499 METmin/week) | | | | | Ref. | |
| Moderate (500-999 METmin/w) | | | | | 0.0978 | (< 0.001) |
| Intense (≥ 1000 METmin/week) | | | | | 0.1106 | (< 0.001) |
| Number of chronic conditions | | | | | | |
| 0 | | | | | Ref. | |
| 1 | | | | | -0.0389 | (< 0.001) |
| 2 | | | | | -0.0690 | (< 0.001) |
| 3 or 4 | | | | | -0.0994 | (< 0.001) |
| 5 or more | | | | | -0.1845 | (< 0.001) |
| Log-likelihood | -502.0 | | -497.4 | | -237.4 | |
| df | 12 | | 15 | | 28 | |
| p-value | | | 0.026 | | < 0.001 | |

^a Social class categories: Managers, professionals (Social class I, II); Intermediate occupations (Social class III, IV); Lower and manual workers (Social class V, VI, VII). ^b Metabolic Equivalent of Task (MET)

Supplementary Table S1. Socio-demographic differences between participants in the 2016 – 2017 Barcelona Health Survey with and without information on sexual attraction. Unweighted frequencies and weighted percentages.

| | Data on sexual attraction n = 3051 | No data on sexual attraction n = 311 | p-value weighted (unweighted analysis) |
|--|--|--|--|
| SOCIODEMOGRAPHIC | | | |
| Gender | | | |
| Men | 1454 (47.5%) | 142 (45.4%) | 0.476 |
| Women | 1597 (52.5%) | 169 (54.6%) | (0.502) |
| Age group | | | |
| 15-29 | 525 (17.9%) | 39 (13.4%) | < 0.001 |
| 30-44 | 898 (30.1%) | 47 (15.7%) | (< 0.001) |
| 45 - 59 | 753 (24.2%) | 56 (17.6%) | |
| 60 or more | 875 (27.9%) | 169 (53.3%) | |
| Education level | | | |
| Primary or less | 1052 (33.9%) | 168 (53.1%) | <0.001 |
| Secondary | 831 (27.7%) | 76 (25.2%) | (< 0.001) |
| University or more | 1161 (38.4%) | 67 (21.6%) | |
| Social class | | | |
| Employers, Managers and higher- or lower-grade professionals | 974 (33.0%) | 53 (18.8%) | < 0.001 |
| Intermediate and self-employed occupations | 723 (24.6%) | 65 (22.8%) | (< 0.001) |
| Lower supervisory or technician occupations and manual workers | 1266 (42.4%) | 164 (58.3%) | |
| Country of birth | | | |
| Low-middle income countries | 561 (18.7%) | 55 (18.5%) | 0.954 |
| High income countries | 2455 (81.3%) | 249 (81.5%) | (0.828) |
| Marital status | | | |
| Single | 1141 (38.2%) | 92 (30.4%) | < 0.001 |
| Married / Cohabiting | 1465 (47.5%) | 165 (54.4%) | (< 0.001) |
| Widow | 204 (6.4%) | 35 (11.8%) | |
| Divorced / Separated | 239 (7.8%) | 10 (3.4%) | |
| DISCRIMINATION | | | |
| Sexual orientation-related discrimination | 26 (0.8%) | 4 (1.3%) | 0.366 (0.428) |
| Sex-related discrimination | 216 (7.2%) | 11 (3.7%) | 0.020 (0.019) |
| Ethnicity-related discrimination | 100 (3.3%) | 4 (1.3%) | 0.058 (0.056) |
| HEALTH RELATED BEHAVIORS | | | |
| Smoking | | | |
| Never smoker | 1477 (48.5%) | 183 (59.4%) | 0.001 |
| Former smoker | 828 (27.0%) | 77 (25.1%) | (0.001) |
| Occasional smoker | 122 (4.1%) | 7 (2.3%) | |
| Current smoker | 616 (20.5%) | 41 (13.2%) | |
| Alcohol Consumptions | | | |
| Non-drinker | 714 (23.2%) | 111 (35.5%) | < 0.001 |
| Moderate drinker | 2123 (69.9%) | 192 (62.2%) | (< 0.001) |
| Risk drinker | 203 (6.9%) | 7 (2.3%) | |
| Psychoactive drug consumption (30 days) | | | |
| No | 2778 (91.2%) | 300 (97.4%) | < 0.001 |
| Yes | 269 (8.8%) | 8 (2.6%) | (< 0.001) |
| Work-related physical activity | | | |
| None | 1245 (40.9%) | 150 (48.5%) | 0.018 |
| Low | 274 (9.2%) | 26 (8.4%) | (0.015) |
| Moderate | 1237 (41.4%) | 116 (38.8%) | |
| Intense | 251 (8.4%) | 13 (4.3%) | |
| Physical activity in leisure time | | | |
| Low (≤499 METmin/week) | 132 (4.1%) | 35 (10.5%) | < 0.001 |
| Moderate (500-999 METmin/week) | 1575 (51.7%) | 193 (62.0%) | (< 0.001) |
| Intense (≥1000 METmin/week) | 1344 (44.3%) | 83 (27.5%) | |
| CHRONIC CONDITIONS | | | |
| Number of chronic conditions | | | |
| 0 | 843 (28.0%) | 89 (29.5%) | 0.006 |
| 1 | 560 (18.4%) | 47 (14.8%) | (0.019) |
| 2 | 409 (13.4%) | 51 (16.4%) | |
| 3 or 4 | 556 (18.2%) | 39 (11.8%) | |
| 5 or more | 683 (21.9%) | 85 (27.5%) | |

Supplementary Table S2. Differences on EuroQol index **by sexual identity among WOMEN** in the 2016 – 2017 Barcelona Health Survey. Tobit Models.

| | Model 1 | | Model 2 | | Model 3 | |
|--|----------|----------------------------------|----------|----------------------------------|----------|----------------------------------|
| | Estimate | p-value (unweighted analysis) | Estimate | p-value (unweighted analysis) | Estimate | p-value (unweighted analysis) |
| Intercept | 0.5850 | (< 0.001) | 0.5921 | (< 0.001) | 0.4970 | (< 0.001) |
| Sexual Identity | | | | | | |
| Heterosexual or straight | Ref. | | Ref. | | Ref. | |
| Bisexual | -0.0762 | (0.004) | -0.0571 | (0.040) | -0.0427 | (0.068) |
| Homosexual, gay or lesbian | 0.0078 | (0.842) | 0.0115 | (0.775) | -0.0176 | (0.609) |
| Age | | | | | | |
| 15-29 | Ref. | | Ref. | | Ref. | |
| 30-44 | -0.0444 | (0.001) | -0.0466 | (< 0.001) | -0.0162 | (0.155) |
| 45 - 59 | -0.0885 | (< 0.001) | -0.0928 | (< 0.001) | -0.0316 | (0.007) |
| 60 or more | -0.1575 | (< 0.001) | -0.1639 | (< 0.001) | -0.0590 | (< 0.001) |
| Education level | | | | | | |
| Primary or less | Ref. | | Ref. | | Ref. | |
| Secondary | 0.0182 | (0.075) | 0.0209 | (0.041) | 0.0087 | (0.314) |
| University or more | 0.0374 | (0.002) | 0.0402 | (0.001) | 0.0137 | (0.179) |
| Social class * | | | | | | |
| Managers, professionals | Ref. | | Ref. | | Ref. | |
| Intermediate occupations | -0.0199 | (0.079) | -0.0229 | (0.044) | -0.0223 | (0.021) |
| Lower and manual workers | -0.0508 | (< 0.001) | -0.0508 | (< 0.001) | -0.0324 | (0.002) |
| Country of birth | | | | | | |
| High income countries | Ref. | | Ref. | | Ref. | |
| Low-middle income countries | -0.0075 | (0.474) | -0.0089 | (0.415) | -0.0136 | (0.144) |
| Sexual orientation-related discrimination | | | | | | |
| No | | | Ref. | | Ref. | |
| Yes | | | -0.0257 | (0.596) | -0.0022 | (0.957) |
| Sex-related discrimination | | | | | | |
| No | | | Ref. | | Ref. | |
| Yes | | | -0.0403 | (0.001) | -0.0198 | (0.065) |
| Ethnicity-related discrimination | | | | | | |
| No | | | Ref. | | Ref. | |
| Yes | | | -0.0142 | (0.536) | 0.0053 | (0.786) |
| Smoking | | | | | | |
| Never smoker | | | | | Ref. | |
| Former smoker | | | | | -0.0084 | (0.280) |
| Occasional / Current smoker | | | | | 0.0029 | (0.740) |
| Alcohol Consumption | | | | | | |
| Non-drinker | | | | | Ref. | |
| Moderate drinker | | | | | 0.0191 | (0.008) |
| Risk drinker | | | | | 0.0258 | (0.112) |
| Psychoactive drug consumption (30 days) | | | | | | |
| No | | | | | Ref. | |
| Yes | | | | | -0.0671 | (< 0.001) |
| Work-related physical activity | | | | | | |
| None | | | | | Ref. | |
| Low | | | | | 0.0266 | (< 0.001) |
| Moderate or Intense | | | | | 0.0186 | (0.164) |
| Physical activity in leisure time | | | | | | |
| Low (≤499 METmin/week) | | | | | Ref. | |
| Moderate (500-999 METmin/w) | | | | | 0.1025 | (< 0.001) |
| Intense (≥1000 METmin/week) | | | | | 0.1174 | (< 0.001) |
| Number of chronic conditions | | | | | | |
| 0 | | | | | Ref. | |
| 1 | | | | | -0.0344 | (0.004) |
| 2 | | | | | -0.0771 | (< 0.001) |
| 3 or 4 | | | | | -0.0942 | (< 0.001) |
| 5 or more | | | | | -0.1727 | (< 0.001) |
| Log-likelihood | -440.5 | | -434.2 | | -174.5 | |
| df | 12 | | 15 | | 28 | |
| p-value | | | 0.006 | | < 0.001 | |

* **Social class categories:** Managers, professionals (Social class I, II); Intermediate occupations (Social class III, IV); Lower and manual workers (Social class V, VI, VII).

Supplementary Table S3. Differences on EuroQol index **by sexual identity among MEN** in the 2016 - 2017 Barcelona Health Survey. Tobit Models.

| | Model 1 | | Model 2 | | Model 3 | |
|--|----------|----------------------------------|----------|----------------------------------|----------|----------------------------------|
| | Estimate | p-value (unweighted analysis) | Estimate | p-value (unweighted analysis) | Estimate | p-value (unweighted analysis) |
| Intercept | 0.5359 | (< 0.001) | 0.5369 | (< 0.001) | 0.4272 | (< 0.001) |
| Sexual Identity | | | | | | |
| Heterosexual or straight | Ref. | | Ref. | | Ref. | |
| Bisexual | 0.0401 | (0.328) | 0.0489 | (0.243) | 0.0405 | (0.201) |
| Homosexual, gay or lesbian | 0.0461 | (0.070) | 0.0517 | (0.046) | 0.0385 | (0.055) |
| Age | | | | | | |
| 15-29 | Ref. | | Ref. | | Ref. | |
| 30-44 | -0.0504 | (< 0.001) | -0.0521 | (< 0.001) | -0.0180 | (0.072) |
| 45 - 59 | -0.0718 | (< 0.001) | -0.0745 | (< 0.001) | -0.0180 | (0.096) |
| 60 or more | -0.1090 | (< 0.001) | -0.1118 | (< 0.001) | -0.0090 | (0.441) |
| Education level | | | | | | |
| Primary or less | Ref. | | Ref. | | Ref. | |
| Secondary | 0.0439 | (< 0.001) | 0.0457 | (< 0.001) | 0.0201 | (0.011) |
| University or more | 0.0476 | (< 0.001) | 0.0492 | (< 0.001) | 0.0220 | (0.014) |
| Social class ^a | | | | | | |
| Managers, professionals | Ref. | | Ref. | | Ref. | |
| Intermediate occupations | -0.0115 | (0.339) | -0.0118 | (0.325) | -0.0090 | (0.321) |
| Lower and manual workers | -0.0266 | (0.024) | -0.0259 | (0.029) | -0.0183 | (0.044) |
| Country of birth | | | | | | |
| High income countries | Ref. | | Ref. | | Ref. | |
| Low-middle income countries | -0.0181 | (0.098) | -0.0118 | (0.294) | -0.0200 | (0.022) |
| Sexual orientation-related discrimination | | | | | | |
| No | | | Ref. | | Ref. | |
| Yes | | | -0.0382 | (0.338) | -0.0253 | (0.425) |
| Sex-related discrimination | | | | | | |
| No | | | Ref. | | Ref. | |
| Yes | | | -0.0502 | (0.036) | 0.0056 | (0.762) |
| Ethnicity-related discrimination | | | | | | |
| No | | | Ref. | | Ref. | |
| Yes | | | -0.0380 | (0.083) | -0.0039 | (0.813) |
| Smoking | | | | | | |
| Never smoker | | | | | Ref. | |
| Former smoker | | | | | -0.0054 | (0.468) |
| Occasional / Current smoker | | | | | 0.0036 | (0.652) |
| Alcohol Consumption | | | | | | |
| Non-drinker | | | | | Ref. | |
| Moderate drinker | | | | | 0.0108 | (0.172) |
| Risk drinker | | | | | 0.0229 | (0.072) |
| Psychoactive drug consumption (30 days) | | | | | | |
| No | | | | | Ref. | |
| Yes | | | | | -0.0535 | (< 0.001) |
| Work-related physical activity | | | | | | |
| None | | | | | Ref. | |
| Low | | | | | 0.0196 | (0.003) |
| Moderate or Intense | | | | | 0.0197 | (0.063) |
| Physical activity in leisure time | | | | | | |
| Low (≤499 METmin/week) | | | | | Ref. | |
| Moderate (500-999 METmin/w) | | | | | 0.0990 | (< 0.001) |
| Intense (≥1000 METmin/week) | | | | | 0.1118 | (< 0.001) |
| Number of chronic conditions | | | | | | |
| 0 | | | | | Ref. | |
| 1 | | | | | -0.0377 | (< 0.001) |
| 2 | | | | | -0.0676 | (< 0.001) |
| 3 or 4 | | | | | -0.0972 | (< 0.001) |
| 5 or more | | | | | -0.1818 | (< 0.001) |
| Log-likelihood | -495.0 | | -490.2 | | -232.7 | |
| df | 12 | | 15 | | 28 | |
| p-value | | | 0.023 | | < 0.001 | |

^a **Social class categories:** Managers, professionals (Social class I, II); Intermediate occupations (Social class III, IV); Lower and manual workers (Social class V, VI, VII).

**Health inequalities by sexual orientation
and their association with discrimination**

Marcos Marti Pastor