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Lucinda Cash-Gibson

Where, Why and How Scientific Knowledge on Health Inequalities is Generated?
An integrated perspective to strengthen understanding of health inequalities research capacities.
Key insights from the United Kingdom and the city of Barcelona

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"Health is telling us a story about the major influences on the quality of life in modern societies, and it's a story which we cannot afford to ignore".

Richard Wilkinson, 1996

Unhealthy Societies: The Afflictions of Inequality. Routledge.

"Public Health success is as much about imagination as evidence: challenging what is accepted as the so called normal, or business as usual. Public Health must regain the capacity and will to address complexity and dare to confront power."

Lang and Rayner, 2012

Ecological Public Health: the 21st century's big idea? BMJ. 345: e5466

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ABSTRACT

This dissertation aims to understand where, why and how scientific knowledge on health inequalities is produced, why and how some places have strong capacity to produce this, and what determines this capacity. It consists of five main research articles, which integrate diverse disciplinary perspectives and methods (e.g. bibliometric and network analyses; critical review, realist explanatory case studies, with semi-structured interviews and data triangulation from literature reviews). Results show significant inequalities within the health inequalities scientific research field, and propose a global hypothesis on the health inequalities research production process at the local/national level, and some of the potenital conditions, determinants and dynamics involved. In the case of the United Kingdom, and the city of Barcelona, evidence suggests that six causal mechanisms, when activated under certain conditions, are key contributors to the generation of a high volume of health inequalities research. Further research should confirm and analyse them in other settings.

RESUMEN

Esta disertación tiene como objetivo comprender dónde, por qué y cómo se produce el conocimiento científico sobre desigualdades en salud, e identificar qué determina la capacidad para crear este conocimiento en distintos contextos. Incluye cinco artículos de investigación que integran diversas perspectivas y métodos (análisis bibliométricos y de redes; revisión crítica; estudios de casos explicativos realistas; entrevistas semiestructuradas; y triangulación de datos). Los resultados principales señalan importantes desigualdades en la producción de conocimiento científico en desigualdades en salud a nivel global; se plantea una hipótesis global sobre dicho proceso y los principales determinantes, dinámicas y condiciones implicados a nivel local o nacional; en el caso del Reino Unido y Barcelona, la evidencia sugiere que seis mecanismos causales han contribuido a la generación de un alto volumen de investigación sobre desigualdades en salud, los cuales se activan bajo ciertas condiciones. Investigaciones futuras deberán analizar dichos mecanismos y determinantes en distintos entornos.

Table of Contents

1. INTRODUCTION

This introductory chapter includes an overview of several key definitions, concepts and topics which are helpful to provide sufficient context, and to understand the rationale, hypotheses, and objectives of this thesis dissertation.

1.1 DEFINITIONS OF KEY CONCEPTS TO ENSURE A COMMON UNDERSTANDING

- ***What is (good) Health?*** **-** Historically, health has been defined in many ways; perhaps the most well-known definition is the one that the World Health Organization (WHO) created in 1948, which considers (good) health to be more than just the absence of mortality or morbidity; it represents a good state of physical and mental health, and well-being [1]. Also, the WHO constitution states that everyone has the right to enjoy the highest attainable standard of health in their society [1]. Therefore, in this sense, 'good health' can be viewed as a right in itself, as well as a key resource for achieving other objectives in life [2]. The People's Health Movement, a global grass roots social movement advocating for "Health for All", recognizes health as a political, economic, and social, and issue, and a fundamental human right [3]. It also considers the main drivers

of ill-health to be inequality, injustice, and exploitation, violence and poverty [3].

- ***What is Public Health?*** - In 1920, Charles Winslow, an American public health professional, defined the field of public health to be about prevention and management of disease, prolongation of life, and the promotion of physical health through community-level efforts [4]. This included personal hygiene education, organization of health services, and the development of social structures which ensure everyone has an adequate standard of living to be able to maintain their health [4]. In 1988, Sir Donald Acheson, the Chief Medical Officer in Britain at that time, adapted this definition to emphasise the importance of health promotion, as he considered the field of Public Health to have been too focused on sanitation and infectious disease control, without giving equal importance to lifestyles and behaviours in promoting good health [5]. This definition is still used today, by the WHO European Region for example [6]. Other scholars have defined public health as "…[t]*he effort organized by society to protect, promote and restore people's health, through collective actions*" [7] (p.240). With this definition in mind, the main public health functions are as follows: i) to assess of population health needs, to understand and measure the determinants of health and well-being problems within their socio-political and ecological context; ii) to develop health policies to promote, protect and maintain (good) health, and iii) to provide health policies,

programs and services that are efficient, affordable, safe, equitable, and sustainable [7].

- ***What are Health Inequalities (HI)?*** - Although part of the differences in health outcomes between individuals can be attributed to biology, HI between social groups, within and between countries, are largely determined by the eco-socio-political factors, and choices about the way we organise our society; these choices can shape and influence peoples' opportunities to be healthy, and include interactions between society, psychology and biology [2]. Whitehead and Dahlgren [2] famously defined three main features that, when combined, are considered fundamental to transform differences in health outcomes between different social groups within a population, into HI: i) when these differences in health outcomes are systematic (i.e. not random); ii) when they are socially, rather than biologically, determined, and iii) when they are generated and maintained by unjust social arrangements, which makes them 'unfair' and avoidable´ [2,8,9].

  These features imply that HI are socially created, rather than inevitable outcomes, and therefore that they should be responsive to social action. In this thesis dissertation, the term HI is used in line with Whitehead and Dahlgren [2]'s features to refer to all of the following terms: health disparities, HI, health inequities, and social inequalities in health.

- ***What is Health Equity?*** – Health equity is considered to be a relevant indicator of social justice. In line with Whitehead and Dahlgren [2]'s work mentioned above on HI, health equity implies that everyone should have the opportunity to achieve their 'full health potential', regardless of their social circumstances [2]. Therefore, any actions aiming to promote it should aim to create 'fair' access to opportunities and resources to ensure that everyone is able to achieve their full health potential [2].

- ***What is HI research, and why is it important?*** - Evidence on HI is needed to be able to demonstrate their existence, to establish their characteristics, magnitude, trends, and most importantly to identify their causes. This type of knowledge can be used to raise awareness of the problems, describe and monitor their evolution, analyse their causes, and inform the effective design, and implementation of interventions, policies and practices aiming to reduce these HI, as well as to monitor and evaluate the impact of these interventions [10,11]. As such, having a strong capacity to produce research on HI, at local, national and global level is essential. However, HI are complex to understand and address, both theoretically and practically [12]; therefore, establishing in-depth causal explanations about their causes can be challenging. There are different schools of thought on the causes of HI, stemming from different disciplinary training, which have different practical and political implications [13–15]. HI have often been studied from distinct,

siloed disciplinary perspectives, which has generated important, yet fragmented, understanding of these complex problems and their causes [16–18]. Several scholars have therefore advocated for more research that attempts to integrate different methodological and theoretical approaches, and transdisciplinary perspectives to study HI, to synthesise different sources of knowledge, and establish more in-depth understanding about HI, as well as develop more pursuable causal hypotheses [16,18,19]. These considerations are also relevant for research on HI research, as they can assist to develop causal hypotheses for why and how different settings may have stronger or weaker capacity to produce scientific research on HI, and what determinants this capacity.

- ***What is research on HI research?*** - While the scientific HI evidence has grown substantially over the past few decades, this has not been translated into a greater success in reducing HI. As such, there has been a lot of research which has focused on the relationship between HI research, policy, and practice to try to tackle HI [20]. Yet, there has been substantially less empirical research focused on trying to understand where, why, and how scientific knowledge on HI is produced, and what determines the capacity to create and produce HI scientific research, in different settings? This is the focus of this dissertation.

1.2 A BRIEF HISTORY OF THE FUNDAMENTAL EVENTS NECESSARY TO UNDERSTAND THE HEALTH INEQUALITIES RESEARCH FIELD

During the 19th century, several countries started collecting administrative data on population health, with increasingly accurate populations statistics, and epidemiology emerged as a branch of medicine to study and analyse the distribution, trends and determinants of health and disease in populations [21,22]. Epidemiology, alongside historical, qualitative and narrative approaches, has been very useful to study public health issues, and to generate understanding about HI [23,24]. For example, William Farr, a British Physician and epidemiologist, and considered as one of the founders of medical statistics, observed that variations in health outcomes were not due to chance, they were the result of the physical and political conditions in which societies live [25]. This implies that there is a need to understand in-depth the diverse contextual conditions within which we live [10], to be able to improve the health for all citizens. During that time, several well-known physicians and public health reformers, such as Louis René Villermé, Rudolf Virchow, Friedrich Engels, James Chadwick and William Henry Duncan, amongst others, were trying to understand how social conditions affected health and disease [22,24,26]. They observed, for example, the link between hygiene, living standards, working conditions, and heath, as well as the associations between high mortality and poverty [26]. Yet, they differed in what they considered to be the main causes of health and illness, and also in the potential solutions to improve the health of

the poor. However, they shared many other ideas, and they used their findings to advocate for their governments to recognise both the social and medical aspects or models of health and disease, in the design of health improvement interventions [24]. Virchow, for example, was a pathologist and political reform activist [27], and conducted a series of broad public health studies on the effects of social conditions on morbidity and mortality. He famously concluded that the two main causes of diseases were 'pathological and political' in nature [28], and that medicine is both a social science, and a political issue; therefore, the solutions to these health problems required fundamental social and political change [29,30]. His work heavily influenced the field of social medicine.

By the end of the 19th century, due to the rise of infectious diseases and the increase in available biological knowledge, there was a shift in focus in the field of public health, away from the social aspects of ill health and disease, and towards understanding the exposures to infectious diseases (as the germ theory became popular) [5]. Also, the majority of epidemiological studies began to concentrate more on identifying biological and individual risk factors [5,22], rather than on the previously popular miasma theory, the socio-environmental factors, and the more structural and material conditions of living and working. During the 20th century, overall improvements in life expectancy were observed (especially in High Income Countries (HIC)), which were thought to be mainly due to the decrease and control of infectious diseases related-mortality [23]. However, we now know that those improvements were likely

to be due to a combination of biomedical and social interventions that were promoted and implemented by political changes. For example, the availability of antibiotics and immunizations, preventive action and health services to address malnutrition and infanticide [5,23] and the improvement of living conditions and hygiene standards all played a key role. Since the latter part of the 20th century, there has also been a better understanding of how social structures can expose different social groups to different combinations of material and psycho-bio-social vulnerabilities, and how these can converge to influence the distribution of disease, creating a consistent, and remarkable 'social gradient' in health [5,23,31].

During the interwar years of the 20th century, there was an international debate over the aims of social medicine, and the role and responsibility of governments in the provision of welfare to achieve universal health for all [30]. For example, following the Russian Revolution, the Soviet model of social hygiene/social medicine, had a strong focus on the study and elimination of HI, and highlighted the relevance of examining the social relations and political practices of health and medicine [30]. The model was said to have influenced a generation of medical and public health professionals from across Europe and the United States, interested in developing social medicine in their own contexts [30]. Social medicine was thus internationally promoted, and aimed to create a new role for medicine, to analyse the social causes of health and illness, and to tackle the challenges created by economic and social

developments of the 20th century [30]. In Latin America, for example, a number of social medicine institutions and departments were created, such as the the Oswarld Cruz Foundation and Institute (FIOCRUZ is the Portuguese acronym) in Rio de Janeiro, Brazil, and the University San Marcos in Lima, Perú [30]. This developed into a diverse and interesting tradition and research field within the Latin American region, which frames poor health in the context of underdevelopment, international dependency, and deprived social conditions [32], and advocates for social and political, rather than solely medical, solutions to health problems [33]. Several decades later, this research tradition has been re-energised, under the Latin American Social Medicine Association (ALAMES is the Spanish acronym) [34].

During the post World War II period, in Europe, discussions over the role and responsibility of the State in hublic health and social welfare continued. Initally, the new climate created new pressure to increase the State's involvement in the provision of health services, welfare and social protecion [5,13,30]. However, the thinking and focus of social medicine began to shift, with the field evolving into medical sociology, and public health issues began to be seen by some as less of a socio-political concern, which required social-structural reforms, and more of a collection of individuals with health problems who's behaviours required 'reform' [30]. This shift in focus, probably fueled by the emergence of epidemiology as the hegemonic science in public health, had important implications in terms of the research that was subsequently undertaken, so that

social behavioural studies, for example, started to became hegemonic in preventive medicine [30,35,36].

Also during this period, international development, and scientific philanthrophy became popular. The International Monetary Fund (IMF) and the World Bank were created to support international economic cooperation and development; as well as other intergovernmental organizations such as the United Nations (UN) and the WHO, to promote international cooperation for peace and security, and better health and well-being. This was followed in the 1960s by the succession of decolonization processes across the continent of Africa, as many countries and territories fought to gain their independence from European colonization. It was also around this time that the early theories of economic development and modernization were 'commonplace' [37], with a strong emphasis on scientific philanthropy (i.e. international health projects and research activities), and the provision of financial aid by donors from 'developed' countries to the so-called 'developing' countries [38]. As Danny Dorling (2015) summarises:

> *"…the story was that there was a path that could be followed, and that if poorer countries were to do what rich countries mythologies said they had done, then the poor could be rich too. All that was needed was to mechanise, industrials and democratise… in the 1970s, the rich began again to see their destiny as to rule, but now through intervention, co-option and conversation*

rather than directly through colonial mandate." [37](p.221-2).

These ideas of 'development', 'modernization', and 'progress', have received a lot of criticism over the past decades, to the extent that 'international development' is considered by some to be a form of 'neo-colonialism' [39]. This has given rise to subsequent searches for alternative forms of development, as well as more 'reflexive', sustainable, and participatory approaches to address these challenges [38]. These criticisms have also been extended to the field of international (public) health, where knowledge and effects to improve public health within Low and Middle Income Countries (LMIC), have traditionally been led and controlled by HIC researchers and practitioners, together with international institutions and Non-Governmental-Organizations, without proper inclusion and participation of people and other institutions from LMIC. The term '*International health'*, has since been replaced by the term '*Global health'*, which involves a shift in focus towards globally relevant public health issues, and attempts to develop more inclusive collaborative practices [28,40]. This is relevant, because a lot of effort and investment to try to strengthen health and HI research capacities, particularly in LMIC, involve international development practices. Therefore, these processes bring new factors into the contextual equation that need to be considered when trying to understand what determines the capacity to produce HI research in different contexts.

During the 1970s, an economic crisis throughout the so-called 'developed' countries, led to the implementation of a Neoliberal policy agenda [41,42]. Neoliberalism is an economic policy agenda and political ideology, that stems from modern capitalism, which in general promotes deindustrialisation, deregulation, and privatization of public goods and services [41,42], and "…*equates justice with what a supposedly 'free' market will produce…*" [41](p.128). As such, individualism is promoted and takes precedence over society and social solidarity [43], private interests takes precedence over public needs, and the rise of social and HI are considered to be acceptable, inevitable, or even natural consequences of these 'progressive, and modern' actions [41,44]. This has developed into 'neoliberal globalisation', which we are still experiencing today, and is considered to be part of the 'causes of the causes' of HI [28]. It represents all the macro-historical-eco-political processes by which people are integrated into a single global society, and the intensification of the interconnectedness of the world and its social relations [28].

Consistent with this evolution, during the 1980s there was the roll-back of the Welfare State and social protection, mandated through the international development of Structural Adjustment Policies (SAPs), and the roll-out of the neoliberal policy agenda by institutions such as the IMF and the World Bank in many LMIC. These practices consequently increased social inequalities and HI within and between LMIC [28,45,46], and similar types of policies were later implemented in many HIC, in the so-called 'austerity agendas' [28,46]. Critics of these policies and processes, have

consistently argued that these interventions are in fact weakening countries efforts to 'develop' and improve public welfare, as opposed to strengthening them ,which is said to be the intended aim [28].

During the 80s´, the '*New Public Health'* movement also emerged [5], which advocated for the promotion and protection of public health, by going beyond a biological understanding of public health, and considering individual prevention measures, healthcare services, and social aspects of ill-health [5,47]. This included a renewed recognition of the role that cities can play in improving healthy living (a concept which originated in the 19th century) [5], and led to a push for '*Healthy Public Policies'*, and multisectoral action to support their implementation across all sectors [5,48]. A number of reports and initiatives have contributed to this *New Public Health* approach [5]. For example, at country level, in 1974, the Canadian Minister of Health Marc Lalonde led a report on '*New perspectives on Public Health of Canadians*'[49]. The report focused on the fact that a great deal of the premature death and disability in Canada was preventable, and included a community diagnosis and a theoretical model of causal factors on health, which, for the first time, separated out biology, environment, lifestyle factors and health care. The report also set an agenda for a new era of preventive medicine in Canada, and was said to been influential on other HIC [5]. In addition, in the UK in 1980, the famous *'Black Report'* was published [50] by the UK Government´s first Commission of HI research, led by the Chief Scientist at the

Department of Health at the time, Sir Douglas Black [51]. The Report accumulated all of the available evidence on HI at the time, in the UK and elsewhere, and confirmed the existence of HI, it also proposed a number of potential models of explanation for HI, and presented several policy recommendations [23,50,51]. Historically, the *Black Report* has played a key role in generating interest in understanding and studying HI in many other countries, which later developed into a solid scientific research field, and a priority issue in public policy [23], at the regional, national and global level. In 1987, the UK government commissioned *'The Health Divide'* report led by Margaret Whitehead, which provided an updated synthesis on the available evidence on HI [51,52]. In 1998, an Independent Inquiry into HI, the so-called '*Acheson report'* [53], also provided a comprehensive synthesis of the evidence on HI, as well as a long list of recommendations, mainly consistent with the findings of the *Black Report* [53,54]. In addition, several other European countries were able to publish their own '*Black Reports'*. For example, in 1993, the Ministry of Health of the Spanish Socialist Government (PSOE) established a Scientific Commission to study socio-economic inequalities in health, which followed the model of the UK's *Black Report* [50,55].

Over the past four to five decades, the WHO has made several influential international declarations, and developed a number of work programmes and agendas, which has increased momentum for '*New Public Health'* [5], and a range of actions to improve population health, address HI, and strengthen health research

capacities to be able to produce more evidence, which can ideally inform further action. For example, the WHO's 1978 *'Alma Ata declaration'* [56] emphasised the need for action to protect and promote '*Health for all'*, and the *'Global Strategy of Health for All by the Year 2000'* [5,57]. The WHO European Region subsequently developed their own '*Health for All Strategy*', which in 1985 included accompanying targets, the first of which focused in reducing HI by 25% [5]. This was extremely influential to support and legitimise the work on HI that had been done during this period, at local, national and international level [58]. The WHO European Region also created the *'Healthy Cities Project'*, which considered the creation of structural opportunities for citizens to be healthy through the implementation of '*Healthy Public Policies'* [5]. The original intention was to bring a few European cities together to collaborate on the development of urban health promotion initiatives, based on a commitment to equity, community participation and intersectoral action, and to promote models of good practice at the city level [5]. The cities of Liverpool in the UK, and Barcelona in Spain, for example, were part of this early initiative, which has developed into a larger WHO-led network and movement, still active today [59]. Later in 1986, the Ottawa conference and the first declaration on Health Promotion took place, which led to the Ottawa Charter for action to achieve '*Health for All by the year 2000 and beyond'* [5,60]. This work highlighted the conditions and resources required to achieve good health beyond the health care services, and again identified the role of *Healthy*

Public Policies, organizations, communities and individuals in creating opportunities to achieve better health outcomes [60,61].

In 1987, the Commission on Health Research for Development (CHRD) was set up, an independent international initiative with the aim of looking into how to improve health for development by strengthening capacities to produce health research, particularly in LMIC where health research capacities have traditionally been limited [11]. In 1990, the CHRD published the influential '*Health Research: Essential Link to Equity in Development'* report [11], which highlighted the '*10–90 gap'* in health research expenditure, worldwide – where only approximately 10% of the world's research expenditures were spent on certain diseases and health problems, mostly prevalence in LMIC, but caused approximately 90% of global preventable mortality. The CHRD 1990 report also highlighted the urgent need to expand country-specific health research, particularly in LMIC, through the development and strengthening of national health research capacities, to improve health and health equity, and included a number of recommendations [11]: i) countries should invest in and sustain the development of national health research, to analysis the burden of disease and their determinants, identify public health priorities, and develop new measurement tools, amongst other things; ii) increase domestic and foreign investment in LMIC, to strengthen their capacity to produce locally-relevant health research; iii) establish international health research collaborations to support and strengthen health research capacities in LMIC, and iv) establish a

forum to monitor progress towards reducing the '10/90' gap in health research expenditure, worldwide.

These findings and recommendations led to a number of on-going activities, such as calls to increase government expenditure on health research, investments in health research systems to guide national health research and health agendas, and the establishment of new institutions, initiatives and international partnerships to exchange and link expertise, all to strengthen the production and use of country-specific health research in policy and practice in LMIC [11,62–69].

In 2005, the WHO established '*The Commission on Social Determinants of Health'* (CSDH), to raise awareness about HI, and to support countries to take action to address them [10]. The work concluded with the 2008 report entitled '*Closing a gap in a generation*' [10], which set an aspirational goal of narrowing the health gaps between all levels of society, in every country, in a generation. Since its publication, the 2008 CSDH report has been rather influential in terms of legitimising the HI research field, increasing the global interest and investment in HI research, and the worldwide use of the term *´Social Determinants of Health´* (SDH) [10]. The report included a number of recommendations and priority action areas to improve population health and address HI, by:

> "*...improve daily living conditions, through taking a life course approach to health and well-being and investing in society; tackle the inequitable distribution of power,*

money, and resources; and measure and understand the problem and assess the impact of action" [10] (p.26).

The latter point relates to the need to strengthen HI research capacities to support evidence-based action to address SDH and HI. More specifically, the report highlighted that the capacity to routinely collect health and sociodemographic data, and to monitor HI, varies by country [70,71], and there is an urgent need for: i) good data to be collected on the problems; ii) up-to-date evidence on the potential causes of HI, and effective solutions, and iii) decision makers to understand the evidence and have institutional support to be able to act on it [10]. The report specifically recommended the following, to be able to inform and propose effective interventions and policies to address HI [10]: i) *"…routine monitoring systems for health equity and the social determinants of health to be in place, locally, nationally, and internationally"* [10] (p.180); ii) further investment to strengthen the production of the SDH/ HI evidence; iii) broadening of the SDH/HI evidence base by "*…expanding the methodological tool box to include both qualitative and quantitative data, going beyond the traditional hierarchies of evidence and instead judge evidence on 'fitness for purpose*" [10] (p.178-179), to include more interdisciplinary research, and iv) development of more context specific SDH/HI evidence.

Stemming from the WHO-CDSH's work, in 2010, the UK New Labour left-wing government commissioned a policy-oriented

review of SDH in England (also known as the '*Marmot Review*'), which compiled the evidence on the upstream and downstream determinants of HI [72]. The majority of the policy recommendations were in line with those presented in the *Black Report* and the *Acheson Report*. Also in 2010, in Spain, a second Scientific Commission on HI was created by the PSOE left wing government at the time [73,74], which developed a number of policy and research recommendations which were very much in line with the first Commission (1993), and its so-called '*Spanish Black Report'* published in 1996. Interestingly, both of these cases highlight that despite the volume of HI research produced over the past decades, many early research and policy recommendations, which were proposed during the heyday of Neoliberalism, had not been followed, which might partly explain why action aiming to address HI has not been as effective as one had hoped [75].

In 2011, the '*Rio Political Declaration*' on SDH was adopted during the World Conference on SDH held in Brazil, and it expressed the global political commitment for implementing a SDH approach to tackle and reduce HI at the local level [76]. In 2014, *'The Lancet–University of Oslo Commission on Global Governance for Health'* was developed, which published interesting work focusing on the global political determinants of health, how they could be addressed, and the role of global governance [77]. Since 2015, all countries have been working on the UN´s 2030 agenda, and towards the Sustainable Development Goals (SDGs) [78], which includes a renewed commitment to improving health and

well-being, as a central component and equity as a cross-cutting theme [78,79]. There are 17 goals and main areas of action, one of which (SDG3) is specifically focused on health and well-being [78]. At the regional level, in 2018 the Pan-American Health Organization set up a Commission on Equity and HI in the Americas, which developed a number of recommendations to reduce HI for the different countries [80]. In 2019, the WHO European region's held the first Regional Conference on Health Equity, in Slovenia, where evidence was presented on the potential solutions to reduce HI, and to accelerate progress towards better health and well-being for all in the region [81]. Also, in 2019, the WHO established a CSDH for the Eastern Mediterranean Region, which aims to work towards reducing HI, by developing recommendations, and strategic guidance, and assessing how to strengthen SDH research capacity [82].

1.3 IN SEARCH OF CAUSATION: MAIN EXPLANATORY APPROACHES USED IN HEALTH INEQUALITIES RESEARCH

The study of HI within public health, has experienced several so-called 'paradigm shifts', where the different scientific theoretical lens through which to observe and analyse health and HI problems, and their main causes, seem to have been competing with each other over time, to be the most dominant perspective [83]. With these paradigm shifts, there have been academic debates over the different types of methodological and philosophical approaches to use in HI research, and to accompany the different perspectives [16,84,85].

The UK's influential *Black Report*, for example, proposed a number of models of explanation for HI (i.e. selection, artefact, material and behavioural-cultural causes) [23,50,51,72]. The report did not include the biological or genetic argument, which scholars' have the hypothesis that was due to the fact that at that time "…*there was far less interest in genetics than nowadays* [despite the existence of the Eugenics society, and perhaps because]… *the memories of the Holocaust were too fresh in their minds"* [23] (p.41-42). Since the *Black Report*, and further investment in HI related information resources, other explanatory models have been proposed, such as the psychosocial stress at work, social isolation and life-course approach, which have strengthened our understanding of HI and their potential causes [23,50,51]. These different explanations are not necessarily mutually exclusive [23].

Below is a typology of four main families of explanatory perspectives used in HI research, to try to establish causality. The purpose here is not to provide a detailed account of all the different theories and explanations for HI, but rather to emphasise that there are different approaches used within the HI research field, which incorporate different disciplinary epistemological, ontological and theoretical perspectives [23,52], and different implications in terms of research findings, policy and practice. This is also relevant to highlight that are likely to be different approaches to try to understand where, why and how scientific knowledge on HI is produced, and what determines this capacity in different settings over time.

1. ***Biomedical perspectives on HI*** **-** often used by researchers who have been trained mainly or exclusively in biomedicine, genetics, biology and medicine. The focus is oriented downstream toward the biological and genetic causes of illness, disease and HI. This can also include research on the buffering role of the health system in reducing HI. These perspectives do not typically consider the upstream structures and wider social context that can shape and condition these downstream individual factors, be embodied, and interact with psycho-biological factors to create ill-health and HI [86]. However, due to the technological advances in medical treatment, research developed, and health gains over the past few decades, these perspectives have achieved some important successes [77]. Nevertheless, while these downstream factors play important

roles in determining certain health outcomes, they play a relatively minor role in the production of HI. Also, since HI persist, and scholars have pointed out that "…*there is little evidence of association of genetic variants with a measure of social position such as social class or income*" [23] (p.4). Evidence therefore suggests that applying this perspective alone cannot capture the full complexity of HI in the research findings [77].

2. ***Psychosocial and risk factor perspectives on HI*** - can be slightly more comprehensive than the previous ones, although they also mainly focus on the downstream determinants of HI. For example, on examining the role of certain psychosocial effects on health, such as experiencing stressful conditions at work or at home, the lack of employment, social isolation or low social status [23,87], and the numerous individual 'risk' factors (e.g. biological characteristics, behaviours or lifestyle choice) affecting health outcomes [88]. While there is clearly a relationship between these risk factors variables and health outcomes, the challenge with using this 'atomistic' approach is said to be that it tends to reduce social reality to small entities, i.e. risk factors, and attempt to disconnect individuals from their social context, network and structures within which they exist [88]. Therefore, applying this approach also only provides a partial understanding of HI [16,77,85].

3. ***SDH perspectives on HI*** **-** integrates more disciplinary perspectives than the previous ones, to try to understand how more upstream structural and intermediate determinants of health and HI (e.g. public policies, labor market features, socio-cultural values), can shape, influence and interact with the more downstream determinants (e.g., lifestyle choices, individual and biological behaviors) [10,89], to produce HI.

   There are two very influential conceptual models and frameworks that use this perspective, which are the most widely known and used in HI research globally, today. Firstly, the Dahlgren and Whiteheads *´Social Model of Health´,* also known as the '*Rainbow model*' [90], developed in the 1990s, which conveys that many biological, individual, community, and social determinants can influence health and HI. However, some scholars have since highlighted some of its drawbacks; for example, it does not put into play key axes of HI, such as gender and social class, the interaction between the different layers of determinants is missing, and the issues of power are neglected [88]. Secondly, the more recent '*SDH conceptual framework'*, originally developed by Solar and Irwin, which was included into the WHO-CSDH's 2008 report [10], The framework specifically distinguished between those factors considered to be structural determinants, and intermediary determinants of HI, and convincingly argues that the root causes and structural drivers of daily living conditions and HI, lie in '*the unequal distribution of power, money, and resources*' [10]. The WHO-CSDH's work has also been extremely influential in raising

global awareness and acknowledgment of the importance of inequalities, and their implications for health, in mobilising many decision makers from around the world to think and act on SDH, and for providing a necessary alternative to the biomedical perspectives on HI [91,92].

At the same time, many scholars have criticized the lack of an in-depth comprehensive assessment of these conditions and determinants in the WHO-CSDH's work [93], its limited historical and political perspectives, and how it neglects the impact of other complex determinants such as the ecological crisis, the economic crisis, the role of violence and war, or the pervasive influence of the labour market and precarious employment [93]. In addition, a few scholars have also pointed out that the current mainstream SDH approach, often assumes that single events are capable of generating HI through unidirectional relations, and fails to consider how to address the underlying global forces, and the social mechanisms that create exploitation, oppression, domination, discrimination or segregation, among others [33,86,92–95]. Furthermore, mainstream SDH work has also been criticized for focusing on HIC experiences of HI, and downplaying the relevance of other significant scientific perspectives on these issues, such as those taken by the Latin American Social Medicine tradition, and the public health tradition which is interested in critical thinking and in the analysis of history and politics [95].

4. ***Macro-social, ecological, and political economy perspectives on HI*** **–** these are often more systemic, using integrated disciplines, with additional perspectives coming from history, ecology, social and political sciences. These approaches typically emphasise how traditionally public health theoretical frameworks and empirical research "*…focus on individualizing and dissecting risk…"* [96](p.1030), and fail to consider biological factors within their socio-cultural and eco-political contexts, which limits the development and testing of "*more sophisticated (and realistic) models of disease causation."* [96](p.1030). The eco-social theory, for example, tries to understand how people embody and biologically express social inequalities that they have experienced across their life course [86]. Also, the Latin American Social Medicine and Collective Health tradition focuses on the social, historical and (geo) political roots causes and evolution of illness, health and HI, in combination with the explicit use of rich theories, to establish more complex approaches to study causality [27,29,33,95]. This tradition *"…envisions populations, as well as, social institutions, as totalities whose characteristics transcend those of individuals…"* [27](p.1594), rather than seeking mono-causal explanations of illness, health and HI, and seeing populations as simply a collection of individuals and characteristics [27]. Also, it *"…conceptualises 'health-illness' as a dialectic process, rather than a dichotomous category…"* [27] (p.1594), and considers the dynamics that might be involved in this process [27,29,33,95].

1.4 JUSTIFICATION

While the study of HI from a systematic public health perspective, can be traced back to 19th century, during the last four decades in particular, there has been a growing attention and interest in the analysis of HI, as well as the role of research and evidence to inform action [10,11,97]. This has led to an increasing volume of scientific evidence on HI, which has intended to improve understanding, raise awareness of these issues, and inform the development of interventions, policies and strategies aiming to improve population health and health equity [10,98]. At the same time, there has been a substantial increase in calls and investments in national health research systems, to strengthen the scientific knowledge base, to support action to improve population health and heath equity [11,62–68,99]. As a result, the analysis of the capacity to produce health research has developed into an area of study, to determine what type of capacities exists, and where [12].

However, while there has been a fairly strong emphasis on trying to understand and strengthen health research capacities to improve population health and heath equity, there has been rather limited research focused on understanding where, why and how HI research more specifically is produced, what determines the capacity to produce HI scientific research, in different settings, and how to strengthen these capacities. A specific focus on HI research capacities has only really developed over the past 15 years [10,69,97], and despite these fairly recent efforts, which have mainly focused on strengthening certain aspects of the HI research

infrastructure [12,100–102], there are still many pending challenges to be addressed, within and between countries [10,65,69,91,97,103], as well as uncertainty over the most effective ways to strengthen and sustain these research capacities [101,104–109]. This might be due, in part, to the fact that the study of HI requires different skillsets, information and perspectives than in the study of health more broadly; therefore, while learning on health research capacities more broadly, it may be useful in part to reflect on HI research capacities more specifically, as HI research capacities will likely involve unique features, which warrant separate and further investigation.

An important first step is to establish a ´diagnosis´ or an overview of the global HI evidence base, and identify where scientific knowledge on HI is being produced. This diagnosis can then be used to guide more specific in-depth explorations into HI research capacities in different settings. Scientific output (i.e. research published in international peer review journals), is considered to be a good indication of scientific research capacity, since it is a comparable standardised source that can indicate the magnitude, patterns and trends of science research that has been undertaken as well as where, and by whom. Bibliometric analysis is a powerful tool that can measure and evaluate the trends in scientific outputs over time [110]; yet so far this analysis has been limitedly applied to the HI research field [111–113]. While these findings are useful to understand the production of HI research in different countries, during certain time periods, they highlight the need for an up-to-date comprehensive diagnosis of the HI scientific research field,

which considers the global evolution of what is now identified and understood to be research on HI, and imply that inequalities may exist within the global production and research practices of this research field [114,115]. Furthermore, some scholars have highlighted the need to develop a more in-depth socio-historical understanding of why some countries produce more HI research than others [112], and how various contextual conditions influence where HI research is produced or not, in different countries. For example:

> "[the need to]… *fully acknowledge the connections between the particular social, political, and economic contexts that… have allowed this type of research to proliferate in specific countries...* [a] *discussion of these historical and political contexts can help to explain unequal gaps and trends and thus explain why research is not conducted in certain parts of* [the world] *in* [the] *same manner…*" [112] (p.2042-43).

Existing research findings enable us to pose some important research questions, such as where, how and why scientific knowledge on HI is produced? Why and how some settings have strong capacities to produce this type of research than others? What determines this capacity? What types of key processes, components, conditions, determinants and causal mechanisms might be involved? Establishing answers to these questions may provide the basis for a new understanding in the field of research on HI

research, and on how to strengthen HI research capacities in different settings. This new understanding might lead to a stronger HI evidence base, and breakthroughs in the monitoring and actions taken towards achieving health equity.

As such, this dissertation aims to address these knowledge gaps to establish more in-depth contextual and causal understanding about HI research capacities in different settings. The focus will be on the scientific production on HI specifically, and will not include the production of HI grey literature, as this is likely to involve different processes and factors. Also this dissertation will mainly refer to the production of HI research in general, rather than specific types of HI research, unless otherwise stated. The dissertation aims and objectives will be met by integrating diverse disciplinary perspectives, innovative approaches, and methods. A number of case studies will be selected from the research findings that emerge during the development of this thesis dissertation.

1.5 MAIN HYPOTHESIS

This thesis dissertation consists of four main hypotheses:

- **Hypothesis 1:** Significant inequalities across countries exist within the global production of HI scientific research.

- **Hypothesis 2:** Current knowledge on why and how some settings have stronger capacity to produce HI research than others is limited, due in part to a limited theoretical understanding of the HI research production process, and related research capacities, at national and local level.

- **Hypothesis 3:** There are different combinations of key contextual conditions, determinants and dynamics that enable or inhibit the capacity to produce HI research in different settings.

- **Hypothesis 4:** There are key underlying causal mechanisms that enable the capacity to produce HI research in different settings.

1.6 MAIN OBJECTIVES

This thesis dissertation has five main objectives:

- **Objective 1:** To establish a comprehensive diagnosis of the global and historical scientific production on HI to determine where scientific knowledge on HI is being produced.

- **Objective 2:** To establish whether inequalities across countries exist within the global production of HI scientific research.

- **Objective 3:** To develop a comprehensive conceptual understanding of the HI research production process at local or national level, and the potential types of conditions, components, determinants, pathways, and dynamics might be involved. This knowledge will be used to inform in-depth evaluations of the HI research production process, and the capacity to produce HI research, in specific settings.

- **Objective 4:** To identify some of the key contextual conditions and determinants involved in generating a high volume of HI research in certain settings (e.g. the UK and the city of Barcelona).

- **Objective 5:** To identify some of the key causal mechanisms involved in generating a high volume of HI research in certain settings (e.g. the UK and the city of Barcelona).

These five main objectives will be met through the specific objectives of five main articles:

- **Article 1: Inequalities in global health inequalities research: A 50-year bibliometric analysis (1966-2015):** In line with objectives 1 and 2, the aims are to: i) analyse the volume of HI scientific production (1966-2015); ii) analyse the distribution of HI scientific research by country income group and world regions, iii) analyse the international HI research collaborations, and iv) establish whether inequalities exist within this research field.

- **Article 2: A novel conceptual model and heuristic tool to strengthen understanding and capacities for health inequalities research.** In line with objective 3, the aim is to develop a conceptual model to strengthen theoretical understanding of how HI research is likely to be produced (or inhibited) at local level, considering the potential processes, components, determinants and dynamics involved. The model can serve as a tool to guide comprehensive assessments of local and national capacity to produce HI research.

  Article 3: What key conditions and mechanisms generate health inequalities research in different settings? Study protocol for two realist explanatory case studies and critical considerations. In line with objectives 4 and 5, the aims are to: i) provide the rationale and methodology for conducting two

realist explanatory case studies, which aim to understand why and how the UK, and Barcelona have generated high volumes of HI research over the past few decades. This work can guide the development of further case studies on this topic, in different settings.

- **Article 4: Why and how the UK is a high producer of health inequalities research? Realist explanatory case study to test six causal mechanisms**. In line with objectives 4 and 5, the aim is to understand why and how the UK has generated a high volume of research on HI over the past few decades, by testing six theoretical causal mechanisms to establish whether they might have contributed to this outcome, and what key contextual conditions might have activated them.

- **Article 5: Why and how the city of Barcelona has become a health inequalities research hub? Realist explanatory case study to test six causal mechanisms.** In line with objectives 4 and 5, the aim is to understand why and how Barcelona has produced a high volume of research on HI over the past few decades, by testing six theoretical causal mechanisms to establish whether they might have contributed to this outcome, and what key contextual conditions might have activated them.

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2. METHODS

This chapter provides an overview of the diverse methods and approached used in the five main articles presented in this thesis dissertation.

2.1 BIBLIOMETRIC AND NETWORK ANALYSIS

The following methods are used in **Article 1**.

Bibliometric analysis

Bibliometric analysis is an extremely useful tool which can measure and evaluate patterns and trends in scientific publications within a research field [1,2]. It can provide a proxy indication of research capacity, as well as insights into some of the research dynamics within a research field [1]. The tool can be used to support evidence informed decision-making [2].

Network analysis

Network analysis can be used to analyse the strength of social networks or research collaborations within a field research [3]. VosViewer is a freely-downloadable software tool [4], which allows researchers to create different types of bibliometric network visualization maps from their data. The maps can depict different types of collaborations (e.g. by individual researchers, institution

affiliations, journal type etc.), depending on the research interests, and has been used in a wide range of research fields [5].

2.2 CRITICAL REVIEW TO DEVELOP A CONCEPTUAL MODEL

The following methods and approaches are used in **Article 2**.

Critical reviews

Analyse, synthesize and present literature from diverse sources, in a similar way to other type of reviews; however, they attempt to go beyond the provision of a description of the content, and include an analysis and 'critical evaluation´ of the potential value of the literature collected via the review process, particularly the conceptual contributions [6]. While this 'critical evaluation' is subjective, the intention is not necessarily to collect all of the available literature on a topic, or to provide a definitive answer to a particular question, rather it is to develop new theoretical understanding on a topic, such as a new hypothesis or a new conceptual model, which can act as a starting point for further research [6].

Conceptual models

Visual tools that represents a set of concepts, assumptions, theories, and components, and their potential relationships [7]. Conceptual models are more focused than conceptual frameworks, and possess certain ontological and epistemological assumptions about social reality, and how things might work within it [7]. As such, they can influence the types of questions that are asked, how a topic is studied (i.e. the

analytical and data collection approaches used), and how research findings are interpreted, and used [8]. They can inform a specific research framework that may be used to test the original assumptions, and can enable theory development [7,8]. The value of a conceptual model depends upon its utility, and its purpose [7,8]; in general, the purpose is "*... not to replicate reality exactly but to identify the elements for understanding*" [9] (p.55). These models should be comprehensive enough that they realistically represent the system or process of interest, yet simple enough that they can be understood, and used by various stakeholders [7].

2.3 REALIST EXPLANATORY CASE STUDIES

The following methods and approaches are used in **Articles 3-5**. **Article 3** is a study protocol and provides further details on the design of realist explanatory case studies.

Explanatory case studies

A case study is a qualitative method that can serve as a tool to describe and explore concepts, explain causal relationships, and support theory testing or development [10,11]. A case can be defined as "*…an empirical inquiry that investigates a contemporary phenomenon within its real-life context*" [10] (p.13), or as "*…an in-depth study of a single unit (a relatively bounded phenomenon) where the scholar's aim is to elucidate features of a larger class of similar phenomena*." [12] (p.19). Some critics of case study research, say that it lacks rigour, and it can be difficult to establish generalisation of

scientific findings [10,11]; however, this is said to be more applicable to descriptive and explorative case study research.

Explanatory case studies can extend beyond the traditional descriptive and exploratory case study approaches, enabling cases to be used with more rigour, to potential explain causal relationships, and to test and/or generate hypotheses [10,11]. They aim to answer 'how' and 'why' questions concerning a particular phenomenon of interest [12–14]. Each explanatory case study is a separate inquiry, which together with prior theories, can enable further hypothesis generating and testing, and produce empirical evidence to support or refute the proposed hypothesis [12,15]. Depending on the research purpose, explanatory case studies can enable researchers to either investigate the uniqueness and complexity of a single (atypical or unique) case, or the generalizability within a typical case, as part of a multiple case analysis [12,15].

To strengthen the design and implementation of explanatory case studies, Yin [10] developed an research approach to follow, which helps to convert this type of case study into a valid and rigorous research method. During the study design phase, justification, theory, and inclusion and exclusion criteria are important guidelines for defining and selecting which cases to investigate [10,13], and to avoid selection bias [10]. This can ensure that the research findings are credible, and the process can be replicated to ensure accurate comparison of results, which is important when conducting multiple case studies [10,11]. In addition, some scholars consider that explanatory case studies call for case study logical, rather than statistical inference or sample-based logic [10,15], to produce more

logical hypotheses and more transparent empirical data. Also, that searching for societal significance, rather than statistical significance, may assist to overcome the concern for generalisation when conducting a single case-study, as the priority is analysing a particular phenomenon, within its unique context [15–18]. Some scholars consider statistical representativeness to be a potentially irrelevant criterion when planning single-case studies, and the process of trying to find representative case as a mistake [15]. Instead, they consider that the "…*extrapolation* [should be] *based on the validity of the analysis rather than the representativeness of the events…"* [15] (p.21-23). One way to achieve societal significance is by applying a historical perspective (i.e. the method of ´extending´ the case study, often used in ethnographic research, for example), which is relevant when trying to uncover a broad process, by identifying the sequence of events over a considerable period of time, and linking them to one another to try to explain the nature of social reality [16,17]. As such, providing that single-case studies are designed and implemented correctly, they are capable of demonstrating whether a particular process, phenomenon, mechanism, relationship or dynamic, exists or not [15].

Realist inquiry and approaches

Realism is a strand of philosophy of science, which has emerged as a credible approach to capture a more encompassing view of the complex nature of social reality, by focuses on in-depth causal explanations, rather than just descriptions or partial, fragmented understanding [19–22]. As a model of scientific explanation, realism

considers that both i) positivism, and ii) constructivism or interpretivism [19,22], the main traditional positions used, have certain ontological and epistemological limitations, and that to understand causality, it is necessary to go beyond these two tradition positions [21], and to establish what is going on inside social systems (i.e. to peak into the 'black box of causality', a common phrase used in public health) [13,23]. For example, realism considers that observable evidence alone (i.e. via positivist approaches) cannot establish causality between certain variables [21], and certain causal forces can not always be expressed or perceived by study participants (i.e. via constructivist or interpretivist approaches), which does not mean that they do not exist [21]. In addition, rather than trying to establish which single individual variable has generated a certain outcome of interest [13], realism places a focus on the underlying, hidden but real, causal forces (i.e. mechanisms) and dynamics that connect certain individual variables [19,23]. The causal forces are likely to be sensitive to changes in the pre-existing context, and once activated, can generate certain outcomes of interest [19,23]. Furthermore, social systems are thought to comprise of continuous agency and structure interplays at different socio-contextual levels [24]; yet positivist research prioritises the role of structure, and provides descriptions of surface structures [21,22], and constructivist research prioritises the role of agency [21,22]. As such, realist approaches attempt to prioritises both, and acknowledges that social structures shapes human choices and actions, which in turn re-shapes and transforms the social structure etc. [19,23–26], when trying to develop theoretical explanations of the causal mechanisms that

generate certain outcomes [21,22]. These hypotheses should be able to provide an account of how both macro and micro processes which constitute a social process or intervention of interest, and contribute to generating the outcome of interest [19].

Over the past few decades, scientific realist evaluations have been promoted and developed, which try to go beyond establishing whether an intervention or process works or not, to also learn what works, how, for who, and under which conditions? [19,23,27].

Semi-structured interviews

A type of interview method, which allows researchers to collect qualitative data from key informants about the nature of a particular phenomenon of interest. The aim of semi-structured interviews is to explore the study participants perspectives, feelings, and experiences, about a particular phenomenon of interest, or how they construct their social realities [29,30]. With this method, the researcher develops a guiding set of questions to be covered in the interview a priori, and during the interview, depending on the study participants responses, the researcher can also prompt the participants for more information, as necessary [29,30]. Hence the use of the term 'semi-structured'.

During the planning phase, inclusion and exclusion criteria for selecting study participants needs to be established. Once selected, and if they agree to participate, the participants should receive an overview of the research project and purpose of the interview, and sign an informed consent form, which also details a number of ethical considerations.

The purpose of the study can help to establish how many interviews should be conducted [30], and a common approach to establish qualitative sample sizes is to keep conducting interviews with new study participants until thematic saturation of the ideas and concepts are reached [15,31]. This means that data should continue to be collected until repeated ideas and concepts are found in the different interviews, and there are no new patterns or themes emerging from the qualitative data being collected [15,31].

During the analysis phase, the data collected (e.g. audio recordings, transcripts, and interview notes) should be reviewed, and descriptive codes and categories applied to look for relevant emerging patterns and themes to present [29,30].

Data triangulation

Data triangulation or 'evidential pluralism' [32], involves collecting, integrating and synthesising evidence from various independent sources, to establish in-depth understanding and explanations of a particular phenomenon [19,32]. One of the underlying assumptions is that no single method can accurately capture the full complexity of the phenomenon, and so the use of multiple data sources can benefit from the strengths of each of the different methods used to generate the data, while overcoming their individual study limitations [10,11]. Also, if different interpretations of a phenomenon, from different data sources, provide similar results, then the researcher can be reasonably confident about the accuracy of their research findings, the truth of the hypothesis being tested with the data, and/or the strengthen of causal inference under investigation [19,29,32].

Literature reviews

A generic term used to refer to the gathering and analysis of various literature sources. The method seeks to identify what knowledge is already known on a particular topic, to avoid duplication of efforts, or important omissions of evidence, and makes an analysis of the value and contributions of the findings in the existing literature [6]. Depending on the type of the review, the degree of comprehensiveness can vary, and so the conclusions may be open to certain biases, such as selection and omission bias [6].

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3. RESULTS

The main five articles that form part of this thesis dissertation are as follows:

- Inequalities in global health inequalities research: A 50-year bibliometric analysis (1966-2015). (2018) PLoS ONE 13(1): e0191901.

- A novel conceptual model and heuristic tool to strengthen understanding and capacities for health inequalities research. *Health Res Policy Sys.* 18**;** 42 (2020).

- What key conditions and mechanisms generate health inequalities research in different contexts? Study protocol for two realist explanatory case studies. (Under review).

- Why and how the UK is a high producer of health inequalities research? Realist explanatory case study to test six causal mechanisms (In preparation).

- Why and How the city of Barcelona has become a health inequalities research hub? A realist explanatory case study to test six causal mechanisms (In preparation).

ARTICLE 1

Inequalities in global health inequalities research: A 50-year bibliometric analysis (1966-2015).

Cash-Gibson L, Rojas-Gualdrón DF, Pericàs JM, Benach J (2018) Inequalities in global health inequalities research: A 50-year bibliometric analysis (1966-2015). PLoS ONE 13(1): e0191901.

Inequalities in Global Health Inequalities Research: A 50-year Bibliometric Analysis (1966-2015).

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Abstract

Background: Increasing evidence shows that health inequalities exist between and within countries, and emphasis has been placed on strengthening the production and use of the global health inequalities research, so as to improve capacities to act. Yet, a comprehensive overview of this evidence base is still needed, to determine what is known about the global and historical scientific production on health inequalities to date, how is it distributed in terms of country income groups and world regions, how has it changed over time, and what international collaboration dynamics exist.

Methods: A comprehensive bibliometric analysis of the global scientific production on health inequalities, from 1966 to 2015, was conducted using Scopus database. The historical and global evolution of the study of health inequalities was considered, and through joinpoint regression analysis and visualisation network maps, the preceding questions were examined.

Findings: 159 countries (via authorship affiliation) contributed to this scientific production, three times as many countries than previously found. Scientific output on health inequalities has exponentially grown over the last five decades, with several marked shift points, and a visible country-income group affiliation gradient in the initiation and consistent publication frequency. Higher income countries, especially Anglo-Saxon and European countries, disproportionately dominate first and co-authorship, and are at the core of the global collaborative research networks, with the Global South on the periphery. However, several country anomalies exist that suggest that the causes of these

research inequalities, and potential underlying dependencies, run deeper than simply differences in country income and language.

Conclusions: Whilst the global evidence base has expanded, Global North-South research gaps exist, persist and, in some cases, are widening. Greater understanding of the structural determinants of these research inequalities and national research capacities is needed, to further strengthen the evidence base, and support the long term agenda for global health equity.

Introduction

Globally, there is ever growing interest in health inequalities, and with this there has been an increasing volume of research, which identifies that avoidable systematic differences in the health status of a society exist between and within societies, at all levels (i.e. countries, regions, neighbourhoods) [1–3]. This research has been produced in the context of different global and historical trends in the theoretical and methodological approaches used for the aetiology of health inequalities and their social mechanisms [4,5].

Language and linguistics matters [6], and consequently, the terminology used in this research field has differed over time, as well as between countries and regions. However, most terms share a common element of descriptively identifying a systematic difference in health status between social groups that are unnecessary and avoidable, whilst some go beyond this by emphasising the unfair and unjust nature of these differences [7–9].

Whilst public health research on this topic can be traced back to 19th century [10,11], global interest in health inequalities has consistently grown in the last three decades, and particularly since the establishment of the World Health Organization (WHO)'s Commission on Social Determinants of Health (CSDH) in 2005. The CSDH started to gather global evidence to inform effective action and address 'avoidable' health inequalities [2]. While there was collective agreement at the time, that the CSDH approach - which focused on the Social Determinants of Health (SDH) perspective [12] - provided a necessary alternative to the biomedical and individual determinants of health inequalities paradigms, many scholars in the Global South [13,14] and Global North [9,15,16], have further criticised the conceptual and epistemological reductionist approach taken by the CSDH, and in the subsequent mainstream health inequalities literature, that has predominately concentrated on the North's experience of these inequalities [10,17,18].

Many social scientists have discussed the historical and persistent undervaluing of scientific knowledge generated in the Global South, which is thought to include Eurocentric, Anglo-Saxon and Neo-colonialist tendencies, in the production and evaluation of research, as well as in authorship [5,6,17,19–22]. Thus, in the case of health inequalities research, if a dominant focus is on the Global North's experience and understanding of these inequalities, this may then feed an assumption that the Global North's scientific approaches may be methodologically more developed in their attempts to answer the question of *how to achieve population health equity?* [6];[23] and to define and guide global action [22], and indirectly reduce the Global

South to a peripheral player and data-gathering source, rather than an active, research peer [19,20,24,25].

The CSDH 2008 final report '*Closing a gap in a generation'* [2] set an aspirational goal of a narrowing the health gaps that exist at all levels of society, and included three main overarching recommendations for action; one in particular was focused on the need to understand and measure the problem and impact of action [2]; [26], based on the dominant assumption that evidence provides the basis for action [16];[27]. Within this overarching recommendation, included the need for dedicated efforts to strengthen and share the global evidence base on health inequalities, expand the scope of public health research, and to develop dedicated trained workforce and information systems, as well as to raise public awareness - all to improve the capacity to act and address health inequalities.

At the same time, in the global health and development agenda over the past three decades, there has been a strong emphasis on capacity building and strengthening national health research systems, with a need for more country-specific research, particularly from the Global South, which has seen a rise in international research partnerships - all to support a more equitable, global presence in the production and utilization of research for action [2,28–32].

Research capacity, refers to the potential to effectively use resources in order to produce research, and the analysis of health research capacity has become a specific object of study in itself, to determine *what kind of capacity* exists, *where,* by whom, and what *needs to be strengthened* [30,33–35] and this has begun to be examined for health inequalities research, specifically [17,36–42]. Scientific output is

considered a crude indication of research capacity, as it is a comparable source that can indicate the amount of research that has been undertaken, where, and by whom. Bibliometric analysis is a useful quantitative tool that can measure and evaluate trends of scientific output, and as such is increasingly used to support evidence informed decision-making processes [43]. Despite its wide application to the health research field, so far this tool has been limitedly applied to the health inequalities research field [44–46]. Nevertheless, these previous analyses show the current lack of global bibliometric knowledge on health inequalities research, and even suggest that systematic differences (potential inequalities) exist in the scientific production on health inequalities. For example, Almeida-Filho et al.[45] found that 75% of the total Latin American and Caribbean (LAC)'s regional scientific production on this topic during 1971 to 2000, was concentrated mainly in four countries, and considered there to be only three country 'epicenters' for this type of research in the region; regional results are discussed collectively in the article, but only a few countries were discussed in detail, and there has been no updated regional analysis since. In addition, Bouchard et al. [46] found 56 countries had contributed to this research field during 1966 to 2014, 10 of which contributed to 94% of this production; however, the results only mention a handful of the top contributing countries, all of which were examples from the Global North.

As such, these results enabled us to pose some important research questions, such as what is known about the global and historical scientific production on health inequalities to date? How is it distributed, in terms of country income groups? What has emerged

from different countries and regions, especially those not previously studied? How has this changed over time? What type of research networks and dynamics exist within this global scientific output – to establish which countries are the most influential concerning their contributions to the international journals in this field? And, do inequalities in fact exist in this research field, globally?

The aim of this study is thus fourfold: i) to analyse the volume of global scientific production on health inequalities for over a half of a century (1966-2015); ii) to analyse the distribution of this scientific production by country income groups and world regions, iii) to analyse the international collaborations (e.g. co-authorship relations) within this production, and iv) to establish whether inequalities do exist within global health inequalities research.

Methods

Data source

A bibliometric analysis of scientific publications on health inequalities was conducted over a 50-year period (1966-2015). To accommodate the expected lag in the indexing of publications into the bibliometric databases, publications from 2016 were not included in the analysis. Health inequalities research is known to be transdisciplinary, with health inequalities having been analysed from most scientific fields; for this purpose, Scopus database was selected as the best choice since it allows for bibliometric analysis (similarly to Web of Science, but unlike PubMed), and it offers more journal coverage than Web of Science [47].

Search strategy

To ensure high sensitivity of the results, our theoretical and methodological approaches considered the historical and global evolution of what is now identified and understood to be research on health inequalities [5];[48], and the following comprehensive search strategy was defined to:

> [Title, Abstract or Keyword]: (health inequ*) OR (health equal*) OR (health equity) OR (health disparit*) OR (health/ disparit*) OR (health/ inequ*) OR (disparit*/ health) OR (ineq*/ health) OR (equit*/ health) OR (equal* /health) OR (inequ*/ mortality") OR (disparit*/ mortality) OR (social /gradient / health) OR (poverty/ health) AND (1 January 1966 - 31 December 2015) AND Doctype (Article/ Review/ Editorial).

The 'fixed-term' search terms *(health inequ*), (health equity)*, (*health disparit*)* and (*health / disparit*)* were used to retrieve publications referring to (and including the terms) health (and/or status) inequalities for example, and that accounted for the different terminology used in the literature. The semi-free-text search terms (*poverty / health*) and (*social / gradient / health*) were chosen to retrieve historical publications that analyse relationships between poverty and health outcomes, and those that identify and describe the different gradients in health or health inequalities according to social (socioeconomic) stratification; followed by (*inequ* or disparit* / health*) to retrieve publications that try to understand the potential causes and/or mechanisms (acting through the multiple axes of social position) that generate health inequalities e.g. social inequalities of

health or disparities in healthcare access [5];[48]. Additionally, the semi-free-text search terms (*inequ* or disparit* / mortality*) was chosen to retrieve publications that examine different eco-social or socio-demographic inequalities in mortality outcomes.

In order to capture both the CSDH and Latin-American perspectives, the terms SDH and Social Determination of Health [49] were also considered and other related search terms tested, however through random sampling, we established that the relevant publications could be captured through the use of the other search terms; therefore, no additional search terms were included.

The semi-fixed text search term (*health variation*)* was also considered to potentially retrieve publications from the United Kingdom (UK) specifically, since under the conservative governments of Margaret Thatcher and John Mayor in the 1980s and early 1990s, the neutral expression "health variations" was deliberately promoted in place of "inequalities" in health [50]. However, after applying this search term and screening all retrieved results from the entire period, the majority of the publications were found to be false positives (i.e. publications retrieved through the search, by the search term(s), but that were not actually relevant to the topic of interest), and the search term was thus excluded from the final search strategy.

Due to the sheer volume of publications retrieved was impractical to hand-search them all, to validate the approach two authors hand-searched all publications from 1966-1990 as well as a random sample from 1990-2015, testing individual search terms and combined search terms, and any uncertainties were discussed between two authors.

Selection criteria

Inclusion criteria were all publications during the period from 1 January 1966 (when the first bibliometric database was created) to 31 December 2015 (1966-2015); with the search terms mentioned in the Title, and/or Abstract and/or Keywords; document type was restricted to original articles, reviews and editorials; geographical or language restrictions were not applied. Publications from unrecognized or former countries, or with any incomplete author affiliation indexed information, were omitted from the distribution related analysis.

Data processing

Data on authors country of affiliation and year of publication was exported from Scopus database (March 2017). As country income group can be an indication of the potential size of its national budget for research, author's country of affiliation were classified by income group (HIC: High income countries, UMIC: Upper middle income countries, LMIC: Lower middle income countries, LIC: Low income countries) according to World Bank classification [51]. Publications were classified into country income group, according to the affiliation reported by each author. Multiple affiliations were considered, so publications can be assigned into more than one income level. For each country income group, analyses were only performed on periods where at least one publication per year was reported.

Furthermore, author's country of affiliation were also classified by world regions (seven regions), according to World Bank classification [51]. Data on Gross Domestic Product (GDP) per capita, 2015 or latest year, (current USD- Dollars, World Bank database updates as of 1/02/2017), and population size (2015) was obtained from the World

Bank as primary source [51] or the World Fact Book as a second choice [52].

We analysed both the related country income group and geographical distribution of scientific production, which quantifies the volume of scientific production on health inequalities that each country has contributed to, according to the authors' country of affiliation at the time of publication (i.e. country is the unit of analysis).

It should be noted that this does not necessarily represent the original nationality of the author, however it is the best proxy indication available for country contribution, and if a foreign author signs their affiliated to a certain institution in a certain country, then the implied assumption for the analyses was that they may be considered as a "member" of the scientific community of that country.

Publications where co–authorship was international, were counted more than once, therefore the sum of the number of publications per country (income group and world region) does not directly correspond to the overall volume of production retrieved, but reflects the participation and contribution of each country to global health inequalities research.

National scientific production refers to the ability of a country to perform certain research outputs, which measured alone, may indirectly represent a number of potential factors, such as level of investment in research, population size or the presence of institutional support. Whereas national scientific productivity, refers to the ability to achieve research outputs, whilst also considering the available resources (e.g. research co-authored per human, financial or technical unit), of lack thereof; thus we also calculated proxies of national

scientific productivity by country population size and GDP per capita [53]. For example, calculating Brazil's health inequalities scientific productivity per GDP per capita = volume of historical health inequalities scientific production (n=737)/ Income of country (i.e. 8757.21 USD GDP per capita, 2015) = 0.08 co-authored publications by GDP per capita. For example, Calculating Brazil's health inequalities scientific productivity by total population = volume of historical health inequalities scientific production (n=737)/ total population (n=205.96 million) =3.6 co-authored articles per million population.

Data analysis

Volume of scientific production

Our study analysed the annual volume of global scientific production on health inequalities (1966-2015); joinpoint regression analysis was undertaken to examine the time trends in health inequalities scientific production over the last half a century, by country income group.

The number of publications was set as the dependent variable; the year was set as the independent variable. Constant variance for error terms was assumed. We considered independent models with 0 to 3 joinpoints, and used permutation tests to identify the best fitting number of statistical different periods to describe time trends for each income level group. Additionally, Average Percent Change (APC) and its statistical significance was estimated to summarize and compare the magnitude of intra-period changes by country income groups; a p-value ≤ 0.05 was considered statistically significant. As initiation and consistency in publication frequency differed by income group,

joinpoint analyses were performed starting in the year from which at least one publication per year was reported. Analysis were performed in JoinPoint Regression Program [54].

Distribution of scientific production

We analysed both the income related and geographical distribution of scientific production, which quantifies the volume of scientific production on health inequalities that each country has contributed to. The percentages of publications that include at least one author from the different country income groups and each world region were also calculated, to show the publication distribution between different country income levels and world regions. We presented only the first 20 country contributors per income group. Additionally, for each of these categories the percentage of publications, with first authors' country affiliation only to countries within the same income group, and the same world region, were calculated and compared; this process was independently performed for first author and for all authors within each publication. All-authors estimates include the first author. Furthermore, we calculated proxies of national scientific productivity, by country population size and GDP per capita.

International collaborations and co-authors network relations

Our study analysed the strength of international collaborations within health inequalities research, through the analysis of co-author networks [55]. We used VosViewer software 1.6.5 [56] to create two types of bibliometric network visualization maps, which depict the publications co-authored by each country of affiliation relating to i)

the cluster´s link strength network within this global research activity (Map 1) and ii) the individual countries link strength network (i.e. inter-country co-author relation) within these clusters (Map 2).

The cluster´s link strength network map (Map 1), highlights the separation between main clusters by density measures. In the individual countries link strength network map (Map 2), location and colour are identical, but proximity must be evaluated by visual inspection. As distance metric is not intuitive, the inclusion of density measures tries to support this process.

Within both network maps, the different colours represent different clusters memberships within these two network levels, based on link strength. Centrality in the maps is relevant, as it represents core countries. Relative proximity is also relevant, for example, the smaller the distance between the i) clusters or ii) individual countries, the stronger relation.

In addition, for the countries link strength network map (Map 2), each country affiliation is represented by a circle, the size of a circles indicates the total links (co-author activity) of the country, and the lines between countries represent bi-national co-authorship links, and the thickness of the line represent the strength of the co-authorship inter-country relation.

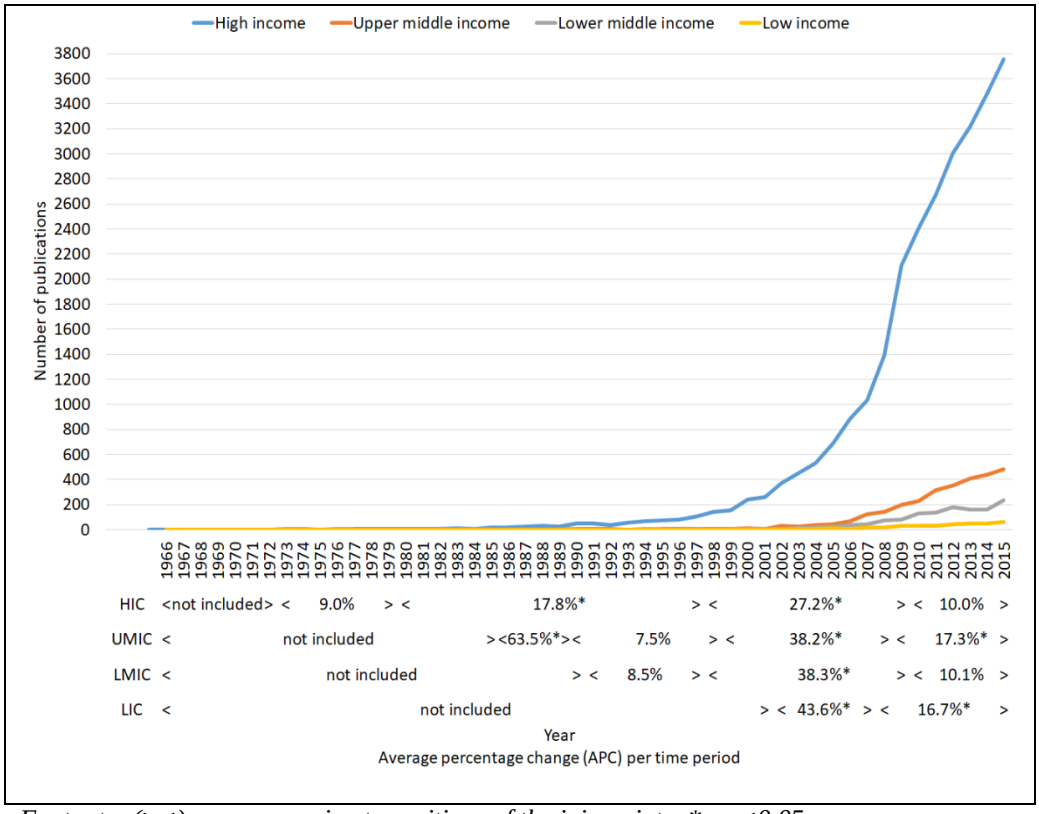
Results

We initially retrieved 33,954 scientific publications on health inequalities (1966-2015), of these, 4,575 publications were then excluded as co-authors country affiliations were undefined. A final total of 29,379 scientific publications were then used in the data analysis, the majority of which were original articles, followed by reviews, and editorials.

Volume of scientific production

According to our results, the volume of scientific production on health inequalities has exponentially grown over the last five decades (Fig 1). The first publication dates back to 1966, however it was not until the early 1970's (1973-1979) that publications begin to appear annually (e.g. with at least one publication per year reported), visible by the appearance of the first joinpoint period of analysis, but specifically by HIC affiliations only. It was not until the early 2000's, that publications began to appear annually by LIC affiliations. We found a visible country-income group affiliation gradient in the initiation and consistent publication frequency on health inequalities. There are also important similarities in the position of the last two joinpoints (e.g. around the same years) for all income groups, between 1997 and 2002, and between 2007 and 2010, statistical significant changes in time trend were observed for all income groups, with a consistent increase in publication frequency (Fig 1).

Fig 1: Global Health Inequalities Research Time Trends, by Income Group of Authors' Country of Affiliation (1966 -2015).



*Footnote: (><) = as approximate positions of the join points; *= p<0.05*

For HIC author affiliations specifically for example, consistent co-authorship in health inequalities research started in 1973, and showed four periods (three joinpoints) with different time trends: period one (1973-1979) with non-significant average change in co-authored publications, periods two (1980-1997) and period three (1998-2009) when co-authored publications annual average growth were 17.8% and 27.2%, and, period four (2010-2015) with non-significant APC.

Distribution of scientific production

We found that 159 countries contributed to the global scientific production on health inequalities during this 50-year period. The top 20 countries that have contributed the most to global health inequalities research field were established, as well as each country proportional contribution to the total research output, and scientific productivity, considering both GDP per capita, and population size. Of these 20 countries, 16 were HIC from North America, Europe and Central Asia, and East Asia and the Pacific Regions, two UMIC from LAC, Sub-Saharan Africa, and East Asia and the Pacific Regions, and one LMIC from South Asia. We also established the top 20 countries contributors per country income group, as well as their proportional contribution, and scientific productivity by population size and GDP per capita (Table 1-4).

Table 1: Top 20 High Income Country Contributors to Global Health Inequalities Research (1966-2015), ranked by co-authorship affiliation.

HIC rank	Global rank	Country of co-authorship affiliation	Volume of scientific production (n)	Proportional Co-authorship contribution to global scientific production (%)	Scientific productivity per GDP per capita	Scientific productivity per million population
1	1	United States	16495	48.58	0.29	51.4
2	2	United Kingdom	4257	12.54	0.10	65.4
3	3	Canada	2116	6.23	0.05	59.0
4	4	Australia	1650	4.86	0.03	69.4
5	5	Netherlands	741	2.18	0.02	43.8
6	7	Germany	713	2.10	0.02	8.7
7	8	Sweden	673	1.98	0.01	68.7
8	9	France	663	1.95	0.02	10.0
9	10	Spain	623	1.83	0.02	13.4
10	11	New Zealand	518	1.53	0.01	112.7
11	12	Switzerland	453	1.33	0.01	54.7
12	13	Italy	418	1.23	0.01	6.9
13	15	Norway	381	1.12	0.01	73.5
14	18	Belgium	334	0.98	0.01	29.6
15	19	Finland	311	0.92	0.01	56.8
16	20	Denmark	292	0.86	0.01	51.4
17	21	Japan	253	0.75	0.01	2.0
18	22	South Korea	244	0.72	0.01	4.8
19	24	Israel	183	0.54	0.01	21.8
20	25	Ireland	166	0.49	0.0	35.5

Table 2: Top 20 Upper-Middle Income Country Contributors to Global Health Inequalities Research (1966-2015), ranked by co-authorship affiliation.

UMIC rank	Global rank	Country of co-authorship affiliation	Volume of scientific production (n)	Proportional co-authorship contribution to global scientific production (%)	Scientific productivity per GDP per capita	Scientific productivity per million population
1	6	Brazil	737	2.17	0.08	3.6
2	16	South Africa	362	1.07	0.06	6.6
3	17	China (ex. HK)	347	1.02	0.04	0.3
4	23	Mexico	221	0.65	0.02	1.8
5	28	Iran	129	0.38	0.03	1.6
6	31	Thailand	104	0.31	0.00	1.5
7	35	Argentina	91	0.27	0.01	2.1
8	45	Turkey	68	0.20	0.01	0.9
9	49	Peru	57	0.17	0.01	1.8
10	50	Malaysia	54	0.16	0.01	1.8
11	54	Slovenia	44	0.13	0.00	21.3
12	57	Estonia	40	0.12	0.00	30.4
13	60	Romania	37	0.11	0.00	2.0
14	62	Lebanon	35	0.10	0.00	6.0
15	68	Cuba	27	0.08	0.00	2.4
16	70	Serbia	23	0.07	0.01	3.2
17	71	United Arab Emirates	22	0.05	0.00	2.4
18	78	Bulgaria	18	0.05	0.00	2.5
18	78	Costa Rica	18	0.05	0.00	3.7
20	81	Georgia	15	0.04	0.00	4.1

Table 3: Top 20 Lower-Middle Income Country Contributors to Global Health Inequalities Research (1966-2015), ranked by co-authorship affiliation.

LMIC rank	Global rank	Country of co-authorship affiliation	Volume of scientific production (n)	Proportional Co-authorship contribution to global scientific production (%)	Scientific productivity per GDP per capita	Scientific productivity per million population
1	14	India	404	1.19	0.25	0.3
2	27	Colombia	139	0.41	0.02	2.9
3	30	Kenya	111	0.33	0.08	2.3
4	38	Nigeria	85	0.25	0.03	0.5
5	44	Pakistan	69	0.20	0.05	0.4
6	47	Ghana	65	0.19	0.05	2.4
7	48	Bangladesh	64	0.19	0.05	0.4
8	51	Vietnam	50	0.15	0.02	0.5
9	56	Egypt	40	0.12	0.01	0.4
10	58	Philippines	39	0.11	0.01	0.4
11	64	Indonesia	34	0.10	0.01	0.1
12	72	Zambia	22	0.06	0.02	1.4
13	74	Congo (Dem. Rep)	21	0.06	0.04	0.3
14	76	Sri Lanka	19	0.06	0.00	0.9
15	81	Guatemala	15	0.04	0.00	0.9
16	84	Tunisia	14	0.05	0.00	1.5
16	84	Morocco	14	0.04	0.00	0.4
18	88	Sudan	13	0.04	0.01	0.3
19	92	Nicaragua	12	0.04	0.01	2.0
20	96	Senegal	11	0.03	0.01	0.7

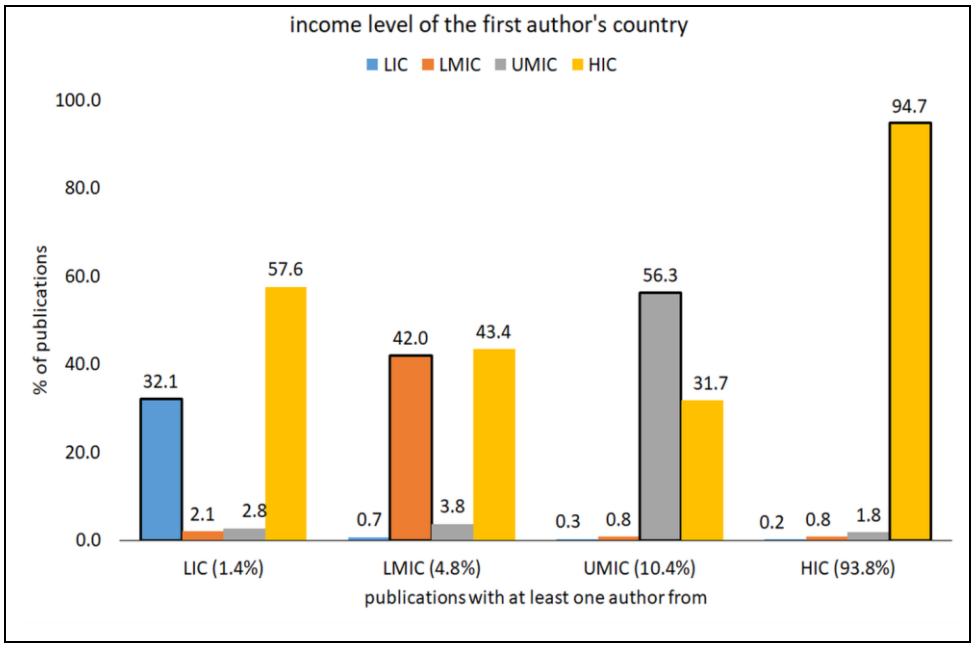
Table 4: Top 20 Low Income Country Contributors to Global Health Inequalities Research (1966-2015), ranked by co-authorship affiliation.

LIC rank	Global rank	Country of co-authorship affiliation	Volume of scientific production (n)	Proportional Co-authorship contribution to global scientific production (%)	Scientific productivity per GDP per capita	Scientific productivity per million population
1	43	Tanzania	70	0.21	0.08	1.3
2	46	Uganda	68	0.20	0.10	1.7
3	61	Malawi	36	0.11	0.10	2.0
4	65	Nepal	33	0.10	0.04	1.2
5	66	Ethiopia	29	0.09	0.04	0.3
6	73	Burkina Faso	21	0.06	0.04	1.2
7	75	Cambodia	20	0.06	0.02	1.3
8	80	Laos	16	0.05	0.01	2.4
9	81	Rwanda	15	0.04	0.02	1.3
10	84	Mozambique	14	0.04	0.03	0.5
11	88	Zimbabwe	13	0.04	0.01	0.8
12	101	Gambia	8	0.02	0.02	4.0
13	107	Haiti	6	0.02	0.01	0.6
14	112	Sierra Leone	5	0.01	0.01	0.7
15	124	Afghanistan	4	0.01	0.01	0.1
15	124	Mali	4	0.01	0.01	0.2
17	133	Benin	2	0.01	0.0	0.2
17	133	Guam	2	0.01	-	12.3
17	133	Guinea	2	0.01	0.0	0.2
17	133	Guinea-Bissau	2	0.01	0.0	1.1

The top HIC contributor in terms of scientific output was the United States, which alone contributed to 48.5% of the global scientific production on health inequalities, with at least one author affiliation in each publication, and the Anglo-Saxon countries, with the United States, UK, Canada and Australia combined having contributed to ~ 70% of this scientific production, with at least one author affiliation from these countries (Table 1). Brazil was the top UMIC contributor, having contributed to 2.2% of the global scientific production, India was the top LMIC contributor having contributed 1.2%, and Tanzania was the highest LIC contributor, having contributed 0.2% (Tables 1-4).

With respect to the proportional distribution of authors and first author country of affiliation, the higher the country income group of author's affiliation, the higher the proportional distribution of authors (visible by the percentages of publications in the horizontal axis bar) (Fig 2).

Fig 2: Global Health Inequalities Research by Income Group of First Authors' and Co-Authors' Country of Affiliation (1966-2015).

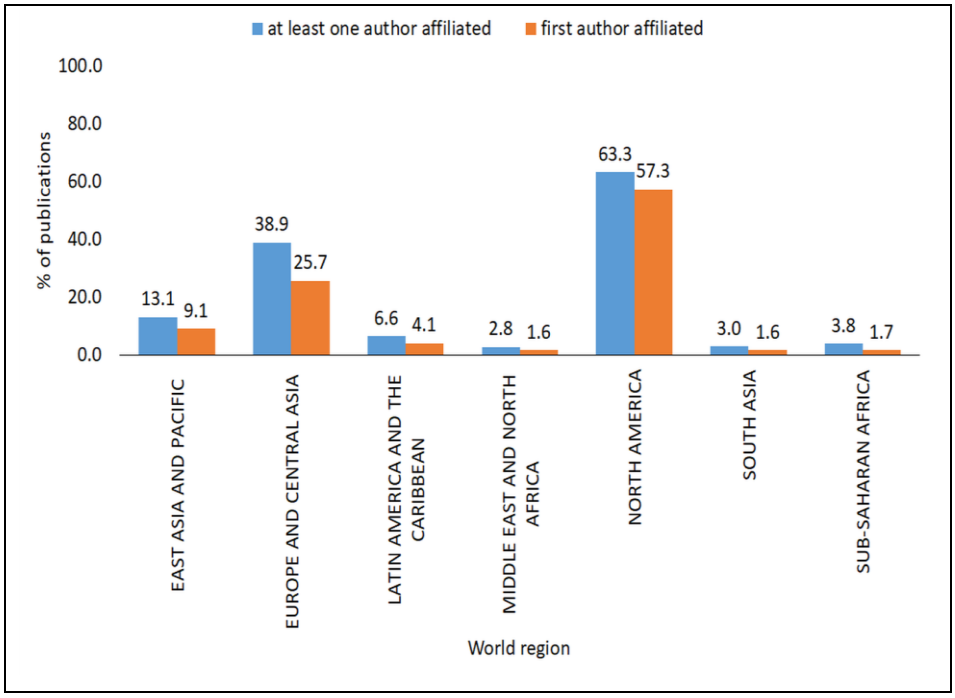


We observe that amongst the publications with co-authors affiliated to HIC and UMIC, the higher the proportional distribution of first author's affiliated to that same income group. However, amongst the publications with LMIC and LIC affiliations, the distribution of first authors was disproportionally higher for HIC affiliations than from LMIC, and even more so compared to LIC visible by the bold-line bars. The proportional distribution of LIC first authorship appears to decrease with increasing income group of affiliation of co-authors (visible by the blue bars in each income group) (Fig 2).

With regards to proportional distribution by world region, the higher proportional distribution of co-authors region of affiliation, the higher

the proportional distribution of first authors region of affiliation, and world regions which included Anglo-Saxon countries (e.g. North America**,** Europe and Central Asia, and East Asia and Pacific regions), had the highest proportional distribution of both co-authors and first authors' country of affiliation, compared to other regions (Fig 3).

Fig 3: Global Health Inequalities Research by World Region of First Authors' and Co-Authors' Country of Affiliation (1966-2015).



North America had the highest proportional distribution of both co-authors and first authors' country of affiliation, followed by Europe and Central Asia, East Asia and the Pacific, then LAC, Sub-Saharan Africa, South Asia and then the Middle East and North Africa (Fig 3).

International Collaborations and co-author networks

The main network clusters (Fig 4a) and individual inter-country relations within and between these network clusters (Fig 4b) were also depicted within the global health inequalities research field (1966-2015).

Fig 4a: Global Co-Authorship Network of Health Inequalities Research (1966-2015): Cluster's Link Strength

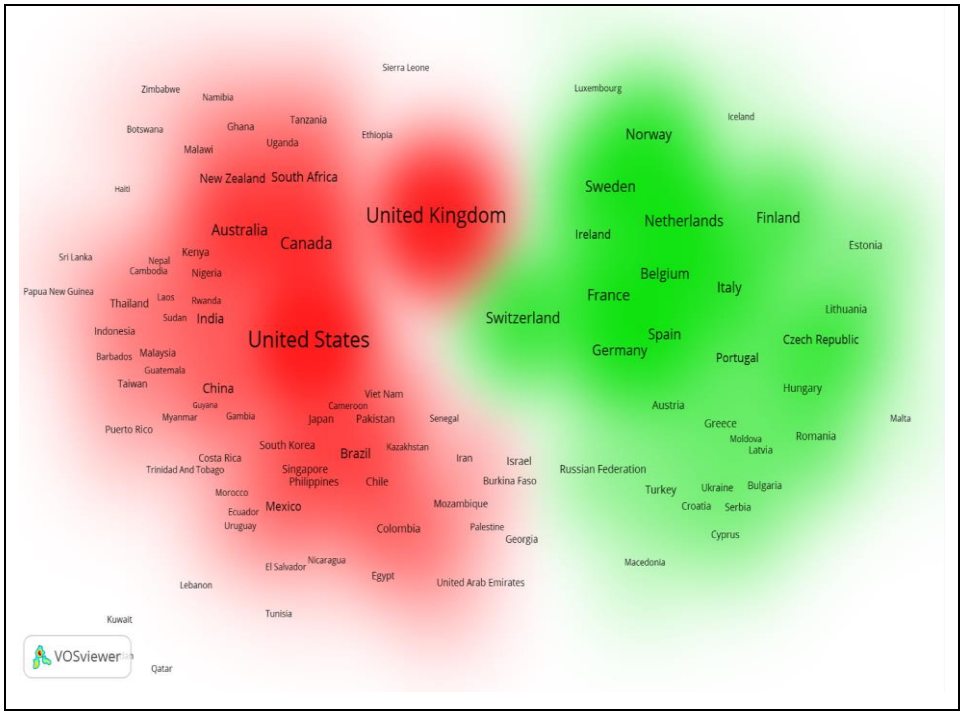
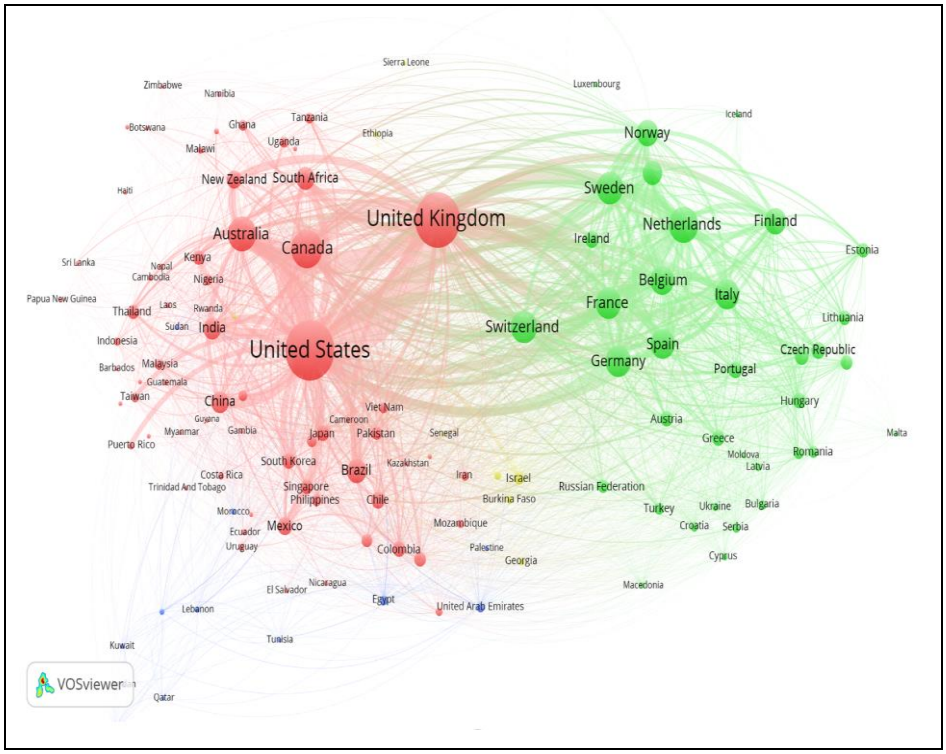


Fig 4b: Global Co-Authorship Network of Health Inequalities Research (1966-2015): Countries' Link Strength



Four clusters were identified based on countries' total link strength; kernel density colour gradient shows a marked difference between country clusters (Fig 4a). Two small clusters with minor participation in global production in health inequalities research formed mainly by Middle East and North African Countries (blue) and by Sub-Saharan Africa countries (yellow), and two main clusters, one led by UK, the United States, Canada and Australia and formed mainly by non-European countries (red), and the other one led by Netherlands and Sweden and formed mainly by European countries (green). The rest of the countries from different world regions (e.g. LAC, South Asia, Sub-Saharan Africa), appears to orbit around these core countries

(with different regions) with stronger links with the United States, followed by the UK, than with Europe and Central Asia (Fig 4a, Fig 4b).

Bi-national links (Fig 4b) show that the UK, at the core of international collaborations, plays a central role at bridging these two main clusters (red and green); however, it is classified as a member of the red cluster because the UK-United States shows the strongest link (503 points) followed by US and Canada (493 points). UK is also strongly linked to Canada (225 points) and Australia (259 points). In relation to European countries (green cluster), the UK strongest links were observed with Netherlands (175 points) and Sweden (148 points). However, their link strength is less than half of the UK-North America link. Besides the UK related links, strong links were also observed between United States and Switzerland (141 points), Germany (131 points) and Netherlands (115 points). Other relevant non-North America-Europe inter world-region links were identified for Australia (-United States 223 points, -UK 259 points, -Canada 149 points), Brazil (-United States 139 points, - UK 67 points), Mexico (-United States 114 points), China (-United States 140 points), India (-United States 99 points, -UK 88 points), and South Africa (-United States 102 points, -UK 91 points).

Moreover, by cross checking study results (Fig 4b with Tables 1-4), it is potentially possible to establish whether a country has more domestics vs. international collaborations within the publications that they have contributed to, relative to other countries.

Discussion

Our study comprehensively analysed the historical and global scientific production on health inequalities research (1966-2015), and clearly demonstrates the magnitude of asymmetric trends, inequitable systematic differences, and potential global dependencies that exist and persist within this research field. While there has been an exponential increase in health inequalities scientific output globally during this 50-year period, Global North-South research gaps still exist, and may even be widening with respect to country income group. HIC disproportionally dominate co-authorship and first authorship contributions, with the Global North positioned at the core of the global collaborative research networks, with the rest of the world (i.e. Global South) on the periphery of this activity.

Volume of production

Over the past five decades, the volume of health inequalities scientific output has grown exponentially, more so than the average trends in scientific output in general [57], likely linked to the increased interest and sophistication in the analysis and understanding of health inequalities over time [5;48], and how they are the social consequence of a hegemonic eco-political agenda that only benefits narrow class interests [9]. However, within these trends there is a visible country income level affiliation gradient with respect to the initiation in the production of the first publication and in the consistent frequency in production, where authors' affiliated to HIC started to publish first (during the 1960s), and more frequently (during the 1970s), as well as in the designation of first authorship.

We found several notable shift points in the volume of research production, firstly around the late 1980's-90s there was a significant, consistent increase in publications for HIC and UMICs, coinciding with the government interest and awareness of how social conditions and material deprivation shape health inequities and mortality, firstly in the UK [58–60] the United States [61,62] and Canada [63], later followed by European counties [64], which most likely drove further research interest on this topic in these countries and regions. Alongside this, has been the long research tradition in Social Medicine and Collective Health within Latin America, studying the link between social (and power) inequalities and health, that traditionally has not been as widely known or acknowledged outside of the region [6], and which appeared to enter the international scientific literature around this time.

There was a significant, consistent increase in publications for all income groups in the early 2000s, a likely consequence of the rise in social justice and 'equity in health' disource in the 1990s, that acknowledged the need to assess both economic development of countries and human welfare [65]. This, in combination with the increased sophistication in the analysis of these issues, created new perspectives on health and well-being, which likely fed into the shifts in the global health and development agendas, which we described in the introduction, and that subsequently led to the establishment of CSDH in the early 2000s. A few years later, another significant and consistent increase in publications also occurred, again for all income groups, likely coinciding with CSDH's final report (2008) and its recommendations that emphasised the need for further global research

on this topic, and the additional importance placed on addressing health inequalites [2]. Since that point, there was another significant consistent increase in publications, for authors affiliated to UMIC and LIC income groups specifically. By 2015, there appeared to be a difference of around 25 years between the volume of research production by authors affiliated to LIC, compared with when authors affiliated to HIC reached this same volume of production (i.e. during the 1990s). The visible country income related gradient and time difference in volume of production, may partly be explained by the fact that traditionally, there has been a high publishing and subscription costs for international journals, which may have impeded some lower income countries research publication process, even despite the later open access movement and reduced costs for lower income countries [16,37], amongst other things.

Another possible explanation, linked to the CSDH 2008 report recommendations, is that in general lower income countries have more limitations in their national health information and surveillance systems, which reduces the capacity to collect, monitor and analyse reliable health and social-demographic data, and subsequently hinders the capacity to produce research on the social determinants of health inequalities within a national context.

Distribution of scientific production

We found that 159 countries have contributed to this global scientific production indexed in Scopus, which equates to 86% of the world. When examining the proportional contributions of country (corresponding to author affiliations) to the global research base, the

following Anglo-Saxon countries - The United States, UK, Canada and Australia - combined have contributed to around 70% of this scientific production, with at least one author affiliation from these countries. The European and Central Asian region collectively, has contributed to approximately 33% of this scientific production.

Bouchard et al. [46], previously found notably more health inequalities publications during 1966-2014 (n=49,294) than our study, yet only found 56 countries had contributed to the global scientific production. These important differences are likely due to the differences between the theoretical and methodological approaches used in our studies. For example, Bouchard et al. [46] do not state the theoretical assumptions used to inform their approach, although, based on the search strategy, they appear to have a slight tendency towards "*health care (e.g. Medicare)"* inequalities (p.101), which would have likely led to the retrieval of false positives into the initial search results; whilst healthcare services are linked to health inequalities, the health-care system itself is considered just one of many intermediary determinants which can be influenced by, and influence the effect of, other determinants of health inequalities [4].

However, our theoretical and methodological approach specifically considered the historical and global evolution of, what is now identified and understood to be, research on health inequalities, produced by different countries and over time, to ensure a high specificity in our retrieve process. This likely explains how, even though we retrieved fewer publications (potentially due to our search strategy document type restrictions), even with the inclusion of one

extra year in our analysis, we retrieved publications from 103 more country affiliations than Bouchard et al [46].

Scientific productivity

Distinguishing between the proportional contributions to the global health inequalities research, by income group and world regions, not only helps to better understand the global research landscape, but it can potentially allow for fairer country comparisons to be made amongst countries with similar resources levels and geo-cultural perspectives, and moves one step closer to a deeper understanding of the potential reasons behind the different national levels of scientific production on this topic. This type of disaggregated information may also be useful to consider when conceiving future Global South-South and Global North-South research collaborations and partnerships within this research field. Furthermore, when national health inequalities research output was adjusted by socio-economic and socio-demographic country characteristics (i.e. scientific productivity), we found several countries actually perform particularly well, despite their limited resources; these results are similar to what Bahenhorst et al. [66] found for public health research more broadly. For example, when scientific production on health inequalities was adjusted by country income (GDP per capita), Uganda and Malawi perform equally well as the UK, and when adjusted by population size, Estonia performs better than Germany. We would have liked to have adjusted national scientific output by the proportion of GDP expenditure on Research and Development (R&D), however challenges exist regarding governance and capacity to collect and

report this type of data consistently, across years [67], and for all countries [68]. However, the WHO Global Observatory on Health R&D uses the limited data available to show general trends, and so we considered these findings with respect to our study results [69]. These general trends show that, on average, HIC have 3524 health researchers full-time-equivalent (FTE) per million inhabitants compared to UMIC which have 885, LMIC which have 53, and LIC which have 10 FTE per million inhabitants on average [69]. These trends, as well as our study results, do not of course account for '*brain drain*', the migration of trained professions, mainly from the Global South to Global North, which translates into a considerable loss of resources that were invested into the trained professionals by the home country, that the recipient country then benefits from [70]. Nevertheless, these results do provide an indication of potential human resource availability within countries; the presence of a trained national work force can strongly influence national scientific output and is another important component and/or determinant of national research capacity [33]. These results may partly explain the income related differences in national research output that we found.

At regional and country level, there are some interesting cases, specifically from the Global South, worth highlighting. For example, Brazil was the 5th global contributor of health inequalities research, after the United States, UK, Canada and Australia, and the top LAC regional contributor, followed by Mexico. Brazil is classified as a UMIC, and is well-known for its long research tradition in public health and Social Medicine and Collective Health [71], for its strong political commitment that has contributed to the national mobilization

for social and health equity [45,72], and for its national repository and observatory of health and its social determinants [73,74], which contributes to the on-going systematization of evidence and aims to guide future national research and policy agendas on this topic. All of which, without a doubt, has fostered the countries strong health inequalities research capacity that can be observed here.

Almeida-Filho et al. [45] considered there to be three main regional 'epicenters' for health inequalities research during 1977 to 2000, based in Brazil, Mexico and Chile, with Argentina's and Colombia´s scientific output being more *"scattered and unstable"*. In 2001, Waitzkin et al. [23] stated that the most favourable institutional conditions for social medicine research in Latin American at the time, existed in Mexico, Ecuador, Brazil and Cuba, and that in Argentina, Chile and Colombia, as the socio-political conditions remained more adverse, researchers faced challenges in producing research in this specific field. Fifteen years on, we can still identify the regional "epicenters" that Almeida-Filho et al. [45] describe, as well as the strong intra-regional co-author links, potentially due to geographical and socio-cultural proximity, and linguistic relationships, and the strong national and regional interest in this research topic. However, Colombia's volume of health inequalities scientific output increased specifically in the last decade, and by 2015 overtaking that of Chile's. Also, interestingly, the LAC region, especially its 'epicenters', have stronger co-author relations and links with the United States, followed by the UK, than with Europe, the reasons for which, may again firstly be due to geographical proximity (to the United States), and or

historical and global geopolitical relationships, which we elaborate on in the next section.

Another interesting case is India, positioned as 14th global contributor of health inequalities research, the top LMIC contributor, and the top South Asian regional contributor in this research field. A recent systematic review focusing on health inequalities research production in India over the last 30 years, found that 75% of papers retrieved were led by Indian institutions, and stated that national social and political movements have played an important role in highlighting inequalities, in addition to social medicine developments in public health education, and increased availability in population survey data, which collectively, similarly to the case of Brazil, have likely assist to build strong national capacity for research on health inequalities [75].

International collaborations and co-author network relations

With respect to the international collaborative research networks, there appears to be a clear distinction between those countries at the core of the global health inequalities research collaborations (e.g. United States and the UK, followed by the other Anglo-Saxon countries, the Nordic and Central-Northern European countries), and those on the periphery of this activity (e.g. the Global South). Furthermore, the proportional distribution of both co-authors and first authors' country of affiliation were higher for authors affiliated to worlds regions that specifically include Anglo-Saxon countries.

There was also a visible country income affiliation gradient with respect to the proportional distribution of authors and first authors' country of affiliation, with HIC affiliations disproportionally

dominating co-authorship in general, and first authorship positions specifically, especially amongst the publications with authors affiliated to lower country income groups. This underrepresentation of LIC affiliated co-authorship, and first authorship amongst those papers which do include LIC affiliated co-authors, may partly be a result of, what has been described as, 'neo-colonial science' [20]. However, as mentioned previously, if national research infrastructure and human resources research capacities are limited, then the national capacity to produce research will in turn be limited. It is also important to note that our study only focused on co-authors and first authors, we did not analyse corresponding author affiliation, which provides another indication of research leadership, although we suspect that similar trends and dynamics are likely to exist for corresponding authorship affiliation.

These respective asymmetries in the global scientific output and collaborations appear to mirror the geopolitical hierarchies and the subsequent dependencies and conditionalities that are known to have been created over time; it is surely no coincidence that the countries known for being international funding sources and also the countries at the core of these global research collaborations [76–78] and those known to be more 'dependent' on external research funding are on the periphery. In many lower income countries, the majority of research is externally funded, which may play a role in fostering and influencing the types of domestic vs. international research collaborations that are built, as well as potentially creating donor-driven research agendas that may influence policy agendas, and decisions on national research

priorities, which may not necessarily correspond to local population needs [29,30,38,79].

Study limitations and other possible explanations

Our study is constrained by a number of limitations; firstly, in terms of the study design, we only focused on articles, reviews and editorials that have been published in academic journals indexed in Scopus. Therefore, this study does not presume to fully reflect all of the work produced on this topic, which may have been published in other forms (e.g. books, reports, and national journals). Nor do we claim to present exact numbers in terms of country contributions to the global scientific production, as we have not hand-searched all retrieved publications to confirm their relevance, although we suspect that our results reflect the general trends that exist within the global health inequalities research landscape.

In addition, the primary source of this bibliometric analysis was international academic journals indexed in Scopus, and international journals are known to contain an English language bias, which may skew our results in favours of Anglo-Saxon countries and/or countries were the national research system incentives publishing predominately in these types of journals [36][45]; some non-Anglo-Saxon countries have national research systems that incentive and prioritise national publishing of research findings, in the native language and in different forms, to facilitate national dialogue and local strategic decision-making [17][72]. This may reduce the international visibility of the research, and mask the actual volume of

research being conducted in these countries, regardless of bibliometric databases increasing their breadth of journal coverage.

There has also been some speculation by scholars, as to whether 'editorial racism' exists in the evaluation and selection of manuscripts for publications in international journals with prejudice against authors from the Global South [21], and Harris et al. [80] show (and measure) the bias by health professionals and researchers, against research produced by LIC in comparison to HIC. Nevertheless, such peer prejudice could be potentially offset by increased investment in research in the Global South, that includes an additional emphasis on solid methodology, research infrastructure, and high quality presentation, in terms of both writing and (English) language skills [21]. Thus, while our results are based only on publications in international academic journals, these findings are important to consider, given the weight placed in academia on publishing in international academic journals, and how it is often used to inform decisions regarding international development, policy and research agendas. Furthermore, our results likely allude to the global dynamic within this research field itself.

Lastly, quantitative bibliometric results say nothing about the type of health inequalities research that has been conducted in countries, globally; further research is needed to contextualise our results and provide in-depth insights into the type of theoretical and methodological approaches being used and where, and the national research priorities, as well as enrich current understanding of the historical and structural determinants of theses global bibliometric

trends and inequitable gaps in health inequalities scientific output, and collaborative co-author network dynamics.

Conclusions

Bibliometric analysis is an extremely useful tool despite its focus on international peer review journals, therefore together with our theoretical and methodological approaches taken to identify relevant global publications, and the data analysis used, we have a strong base on which to state that our study presents a comprehensive systematisation of global health inequalities research (1966-2015), as well as the magnitude of the inequitable bibliometric trends and asymmetries that exist, and persist, in this research field, globally.

Whilst there has been an exponential increase in health inequalities research output during this 50-year period, and three times as many countries have contributed to this global evidence base than previously found, Global North-South research gaps still exist, and in some cases are ever widening. Higher income countries, especially Anglo-Saxon and European countries, disproportionately dominate first and co-authorship, and are at the core of the global collaborative research networks, with the rest of the world (i.e. the Global South) on the periphery of this activity. However, several interesting country anomalies exist, that suggest that the causes of these inequalities and potential underlying dependencies within this research field, run deeper than simply differences in country income and language.

Greater understanding of the structural determinants of these research inequalities and national research capacities is needed, so as to strengthen the evidence base on health inequalities, making it more

inclusive and globally representative, which can foster more shared learning, and provide more effective support towards the long term agenda for global health equity.

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ARTICLE 2

A novel conceptual model and heuristic tool to strengthen understanding and capacities for health inequalities research

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A novel conceptual model and heuristic tool to strengthen understanding and capacities for health inequalities research.

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Abstract

Background: Despite increasing evidence on health inequalities over the past decades, further efforts to strengthen capacities to produce research on this topic are still urgently needed to inform effective interventions aiming to address these inequalities. To strengthen these research capacities, an initial comprehensive understanding of the health inequalities research production process is vital. However, most existing research and models are focused on understanding the relationship between health inequalities research and policy, with less focus on the health inequalities research production process itself. Existing conceptual frameworks provide valuable, yet limited, advancements on this topic; for example, they lack the capacity to comprehensively explain the health (and more specifically the health inequalities) research production process at the local level, including the potential pathways, components and determinants as well as the dynamics that might be involved. This therefore reduces their ability to be empirically tested and to provide practical guidance on how to strengthen the health inequalities research process and research capacities in different settings. Several scholars have also highlighted the need for further understanding and guidance in this area to inform effective action.

Methods: Through a critical review, we developed a novel conceptual model that integrates the social determinants of health and political economy perspectives to provide a comprehensive understanding of how health inequalities research and the related research capacities are likely to be produced (or inhibited) at local level.

Results: Our model represents a global hypothesis on the fundamental processes involved, and can serve as a heuristic tool to guide local level assessments of the determinants, dynamics and relations that might be relevant to better understand the health inequalities research production process and the related research capacities.

Conclusions: This type of knowledge can assist researchers and decision-makers to identify any information gaps or barriers to be addressed, and establish new entry points to effectively strengthen these research capacities. This can lead to the production of a stronger evidence base, both locally and globally, which can be used to inform strategic efforts aimed at achieving health equity.

Introduction

The social, economic and political contexts in which we live generate and maintain the social hierarchies of power and access to resources that are embedded in institutional settings and policies that create socioeconomic positions [1]; these upstream social mechanisms, or the so-called 'structural determinants' operate through intermediary (e.g. social, occupational) determinants that shape the distribution of risk factor exposures and social vulnerabilities in a population [1]. These processes, which are generated and maintained by "*unjust social arrangements*" [2], then become embodied by individuals, and can lead to avoidable and unfair systematic differences in health, within and between communities and countries (i.e. health inequalities (HI)) [1, 3, 4]. In this article, we use the term 'health inequalities' to

refer to all of the following terms: HI, health disparities, health inequities and social inequalities in health.

Over the past several decades, HI have increased, along with a global awareness and evidence about this complex phenomena [5], provoking the formulation of recurring questions concerning their potential explanations – questions that all countries should answer to be able to develop effective solutions to tackle HI [6]. For example, why are there considerable inequalities in the opportunities to be healthy, between and across societies? What are the causes and conditions that lead to HI? Where and how can we intervene to improve health and well-being for all?

A prerequisite for answering these questions is investment in local capacities for HI research to be able to produce a strong evidence base to potentially inform effective policies and interventions aiming to address HI. Although the claiming of this need goes back in time, a particular emphasis was placed in the 1990 report by the Independent Commission on Health Research for Development [7], which showed major gaps in global health research and in the monitoring and evaluation of public health needs, particularly in low- and middle-income countries, and advocated for the examination of the health scientific production process itself to expand country-specific health research and its usage to improve health and health equity.

The HI research production and usage processes are important to support effective action to address HI, yet most of the current research and models focus on understanding the interplay or relationship between HI research and HI policy and action [8, 9], with less emphasis being placed on understanding how HI research itself is

produced. Nevertheless, research on HI research has been growing in interest over the past few of decades, particularly in trying to establish the necessary capacities to produce HI research at the local level in different global settings [10,11,12,13,14,15,16]. This interest was encouraged by the final report of the WHO's Commission on Social Determinants of Health (SDH), entitled 'Closing a Gap in a Generation' [17], which presented a number of recommendations to achieve health equity, including strengthening the global and local SDH and HI evidence base and research capacities.

Scientific production is considered to be a good proxy indicator of research capacity; within the HI research field itself, substantial inequalities have been found to exist between countries and world regions, in terms of the volume of production and collaborative dynamics [5]. These findings raise further questions that need to be answered; for example, why do some countries (and potentially also certain regions and institutions within countries) produce more HI research than others, particularly when HI exist everywhere? Why do some countries, despite similar level of financial resources, seem to be more 'productive' in this research field than others? What determines the capacity to produce HI research at the local level, in different settings? What mechanisms are involved in this process? How can local HI research capacities be strengthened? To attempt to answer these questions, the HI research production process itself needs to be better understood.

The health research systems (HRS) and policy field has been driving the thinking on how health research is produced, which is a useful starting point to try to analyse how HI research is produced. Several

definitions and conceptual frameworks on national HRS and how to strengthen health research capacities have been proposed. Deciding which explanatory frameworks to use can have important implications for how one envisions the practical possibilities to proceed [18].

For example, the work by Pang et al. (on behalf of WHO) [19] was an important step forward in trying to simplify the complex systems and processes through which health research is produced to improve population health and health equity, and to establish the attributes, functions and goals of HRS, to guide the development of further operational work. Pang et al. define an HRS as "[t]*he people, institutions, and activities whose primary purpose in relation to research is to generate high-quality knowledge that can be used to promote, restore, and/or maintain the health status of populations"* ([19]. p. 816).

However, the related conceptual framework [19] presents an oversimplification of HRS, and lacks the capacity to comprehensively explain the health (and HI) research production process at the local level, thereby providing limited resources to be able to comprehensively assess these research capacities at the local level. Specifically, it fails to sufficiently account for the essential components, pathways, determinants and dynamics that are likely to be involved in creating and producing this type of research, nor does this conceptual framework consider the vital role of context and its different levels (i.e. historical, socio-cultural and eco-political choices, decisions and actions, as well as institutions within countries and regions that have shaped how HRS have emerged and developed) [1, 20].

Since Pang et al.'s [19] initial work, "*understanding local context*" has been recognised as a key component of research capacity assessments and strengthening initiatives [21]. Furthermore, a study in Guinea Bissau [22] assessed how the national HRS has developed and evolved over time, and highlights a number of important, yet often overlooked, factors that assist to provide context to the current capacity of the national HRS. For example, the authors highlight the role of history, politics and power struggles, as well as war and conflict, international development and epidemics, amongst others. Such contextual factors are likely to be highly relevant to consider when trying to understand and evaluate the current capacity to produce heath and HI research, in other post-colonial and post-conflict settings, for example.

In addition, a study in Palestine [23] found that the conceptual understanding of national HRS amongst national stakeholders varied, and was not fully aligned to the work of Pang et al. [19], concluding that clearer conceptualisation and definitions (and awareness of them) are needed to potentially improve the understanding of national HRS and facilitate progress in strengthening these research system capacities. Another study in the Eastern Mediterranean region found similar results [24].

Subsequent tools that build on the work by Pang et al. [19] have been developed [25,26,27,28,29,30], which share similar shortcomings in terms of guiding the development of further operational work. Other conceptual frameworks focused on strengthening health research capacities acknowledge that different levels of research, and research capacities, are involved in the health (and HI) research production

process [3, 31,32,33]; however, these conceptual frameworks also present similar, limited specifications of how these research capacities are created, what factors shape or condition them, and how these different levels of research and capacities connect and interact to produce health (and HI) research at the local level, thus limiting their ability to be empirically tested in the design of integral strategies aiming to strengthen these capacities in different settings. Furthermore, a systematic review assessed the main approaches used in the health research capacity strengthening field and found insufficient insights on how sustainable national HRS are formed, limited guidance on how to address research capacity gaps and persistent ineffective strengthening strategies being utilised [34].

These challenges, both in developing comprehensive HRS analyses and effective strategies to strengthening health (and HI) research capacities, seem partially due to a limited conceptual understanding of HRS and the research production process(es). This has likely reduced the scope of knowledge necessary to make progress in strengthening these research capacities but also in developing effective multisectoral interventions to promote health equity.

The additional challenge with HI research is that HI are theoretical, empirical and practically complex [12]; therefore, to establish in-depth causal explanations, HI research often requires going beyond the use of traditional (bio)medical models of health and disease, discipline-specific theories, concepts and methods [35], and specific risks factor analyses as well as traditional hierarchies of evidence, all of which produce useful, but often 'fragmented' or partial, assessment of the complex problem(s) [36,37,38]. Instead, the development and

application of integrated, transdisciplinary approaches are needed [12, 35], which include innovative methodological and theoretical approaches [12, 35, 39] and "*jointly developed*" conceptual models and frameworks that synthesise discipline-specific perspectives from the socio-political to the biological level and from the macro to the micro level [18, 35].

As such, in order to attempt to address the HI research production process knowledge gap, we present a novel conceptual model that comprises an intertwined, comprehensive approach to understand how HI research (and research capacities) are produced; by using the SDH and political economy perspectives, we build an intricate theoretical understanding of HRS, the HI research production process and research capacities at the local level. This model incorporates a number of additional aspects that have not been included in existing models/frameworks and can serve as a heuristic tool to guide HI research assessments at the local level.

Our aim is to provide the basis for new understanding and more focused empirical questions on how to strengthen the HI research production process, related research capacities and HRS in different settings, which in turn might eventually lead to breakthroughs in action towards achieving health equity.

Methods

We conducted a critical review [40] to evaluate the scientific and grey literature related to capacity-building/strengthening, HRS and HI research to develop our conceptual model. Whilst reviewing the selected literature, snow-balling search techniques were also used to

identify any additional literature that may provide further critical reflections on these topics.

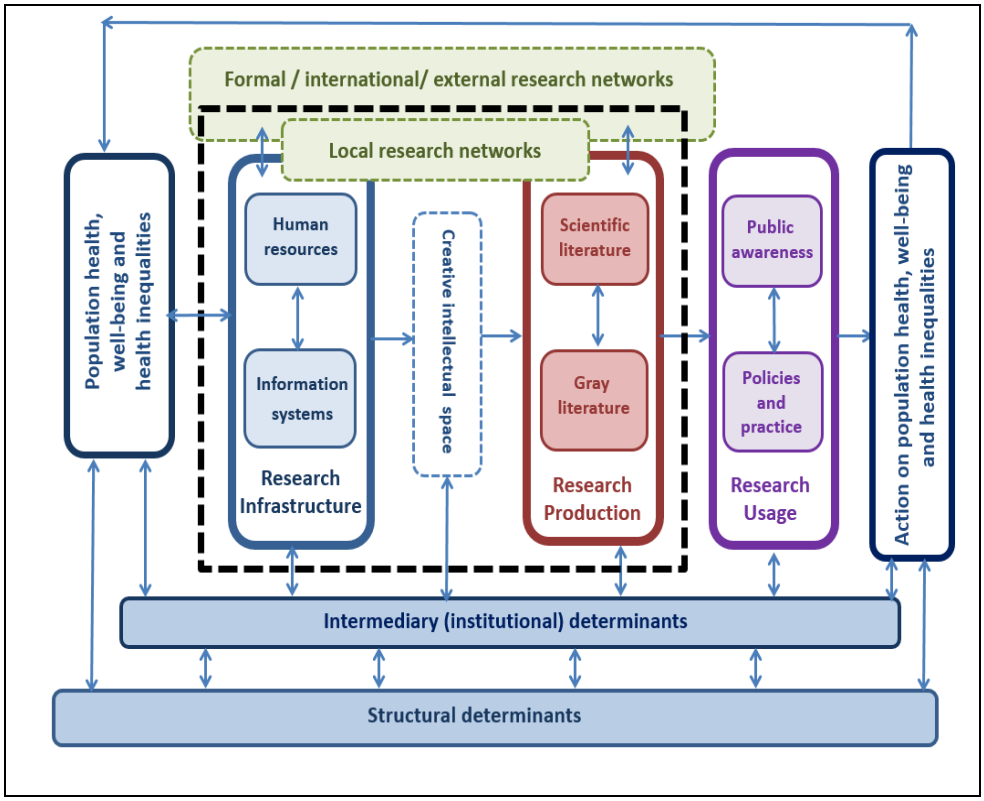
The public health analysis under the lens of political economy is a potent approach useful to understand HI and how people's opportunities for health are conditioned by social, eco-political and power structures, beyond control of the individuals affected [3, 6] and can provide useful knowledge to improve the effectiveness of global public health policy analyses and action [41]. Analogously, it is also useful to understand how the opportunities and access to resources to produce HI research are conditioned in a given context. This perspective can prompt novel research questions to challenge the status quo of the distribution of resources and power in HI research structures and practices, and to explore potential ways to modify these conditions [6].

Our conceptual model describes the potential components, determinants and pathways through which HI research is created and aims to achieve a better understanding of the context within which HI research is produced at the local level; the main determinants and components of HRS and capacities for HI research; the relationship between these main determinants and components, and the production of HI research, clarifying the pathways that may lead to improvements in health equity; use of the model for evaluating local capacities for HI research; and identification of entry points for interventions aiming to strengthen capacities for HI research.

Results

Figure 1 depicts our conceptual model of a local HRS along with the potential processes involved in creating and producing HI research and HI research capacities as well as how this relates to HI research usage and action; however, this latter process is not the focus of our study. Arrows indicate the pathways involved and the direction of activity.

Fig 1. Conceptual model of a local health research system, with a focus on how health inequalities research and research capacities are produced



Just as it is recognised that there are sets of structural determinants that condition people's health opportunities [1], our conceptual model proposes that there are also (different) sets of structural determinants which operate through (different) sets of intermediary determinants to condition and shape HI research practices and HRS opportunities to produce HI research, and consequently the opportunities to address HI in a given context.

We consider the core of HRS and HI research capacity to be comprised of research infrastructure and research production (indicated by dotted lines in Fig. 1). The HI research infrastructure is composed of two multifaceted subcomponents, namely HI human resources and integrated health and socio-demographic information systems, which can come together within a creative intellectual space and interact (as appropriate, depending on the research questions proposed), to enable critical HI research to be created and produced.

Furthermore, we consider financing, stewardship and governance to be threads that run throughout the HRS, each with their own internal dynamics that will shape the opportunities and access to the resources available, and which can enable or disable the HI research production process at various points.

To explain our model, we start from HI research production (i.e. the outcome of interest in this study) and elaborate backwards to cover the main pathway(s), components and determinants as well as the dynamics potentially involved in this overall process.

Research production

As mentioned, an indication of research capacity is the counting of scientific international peer-review journal publications [30]. Whilst grey literature (e.g. briefs, reports) can also be produced, disseminated and used alongside scientific (HI) research, it is a separate process and not the focus of our paper.

Creative intellectual space

To create critical HI scientific research, the intellectual and creative autonomy of HI researchers needs to be fostered through a supportive research infrastructure at the systemic and institutional (macro and meso) levels. This includes career pathways and (transdisciplinary) research training so that HI researchers are given the opportunity and resources, including sufficient time [8], to reflect and pose relevant innovative questions, pursue critical HI research on complex global-societal issues, and be in a better position to be able to explore potential ways to modify these inequitable conditions and outcomes. Such issues include HI and/or the (unequal) distribution of resources and power in social structures, between and within countries, which are maintained by contemporary global and societal norms and policies, and 'privileged' actors [42] as well as the micro level power struggles that manifest and impact people's health and well-being [6]. However, several scholars have mentioned the "*limited academic freedom*" there is in the health and social science research fields in certain countries due to academic institutional structures, ideologies and dependence for research funding, and the impact this can have on the framing of the HI research design and findings [43, 44].

Critical HI research requires the application of integrated transdisciplinary approaches, such as an eco-social lens [45], to consider the social, historical and ideological forces and power structures that can maintain and (re)produce HI. Additionally, it requires going beyond the privileging of scientific knowledge created in certain (often higher-income country) settings [46, 47] and the adoption of privileged, hegemonic methodological (and philosophical) approaches often used in public health and HI research due to "*their perceived strength in establishing cause and effect*" ([36], p. 252–253), which provide only partial accounts of social reality, or of a complex social phenomenon [38], resulting in a limited contribution to the knowledge required to address HI in a given setting, globally [31].
At the global scale, efforts aiming to strengthen HI research capacity need to consider these dynamics so as to determine how to develop enabling HI research conditions and individual research skillsets as well as how to overcome the "*epistemic injustices*" and deep-seeded "*unconscious biases*" still prevalent in varying degrees in global health research production and research practices [46, 48,49,50,51] and in particular the HI research field [5, 38].

Research infrastructure

As existing research highlights, development of HI research infrastructure requires a conducive research environment and the provision of resources such as facilities, financial research support, and scientific leadership as well as enabling career structures, good research management, and access to technical information and equipment [33, 52], amongst other things. A key component of HI

research infrastructure is a critical mass of skilled workforce that, through adequate (ideally transdisciplinary) training, mentoring and research infrastructural support [53], will have the competences to understand and assess the broader determinants of HI, to design, lead and conduct critical HI research, as well as to establish sustainable research institutions, teams, and networks, and co-develop effective solutions to address HI at local level [33]. These have been identified as pending needs in many countries and regions around the world [12, 31, 54].

In addition, the capacity and governance to consistently collect, manage and report data at the macro, meso and micro level, across time, are also pending issues in many countries [5, 55, 56]. However, with the limited data that is currently available, the WHO Global Observatory on Health Research and Development calculates that, on average, higher-income countries have 73 times more health researchers than low-income countries [57]. This highlights the average size of the human resource capacity gap that is likely to exist between certain groups of countries, globally, in being able to undertake health and HI research. Furthermore, substantial gaps in data and human resource capacity are also likely to exist within countries, which have not been reported.

At the same time, countries and local regions need to be able to describe and measure the extent of HI and their determinants, understand and monitor their evolution overtime, and use this evidence to design and adjust interventions to maximise the health benefits for all [17, 33, 58]. This requires reliable, disaggregated and integrated health and socio-demographic data, information systems

and routine monitoring mechanisms, supported by human resources. Such information systems can assist researchers and decision-makers to identify entry points for HI intervention, evaluate the impact of policies and prioritise the use of resources to work towards health equity [59].

Global efforts have been made to enhance the equity orientation of national health information systems and to build HI observatories, which have also identified several pending challenges to be addressed and which can provide useful learning for other settings [54, 58,59,60,61,62,63]. For example, an evaluation of the capacity of Mozambique's national health information systems to monitor and measure health equity [64] identified significant gaps in the availability of disaggregated equity stratifiers to be able to measure and monitor the targets for United Nation's Sustainable Development Goal three, which is focused on ensuring healthy lives and promoting well-being [65, 66]. Such technical gaps, which are likely to exist in similar low-income country settings, not only inhibit the monitoring and measuring of HI, health equity and other related outcomes themselves, but also the potential design and adjustment of much needed multi-sectoral policy changes in these settings [64, 66].

Intermediary determinants of HI research

Local research agendas and prioritises are not always aligned with, and driven by, local population health and well-being needs. Institutions also play a key role in the politics (understood as the exercise of power between groups) of health [67], in the process of HI (re)production, and in the HI research production process itself, acting

as ‘vectors of power’ that is exercised and controlled by hegemonic groups [44, 68]. Research funding institutions, for example, do not simply provide and allocate research funding resources, they also play a role in framing and steering research agendas and priorities [68], and in deciding what type of research gets supported (or not), where and by whom, as well as the ‘appropriateness’ of the research frame used, often in line with certain ideologies [32, 33, 47, 52, 69, 70]. By ideology, we mean a system of value judgments and beliefs that shape how research, and policy, is conventionally developed and carried out [44, 71]. Furthermore, scholars have pointed out that (research) institutions at all different levels, including universities, can be deeply ideological, which can sometimes (negatively) impact the HI scientific discourse, and researcher academic careers in the case of those interested in potentially controversial topics such as HI [43, 44].

Applying a political economy perspective and an integrated transdisciplinary approach to the (HI) knowledge production process, for example, allows one to see that it is not a value-neutral, apolitical and purely scientific process [43, 44], rather it is shaped by “*...ideological values, political and power relations, and economic forces*” ([44], p. 916). However, so far, these types of approaches, reflections and considerations have been limitedly applied to HI research [44, 68], and even less so to the HI research production process and HI research capacities.

Structural determinants of HI research

It is understood that structural determinants of HI exist within specific political and historical contexts, which consist of a number of

interacting macro-level factors or determinants (e.g. macroeconomic and public policies, socio-cultural values and epidemiological conditions, among others) that change over time, and can generate, configure and maintain social structures, and exert influence (and power) at an intermediary (meso) level(s); this, in turn, can be embodied and can condition the subsequent opportunities to produce certain (health) outcomes at the individual (micro) level [1].

Our conceptual model therefore proposes that there are also sets of structural determinants that operate through intermediary determinants to condition and shape domestic HI research practices, and HRS opportunities to produce HI research, which consequently condition and shape the opportunities and access to resources to be able to potentially address HI in a given context.

Additionally, within and across social contexts, the views, values and ideologies around HI differ [1, 44], which, as mentioned, likely impacts the type and degree of action taken to address them [16, 26, 33]. For example, HI are either seen as 'natural' and 'inevitable' outcomes of individual (lifestyle) choices and genetic differences, where the State has less 'responsibility' in creating the necessary changes [72,73,74] or as a social injustice that needs to be tackled by all at various social levels [72]. The first perspective is thought to be partly due to the fact that the public health field has traditionally been dominated by professionals trained (only) in medicine or biology, and who focus on the "*biomedical models of heath and disease*" (rather than the 'social models'), where health is considered as the absence of disease (and/or a commodity), and the distribution of ('poor') health and HI are predominantly the result of

('poor') individual choices and behaviours [72]. The biomedical models do not acknowledge the role of upstream structures and (class, gender and race/ethnicity) power relations within which individual agency exists and can be shaped by [1, 43, 72, 73]. As a result, "*socio-structural violence*" is often committed ([74], p. 239), where the victims of HI are often blamed and stigmatised for their own injuries [43, 74] and political attention and interventions are mainly directed downstream towards promoting (and correcting 'poor') individual lifestyle choices and behaviours, and improving healthcare services [72] – despite the health system being just one of the many intermediary determinants of HI [1]; this has occurred in the United Kingdom, for example, during various historical periods [74,75,76].

Underpinning all of this are not only divergent views of what action is possible, but also different institutional and individual ideologies and values about what is considered to be socio-politically desirable in society (i.e. egalitarian versus individualism) [44], including giving more or less importance to issues related to territory, class, gender, ethnicity, etc. As such, it becomes clear that the way HI are considered, and the subsequent action taken to address them, is highly political [72].

Furthermore, under globalised neoliberalism [77], changes in the roles and regulations of the state, foreign affairs and the market have led to the increasing influence of global eco-political conditions in domestic decisions and global governance issues, i.e. global political determinants, that impact on health and HI [6, 78]. These constitute important dimensions of 'context' that need to be analysed and

considered, alongside the strategies pursued by actors and institutions involved in such global and local arrangements [1].

Research networks

Our model presents how different types of (local and international, formal and informal) research networks can interact with HRS to pool and mobilise differential individual and institutional resources and capacities to strengthen research capacities [79]. These networks bring new conditions, pathways and relations to the HI research production process as well as new individual behaviours, interests and micro (power) struggles to the research process [8, 76].

Formal, international research networks, for example, can pool and mobilise international and local resources and capacities, and have become important players in strengthening research capacities for research, particularly in low- and middle-income countries. Examples of such types of networks include vertical research projects, centres of excellence, and global North–South (and more recently, global South–South) research partnerships and consortia [34].

Discussion

Firstly, we find that the distinction must be made between the processes of producing, and of using, health or HI research. For example, Pang et al. [19] consider both the 'research production' process and 'research usage' process as the two main processes and goals of HRS, but then consider 'producing and using research' to be one single HRS function. However, this perspective takes a linear

view on how health or HI research is produced, disseminated and incorporated into policy and practice to improve health and well-being [8, 80]. In reality, as many political and social scientists discuss [8, 81], the process of 'research usage' is neither linear, nor simultaneous, but rather influenced by a number of other factors and stakeholders that are intertwined with institutional and individual ideologies, values and interests [8, 76, 82]. Therefore, instead, we propose that the main goal and function of HRS are to produce health or HI research that may or may not be used, and we conceive 'research usage' to be a separate process and secondary goal (and function) of HRS, which is beyond the scope of our paper.

Secondly, HI and health equity are inseparable from power and politics [72], which means that action on HI, including creating and producing HI research, is a political process [26, 83]. Yet, the political determinants of health and HI have been largely neglected and marginalised from mainstream public health debate and analyses [31, 34, 72, 84], this includes an absence of questions related to politics and power dynamics within and between societies and countries [44]. As one study in Ethiopia highlights [85], if and when politics is referred to in mainstream public health research, it is often in regard to whether there is political commitment or not, rather than going deeper into the political context to consider how politics impacts health, HRS and the related research practices, or how internal power relations could be changed to achieve better health (and related research) outcomes [85, 86]. This is thought to be due, in part, to what we mentioned previously about the two main models of health, disease and HI. However, between these two main stances,

there are also more nuanced perspectives. For example, some may consider the topic to be too complex (i.e. a "*wicked*" problem) or "*too political*" ([73], p. 115), not covered within their "*disciplinary skill set*" and/or not in their "*own interest*" to question or challenge HI, the status quo or their positionality [43, 73]. Scholarly debates over HI research findings, ultimately epidemiological and ontological debates over "*causality and causal relationship*" [35, 38] and the relative importance of individual behaviour and action and social structures [3], have stated that these issues are not only of scientific interest, but can also be used to push for certain policy responses and, therefore, hold significant political implications [35, 87]. For example, this has been highlighted in the case of the United Kingdom over various historical and political periods [8, 75, 81, 87].

Thirdly, formal international health research networks are also shaped and conditioned by underlying historical and contemporary geo-political power relations that exist amongst country partners at institutional and individual level [47, 70, 88]. These types of networks are often led by external partners (linked to funding sources) [20, 28, 42, 47] and are considered to be valid approaches to enhance local HI research capacities, with potentially mutual benefits for all involved, providing that certain ethical principles are followed and contractually established [12, 89, 90]. However, there are also concerns that, as unanticipated consequences, these new research environments can potentially create research dependence, "*intellectual colonialism*" [70, 91, 92] and/or establish parallel structures that bypass domestic research systems [15, 22], which can restrict and/or erode local sovereignty [16] and exasperate the very problems they

claim to aim to solve [33, 93]. Yet, concepts of power (and power struggles) at the meso- and micro-levels within these networks are insufficiently recognised, and need to be addressed to be able to determine to what extent countries, institutions and researchers have the power, capacity (including equitable access to opportunities and resources) and agency to determine if, and what type of, HI research is produced at local level. This need to acknowledge and address unequal power relations in public health research collaborations has been highlighted in a study conducted in Zambia [94], and in a systematic review on managing (formal, international) health research capacity strengthening networks [95].

Fourthly, applying a political economy perspective to public health analyses can help to assess the distribution of power and resources within HI research and its development [6], despite public health researchers and practitioners not being typically trained to conduct this type of analysis [96]. A political economy perspective has been discussed and advocated for in the context of the Sustainable Development Goals and the 'leaving no one behind' agenda [65, 96], which acknowledges the need to challenge the "*enormous disparities of opportunity, wealth and power*" that exist globally [65, 96]. This also requires integrated, interdisciplinary and intersectoral collaborations and approaches to understand and inform programmatic action on the various commercial, political, economic, environmental and social determinants of HI [66].

Fifthly, in addition to identifying the components, determinants and pathways involved in this process, the identification of mechanisms and causal linkages that are triggered in certain contexts, and which

can lead to the outcome of interest [97] (i.e. stronger HI research capacities and increased HI research production in this case) is also crucial. This type of in-depth understanding about causal explanations can be used to inform the strategic development of more effective strategies to strengthen this research process and its related capacities. This is important since research is more than just a tool to generate new knowledge, it can also serve as a strategy to advance population health and social change [44]. As such, scholars have argued for more HI research to go beyond what can be "*observed or measured*" via positivistic quantitative approaches or "*perceived*" by study participants via interpretivisitic qualitative approaches which only provide descriptions and partial understanding of social reality [38]. Broader epistemology and ontological approaches, such as realist approaches, are thought to be useful since they try to consider both structure and agency [38, 98], and to reconcile the tension between scientific objectivity (which promotes neutrality or value-free science) and value judgments [44], amongst other things, to establish more in-depth causal explanations and understanding of the complex issue under study [38]. Realist approaches have started to be used to evaluate complex health and social issues and interventions [36, 38, 97]; such approaches should also be considered by researchers and decisions-makers in combination with our guiding conceptual model when planning local HI research capacity assessments and evaluations.

Lastly, critical reviews are useful to develop a hypothesis or model that acts as a starting point for further evaluation with the aim of critically evaluating the potential value from the aggregate literature to

provide a new phase of conceptual development and subsequent testing. Whilst these critical interpretations are essentially subjective, emphasis is placed on the conceptual contribution of each item of the included literature [40], serving as a value method for our article.

To conclude, our model was purposefully designed to understand the HI research production process at a global level to ensure its relevance for different settings since HI research capacity challenges exist globally [5, 63]. An application of our model to a specific country or local setting would require an exhaustively defined context-based model that exceeds the limits of this paper. However, it is expected that such application should be developed in the future to empirically test and analyse our model, and guide further in-depth analyses of the HI research production process in different contexts. For example, we encourage the development of in-depth case study analyses, using realist approaches, to identify key contextual factors and mechanisms involved in creating and producing HI research and research capacities. This knowledge can support more pragmatic thinking on what type of intervention could effectively strengthen the HI research production process and HI research capacities, where, how and for whom.

Conclusion

Despite increase evidence on HI over the past decades, efforts are still urgently needed to strengthen capacities to produce HI diagnoses, and to establish entry points for interventions aiming to address HI and population health needs. Comprehensive conceptual understanding of the HI research production process is a vital first step, yet current

research and models have mainly focused on the HI research utilisation process rather than on the HI research production process itself.

A number of existing conceptual frameworks, focused on understanding how health research is produced, used and strengthened, provide valuable yet limited advancements in this area. For example, they lack the capacity to comprehensively explain the potential pathways, components, key determinants and dynamics involved in the health, and more specifically the HI, research production process at the local level, thus limiting their ability to be empirically tested and to provide practical guidance on how to strengthen the HI research production process and related research capacities in different settings. Several scholars have also identified insufficient insights in these areas and have highlighted the need for further understanding and guidance in this broad topic.

To fill this knowledge gap, we developed a novel conceptual model that integrates the SDH and political economy perspectives to provide a comprehensive understanding on how HI research is potentially produced (or inhibited) at the local level. Our model represents a global hypothesis on the fundamental processes, and key components, determinants and dynamics involved, and can serve as a heuristic tool to guide the assessment of the HI research production process and research capacity at the local level. The application of this model could assist to identify information gaps and barriers, and provide the basis for new understanding and more focused empirical questions on how to strengthen HI research capacities.

We encourage researchers and decision-makers working in this broad area to test and adapt our model to different local contexts, potentially in combination with a realist approach, to develop more comprehensive assessments of local capacities for HI research as well as to establish the potential mechanisms and causal linkages involved. Such information might assist in establishing new entry points to strengthen HI research capacities and the evidence base, which in turn can be used to inform more locally relevant interventions aiming to address HI as well as to inspire the praxis and social transformation necessary to achieve health equity.

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ARTICLE 3

What key conditions and mechanisms generate health inequalities research in different contexts? Study protocol for two realist explanatory case studies.

What key conditions and mechanisms generate health inequalities research in different contexts? Study protocol for two realist explanatory case studies. (Under review).

What key conditions and mechanisms generate health inequalities research in different contexts? Study protocol for two realist explanatory case studies.

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Abstract

Evidence on health inequalities has grown in recent decades, however the capacity to generate this type of research is uneven, worldwide. A recent bibliometric analysis found notable inequalities of the global production of health inequalities scientific research across countries by country income groups and world region. What determines the capacity to produce high volumes of health inequalities scientific research, in different settings? What mechanisms are involved? To answer these questions, requires in-depth knowledge on the health inequalities research production process, in different settings. As such, we plan to conduct two realist explanatory case studies, to understand why and how certain settings (particularly the United Kingdom and the city of Barcelona) have generated high volumes of health inequalities research over past decades, and identify the potential key contextual conditions and causal mechanisms involved. This study protocol outlines the rationale, and methodology involved. It also complements existing research on this topic and approach, highlights the strengths and limitations of the approach, and provides guidance on how to overcome certain operational challenges, and strengthen validity and credibility of research findings. This work can serve as a tool for researcher and planners to guide the development more realist explanatory case studies which aim to evaluate the capacity to produce health inequalities research in other global settings. Valuable learning can potentially be derived from these case experiences, with implications for research, policy and practice.

Introduction

Growing evidence, particularly over the past several decades, demonstrates that health inequalities (HI) (i.e. unfair, avoidable, systematic differences in health outcomes within a population [1,2]), exist within and between communities, and countries [3,4]. Scientific research on HI is crucial to be able to assess their characteristics, magnitude, and trends, and obtain evidence on their causes. This type of information can inform the design, implementation, monitoring, and evaluation of policies and interventions aimed to reduce HI and improve population health [3,5,6]. As such, having a strong capacity to produce research on HI, at local, national and global level is essential. Yet, despite great research advances, strong capacity to generate scientific knowledge on HI does not exist everywhere [3,7]. Currently, scientific research output is the best approach to assess the capacity to produce research, and a recent bibliometric analysis of the global HI scientific research (1966-2015) identifies notable inequalities within the global production of HI scientific research, and authorship, across countries, by country income groups and world regions [7]. The study also establishes the top 20 countries that have contributed the most to the HI research field, per country income group, and their proportional contribution to the total research output [7]. Overall, the findings raise a number of key research questions, as other scholars have recently noted [8], such as why do some countries produce so much more HI research than others, even when the extent of HI, or country wealth, may be similar? What determines the capacity to generate a high volume of HI research in different contexts? What mechanisms might be involved? There is a need for

more in-depth socio-historical and political understanding, and analyses on why some countries produce more HI research than others[8,9], and how various contextual conditions influence the capacity to produce HI research, in different countries and settings. A recent study proposed an innovative conceptual model on how the HI research production process might work at local or national level, and proposes the potential pathways, components, key determinants and dynamics that might be involved [8]. This work provides useful insights into this complex process, and the type of information that should be considered when assessing local capacities to produce HI research. Yet, it does not mention the potential causal mechanisms that might be involved in generating HI research [8,10]. Establishing this additional knowledge, along with the key contextual conditions and determinants that activate them [10,11], could provide much-needed in-depth insights about the 'black box of causality', and eventually inform the development of effective locally-relevant strategies to strengthen HI research capacities.

In recent decades, valuable approaches have emerged from theory-based evaluation, with increasing acknowledgment and focus on understanding the richness of context, the complexity of social phenomena, and causal mechanisms that generate certain outcomes [12–14]. In the late 1990's Pawson and Tilley [10] proposed the scientific realist evaluation approach, to analyse complex social interventions, and to try to establish 'what works, how, under which conditions, and for whom' [10,11,15], which has attracted increasing attention in various research disciplines [11,12,15], and has been used to evaluate a number of complex public health-related interventions,

such as Health in all Policies implementation [16,17], antiretroviral adherence [18], and the Universal Health Coverage Partnership [19], amongst others. The use of this innovative approach within the field of public health, is still relatively novel, and as scholars have highlighted, there is still limited consensus and in-depth guidance on how to operationalize these types of approaches [12], how to define, and differentiate the concepts of ´Mechanism´ and ´Context´ [12,15,20], and what level of abstraction is appropriate to such complex evaluations [21]. Furthermore, whilst the guidance and examples on how to conduct realist reviews, and realist evaluation of health interventions have increased, we have found that there is substantially less comprehensive guidance and examples on how to specifically conduct realist explanatory case studies, as well as limited a priori justification for the selection of the causal mechanisms (i.e. the hypotheses) that authors plan to test them through their realist evaluations, which we consider to be a key step in the realist explanatory case study planning phase.

Given the novelty of this approach, and this research area, we decided to conduct two in-depth realist explanatory case studies initially, to understand how and why certain settings have been able to produce high volumes of HI scientific research over the past few decades, in line recent bibliometric analysis findings [7]. This paper provides the rationale for developing these two realist explanatory case studies, and the methodological steps involved, in line with existing research [12,15,21,22]. It also includes the rationale for proposing our six theoretical causal mechanisms to be tested, and refined through the implementation of the case study, again in line with existing research,

as well as a number of critical considerations. This work can serve as a tool to guide the development of future realist explanatory case studies on this topic, based in similar settings, as well as provide useful insights for future realist explanatory case studies which aim to understand why and how certain settings have produced lower volumes of HI research based, in other settings.

Methods

Explanatory case studies are a type of case study that attempt to explain causal relationships, and answer 'how' and 'why' questions [23,24] regarding a certain social phenomenon of interest, and observing it either at a single point in time or over a period of time [24].

Realism is a strand of philosophy of science, which includes different schools of thought (e.g. scientific and critical realism). In general realist models of explanation, attempt to go beyond positivist and constructivist (or interpretive) models of explanation, to consider the role of both structure and human agency in social change, and focus on understanding the nature of hidden, underlying causal forces (i.e. mechanisms) that are sensitive to differences in contextual conditions, and which can create changes, and generate certain outcomes of interest [10,11,15,22,25,26]. Over the past two decades, mechanisms and mechanism-based explanatory models have attracted attention in the social sciences and in the philosophy of science [14], and developing and testing hypotheses about the underlying causal mechanisms of change, their relationship to the context within which

they lay, and their locus of activation, have become important areas of research [10,11,15]. Scholars have defined mechanisms as dynamic, hidden, but real elements underlying social changes, adaptive and sensitive to specific contexts and conditions [10–12,15,17,24,25,27–29], and provide an account of *"…the powers inherent in a system"* [10] (p.23) (i.e. the interplay between agency and structure), that responsible for generating certain outcomes [10,30]. However there are different perspectives about what, and where causal mechanisms might lay [15]. Conceptually, several scholars (in line with scientific realism) have classified mechanisms are either new resources or new agent's reasoning (e.g. ideas or reactions), which can be introduced into a given context, and under the right conditions, can be activated for a purpose, to create a change, which leads to generating a particular outcome of interest [11,12,32]. Scholars also consider that mechanisms may interact with each other, vary in intensity, and operate on a '*continuum of activation*' as opposed to an *'on-off switch*' [12,15].

How to design and implement realist explanatory case studies?

The interest in realism, and the focus on mechanisms, have enhanced the appeal of using explanatory case studies as a 'causal investigation' method and to establish relevant evidence [23,24,27]. To guide the design and implementation of our realist explanatory case studies, we have mainly followed Gerrings [24] and Yin [23,33] guidance on case study research, Pawson and Tilley´s [10] methodology to conduct (scientific) realist evaluations, and Shankardass et al. [17] methodology for realist explanatory case studies. We also considered

key findings from previous literature based on this approach [12,16,27,34,35]. To ensure rigor, quality and replicability, we outline the key steps involved:

- **Step A: Realist explanatory case study preparation**: Firstly, select the type of case study to conduct (e.g. typical or atypical etc.) [24]. Secondly, to guide the realist inquiry, obtain in-depth knowledge of the overall process of interest (e.g. from previous literature and models), to develop a guiding conceptual model, and a Context + Mechanism = Outcome (CMO) configuration, in line with Pawson and Tilley [10], to simplify the complex process down to its core components, and to articulate the key components involved to generating different outcomes states. These should also include the proposed causal mechanisms/hypotheses to test, and the potential key contextual conditions. Thirdly, select the case study(s) of interest, and their boundaries, and lastly, select the methods to use with the case study(s) collect the evidence to test the theoretical mechanisms/ hypotheses.
- **Step B: Realist explanatory case study implementation:** Collect multiple independent sources of data, analyses and synthesise the evidence and the potential emerging patterns and themes, to iteratively test and refine these theoretical mechanisms/ hypotheses. At the same time, identify the key sets of contextual conditions and factors that appear to have activated these mechanisms, during certain moments in time.
- **Step C: Realist explanatory case study presentation:** Refine the causal mechanisms/hypothesis accordingly, and present the case evidence in various formats, as appropriate.

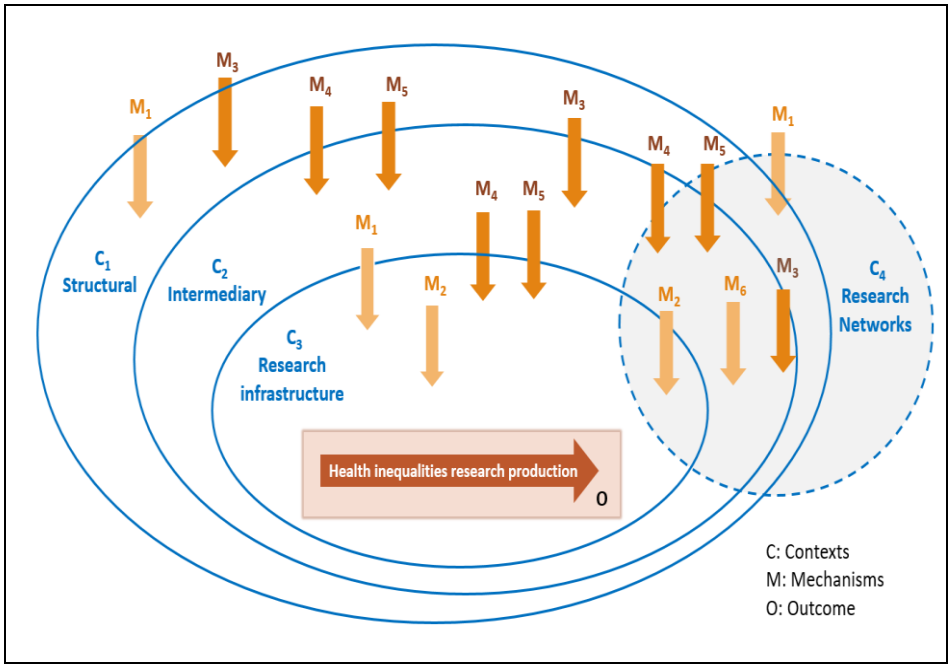
STEP A: Realist explanatory case study preparation

Since there is no previous research in this area, we aim to treat each case that we select as potentially unique single cases, that will be explored in-depth, using an extended historical perspective that connects chains of events over time [35–38], and data triangulation [23] to try to test our theoretical casual mechanisms and answer our research questions. We will consider the socio-political-historical and institutional contexts, to iteratively identify the main causal mechanisms that have led to a high volume of HI scientific research production in a particular setting, over the several decades [7,39]. The case study findings may or may not be generalizable to other settings; however, generalizability is not the aim of this case studies research at this stage, rather it is to ensure case validity and case logic [34,35,38], and to establish an in-depth contextual understanding of the selected cases. Furthermore, due to the complexity of the process under investigation, the novelty of the work proposed, and time and resource constraints, we plan to conduct only two case studies at this stage.

Next, we developed a guiding conceptual model and CMO configuration to simplify the HI research production process down to its essential core of attributes, to support the operationalization of the case studies [17]. We also state our initial hypotheses on the main causal mechanisms, which reflect how we consider the HI research production process to work in settings where a high volume of HI scientific research has been generated [10]. To develop our guiding conceptual model, we reviewed the existing relevant literature and conceptual models; in particular, we considered a recent conceptual model which proposes a global hypothesis on how HI research might

be generated at the local level; the model uses an integrated political economy and social determinants of health approach, and proposes that there are sets of structural determinants which operate through intermediary determinants and power dynamics, to shape and condition HI research practices, and opportunities to produce HI research at local level [8]. As well as Whitehead's [40] *´Action spectrum on inequalities in health´* model, which is based on different European country experiences (i.e. over time, and between and amongst individuals, groups and networks). In line with these conceptual models [8,40], and Pawson and Tilley scientific realist evaluation models [10], we develop our guiding conceptual model to understand why and how certain settings might have generate high volumes of HI research, and to guide our realist inquiries. We hypothesize that within a 'successful' HI research production process, there are at least four key contextual levels (marked in blue): structural-contextual factors (**C1**), influence, shape, and condition the intermediary-contextual factors (**C2),** and the subsequent HI research infrastructure (**C3**), as well as research networks (**C4**). Within the different contextual levels, there are also likely to be combinations of enabling and inhibiting contextual factors and power relations, which interact and activate the main theoretical causal mechanisms (**M1-6**) (marked in orange), that exist across the different contextual levels (**C1-4**), to create a positive change in the HI research production outcome state and generate the high volume of HI research produced (**O**) (marked in red) (*Fig 1*).

Fig 1: Guiding conceptual model for our realist explanatory case studies on why and how a high volume of health inequalities research might be production in certain settings.



In addition, we propose that there are likely to be different agents operating within the different contextual levels (**C1-4**) (marked in blue) of the HI research production process. Different agents are likely to experience different types of nested CMO configurations, which create changes in behaviours and actions, this in turn can transform the structures and available resources in the different contextual levels [12,15]. For example, such transformations at one contextual level (e.g., macro), can potentially influence and shape the ideas, structures and available resources for other agents in the subsequent contextual levels (e.g., meso), and so on. Collectively, this chain of events likely creates a change in the HI research production outcome state, and generates the high volume of HI research produced (**O)** (marked in

red) (Fig 2). (Fig 2 is inspired by Pawson and Tilley's model of realist evaluation and policy making cycles [10]).

Figure 2: *Guiding conceptual model of the potentially different agents' experiences within our realist inquires.*

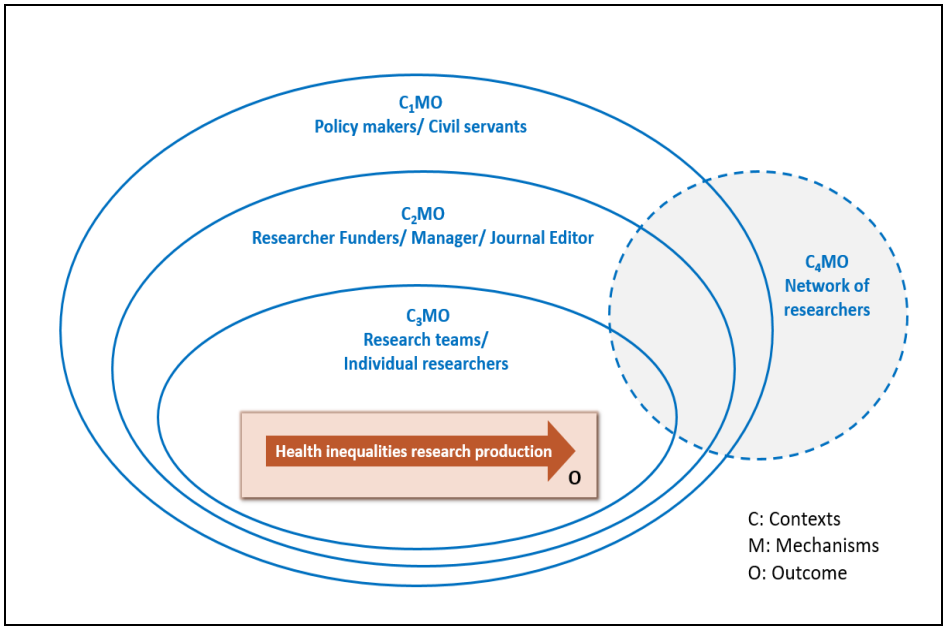


Fig 1 and Fig 2 aim to simplify some of the complexity that is likely to be involved in these processes, in each of our realist inquiries. Alongside our main guiding conceptual model (*Fig 1*), and based on existing literature and theories [41–43], we propose six causal mechanisms, that might be involved in generating a high volume of HI research, as well as the key set of contextual factors required to active them, and present them in a CMO configuration to guide our realist inquires. We also include some of the possible agents (A) involved in this process, similarly to other scholars [18], which potentially builds on the CMO configuration (*Table 1*).

Table 1: Context-Mechanism-Outcome-Agent configuration to guide our realist explanatory case studies.

CONTEXT (C1-4)	MECHANISM (M1-6)	OUTCOME (O)
STRUCTURAL (C1): Ideologies, politics; HI exist in society; tradition of recognition of HI; minimum level of domestic resources to invest in health and social sciences. **INTERMEDIARY (C2):** Institutional research funders; research institutions; stewardship. **RESEARCH INFRASTRUCTURE (C3):** Minimum level of human and information research capacities (e.g. data; data collection systems; critical mass of trained professionals; scientific leadership mentorship; stewardship. **RESEARCH NETWORKS (C4):** Scientific knowledge networks; knowledge and/or financial resources.	**M1:** Recognition with concern. **M2:** Sense of moral responsibility to act. **M3:** Stewardship for HI research. **M4:** New resources to strengthen HI human resources. **M5:** New resources to strengthen HI information resources. **M6:** Cognitive social capital.	**O**: High volume of HI scientific production
AGENT (A)		
E.g. researchers, civil servants, civil society, media, journal editors, general public.		

We propose that these 'enabling' causal mechanisms may exist at different contextual levels, and involve different actors, leading to multiple changes in behaviours and/actions, actions at any one time. In addition, we suspect that if these 'enabling' mechanisms were absent, a negative outcome state might be generated (i.e. no or low volume of HI research produced), however, this will require further research beyond our initial two studies. Below we explain in more detail each of the causal mechanisms/hypotheses that we propose, and give theoretical examples of how they might operate in practice ***(Table 2)***.

Table 2: Detailed explanations of the six causal mechanisms we plan to test during our realist explanatory case studies.

Justification of our six theoretical causal mechanisms/ hypotheses
M1: Recognition with concern **Mechanism type:** Reasoning. **Related social change theories:** Recognition [40]; egalitarianism [39,41]. **Example**: Political recognition with concern is developed, which when introduced into certain contextual conditions creates a tipping point and activates the mechanism (i.e. a change in reasoning), and generates a change in political behaviours or actions e.g. deciding to develop relevant policies, or release resources to invest in more HI research to inform policies.
M2: Sense of moral responsibility to act **Mechanism type**: Reasoning. **Related social change theories: (**Moral) egalitarianism [39,41]. **Example:** Researchers experience a sense of moral responsibility to act, in line with their personal egalitarian values, which when introduced into

certain contextual conditions creates a tipping point and activates the mechanism (i.e. a change in reasoning), and generates a change in their behaviours or actions e.g. creating new research on HI.

M3: Stewardship for HI research

Mechanism type: Resource and/or reasoning

Related social change theories: Change management [42–44].

Example: A new type of stewardship for HI research is introduced into certain contextual conditions creates a tipping point and activates the mechanism (i.e. a change in resources or reasoning), and generates a change in behaviours and action e.g. implementing more 'competitive' or strategic (HI related) research team plans.

M4: New resources for HI human resources

Mechanism type: Resource

Related social change theories: Change management [42–44].

Example: Government research funder to provide new financial resources to an institution to develop necessary HI training programme, which when introduced into certain contextual conditions creates a tipping point and activates the mechanism (i.e. a change in resources), and generates a change in behaviours or actions e.g. development of new training programmes.

M5: New resources for HI information resources

Mechanism type: Resource

Related social change theories: Change management [42–44].

Example: Non-government research funder provide new financial resources to an technical group to develop new health and socio-demographic data collection systems, which when introduced into certain contextual conditions creates a tipping point and activates the mechanism (i.e. a change in resources), and generates a change in behaviours and

actions e.g. development of such data collection systems.
M6: Cognitive social capital **Mechanism type**: Reasoning and/or resource **Related social change theories:** Cognitive Social Capital [45–48]. **Example:** Cognitive Social Capital (e.g. social values, norms [46–48], related to social trust, solidarity, sharing, and social participation and integration [49]) develops between researchers in informal research networks, which in certain contextual conditions creates a tipping point and activates the mechanism (i.e. a change in reasoning), and generates a change in action e.g. co-producing HI research.

We propose **M1**, firstly, as political philosophy theories of recognition assume that for something to be 'recognised' to exist, depends on the feedback of agents and society [44], and that socio-political struggles for ´fair´ recognition involves psychological and normative mechanisms [44]. Furthermore, egalitarianism is said to evaluate social relations and inequality through value judgments, which guide human reasoning, reflection and action about what is morally unjust or fair, and what should be done to address these types of problems [43,45]. This involves concern about the impact of particular social hierarchies, and their distributive access to opportunities and resources for human welfare [43,45]. In addition, Whitehead's *´Action spectrum on inequalities in health´* model [40] includes recognition of HI as one of the initial activities; to develop the model, she attempts to identify the combination of influential contextual factors that have created favorable conditions, which then interact to create a tipping point and activates certain mechanisms to generate political action to address

and conduct research on HI. For example, in the case of the UK, she explains that there was already a strong pre-existing tradition of research and recognition of HI dating back to the 19th century, which in combination with a new type of recognition of HI in the 1970s, strategies to '*promoting awareness'* of the problem, and raised "…*voices of concern*… [which]… *reached such a level*... [that political act was then taken, and this led to the famous 'Black Report' being produced]" [40] (p.482).

We propose **M2**, as scholars mention the tension between different ideological values [46,47], and how action on HI is shaped by the extent to which a society and individuals embraces the ideological values of egalitarianism at one end of the political spectrum, or the ideological values of individualism, libertarianism, and neo-liberalism, at the other [46,47]. These differences in ideological values can be reflected in the actions taken by society, institutions and individuals [8,46–48]. Scholars have also highlighted the need to reconcile the tension between Weberian views of scientific objectivity [46,49], and personal value judgements when conducting HI research, since HI researchers must establish value judgments of what social justice is, however, if this is done explicitly it can frame, rather than bias their HI research [8,46,50]. Previous research also identified a similar mechanism '*feeling that you are making a difference'* [51].

We propose **M3**, as stewardship is thought to be important for health research capacity strengthening more broadly [41,43,52], and involves managing the performance of health research systems, and the HI research production process [8,41,42], as well as making strategic decisions on planning, priority settings, resource generation and

allocation, monitoring and evaluation etc. [8,42,52]. This can also include the use of change management theories and tools, which combines logic and critical thinking to map the pathways of change, including a description of the chain of events, key factors and agents involved, the underlying assumptions, and the outcome of interest [53,54]. Previous research identified similar mechanisms '*leadership and management', 'shared strategic vision', 'relations and local ownership',* and *'accountability'* [55].

We also propose **M4** and **M5**, as scholars have mentioned that to strengthen HI research capacities and develop critical HI research, requires an enabling environment and supportive research infrastructure (which includes strong HI human and information resources) [8,52,56]. Previous research also identified a similar mechanism '*releasing resources'* [51].

Lastly, we propose **M6** as cognitive social capital [57–59], incorporates important internal psychological senses, such as social trust, solidarity, and sharing for mutual benefit [57,60,61]. This can collectively lead to innovative, co-produced scientific knowledge on HI. Previous research identified similar mechanisms '*exceeding the sum of the parts'* [51], and '*providing mutual support'* [22].

We selected our two cases of interest i.e. two settings which have produced a high volume of HI research from the recent bibliometric analysis [7]. We noted that the UK is the 2nd highest global contributor to this research field after the United States, and that Spain is the 10th highest producer in this research field. Using the same bibliometric analysis search strategy [7], we found that the national HI

scientific production was distributed in different ways through both countries. In the UK the production has been created by a variety of institutions spread-out through the country, whereas in Spain it has been more homogeneous, and concentrated in certain places, with a large majority produced in just a handful of institutions within the city of Barcelona. These additional findings raised other interesting questions which warrant further investigation, such as why and how do some institutions, with certain cities, produce more HI research than others, within the same countries? Consequently, through our two case studies we aim to understand why and how the UK, and Barcelona have produced high volumes of HI scientific research over the past four to five decades, and establish some of the key causal mechanisms and contextual conditions that might have been involved.

Within each case study, we will use semi-structured interviews with key informants to establish precise information on how HI research initiated and developed over the past four to five decades. In the case of the UK, study participants will be selected and invited for interview if they met the following inclusion criteria: i) a senior researcher working (or having worked) in UK, of any gender; ii) have produced research on HI while working in UK during the last four to five decades, therefore from their research focus and experience, they will have an understanding of the evolution of HI research field in the UK, and the social and technical environment, over the last four to five decades. These participants will be identified from the bibliometric analysis findings [7]. In the case of Barcelona, study participants will be selected and invited for interview if they met the following inclusion criteria: i) a senior researcher working (or having worked) in

Barcelona, of any gender, and ii) have produced some level of research on HI, whilst working in Barcelona during the last four decades, and would therefore have some understanding of the evolution of public health, and HI research in Barcelona, and the social and technical environment, over the past four decades. These participants will also be identified from the bibliometric analysis findings [7]. We anticipate a smaller sample size for this case, therefore other potential participants may also be selected and invited for interview, providing that they had worked on health related researcher at some point, and from their research focus and experience they have a good understanding of the evolution of public health research, and HI research, in Barcelona, over the past four decades.

Interview questions have been developed in line with our guiding conceptual model, and literature that was used to inform it [8], and will apply an political economy perspective. Our initial list of questions will be tested in a pilot interview conducted by two of the authors, and adjust them accordingly to establish the key questions for the rest of interviews. Participants will be asked about their professional background and their motivation for working in the HI research field to establish positionality, and/or why they think people are motivated to work in this research field. They will also be asked about their perspectives on why and how the UK, or Barcelona has produced such a high volume of HI research over the last few decades, and why some institutions have produced more HI research that others. In the case of Barcelona, they will also be asked about their perspectives on this process in the city, in comparison to the rest of

Catalonia, and Spain. Study participants will not be directly asked about these six specific mechanisms (M1-M6) that we plan to tested.

STEP B: Realist explanatory case study implementation

Evidence from the multiple data sources will be synthesised and used to test the proposed causal mechanisms [11], and examine the relationships within the CMO configuration. The semi-structured interviews will be planned to saturation, and a pilot interview will be conducted to refine the research questions. In line with ethics approval, participants will receive a participant informed sheet, and sign an informed consent form, prior to their interview. All interviews will be conducted in either English or Spanish language, as appropriate, and depending on the interviewee's comfort. All interviews will be audio recorded, one author will be responsible for transcribing and translating the audio recordings, which will be double checked. All data will be anonymised by the removal of any personal information that may reveal the interviewees personal identity. The original and anonymised data (audio and transcripts) will be stored separately in secure encrypted external hard drives, that only the research team will have access to. To ensure validity and credibility of the research findings, data from the semi-structured interviews will be triangulated with scientific and grey literature to identify relevant documented evidence, as well as through a snowballing process. One author will code the data using Microsoft Word 10, and thematic content analysis will be applied to all the texts to identify recurrent themes. Evidence from the various data sources will then be synthesised, examined and interpreted, and any discrepancies will be discussed between the authors, until consensus is reached.

STEP C: Realist explanatory case study presentation

From the evidence generated, we will present our refined hypotheses on the potential key sets of contextual factors and main mechanisms that have been involved in generating a high volume of HI research production in the UK, and Barcelona, over the last few decades. This information will have important practical implications for a variety of agents (e.g., governments, research funding agencies, public health professionals, researchers etc.) involved in the processes of strengthening HI research capacities, and co-creating scientific knowledge on HI. Case evidence will be shared in potentially different formats.

Discussion

This study protocol provides comprehensive explanations and justifications for conducting two realist explanatory case studies, with semi-structured interviews with key informants, to gather and analyse multiple sources of evidence, to test our hypotheses on six causal mechanisms, and to establish in-depth understanding of why and how the UK and Barcelona have generated high volumes of HI research over the last few decades. We explain how we selected our cases of interest (i.e. high producer of HI research), and how we developed the guiding conceptual model, and CMO configuration to simplify the complex process (i.e. HI research production) down to its core of attributes [39]. We also provide clear justification for the six mechanisms that we propose to test, which are in line with literature from diverse disciplines, which likely increases their plausibility,

'theoretical rigor and empirical relevance' [14]. We consider that this should become standard practice when planning in realist explanatory case studies, to strengthen the quality and consistency of future realist explanatory case study design and implementation [14,21], as well as to enhance the validity and credibility of their research findings.

Several scholars have mentioned how it is difficult to distinguish in theory, but especially in practice, whether something contributes contextually or mechanistically to the process under investigation, and in generating the outcome of interest [12,15,62]. This is because, conceptually, it is complex to untangle the various interconnected factors, which raises different degrees of relevance for the process of interest, at different time periods. Adding to this complexity framework, is the fact that certain factors can act as both a contextual factor and as a mechanism, depending on different time periods, and the focus of the research. For example, we imagine that in a certain context, and at a certain point in time, recognition of HI, and certain types of training can act as pre-existing contextual factors, which can assist to active certain mechanisms (such as M1 or M4). Yet, in a different moment, they can be introduced into a new context with new conditions, or they can accumulate in the existing context over time until a tipping point is reached, both of which then activates them, causing them to then act as mechanisms instead (e.g. M1 or M4). We found this distinction particularly challenging for our case studies, since we are interested in understanding and evaluating a complex process over a fifty-year time period, which involves numerous determinants, components, pathways, mechanisms and agents, and where the temporal and physical boundaries are less defined as those

of say a specific intervention that was implemented in a clearly defined context, and moment in time. Nevertheless, this distinction became easier, after established clear conceptual understanding of the HI research production process, and the potential relationship between contexts (including the factors and conditions), mechanisms (which require activation) and the outcome of interest (i.e. a high volume of HI research) [12]. The planning stage of the realist explanatory case studies can therefore be extremely lengthy, but it's crucial to support the smooth implementation of the case study.

To the best of our knowledge this is the first attempt to apply this methodological approach to assess HI scientific production in different settings, and to identify the main causal mechanisms involved [8], therefore, we have chosen to only focus on what we consider to be the main first-level causal mechanisms, to test with empirical data. However, we assume that not all mechanisms and contextual factors play equally important roles in the HI research production process, across all time periods, and all levels of context. Also, there are likely to be other, secondary and tertiary-level mechanisms, and factors present in this process, beyond the main ones we present in our CMO configuration. We anticipate that more research will be needed to explore these in greater depth, both in these two case contexts, and in other settings. Connected to this point, it must be highlighted that while this realist and mechanism-focused approach can help to reveal previously hidden aspects of a social process and an outcome of interest, it is not a panacea [10]. There are still limitations to reducing the predominant analytical focus to certain mechanisms [63], where the presence of a factor (and its interactions

or activities) is only determined to be relevant if it appears to make a significant change to the outcome state of interest, otherwise it is considered irrelevant and 'abstracted' away through the research process [63]. In this way, other potentially important factors, that might also partly account for certain outcome states of interest, may be missed.

Nevertheless, realist approaches combined with explanatory case study methods, seem highly relevant to try to answer our research questions. Through the development of these realist explanatory case studies, valuable learning may potentially be established on why and how high volumes of HI research have been generated in the UK and Barcelona, and what type of HI research capacity strengthening activities have occurred over the past few decades. We also consider this to be the start of a new line of research, where more realist explanatory case studies can be developed to examine the capacity to produce HI research, in different global settings. Such evaluations could assist to identify capacity strengths and limitations, and potential enabling and inhibiting contextual conditions, and mechanisms. This type of information may help to guide researchers and decision-makers in their development of new, locally relevant HI research capacity strengthening strategies, which could eventually lead to the production of a stronger evidence base on HI. In turn, this new evidence could guide the development of more effective interventions aiming to improve population health and address HI.

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ARTICLE 4

Why and how the UK is a high producer of health inequalities research? Realist explanatory case study to test six causal mechanisms.

Why and how the UK is a high producer of health inequalities research? Realist explanatory case study to test six causal mechanisms (In preparation).

Why and how the UK is a high producer of health inequalities research? Realist explanatory case study to test six causal mechanisms.

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Abstract

Background: Despite growing evidence on health inequalities, particularly over the past few decades, further efforts to strengthen the capacities to produce scientific research on this topic are urgently needed to inform effective policy interventions. Yet, what determines the capacity to produce health inequalities research? How can these capacities be strengthened? To answer these questions, an in-depth understanding of the socio-historical, political and institutional processes that generate this type of research in different contexts is needed. A recent bibliometric analysis of health inequalities research found inequalities in the global production of this type of research, across countries, and world regions. The study found the United Kingdom to be the 2nd highest global contributor to this research field after the United States. Our aim is to generate knowledge that helps to understand why and how the United Kingdom has produced a high volume of research on health inequalities over the last five decades.

Methods: A realist explanatory case study to test six theoretical causal mechanisms, based on previous theories and literature, and establish whether they might have been involved in this process, and what contextual conditions might have activated them. Our approach includes a historical perspective, semi-structured interviews and data triangulation with scientific and grey literature.

Findings: Evidence supports our hypotheses that the following six causal mechanisms have been activated by certain historical socio-political-institutional contextual conditions, generating HI research over time: M1) recognition with concern; M2) sense of moral responsibility to act; M3) stewardship for health inequalities research;

M4-) resources to strengthen health inequalities human resources; M5) resources to strengthen health inequalities information resources, and M6) cognitive social capital.

Conclusions: Valuable learning can be derived from the United Kingdom's experience on how to build health inequalities research capacities and generate health inequalities research. More research is needed to expand knowledge of these processes in other settings.

Introduction

Growing evidence, particularly over the past four decades, demonstrates that health inequalities (HI), i.e. avoidable, systematic differences in health outcomes [1], exist within and between countries [2–4]. Scientific research on HI is essential to be able to demonstrate that they exist, to assess their characteristics and trends, and to establish their causes. In turn, this knowledge can be used to inform the design and implementation of more effective and equitable policies and interventions which aim to reduce HI. A strong capacity to produce HI research at local, national and global level is therefore crucial to be able to work towards addressing these inequalities. However, it does not exist everywhere [5,6]; despite notable advances, and global efforts to invest in and strengthen capacities to produce HI scientific research are still urgently needed. A recent bibliometric analysis of global production of HI research (1966-2015), shows that significant inequalities exist within this global production across countries, by country income groups and world regions [5]. These findings raise important questions about why and how some settings have been able to produce a higher volume of HI research, and others

not, and what might determine this capacity. The bibliometric analysis also established the top 20 countries that have contributed the most to the HI research field, per country income group, as well as each of the country´s proportional contribution to the total research output. The United Kingdom (UK), for example, was identified to be the 2nd highest global contributor to this research field after the United States (US), with 12.5% proportional co-authorship contribution to the global HI scientific production [5]. Why and how has the UK been able to produce such a high volume HI research during the last half a century? What key contextual conditions, determinants, and casual mechanisms might have been involved in generating this strong capacity to produce HI research, over time. While there is ample literature on the HI research to policy process in the UK context [7], there is substantially much less research on the HI research production process, in the UK. As such, we aim to conduct a realist explanatory case study, to try to establish answers to these questions.

Methods

The study design is a realist explanatory case study, with semi-structured interviews with key informants, and the data has been triangulated with scientific and grey literature. We selected our unique case of interest (i.e. a high producer of HI scientific research) based on recent bibliometric analysis results [5]. Following Pawson and Tilley´s [8] methodology to conduct realist evaluation inquiries, and Shankardass et al. [9]´s methodology for realist explanatory case studies, we developed a Context + Mechanism = Outcome (CMO) configuration, and an guiding conceptual model, informed by previous

conceptual models and literature [10,11], to simplify the complex process (i.e. HI research production) down to its essential core of attributes [9]. This helped to articulate the key combinations of components, agents and factors, embedded in specific historical, political and institutional contexts (C), which interact over time and activate certain mechanisms (M), and might have contributed to the outcome of interest (O) [8]. Through the development of this case study, we aimed to test six theoretical main causal mechanisms involved (M1-M6), and refine them based on our findings [8,10] (see *Table 1*). (See study protocol [10] for more details on the case study design).

Table 1: Six theoretical causal mechanisms tested during our realist explanatory case study in the UK

Six main theoretical causal mechanisms to test (M1-M6)
M1: Recognition with concern
M2: Sense of moral responsibility to act
M3: Stewardship for HI research
M4: New resources to strengthen HI human resources
M5: New resources to strengthen HI information resources
M6: Cognitive social capital

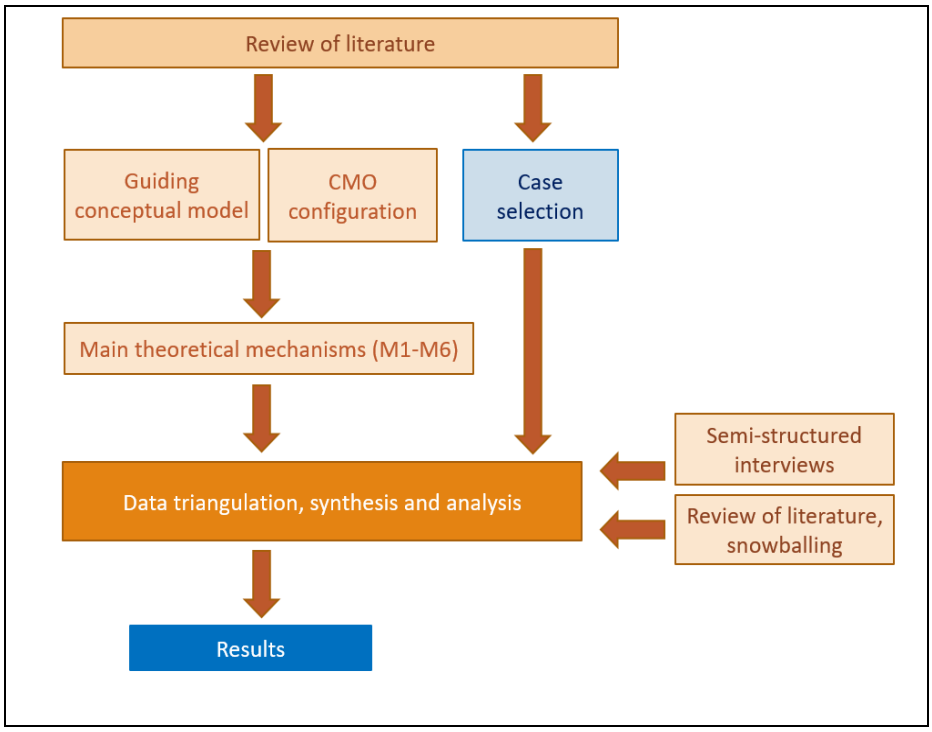
The aim of the semi-structured interviews was to establish a broader perspective on the context of HI research in the UK, how it was initiated, and how it was developed over the past few decades. Study

participants were selected and invited for interview if they met the following inclusion criteria: i) being a senior researcher working (or having worked) in UK, of any gender; ii) have produced research on HI while working in UK during the last four to five decades, therefore from their research focus and experience, they would have an understanding of the evolution of HI research field in the UK over the last four to five decades. These participants were identified from the bibliometric analysis findings [5]. In total, 12 interviews with key informants were conducted until we attained thematic saturation [12]. Most of the participants were male (n=7), and were Professors (n=11). The study participants worked in different institutions and cities throughout the UK, and had been trained in a range of disciplines i.e. political and social sciences, medicine, public health and epidemiology, statistics and geography. Given the sample size, and the well-known profiles of many HI researchers from the UK, we do not provide further details to preserve participant anonymity.

Interview questions were developed in line with our guiding conceptual model and supporting literature [10,13], tested in a pilot interview conducted by two of the authors, and then adjusted accordingly to establish the core set of key questions for the rest of interviews. Participants were asked about their professional background and their motivation for working in the research field to establish positionality. There were also asked about their perspectives on why and how the UK has produced such a high volume of HI research over the last five decades, and why some institutions have produced more HI research that others. They were not directly asked about the six specific mechanisms being tested.

In line with ethics approval, participants signed an informed consent form prior to their interview. Interviews were conducted by either one author or two of the authors in English language. Five interviews were conducted in person, and seven by teleconference. All interviews were audio recorded, one author was responsible for transcribing and translating the audio recordings, which were double checked. All data were anonymised by the removal of any personal information that may reveal their personal identity. The original and anonymised data (audio and transcripts) were stored separately in secure encrypted external hard drives, that only the research team have access to in order to perform the analysis. To ensure validity and credibility of the research findings, data from the semi-structured interviews was triangulated with in-depth selective scientific and grey literature reviews to identify relevant documented evidence, as well as through a snowballing process. One author coded the data using Microsoft Word 10, and thematic content analysis was applied to all the texts to identify recurrent themes [10]. Evidence from the various data sources was then synthesised, examined and interpreted, and any discrepancies were discussed between the authors, until consensus was reached. Figure 1 summarises the case study design.

Figure 1: Realist explanatory case study design flow diagram



Results

We identify supporting evidence to confirm that our six theoretical causal mechanisms (**M1-M6**) which we proposed to test, have been present and activated, under different contextual conditions and across different time periods, and have been involved in generating a high volume of HI research in the UK over the past 50 years.

Mechanism M1: Recognition with concern

Evidence suggest that **M1** has been activated at the individual, social and political level. For example, Margaret Whitehead's [11] '*Action spectrum on inequalities in health*' model includes recognition of HI

as one of the initial activities. She explains that there is a strong pre-existing tradition of research and recognition of HI in the UK, dating back to the 19th century, when there were '*pioneering collectors of statistics, also offering social commentary on the data they gathered'* [11] (p.480). This, in combination with the new recognition of noticeable "…*deteriorating socio-economic conditions* [and] *worsening health trends…"* [11] (p.472-3), and strategies to '*promoting awareness'* of the problems, raised "…*voices of concern…about the extent of* [HI (i.e. **M1**). This "…*concern reached such a level by 1977 that the Labour government was persuades to set up the* [HI] *Research Working Group, under the chairman of Sir Douglas Black*…" [11] (p.482), which led to the famous Black Report published in 1980 [14,15] (i.e. **M1**). This Commission, led by Sir Douglas Black former chief scientist at the Department of Health, represented a significant shift in government thinking towards HI [16]. So what sparked the Labour Government's decision to set up the Committee? Firstly, evidence suggests that active investigation and social concern, tend to be stimulated by 'dramatic event' and/or perceptions of socio-economic crisis [16–18],which stimulates public debate, recognition, and concern about socially-relevant issues, such as HI [19–21]. For example:

> *"I think it's a kind of long running line of debate and concern, political concern…it was really about a kind of moral panic… so there are these sort of moments I think, partly political, partly science based, and partly a kind of public outcry about social conditions..."* (Professor).

> "…*you get a sudden collection of interests in social inequality, which maybe because either a change of government or a mini-revolution… and people may ask the question, why there is a lot of inequality in these country … So that's the spark".* (Professor).

Prior to the mid-70s, there had been an economic crisis, and an increase in social and HI [16,17,22,23], which triggered "…*public outcry* [with] *growing public perception of a divided society"* [24] (p.484). Also, after the establishment of the UK´s Welfare State and National Health Service (NHS) in the early post World War II period, there had been a general assumption that population health would improve, and HI's would eventually decline, which they started to do [21,25]. Yet, by the 70s, they had increased once again, which raised concern over the effectiveness of the NHS and related public expenditure [16,22,25–27]. For example:

> "…*we knew there were health inequalities, but it didn't become a big deal until there was a whole discourse on sort of rationalising health services…"* (Professor)

> *"…the Black Report was due to the fact that people said at that time, 'we've had around 25 years of the NHS, and health inequalities are just as wide, why is this, why didn't the NHS reduce health inequalities? …"* (Professor).

Whitehead (2008) also mentions the role of "*professional advocates*" [24] (p.487), the "*intense professional pressures from health-related bodies and medical journals*" [24] (p.483), which, in combination with a number of solid reports, and the other actions [28], raised further awareness and interest in HI. Subsequently, The Black Committee was set up, to assess national and international evidence on HI, and draw-up policy implications [15]. The report accumulated evidence, which confirmed the existence of HI, and showed the clear link between health and social position [25]. These findings sparked an interest in HI, and growth in the HI research field, both in the UK and abroad [3,14,15,29].

Another example of **M1** at the political level, is in 1997, when HI were once again 'recognised' as an important issue and placed on the national political agenda by the New Labour (moderate social democratic party) government at the time [3,20,25,30,31]. The government commissioned an Independent Inquiry into HI, the so-called 'Acheson report' [32], which provided a comprehensive up-to-date synthesis of the HI scientific evidence and recommendations, mainly consistent with those of the Black Report [3,25]. During this time, political commitment towards addressing HI was said to be strong [31], which created favourable HI research conditions, such as an increase in dedicated research funding for HI research [25]. For example:

> "*... New Labour in 1997, they came into and wanting to confront those issues and wanting to tackle inequalities,*

I'm not sure it succeeded entirely, but at least it had the effect of putting that on the agenda." (Professor).

A third example of **M1** at the political level, is in 2010, when the New Labour government commissioned the English review of the Social Determinants of Health (SDH), (also known as the Marmot review) building on from the World Health Organization´s Commission on Social Determinants of Health. The aim was to compile the evidence on HI, and its recommendations also built on the Black and Acheson reports [23,33].

Interestingly, however, evidence also suggests that the lack of recognition and concern (or even denial) about HI, particularly at the political level during the 1980s and 90s [11], was important to stimulate the generation of HI research. By the time that the Black Report was published in 1980 (despite having been commissioned by the former Labour Government), the Thatcher Conservative government was in power, and was not keen to acknowledge the evidence or recommendations presented to them [3,20,34]. As Margaret Whitehead mentioned during the Witness Seminar of the Black Report:

"… *the Government at the time was very sensitive to any criticism of their policies on the health side, and they saw the inequalities issue as a direct attack on their policies, so they were very keen to counter any of those arguments"* [35](p.164).

However, the way in which the Conservative Government released the Black Report, dismissed its findings, and refused the evidence on HI, triggered outcry by the public health community, and top medical journals, as well as intrigue from the media [3,14,18,34,35] (e.g. **M1**). For example:

> *"The publication the Black Report in 1980 was absolutely pivotal… its fame was fuelled by the fact that the government tried to bury it, and when it couldn't, it tried to discredit it…that was like a red rag to a bull as far as the medical professional was concerned… and The Lancet and the BMJ… there was a feeling that it was being somehow pushed under the carpet, so as soon as journalists got wind of it, they thought 'oh there's a story here, you know the government is trying to hide it', so that helped circulate it."* (Professor).

Strong evidence suggests that the Conservative Governments negative reaction also 'incentivising' certain individual to act (**M2**) [3,23], and throughout the 80s and 90s, while the Conservative Government was in power, there was a socio-political-scientific struggle for recognition for HI, and to prove that they existed [10,36] (**M2**). For example:

> "*… back in the 80's, there was a real attack on any idea that health inequality was real, and a lot of us spent a lot of time on this … it's much, much less political than it was*

> *in the 1980s… we had a big struggle to prove health inequalities exist…"* (Professor).

> "*…as a result of Thatcher's suppression of the health inequalities discourse… It sort of went underground, but equally true, it flourished outside the* [central] *government public sector… there were lots of Labour local authorities that produced what we used to call 'local Black Reports*'*… and the third sector…* [all] *working together to keep the flag flying, and the concept alive"* (Lecturer).

In addition, during the Witness Seminar of the Black Report, John Fox stated:

> "*The governments disapproval motivated a lot of people. There was an area that needed to be researched, I think there were attempts at the time that the Black Report come out to address the different explanations. There was a lot of discussion about alternative explanations. And I think that promoted a lot of different research to help to address those issues.*" [35] (p.168).

Furthermore, evidence suggests that the media, and certain academic journals have been important to facilitate the HI discourse and research production over the years [18,29], due to their *"…recognition of the importance of the issue"* [18](p.28), and acceptance to publish (e.g. **M1**)[3,18,28]. This likely assisted to circulate or 'diffuse' HI

ideas, which then got 'picked up' by others [7,11,18], and activated **M1** at the societal and scientific level. For example:

> "…*when I first started doing research on health inequalities…* [people] *didn't know whether they were higher at the top or bottom… then all the little bits of research on poverty and health, unemployment and health and so on… 10-15years later you could talk to people at a bus stop … they'd ask what are you doing… you'd* [explain] *and they would say 'what's the point, isn't it obvious?' and that was such a huge change. I think that was done though little bits and pieces, over time, by little bits of research coming out in the media* ... [creating] *a common sense that hadn't existed earlier."* (Professor).

Mechanism: M2: Sense of moral responsibility to act

Interviewees were asked how important they thought individual and/ or institutional values have been in the development of the HI research field in UK over time; all responded that they mattered, particularly individual values. For example:

> *"It's very important, the values, because otherwise researchers who don't have that feeling and passion, will just go where the money is… I mean now it is more fashionable than it was* [HI research], *better funded than it was, in this country anyway, but still it's not where the big*

grants are… so it definitely attracts people who have certain values and views." (Professor).

"*Certainly, all of my research has been driven by my values… and my commitment - personally and politically- to social justice. So I don't think my research is biased by that, but its driven by that… and I think that it's probably the case for anyone in this field. I just think that some people are more explicit about it than others … for me, health inequalities are profoundly political…You can de-politicise health inequalities in a research frame… but you can´t de-politicise the issue really…"* (Professor).

The 1980s and 90s, it was difficult to obtain funding for HI research, and it was said to have been '*a lonely time'* for those HI researcher who decided to '*stick it out'* [37], and whose work was under heavily scrutiny [29]. The presence of strong individual (egalitarian) values might partly explain why some remained so committed to working in this research field, despite these unfavourable conditions. Several interviewees also stated that they thought that individual values, combined with different disciplinary perspectives combined, and other factors, have been important to produce different types of HI research. For example:

"*…there are researchers who would focus more on the psychosocial explanations, and there are researchers who would focus more on the social-material conditions, and*

would maybe have different values around that ... you get these very deep and personally felt controversies… I'm sure there is a whole mix of the biographic, i.e. the psychological and the political, and the two are probably entwined." (Professor).

"*Most people studying health inequalities… identify themselves as left-of-centre, but then there is a really big difference between how left-of-centre, and who they see as their allies … those kind of personal relationships have an impact on how the field is shaped… there's political and ideological, and kind of value based things that everyone is bringing to the field, but they are also bringing their disciplinary training, and their personal likes… and all of those things interact...."* (Professor).

However, some evidence suggests that **M2** may not activated by all academics working in this research field, all of the time; there may be other professional motivates at play [18]. For example:

"*I've always been left wing, and worried about social justice, but being more honest, the real reason I did so much work on* [it] *was just that the data was good…"* (Professor).

"My concern started with scientific interest, 'gosh look at this, this is interesting, I wonder how we explain that'… it

didn't start with strong political commitment... it's not like my politics lead me to do research on health inequalities… my political commitment grew strong the longer I looked at the evidence, the more I did the research...when I was younger, I was just more interested in doing the research." (Professor).

"*…I think that there was a period in which health inequalities looked like a way of creating territory, that you could then get a job in*…" (Professor).

Mechanism M3: Stewardship for HI research

Evidence suggest that individual and institutional stewards have played a key role in generating HI scientific production, and in creating an enabling HI research environment. In terms of key certain HI scientific leaders in the field, for example:

"*Oh it will be a story of individuals… a couple of plucky individuals who would have plugged away* …" (Professor).

"*…there have been some really key figureheads, who have set up institutions and they've attracted a lot of funding, got a strong reputation, and there's been people who have been training through them"* (Professor).

Other interviewees emphasised the role of certain academic institutions, due to their history and strong tradition within certain

cities, which have likely attracted certain individuals to work there, and that have had access and control to certain key datasets (such as the birth cohorts, linked to **M5**). For example:

> *"Some of it is the more disadvantaged cities…* [also] *Liverpool* [for example] *… it's very proud of the fact that the city council appointed the first Medical Officer of Health in the country, and then the rest of the country followed, and he was very active in advocating for Public Health, so … Liverpool has always felt that it's had a tradition to uphold, and I think that Glasgow is the same*." (Professor).

> *"I think that institutions or centres within institutions that have either unique or special access to key data are well positioned... For example, UCL holds the '46 and 58, and 70s, and also the millennium cohort study, so those are extraordinarily resources... So I think there is a kind of science bit, but I also think that the politics of the city is really important, and Glasgow and Liverpool are absolutely sort of centre stage in that…maybe that gives them a counterweight to the London strengthens. I guess it's a combination of the history of the city, and the access to datasets."* (Professor).

> Interviewer: *"And you don't think it's to do with individual researchers as well?"*

> *"I don't know. I'm sure lots of other people would say it's the individuals. I think that maybe the individuals are drawn to cities that have a strong social history or politics. I am not a great believer that science is created by individuals, I think it emerges in particular contexts that are rich for certain sorts of research to develop".* (Professor).

Evidence also suggests that the UK has had a lot of national research funding institutions that have played important roles in stewarding HI research, at certain points over the past few decades, as well as investing in HI research infrastructure (see more examples under **M4** and **M5**). Such as the Medical Research Council (MRC), the Economic and Social Research Council (ESRC) [3,25,29,37,38], and the National Institute for Health Research (NIHR) in England, which was developed in 2006 by the Department of Health [39–42]. For example:

> *"I think the establishment of the NIHR in 2006 in the UK, or at least in England, with certainly implications for the whole UK… within the NIHR, there are about half a dozen programmes that people can potentially go for if they are interested in health inequalities… and if you think of all the pin-offs, in relation to the School of Public Health Research…the investment in applied research collaborations, Public Health England funding research…*

you've [also] *got the academic health science networks …"* (Professor).

However, these national research funding institutions have mainly acted as HI research stewards during supportive political climates, which highlight the political nature of HI research funding [7,18,20,22,37,43]. For example:

> *"…a large chunk of the government funding comes through NIHR, through government sources, and that research agenda… so there is a kind of clear link between the political climate of the day and that of the type of research that gets funded…"* (Professor).

Mechanism M4: New resources to strengthen HI human resources

Over the past five decades, there has been a range of MRC and the ESRC funded initiatives that have provided new resources to strengthening HI (particular human resources) research infrastructure in the UK (e.g. **M4** and **M5**), which have helped to strengthen the understanding and production of HI research [3,25,38]. For example:

> "*…you can actually tract some funding from research councils that will have doubled the number of researchers in that area… Having the research council funding for PhDs is essential*…" (Professor).

"*ESRC… decide*[d] *to fund a big programme and they decided to do that shortly before we had a* [New] *Labour government… that made clear commitments to reducing health inequalities… and there were a lot of people who were trained during that programme...* [also] *there have been specific initiatives from the ESRC to train people in more kind of 'more sophistically quantitative' approaches at various points, and health inequalities researchers have kind of connected to that…* [which] *have been developed in quite a strategic, conscious way...*" (Professor).

"…the ESRC got the health variations programme going…in terms of capacity building it was very enormously successful… [also] *the MRC set up a 'health of the public' initiative which was pretty much the same…and then obviously the millennium birth cohort study was founded, and once you've got something like that, then you get a kind of gravitational pull of early career researchers who want to work on it for their PhDs… So I think it's a combination of investment in research infrastructure, and then these grants which really provide stepping stones for early career researchers"*. (Professor).

In addition, to various Masters programmes, and Doctoral fellowships, and dedicated research groups within Universities. For example:

"*Training programmes are really important, and the dissertations that students do kind of wet their appetites and thinking…*" (Professor).

"There are a few senior figures, at various points they will have done some teaching, some PhD supervision…probably been involved in setting up courses, so then you get institutions settings up courses and programmes, specially focused on health inequalities… [also] *people who are recognised for having expertise in an issue, attract PhD funding and PhD students who want to study an issue, as then you are training..."* (Professor).

"…Universities also respond on mass to where the funders are putting the money. So if they legitimise the studies, by doing calls and funding different groups then the universities will recognise those groups and support them." (Professor).

A few interviewees also mentioned how supportive academic career structures that were in place several decades ago, also assisted the local production of HI research, even in the absence of political and research funding support. However, these structures have since changed, which raises concern for the sustainability of the current strong HI human resource capacity at national level. For example:

"...in terms of universities, they were in a better position than they are now to just continue to employ people who had tenured posts and who might have an interest in a subject that was not popular, and which didn't get research funding at the time. So obviously sometimes people could apply for research funding for a topic that wasn't explicitly about health inequalities but it was on a related topic, they were able to do that. Now of course, virtually academic tenure has been abolished and there is pressure on all academic staff to publish large amounts of articles each year and obtain research funding… so if it happened again now [the political and academic context of the 1980s-90s], *it would be much more difficult for academic institutions to support people.*" (Professor).

In addition, to the five-year Faculty of Public Health training programme which forms part of the NHS, all of which had a focus on HI [44]. For example:

"The Public Health training programme in the UK… [is] *a large investment in a five-year programme… its traditionally been a kind of medical programme… but also because it's been open to non-medics, it means that it is actually a much broader set of expertise… It's very much framed around health inequalities… it generally takes that as its starting point, the historical work that has been done around health inequalities...there are basically advocates*

for that approach in every area across the whole country" (Professor).

Mechanism M5: New resources to strengthen HI technical resources

There has been a strong tradition of recognition of HI in the UK, since the 19th century, with the development of the Registrar General decennial censuses in England and Wales, and the work of William Farr, which introduced the classification of causes of death [45,46]. In the early 20th century, THC Stevenson incorporated social class (e.g. occupation) into the official death statistics, which led to the Register General's Social Class (RGSC) schema, and a long series of reports of social class inequalities in health, which lasted into the early 21st century [23,46–48]. All of which has stimulated, and enabled a large body of HI literature to be produced [25]. For example:

"Some of it is to do with the foresight of some of the people who set up some of the national data collection… the first census was 1838, and almost at the last moment they decided to add age and occupation to the death certificates, and that actually allowed you to do all sorts of things… so we were one of the few countries that actually had some measure of social class attached to the official births and marriages and deaths, so that was very fortuitous and farsighted of them to do that, but they were extraordinary social reforms as well... every 10 years the Register General does a social class analysis of all the data –

the decennial supplements, and from the very beginning, they are powerfully written documents..." (Professor).

Also, the UK Office of National Statistics developed the Longitudinal study which linked census longitudinal data to mortality [49], and the British Regional Heart Study [18], and the Whitehall studies were set up by various grants [25,50]. In addition, various MRC and ESRC funded initiatives have strengthened health and socio-demographic (e.g. HI related) technical resources through the country [3,25,38]. In addition, there have been the British birth cohorts, which were created via bottom up foresight and pressure, and top down investment [51], which have enabled more explanatory models of HI to be proposed (e.g. the psych-social stress at work, social isolation and life-course perspective/approach) [14,25]. For example:

> *"I think there has been an enormous farsighted investment in datasets. Like some of the different birth cohorts that have been set up in the UK, fantastic longitudinal studies; that sort of infrastructures and resources and data that goes back a long way, and that requires investment over many decades to maintain it… and support for all sorts of people to use them… actually they are officially called the national treasures, so some people house the national treasures. So nurturing those is really important*." (Professor).

"… the birth cohort studies I think is the kind of unique bit of the UK infrastructure. It was all very accidental, and it was people working really hard to try and keep, get the money for the next wave…they got the '46 money, and then they said 'right, we need to raise some money to go back', so it's been a wave by wave process... these things came together by good will and tenacity, so I don't think the government had this overarching strategy, I think its scientists pushing very hard and Research Councils responding, and realising that…So I don't think it's a strategy, I think it's been very much a bottom up pressure.... [this] *creation of incredibly rich data*." (Professor).

Mechanism M6: Cognitive social capital

The formation of informal and later by formal research networks, have been extremely important to support HI researchers and act as sources of news ideas, sharing and exchange knowledge and resources, and build cognitive social capital (**M6),** which have led to the (co-) production of new HI research [13]. During the Black Report Witness Seminar, John Fox mentioned that during the 1980s and 90s, *"…lots of people* [were] *supporting each other, strong networks* [were] *building up, which didn't exist before that time"* [35] (p.168). Also, for example:

"*…it was probably '76… I always remember thinking that we had a kind of telephone community, and because we all*

had shared an interest in social justice, we could ring each other up with questions and so on, and always know you would get some help, and people, we were always of course reviewing each other research proposals and papers and so on…" (Professor).

"Informal networks, I think that that's really important… both within countries and between countries, it gives people the academic support, the intellectual support and the personal support … to continue to do the research over four decades, when over that period, you get these massive shifts in the political climate". (Professor).

"*…the informal stuff is really important… I do think the formal networks kind of catalyse informal connections, connections of trust and respect, and it's those then that then become the kind of stepping stones to closer collaborations.*" (Professor).

In addition, the UK has a strong tradition of integrating different disciplinary perspectives and approaches to study HI. For example:

"I think having a health inequalities research tradition that is open at its boundaries to social science has been incredibly important. So in the UK context, the overlap between social inequalities research and health inequalities research…and in the interest in class, and

how inequalities and class are reproduced over generations. I think has been probably an under-acknowledged resource for health inequalities research" (Professor).

"I guess a lot of the strength of UK research has come through people working… across disciplines and sharing expertise, and synthesising their approaches… maybe that kind of public health tradition has helped to have a more, interdisciplinary approach..." (Professor).

All of which seems to have been important to strengthen the local and national capacity to conduct HI in the UK, over time, and to advance the study of HI.

Discussion and conclusions

This study provides in-depth insights into why and how the UK has produced a high volume of HI research over the past five decades. We tested our six theoretical causal mechanisms, and found evidence that supports the hypotheses that they have been activated by a combination of key contextual conditions, and individuals, during different moments over the past 50 years, and have been involved in generating a high volume of HI scientific research in the UK

While there was some research on HI during the 1970s, in the UK, the local HI research field was not really established until after the publication of the *Black Report* in 1980 [3,15,21,25]. The report provided strong evidence on HI, and proposed different explanatory models for HI, which guided subsequent research to explore this ideas further [14,15,23,25]. Scientific debates over HI, and their root causes, have existed since the 19th century [3,16,25,29,52]. Scholars consider that this debate is due, in part, to the different disciplinary perspectives, professional training and intellectual traditions that different individuals, and groups, bring to the HI research field [27,34,53]; as each perspective frames the HI problem differently, and provides different accounts of their causes, which makes it challenging to reach consensus on which research findings to follow, and which political approach to take to try to address these inequalities [3,13,16,25,34,53,54]. However, the tradition of integrating diverse disciplinary perspectives to study HI in the UK, has also assisted to create novel research, and strengthen our understanding of HI over time.

During the UK´s Conservative political period of 80s and 90s, Whitehead [24] characterizes the diffusion of HI ideas as '*confrontational*' [24], where '*political confrontation* [was] *met with denial'* [24](p.481). Scholars mention how "*...egalitarian ideas disappeared from public debate and those with a strong sense of justice became – in effect – closet egalitarians...*" [19](p.298). Availably of research funding to study HI was also extremely limited [37], and there have been claims that the Conservative government attempted to suppress official reports which presented evidence on HI, such as the *Black Report* in 1980 [35], and the '*Health Divide'* in 1987 [3,35], as well as some official data to prevent further research on HI [14,15,18,55,56]. Despite the hostile (socio-political and research) environment, some HI research was still produced during this period. Our findings suggest that this controversy around the *Black Report´*s publication, and the lack of official recognition of HI, and related evidence, in fact fuelled some of this scientific production [5,11,25,27,57]. There appears to have been an persistent underlying 'struggle for recognition' of HI [25,27,35,36,57], mixed with heightened concern (**M1**), which consisted of certain motivated individuals and groups, with strong egalitarian values, who persevered in their efforts to prove that HI existed, and try to address them (**M2**). Previous research also identified that many individuals working in HI research and policy in the UK "…*frame health inequalities as a moral issue around which urgent action is required*" [58] (p.82). Garthwaite et al [54] identify different types of HI researchers within the UK, who use different perspectives approaches, which *"...seem to relate to deeply held epistemological and ideological positions"* [54](p.475).

Our findings also allude to the presence, and importance of other 'professional interests' which might motivate some individuals to enter this research field at certain points, particularly when the topic becomes 'fashionable' and a political and research priority. This is in line with previous research, which suggests that scientists view themselves as competing with one another for access to resources, credibly and territory [18,54,59–61].

After the 1997, with New Labour in power, there was strong shift in political focus towards addressing HI, although mainly towards the so-called downstream, individual-level determinants of health and HI [31], and a mandate for 'policy-relevant' evidence to be produced [31]. Whitehead (1998) characterized the diffusion of HI ideas during this period as '*pragmatism*' [24] (p.480). The National Research Council´s and research funded subsequently placed HI as a priority research area, which translated into the provision of more funds and resources to strengthen HI research capacities (**M4-M5**), and to generate HI research. [13,41,42,62], This fuelled the production of HI research, although with a strong preference towards research focused downstream [25,31,38], causing some scholars to raise concern over this predominant policy and research focus on 'lifestyle drift' [54,63,64], and the "…*limiting opportunities to study the impacts of macro-level policy changes*" [54](p.473). Evidence emphasises the influential roles of politics and research funding, in shaping the production, and use of HI research, as well as the type of HI research [7,13,18,25,38,54,61,64], and the need to evaluate the socio-political context in which HI research, and research priorities are planned and implemented [13].

The UK has a unique and strong tradition of recognition and foresight to have systematic, available and reliable health and sociodemographic data to produce evidence on population health and HI [3,23,25], which has greatly enhanced our understanding of HI [3,25,51]. We also identify a number of stewards for HI research in the UK, both committed individuals and groups, and supportive institutions (**M3**), which have helped to strengthen the local HI research infrastructure over time (**M4-M5**). In addition, the formation of informal and formal research networks have been important [18,35], particularly informal networks at the beginning, which appear to have been formed through aligned perspectives, and individual (egalitarian) values, amongst other things, which has helped to build trust, solidarity, and cogitative social capital (**M6)**. Interestingly, new public health funding initiatives, such as the MRC UK Prevention, Research, Partnership programme [65], recognise the importance of strengthening transdisciplinary research networks to establish new perspectives to address complex issues, with a strong focus placed on the upstream determinants. The programme supports existing research networks, but also actively fosters the formation of new one. Hopefully, such initiatives will assist to address concerns about past efforts being excessively focused downstream [54,63,64], and led to new effective ideas on how to reduce HI.

This realist explanatory case study provides valuable insight into the UK´s experience of produce a high volume of HI research, and the type of HI research capacities strengthening activities that have occurred over time. These findings may or may not be generalizable to other similar settings; however, case validity and case logic were the

main aims, rather than generalizability [10,12,66,67], as well as to establish an in-depth contextual understanding [12]. To enhance the study's rigour, and the validity and credibility of findings, we provided comprehensive justification for our case selection and initial theoretical causal mechanisms to test, in line with previous literature and theories [5,10], and we use data triangulation to test and confirm our mechanisms [10,68] (see study protocol [10] for further details). Given the novelty of this work, we only tested what we considered to be main mechanisms. Future research should explore other secondary or tertiary level mechanisms, evaluate the capacity to produce HI scientific research in other global settings [10], as well as evaluate why and how different types of HI research have been produced, in different settings, during different time periods. This knowledge could be used to guide future strategies to strengthen HI research capacities, and support the development of innovative research ideas, and strategic action on HI.

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ARTICLE 5

Why and how the city of Barcelona has become a health inequalities research hub? Realist explanatory case study to test six casual mechanisms.

Why and how the city of Barcelona has become a health inequalities research hub? Realist explanatory case study to test six casual mechanisms. (In preparation).

Why and how the city of Barcelona has become a health inequalities research hub? A realist explanatory case study to test six causal mechanisms

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Abstract

Background: Despite growing evidence on health inequalities over four decades, global efforts to strengthen the capacities to produce research on health inequalities are needed to inform effective interventions. Yet, what determines the capacity to produce health inequalities research in different social contexts? How can these capacities be strengthened? To answer these questions, an in-depth understanding of the historical, social and institutional processes that generate health inequalities research in different contexts is needed. A recent bibliometric analysis of health inequalities research (1966-2015) found striking research inequalities by countries and global regions. The study found Spain to be the 10th highest global contributor to this research field. Yet, we established that a significant proportion of this production (approx. 45%) is concentrated and affiliated to a few institutions based in the city of Barcelona, making it? a potential health inequalities research hub. Our aim is to understand how and why Barcelona has produced so much scientific research on health inequalities over the past four decades, and what main causal mechanisms have been involved.

Methods: We conducted a realist explanatory case study to test six theoretical causal mechanisms, and establish key contextual conditions that might active them, to generate a high volume of health inequalities research. Our approach includes a historical perspective, and triangulation of data from semi-structured interviews with key informants, and scientific and grey literature reviews.

Results: Strong evidence supports our hypotheses on the six causal mechanisms involved: Recognition with concern; sense of moral

responsibility to act; stewardship for health inequalities research; resources to strengthen health inequalities human resources; resources to strengthen health inequalities information resources; and, cognitive social capital.

Conclusions: Valuable learning can be established from Barcelona's experience. These findings may or may not be applicable to other similar contexts. More research is needed to investigate these processes in different settings.

Introduction

Since the 19th century, visionary public health professionals have been studying what is now generally known as the social determinants of health, and identifying and demonstrating the existence of health inequalities (HI) (i.e. avoidable systematic unjust differences in health outcomes) within and between communities and countries [1–3]. Particularly over the past few decades, there has been notably growing evidence on HI, as well as the type of analyses, useful not only to describe and understand the problem, but also to inform effective strategies, interventions and action aiming to tackle HI. In addition, there have been increasing efforts aimed at understanding and strengthening the capacity to produce research, to be used to improve public health and health equity [4–6].

A recent bibliometric analysis of the global HI scientific research (1966-2015) found a number inequalities within this research production by countries and world regions [7]. Scientific research output provides a proxy indication of research capacity [4,5], therefore these findings raise a number of significant questions, such as: Why

and how some countries, regions or cities produce more research on HI than others? What determines these different capacities? How to strengthen these processes to generate more country-specific HI evidence, to potentially inform effective action to improve health and health equity? [4,5,8]. To attempt to answer these questions, in-depth analyses of the HI research production process, in different settings, are needed [5], yet there is currently limited global evidence on this.

The same bibliometric analysis on HI research found Spain to be the 10th highest global contributor to this field, with a 1.83% proportional co-authorship contribution to global HI scientific production [7]. In an analysis of the HI scientific production by institutional affiliations, we observed that a large majority of articles produced in Spain (approx. 45%) are affiliated to a small number of institutions based in the city of Barcelona, making the city a potential research hub for HI [8]. Another bibliometric analysis examined the volume of HI articles published by author [9], and found that three of 20 most productive authors in the HI research field (1966- 2014) were from Spain, two based in Barcelona, the Barcelona Public Health Agency of Public Health (ASPB acronym in Catalan), and Pompeu Fabra University (UPF acronym in Catalan), and one from Madrid [9]. These additional findings raise further research questions e.g. why and how do some institutions in specific cities produce such a high level of research on HI compared to others within the same country?

We aim to establish an in-depth understanding of why and how the city of Barcelona has produced a high volume of HI scientific research over the past four decades, and to iteratively identify some of the main causal mechanisms which might have been involved, and the type of

contextual conditions that have potentially activated these mechanisms [8]. This type of knowledge tries to understand more specifically 'what works, how, under which conditions, and for whom' [10], by providing valuable 'black box causal' research insights [5,8]. This approach can also identify some of the HI research capacity strengthening activities have been successful in this setting, over time.

Methods

The study design is a realist explanatory case study, with semi-structured interviews with key informants, and this data has been triangulated with scientific and grey literature reviews. We selected our unique case of interest (i.e. a high producer of HI research) based on recent bibliometric analysis results [7]. Following Pawson and Tilley´s [10] methodology to conduct realist evaluation inquiries, and Shankardass et al. [11]´s methodology for realist explanatory case studies, we developed a Context + Mechanism = Outcome (CMO) configuration, and an guiding conceptual model, informed by previous conceptual models and literature [8,12], to simplify the complex process (i.e. HI research production) down to its essential core of attributes [11]. This helped to articulate the key combinations of components, agents and factors, embedded in specific historical, political and institutional contexts (C), which interact over time and activate certain mechanisms (M), and might have contributed to the outcome of interest (O) [10]. Through the development of this case study, we aimed to test six theoretical main causal mechanisms involved (M1-M6), and refine them based on our findings [8,10] (see

Table 1). (See study protocol [8] for more details on the case study design).

Table 1: Six theoretical causal mechanisms tested during our realist explanatory case study in Barcelona.

Initial theoretical causal mechanisms (M1-M6)
M1: Recognition with concern
M2: Sense of moral responsibility to act
M3: Stewardship for HI research
M4: Resources to strengthen HI human resources
M5: Resources to strengthen HI information resources
M6: Cognitive social capital

The aim of the semi-structured interviews was to establish precise information on how HI research initiated and developed over the past four decades. Study participants were selected and invited for interview if they met the following inclusion criteria: i) a senior researcher working (or having worked) in Barcelona, of any gender, and ii) have produced some level of research on HI, whilst working in Barcelona during the last four decades, and would therefore have some understanding of the evolution of public health, and HI research, and the social and technical environment, in Barcelona, over the past four decades. These participants were identified from the bibliometric analysis findings [7]. Due to the small sample size, a number of other

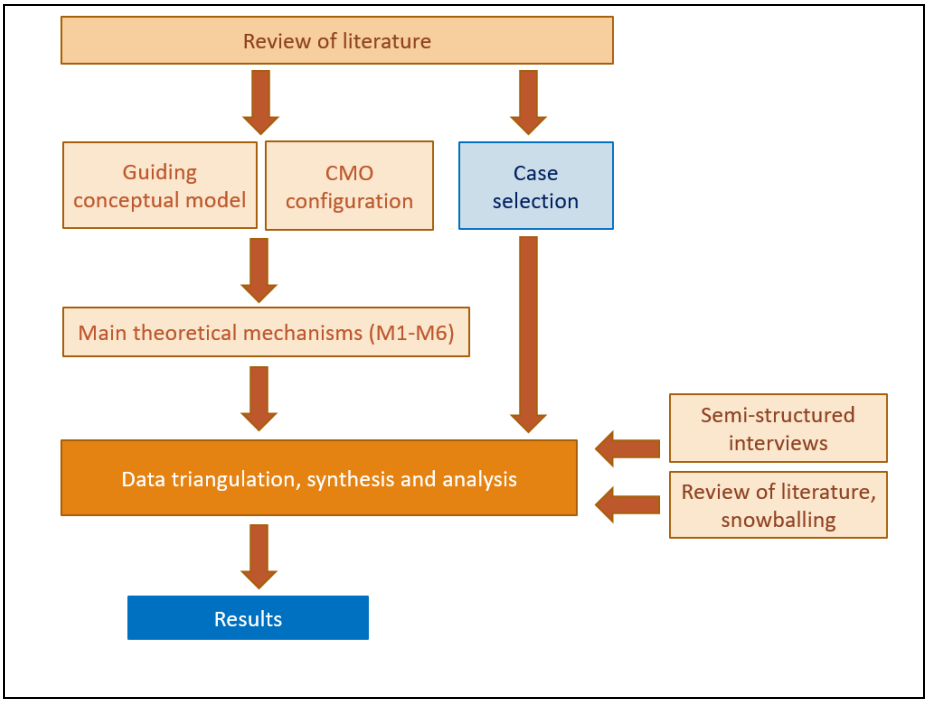
study participants were selected and invited for interview who had worked in health research at some point, and from their research focus and experience, would also have a good understanding of the evolution of public health research, and HI research in Barcelona, over the past four decades. In total, 10 interviews with key informants were conducted until we attained thematic saturation [13]. Most of the interviewees were male (n=9); had a Doctoral Degree (n=9); had a Medical Degree (n=8); had worked at ASPB at some point over the past 40 years (n=7); had been trained in Public Health Research (n=8) and had University teaching positions in Barcelona (e.g. Full Professor, Associate Professor or Lecturer) (n=8). Given the sample size, we do not provide further details to preserve participant anonymity.

Interview questions were developed in line with our guiding conceptual model and supporting literature [5,8], tested in a pilot interview conducted by two of the authors, and then adjusted accordingly to establish the core set of key questions for the rest of interviews. Participants were asked about their professional background and their initial motivation for working in the HI field to establish their positionality (as appropriate). They were also asked about their perspectives in order to raise clues and knowledge to understand why and how Barcelona produced such a high volume of HI research over the past few decades in absolute terms, and in comparison to the rest of Catalonia, and Spain. Interviewees were not asked directly about the specific mechanisms (M1-6) being tested.

In line with ethics approval, participants signed an informed consent form prior to their interview. All interviews were conducted by one

author, in either English or Spanish language depending on the interviewee's comfort. Eight interviews were conducted in person, and two by teleconference and email exchange. All interviews were audio recorded, an author was responsible for transcribing and translating the audio recordings, which were double checked. All data were anonymised by the removal of any personal information that may reveal their personal identity. The original and anonymised data (audio and transcripts) were stored separately in secure encrypted external hard drives, that only the research team have access to in order to perform the analysis. To ensure validity and credibility of the research findings, data from the semi-structured interviews was triangulated with in-depth selective scientific and grey literature reviews to identify relevant documented evidence, as well as through a snowballing process. One author coded the data using Microsoft Word 10, and thematic content analysis was applied to all the texts to identify recurrent themes [8]. Evidence from the various data sources was then synthesised, examined and interpreted, and any discrepancies were discussed between the authors, until consensus was reached. Figure 1 summarises the case study design.

Figure 1: Realist explanatory case study design flow diagram



Results

We found supporting evidence to confirm that all of the theoretical causal mechanisms **M1-M6** have been activated under different contextual conditions, across different time periods, and have contributed to the generation of local HI scientific research in Barcelona.

Mechanism M1: Recognition with concern

Evidence suggests that Barcelona has a long tradition of social medicine, public health and hygiene, and medical geography, which includes recognition of HI [14,15], and strong local egalitarian values

and political ideology, which have been important pre-existing contextual conditions to activate **M1** [14]. For example:

> *"…the actual existence or recognition of the problem is prior to all of this development. So the recognition of inequalities as a problem in society … we could go back to moments before the civil war probably, because there is a wealth of, especially in the anarchist way, of thinking about hygiene and inequalities and the distribution of health services…"* (Public Health Consultant).

Focusing on the last half a century, Spain was under a military dictatorship from 1939 (the end of the "civil war") until 1975 when Franco died, which sparked a political transition and a number of political-economic and social changes to the country as a whole [16]. The first democratic elections took place in 1979, and in the 1980s a decentralization process created 17 regions or 'autonomous communities' with their own political institutions and different degrees of legislative and executive powers, which included the 'transfer' of political competences and attributions [16,17]. In the 1979 democratic municipal elections, the Barcelona City Council was governed by a succession of coalition Left wing parties led by the *Socialist Party of Catalonia (PSC-PSOE)* until 2011, and then again from 2015 onwards [17,18]. Evidence suggests that in the 70s and 80s, there were high levels of recognition and concern about public health and social justice issues in the city, at the individual and political level (**M1**) [19,20]. For example:

> *"I think there was a lot of activities in the '70s, there were a number of what I would call social movements during the late Franco regime phase…* [also] *in the '60s, there was huge migration from* [other parts of] *Spain, to the industrial centres…that created a lot of ghettos or slums in the cities with appalling conditions, and it became very clear for a lot of practitioners at the time, that that was a problem that had to be dealt with…"* (Public Health Consultant).

> "*I think we should see any scientific production in the context, historical, cultural and socio-economic context…There was a group of students in the medical college ...we were active in politics, we were in the left spectrum of politics… in the Left parties there is a tradition of concern about health inequalities… and we were concerned about after the dictatorship, how health was going to have a role…"* (Public Health Professional).

The Barcelona Municipal Institute of Public Health (which later changed its name to ASPB), led several public health programs which included the need to address HI, and in 1984 the primary health care reforms began in the most disadvantaged districts of the city [17,21]. This activation of **M1** at the scientific level, contributed to the initiated of the HI research field in Barcelona (and in Spain) in the 1980s [22,23], potentially by creating changes in behaviours and

actions towards addressing HI [20]. The early analyses were carried out to understand mortality and morbidity in the city districts, some of which were evaluations of the public health programmes which identified geographical inequalities by city districts [17,20,24–28]. For example:

> *"We started with just descriptive* [information] *because we didn't know anything. At the beginning, we were just trying to understand why Ciutat Vella* [The old district of the city] *had more mortality."* (Manager, Public Health Institute).

> *The interest in inequalities was initially natural, and then because some of our programmes were oriented towards reducing inequalities, then just the natural interest in evaluating our own work resulted in papers… those of us who were there at this time, developed this ethos, that it was important to mix research with practiced…"* (Manager, Public Health Institute).

All interviewees, and the early HI research produced locally, referred to the influential role of international HI research in Barcelona, around this time [20,24–27], specifically the 1980's Black Report on HI [29,30], and other studies in the UK [31,32], and the United States (US) [33]. Sir Douglas Black, who led the UK Black Report, was even invited to give a public lecture in Barcelona, by the Institute of Health

Studies (IES, acronym in Catalan), part of the Catalan Government [34,35]. For example:

> "*The topic of inequalities in health was practically imported by a couple of people…who went to the UK…at the time when the Black Report was produce…this had quite an influence."* (Manager, Public Health Institute).

> "*My mantra at that time…was the Black Report, it was very present in our minds…"* (Professor).

> *"Douglas Black was here in 1983... paid by the IES ... it was an open lecture for health professionals and officials... that was an important gathering…"* (Public Health Consultant).

A more recent example of activation of **M1** at the societal, and then political level, has been the '15M' or 'the indignados' movement, which emerged after 15th May 2011 in Spain [18,36,37]. This is considered to be the *"…biggest episode of social unrest* [in Spain] *since the end of the Transition in the 1970s*" [36] (p.136); many (especially young) people were protesting in the streets, criticising the neoliberal capitalist model, austerity measures, precaritization of work and lives, and increasing inequalities [36,37]. For example:

> *"...economic crises always produce an interesting public debate, and always attract attention to the issues of*

inequalities, obviously, because they expand poverty, unemployment etc. The '15M' movement for example, was very important." (Professor).

"*…it was very strange for people to talk about social class, inequalities, I mean the general population, politicians, professions… after '15M' that changed completely, now everybody talks about health inequalities…"* (Manager, Public Health Institute).

In Barcelona, this was directly followed by a four-year period of privatization and severe cuts in the public sector, and the forceful adaption of austerity policies by *Convergència i Unió (CiU)* (a centre-right political party) who governed the city between 2011-2015, which were widely rejected by society [36]. This had a negative impact on HI research. For example:

"…the political will around those years was "well, health inequalities are important but it is not necessary to show them"; perhaps they didn't say it explicitly, but they didn't like our work. The four years with CiU, our work was censored …at that moment we had a big European project… we could do it, but we couldn't talk about health inequalities." (Manager, Public Health Institute).

However, *"…the 'spirit' of 15M permeated political, social and cultural life…*" [36] (p.12), cultivated social recognition and concern,

and gave rise to new progressive political alternatives such as *Barcelona en Comú* (the Catalan branch of *Podemos,* a left wing political party), which emerged from this movement. In 2015, they won the city elections and had included social and HI in their political agenda (E.g. **M1** at the political and social level) [18,37]. The new City Council boosted action on HI, and took several measures to work towards reduce inequalities [17,18,37], which included encouraging health equity-oriented evaluations, HI research, and the use of HI evidence to improve action on HI [18,37].

Mechanism M2: Sense of moral responsibility to act

Interviewees were asked about their perspectives on how important individual and institutional values have been in the development of the HI research in Barcelona over time; all of them responded that they mattered, particularly individual values, and in the early 1980s and 90s. At the time, (as mentioned under **M1**) there was a generation of politically and socially motivated doctors, epidemiologists and public health professionals who wanted to improve public health for all, which often involved working outside of their standard working hours, and expanding their technical training to ensure more rigorous research approaches were applied to their work each time (**M2**). For example:

> *"This was a very special period, passing from the dictatorship to New Public Health...we put a lot of hours in order to do research …we were very motivated, we liked it... we felt that our work was very important… our free*

time was used for work…but it was also a personal cost…" (Manager, Public Health Institute).

"… it was a generation that was committed, largely at the individual level, that was reasonability better trained than the previous one, that was reading, and trying to do new things… we were excited to try to somehow make things better." (Manager, Research Institute).

"…at the time of the political regime change, the development of public health was carried out largely by young professionals, with a high degree of left-wing ideological and political motivation, which implied a remarkable sensitivity towards the influence of social determinants of health… It was an underdeveloped area, where the new generations could make their way without much competition, although opening the way was not easy." (Professor).

A few interviews specifically referred to the different institutional values between different local and regional political institutions e.g. La Generalitat/ the Catalan Government, and the Barcelona City Council. For example:

"…*what happened with the* [World Health Organization's] *Healthy Cities Movement, locally* [it] *was taken seriously by the local* [City] *Council, while the Generalitat, being*

CiU, had a more hands-off approach because it was felt too communist in a way... I think a lot of it goes to, who holds responsiblites... the individuals who took over public health responsibilities in the Generalitat were less of that tradition, rather than the people who took over in [the City Council] *...although it is true that a political divide was present, PSC in the* [the City Council] *versus CiU in the Generalitat, I think there was also far more interaction between them in that field than what the official story tends to simplify*" (Public Health Consultant).

The interviewees who had conducted some HI research, were asked about their motivation to study HI; others were asked why they thought people worked in this field. All responded that individual (egalitarian) values, with the motivation to improve the situation, combined with the emerging need to conduct more rigorous, empirical research, and to publish. For example:

"...believing that health [inequality] *is one of the consequence of injustice in society,* [and] *that it's important to try to change it, that is why we started. It's very personal"* (Manager, Public Health Institute).

"...some type of ideology of willingness to change something.... a lot of it was work done outside of working times... also [the] *need to be more rigorous... publishing*

then became an important thing, to justify...and to demonstrate..." (Public Health Consultant).

Mechanism M3: Stewardship for HI research

Some evidence suggests that **M3** occurred at the individual level, by public health professionals who were based in the ASPB and acted local HI scientific leaders and stewards. Also, by individual civil servants in the City Council, working to address social and HI, and partly acting as leader and stewards of public health and HI research; for example, the role of Pasqual Maragall and Dr Joan Clos in the City Council. Maragall was Major from 1982-1997, and worked in urban planning, redesigning and reducing social inequalities in the city [38,39], Clos was responsible for health, before he became Major of Barcelona in 1997, and initiated a number of things to strength local public health services and research infrastructure at ASPB. Clos was also involved in the creation of the '*Spanish Association of Epidemiology',* and the associated peer-review journal '*Gaceta Sanitaria'* in 1987 (which had historically been a city health bulletin), edited by ASPB, which became an important tool for the public health community in Spain, and later internationally [40]. These actions created the right contextual conditions to activate **M3**, and **M4** and **M5**, and led to more HI research being produced. (See more examples under **M4** and **M5**). For example:

"I think there was a handful of people with good ideas, clear ideas, that created the conditions for it to exist…in 1979, Joan Clos was part of the Directors of the Health

division of the City Council, and then he became the Councillor of health, during this process he recruited a few very good, young people …they were reading the Black Report very carefully, and they began using it to guide the politics of health in the city." (Manager, Public Health Institute).

"*…the City Council played a role…* [with] *this idea of the state of the Public Health in the city… you also end up looking at individuals, but of course individuals appear and express themselves because of the situation."* (Public Health Consultant).

"*In the mid-80s, definitely the Municipal Administration, especially in the time of Joan Clos* [was a key moment] *... he was trained in Edinburgh, he did a Master's in Public Health there, so he had a little of the UK/ British approach to public health… among the different things, he started attracting a number of people who had been trained abroad… somehow there was a critical mass of people who had more or less been trained, largely in public health or in other disciplines, or self-trained, but who had a medical speciality in family and community medicine…*" (Manager, Research Institute).

Evidence also suggests that the ASPB has played a role in the stewarding of HI research, to some degree, during different periods

(**M3**). Officially and traditionally, ASPB is a public health practice institution which, prior to having an official research strategy on HI in place, provided a permissive or 'not strongly opposing' public health and HI research environment for several decades [18]. This 'allowed' employees to scientifically evaluate their work and open up new lines of HI research, alongside their work, although it was not actively promoted, and the political environment towards HI could be qualified as 'permissive' [18]. For example:

> "*Largely it's been an individual effort… in the mid-80s to early 2000s, largely the institutional effort* [in ASPB] *was not to make it difficult, but there was not necessarily a formal statement or strategic thinking about the role of research…I wouldn't exactly call it research, more good practice public health… we were not there to generate more knowledge, but to generate relevant knowledge for public health practice in the city…I think it was a conjunction of a political vision, but that was more of 'laisse faire' because 'these guys know what to do and eventually we'll see what we can use'…"* (Manager, Research Institute).

> *"…the majority* [of research funding] *came from external resources. It was our willingness* [to do research], *but also* [ASPB] *permitted us… they accepted it. They liked it. But that was all. 'You put in your time, when you finish your work you can do your research, and during the weekends*

you can do your research'..." (Manager, Public Health Institute).

However, in recent years, with Barcelona en Comú in the City Council, a 'political-technical co-leadership' for HI has developed within ASPB (**M3**), which resulted in an increase in resources allocated to address HI, and HI research [18] (See examples under **M5**).

Mechanism M4: Resources to strengthen HI human resources

Evidence suggests that during different periods, **M4** has been activated by a number of pre-existing contextual conditions, which include provisions of new (human) resources to first build a critical mass of doctors and epidemiologists, and professionals trained in 'New' Public Health research [3]. In the 70s and 80s, some resources were available to fund Masters degrees on Public Health abroad, as a result several of these beneficiaries returned to Barcelona with an understanding and interest in the New Public Health Movement that was building traction in other countries [3,41]. Likewise, in the early 1980s, short courses and workshops on Public Health were organised by the Health Advisory and Promotion Cabinet, part of the Barcelona Medical Association (GAPS, acronym in Catalan) to strengthen primary care and public health human resource capacity of clinicians, and provide accredited training, locally. Also, the Center for Health Analysis and Programs (CAPS, acronym in Catalan), a scientific non-profit private association began to promote Public Health seminars and courses for young students and professionals. Building on these

efforts, has been the provision of specific resources, which have either created positive conditions to activated **M4,** and/or have acted as **M4** themselves. For example, the formation of certain informal local networks (e.g. between friends and colleagues), which help to create informal and formal international institutional research collaborations (e.g. between the City Council, ASPB and Johns Hopkins University in the US) [42,43]. Later, there was the development of academic units, and the creation of the first Master programme in Public Health in 1989 in the University of Barcelona [41], and in 2006 another programme was created in UPF and the Autonomous University of Barcelona, that still exists together [44] and which includes courses on HI. For example:

> "*In the 70's, research was very basic... you didn't have university units looking at that .... it was obviously still very poor in terms of resources… a number of people had to travel abroad* [for training], *this is important, who got in contact with those* [international public health research] *traditions..."* (Public Health Consultant).

> "*In the very late 70s and 80s…* [there were] *some funds from the Ministry and other foundations … a number of grants to go to the US for Masters programmes and so on… things were pretty centralised, and one of the things that happened was that there was training and education offered, I mean ad-hoc, then after it became the Masters of Public Health, but it took a while. There was the Diploma*

in Sanitation, provided in Barcelona, and I remember people coming from all over Catalonia, even from outside ... [also] *the City Council and ASPB were promoting Johns Hopkins Professors to give intensive one week courses… you couldn't find this offer anywhere else in Spain, this happened, maybe in the 80s and 90s, then it became the Fall Institute, but it was much more important during those 10 years when there was nothing else than that…"* (Professor).

"[One] *influence was Vincente Navarro; he was from Barcelona, he was in Hopkins, he wrote about inequalities in health, he was a good friend of Pasqual Maragall from their youth… Pasqual worked for many years in the city planning department at the end of the dictatorship, and took a sabbatical and went to Hopkins…* [then] *in the early 80s, there was an agreement between the City Council and Hopkins… a few people in* [ASPB] *spent a year in Hopkins under this agreement…* [the idea was] *to bring excellent professors, and some knowledge here, without having to go abroad…by the early 90s we had a local Master of Public Health programme…"* (Manager Public Health Institute).

"*The Masters of Public Health…has a strong component of social inequalities in health…in the past, in terms of training opportunities, a big name is Vicente Navarro and*

the link with John Hopkins… and this related to the sensitivity of the City Council on this issue" (Professor).

A few interviewees also highlighted that it has not only about the provision of educational courses and workshops, but also the resources, support and experience gained by students conducting Masters and PhD theses in HI research groups. For example:

"…for me, the most important thing is for people to do their PhD and their [Masters' thesis] *with a group that is studying these issues… the environment is important… they learn from the group, as well as through the Masters of Public Health…"* (Manager, Public Health Institute).

Mechanism M5: Resources to strengthen HI information resources

Evidence suggests that there has been some local political will and investment over the past four decades, at the individual, institutional and political level, to have health information to assist with planning and action, and this includes linking socio-demographic data to report on HI, and to periodically report on it (**M5**). For example:

"*… there was some political will, sometimes linking health information to planning, and also to evaluating the performance of the things that the City Council was responsible for in public health terms…".* (Professor*).*

> *"I guess it was a managerial need…it meant having a vision…that valued the importance of data, having data and of improving the data, analysing the data, that this data was grouped in periodic reports that had political implications, or at least visibility, and there was also a passive investment…".* (Manager, Research Institute).

This started in 1980s; in 1983, the ASPB developed the first Health Interview Survey in Spain [18,23,25], and this was accompanied by the Annual Health Report of Barcelona [17,18,23], which uses various health information sources to document the public health and HI situation of the city. This was important for the development of HI oriented information systems [45]. The report is still produced and serves as an tool to plan and evaluate health policies the actions to be taken to improve public health and HI [15,17,18,46–48]. Also, the establishment of geographic information systems enabled small area analyses of mortality and morbidity, and early descriptive HI studies to be created [20,25,26,49–52]. Numerous HI studies have since used local mortality statistics, health surveys or disease registers [18]. For example:

> "*…the Health Interview Survey itself was envisioned as an instrument to monitor health status and the gaps in health between groups and geographic groups defined by city districts...an important tool for the health information of the city*." (Professor).

"…the analysis by social gradient came in because the Health Interview Survey started looking at health using social class indicators; the UK had started these periodic population health surveys… before that, there is a very famous, simple paper... the adaption of the British social class classification, and everyone used that…[also] *to complement this, there was the idea of having a health report… a more or less dynamic, yearly picture of health trends, or health distribution in time, place and so on… presented yearly to the municipal government and to the municipal plenary*…" (Manager, Research Institute).

With the local reform of primary health services in 1984, and the establishment of the National Health Service, which created 17 autonomous health systems in 1986 [17,23], the Catalan health system being one of the first, there was a general political and institutional need to plan the provision health services, and establish health records. For example:

"[An] *important point is the interest in the health services planning... the devolvement of the health services to the communities, that starting in Catalonia… all the medical records were being organised… There was some investment, not only in Barcelona or Catalonia, but there was some kind of leadership for some of the health registries in Catalonia…"* (Professor).

Also there were specific activities and resources provided which seem to have been relevant for the activation of **M5**. In the UK in 1982, John Fox and Peter Goldblatt's published their work on the Longitudinal Study (LS) [32]; several years later they were invited by IES, to Barcelona to give a seminar on their work. For example:

> *"…we set up a seminar with John Fox who was doing the LS at the time, Peter Goldblatt too, that created a lot of interest…organised in the 80s. That was paid by the ISE… obviously* [setting up an LS] *was not possible here, as we didn't have the resources or the capacity to do that; we had another problem at the time, which was that most of the census data, did belong and still belongs to the* [National Institute of Statistics] ... [it] *was not perceived as something that we could do, but then the local Council found a way…using the Padró Municipal, which is a kind of population, patient, register that they had, which allowed some of those linkages… so that started in those years, and that was part of this presence of Fox and Goldblatt… I think the seminar convinced people how vital statistics and census could be used to show empirically health inequalities, in a background where empirical research was seen as something irrelevant for the political struggle…"* (Public Health Consultant).

More recently, with Barcelona en Comú in the City Council, **M5** has been activated by the government, who developed a joint action plan

to measure and try to reduce HI [53], and implemented several recommendation from the Commission to Reduce Social Inequalities in Health in Spain [18,54]. This included: strengthening the information systems to monitor health, prioritize and evaluate interventions, and improve the communication and transparency of the results obtained [18]. As well as setting up an Observatory of Health, Inequalities in 2016, to provide information and evidence to organizations and decision makers to improve public health and reduce HI [18].

Mechanism M6: Cognitive social capital

Evidence suggests that **M6** has been activated by the formation of, firstly, informal networks, and later, by formal research networks, which have acted as sources of news ideas, sharing and exchange knowledge and new resources, and led to the co-production of new HI research locally [8,18]. For example:

> *"*[In the 80s] *it was less formal... there was a lot less money, and it was a network of, like of friends. But now the connections are more formalised… and with resources… in the European projects…there has been a lot of transfer, not only technology, of methodologies and knowledge related to this, but also practices…"* (Professor).

> "*...CIBER is important…Also the European groups, for example when we applied for the* [X] *project, it was an*

> *advantage that we already knew the different people and groups from the UK, the Netherlands that were doing research on health inequalities."* (Manager, Public Health Institute)

Also, the World Health Organization's Healthy Cities movement in the 80s-90s [55], the Spanish Biomedical Research Consortium on Epidemiology and Public Health Network (CIBER, acronym in Spanish) [18,56], and formal international (European) networks and projects have been particularly important in providing resources to conduct HI research [57,58].

Discussion and conclusions

Our study provides in-depth understanding on why and how Barcelona has produced a high volume of HI scientific research over the past four decades, and how it has likely become an important HI research hub, not only in Spain, but worldwide [8]. Using a realist explanatory case study approach, we gathered, analysed, and synthesised evidence to test and support our six theoretical mechanisms (**M1-M6**) [8]. Evidence suggests that there has been a combination of key historical socio-political-institutional contextual factors, and individual agents, that have activated these mechanisms (during 1980-present), which have collectively led to the generation of a high volume of HI research.

A bibliometric analysis focused in Spain (1980-94) [22], found that it was not until the mid–to-late 80s that the HI research field was really initiated in Spain, mainly in the regions of Catalonia and Valencia [23]. The so-called political transition in Spain, marked a key moment of change throughout the country, yet while some of the historical, socio-political contextual conditions have been similar across Spain, there have also been some important differences, over time. For example, politics, and different political/ ideological values at the institutional level, could partly explain the differences in HI research production in Barcelona compared with Catalonia, and the rest of Spain [17]. Barcelona has almost always been governed by socio-democratic governments, in coalition with other progressive forces (except 2011-2015 with CiU), with strong egalitarian values and a consistent concern for reaching a more just society [8,59]; values which have been accelerated with the arrival of *Barcelona en Comú* in 2015 onwards, and the city administration has made public health and action on HI (including HI research) one of its main priorities [17,18]. Whereas Catalonia has predominately had Conservative Government in power. In Spain, from 1982 to 1996 the PSOE party were in power, yet scholars have mentioned that there had been a lack of official recognition of HI and HI research through country [18,23]. This is thought to be mainly due to a limited number of research groups focusing on HI, public health institution's, and funding support, as well as limited social organisations and social movements, and a "*…lack of political will by the Conservative government"* [23] (p.271) from 1996 onwards [18,23]. One illustration of this took place in 1993, when the Ministry of Health of the Spanish Socialist

Government at that time appointed a Scientific Commission to study social inequalities in health, following the model of the UK Black Report [29,30]. The Commission generated the so-called '*Spanish Black Report'* in 1996 [18,23,60,61], but similarly to the case of the UK's Black Report in 1980s [12,29,30], the report was buried by the new *Partido Popular* (PP) Conservative government elected in 1996, and the findings and recommendations were not considered until the next left-wing party (PSOE) won power in 2004 [23,49]. A second Commission was created in 2010 [54,62], but again this was followed by a new PP Conservative Government in 2011 that rejected the Commission's findings. This emphasises the crucial need to evaluate the socio-political context in which HI research priorities are planned and implemented, as well as the causal forces and dynamics operating at different macro-to-micro levels, which influence and determine the capacity to generate HI research [5], alongside other factors.

The case study found strong evidence to suggest that the historical and political processes, combined with a tradition of recognition of HI, strong egalitarian values, and concern, have been essential to activate **M1** and **M2** in the city, over time, and to initiate and sustain the local production of HI research. Also, Barcelona is a rather progressive city, open to international ideas, and fosters a strong scientific community; this openness (in terms of learning and training), particularly during the 80s and 90s, appears to have facilitated the local development of HI research. In addition, the presence and leadership of key individuals and institutions in the city, at the political-institutional level, have been instrumental, and the City Council and ASPB have made a number of important strategic decisions related to developing

public health services and research in the city [18]. For example, the strategy in the 80s and 90s to attract a small critical mass of well-trained, dedicated public health young professionals and civil servants, sensitive to public health and societal needs and keen to act, several of who acted as individual research stewards, were key to activate other mechanisms (**M2**-**M6**). This, in combination of the (passive and later, active) institutional stewardship of ASPB (**M3**), will, and provision of resources to strengthen the capacity to understand, monitor, and analyse the public health situation in the city, have been important to lay the foundations to develop the local HI research field. Other research also finds that research capacity strengthening efforts often revolve around key individuals, as institutional changes take longer to develop [63]; yet an enabling environment, which includes leadership, management and stewardship, and a supportive research infrastructure [8,63], are important to strengthen and sustain these research capacities [5,8,64]. Furthermore, despite the limited domestic research funding throughout Spain over the past four decades [65], particularly for HI research [7,23,65], strong cognitive social capital has been built by some research groups in Barcelona (**M6**), and a few others across Spain [9], through the formation of research networks. Collectively, this have led to the co-creation and production of a high volume of HI scientific research.

A realist approach, combined with explanatory case study methodology, has been highly relevant to answer our research questions. The key strengths of this case study, are the use of extended historical perspective to connect chains of events over time [13], and data triangulation to test and confirm our theoretical mechanisms [66].

Also, to enhance case study rigour, and the validity and credibility of our research findings, we provide clear and comprehensive justification for the selection of our case [7,8], and initial theoretical causal mechanisms, based on previous literature and theories (see study protocol [8] for further details).

Valuable learning can be derived from Barcelona's experiences of building HI research capacity, and generating HI scientific research. These findings may or may not be generalizable to other similar settings; however, generalizability was not the main aim of our case study, rather case validity and case logic [13,67,68], and to establish an in-depth contextual understanding [8]. Given the novelty of this research, we only tried to test what we considered to be main mechanisms. We anticipate that more research will be needed to explore other secondary or tertiary level mechanisms [8]. Also, given the predominately male sample in the interviews, and known socio-institutional discrimination towards women scientists [69], the role of gender in this scientific production, warrants further investigation. Lastly, more realist explanatory case studies are required to evaluate these processes in other settings, across different country income groups and world regions. This will assist to identify good practices and pending challenges, and this knowledge can be used to guide future strategies to strengthen HI research capacities, and support cross-fertilization of ideas for new research and action on HI.

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4.DISCUSSION

This dissertation provides new contextual and causal insights into the HI research process. Specifically, it provides a new understanding about where, why, and how scientific knowledge on HI is produced, why and how some countries and/or cities have been able to produce high volumes of HI scientific research, and what might determine this capacity. This concluding chapter includes reflections on the main results and contributions made, the strengths and limitations of this dissertation, future research and policy recommendations, and main conclusions.

4.1 REFLECTIONS ON THE MAIN RESULTS

Where is scientific knowledge on health inequalities produced?

The research findings provide a comprehensive diagnosis of the global scientific production on HI over the last half a century (1966-2015), of the global HI research collaborations and networks, and of the general inequitable trends that exist within this research field (article 1). This overview is useful to establish the current state of where scientific knowledge on HI is being produced, how much, but also where it is not [1,2]. This is important information, as several scholars have discussed [2–4], because if we reduce our understanding of the world to simply the scientific knowledge that is (made) 'visible', we will only have partial and limited knowledge on global problems, such as HI,

and only partial and limited options to work towards positive social change, such as health equity.

The research findings show that the global HI scientific production has exponentially grown over the last five decades, and approximately 86% of the countries, worldwide, have contributed to the overall HI scientific production (established via authorship affiliation), with 14% of them having not contributed to even one HI scientific publication [5]. The study found three times as many countries have contributed to this research field than previous bibliometric analysis found, despite retrieving fewer scientific publications overall [5,6]; this is likely to be due to the different theoretical approaches taken in the different studies. For example, our search strategy considered the historical and global evolution of the study of HI, and the diverse terminology and perspectives that have evolved over the past 50 years, to try to capture a more accurate and complete picture of the HI research field [5].

The research findings also identified significant inequalities across countries within the global production of HI scientific research and related research practices, by country income group and world regions (thesis hypothesis 1). High Income Countries (HIC), particularly Anglo-Saxon and European countries, were found to *"…disproportionally dominate co-authorship and first authorship contributions,* [and were] *… at the core of the global collaborative* [HI] *research networks*…" [5](p.18). Also, a " *country-income group affiliation gradient in the initiation and consistent publication frequency*" [5](p.18) was noted. In addition, the results established the top 20 countries that have contributed the most to the global HI scientific production, per country income group, as well as each

country proportional contribution to the total scientific research output, and scientific productivity - considering both Gross Domestic Product (GDP) per capita, and population size [5]. From this, it was identified that four HIC, Anglo-Saxon countries (e.g. the USA, UK, Canada and Australia) alone have contributed to approximately 70% of the global HI scientific production (1966-2015), with at least one author affiliation from these countries [5]. When disaggregated, this information helps to better understand the global HI research landscape, and it can also allow for potential ´fairer´ comparisons to be made amongst countries with similar resources levels, population size, etc.

To interpret the scientific collaborations, the network analysis used dependency theory [7], which critiques early hegemonic theories of economic development and modernization, rejects the idea that all societies progress through similar stages of economic development, and that inclusion into the global economic market, amongst other things, will accelerate this progress. Instead, it argues that so-called 'developing' countries have their own unique structures independent of global capitalism, and that the main reason why certain countries are so-called 'underdeveloped' is mainly due to their forced dependency on external/international sources, and labour position in the global market economy [7,8]. Dependency theory is useful to interpret the systematic differences and general asymmetric trends within the global production of HI scientific research [5], as it alludes to the need to consider history, (geo)political economy and relations, as well as country power struggles, amongst other key fundamental topics, in the analysis of why and how some countries (mainly Low

and Middle Income Countries (LMIC)) might not have 'developed' such a stronger capacity to produce HI research as others (mainly HIC). Similarly to these results, scholars have found that the capacity to produce health research more broadly, is also disproportionately located in HIC [9]. A number of factors are thought to limit the capacity to conduct health research in LMIC [9–11], namely "*…historical inequalities and colonial exploitation and replicated by persisting macro-economic inequalities*…" [11](p.1-2), neo-colonial tendencies in research practices [12], 'brain drain′ i.e. the loss of expertise from LMIC to other countries, and LMIC dependence on research funding from HIC [11,13], as well as *"…power imbalances between researchers and institutions…*[in HIC and LMIC]" [11] (p.1-2) [14]. These factors and dynamics may also be relevant in HI research capacity analyses as well. However, dependency theory, as with these ideas, tend to place more emphasis on the negative external factors which might be involved, and less on the internal factors [8]. That is to say, while some of the reasons for these HI research capacity challenges are likely to be external and negative, there are also likely to be some positive ones, as well as many important internal factors at play, which warrant further investigation.

Overall, the findings from the bibliometric and network analyses illuminate that challenges exist in the capacity to produce HI research, globally, and in many countries, and they provide a solid basis to justify further research on why and how some settings have stronger or weaker capacity to produce HI scientific research, and what determines this capacity. Further research is needed to contextualise these quantitative bibliometric results [5], and to identify the potential

structural and intermediary determinants, dynamics, and causal mechanisms which might influence and shape the capacity to produce HI scientific research, in different settings.

Why and how scientific knowledge on health inequalities is produced? - Strengthening theoretical understanding.

A fundamental requirement to comprehensively evaluate the capacity to produce HI research in a particular setting, and to establish effective ways to strengthen this capacity, is a strong theoretical understanding of how the HI research production process works is needed. Yet, the research findings support the hypothesis that current conceptual understanding is limited, and is likely due to a limited research focus placed on understanding the HI research production process, and HI research capacities, more specifically (thesis hypothesis 2). Furthermore, this limited theoretical understanding might explain why there has been limited practical guidance, and advancements in strengthen HI research capacities in different settings.

Through a critical review, several conceptual frameworks were identified, which focused on the health research production process more broadly, and on how to strengthen health research capacities [15–19]. However, a close examination of these frameworks established that they provide valuable, yet limited advancements in the understanding of these important processes, and even less on the capacity to produce HI research more specifically. This limits their ability to be empirically tested, or to provide practical guidance on how to strengthen these specific research capacities, and thus to be

able to work towards improving population health and health equity. As such, a new conceptual model was developed as part of this dissertation, which can serve as a global heuristic tool of the fundamental processes involved in producing HI research at local level [3] (article 2).

The conceptual model integrates the SDH and political economy perspectives, and supported by existing literature, proposes that *"…there are sets of structural determinants which operate through sets of intermediary determinants to shape and condition the… opportunities to produce HI, and the HI research practices in different settings…*[which]*…consequently shape and condition the opportunities to address HI in a given context, globally"* [3](p.4-5). It incorporates a number of additional aspects which have not been included in the existing conceptual frameworks on health research capacities (more broadly); for example, it consists the role of context, history, and politics, ideology, value judgments, and power struggles, alongside the importance of resources, stewardship, leadership, infrastructure, institutions and actors, in shaping the development of HI research capacities over time, and the capacity to create and produce critical HI research [3,20–24]. Political and social sciences perspectives typically question the role that interests, values, beliefs, and institutions play in various social processes [25], which have been largely marginalised from traditional, mainstream public health research [26–29], although, they are building traction. The model integrates these perspectives, and emphasises the need for HI research capacity assessments to consider "*…the distribution of power and resources within HI research…"* [3](p.8), and *"…how the*

opportunities and access to resources to produce HI research are conditioned in a given context" [3](p.17).

This new conceptual understanding has also been used to inform the design and operationalization of the two realist explanatory case studies, which analysed the HI research production process in-depth, in the UK and Barcelona (articles 3-5). The case study findings suggest that these types of dynamics have played an influential role in shaping the generation of HI scientific research, in both the UK and Barcelona, over the last few decades (articles 3-5). These findings also suggest that the political economy perspective is not only relevant to understand how HI might be produced [24,27,30,31], but also how scientific research on HI may be produced, or inhibited, in different settings. In addition, they support the hypothesis that there are different combinations of dynamics that may enable or inhibit the capacity to produce HI scientific research in different settings (part of thesis hypothesis 3).

Furthermore, and again in line with existing literature [2,3,5,11,32–38], the conceptual model proposes that there are likely to be a number of potential epistemic and systemic injustices, and deep-seeded conscious and unconscious biases prevalent in varying degrees in the global production of HI scientific research and research practices, which influence the capacity to produce of HI scientific research in different settings (article 2), and skew the ´visibility´ and representation of authorship in the geographical distribution of HI scientific production (article 1). Further research is needed to empirically test whether, and how, these dynamics may play a role in

determining the capacity to produce HI research in different settings, and establish ways to potentially address them.

Why and how a high volume of scientific knowledge on health inequalities is produced in the UK and Barcelona?

The case study research findings identify different combinations of key contextual conditions, determinants, and causal mechanisms which have been involved in generating HI scientific research, in both the UK, and Barcelona (thesis hypotheses 3 and 4). They also provide valuable insight into some of the HI research strengthening activities that have been successful in these two settings, over the past few decades.

Six causal mechanisms or hypotheses were proposed to be tested, as follows: *M1: Recognition with concern*; *M2 Sense of moral responsibility to act*; *M3: Stewardship for HI research*; *M4: Resources to strengthen HI human resources; M5: Resources to strengthen HI information resources*, and *M6: Cognitive social capital*. Each was conceived in line existing theories and literature from diverse disciplines, related to social change (e.g. from political philosophy, political and social sciences, public health, international development, management) (see article 3 for further details on the justification for proposing these six theoretical mechanisms). Through the development of the two in-depth case studies, substantial evidence was found to support these hypotheses, suggesting that all of these six causal mechanisms have contributed in generating a high volume of HI scientific production over time, in

both the UK and Barcelona. The two case studies also identified a combination of key historical socio-political-institutional contextual factors, which have been important to create the right conditions to activate these six mechanisms, during different time periods, and have involved different institutions and agents. The activation of the different mechanisms appears to have created a chain of non-linear new actions and events, which collectively led to the generation of HI scientific research, in both the UK and Barcelona. The case studies do not provide a full historical accounts of all the chain of events that have taken place in each setting over the past 50 years, rather a critical historical lens was applied to test the six theoretical mechanisms, and to try to identify examples of when, why, and how they might have been activated, by whom, at certain moments over time.

There were a number of similarities identified between the research findings from the two case studies:

- Both the UK and Barcelona have a strong public health tradition, which dates back further than the last 40-50 years, and includes recognition of HI and social justice. Evidence suggest that this recognition has accumulated over time, and when mixed with heightened concern (M1), under the right contextual conditions, a change in certain agents' behaviours and actions was triggered, which likely initiated a chain of events and contributed to the local production of HI scientific research.

- Strong evidence suggests that the UK´s 1980 *Black Report*, inspired future research on this topic, in both the UK and in Barcelona [39–45].
- Both case studies emphasized the strong political nature of the HI scientific production process, and identified the influential role of politics, and institutional and individual values in activating certain causal mechanisms, over time. Evidence from both case studies suggests that left-wing and egalitarian political parties have showed more political recognition and concern for HI (M1), which has led to more investment made to strengthen the capacity to produce HI research than compared with right-wing conservative political parties. In addition, individual left-wing egalitarian values seem to have been important to initiate and sustain the production of HI scientific research in both the UK and Barcelona, potentially via the activation of M2, and particularly during periods of socio-political, and scientific struggles for recognition of HI. This is partly in line with previous research that found that in order to strengthen a health research system, strong political will must exist somewhere within the political system [46], and that politics appear to have a positive effect on population health, in contexts with left-wing and egalitarian political traditions [47].
- The formation of different informal and formal HI research networks has also been important in both case studies. Evidence suggests that these networks have provided intellectual and emotional support, helped to build trust and solidarity, share ideas, and mobilise resources, which appears to have created and

activated cognitive social capital (M6), and led to the co-production of innovative HI research over time. Furthermore, evidence from both cases suggests that during certain periods when domestic research funding for HI research has been limited, these research networks have been even more important to help to generate HI scientific research.

- Both case studies highlight the influential role of research funders in shaping the volume of local HI research production, over the past few decades. This finding is in line with previous research focused in the UK [48,49]. Also, evidence from the UK case implies that national research funding agendas (e.g. National Research Councils), despite being independent organizations, typically run in line with the political climate of the day. In Barcelona and Spain, domestic HI research funding has been extremely limited through the past four decades, even less than with other research areas [50], and the majority of the HI research funding has come from external (European) sources.
- Evidence suggests that certain institutions, such as national research funders in the UK, and local public health and political institutions in Barcelona, have acted as potential stewards of HI research, during different time periods (M3). So too have certain individuals, who have acted as HI research stewards or 'change agents (M3). Collectively, these stewards have helped to guide the strengthening of HI research capacities, which has led to the generation of more HI research, over time. These findings are in line with previous evidence, which found that key committed individuals must have the capacity and opportunity to provide

leadership to strengthen the health research system or specific components of the health research system, but that in order to sustain this progress, it must be supported by institutional commitments [46].

- Both case studies identify the need of a minimum level of investment into local public health (and social sciences) research, and related research infrastructure, as well as a critical mass trained public health professionals (many of whom are highly motivated, with strong individual egalitarian values), who have the foresight for the need to have regular available and reliable health and sociodemographic data [40,51,52]. Over time, this critial mass need to have sustained access to regular, relevant training, and enabling career structure as well as access to available, reliable, disaggregated health and socio-demographic data, and comprehensive data collection systems; which requires regular investment of dedicated resources (M4-M5), amongst other things. These findings are also in line with existing evidence on health and HI research capacities in different global settings [3,46,53–55].

Furthermore, a number of additional factors were identified as being important in the HI research production process in the UK, over the past 50 years:

- Firstly, evidence suggests that certain academic top peer-review journals and the media, have played a role in fostering recognition and concern for HI in the UK, (M1), by agreeing to publish various HI research findings over the past few decades

[49,56]; this has also likely to have helped to circulate, and share this scientific recognition and concern with other agents (M1). In the case of Barcelona, there was some evidence to suggest that *Gaceta Sanitaria*, a public health peer-review journal, served as a useful tool from the late 80s onwards, to strengthen local and national human resource research capacities to produce solid public health and HI research, as well as to share findings, and build recognition or visibility of researchers throughout Spain (although this was only touched upon in the case study report). The journal (in the form that exists today) was created in 1987, as part of the Spanish Society of Public Health and Health Administration (SESPAS acronym in Spanish), it is managed locally; historically, it was a city public health bulletin in Barcelona [57]. Further research should explore in more detail the roles of academic journals and the media in strengthening local HI research production process and local HI discourse, in the UK, Barcelona, and Spain, as well as in other settings.

- Secondly, strong evidence suggests that the (political) controversy around the release of the *Black Report* in 1980, and the lack of official recognition of the HI evidence by the Thatcher Conservative government, also fuelled some of the HI scientific production during the 80s and 90s in the UK [5,39,58–60]. During this period, there appears to have been an persistent underlying (socio-political and scientific) 'struggle for recognition' of HI [39,58,60–62], mixed with concern (M1), which motivated certain individuals and groups, with strong egalitarian values, to persevere in their efforts to prove that HI

existed, as well as trying to address them (M2). As mentioned in the Barcelona case, a similar (negative) political reaction occurred in Spain in 1996, and in 2011; the (PP) Conservative government rejected the evidence and recommendations from the so-called ´*Spanish Black Reports*´ which had been Commissioned by the former PSOE socialist governments [59,60,63–67]. Therefore, given the similar contextual conditions and factors present in Barcelona, as discussed, a similar reaction might have occurred in Barcelona, where some motivated individuals with strong egalitarian values, might have been incentivized to persevere in their efforts to prove that HI existed, and ´fight´ against the Spanish governments reaction, which might have fuelled some of the HI scientific production locally. Future research should explore this further.

- Thirdly, evidence suggests that individual values have been important in shaping the formation of research networks in the UK, alongside individuals disciplinary training, and personal relationships, which likely interact, and ultimately impact the research field itself. Further research is needed to confirm where this is also the case in Barcelona, as well as in other settings.
- Fourthly, evidence suggests that individual values have also been important in determining the type of HI research produced in the UK (e.g. the psychosocial explanations vs the social-material conditions etc.) [3,28,39,48,49,68–70] (see introductory chapter for the different types of HI research). While this was not directly discussed in the Barcelona case, this may also be relevant. Future

research should build on this, and explore why and how certain types of HI research are produced, in different settings, over time.

- Fifthly, there was some evidence to suggest that other professional interests, besides individual (political) values, may have also motivated certain individuals to enter this research field, in the UK, during different time periods. This might most-likely occur when a topic became more 'fashionable', i.e. when the topic of HI was a political and research (funding) priority. For example, after 1997 in the UK, when the New Labour Government was in power. This finding is in line with previous research on HI research in the UK, that suggests that scientists view themselves as competing with one another for access to resources, credibility and territory [48,70–72]. In addition, a recent study on social movements for *´Health For All´*, found evidence to suggest that certain employees of non-government organisations are more often motivated by career advancement, rather than by political or ideological values, which was thought to have detrimental effects in terms of the types of actions taken, and the subsequent impact on health equity [73]. Future research should explore this idea further, both in the UK, and in other settings.

4.2 THESIS STRENGTHS AND LIMITATIONS

Strengths

- This dissertation provides an up-to-date comprehensive bibliometric analysis (1966-2015), and the first comprehensive network analysis of the global HI scientific production. The search strategy considered the historical and global approaches, terminology, and perspectives used in the HI research field over time, which likely led to a more accurate retrieval of the global production of HI scientific publications than in prior studies [6]. This analysis found a number of inequitable trends across countries within the HI research field, based on publications in international peer-review journals that were indexed in the multidisciplinary database of Scopus. The study did not consider HI research published in grey literature, however, they likely provide solid insights into the types of trends, practices and dynamics that exist within this research field [5]. It also provides a solid basis for further investigation into global HI research capacities.

- The approach used in this dissertation is innovative; it attempts to expand current understanding on where, why, and how scientific knowledge on HI is produced, establish why and how certain settings (i.e. the UK and Barcelona) have produced high volumes of HI scientific research over time, and what contextual

conditions, determinants, dynamics, and main causal mechanisms might have been involved.

- Firstly, it attempts to integrate diverse disciplinary perspectives and methodological approaches (i.e. from health, social and political sciences, history, ethnography, philosophy of science, political philosophy, management, and development studies), to strengthen the justification of the research conducted, the dissertation's rigour, and the validity and credibility of the research findings.
- Secondly, it attempts to expand the traditional methodological toolbox used in public health, to answer key research questions and explore potential causal inference pathways about HI research capacities. For example, the use of scientific realism perspective, which has emerged from philosophy of science, to evaluate complex social processes, and explore causality [74,75]. Its wide implementation in public health is still emerging, and clear comprehensive guidance and user experiences have been limited. As such, this dissertation has attempted to advance current methodological guidance on how to plan and implement a realist explanatory case study (articles 3-5). The case study research findings demonstrate the relevance of using realist approaches, combined with explanatory case study methods, to answer this thesis´s research questions.

- This dissertation provides new conceptual understanding of the HI research production process, and capacities for HI research, by

integrating diverse disciplinary perspectives and developing an innovative conceptual model. The model can serve as a global hypothesis of the key processes involved; as mentioned, its purpose is not to try to replicate social reality exactly, rather it is to identify the essential elements that might enable these complex processes to work within an assumed social reality, to support theory development. At the same time, it can act as a heuristic tool to be tested and adapted in different settings, and to guide the development of local and national HI research capacity assessments, and further research on this topic.

- This dissertation presents two pioneering realist explanatory case studies, to try to establish causal explanations for how and why the UK and Barcelona have been able to generate high volumes of HI scientific research over the past few decades. These case studies also provide valuable insights into the key contextual conditions, and causal mechanisms involved, as well as the type of HI research strengthening related activities that have been successful over time. These findings may or may not be generalizable to other similar settings; however, generalizability was not the aim of our case studies research at this stage, rather it was to ensure case validity, case logic, and establish in-depth understanding of our two selected cases. To our knowledge, there has been no previous research on this topic, using this method and approach. As such, we treated each case as separate unique/atypical cases, and used an extended historical perspective, to consider the socio-politico-historical and institutional contexts, and to try to answer our

research questions. To strengthen the reliability, accuracy and credibility of the research findings, justification for case selection was provided, and data triangulation was used to test, and confirm the different hypotheses, and develop our findings.

Limitations

- The main focus on this dissertation is research on HI research, specifically the HI scientific production process, and HI research capacities, rather than on HI research usage. In addition, the primary focus has been HI research published in international academic journals (e.g. articles, reviews and editorials), rather than in grey literature (e.g. reports and books). While all of these processes are important to investigate and to understand, we assume that each potentially involve different factors and dynamics which warrant separate, further investigation [3,5]. In fact, previous research exists on the relationship between HI research and HI policy, in the UK [49]. However, there are limitations to only focusing on scientific production; for example, English language bias in international peer-reviewed journals, may skew our results in favours of Anglo-Saxon countries [5,76,77], reduce the international visibility of the HI research produced in countries, and masking the actual volume of research being conducted in these countries. Therefore, as mentioned [5], the bibliometric and network analyses results do not presume to fully reflect all of the work produced on HI, or claim to present exact

numbers of publications, yet the findings are likely to reflect the general trends that exist within this research field.

- The focus of this dissertation has also been more on the volume of HI scientific research produced in difference places, and less on the ´quality´ or the type of HI scientific research that has been produced (e.g. which type of explanatory models for HI have been used in the research), although this was touched upon in the UK case study´. This warrants further investigation, since the use of the different perspectives in the HI research may likely require different types of research capacities, conditions and factors to be present.

- Due to time and resources constraints, and given the pioneering nature of conducting realist explanatory case studies on this topic, the decision was to start with just two in-depth case studies, both of which are examples of high producers of HI research, which happen to be from the same country income group and world region. We also chose to only focus on what we considered to be the potentially main first-level mechanisms to test with empirical data. However, we clearly justify our case select and the six casual mechanisms to test. While realist and mechanism-focused approaches can help to reveal previously hidden aspects of a social process and an outcome of interest, there are still limitations to reducing the predominant analytical focus to only certain mechanisms, as discussed in the study protocol (article 3). In this way, other potentially important factors, which might also partly account for the volume of HI scientific research produced in a

given setting, may be missed. We anticipate that more research will be needed to consider and explore these aspects in greater depth. In addition, further realist explanatory case studies should be conducted to evaluate other cases which have been identified as a high HI research producer, as well as cases which have been identified as lower producers of HI research, which are based in different country income groups and world regions. This will assist to develop more comprehensive assessments of the capacity to produce HI scientific research, locally, nationally, and globally, as well as provide potentially valuable information on where, why and how to strengthen these capacities.

4.3 FUTURE RESEARCH AND POLICY RECOMMENDATIONS

Future research and action will be required to build on these findings, to further strengthen understanding on where, why and how scientific knowledge on HI is produced. The aim of which is to support both theoretical and practical thinking on what types of interventions could effectively strengthen the capacity to produce HI research (including different types of HI research) in different local and global settings, and assist to strengthen the local and global HI evidence base. In turn, this could eventually lead to more effective, strategic efforts aiming to reduce HI and improve health for all. The following is an ample list of recommendations, although not necessarily a comprehensive list, given the complexity of the topic.

Future research recommendations

- Strengthen the study of the HI research production process, and HI research capacities, to complement the findings of this dissertation. For example:
  - Identify and evaluate different type of mechanisms (e.g. operating at secondary and tertiary levels), and factors that might be involved in generating HI scientific research, over time. This should include an evaluation of not only the potentially 'enabling' causal mechanisms, but also the 'inhibiting' mechanisms involved, over time.

- Expand the use of integrated, transdisciplinary approaches in future research on HI research, to explore the different dynamics within the HI research production process in detail.
- Evaluate and establish the roles of different agents involved in generating HI scientific research, in particular settings, over time.
- Conduct descriptive content analysis of the HI scientific production (identified via the bibliometric analyses) in particular settings, over time, to assess, and enrich understanding about the type of theoretical and methodological approaches used in HI research, as well as the content of the HI research being developed.
- Apply complex systems thinking [78,79] to strengthen in-depth understanding on the HI research production process, in particular settings.
- Evaluate the HI research production process in other areas of Spain for example, to potentially compare and contrast findings with those from Barcelona.
- Evaluate the HI research production process within certain cities and regional areas within the UK, to potentially compare and contrast findings with those established at the national level.

- Strengthen the study of the HI research production process, and HI research capacities, in different global settings. For example:
  - Apply and adapt the conceptual model in different settings, to test it, as well as to guide in-depth analyses of the local HI

research production process in different global settings. This work may also assist to identify various capacity strengths and weaknesses, missing information, and establish locally relevant recommendations for future action.

- Conduct more realist explanatory case studies to evaluate the type of mechanisms, and contextual conditions and factors involved in generating different volumes of HI scientific research, in other global settings, across country income groups and world regions. This work can build on, and complement existing descriptive assessments of HI research capacities in some LMIC [77,80–83], as well as the more focused evaluations of certain aspects of the HI research infrastructure in some LMIC [84–88].
- Analyse the role of gender, and intersectionality in the authorship of HI scientific research, locally and globally. Particularly, as gender inequalities in science, and global health practices have already been identified [89–96].
- Analyse the role of research funders and financial investments made into HI research and HI research capacities, at local, national and global level.

Policy recommendations

- Increase awareness and recognition of HI, and HI evidence. For example:
  - Foster political recognition and concern for HI, and the benefits of having, and using locally-relevant evidence on HI [66].
  - Conduct comprehensive HI research capacities assessments at the global, national, regional and local level to identify HI research capacity strengths, weaknesses, and potential information gaps. This valuable information can guide the development of more effective HI research capacities strengthening strategies [3].
  - Foster general recognition and concern for HI, which includes strengthening public awareness and literacy on HI [54], and the benefits of having solid, locally-relevant evidence on HI being consistently produced over time.
  - Foster HI related communication and dissemination channels between different agents (i.e. researchers, practitioners, policy makers and civil servants, as well as civil society and the public) [97,98].
  - Foster stronger citizen participation in HI research, and in the local demand for relevant data, research priorities and actions to be taken [97,98].

- Foster and invest in both institutional and individual leaders and stewards for HI research.

- Prioritise and invest in HI related information resources. For example:
  - Ensure the sustained availability of reliable, disaggregated and linked health and socio-demographic data, at local, national, regional, and global level [39,86,99,100];
  - Prioritise and invest in comprehensive health information systems, and data surveillance systems that enable regularly measuring and monitoring of population health and HI [85,86];
  - Prioritise and invest in local HI observatories, which collect reliable disaggregated health and socio-demographic data at national, regional, city level [66,81,84,101];
  - Prioritise and invest in health and socio-demographic training for professionals to be able to work on, and manage such data collection and surveillance systems (linked to HI human resources);
  - Promote transparency in HI data collection and reporting [39,86,99,100];
  - Ensure compulsory data collection of the UNESCO Research and Development data by all relevant local institutions to support monitoring and evaluations purposes [102];

- Prioritise and invest in HI related human resources, to foster HI scientific leadership and develop a critical mass of trained professionals, at local, national and global level [13,25,53,55,98,103,104]. For example:
  - Prioritise and invest in training courses that incorporate transdisciplinary approaches, to foster individual HI research

capacities, and create critical HI research; such as dedicated Master's and PhD degree programmes, and short courses, joint-institutional training programmes, which are available nationally, regionally and internationally.

- International peer-review journals should expand HI research capacity strengthening activities of early career researchers, which some journals already provide [105,106].
- Prioritise and invest in enabling career structures, and pathways for HI researchers, for early career researchers (e.g. Masters, PhD and post-doctoral fellowships for HI research), middle level career researchers, and senior researchers.

- Prioritise and invest in the formation of HI research networks, across disciplines, sectors, and institutions, to foster cognitive social capital, and co-produce innovative, critical HI research and ideas to address HI. For example:
  - Promote transdisciplinary and intersection research collaborations, with a focus on upstream determinants, to try to address complex health and social problems, similar to the UK´s recent MRC UK-PPR programme [107].
  - Foster the formation of equitable HI research collaborations and partnerships, by ensuring that ethical principles are followed and contractually established during their formation [3,98,108–110].
  - Foster long-term sustainable HI research collaborations, rather than short-term projects, to enable the development of in-depth

causal explanations of complex global and social issues, such as HI [110].

- Prioritise and invest in critical HI research. For example:
  - Develop dedicated Regional and National Strategic Commissions on HI, which includes research on, and evaluation of HI research [111–113].
  - Provide dedicated research funding which promotes the use of diverse, integrated, disciplinary perspectives and methods in HI research.

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5. MAIN CONCLUSIONS

- Significant inequalities exist within the global production of HI scientific research, with notable trends by country income group, and world region. High income countries, especially Anglo-Saxon and European countries, disproportionately dominate authorship, and are at the core of the global HI research collaborations. This hegemony tends to magnify particular settings, and particular scientific approaches.

- Different stakeholders conceptual understanding of the HI research production process, and HI research capacities needs to be strengthened, in different settings. This will help to design and implement more comprehensive assessments of local and national HI research capacities. This in turn will assist, and potentially inform, more effective guidance and strategies on how to strengthen these capacities, and produce more HI scientific research, at local, regional, national and global level.

- Evidence suggests that there are certain contextual conditions and determinants which have assisted to activate certain causal mechanisms over time, and have contributed to the generation of a high volume of HI scientific production, in the UK and Barcelona. For example: left-wing egalitarian political traditions; individual and institutional (egalitarian) values; a strong tradition of public health and social science research; a strong tradition of recognition of HI and social justice; foresight for the need and benefit of

having available, reliable, disaggregated health and sociodemographic data and comprehensive data collection systems, as well as access to this type of data; a critical mass of motivated, socially-minded, trained individuals; effective public health, and public health research institutions in place; a minimum investment in HI research capacities, and HI scientific production; access to relevant training and enabling career structures; the formation of informal and formal research networks; recognition by academic journals, and the media. These may or may not be relevant in other settings. More research is needed to explore and analyse them in other settings.

- Evidence supports the hypothesis that there are a number of underlying main causal mechanisms, which when activated in certain contextual conditions, have enabled the generation a high volume of HI scientific production, in both the UK, and Barcelona; namely: recognition with concern; sense of moral responsibility to act; stewardship for HI research; new resources to strengthen HI human resources; new resources to strengthen HI information resources, and cognitive social capital. These may or may not be relevant in other similar settings. More research is needed to explore and analyse them in other settings.

- Findings suggest that different dynamics, such as ideology and normative value judgments and power relations and struggles have enabled or inhibited the capacity to produce HI scientific reseach, in the UK and Barcelona, at different moments over the past few

decades. These dynamics may also be influencing the type of HI research that is being created and produced. These may or may not also be relevant in other settings. More research is needed to explore and analyse them in other settings.

- This thesis demonstrates the utility of integrating diverse disciplinary perspectives, approaches, and methods to establish more in-depth understanding about where, why and how scientific knowledge on HI is being produced, why and how some settings have been able to generate high volumes of HI scientific research (particularly the UK and Barcelona), and what might determine this capacity. More research is needed to expand on these insights and evaluate the capacity to produce HI research in different global settings. This will assist to identify capacity strengths and limitations, and potential enabling and inhibiting contextual conditions, determinants, and mechanisms. This information may help to explain why and how some countries, regions or cities have stronger capacity to produce HI research than others, and help to guide researchers and decision-makers in their development of new HI research capacity strengthening strategies. This type of knowledge could eventually lead to the production of a stronger evidence base on HI, both locally and globally, which could guide the development of more effective strategies aiming to address HI and improve health for all.

ANNEXES

Annex I: Dissemination of PhD results

Annex II: Internship at the World Health Organization

Annex III: Additional relevant articles

ANNEX I: DISSEMINATION OF DOCTORAL THESIS RESULTS

- **Poster presentation**: *Why and how the UK is a high producer of health inequalities research?* UK's Public Health Science 2019: New Research in UK Public Health, London, UK, November 29, 2019.

- **Presentation and class:** *Understanding Global Health Inequalities Research Capacities.* As part of the course: Emerging Dimensions of Social Determinants of Health Inequities: A Transdisciplinary Integrated Approach. Johns Hopkins Fall Institute in Health Policy and Management. 21-23 November 2019. Barcelona, Spain.

- **Poster presentation:** *Introducing a novel conceptual model and heuristic tool to strengthen capacities for health inequalities research.* Association for Public Policy Analysis and Management and The Johns Hopkins University- University Pompeu Fabra Public Policy Centre Joint Conference. 29-30 July 2019. Barcelona, Spain.

- **ePoster presentation**: *Inequalities in the Global Health Inequalities Research: A 50-year Bibliometric Analysis (1996-2015).* Fifth Global Symposium on Health Systems Research. 8-12 October 2018. Liverpool, UK.

- Online article on InfoMed Red de Salud de Cuba: *Inequalities in the Global Health Inequalities Research: A 50-year Bibliometric Analysis (1996-2015).* 25 February 2018.

- **Flash Talk Presentation:** *Inequalities in the Global Health Inequalities Research: A 50-year Bibliometric Analysis (1996-2015).* Jornada d'Investigadors Predoctorals Interdisciplinària/ Interdisciplinary Meeting of Predoctoral Researchers in Catalonia.19 February 2018. Barcelona, Spain.

- **Online article in UPF news**: *Inequalities in the Global Health Inequalities Research: A 50-year Bibliometric Analysis (1996-2015).* 15 February 2018. Barcelona, Spain.

- **Online newspaper article in La Vanguardia**: *Inequalities in the Global Health Inequalities Research: A 50-year Bibliometric Analysis (1996-2015).*15 February 2018. Barcelona, Spain.

- **Online newspaper article in La Sexta**: *Inequalities in the Global Health Inequalities Research: A 50-year Bibliometric Analysis (1996-2015).* 15 February 2018. Barcelona, Spain

- **Presentation**: *Inequalities in the Global Health Inequalities Research: A 50-year Bibliometric Analysis (1996-2015).* Development In The Face of Global Inequalities. Conference. Institut Barcelona D'Estudis Internacionals. 12 May 2017. Barcelona, Spain.

ANNEX II: INTERNSHIP AT WORLD HEALTH ORGANIZATION

During my second PhD year, I conducted a six-month internship at the World Health Organization, Regional Office for Europe, Division of Health Systems and Public Health, Barcelona Office for Health Systems Strengthening (October 2017 to April 2018). I provided technical support to the Health systems response to noncommunicable diseases work program, which incorporated a health equity lens, a series of good practice briefs, and a EUROHEALTH special issue:

- Health systems respond to noncommunicable diseases: time for ambition (2018). (Mentioned in the acknowledgements).

- **Cash-Gibson, L**. Health Systems Respond to NCDs– Opportunities and challenges for leapfrogging. Voices from the WHO European Region. *Eurohealth.* 2018; 24(1)

- Jakab M; Palm, W; Figueras, J; Kluge, H; Galea, G; Farrington, J; Borgermans, L; **Cash-Gibson, L**. Health Systems Respond to NCDs– Opportunities and challenges for leapfrogging. *Eurohealth.* 2018; 24(1).

- Adams, E; B Maier, C; Buchan, J; **Cash-Gibson, L**. Good Practice Brief: Advancing the role of nurses and midwives in Ireland: Pioneering transformation of the health workforce for noncommunicable diseases in Europe (2017). *World Health Organisation, Regional Office for Europe*.

ANNEX III: ADDITIONAL ARTICLES

Additional articles published which relate to the thesis topic:

- Llop-Girones, A; **Cash-Gibson**, **L;** Chicumbe, S; Alvarez, F; Zahinos, I; Mazive, E; Benach; J. Strengthening health equity monitoring is essential in public health: lessons from Mozambique. *Global Health* **15,** 67 (2019). Q1.

- Peralta, A; Benach, J; Borrell, C; Espinel, V; **Cash-Gibson, L**; Marí-Dell'Olmo, M. Evaluation of the Mortality Registry in Ecuador (2001-2013): Social and Geographical Inequalities in Data Completeness and Quality. *Population Health Metrics*. 2019. Q1.

- **Cash-Gibson, L**; Benach, J. (2017). K.E Smith, S. Hill and C, Bambra (eds.) 2015. Health Inequalities: Critical Perspectives, Oxford: Oxford University Press, £34.99.pp.352, pbk. *Journal of Social Policy*, p10-12. 2017. (Invited book review) Q1.

- **Cash-Gibson, L**; Guerra y Guerra, G; Salgado de Snyder, N. SDH-Net: A South-North-South collaboration to build sustainable capacities for research on social determinants of health in low and middle income countries. *BMC Health Research Policy and Systems Journal.* Vol 13. 2015. Q1.