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Social inequality, health behaviour determinants and health behaviour:

A Systematic Review

Abstract

Objective: Health inequalities are partly due to inequalities in health behaviours. However, little is known about psychosocial mechanisms underlying health behaviour inequalities. Health behaviour determinants, e.g., those outlined in the Theoretical Domains Framework (TDF) may help understanding health behaviour inequalities. Previously two effect pathways have been theorized: behavioural determinants as mediators of the relationship between inequalities and health behaviour and inequalities as moderators of the relationship between behavioural determinants and health behaviour. This systematic review will summarise the existing literature on both pathways.

Design: Relevant databases will be searched systematically for observational quantitative studies examining the indirect or moderating effects of inequality in the relationship between health behaviour determinants and health behaviour. Health behaviour determinants will be categorized according to the TDF, inequality indicators will be operationalized according to the PROGRESS-Plus framework. We will extract estimates of indirect effects and estimates of interaction effects. Quantitative meta-analysis will be conducted if study numbers allow.

Discussion: This systematic review will summarise the current of evidence on indirect or moderating effects of social inequality in the relationship between determinants of health behaviour and health behaviour. The results of this review have substantial relevance for theory development, theory refinement and development of equity-focused interventions.

Keywords: Social Inequality, Health Behaviour, Determinants of Health Behaviour, Theoretical Domains Framework, Mediation, Moderation

Introduction

Recent decades have seen improvements in health across the globe. However, health is still distributed unequally. Worldwide, individuals and groups with lower socio-economic status, on average, live shorter and in worse health compared to individuals and groups with higher socio-economic status (CSDH, 2008). Current OECD statistics indicate a difference of 7.7 years in life expectancy between men with low education and men with high education across 23 OECD nations (Murtin, Mackenbach, Jasilionis, & d'Ercole, 2017). One explanation for the social patterning of health outcomes are social inequalities in health behaviour, especially smoking, alcohol consumption, eating behaviour and physical activity (Laaksonen et al., 2008; Lantz et al., 1998; Stringhini et al., 2010). Indeed, research suggests that differences in health behaviour according to socioeconomic status and sociodemographic factors are some of the key mechanisms translating social inequalities into health inequalities (Petrovic et al., 2018; Stringhini et al., 2011; Stringhini et al., 2010). Although there are a number of interventions that aim at promoting health-related behaviours and at reducing health inequalities, these inequalities have not decreased in the past few years (Maynou & Saez, 2016). Recent research findings even indicate that some intervention approaches and strategies may unintentionally increase or even cause health inequalities between social groups within a society (so called 'intervention-generated inequalities') (White, Adams, & Heywood, 2009). These observations and findings suggest that we need to understand more about how inequality affects engagement in health behaviours.

At first glance, inequality affects health behaviours because being member of a specific social category in a society is associated with social roles, social status, and expectations which in turn determine access to resources or barriers. Such barriers and resources exist on multiple levels, from the individual (e.g., educational attainment) via the micro-environment (e.g., neighbourhood walkability) to the macro-environment (e.g., societal norms towards overweight and obesity) (Diez Roux, 2011). However, it is unclear how these resources and barriers can be

integrated with evidence-based proximal determinants of health behaviours. One key challenge therefore is to identify the mechanisms that underlie socioeconomic differences in health behaviours, and in particular to assess in how far current evidence and theorising on determinants of health behaviour can be applied to explain these differences. If we understood more about how structural features of inequality on multiple levels interact with individual determinants of health behaviour, better and more focused intervention content might be developed that reduces social inequalities in health behaviours. The aim of this review therefore is to explore in how far indicators of inequality interact with theory- and evidence-based determinants of health behaviours in predicting health behaviours.

Determinants of health behaviours and social inequality

Health behaviour research that includes inequality as a predictor, mediator or moderator is based on a multitude of theories and is often conducted as a by-product of examining different research questions, as the influence of inequality on health behaviours is poorly specified in most theories of health behaviour (Schüz, 2017). This implies that an integrative theoretical framework is needed that allows categorising the constructs of multiple theories into theoretical domains for further investigation of inequality effects. A scoping review across the behavioural and social sciences (Davis, Campbell, Hildon, Hobbs, & Michie, 2015) identified key theories in research on health behaviour and clustered the key component constructs in these theories into the 14 domains of the theoretical domains framework (TDF; Cane, O'Connor, & Michie, 2012; French et al., 2012). These include in the most current version (Cane et al., 2012) knowledge, skills, social/professional role or identity, beliefs about capabilities, beliefs about consequences, optimism, reinforcement, intentions, goals, memory (as well as attention and decision processes), environmental context and resources, social influences, emotion, and behavioural regulation. However, neither the TDF nor most theories of health behaviour specify how social inequality might affect engagement in health behaviours. Some theories like the Health Belief Model (Rosenstock, 1974) and the Social-Cognitive Theory (Bandura, 1986)

feature social inequality indicators as parts of the environment that provides opportunities or impediments to action, but influences of social inequality on health behaviour aren't explicitly conceptualized in health behaviour theories yet (Schüz 2017).

However, several studies exist that have examined inequality in health behaviour regulation. Key research in this context (Conner et al., 2013; Hankonen et al., 2017; Schüz, Li, Hardinge, McEachan, & Conner, 2017; Vasiljevic, Ng, Griffin, Sutton, & Marteau, 2016), has identified two main routes of the influence of social inequality on health behaviours – a *mediational* one and a *moderating* one.

A mediational (indirect) influence could be assumed in most social-cognitive theories of health behaviour (Conner & Norman, 2015a). Empirically, this indirect effect is indicated by individual socioeconomic status (however defined) effecting the level and direction of determinants of health behaviour, which in turn affect behaviour. For example, lower versus higher educational attainment might be reflected in lower knowledge, lower positive expectations, and lower skills, which in turn result in lower levels of health behaviour. In accordance with this idea, one recent study (Hankonen et al., 2017) showed that differences in activity and screen time between individuals with lower and higher educational attainment were due to differences in level of determinants derived from the TDF.

In contrast, the *moderating* pathway assumes that – potentially even accounting for socioeconomic and sociodemographic differences in the determinants of health behaviour - the strength and direction of the relationship between these determinants and health behaviour is affected by inequality (Conner & Norman, 2015b; Schüz, 2017). This means that for example the effects of intention on subsequent health behaviour should vary according to an individual's socioeconomic status. There are a number of primary studies (Conner et al., 2013; Pan et al., 2009; Schüz et al., 2012) and a systematic review (Schüz et al., 2017) that suggest such moderating effects of inequality. A moderated pathway could further be particularly relevant for the understanding and prevention of intervention-generated inequalities. If behavioural

determinants affect behaviour differentially according to indicators of social inequality, interventions based on these determinants will work differentially as well. For example, if, as the review mentioned above indicates (Schüz et al., 2017), intentions have stronger effects on physical activity in individuals with higher educational attainment, an intervention that aims at increasing individual motivation for activity (intention) would, even if successful in increasing intention levels in a population, lead to stronger increases in activity in those with higher educational attainment compared to those with lower attainment – thus increasing the already existing socioeconomic gap in physical activity (Gidlow, Johnston, Crone, Ellis, & James, 2006; Lampert, Kroll, Von Der Lippe, Müters, & Stolzenberg, 2013).

The current systematic review aims at summarizing the current evidence regarding the role of indicators of social inequality in health behaviours, either indirectly, mediated through determinants of health behaviours, or as moderators of the effects of determinants on health behaviours. This will provide a basis for further refinement of theory and research on inequalities in health behaviours.

Social inequality and health behaviour – heterogeneity in concepts and assessment

A further key challenge for this line of research lies in the heterogeneity of assessments and concepts of socioeconomic status or inequality. Currently, a range of structural and social indicators are used to indicate differences in the social position an individual assumes within a society.

As a means of harmonising these indicators, the Campbell and Cochrane Equity Methods Group proposed the PROGRESS-Plus framework that summarizes the factors contributing to unequal health status (O'Neill et al., 2014). The acronym PROGRESS represents eight dimensions across which inequalities may exist. PROGRESS stands for: Place of residence, Race/ethnicity/culture/language, Occupation, Gender/sex, Religion, Education, Socioeconomic status and Social capital (The Cochrane Collaboration, 2018). 'Plus' considers other characteristics of populations which may be associated with social disadvantage (e.g., age

or disability) (Oliver et al., 2008). This review will conceptualise social inequality along the PROGRESS-Plus framework as it is important to examine all factors contributing to health inequality. It will summarize the research examining whether inequality effects on health behaviour are mediated via the determinants of the TDF, and the research examining whether the effects of determinants mentioned in the TDF on health behaviour are moderated by PROGRESS-Plus indicators of inequality.

Objectives

The main objective of this systematic review therefore is to synthesise the current evidence base on (i) indirect and (ii) moderating effects of social inequality in the relationship between determinants of health behaviour and health behaviour [Figure 1 near here]. The review findings have implications for both theory refinement and the development of more effective interventions to change health behaviours. If determinants of health behaviour affect behaviour differentially according to SES, interventions based on these determinants have the potential to exert equity effects (Lehne & Bolte, 2017), thus potentially increasing health inequalities.

This review will summarise (i) evidence of which health behaviour determinants categorised in the TDF domains are most likely to translate social inequality into differences in health behaviour, and (ii) evidence on which relations between health behaviour determinants and health behaviours are most likely to be moderated by indicators of inequality.

Methods

Protocol and registration

This systematic review protocol has been registered with the PROSPERO international prospective register of systematic reviews database (Registration ID: CRD4201809127) and was developed based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols (PRISMA-P) 2015 statement (Moher et al., 2015) (see Additional file 1).

Important protocol amendments will be documented and published with the results of the review.

Eligibility criteria

Type of studies

We will include observational studies (cohort, case-control or cross-sectional) written in English or German language that provide (i) estimates of indirect effects of inequality on health via determinants mentioned in the TDF, or (ii) estimates of moderating effects (interactions) between inequality and determinants mentioned in the TDF predicting health behaviours. Qualitative studies as well as studies with a research focus on animals will be excluded. Studies which duplicate included published data will be excluded.

Type of participants

To avoid excluding potentially disadvantaged populations, this review will not be limited to a particular population, but studies have to provide information that allow classifying participants according to PROGRESS-Plus factors.

Type of Variables

As intervention or exposure (required items in the Cochrane guidelines) are not applicable for the review, we outline the variables of interest. We will include studies that report moderating effects of PROGRESS-Plus indicators on the relationship between TDF determinants of health behaviour and health behaviour, or indirect effects of PROGRESS-Plus indicators on health behaviour via TDF determinants of health behaviour. A list of our corresponding definitions of the 84 component constructs across the 14 domains of the TDF (Cane et al., 2012) can be found in Additional file 2. We will consider for analysis any operationalization of a TDF construct that quantitatively assesses variables that meet the definition provided in Additional file 2 and is described in the original study as an operationalisation or measurement of this construct.

Primary Outcome

The primary outcome of the review will be health behaviours defined as 'overt behavioral patterns, actions and habits that relate to health maintenance, to health restoration and to health improvement' (Gochman, 1997, p.3) and effect size estimates of (a) indirect effects of social inequality indicators (described by PROGRESS-Plus) on health behaviour via health behaviour determinants categorized in the TDF domains and (b) moderator effects of social inequality indicators on the relationship between health behaviour determinants and health behaviour. To be included in the review, studies therefore have to report analysis of moderating or indirect effects.

Search strategy

Electronic searches

Studies will be identified by searching the following electronic databases:

MEDLINE (via PubMed), PsycINFO (via Ovid), Applied Social Sciences Index and Abstracts (ASSIA) (via ProQuest), Sociological Abstracts (via ProQuest), International Bibliography of the Social Sciences (IBSS) (via ProQuest), Scopus and Web of Science. The search strategy will comprise searching MeSH Terms and words in titles and abstracts, where applicable. Search terms will include keywords for social inequality, combined with terms for determinants of health behaviour, health behaviour and effect modifiers using the Boolean operators AND and OR. Restrictions on English and German language will be applied. The sensitivity of the search strategy will be tested by checking whether it retrieves several key articles (Conner et al., 2013; Hankonen et al., 2017; Schüz et al., 2017; Vasiljevic et al., 2016) identified in preliminary searches. An example search strategy for MEDLINE (via PubMed) and Web of Science can be found in Additional file 3.

Searching other sources

The reference lists of all included articles will be screened to capture any relevant publications missed by the electronic searches.

Data management

The database search will be conducted by one reviewer. An EndNote (ENDNOTE X8, Thomson Reuters) database will be created to store all citations retrieved by the seven electronic databases. Using EndNote's auto-deduplication function, duplicate citations will be removed. Remaining duplicates will be identified by hand-searching techniques.

Study selection

The screening process for study selection will be completed in two stages. Stage one will include screening the titles and abstracts of each publication against the inclusion criteria by two independent reviewers. Inter-rater reliability between the two reviewers will be assessed using a Cohen's kappa statistic (Cohen, 1960) and disagreement between the reviewers over the inclusion or exclusion of particular studies will be resolved through discussion and by consultation of a third reviewer.

In stage two the full text of the potentially eligible studies will be retrieved and systematically assessed for exclusion by one reviewer, with a random sample check by a second reviewer. Any disagreements between the reviewers over the eligibility of particular studies will be resolved by discussion and if necessary by consulting a third reviewer. The PRISMA guideline (Moher, Liberati, Tetzlaff, Altman, & Prisma Group, 2009) will be used to produce a flow diagram.

Data extraction

Data from all included studies will be extracted by one reviewer using a pre-designed and piloted extraction data form. We will aim at obtaining missing data from studies otherwise fulfilling inclusion criteria by contacting authors. Data will be extracted electronically and stored in a database. Extracted data will include:

- First author, year, publication language, country of study
- Study design and Study aim(s)
- Study population, Sample (N)
- PROGRESS – Plus characteristics reported in the study

- TDF constructs and type of assessment used (self-reported (validated questionnaire or other), objectively measured)
- health behaviour and type of assessment used (self-reported (validated or non-validated) or objectively measured)
- Length of follow up (in longitudinal studies and studies with repeated assessment)
- Methods used to operationalize or measure social inequality
- Risk of bias
- Relevant references found in the included studies.
- Intercorrelations between determinants of health, health behaviour and any PROGRESS-Plus indicator
- Estimates of interaction effects between PROGRESS-Plus indicators and health behaviour determinantsTDF constructs in predicting health behaviour
- Estimates of indirect effects of PROGRESS-Plus indicators on health behaviour via TDF constructs

The estimates of interaction effects and indirect effects (last two list points) comprise any interaction or indirect effect that results from combining the 84 constructs in the TDF (Additional File 2) with the social inequality factors in the PROGRESS-Plus framework. Considering all combinations could results in the need to test 840 potential interactions (e.g., moderation of intention (TDF construct) effects through gender (PROGRESS-Plus dimension)) plus 840 potential indirect effects (e.g., effects of education attainment (PROGRESS-Plus dimension) mediated via self-efficacy (TDF construct)). However, it is likely that in practice only a very limited number of interactions and indirect effects will have been tested and each of these will be explored.

Risk of bias assessment of included studies

Two reviewers will independently assess the risk of bias in the included studies using a checklist adapted from previous systematic reviews (Li, Figg, & Schüz, 2019; Schüz et al., 2017; Talsma, Schüz, Schwarzer, & Norris, 2018) and based on two existing study quality assessment tools – the Effective Public Health Practice Project (EPHPP) "Quality Assessment Tool for Quantitative Studies" (Effective Public Health Practice Project, 2019) and the RTI Item Bank (Viswanathan, Berkman, Dryden, & Hartling, 2013). Among other things the check-list will contain the following:

- Assessment of the reliability and validity of assessment of TDF constructs
- Assessment of reliability and validity of assessment of examined health behaviour in the included studies
- Representativeness of study sample

Disagreements between the two reviewers will be resolved through discussion and a third reviewer will be involved, when necessary.

Data synthesis

A narrative synthesis of results will be provided including a summary of the extracted data in tables and figures relevant for the main objective of this review. Furthermore we will describe which PROGRESS-Plus dimension(s) the studies considered for operationalizing social inequality and how they measured it (e.g. using an index).

If sufficient data is available (i.e., there are at least five effect size estimates available per cell of the matrix of interactions and indirect effects outlined above), quantitative meta-analyses will be conducted. We will conduct two sets of analyses: (1) summarizing the estimates of indirect (mediated) effects of social inequality dimensions (PROGRESS-Plus) on health behaviour via TDF constructs, and (2) the moderator effects (interactions) between TDF constructs and social inequality dimensions (PROGRESS-Plus) in predicting health behaviour.

For the meta-analysis of each cell of the matrices resulting from combining TDF constructs with PROGRESS-Plus dimensions, we will first fit a random effects meta-analysis model using the DerSimonian-Laird estimator with Knapp-Hartung adjustments implemented in metafor (Viechtbauer, 2010), and examine heterogeneity in the summary measures using I^2 and the Q-statistic. Significant heterogeneity as indicated by a significant Q-statistic will be interpreted to indicate that a random-effects meta-analysis model is appropriate; non-significant Q-statistics will be interpreted to indicate that a fixed-effects model might be appropriate (Guolo & Varin, 2017). Example scripts are available in Additional File 4.

In the case of significant heterogeneity in a random-effects model, we will conduct moderator analyses with study-level variables (see data extraction) as predictors of between-study variation using meta-regression (Viechtbauer, Lopez-Lopez, Sanchez-Meca, & Marin-Martinez, 2015). Publication bias will be examined using tests for funnel plot asymmetry and conducting fail-safe-n analyses. All quantitative meta-analyses will be conducted using the metafor package for R (Viechtbauer, 2010). An exemplary R script can be found in Additional file 4.

Discussion

The main aim of this review is to summarize the current state of the evidence regarding the role of social inequality in understanding engagement in health behaviours through determinants of health behaviours categorised according to the Theoretical Domains Framework (Cane et al., 2012). This framework summarizes determinants of health behaviour from the theories used most often in research on health behaviour into broad theoretical domains based in commonalities. These determinants at the same time form the basis of the majority of health behaviour change interventions. Thus, this systematic review has the potential to provide a first overview of the relationships between social inequality and determinants of health behaviour by summarising the evidence on both mediated effects and moderating effects of inequality. Identifying which TDF determinants mediate the effects of inequality on behaviour has the

potential to inform the systematic development of more effective interventions to change health behaviours that avoid intervention-generated inequalities (White et al., 2009). Identifying moderator effects, i.e., which health behaviour determinants affect health behaviour differentially according to inequality factors, can support the development of health behaviour change interventions that either benefit all parts of society or that help reduce the health gap between different social groups.

The review will further provide an overview of how social inequality is operationalized/measured in this context. To our knowledge, this will be the first review of this kind. We anticipate that the review will be useful to researchers and practitioners as results will have implications both for theory development, theory refinement, and, most importantly, for understanding the mechanisms underlying intervention-generated inequalities in health behaviour and ultimately health.

Timeline

The Title/Abstract Screening will prospectively be finished in May 2019, the Systematic Review is expected to be completed in autumn/winter 2019.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Additional files

Additional file 1: **PRISMA-P (Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol.**

This file provides a completed PRISMA-P 2015 checklist.

Additional file 2: **TDF framework and operationalization of TDF constructs for the systematic review**

This file contains the TDF domains, component constructs and the operationalization of the constructs for the systematic review.

Additional file 3: **Sample search strategy for PubMed MEDLINE and Web of Science**.

This file contains the search strategy for PubMed Medline and Web of Science.

Additional file 4: **Exemplary R script for meta-analysis**

This file contains an exemplary R script for the meta-analysis.