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METHODOLOGICAL CONSIDERATIONS RELATED TO EQUITY, DIVERSITY, AND INCLUSION IN CLINICAL EPIDEMIOLOGY

Methods used to conceptualize dimensions of health equity impacts of public health interventions in systematic reviews

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Abstract

Objectives: Our aims were to, first, identify and summarize the use of methods, frameworks, and tools as a conceptual basis for investigating dimensions of equity impacts of public health interventions in systematic reviews including an equity focus. These include PROGRESS-Plus, which identifies key sociodemographic characteristics that determine health outcomes. Second, we aimed to document challenges and opportunities encountered in the application of such methods, as reported in systematic reviews.

Study Design and Setting: We conducted a methodological study, comprising an overview of systematic reviews with a focus on, or that aimed to assess, the equity impacts of public health interventions. We used electronic searches of the Cochrane Database of Systematic Reviews, the Database of Promoting Health Effectiveness Reviews (DoPHER), and the Finding Accessible Inequalities Research in Public Health Database, supplemented with automated searches of the OpenAlex dataset. An active learning algorithm was used to prioritize title-abstract records for manual screening against eligibility criteria. We extracted and analyzed a core dataset from a purposively selected sample of reviews, to summarize key characteristics and approaches to conceptualizing investigations of equity.

Results: We assessed 322 full-text reports for eligibility, from which we included 120 reports of systematic reviews. PROGRESS-Plus was the only formalized framework used to conceptualize dimensions of equity impacts. Most reviews were able to apply their intended methods to at least some degree. Where intended methods were unable to be applied fully, this was usually because primary research studies did not report the necessary information. A general rationale for focusing on equity impacts was often included, but few reviews explicitly justified their focus on (or exclusion of) specific dimensions. In addition to practical challenges such as data not being available, authors highlighted significant measurement and conceptual issues with applying these methods which may impair the ability to investigate and interpret differential impacts within and between studies. These issues included investigating constructs that lack standardized operationalization and measurement, and the complex nature of differential impacts, with dimensions that may interact with one another, as well as with particular temporal, personal, social or geographic contexts.

Conclusion: PROGRESS-Plus is the predominant framework used in systematic reviews to conceptualize differential impacts of public health interventions by dimensions of equity. It appears sufficiently broad to encompass dimensions of equity examined in most investigations of this kind. However, PROGRESS-Plus does not necessarily ensure or guide critical thinking about more complex pathways, including interactions between dimensions of equity, and with wider contextual factors, and important practical, measurement and conceptual challenges remain. The findings from investigations of equity impacts in systematic reviews could be made more useful through more explicitly rationalized and considered approaches to the design, conduct and reporting of both primary research and the reviews themselves.

Keywords: Public health; Intervention; Equity; Inequalities; Differential impacts; Systematic reviews

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What is new?

Key findings

- PROGRESS-Plus is predominant for conceptualizing dimensions of equity impacts..
- Primary research studies often do not report the information necessary for analysis.

What this adds to what was known?

- Few reviews justify their focus on (or exclusion of) specific dimensions of impacts.

What is the implication and what should change now?

- PROGRESS-Plus does not ensure critical thinking about more complex mechanisms.
- More explicitly rationalized and considered approaches to investigations are needed

1. Introduction

Health inequities are unfair, socially produced, and systematic disparities in health outcomes between population subgroups, associated with their social, economic or personal characteristics [1,2]. To better understand and justly improve the health of the whole population, the practice and reporting of research must take account of such health inequities. Successfully achieving this requires careful consideration of the wide range of factors or characteristics including the ways in which these interact or intersect [3] that potentially function as determinants of health outcomes. In the context of interventions to improve public health, these characteristics act as the dimensions (and combinations thereof) along which unequal impacts can be observed, assessed, and potentially remediated to ensure inequalities are reduced or at least not exacerbated [4,5]. While equity considerations are similarly important in conducting both primary and secondary research, our focus is on how health inequity is addressed in systematic reviews. While systematic reviews can and do inform policy and practice, they often fail to adequately consider equity, impairing their ability to optimally inform decision-making [6].

Health equity impacts can be examined in systematic reviews by applying methods developed for investigating the differential impacts of interventions more generally. From a 'complex adaptive systems' perspective, differential impacts occur when effects of interventions are modified by characteristics of the: intervention; implementation process; setting or context; individuals receiving the intervention; and/or the interactions between these characteristics [7]. Systematic reviews assessing the impact of public health interventions commonly apply some form of description and/or analysis relating to specific dimensions of possible inequity. These include analyzing differences in impacts between specified groups, or along gradients of disadvantage, of disadvantage (gradient approaches), and targeted approaches that analyze effects in specified population subgroups subject to inequity. In addition to, or instead of, formal analysis of differential impacts, systematic reviews may describe, to varying degrees, the populations or contexts within, or the findings of, the included primary studies in relation to their equity-related characteristics. Such descriptions enable the coverage of existing literature to be mapped or patterns of impacts to be identified, both between and within included studies.

This study specifically concerns the methods, frameworks, or tools[2] used as a conceptual basis for investigating dimensions of health equity impacts in systematic reviews of public health interventions. These can be used, for example, to inform research questions and the factors and pathways depicted within logic models, determine characteristics of eligible interventions and populations, and guide the relevant data to be sought. PROGRESS-Plus (see Box 1) is a prominent example of such a framework that is endorsed by the Campbell and Cochrane Equity Methods Group and within relevant guidance such as PRISMA-Equity and the Cochrane Handbook as a basis for considering equity impacts [10,11].

PROGRESS-Plus built on PROGRESS—an acronym for: Place of residence, Race/ethnicity, Occupation, Gender/sex, Religion, Education, Socioeconomic status, and Social networks and capital—which was originally used in the context of the multiple dimensions by which road traffic deaths are distributed [12], and for which studies have supported its utility including in the conduct of systematic reviews [13]. PROGRESS-Plus was initially a pragmatic response that expanded PROGRESS to include factors that were pertinent to particular contexts, such as age, disability and sexual orientation, and other vulnerabilities. This was later developed into a more coherent extension of PROGRESS including three dimensions: personal characteristics associated with discrimination (eg, age, disability, sexual orientation); features of relationships, such as characteristics of members of familial or occupational networks; as well as time-dependent circumstances, such as times where a person may be subject to disadvantage [8].

[2] Our focus on methods, frameworks, and tools, reflects the broad and nebulous meanings of these terms both within and across different contexts and applications. As such, while we did not apply a comprehensive definition of each of these terms, instead making consensus judgements about relevance, we considered them collectively to mean ways of operationalising or harnessing a conceptualisation of equity impacts, which could be at varying levels of explanation and/or practical applicability. At the center of this meaning were formalised structures or systems intended to serve as a support or guide for how to conceptualise the different dimensions of equity.

Box 1 Meaning of the PROGRESS-Plus acronym (adapted from [8,9])

Place of residence
Race/ethnicity/culture/language
Occupation
Gender/sex
Religion
Education
Socioeconomic status
Social capital
Plus
Personal characteristics
Features of relationships
Time-dependent circumstances

1.1. Aims

Our principal aims were:

i) To identify and summarize the use of methods, frameworks, and tools (eg, PROGRESS-Plus) as a conceptual basis for investigating dimensions of health equity impacts of public health interventions in systematic reviews that included some investigation of equity.
ii) To document challenges and opportunities encountered in their application, as reported in systematic reviews.

2. Methods

2.1. Study design and registration

We conducted a methodological study, comprising an overview of systematic reviews [14], reported in accordance with the PRIOR statement [15]. The review was registered on PROSPERO (CRD42022371805) as well as as a project on the Open Science Framework (OSF) (https://osf.io/vzdxj/). The OSF project page contains the study's full protocol and datasets.

2.2. Inclusion and exclusion criteria

2.2.1. Study design

We included systematic reviews of interventions reported in accordance with PRISMA [16] or QUORUM [17] guidance including a flow diagram and/or that were described as a systematic review. Eligible systematic reviews could include primary research studies with any study design or (quantitative or qualitative) analytic approach.

2.2.2. Populations

Eligible systematic reviews could include any population or population subgroup(s) in any geographical area, with no restrictions.

2.2.3. Interventions

We included systematic reviews focused on public health intervention(s), defined as any intervention(s) intended to prevent disease or promote health, including by modifying social or commercial determinants of health, but not aimed at treating or managing an identified or diagnosed health condition or status [1,4,18,19]. Further details are provided in Supplementary Material (Section 1a).

2.2.4. Comparators

No restrictions were applied (ie, any or no comparator).

2.2.5. Outcomes

Eligible systematic reviews were those that included a focus on or aimed to investigate (ie, describe and/or analyze) differential impacts of interventions in relation to one or more dimensions of health equity or disadvantage. This equity focus had to be expressed in the review's Abstract, Introduction, Objective/Aims, or Methods. Such a focus or aim could be more (eg, clearly specified), or less explicit or central (eg, not constituting a main focus or stated aim but a relevant analysis was included in the review and was framed in relation to equity), and we determined whether review authors had framed the relevant group(s) as being at any kind of disadvantage compared to another group or the general population[3]. We excluded systematic reviews that merely described characteristics of included populations that were potentially relevant to equity, and excluded systematic reviews that focused solely on specific disadvantaged population subgroup(s) if no differential impacts within those subgroup(s) were assessed. Any measure(s) of health-related outcomes, including both beneficial and adverse effects (impacts) was considered relevant.

2.2.6. Publication date, type, and language

We included systematic reviews reported in English language journal articles since 1st January 2000. This is due to focusing particularly on identifying those using either QUORUM, which was published in late November 1999, or its successor PRISMA (*see 'Study design').* Conference abstracts, dissertations, preprints and other publication types were excluded.

[3] For example, if a systematic review reported separate results for women (or men) and the authors explained that women (or men) experience specific disadvantages or inequalities, such as worsened health outcomes, we considered it to have an equity focus because women (or men) are a disadvantaged group in this context. The slight exception to this was when groups were framed in relation to lower socio-economic status and closely related constructs (eg, income, education, occupation), we considered this to be inherently related to concepts of equity and disadvantage, even if it was not further emphasised that this characteristic conferred disadvantage.

2.3. Study identification, data extraction and synthesis

2.3.1. Data sources

Articles reporting eligible systematic reviews were identified from electronic searches of the Cochrane Database of Systematic Reviews, the Database of Promoting Health Effectiveness Reviews (DoPHER), and the Finding Accessible Inequalities Research in Public Health (FAIR) Database, supplemented with automated searches of the OpenAlex dataset. Full details are provided in Supplementary Material (Section 1b).

2.3.2. Selecting eligible systematic reviews

An active learning algorithm in EPPI Reviewer was used to prioritize title-abstract records for manual screening against eligibility criteria. Title-abstract screening was principally conducted by a single researcher, with a second researcher involved as necessary to provide a second opinion and reach a joint consensus on any uncertain decisions. At the full-text screening stage, a second researcher verified all exclusion decisions and again consensus was reached following discussion of any uncertainties. It is important to note that the study identification process was purposefully not exhaustive that is, we sought only to include a limited sample of eligible reviews. As such, it was truncated once we had identified a sample of studies that we judged likely to be able to characterize the scope of the wider body of literature adequately. In particular, we were aware we could not be exhaustive in identifying eligible systematic reviews that did not use PROGRESS-Plus, as this would likely have led to including an impractical number given eligibility criteria that were not overly restrictive. Instead, the extent to which these studies were sampled was relative to the size of the set of records using PROGRESS-Plus that were purposefully targeted (primarily via the FAIR database). For further details, see Supplementary Material (Sections 1c and 1d).

2.3.3. Data collection and synthesis

We extracted data on the following: year of publication; country of review authors; the methods, frameworks, tools, or sets of dimensions, that were used or intended to be used to conceptualize dimensions of equity; whether these methods were able to be used as intended in examining (ie, describing and/or analyzing) evidence concerning differential impacts, and if not, why; how these methods were adapted or supplemented with complementary or alternative methods; reflections on a method's use including its strengths and limitations, and justifications or criteria for using or not using a method; authors' rationale for using or focusing on their specified dimensions in investigating equity; and, finally, whether the review included a broader focus on differential impacts or modifiers of intervention effects beyond equity. Data were extracted by a single researcher, with a second researcher checking the accuracy of all extracted data. Review authors' reflections on their use of methods was synthesized by extracting verbatim information from the report and identifying commonalities we judged to have a shared meaning. We assessed whether an emergent classification scheme was able to accommodate all our data, refined the scheme as necessary, and agreed the structure by consensus. This method was similar to an approach we used previously in identifying emergent sets of clusters of data within bodies of scientific literature [20,21].

3. Results

3.1. Results of the search

Details of the search and study identification processes are shown in the PRISMA flow diagram (Figure 1) [22]. Screening of 2060 title-abstract records identified 322 full-text reports that were potentially eligible for inclusion and were subjected to full-text screening. Following assessment of full-text reports, 120 studies (reports of systematic reviews) met the inclusion criteria and were included before the process of identifying new reviews was stopped as planned. Key characteristics of the included reviews are reported in a 'Table of included reviews' in Supplementary Material (Section 2b).

3.2. Publication characteristics of included studies

The year of publication ranged from 2002 to 2021 but most reviews tended to have been published more recently. 107 out of the 120 included reviews (89%) were published in the most recent 10 years of that range (2012−2021), and the majority (64/120; 53%) was published in the last 5 years (2017−2021).

The range of country of origin of the reviews − as determined by the locations of corresponding authors − included the UK (56 reviews), Australia (16), USA (10), Germany (9), Switzerland (6), Netherlands (5), Canada (3), New Zealand (4), Belgium (3), Sweden (2), and one review from each of India, Italy, Nepal, Pakistan, Portugal, and Sri Lanka. Therefore reviews mostly originated from European countries (83/120; 69%) with the UK being predominant (56/120; 47%), with these patterns similar for reviews using and not using PROGRESS-Plus.

3.3. Methods used for conceptualizing dimensions of equity impacts

Our sample purposefully included reviews that explicitly used or intended to use PROGRESS-Plus[4] (see Box 1) (45/120; 37.5%), as well as reviews that did not (75/120;

[4] As explained in Supplementary Methods (Supplementary Material, section 1b), the set of 45 reviews that used PROGRESS-Plus technically comprised 30 that specified use of PROGRESS-Plus and 15 that specified use of its predecessor, PROGRESS, but we did not otherwise distinguish between these.

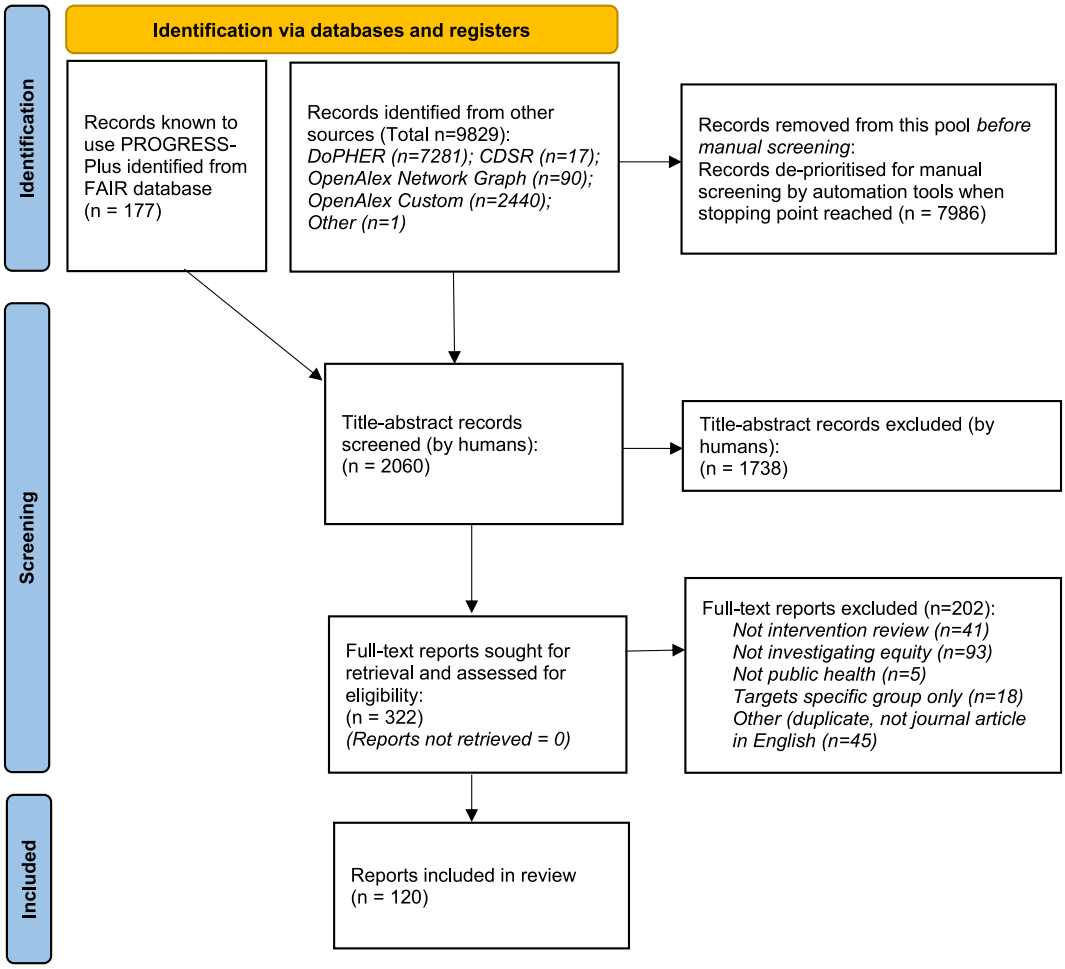

Figure 1. PRISMA flow diagram. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.).

62.5%). Of those that did not use PROGRESS-Plus, the vast majority (68/75; 91%) used dimensions within or equivalent to those outlined by PROGRESS-Plus, but without citing this. In many cases this involved investigating differential impacts by socioeconomic status only.

Several authors using PROGRESS-Plus reported adapting or supplementing it, primarily by specifying a range of additional dimensions linked to equity, considered to be embedded within the 'Plus' component [23–34]. Examples of these additional dimensions included depression and low social support [23], caregiver work hours and civil status [28], substance abuse [30], and sexual health characteristics [34].

A small number of reviews that did not use PROGRESS-Plus included dimensions not typically specified within the scope of PROGRESS-Plus [35–41] but that could be viewed as consistent with the 'Plus' component. Examples included mental health dimensions linked to equity, such as parental level of depression and children's level of disruptive behavior [35], BMI [36] and a range of factors concerning family status and home environment, such as access to literature [36], single parent families, and rented accommodation [37]. No authors of included reviews solely focused on dimensions that are not specified within the broad scope of PROGRESS-Plus.

Importantly, no comparable pre-existing formalized method or framework other than PROGRESS-Plus was used by authors for conceptualizing dimensions of equity impacts for subsequent investigation. While three reviews [42–44] used a sex and gender coding scheme to assess the extent to which this had been considered in primary studies, the coding scheme was not used to investigate inequalities. Also, while some other reviews drew on wider theories or conceptual frameworks (eg, Bronfenbrenner's ecological framework in [45]), these frameworks were used for aspects such as framing or contextualizing the review, rather than for specifying the methods for describing or analyzing differential impacts.

Forty-seven of 120 reviews (39%) investigated equity as part of (either within or alongside) a wider focus on differential impacts. For example, dimensions linked to equity were considered among a wider range of potential intervention effect modifiers, categorized as study, intervention, and

participant characteristics and assessed using metaregression analyses [46,47].

3.4. Whether and why planned methods for conceptualizing dimensions of equity impacts were able or unable to be used

Whichever method was selected by review authors, it could only be applied as intended in examining (ie, describing and/or analyzing) evidence concerning differential impacts in relation to specified dimensions, in less than half of the included reviews (52/120; 43%). In an additional 44 reviews (37%), methods were able to be applied to some extent but not fully as intended, this being either stated explicitly or inferred due to the absence of reporting of differential impacts relative to the review's stated intentions. In the remaining reviews (24/120; 20%), differential impacts in relation to specified dimensions were unable to be examined as intended to any appreciable extent.

Among these systematic reviews, the primary reason why planned methods were unable to be applied fully as intended, was because primary research studies included in the reviews did not report the necessary information (55/68; 81%). Other data-related reasons why methods could not be applied as planned included a lack of included studies, inadequate study quality, or low heterogeneity by key dimensions to enable assessment of differential impacts [40,47−58]. Other reviews, eg, [59,60], were in part prevented from conducting their planned investigations by the absence of universal and standardized definitions, operationalization and measurement of socioeconomic status and its components, and ethnicity (see also 'Broader reflections on methods for conceptualizing dimensions of equity impacts').

3.5. Rationales for investigating equity impacts

Most reviews (87/120; 73%) stated an explicit rationale or justification for including a focus on equity impacts in general. Examples included explaining why equity is important, or highlighting existing inequities in relation to the particular equity dimensions they investigated (eg, existing evidence for inequalities in intervention impacts by socioeconomic status). However, only 7% (8/120) of reviews provided an explicit rationale or justification for focusing (or not focusing) on specific dimensions of equity. Examples included explaining why each domain investigated is particularly important and linking this to the relevant evidence base, and/or providing a rationale for not investigating domains that could have been examined [31,35,61−66]. Twenty-four reviews (20%) provided no clear rationale for a focus on equity impacts.

3.6. Broader reflections on methods for conceptualizing dimensions of equity impacts

A third of reviews (40/120) included explicit discussion, commentary or reflection on the process of applying these types of methods, with no notable differences between reviews that used PROGRESS-Plus and those that did not. From these reflections of authors we identified four common themes, concerning: the lack of consistent and coherent measurement; the complex and contextual nature of differential impacts; potential improvements via applying existing or new methods; and, the inadequacies of primary research (See Table 1 (with a full unabridged version of Table 1 in Supplementary Material, Section 2a)).

4. Discussion

4.1. Principal findings

We found that PROGRESS-Plus was the only formalized[5] framework used in systematic reviews to conceptualize differential impacts of public health interventions by dimensions of equity, and that it was rarely extended or supplemented. In reviews not using PROGRESS-Plus, equivalent dimensions were typically adopted. These findings suggest the PROGRESS-Plus framework is sufficiently broad and applicable to encompass the scope of typical investigations of equity impacts in reviews, at least in terms of the dimensions they consider. In part this is likely because the additional 'Plus' dimensions[6] are highly inclusive in terms of the diverse ranges of factors they can accommodate. The apparent usefulness of PROGRESS-Plus accords with other assessments of its utility by those using it in methodological studies and systematic reviews assessing a range of health care interventions [13].

Although most reviews were able to apply intended methods to investigate equity impacts to at least some degree, they were often unable to fully. Furthermore, investigations were commonly descriptive in nature, such as describing any differential impacts reported within primary studies, rather than conducting formal statistical analysis across studies. The failure to fully apply intended methods was usually because primary studies did not report the necessary information. This reflects similar observations reported elsewhere, including health-equity focused trials rarely reporting data disaggregated for socially disadvantaged populations [79]. Furthermore, beyond insufficient reporting and use of collected data, primary research may even be purposefully excluding more disadvantaged populations from participation for example, due to disability or language [75]. In addition to the practical challenge of such data not being available, authors highlighted significant measurement and conceptual

[5] This merits qualification, in that while the framework now has a relatively clear and consistent structure when described and presented, including by organisations such as the Cochrane and Campbell Collaborations, its conception involved pragmatic development of a list of factors without a formal or planned development process (see 'Introduction').

[6] personal characteristics associated with discrimination', 'features of relationships', and 'time-dependent circumstances'

Table 1. Authors' reflections on conceptualizing dimensions of equity impacts

Theme	Details
Lack of consistent and coherent measurement	Measurement issues related to dimensions of equity impact were a notable problem, eg, [29,35,36,43,58,59,61,62,65,66]. Of primary concern was the difficulty of investigating constructs that lack standardized definitions, operationalization and ultimately measurement, with this being highlighted particularly for socioeconomic status (SES) and closely-related concepts including socioeconomic position, deprivation, and disadvantage. These results in these constructs being reported in widely varying ways by authors of primary research studies, and in them being treated inconsistently within reviews. For example, some reviews opted to generate simpler composite outcomes to integrate a wider range of reported constructs and measures [29,35,36], although harmonizing data in this way risks losing the nuance and explanatory power of different indicators [36]. Other reviews addressed the multidimensional nature of SES by considering constituent parts separately [25], or including data from only a small set of measures of the wider construct [58]. Other examples included authors selecting what they considered the most relevant measure on a by-study basis [61], categorizing primary studies into high or low SES context [46], and asking primary research authors to categorize their own study according to a hierarchy presented by the review authors [65]. Another aspect of this issue [61,62,66] is that dimensions of equity impact are not necessarily distinct or mutually exclusive from one another and so any one measure could apply to more than one dimension.
Complex and contextual nature of differential impacts	Beyond challenges with measuring such dimensions, several reviews highlighted that dimensions of equity impacts exert effects in a complex manner, interacting with one another, as well as with particular temporal, personal, social or geographic contexts or factors, and which also may not always be measured or reported, eg, [35,44,58,64]. As such they cannot necessarily be assumed to be or interpreted as comparable between included primary studies even when they have been measured in a comparable way.
Potential improvements via applying existing or new methods	Reviews advocated applying existing methods to improve the investigation of equity issues [31,40,42–44,58,62,65,67–69]. This included highlighting the benefits of applying PROGRESS-Plus, such as aiding in disentangling the effects of determinants of health that have often been treated in combination (eg, within concepts of SES ([31,62]) and improving treatment of equity within qualitative syntheses [67]. Further examples include support for the use of Health Equity Impact Assessment approaches [68], and highlighting the value of initial scoping reviews to identify the nature of equity evidence to then inform the harmonization of analysis within subsequent reviews [65]. Other authors made specific suggestions about expanding the set of measures to be considered (eg, [40] suggesting incorporating household size and gender of household head into PROGRESS-Plus), or advise the use of particular scales to improve the treatment of particular constructs. Reviews also emphasized or advocated methodological developments with the potential to improve the treatment of equity issues. Several authors propose specific methodological development work that is needed, often concerning standardization of operationalization and measurement of SES and related variables [35,37,58,59,61,62,64,67,70–72].
Inadequacies of primary research	Reports highlighted issues with the conduct and reporting of primary research. This included the absence of a specific rationale(s) or justification in the investigation of equity in primary research studies [58,73] reflecting our finding that this is also an issue within reporting of systematic reviews. As previously mentioned, the lack of availability of necessary data was also emphasized, whether in terms of being potentially available but not reported in primary research studies, or as regards these data not even being assessed or generated in the first place [37,42,43,52,58,59,61,62,64,65,67,68,70,72,74–78].

challenges, including investigating constructs that lack standardized operationalisation and measurement, and the complex and specific nature of differential impacts.

We also found that while most reviews included an explicit general rationale for focusing on equity impacts, few justified their focus on (or exclusion of) specific dimensions. This is a concern because PROGRESS-Plus is not intended to be applied in an invariant and unthinking way, but rather as a means to carefully identify specific factors relevant to the focus of the research [13]. Whilst in many reviews not all equity-relevant dimensions will be relevant, such as when the population is homogenous along a given dimension [80], rarely making explicit the reasons for a particular focus means the reader cannot determine if this is justifiable. The scarcity of clear rationales for analyzing specific dimensions of equity appears inconsistent with PRISMA-Equity guidance, which specifies that assumptions about mechanisms and pathways underpinning impacts should be described [11].

A final observation is that included reviews tended to have been published more recently: in a range from 2002 to 2021, over half were published between 2017 and 2021. This may suggest increasing interest in investigating equity in systematic reviews. However, as our sampling was not exhaustive, it could reflect a similar recent trajectory of growth in the production of systematic reviews [81].

4.2. Strengths and limitations

This review complements previous research on the methods available for assessing equity impacts in systematic reviews, with the potential to inform improvements to evidence synthesis methods, as well as to the conduct and reporting of primary research. Our focus on how dimensions of health equity (which are then subject to those methods) are conceptualized complements recent work mapping the nature and prevalence of descriptive and analytic methods used in relation to PROGRESS-Plus [6]. Our review also complements a study [82] which examined the use of formal guidance for informing the conduct and reporting of investigations of equity in evidence syntheses. This study included PROGRESS-Plus, but also PRISMA-Equity which, as a reporting guideline, was outside the scope of our review. Our review also documents researchers' reflections on why equity impacts were or were not able to be addressed in the ways conceptualized, as well as examining authors' rationales for their focus on equity. Notably, despite differences in our specific review foci and methods, we derive similar and complementary conclusions to previous reviews (eg, [6,82]), including highlighting a lack of thorough justification and definitional clarity in the investigation of equity, and the insufficiency of PROGRESS-Plus for prompting the consideration of more complex pathways.

Our review has several limitations. First, it is not exhaustive, as it was not feasible to identify all reviews with a focus on equity impacts of public health interventions. We attempted to minimize risk by purposefully gathering reviews using PROGRESS-Plus and a deliberately larger sample of reviews not using PROGRESS-Plus, to ensure the broadest range of approaches were captured. However, we cannot be certain our findings are representative of the wider body of potentially eligible reviews. Relatedly, because we included reviews with a clear equity focus or aim, we cannot infer how frequently and adequately equity considerations are included within systematic reviews of public health interventions more generally. We note, however, that authors of other overviews suggest this may be very limited [83].

Second, our review may be unrepresentative in reflecting the reality of dealing with equity issues in systematic reviews because we were necessarily reliant on the often limited information that was included in published reports. It is likely that the challenges encountered are underreported by review authors and this will be reflected in our review. Relatedly, the widespread use and apparent adequacy of PROGRESS-Plus for helping to conceptualize dimensions of equity impact may merely reflect its utility relative to an absence of alternative frameworks, rather than any indication of its absolute value. Because the richness of authors' reflections in published reports is limited, gaining a fuller understanding of the challenges faced in conceptualizing equity and applying available methods, as well as potential solutions, may require additional research, such as interviews with systematic reviewers, policymakers and other stakeholders.

Third, because reporting of relevant data was often inconsistent or lacking in detail, it was sometimes necessary to make judgements based not on explicit statements, but on inferences from data that were not reported. Where this was the case, we reached consensus through discussion between reviewers, and even accounting for some subjectivity in data extraction, we judge it unlikely that this could modify our findings.

4.3. Implications for research and practice

This review highlighted significant challenges with applying available methods, but also potential solutions by which they could be addressed. We focus on three key implications which apply particularly to evidence synthesis, but necessarily also pertain to primary research.

4.3.1. Addressing a lack of availability of equity data

As noted, the data necessary to facilitate evidence syntheses are often lacking in primary studies. While these data may not have been collected, it is also possible that even if available they are not reported in a useable form or are not accessible. This could be addressed through expanding current initiatives to support and motivate researchers conducting primary studies to collect, report or make available these data, including from research funders and regulators [84–86], related organizational support structures [87], and scientific journals [88]. Increased curation of data from primary studies as individual participant level data, able to be queried remotely, without needing to be shared, could produce a range of benefits. These include increasing the potential to apply more consistent, as well as more granular and powerful analyses. Adopting the use of formal reporting guidelines for primary research such as CONSORT-Equity 2017 [89] and the continued development of guidance to encourage systematic consideration of equity (eg, [90]) should facilitate durable norms and standards within the research community for consistent and high-quality collection and reporting of equity-related measures.

4.3.2. Addressing varying conceptualization and measurement

Second, there is significant variation in how dimensions of equity, such as socioeconomic status, are conceptualized and assessed. In part this reflects inconsistencies in defining, operationalizing and measuring constructs within primary research. Such inconsistency is difficult to address, because standardization or harmonization of measurement – such as via formalized core outcome sets – is not necessarily practicable or appropriate at the primary study level [73] across all key characteristics and geographic settings. For example, assessment of socio-economic status and related constructs may not be consistently applicable and

comparable between countries [91]. Furthermore, PROGRESS-Plus does not guide authors to consider or account for the possible relationships between multiple dimensions of equity (including those that overlap such as socioeconomic status, education, and occupation) and the wide variety of indices used to operationalize and measure these [82]. Systematic reviews, particularly those with a substantive equity focus, may therefore benefit from the development of detailed practical guidance on how to more consistently operationalize and analyze the array of data and measures that may be encountered for key dimensions of equity [92]. This could usefully for example, guide when and how different measures of a given construct should be selected between, combined, or focused on separately [36,77,93] and provide concrete examples given a multitude of scenarios. Relatedly, there is also an important complementary role for tools to support consistent basic assessment of equity considerations across all systematic reviews, not just those with an equity focus, for example the ongoing development of the PRO-EDI tool for use in Cochrane reviews [94].

4.3.3. Incorporating complexity perspectives

Third, while our review suggests PROGRESS-Plus is sufficiently broad to encompass the dimensions of equity impacts that are typically examined, several included reviews highlighted that these dimensions often interact with one another, as well as with wider sets of temporal, personal, social and geographic contexts or factors, consistent with applying an intersectionality lens [3]. PROGRESS-Plus is not designed to, and so does not necessarily ensure or guide critical thinking about—nor conceptualization of—complex processes and pathways by which inequities can exert their influence on the outcomes of interventions.[7] To what extent explicit consideration of these complexities needs to be incorporated as part of the systematic review process will depend on the review's purpose and specific questions, as well as its epistemological or disciplinary focus. It may be most important for configurative reviews that seek to build theory through explaining and contextualizing impacts in systems operating over time (for which PROGRESS-Plus can aid in identifying dimensions along which inequity is expressed). For aggregative reviews assessing relatively narrow or static relationships between intervention exposures and outcomes, consideration of such complexities will still usefully inform contextualization and interpretation of the findings.

Increased engagement with the complex nature of equity impacts may be encouraged through incentivizing more detailed and transparent treatment of equity in accordance with PRISMA-Equity, including the use of visualisations and logic models [10], and explicitly defining, rationalizing, and limiting analyses in accordance with GRADE guidance [95]. This could involve, for example, justifying why and how each PROGRESS-Plus dimension has or has not been conceptualized or investigated. A simple and readily achievable action would be the inclusion of standardized separate headings or sections in reports of systematic reviews to make the handling of equity issues more explicit. More fundamentally, however, it may also require moving beyond an approach solely rooted in applying PROGRESS-Plus, acknowledging that this framework is conceptually incomplete, and is unlikely to be similarly applicable, or indeed applicable at all, to all investigations − indeed, as mentioned, it was never intended to be applied in an unthinking, unchanging manner [96]. Adopting elements from broader conceptual frameworks that explicitly represent links and interactions between factors related to equity, and which account for different levels and points of influence, may be beneficial [82]. This could, for example, involve applying more theoretical socio-ecological models, such as those of Bronfenbrenner [97], and Dahlgren and Whitehead [2], alongside PROGRESS-Plus, to enable explicit consideration and visualization of multiple extended pathways [96,98,99]. It could also involve developing new conceptual frameworks, potentially with a more explicit focus on the complex and intersectional nature of equity processes, to supplement or provide an alternative to PROGRESS-Plus, as suggested by other authors [82].

It should be emphasized that, in the main, the issues we have identified are neither unique to frameworks like PROGRESS-Plus, nor to dimensions of equity. Instead they reflect challenges inherent to investigating complex relationships between any constructs that lack standardized definition, operationalization, measurement, or interpretation, potentially exacerbated by inconsistent application of existing guidance for analysis of differential impacts. However, these issues may be more marked or more visible a problem for equity-related dimensions due to the relatively large amount of research and policy attention the topic of inequality receives. Moreover, unlike for some effect modifiers that have highly specific relevance (eg, for particular types of interventions or review questions), equity impacts usually have complex underlying mechanisms with important and wide-ranging implications.

5. Conclusion

PROGRESS-Plus is the predominant framework used in systematic reviews to conceptualize differential impacts of public health interventions by dimensions of equity. It appears sufficiently broad to encompass dimensions of equity examined in most investigations of this kind. However, PROGRESS-Plus does not necessarily ensure or guide critical thinking about more complex pathways or interactions

[7] Albeit the aforementioned breadth of the 'Plus' component means these complexities can potentially be represented within it.

between dimensions of equity, or with wider contextual factors, and important practical, measurement and conceptual challenges remain. The findings from investigations of equity impacts in systematic reviews could be made more useful through more explicitly rationalized and considered approaches to the design, conduct and reporting of both primary research and the reviews themselves.

CRediT authorship contribution statement

Gareth J. Hollands: Writing − review & editing, Writing − original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Emily South:** Writing − review & editing, Project administration, Methodology, Investigation, Conceptualization. **Ian Shemilt:** Writing − review & editing, Software, Resources, Methodology, Conceptualization. **Sandy Oliver:** Writing − review & editing, Conceptualization. **James Thomas:** Writing − review & editing, Software, Resources, Methodology, Conceptualization. **Amanda J. Sowden:** Writing − review & editing, Resources, Methodology, Funding acquisition, Conceptualization.

Data availability

We have shared our data at the study's Open Science Framework project page, linked in the 'Study design and registration' section

Declaration of competing interest

All authors declare no conflicts of interest.

Supplementary data

Supplementary data to this article can be found online at DOI: https://doi.org/10.1016/j.jclinepi.2024.111312.

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SUPPLEMENTARY MATERIAL

CONTENTS:

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1) Supplementary Methods

a) Additional details on inclusion/exclusion criteria for 'Interventions'

Such interventions can be implemented within or across a range of overlapping areas of public policy, including: health promotion; community health; environmental health; population-level communicable disease prevention (including vaccination programmes); social determinants of health concerning living and working conditions *(e.g. agriculture and food production, education, work environments, (un)employment, water and sanitation, built environment including housing, urban planning, transport, education, social welfare, community safety including policing)*; and, commercial determinants of health including commodities (*e.g. food, alcohol, tobacco, illicit substances, gambling*) and practices (*e.g. marketing, lobbying*). They include community or population-level approaches to improving the health of people with a common or undiagnosed condition or status (e.g. obesity, tobacco or alcohol dependence, pregnancy), which do not involve direct clinical treatment or management of a disease.

We excluded studies of interventions intended to modify social determinants of health or commercial determinants of health if an intended health outcome was not explicit. We also excluded interventions targeting healthcare systems or organisations (e.g. concerning access or improvements to services) as these may not necessarily be targeted at the public, and can be focused on healthcare conditions that would fall outside our defined scope of public health interventions.

b) Additional details on data sources

All bibliographic records and corresponding articles were managed using EPPI-Reviewer (ER6). At the outset we were aware that PROGRESS-Plus is a particularly prominent example of a method for conceptualising dimensions of health equity impacts, and we purposefully sought both reviews that used PROGRESS-Plus, as well as reviews that did not. Articles reporting eligible systematic reviews that used (or intended to use) PROGRESS-Plus were primarily identified by screening a collated set of bibliographic records of published systematic reviews in public health, encompassing the years 2008 (when PROGRESS-Plus originated) to 2021. This set of records (of systematic reviews) had already been identified, and manually coded as using PROGRESS-Plus, during a separate, completed study (not yet published) in which we developed the Finding Accessible Inequalities Research in Public Health (FAIR) Database (https://eppi.ioe.ac.uk/eppi-vis/Fair). These systematic reviews (reports) had been identified using conventional electronic searches of multiple literature databases (CINAHL Plus (EBSCO), Cochrane Database of Systematic Reviews (CDSR), Epistemonikos, Europe PubMed Central, Google Scholar, MEDLINE (EBSCO), Microsoft Academic Graph, NICE Evidence Search, Science Direct, SCOPUS, Wiley Online Library), hand searches of other relevant sources (Campbell Collaboration evidence and gap maps and the Campbell Systematic Reviews journal), and consultation with members of a project advisory group. We grouped records that cited or otherwise specified use of PROGRESS with those that used PROGRESS-Plus. Henceforth these records were not distinguished in this regard and throughout the review were simply coded as using PROGRESS-Plus.

Further articles reporting eligible systematic reviews, irrespective of whether they used PROGRESS-Plus or not, were identified from the following sources:
Database of Promoting Health Effectiveness Reviews (DoPHER) (EPPI Reviewer) (1st January 2000 to 8th March 2022);
Cochrane Database of Systematic Reviews (CDSR) (The Cochrane Library) (1st January 2000 to 8th March 2022);
OpenAlex (OpenAlex Tools, EPPI Reviewer): Network Graph Search (1st January 2000 to 11th March 2022) and Custom Search (1st January 2000 to 11th March 2022).

We imported all records indexed in DoPHER that had been published since 2000 and the CDSR search was limited to all Cochrane Public Health Group Intervention Reviews published since 2000. The OpenAlex Network Graph Search was a supplementary, automated search of the OpenAlex dataset that retrieved all records 'connected' to a specified 'seed' record, in the knowledge graph, via a one-step, 'forwards' citation ('cited by') relationship. As such, this type of search does not require any search terms. We specified a single 'seed' record for this Network Graph Search, namely: the PRISMA Checklist Equity Extension article. The OpenAlex Custom Search was a supplementary keyword and 'concept' (topic) search of the OpenAlex dataset, available from: https://eppi.ioe.ac.uk/CMS/Portals/0/OpenAlex_Custom%20Search_Health%20Inequity%20Methods_2022.pdf.

c) Additional details on selecting eligible systematic reviews

Title-abstract records were first de-duplicated using EPPI Reviewer's 'manage duplicates' tools and duplicates discarded. Those records sourced from the OpenAlex dataset were automatically classified using a machine learning classifier designed to identify different types of studies (PubMed Study Types model, EPPI Reviewer) and records classified as likely to report a 'systematic review' were retained for screening. Records sourced from DoPHER, CDSR and OpenAlex were prioritised for title-abstract screening in EPPI Reviewer using 'active learning', where the list of unscreened records was continually reprioritised by a machine learning classifier, trained to distinguish between eligible and ineligible records based on the growing corpus of eligibility decisions made by the researchers. Use of 'active learning' expedites study selection in systematic reviews by ensuring that records of eligible studies are more likely to be identified and selected early in the screening process, compared with screening records in a quasi-random (e.g. alphabetical) order. By contrast, all records sourced from the FAIR database were manually screened as they had previously been selected for their equity focus based on their use of PROGRESS-Plus. Eligibility screening proceeded from title-abstract records to assessment of corresponding full-text articles for those records assessed as potentially eligible.

d) Additional methodological considerations

Although the current methodological study is most accurately described as an overview of systematic reviews, it shares some characteristics that are similar in approach to scoping reviews. First, we did not conduct any risk of bias assessments because our focus was on surveying specific characteristics of the systematic review literature, not its findings. Second, as previously mentioned, we did not intend to be exhaustive, particularly as regards identifying all existing reviews that did not use PROGRESS-Plus but otherwise met our broad criteria. Instead, we sought to identify a sample of reviews that we judged likely to be sufficiently substantial and representative to characterise the scope of the wider body of literature adequately. The screening process to identify new eligible reviews was therefore truncated at a point where we judged it unlikely that we would identify important additional information that had not already been observed in the data and/or that could aid in addressing the study aims.

Because PROGRESS-Plus was known to be the predominant formalised means of conceptualising dimensions of health equity, we purposefully sampled more reviews that did not use PROGRESS-Plus (at least not explicitly). This is because, first, such other approaches are less visible and have been less studied so were of particular interest, and second, because our search was in part focused specifically on identifying reviews that used PROGRESS-Plus (including screening all records within the FAIR database annotated as using PROGRESS-Plus). In practice, by consensus of the review team, we therefore continued including new reviews that did not use PROGRESS-Plus until this subset was at least 50% larger than was the subset that did use PROGRESS-Plus, at which point we

stopped identifying new reviews. The potential size of the subset that used PROGRESS-Plus was dictated by these reviews being identified primarily from the screening of a pool of annotated FAIR database records.

2) Supplementary Results

a) Full unabridged version of Table 1 – Authors' reflections on conceptualising dimensions of equity impacts

Theme	Details
Lack of consistent and coherent measurement	Measurement issues related to dimensions of equity impact were a notable problem [29, 35, 36, 43, 58, 59, 61, 62, 65, 66, 70, 71, 73, 76-87]. Of primary concern was the difficulty of investigating constructs that lack standardised definitions, operationalisation and ultimately measurement, with this being highlighted particularly for socioeconomic status (SES) and closely-related concepts including socioeconomic position, deprivation, and disadvantage, but also for other dimensions including ethnicity, place of residence, and sex and gender. This results in these constructs being reported in widely varying ways by authors of primary research studies, and in them being treated inconsistently within reviews. For example, in order to synthesise the range of SES and related measures used in a practicable manner, some reviews opted to generate simpler composite (e.g. binary) outcomes that attempted to integrate a wider range of reported constructs and measures (e.g. [29, 35, 36]). However, and commonly acknowledged as such, harmonising data in this way risks losing the nuance and explanatory or statistical power of different indicators having different relationships with impact [36, 80]. By contrast other reviews addressed the multidimensional nature of SES by considering its constituent parts separately (e.g. [25]). Alternatively, some authors included data from only a small set of measures of the wider construct whilst acknowledging that this meant potentially excluding relevant data obtained using other measures, such as prioritising parental education as the measure of SES [77], or using parental education as well as the receipt of free school meals [58]. Further examples of different approaches include Attwood et al [61] who selected what they considered the most relevant measure on a by-study basis, Hollands et al [46] who categorised primary studies into high or low SES context, applying an assumption that the context was low deprivation where this was not made explicit, and Love et al [65]. The latter report used an approach whereby primary research authors were asked to categorise their own study according to a hierarchy presented by the review authors. Another component of this measurement issue - highlighted in three studies [61, 62, 66] - was that the various dimensions of equity impact are not necessarily distinct or mutually exclusive from one another and so any one measure could apply to more than one dimension of equity impact. In relation to PROGRESS-Plus, Attwood et al [61]

	highlighted the example of employment status which has its own dimension (occupation) but is also widely conceptualised as central to the dimension of socioeconomic status. Kavanagh et al [62] (the authors who developed PROGRESS-Plus) recognise the tensions highlighted above in their suggestion of employing narrower and wider conceptions of SES, the former being income-based and the latter including other dimensions that are also separately treated, such as education and occupation.
Complex and contextual nature of differential impacts	Beyond challenges with measuring such dimensions, several reviews highlight that dimensions of equity impacts exert effects in a complex manner, interacting with one another, as well as with particular temporal, personal, social or geographic contexts or factors, and which also may not always be measured or reported [35, 44, 58, 64, 71, 73, 80, 86]. As such they cannot necessarily be assumed to be or interpreted as comparable between included primary studies even when they have been measured in a comparable way. For example, Brown et al [80] point out that the effects of SES are likely to interact with other variables such as the setting or country complicating any attempt to draw conclusions about impacts by SES, while Gardner et al [35] highlight that any apparent differential impacts (or the lack thereof) could be due to more individual or micro-level variables such as genetics, personality, family circumstances. Such extensive and complex components of context may be unlikely to be captured in primary research studies of public health interventions, at least not consistently.
Potential improvements via applying existing or new methods	Reviews advocated applying existing methods to improve the investigation of equity issues [31, 40, 42-44, 58, 62, 65, 67-69]. This included highlighting the benefits of applying PROGRESS-Plus, such as aiding in disentangling the effects of determinants of health that have often been treated in combination (e.g. within concepts of SES ([31, 62]) and improving treatment of equity within qualitative syntheses [67]. Further examples include support for the use of Health Equity Impact Assessment approaches [68]; and highlighting the value of initial scoping reviews to identify the nature of equity evidence to then inform the harmonisation of analysis within subsequent reviews [65]. Other authors make specific suggestions about expanding the set of measures to be considered (e.g. [40] suggesting incorporating household size and gender of household head into PROGRESS-Plus), or advise the use of particular scales to improve the treatment of particular constructs. For example, Vondung et al [44] suggest a specific sex/gender checklist, while Tinner et al [58] highlight the value of the Family Influence Scale in studies of SES in adolescents. Reviews also emphasised or advocated methodological developments with the potential to improve the treatment of equity issues. Several authors propose specific methodological development work that is needed, often concerning standardisation of operationalisation and measurement of SES and related variables [35, 37, 58, 59, 61, 62, 64, 67, 70-

	72]. For example, Harbers et al [70] highlight the importance of developing consistent composite measures of SEP that combine income, education and occupational status. Attwood et al [61] similarly emphasise the need for work on consistent definition and operationalisation in specific contexts, drawing on explicit logic models. Tinner et al [58] also highlight the need for greater consensus in SES operationalisation and measures, but emphasise the significant obstacles in doing so. They point out as an example that the use of free school meals eligibility as a proxy of SES in young people is hindered by such eligibility varying by geographic location and also not reliably capturing household income as intended. More fundamentally, even with consensus on which measures should be consistently used, measurement of SES in young people has the potential to be unreliable as it frequently relies on knowledge of parents' education or occupational status.
Inadequacies of primary research	Reports highlighted some issues with the conduct and reporting of primary research. This included the absence of a specific rationale(s) or justification in the investigation of equity in primary research studies [58, 73] reflecting our finding that this is also an issue within reporting of systematic reviews. As previously mentioned, the lack of availability of necessary data was also emphasised, whether in terms of being potentially available but not reported in primary research studies, or as regards these data not even being assessed or generated in the first place [37, 42, 43, 52, 58, 59, 61, 62, 64, 65, 67, 68, 70, 72, 74-78].

b) Table of included reviews, followed by related references. ***NB Numbers assigned to each review in this table relate solely to referencing within this supplementary document and not to the numeric referencing in the main article***

Author (included review number)	Year	Country of corresponding author	Used PROGRESS -Plus?	Used intended methods (to at least some degree)?	General rationale for equity focus?	Rationale for focus on specific dimensions?
Alagiyawanna (1)	2015	Sri Lanka	No	Yes, partly	Yes	No
Allen (2)	2015	USA	No	Yes, partly	Yes	No
Attwood (3)	2016	UK	Yes	Yes, partly	Yes	Yes
Backholer (4)	2016	Australia	No	Yes	Yes	No
Baker (5)	2015	Australia	No	Yes, partly	Yes	No
Baker (6)	2020	Australia	Yes	No	Yes	No
Bambra (7)	2007	UK	No	Yes, partly	Yes	No
Bambra (8)	2008	UK	No	No	Yes	No
Bambra (9)	2015	UK	No	Yes	Yes	No
Baxter (10)	2016	UK	No	Yes, partly	Yes	No
Beauchamp (11)	2014	Australia	No	Yes, partly	Yes	No
Benmarhnia (12)	2014	Canada	No	Yes	Yes	No
Bhaumik (13)	2020	UK	Yes	Yes, partly	No	No
Black (14)	2017	Australia	No	Yes	Yes	No
Blanchard (15)	2019	UK	Yes	Yes	Yes	No
Bock (16)	2014	Germany	No	Yes, partly	Yes	No
Boelsen-Robinson (17)	2015	Australia	No	Yes	Yes	No
Bonell (18)	2016	UK	No	Yes, partly	Yes	No
Brown (19)	2014a	UK	No	Yes, partly	Yes	No
Brown (20)	2014b	UK	No	Yes	Yes	No
Brown (21)	2014c	UK	No	Yes	Yes	No
Brown (22)	2015	UK	No	Yes	No	No
Brown (23)	2019	UK	Yes	Yes	Yes	No
Cairns (24)	2014	UK	No	Yes	Yes	No
Centeno Tablante (25)	2019	USA	Yes	No	No	No
Chamberlain (26)	2017	Australia	Yes	Yes	Yes	No
Coenen (27)	2020	Netherlands	No	Yes	Yes	No
Coren (28)	2016	UK	No	Yes	No	No
Crockett (29)	2018	UK	No	No	No	No
Dangour (30)	2013	UK	No	No	No	No
Das (31)	2019	Pakistan	Yes	No	No	No
De Buck (32)	2017	Belgium	Yes	Yes, partly	Yes	No
Deuba (33)	2020	Nepal	No	Yes	Yes	No
Dowswell (34)	2002	UK	No	Yes, partly	Yes	No
Feteira-Santos (35)	2020	Portugal	Yes	Yes	Yes	No
Field (36)	2021	Switzerland	Yes	No	No	No
Garcia-Casal (37)	2018	Switzerland	Yes	No	No	No
Gardner (38)	2017	UK	No	Yes	No	Yes
Goudet (39)	2018	UK	Yes	No	No	No
Goudet (40)	2019	UK	Yes	No	No	No
Guillaumier (41)	2012	Australia	No	Yes, partly	Yes	No

Harbers [42]	2020	Netherlands	No	Yes, partly	Yes	No
Hartwig [43]	2021	Australia	No	Yes	Yes	No
Hassen [44]	2021	Belgium	No	Yes	Yes	No
Hayba [45]	2018	Australia	No	Yes, partly	Yes	No
Hill [46]	2013	UK	No	Yes, partly	Yes	No
Hillier-Brown [47]	2014	UK	No	Yes	Yes	No
Hollands [48]	2015	UK	No	Yes, partly	Yes	No
Hollands [49]	2019	UK	No	Yes, partly	Yes	No
Hombali [50]	2019	Switzerland	Yes	No	No	No
Humphreys [51]	2013	UK	Yes	Yes, partly	Yes	No
Hunter [52]	2019	UK	Yes	No	Yes	No
Husk [53]	2016	UK	Yes	Yes, partly	Yes	No
Ijaz [54]	2021	UK	No	Yes, partly	No	No
Joyce [55]	2010	UK	No	Yes, partly	No	Yes
Kavanagh [56]	2009	UK	Yes	Yes, partly	Yes	Yes
Kendrick [57]	2012	UK	No	Yes	Yes	No
Kennedy [58]	2020	USA	Yes	Yes	Yes	No
Kock [59]	2019	UK	No	Yes	No	Yes
Lacroix [60]	2013	USA	No	Yes	No	No
Lagarde [61]	2009	UK	No	No	No	No
Langford [62]	2014	UK	Yes	Yes, partly	No	No
Lawrenson [63]	2018	UK	Yes	No	Yes	No
Lehne [64]	2017	Germany	Yes	Yes	Yes	No
Lhachimi [65]	2020	Germany	Yes	No	Yes	No
Liu [66]	2012	UK	No	No	No	No
Lorenc [67]	2014	UK	No	Yes, partly	Yes	No
Love [68]	2019	UK	No	Yes	No	Yes
MacArthur [69]	2018	UK	Yes	No	No	No
Mantzari [70]	2015	UK	No	Yes	No	No
Marx [71]	2017	USA	Yes	Yes, partly	No	No
Mayen [72]	2016	Switzerland	No	Yes	Yes	No
McAllister [73]	2018	Sweden	No	Yes	Yes	No
McCollum [74]	2016	UK	Yes	Yes, partly	Yes	No
McGill [75]	2015	UK	No	Yes	Yes	No
Mölenberg [76]	2019	Netherlands	Yes	Yes, partly	No	No
Moore [77]	2015	UK	No	Yes	Yes	No
Morgan [78]	2020	USA	Yes	No	Yes	No
Nanninga [79]	2019	Germany	Yes	Yes	Yes	No
Ndumbe-Eyoh [80]	2013	Canada	No	No	Yes	No
Nethan [81]	2020	India	No	Yes	Yes	No
Nickel [82]	2020	Germany	No	Yes	Yes	No
Niederdeppe [83]	2008	USA	No	Yes	No	Yes
Nittas [84]	2020	Switzerland	Yes	Yes, partly	Yes	No
Oldroyd [85]	2008	Australia	No	Yes	Yes	No
Olstad [86]	2016	Australia	No	Yes	Yes	No
O'Mara-Eves [87]	2013	UK	Yes	Yes	No	Yes
Owen [88]	2011	UK	No	Yes, partly	Yes	No
Owusu-Addo [89]	2018	Australia	No	Yes, partly	Yes	No
Pega [90]	2013	New Zealand	Yes	Yes, partly	Yes	No
Pega [91]	2015	New Zealand	Yes	Yes, partly	Yes	No

Pega [92]	2017	New Zealand	Yes	Yes, partly	Yes	No
Peña-Rosas [93]	2019	Switzerland	Yes	No	Yes	No
Perski [94]	2021	UK	No	Yes	No	No
Pfledderer [95]	2021	USA	No	Yes	Yes	No
Prasad [96]	2021	USA	Yes	Yes, partly	No	No
Priest [97]	2008	Australia	No	No	Yes	No
Raison [98]	2019	UK	No	No	Yes	No
Robroek [99]	2020	Netherlands	No	Yes	Yes	No
Schlund [100]	2021	Germany	No	Yes	Yes	No
Schulze [101]	2021	Germany	No	Yes	Yes	No
Shepherd [102]	2010	UK	Yes	Yes, partly	Yes	No
Shi [103]	2021	UK	Yes	Yes	Yes	No
Smith [104]	2017	New Zealand	No	Yes	Yes	No
Smith [105]	2020	UK	No	Yes, partly	Yes	No
Tan [106]	2012	USA	No	Yes, partly	No	No
Tancred [107]	2019	UK	No	No	Yes	No
Thomson [108]	2013	UK	No	Yes, partly	Yes	No
Tinner [109]	2018	UK	No	Yes, partly	Yes	No
Van Cauwenberghe [110]	2010	Belgium	No	Yes	No	No
van de Ven [111]	2020	Netherlands	No	Yes	Yes	No
Vargas-Garcia [112]	2017	UK	Yes	No	No	No
Venturelli [113]	2019	Italy	No	Yes	Yes	No
Vondung [114]	2020	Germany	No	Yes	Yes	No
von Philipsborn [115]	2019	Germany	Yes	Yes	Yes	No
Wang [116]	2019	Canada	Yes	Yes, partly	Yes	No
Waters [117]	2011	Australia	Yes	Yes, partly	Yes	No
Western [118]	2021	UK	No	Yes	Yes	No
Yadee [119]	2019	Australia	Yes	Yes, partly	Yes	No
Yuan [120]	2014	Sweden	Yes	Yes	Yes	No

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