

# BMJ Open Role of contextual and compositional characteristics of schools for health inequalities in childhood and adolescence: protocol for a scoping review

Max Herke <sup>1</sup>, Irene Moor <sup>1</sup>, Kristina Winter,<sup>1</sup> Stephanie Hoffmann,<sup>2</sup> Jacob Spallek,<sup>2</sup> Jennifer Hilger-Kolb <sup>3</sup>, Claudia Pischke,<sup>4</sup> Nico Draganò <sup>4</sup>, Anna Novelli <sup>5</sup>, Matthias Richter<sup>1</sup>

**To cite:** Herke M, Moor I, Winter K, *et al.* Role of contextual and compositional characteristics of schools for health inequalities in childhood and adolescence: protocol for a scoping review. *BMJ Open* 2020;**10**:e038999. doi:10.1136/bmjopen-2020-038999

► Prepublication history and additional materials for this paper is available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2020-038999>).

Received 01 April 2020  
Revised 19 November 2020  
Accepted 23 November 2020



© Author(s) (or their employer(s)) 2020. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

For numbered affiliations see end of article.

## Correspondence to

Max Herke;  
max.herke@medizin.uni-halle.de

## ABSTRACT

**Introduction** Childhood and adolescence are crucial life stages for health trajectories and the development of health inequalities in later life. The relevance of schools for health and well-being of children and adolescents has long been recognised, and there is some research regarding the association of contextual and compositional characteristics of schools and classes with health, health behaviour and well-being in this population. Little is known about the role of meso-level characteristics in relation to health inequalities. The aim of this scoping review is to retrieve and synthesise evidence about the mediating or moderating role of compositional or contextual characteristics of schools for the association between students' socioeconomic position and health in primary and secondary education.

**Methods and analysis** We will conduct a systematic search of electronic databases in PubMed/Medline, Web of Science and Education Resources Information Center. Studies must meet the following inclusion criteria: (1) The population must be students attending primary or secondary schools in developed economies. (2) The outcomes must include at least one indicator for individual health, health behaviour or well-being. (3) The study must include at least one contextual or compositional characteristic of the school context and one individual determinant of socioeconomic position. (4) The study must also examine the mediating or moderating role of the contextual or compositional characteristic of the school context for the associations between socioeconomic position and health, health behaviour or well-being. (5) The study must be published since 1 January 2000 in English or German language. We will provide a narrative synthesis of findings.

**Ethics and dissemination** We will not collect primary data and only include secondary data derived from previously published studies. Therefore, ethical approval is not required. We intend to publish our findings in an international peer-reviewed journal and to present them at national and international conferences.

## INTRODUCTION

### Rationale

Childhood and adolescence are periods in life in which the opportunities for health are great and future patterns of adult health are being established.<sup>1 2</sup> Encouragingly, the

## Strengths and limitations of this study

- This scoping review follows the guidelines of the 'Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews'.
- This study is part of a series of scoping reviews of a joint project examining meso-level determinants of the main socialising contexts of young people: family, kindergarten, school, vocational training, university and work, from ages 0 to 25.
- Childhood and adolescence are crucial life stages in due to the influence of health trajectories to adulthood.
- The wide scope of the objective and the expected heterogeneity of included studies only allows for a narrative synthesis of results instead of a meta-analysis.
- This scoping review only examines children and adolescents from developed economies and focusses on socioeconomic position as a cause of health inequalities.

health status of school-aged children and adolescents in Germany and many other European countries has improved over the last decades.<sup>3</sup> Despite this positive development, fundamental socioeconomic differences in young people's health exist. Young people in socioeconomically disadvantaged families (eg, growing up in single-parent families) have a reasonably higher chance of becoming ill or developing early risk factors for chronic non-communicable diseases in later life. For instance, those with a low socioeconomic position report poorer subjective health.<sup>4-7</sup> In addition, higher prevalences of overweight, obesity,<sup>3 8</sup> tobacco use<sup>9</sup> and lower levels of physical activity have been found in this population,<sup>10</sup> as well as evidence that these health inequalities have predominantly increased or remained stable over the last two decades.<sup>6 11 12</sup> While these health inequalities



are receiving renewed scientific interest, little is known about potential factors and mechanisms that impact the relationship between socioeconomic position and health in young people.<sup>13</sup>

Next to the family, the school represents a key institutional context for young people influencing their physical, psychological and social development.<sup>14</sup> Students spend the majority of their weekdays at school and with a group of classmates whom they are required to interact with.<sup>15 16</sup> Students share most of their school time with classmates who have different personality traits, social backgrounds and attitudes towards homework and learning. In general, the school environment can be seen as a 'multilayered phenomenon'<sup>17</sup> that consists of classes, schools and school types. Thus, classes represent an important educational setting for young people and differ in terms of learning environment, student participation and the relationships among teachers, students and classmates.<sup>15 18</sup> In addition, particularly primary schools are often described as comprehensive schools serving students from different socioeconomic positions and with different levels of ability, leading to a very heterogeneous composition of classes.

There has been a growing interest in unravelling the impact of this multilevel environment of schools on students' health and academic outcomes (eg, academic self-concept and performance), taking into account characteristics of schools and classes.<sup>18–20</sup> Accordingly, it is important to distinguish between compositional and contextual features of schools and classes to explain differences in student outcomes not only by individual-level but also by class-level and school-level characteristics.<sup>15 19</sup> Compositional characteristics generally refer to the (social) composition of the student body within schools and classes. They are often measured by aggregating individual student information, such as sociodemographic, socioeconomic or school-related factors (eg, perception of the learning environment or class climate) at the class-level.<sup>21–23</sup> In contrast, contextual characteristics of schools or classes include institutional features of different school types, as well as organisational, structural, cultural and physical factors of schools and classes (eg, qualification of the teaching staff, written and unwritten school norms and values, class or school size, equipment, facilities or schooling hours). Based on this literature, it is generally assumed that these characteristics are associated with cognitive and non-cognitive outcomes above and beyond students' individual cultural and social resources.<sup>15 18–23</sup>

Beyond individual-level determinants, it is important to take environmental determinants into account and consider that inequalities in child and adolescent health may be shaped by institutional contexts in which they grow up.<sup>24</sup> Previous systematic literature reviews examined the association of school-level determinants on students' health. The wide range of school-level determinants can be broken down into several broad categories, which are not conclusive, but allow for a rough classification. These

categories are school composition, school climate, policies, facilities and obesogenic environment.

School or class composition includes determinants that are derived from aggregating individual-level characteristics at the school-level or class-level. These might include determinants, such as the average socioeconomic position or school achievements of students, gender ratios, ethnic composition, rates of school attendance or common health behaviours of students. The impact of social comparison and reference group effects<sup>25</sup> have been well studied in educational and psychological sciences in relation to outcomes, such as self-esteem, academic self-concept and performance,<sup>17 25 26</sup> but rarely with regard to health outcomes.<sup>20</sup>

School climate or school culture includes determinants describing the quality of the interactions within schools and the overall character of school life. These might relate to the teacher–student relationships, such as the way teachers control students and demand school achievements, how teachers promote autonomous learning and interactions between students, or students' perception of teaching practices, in general. Relationships between students are relevant as well, which pertain to the relationships between students, or student's and school staff's norms regarding life in school. A positive school climate is associated with higher school satisfaction and attachment, and such a school environment in turn promotes a healthy physical, psychological and social development.<sup>20 27 28</sup>

Policies include the usually codified norms and expectations present in schools, which are often enforced by staff, and which relate to aspects, such as alcohol consumption or substance use. These have been studied extensively with regard to these health behaviours and are often targeted by school interventions.<sup>20 29–31</sup>

School facilities and the physical school environment, in general, can have an impact on students' health, well-being or health behaviour. The availability of, for example, a gymnasium, sports equipment on the school grounds, or a swimming hall might provide students with opportunities for physical activities (ie, improved health behaviour), or the structural conditions of the school or its surroundings might impact students' health as well.<sup>20 32</sup>

An obesogenic environment includes all aspects of schools that reinforce unfavourable eating behaviours. This overlaps with aspects of other categories, such as policies (eg, guidelines for healthy school meals), or school facilities (eg, the availability and stocking of vending machines on school grounds). Though this might be included in other categories, it is listed separately due to the considerable attention it has gained in previous research.<sup>33–39</sup>

These school-level determinants were examined for their impact on numerous health outcomes. The outcomes most often focused on include alcohol consumption, smoking and substance use,<sup>20 29–31 40</sup> eating behaviour and obesity,<sup>35 36 38 41 42</sup> behavioural and conduct problems,<sup>20 31 43</sup> or physical activity and sedentary behaviours.<sup>33 34 37 39 41</sup>

The evidence of the association between school-level characteristics and student health, well-being and health behaviours suggests that the average impact is low to moderate (eg, the impact of tobacco control policies on smoking, the association of high school attendance rates with lower rates of substance use, the relationship between a good school climate and better subjective well-being.<sup>20 29 30</sup> Some studies consider individual characteristics to mediate the effects of school-level characteristics<sup>20 30 34 37</sup> or to act as a moderator.<sup>39</sup>

While associations between school characteristics and overall health are well studied, little is known about possible effects of meso-level factors on the strength and direction of health inequalities prevalent among young people. This is a relevant lack because it can be assumed that contextual and compositional characteristics of schools are likely to shape socioeconomic inequalities in health among young people above and beyond individual-level determinants.

The examination of the wider social determinants of health<sup>24 44</sup> is necessary to extend the predominant focus on factors at the individual level as drivers of health inequalities. According to existing approaches linking more proximal macro-level determinants (eg, welfare state regimes) to health and health inequalities,<sup>45 46</sup> it is conceivable that meso-level determinants (eg, school composition, school climate, policies, facilities or obesogenic environment) have a direct effect on health and possibly mediating or moderating the association between socioeconomic position and health.<sup>47 48</sup> This expanded focus could contribute to a more comprehensive understanding of the drivers behind socioeconomic inequalities in young people's health.

This review is not limited to specific categories of school determinants, but seeks to examine all possible characteristics of the school level in terms of how they influence health inequalities. This very large scope on the side of school-level determinants will be complemented by a wide range of health outcomes, that is, objective and subjective physical, as well as mental health, and health behaviours. At the level of individual characteristics; however, a restriction to socioeconomic characteristics is made and other determinants of inequalities, such as gender, age or ethnicity are taken into account, if differential results found or if these are essential characteristics of a study's population. Regarding the population, this work focuses on students in developed economies.<sup>49</sup> Student bodies of schools in developing economies often do not represent adolescents' health in a region very well, due to low school retention rates<sup>50 51</sup> and differences in school environments (sometimes fundamental, for example, regarding water, sanitation, hygiene, or facilities<sup>52 53</sup>) further compound the comparison and synthesis of findings. The aim is to answer the following research question:

Is the association between socioeconomic position and child health mediated or moderated by compositional or contextual characteristics of schools?

## Objectives

The objective is to retrieve and synthesise evidence about the mediating or moderating role of compositional or contextual characteristics of schools for the association between students' socioeconomic position and health.

## METHODS AND ANALYSIS

The scoping review will follow an extension to the original Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement,<sup>54</sup> the PRISMA extension for Scoping Reviews (PRISMA-ScR)<sup>55</sup> are conducted to comprehensively assess the existing literature on a complex situation and/or problem which is not well suited for a systematic review. Following the PRISMA-ScR, we will not critically appraise the quality and risk of bias of the included studies and will not conduct a meta-analysis.

### Eligibility criteria

We will include all studies and publications in the scoping review, that fulfil the criteria regarding population, determinants, outcomes, study design, language and publication date given in [table 1](#).

### Information sources

We will search the following electronic databases:

- ▶ PubMed/Medline.
- ▶ Web of Science.
- ▶ Education Resources Information Center.

We will also search the references of studies that meet the inclusion criteria for further eligible studies. However, we will exclude other databases as we already cover health, medical, educational and social sciences. Grey literature will not be included.

### Search

We will conduct the electronic searches using four blocks of search terms, as well as an additional restriction by date. The summary of the electronic search strategy is as follows:

- ▶ Block 1: Schools.
- ▶ Block 2: Context.
- ▶ Block 3: Outcomes.
- ▶ Block 4: Socioeconomic position.
- ▶ Other: Date.

A full overview of all search terms for each block is given in online supplemental appendix 1. The search terms within each block will be linked with the OR logical operators, and the blocks will be linked with the AND operator. We will search titles and if these are inconclusive the abstracts as well. For PubMed/Medline, some of the search terms are also marked as 'Medical Subject Headings' terms.<sup>42</sup> The full syntax that will be used for the electronic search in PubMed/Medline can be found in online supplemental appendix 2.

### Selection of sources of evidence

All search results will be combined and then automatically deduplicated using a reference management software

**Table 1** Overview of inclusion and exclusion criteria

Study designs	<p>Included:</p> <ul style="list-style-type: none"> <li>▶ Cross-sectional studies</li> <li>▶ Intervention studies (baseline data only)</li> <li>▶ Cohort studies</li> <li>▶ Longitudinal studies</li> <li>▶ Case-control studies</li> <li>▶ Qualitative studies</li> </ul> <p>Excluded:</p> <ul style="list-style-type: none"> <li>▶ Case studies</li> <li>▶ Author replies/comments</li> <li>▶ Animal studies</li> <li>▶ Cell studies</li> <li>▶ Reviews</li> </ul>
Population	<p>Included:</p> <ul style="list-style-type: none"> <li>▶ Students attending schools for primary or secondary education (International Standard Classification of Education levels I, II and III<sup>59</sup>)</li> <li>▶ Studies conducted in developed economies (UN classification)<sup>49</sup></li> </ul> <p>Excluded:</p> <ul style="list-style-type: none"> <li>▶ Students attending special schools</li> <li>▶ Studies from economies in transition or developing economies (UN classification)<sup>49</sup></li> </ul>
Determinants of interest	<p>Included:</p> <ul style="list-style-type: none"> <li>▶ To be eligible for inclusion, a study must report at least one determinant which is a contextual or compositional characteristic of school, as well as at least one indicator of socioeconomic position. Furthermore, the study has to examine the associations of the determinants with health outcomes, as well as associations between individual-level and meso-level determinants, in order to assess the mediating or moderating role of meso-level characteristics.</li> <li>▶ Compositional characteristics of schools or classes, for example, <ul style="list-style-type: none"> <li>School socioeconomic position</li> <li>Migrant status ratios of students in the school or class</li> <li>Age ratios of students in the school or class</li> <li>Gender ratios of students in the school or class</li> <li>Competencies of students in the school or class</li> </ul> </li> <li>▶ Contextual characteristics of schools or classes, for example, <ul style="list-style-type: none"> <li>School type</li> <li>School funding</li> <li>School or class size</li> <li>School hours</li> <li>School profile</li> <li>School staff</li> <li>School location</li> <li>School facilities</li> </ul> </li> </ul>

Continued

**Table 1** Continued

	<p>School equipment</p> <ul style="list-style-type: none"> <li>▶ Socioeconomic position at the individual level, for example, <ul style="list-style-type: none"> <li>School type</li> <li>Socioeconomic position</li> <li>Parental education</li> <li>Parental income</li> <li>Parental occupational position</li> </ul> </li> </ul> <p>Excluded:</p> <ul style="list-style-type: none"> <li>▶ Studies which exclusively focus on contextual or compositional characteristics outside of school, for example, <ul style="list-style-type: none"> <li>Family</li> <li>Kindergarten</li> </ul> </li> <li>▶ Studies which do not examine the association between compositional or contextual characteristics of schools in regard to the explanation of health inequalities</li> </ul>
Outcomes	<p>Included:</p> <ul style="list-style-type: none"> <li>▶ Health and health-related outcomes, for example, <ul style="list-style-type: none"> <li>Subjective health</li> <li>Subjective well-being</li> <li>Indicators of objective health (eg, diagnosed diabetes type I, biomarkers)</li> </ul> </li> <li>▶ Health behaviour and related outcomes, for example, <ul style="list-style-type: none"> <li>Nutrition/diet</li> <li>Physical activity/inactivity (eg, sedentary behaviour)</li> <li>Smoking</li> <li>Alcohol consumption</li> <li>Teeth brushing</li> <li>Media consumption</li> </ul> </li> </ul>
Languages	<p>Included:</p> <ul style="list-style-type: none"> <li>▶ German</li> <li>▶ English</li> </ul> <p>Excluded:</p> <ul style="list-style-type: none"> <li>▶ Studies published in other languages</li> </ul>
Publication date	<p>Included:</p> <ul style="list-style-type: none"> <li>▶ Studies published since 1 January 2000</li> </ul> <p>Excluded:</p> <ul style="list-style-type: none"> <li>▶ Studies published before 1 January 2000</li> </ul>

(Citavi V.6).<sup>56</sup> Titles and abstracts will be screened by two reviewers independently. Disagreements will be resolved by discussion between both reviewers. In case agreement between both reviewers cannot be achieved, a third researcher who is familiar with the topic of the review will make the final decision. Full texts of the articles remaining will then be screened independently by two reviewers. Disagreements will be discussed and

resolved by a third researcher in case no agreement can be achieved between both reviewers.

### Data charting process

Two authors will independently extract the data from all studies included in this review using a previously developed data extraction form. A third author will compare and review the extracted data. In contradictory cases, this third author will make a final decision.

In case of missing data which are not relevant for the inclusion of the study (eg, number of males or females), respective columns in the data extraction form will be left empty.

### Data items

The data will be extracted, using a previously developed and tested data extraction form. Extracted information will include, but is not limited to, the following data:

- ▶ Author names.
- ▶ Year of publication.
- ▶ Year that study was conducted.
- ▶ Country of sample origin.
- ▶ Study design.
- ▶ Number of participants.
- ▶ Sociodemographic and socioeconomic characteristics of participants.
- ▶ Compositional and contextual characteristics of schools.
- ▶ Determinants of health inequalities.
- ▶ Outcome measures.
- ▶ Main findings.

### Critical appraisal of individual sources of evidence

We will not provide a critical appraisal of individual sources of evidence.

### Synthesis of results

Due to the wide scope of the review, the expected heterogeneity in methods, outcomes and determinants in included studies, we will conduct a narrative synthesis of findings. We will provide the synthesis following the guidance of the Centre for Reviews and Dissemination.<sup>57</sup> The narrative synthesis is supplemented by further approaches to summarise the studies and visualise their key findings. A tabulated summary will provide an overview over the studies' characteristics. Harvest plots might help visualise the results,<sup>58</sup> for example, by providing a simple overview how many studies show either a mediating or moderating role of school-level determinants or not, similar to a cross table.

### Patient and public involvement

This research is done without patient involvement. Patients are not invited to comment on the study design and not consulted to develop patient relevant outcomes or interpret the results. Patients are not invited to contribute to the writing or editing of this document for readability or accuracy.

### ETHICS AND DISSEMINATION

We will not collect primary data for this scoping review and will only include secondary data derived from previously published studies. Therefore, an ethical approval is not required. We intend to publish our findings in an international peer-reviewed journal and to present them at national and international conferences.

#### Author affiliations

<sup>1</sup>Institute of Medical Sociology, Medical Faculty, Martin-Luther-University Halle-Wittenberg, Halle (Saale), Germany

<sup>2</sup>Department of Public Health, Faculty for Social Work, Health, and Music, Brandenburg University of Technology Cottbus-Senftenberg, Senftenberg, Germany

<sup>3</sup>Mannheim Institute of Public Health, Social and Preventive Medicine, Medical Faculty Mannheim, Heidelberg University, Mannheim, Germany

<sup>4</sup>Institute of Medical Sociology, Centre for Health and Society, Medical Faculty, Heinrich Heine University Duesseldorf, Duesseldorf, Germany

<sup>5</sup>Department of Health Services Management, Ludwig-Maximilians-University Munich, Munich, Germany

**Twitter** Matthias Richter @mrich\_er

**Contributors** MH drafted the manuscript. MH, JH-K, IM and MR contributed to the development of the selection criteria. SH, JS, JH-K, IM, KW, CP, ND, AN, and MR critically revised the draft manuscript for important intellectual content. All authors read and approved the final version of the manuscript.

**Funding** This work was supported by the German Research Foundation grant number FOR2723 (project number 384210238). The individual grant numbers for this subproject and the coordination project are RI2467/8-1 and RI2467/9-1.

**Competing interests** None declared.

**Patient consent for publication** Not required.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Supplemental material** This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

**Open access** This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

#### ORCID iDs

Max Herke <http://orcid.org/0000-0001-6425-4366>

Irene Moor <http://orcid.org/0000-0003-3245-5176>

Jennifer Hilger-Kolb <http://orcid.org/0000-0003-0347-1900>

Nico Dragano <http://orcid.org/0000-0002-0378-0757>

Anna Novelli <http://orcid.org/0000-0002-4600-0183>

### REFERENCES

- 1 Green MJ, Stritzel H, Smith C, *et al*. Timing of poverty in childhood and adolescent health: evidence from the US and UK. *Soc Sci Med* 2018;197:136–43.
- 2 Sawyer SM, Afifi RA, Bearinger LH, *et al*. Adolescence: a foundation for future health. *Lancet* 2012;379:1630–40.
- 3 Inchley J, Currie D, Jewell J, *et al*. *Adolescent obesity and related behaviours: trends and inequalities in the who European region 2002–2014: observations from the health behaviour in school-aged children (HBSC) WHO collaborative cross-national study*. Copenhagen: WHO Regional Office for Europe, 2017.

- 4 Magklara K, Skapinakis P, Niakas D, *et al.* Socioeconomic inequalities in general and psychological health among adolescents: a cross-sectional study in senior high schools in Greece. *Int J Equity Health* 2010;9:3–9.
- 5 Heilmann K, Bräsen J, Herke M, *et al.* Soziale Determinanten Der subjektiven Gesundheit, Lebenszufriedenheit und krankheitsbedingten Schulfehltag von Heranwachsenden in Deutschland: Erste Ergebnisse des Nationalen Bildungspanels (NEPS). *Gesundheitswesen* 2018;80:613–20.
- 6 Duinhof EL, Stevens GWJM, van Dorsselaer S, *et al.* Ten-year trends in adolescents' self-reported emotional and behavioral problems in the Netherlands. *Eur Child Adolesc Psychiatry* 2015;24:1119–28.
- 7 Reiss F. Socioeconomic inequalities and mental health problems in children and adolescents: a systematic review. *Soc Sci Med* 2013;90:24–31.
- 8 Knai C, Lobstein T, Darmon N, *et al.* Socioeconomic patterning of childhood overweight status in Europe. *Int J Environ Res Public Health* 2012;9:1472–89.
- 9 Hublet A, Bendtsen P, de Looze ME, *et al.* Trends in the co-occurrence of tobacco and cannabis use in 15-year-olds from 2002 to 2010 in 28 countries of Europe and North America. *Eur J Public Health* 2015;25:73–5.
- 10 Kalman M, Inchley J, Sigmundova D, *et al.* Secular trends in moderate-to-vigorous physical activity in 32 countries from 2002 to 2010: a cross-national perspective. *Eur J Public Health* 2015;25:37–40.
- 11 Elgar FJ, Pförtner T-K, Moor I, *et al.* Socioeconomic inequalities in adolescent health 2002–2010: a time-series analysis of 34 countries participating in the health behaviour in school-aged children study. *Lancet* 2015;385:2088–95.
- 12 Moor I, Richter M, Ravens-Sieberer U, *et al.* Trends in social inequalities in adolescent health complaints from 1994 to 2010 in Europe, North America and Israel: the HBSC study. *Eur J Public Health* 2015;25:57–60.
- 13 Richter M, Moor I, van Lenthe FJ. Explaining socioeconomic differences in adolescent self-rated health: the contribution of material, psychosocial and behavioural factors. *J Epidemiol Community Health* 2012;66:691–7.
- 14 Bilz L, Sudeck G, Bucksch J, *et al.* *Schule und Gesundheit: Ergebnisse des WHO-Jugendgesundheits surveys 'Health Behaviour in School-aged Children'*. Weinheim, Basel: Beltz Juventa, 2016.
- 15 Eccles JS, Roeser RW. Schools as developmental contexts during adolescence. *J Res Adoles* 2011;21:225–41.
- 16 Rathmann K. *Bildungssystem, Wohlfahrtsstaat und gesundheitliche Ungleichheit. ein internationaler Vergleich für das Jugendalter*. Wiesbaden: VS Verlag für Sozialwissenschaften, 2015.
- 17 Rumberger RW, Palardy GJ. Does segregation still matter? the impact of student composition on academic achievement in high school. *Teachers College Record* 2005;107:1999–2045.
- 18 Allodi MW. The meaning of social climate of learning environments: some reasons why we do not care enough about it. *Learn Environ Res* 2010;13:89–104.
- 19 Kidger J, Araya R, Donovan J, *et al.* The effect of the school environment on the emotional health of adolescents: a systematic review. *Pediatrics* 2012;129:925–49.
- 20 Sellström E, Bremberg S. Is there a 'school effect' on pupil outcomes? A review of multilevel studies. *J Epidemiol Community Health* 2006;60:149–55.
- 21 Bonell C, Jamal F, Harden A, *et al.* Systematic review of the effects of schools and school environment interventions on health: evidence mapping and synthesis. *Public Health Res* 2013;1:1–320.
- 22 Modin B, Östberg V. School climate and psychosomatic health: a multilevel analysis. *School Effectiveness and School Improvement* 2009;20:433–55.
- 23 Andersson HW, Bjørngaard JH, Kaspersen SL, *et al.* The effects of individual factors and school environment on mental health and prejudiced attitudes among Norwegian adolescents. *Soc Psychiatry Psychiatr Epidemiol* 2010;45:569–77.
- 24 Viner RM, Ozer EM, Denny S, *et al.* Adolescence and the social determinants of health. *Lancet* 2012;379:1641–52.
- 25 Van de gaer E, Grisay A, Schulz W, *et al.* The reference group effect: an explanation of the paradoxical relationship between academic achievement and Self-Confidence across countries. *J Cross-Cultural Psychol* 2012;43:1205–28.
- 26 Fang J, Huang X, Zhang M, *et al.* The big-fish-little-pond effect on academic self-concept: a meta-analysis. *Front Psychol* 2018;9:1–11.
- 27 Aldridge JM, McChesney K. The relationships between school climate and adolescent mental health and wellbeing: a systematic literature review. *Int J Educ Res* 2018;88:121–45.
- 28 Kutsyuruba B, Klinger DA, Hussain A. Relationships among school climate, school safety, and student achievement and well-being: a review of the literature. *Rev Educat* 2015;3:103–35.
- 29 Aveyard P, Markham WA, Cheng KK. A methodological and substantive review of the evidence that schools cause pupils to smoke. *Soc Sci Med* 2004;58:2253–65.
- 30 Bonell C, Parry W, Wells H, *et al.* The effects of the school environment on student health: a systematic review of multi-level studies. *Health Place* 2013;21:180–91.
- 31 Wilson DB, Gottfredson DC, Najaka SS. School-based prevention of problem behaviors: a meta-analysis. *J Quant Criminol* 2001;17:247–72.
- 32 Okcu S, Ryherd E, Bayer C. The role of physical environment on student health and education in green schools. *Rev Environ Health* 2011;26:169–79.
- 33 Morton KL, Atkin AJ, Corder K, *et al.* The school environment and adolescent physical activity and sedentary behaviour: a mixed-studies systematic review. *Obes Rev* 2016;17:142–58.
- 34 Ferreira I, van der Horst K, Wendel-Vos W, *et al.* Environmental correlates of physical activity in youth - a review and update. *Obes Rev* 2007;8:129–54.
- 35 Venturelli F, Ferrari F, Broccoli S, *et al.* The effect of public Health/ Pediatric obesity interventions on socioeconomic inequalities in childhood obesity: a scoping review. *Obes Rev* 2019;20:1720–39.
- 36 Frerichs L, Brittin J, Sorensen D, *et al.* Influence of school architecture and design on healthy eating: a review of the evidence. *Am J Public Health* 2015;105:e46–57.
- 37 Naylor P-J, Nettlefold L, Race D, *et al.* Implementation of school based physical activity interventions: a systematic review. *Prev Med* 2015;72:95–115.
- 38 Micha R, Karageorgou D, Bakogianni I, *et al.* Effectiveness of school food environment policies on children's dietary behaviors: a systematic review and meta-analysis. *PLoS One* 2018;13:e0194555–27.
- 39 Hollis JL, Sutherland R, Williams AJ, *et al.* A systematic review and meta-analysis of moderate-to-vigorous physical activity levels in secondary school physical education lessons. *Int J Behav Nutr Phys Act* 2017;14:52.
- 40 Fletcher A, Bonell C, Hargreaves J. School effects on young people's drug use: a systematic review of intervention and observational studies. *J Adolescent Health* 2008;42:209–20.
- 41 Verjans-Janssen SRB, van de Kolk I, Van Kann DHH, *et al.* Effectiveness of school-based physical activity and nutrition interventions with direct parental involvement on children's BMI and energy balance-related behaviors - A systematic review. *PLoS One* 2018;13:e0204560–24.
- 42 Baumann N. How to use the medical subject headings (MeSH). *Int J Clin Pract* 2016;70:171–4.
- 43 Muellmann S, Landgraf-Rauf K, Brand T, *et al.* Wirksamkeit von schulbasierten Interventionen Zur Prävention und/oder Reduktion psychosozialer Probleme bei Kindern und Jugendlichen: ein review von reviews. *Gesundheitswesen* 2017;79:252–60.
- 44 Raphael D. Adolescence as a gateway to adult health outcomes. *Maturitas* 2013;75:137–41.
- 45 Diez-Roux AV. Bringing context back into epidemiology: variables and fallacies in multilevel analysis. *Am J Public Health* 1998;88:216–22.
- 46 Diez-Roux AV. Multilevel analysis in public health research. *Annu Rev Public Health* 2000;21:171–92.
- 47 Högberg B, Strandh M, Petersen S, *et al.* Education system stratification and health complaints among school-aged children. *Soc Sci Med* 2019;220:159–66.
- 48 Baumert J, Stanat P, Watermann R. Schulstruktur und die Entstehung differenzieller Lern- und Entwicklungsmilieus. In: Baumert J, Stanat P, Watermann R, eds. *Herkunftsbedingte Disparitäten Im Bildungswesen: Differenzielle Bildungsprozesse und Probleme Der Verteilungsgerechtigkeit*. Wiesbaden: VS Verlag für Sozialwissenschaften, 2006.
- 49 United Nations. *World economic situation and prospects 2020*. New York: United Nations, 2020.
- 50 Patton GC, Coffey C, Cappa C, *et al.* Health of the world's adolescents: a synthesis of internationally comparable data. *The Lancet* 2012;379:1665–75.
- 51 Bruneforth M, Wallet P. *Out-of-school adolescents*. Montreal: UNESCO Institute for statistics, 2010: 19.
- 52 McMichael C. Water, sanitation and hygiene (wash) in schools in low-income countries: a review of evidence of impact. *Int J Environ Res Public Health* 2019;16 doi:10.3390/ijerph16030359
- 53 Fatusi AO, Hindin MJ. Adolescents and youth in developing countries: health and development issues in context. *J Adolesc* 2010;33:499–508.

- 54 Liberati A, Altman DG, Tetzlaff J, *et al*. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. *BMJ* 2009;339:b2700–27.
- 55 Tricco AC, Lillie E, Zarin W, *et al*. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Ann Intern Med* 2018;169:467–73.
- 56 Citavi 6 (Version 6.5.0.0) [program]. Wädenswil, Switzerland: Swiss Academic Software GmbH 2020.
- 57 Centre for Reviews and Dissemination. *Systematic reviews. CRD's guidance for undertaking reviews in health care*. York: Centre for Reviews and Dissemination, University of York, 2009.
- 58 Ogilvie D, Fayter D, Petticrew M, *et al*. The harvest plot: a method for synthesising evidence about the differential effects of interventions. *BMC Med Res Methodol* 2008;8:1–7.
- 59 UNESCO. *International Standard Classification of Education - ISCED 2011*. Montreal: UNESCO Institute for Statistics, 2012.