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REVIEW

A life-course approach to measuring socioeconomic position in population health surveillance systems

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Measuring socioeconomic position (SEP) in population chronic disease and risk factor surveillance systems is essential for monitoring socioeconomic inequalities in health over time. Life-course measures are an innovative way to supplement other SEP indicators in surveillance systems. A literature review examined the indicators of early-life SEP that could potentially be used in population health surveillance systems. The criteria of validity, relevance, reliability and deconstruction were used to determine the value of potential indicators. Early-life SEP indicators used in cross-sectional and longitudinal studies included education level, income, occupation, living conditions, family structure and residential mobility. Indicators of early-life SEP should be used in routine population health surveillance to monitor trends in the health and SEP of populations over time, and to analyse long-term effects of policies on the changing health of populations. However, these indicators need to be feasible to measure retrospectively, and relevant to the historical, geographical and sociocultural context in which the surveillance system is operating.

collection¹⁷ in repeated, independent, cross-sectional surveys. Its strength lies in its ability to provide trend data on the health of populations over time, and the intelligence about population groups that disproportionately experience certain health-related problems, while suggesting a basis for public health action.^{18–20}

Measuring SEP in population health surveillance systems enables informed decisions to be made about the design, evaluation and monitoring of policies and interventions dealing with inequalities.^{9 21 22} Continuing to refine methods of identifying and measuring risk factors for chronic diseases is valuable for understanding disease aetiology^{23 24} and devising strategies other than those based on behaviour change to modify population risks. Epidemiological analysis of socioeconomic inequalities in health, including their change over time, requires improved measures of SEP in public health surveillance.^{16 25}

Traditionally, surveillance systems measure the current SEP of respondents at the time the survey is conducted. The cumulative and dynamic nature of socioeconomic structures and experiences is more likely to be captured using a life-course approach,⁸ which examines the long-term effects on health and disease of physical and social exposures during gestation, childhood, adolescence, young adulthood and later adult life.²⁶ It includes study of the biological, behavioural and psychosocial pathways that operate across a person's life course, as well as across generations, to influence health status. Life-course effects refer to how health status at any given age reflects not only contemporary conditions but also prior living circumstances for a given birth cohort, from conception onwards.²⁷ Several interrelated conceptual models of life-course influences on health in adulthood exist (table 1),^{28–41} including the critical period, pathway and cumulative theories.

If health status observed in adulthood is the result of social and biological factors that have evolved over the life course,⁴² measuring SEP at only one stage of life is inadequate to explain fully the contributions of socioeconomic factors to health status³⁷ and how these change over time. Indicators of SEP over the life course, particularly during early life, therefore need to be included in population health surveillance systems. The challenge remaining is to determine which specific indicators of socioeconomic circumstances at birth, through childhood,

Chronic disease and risk factor surveillance systems collect information on populations to monitor health and its determinants. Determinants of health in surveillance systems in recent decades have traditionally been confined to behavioural risk factors such as cigarette smoking, physical inactivity and poor diet. More recently, with increased recognition that inequalities in health are associated with social, economic and environmental factors in addition to behavioural factors,^{1–5} more emphasis has been placed on measurement of socioeconomic position (SEP).^{6–14} We use SEP in this paper, rather than socioeconomic status or social class, as it encompasses the material and social resources that influence the position that people hold in societies.^{10 15} A life-course approach, which includes indicators of early-life social circumstances, adds value to the measurement of SEP in surveillance systems.

Although it is recognised that comprehensive population health surveillance systems use data from a wide range of sources, including census data, mortality data and hospital statistics,¹⁶ population surveys are the focus of this paper. Surveillance is characterised by continuous data

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Abbreviation: SEP, socioeconomic position

Table 1 Life-course models explaining the association between early-life circumstances and health in adulthood

Model	Description
Critical period	This model implies that there is a period of development in early life during which exposures to deprivation have long-term effects on adult health, independent of adult circumstances ^{28–29} —for example, the fetal origins of disease hypothesis. ^{30–31}
Pathway	The early-life environment sets people on life trajectories or directions that in turn affect health status over time and into adulthood. ^{32–34} The pathway model views early environment to be important, but only because it shapes and influences the socioeconomic trajectories of people. ³⁵ Circumstances in early life are seen as the initial stage in the pathway to adult health but with an indirect effect, influencing adult health through social trajectories such as restricting educational opportunities, thus influencing socioeconomic circumstances and health in later life. ³⁴
Cumulative	The intensity and duration of exposure to unfavourable or favourable physical and social environments throughout life affects health status in a dose-response fashion. ^{36–40} Unfavourable circumstances throughout life are associated with the greatest risk of poor health in adulthood, whereas unfavourable circumstances at only one stage of life may be lessened by improved circumstances at another stage. ³⁴ This accumulation of risk approach emphasises both biological and social experiences in childhood, adolescence and early adulthood, and how these biological and social risk factors combine and form pathways between early-life experiences and adult disease. ⁴¹

adolescence and young adulthood, should be included. Several reviews have provided detailed discussion of indicators of SEP, including their strengths and limitations, and the theoretical basis of the constructs they intend to measure.^{15–43–46} This paper aims to position population health surveillance within the literature of SEP and health over the life course. It reviews indicators of early-life SEP that have been used previously in longitudinal and cross-sectional studies, and examines their potential value for use in population health surveillance systems.

METHODS

A review of the literature was conducted to identify studies that examine the association of indicators of SEP during early life with health over the life course. Early life was defined as the period from birth, through childhood, adolescence and young adulthood.

Search strategy

PubMed, CINAHL, PsychInfo and Sociological Abstracts electronic databases were used to search for the international literature. The terms “life course” or “lifecourse” in addition to the MeSH headings of “socioeconomic factors”, “socioeconomic status” and “social class” were searched for in titles and abstracts. The search was restricted to studies on humans, published in the English language. Reference lists of included studies were hand searched for publications potentially missed in electronic searches. Searches were conducted from the starting of the databases, and no studies were excluded based on study design or the specific life-course model used. The searches resulted in some studies being extracted that examined health over the life course but did not measure SEP during early life. Figure 1 shows results of the database searches, as at March 2005. A list of excluded studies is available from the corresponding author on request.

Assessment of the studies

The indicators of early-life SEP that were used in the included studies were assessed according to whether they were measured prospectively or relied on retrospective recall in either cross-sectional or longitudinal designs. The potential value of indicators for use in surveillance systems was assessed against criteria based on previous work on the value of public health indicators.⁴⁷ Specifically, in terms of validity, indicators were assessed according to whether they had a sound theoretical base for inclusion in surveillance systems, whether they measured what they were designed to measure, whether they were associated with other indicators measuring the same construct and whether they predicted what was expected in terms of health outcomes. Indicators of SEP were also assessed for their relevance in different times, places and

cultures, the feasibility of measuring them in surveillance systems that necessarily rely on retrospective recall and their ability to be measured consistently over time (reliability). Summary indicators assembled from more than one individual indicator were also assessed for their ability to be deconstructed into their component parts (deconstruction).

RESULTS

Figure 1 shows details of the number of studies obtained from each database. Date of publication of the 83 included studies ranged from April 1992⁴⁸ to January 2005.^{49–50} Multiple publications from the same study meant that 45 separate studies were included in the 83 publications reviewed.

Indicators of early-life SEP were grouped into six categories (education level, income, occupation, living conditions, family structure and residential mobility) that reflected experiences from birth through childhood, adolescence and early adulthood (tables 2–7).^{51–129} Whereas cross-sectional studies always relied on retrospective recall, some longitudinal studies also collected early-life SEP information retrospectively.

Validity

Choosing appropriate measures of SEP should depend on how SEP is considered to be associated with health. A Marxist or Weberian influence may be reflected in the choice of social class structure or life chance indicators such as education, occupation or income.^{14–15–130} Neomaterialist explanations for inequalities focus on the lack of material resources, whereas relative position on the social or occupational ladder is more important in psychosocial explanations.^{27–131}

The association between the education level of respondents and that of their parents can be explained in different ways. Parents with higher education levels are likely to have a higher SEP, with better jobs, housing, neighbourhood and working conditions,¹⁵ higher incomes, and able to finance higher levels of education for their children. Psychologically, parents with higher education levels are more likely to instil strong educational values and norms in their children. Biologically, intellectual ability and thus educational attainment may be, at least partly, inherited.¹³² The influence of mother's and father's education has been shown to be different for men and women, supporting the need to include the education levels of both parents in descriptions of early-life SEP.¹³²

Income relates most closely to the material resources component of SEP. It is inversely correlated with suboptimal environmental conditions such as air quality, housing facilities and overcrowding, and school, work and neighbourhood environments.³ Occupation and employment conditions,

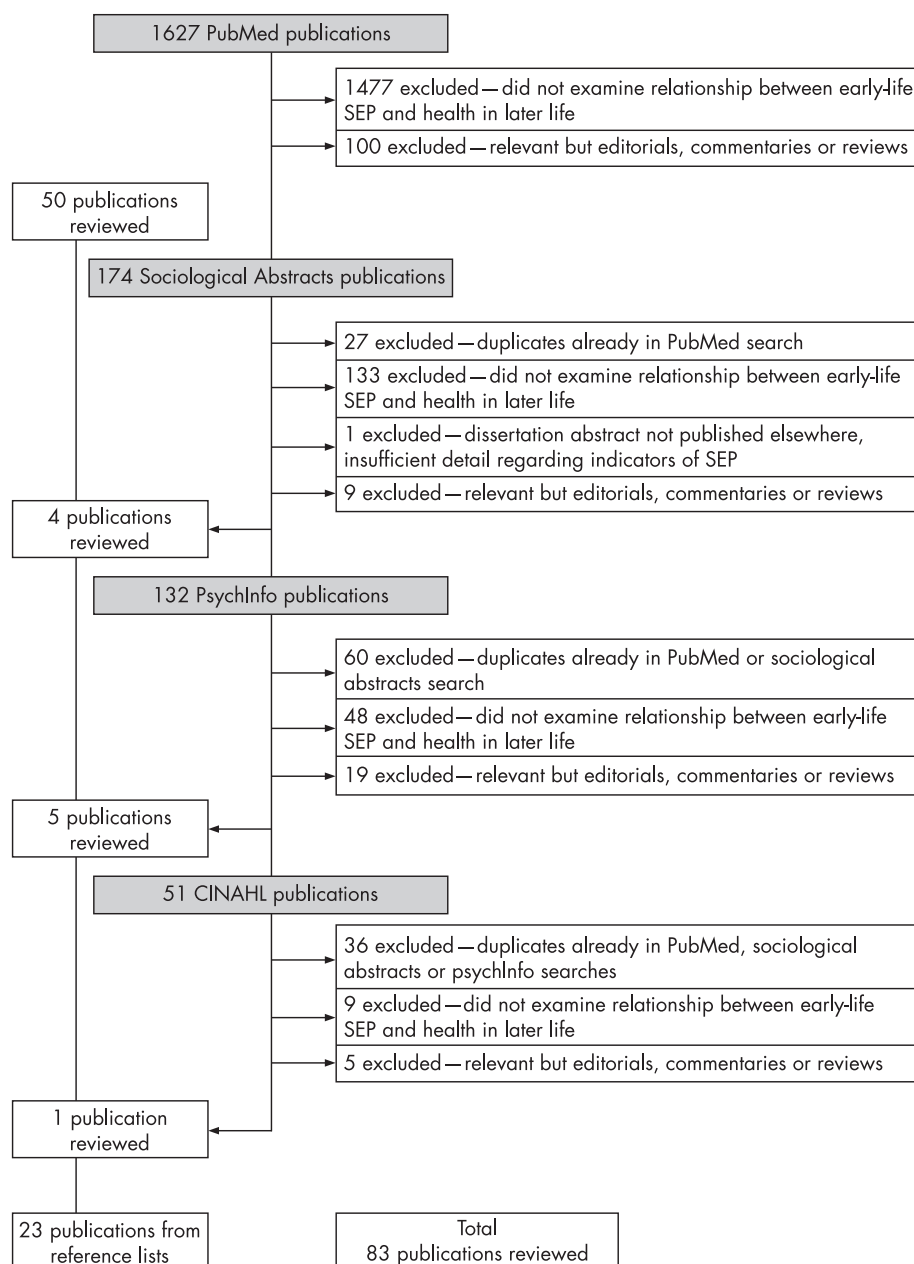


Figure 1 Results of literature searches.

reflecting both the physical and psychosocial environments in which people work, are the major link between education and income.¹⁵ Father's occupation is associated with adult height^{81 82} and early-life material circumstances.¹⁰⁰

In terms of family structure, single-parent backgrounds have been associated with lower incomes and education levels.⁴⁰ Family structure questions may also be important to determine whether the respondent lived with their biological parents, step-parents or in some other arrangement. Obtaining information about education and occupation of parents may be irrelevant if respondents did not live with their parents during their early life. Number of siblings or birth order may also reflect childhood SEP, as human and material resources are likely to diminish as the family grows larger.¹¹⁶ Residential mobility has been negatively correlated with home ownership, which in turn is associated with housing quality and income.³

Living conditions, such as car ownership, housing tenure, crowding or amenities, and indicators of family structure and residential mobility are suggested to be merely proxy measures and should not be used when information on education, income and occupation is available.^{11 43} Although they are strongly correlated with SEP, they may be associated with health outcomes via causal pathways that are not related to SEP. For example, growing up in a single-parent family may be related to poor health outcomes for socio-economic reasons associated with low income, or it may be related to poorer health for psychological reasons resulting from the family breakdown.⁴⁴

The use of various life-course models (table 1) is evident in the specific indicator chosen to measure early-life SEP. A focus on the critical period model is reflected in the measurement of SEP at the time of birth of participants.^{48 116} Use of the pathways model was shown through the

Table 2 Early-life indicators of education

Indicator	Location, study design	Indicators of SEP measured	Criteria
Highest education level of paternal and maternal grandmother	Danish 1958 cohort of men ⁵¹	P	<i>Validity:</i> Education of parents is less likely to change after young adulthood than their occupation or income Low educational level of the mother is an important childhood characteristic in explaining socioeconomic inequalities in health ⁵⁶ <i>Relevance:</i> Relationship between education and health exists almost universally Norms and social meanings of education change over time and are different between population groups and cultures ⁶ <i>Reliability:</i> Potentially affected by recall bias Education level of parents is a relatively stable indicator of SEP <i>Deconstruction:</i> Not applicable
Highest education level of father	1958 British Birth Cohort ⁵²	P	
	USA, Longitudinal Alameda County Study ⁵³	R	
	USA, Cross-sectional National Survey of Midlife Development ⁵⁴	R	
	USA, Longitudinal Normative Aging Study ⁵⁵	R	
Highest education level of mother	Australia, Longitudinal Mater—University of Queensland Study of Pregnancy and its Outcomes ^{48 57}	P	
	Danish 1958 cohort of men ⁵¹	P	
	The Netherlands, Longitudinal Study of Socio-Economic Health Differences ⁵⁸	R	
	USA, Cross-sectional National Survey of Midlife Development ⁵⁴	R	
Mother's education when participant born and aged 7 years	USA, Longitudinal National Collaborative Perinatal Project ^{59 60}	P	
Highest education level of parents	Slovakia, Cross-sectional survey of adolescents ⁶¹	P	
	USA, Longitudinal CARDIA Study ⁶²	R	
	USA, Cross-sectional, Midwestern Public School Survey ⁴⁹	R	
	USA, Longitudinal National Survey of Children ⁶³	P	
Mother's and father's education level when participant aged 13 years	Brazil, Cross-sectional, Cianorte Survey of School Children ^{64 65}	P	
Mother's and father's education level when participant aged 10 years	Finland, Longitudinal Kuopio Ischaemic Heart Disease Risk Factor Study ^{66 67-70}	R	
Mother's and father's education level when participant aged 4 years	1946 British Birth Cohort ^{71 72}	P	
Head of household's years of completed schooling when participant aged 15 years	USA National Longitudinal Survey of Older Men ⁷³	R	
Participant household's highest education level	USA, Longitudinal Harvard Study of Moods and Cycles ⁷⁴	P	

P, prospectively; R, retrospectively; SEP, socioeconomic position.

Table 3 Early-life indicators of income

Indicator	Location, study design	Indicators of SEP measured	Criteria
Family income during childhood	Australia, longitudinal Mater—University of Queensland Study of Pregnancy and its Outcomes ^{48 57}	P	<i>Validity:</i> Poor family financial situation is an important childhood characteristic in the explanation of socioeconomic inequalities in health ⁵⁶ <i>Relevance:</i> May be affected by inflation over time, or changing criteria for definitions of poverty <i>Reliability:</i> Potentially affected by recall bias and poor response rates Timeframe or age within indicator question may affect responses, as circumstances may change throughout early life <i>Deconstruction:</i> Economic distress construct could be broken down into component parts if necessary
	USA, Woodlawn Cohort Study ⁷⁵	P	
Family income when participant aged 13 years	Brazil, Cross-sectional, Cianorte Survey of School Children ^{64 65}	P	
Household income when participant aged 18 years	USA, Wisconsin Longitudinal Study ⁷⁶	P	
Economic distress construct in childhood based on receipt of public assistance or welfare, inability to pay for food, rent or mortgage, not having enough money to make ends meet, or borrowing money to pay for medical expenses	USA, Longitudinal Harvard Study of Moods and Cycles ⁷⁴	R	
Degree to which family was considered wealthy	Finland, Longitudinal Kuopio Ischaemic Heart Disease Risk Factor Study ⁶⁸⁻⁷⁰	R	
Receipt of state welfare benefits	Australia, Longitudinal Mater—University of Queensland Study of Pregnancy and its Outcomes ^{48 57}	P	
	1970 British Birth Cohort ⁷⁷	P	
	1958 British Birth Cohort ⁷⁸	P	
Free school meals or on supplementary benefit	USA, Longitudinal National Collaborative Perinatal Project ^{59 60}	P	
Household poverty status when participant born and aged 7 years	USA, Cross-sectional National Survey of Midlife Development ⁵⁴	R	
Period of 6 months during childhood when family was on welfare	USA, Longitudinal Alameda County Study ³⁹	R	
Number of times household income was at least 200% below poverty line			
Financial circumstances during childhood	The UK, Longitudinal Whitehall Study ³⁵	R	
	The Netherlands, Longitudinal Study of Socio-Economic Health Differences ⁵⁸	R	
	Sweden, Longitudinal level of living surveys ⁷⁹	R	

*P, prospectively; R, retrospectively; SEP, socioeconomic position.

Table 4 Early-life indicators of occupation

Indicator	Location, study design	Indicators of SEP measured	Criteria
Maternal grandfather's occupation	Australia, Longitudinal Mater—University of Queensland Study of Pregnancy and its Outcomes ⁸⁰	P	Validity: Father's occupation is a valid marker of socioeconomic and environmental circumstances in childhood. ^{81 82 83}
Maternal and paternal grandfather's occupation	Danish 1958 cohort of men ⁵¹	P	Information about past occupation could be as important as current occupation given that some occupations are less healthy than others ⁸⁷
Father's occupation	Australia, Longitudinal Mater—University of Queensland Study of Pregnancy and its Outcomes ⁸⁰	P	Relevance: Culturally and historically specific, cohort and period effects likely to exist. ⁵¹
	Britain, Longitudinal Whitehall Study ³⁵	R	Cannot readily be used for groups outside the recognised labour force ¹⁰
	Danish 1958 cohort of men ⁵¹	P	Reliability: Potentially affected by recall bias
	Finland, Helsinki University Central Hospital Cohort ⁸⁴	R	Father's occupation was recalled accurately, reliably and by most respondents
	Finland Valmet cohort ⁸⁵	R	Changing coding criteria need to be taken into account for consistent measurement over time
	The Netherlands, Longitudinal Study of Socio-Economic Health Differences ⁸⁸	R	Deconstruction: Not applicable
	Scotland, Glasgow Alumni Cohort ⁸⁶	R	
	Longitudinal West of Scotland Collaborative Study ^{33 37 88 89 90-93}	R	
	Spain, Cross-sectional study ⁷⁴	R	
	Sweden, Cross-sectional Malmö Diet and Cancer Study ⁸²	R	
	Sweden, Cross-sectional Stockholm Heart Epidemiology Programme ²⁸	R	
	USA, Longitudinal Alameda County Study ²³	R	
	USA, Longitudinal Nurses' Health Study ²⁵	P	
	USA, Cross-sectional National Survey of Midlife Development ⁸⁴	R	
	USA, Longitudinal Normative Aging Study ²⁵	R	
	British Women's Heart and Health Study, cross-sectional ^{38 50 96 97 98 99}	R	
	British Regional Heart Study, longitudinal ¹⁰⁰	R	
	Britain Newcastle Thousand Families Cohort Study ^{101 102 103}	P	
Father's longest held occupation	1958 British Birth Cohort ^{52 77 104 105 106}	P	
	New Zealand, Longitudinal Christchurch Health and Development Study ¹⁰⁷	P	
	New Zealand, Longitudinal Dunedin Multidisciplinary Health and Development Study ^{108 109}	P	
	1946 British Birth Cohort ^{71 72 110 111 112}	P	
	British Household Panel Survey, cross-sectional ¹¹³	R	
	USA, Longitudinal Nurses' Health Study ²⁵	R	
	USA, Cross-sectional National Survey of Midlife Development ⁸⁴	R	
	Slovakia, Cross-sectional Survey of Adolescents ⁶¹	P	
	1970 British Birth Cohort ⁷⁷	P	
	New Zealand, Longitudinal Dunedin Multidisciplinary Health and Development Study ¹¹⁴	P	
	Finland, Longitudinal Kuopio Ischaemic Heart Disease Risk Factor Study ^{66 68-70 115}	R	
	USA, Longitudinal National Collaborative Perinatal Project ^{59 60}	P	
	Sweden, Uppsala Birth Cohort Study ¹¹⁶	P	
	Britain Newcastle Thousand Families Cohort Study ^{101 102 103}	P	
	USA National Longitudinal Survey of Older Men ³	R	
	Finland, Longitudinal Census Data Study ^{40 117}	R	
	USA, National Longitudinal Survey of Older Men ⁷³	R	
	Britain, Longitudinal Whitehall Study ³⁵	R	
	Sweden, Cross-sectional Stockholm Female Coronary Risk Study ¹¹⁸	R	
	West of Scotland, Longitudinal Collaborative Study ^{37 80 91 93}	R	

P, prospectively; R, retrospectively; SEP, socioeconomic position.

Table 5 Early-life indicators of living conditions

Indicator	Location, study design	Indicators of SEP measured	Criteria
Whether family lived on a farm, and size of farm, at age 10 years	Finland, Longitudinal Kuopio Ischaemic Heart Disease Risk Factor Study ⁶⁸⁻⁷⁰	R	Validity:
Number of rooms and number of people in the home	Finland, Helsinki University Central Hospital Cohort ⁶⁴	P	Overcrowding reflects childhood circumstances that may be directly or indirectly connected to health ¹¹⁷
Overcrowding (ratio of people to number of rooms in household)	1970 British Birth Cohort ⁷⁷	P	Living in council housing has been shown to have a stronger association with midlife psychological distress among women than father's occupation and overcrowding ¹¹²
Overcrowding when participant aged 4 years	1946 British Birth Cohort ^{71 112}	P	Relevance:
Overcrowding when participant aged 11 and 16 years	1958 British Birth Cohort ⁷⁸	P	These indicators are culturally, geographically and historically specific
Household amenities (sole use of bathroom, toilet, hot water)	Brazil, Cross-sectional Cianorte Survey of School Children ^{44 45}	P	British data showed a secular change in material resources over time
Lack of hot water in house when participant aged 11 and 16 years	1958 British Birth Cohort ⁷⁸	P/R	A 1970 cohort was more likely than a 1958 cohort to own their own home, and less likely to be overcrowded or share amenities ¹¹⁵
Presence of toilet inside house when participant born and aged 13 years	Brazil, Cross-sectional Cianorte Survey of School Children ^{44 45}	P/R	Reliability:
Presence of toilet inside house before age 16 years	Britain, Longitudinal Whitehall Study ³⁵	R	More likely to be recalled accurately than categories such as parents' education or occupation
Car ownership of family when participant born and aged 13 years	Brazil, Cross-sectional Cianorte Survey of School Children ^{44 45}	P/R	Life grid methods using a temporal reference system have been shown to improve recall ¹²⁰
Car ownership of family before age 16 years	British Women's Heart and Health Study, cross-sectional ^{88 99}	R	Life grid method may improve reliability of recalled information
Family access to a car during childhood	1970 British Birth Cohort ⁷⁷	P	Deconstruction
Housing tenure	1946 British Birth Cohort ^{71 112}	P	Composite or summary indicators may provide less information about the causal nature of associations between SEP and health
Housing tenure when participant aged 4 years	Brazil, Cross-sectional Cianorte Survey of School Children ^{44 45}	P/R	
Housing tenure when participant born and aged 13 years	Brazil, Cross-sectional Cianorte Survey of School Children ^{44 45}	P/R	
Availability of piped water to house when participant born and aged 13 years	Brazil, Cross-sectional Cianorte Survey of School Children ^{44 45}	P/R	
Type of material used to build house when participant born and aged 13 years	Brazil, Cross-sectional Cianorte Survey of School Children ^{44 45}	P/R	
Childhood household amenities (living in a house with a bathroom, living in a house with a hot water supply, sharing a bedroom)	British Women's Heart and Health Study, cross-sectional ^{88 99}	R	
Housing conditions at birth and ages 5 and 10 years based on overcrowding, lack of hot water, shared toilet, and dampness or poor repair of house	Britain Newcastle Thousand Families Cohort Study ^{102 103}	P	
Material home conditions at age 4 years was an aggregate variable based on state of repair of house, age of house, crowding, cleanliness of house, cleanliness of participant, and condition of participant's shoes and clothes	1946 British Birth Cohort ^{71 72}	P	
Life-grid method to collect retrospective personal, residential and occupational histories. Lifetime exposures to a range of generally accepted health hazards, including atmospheric pollution, residential damp, occupational fumes and dusts, physically arduous work, lack of autonomy, cigarette smoking and inadequate nutrition during childhood and adulthood were estimated from details of household, residential, occupational and smoking histories.	Britain Boyd Orr Cohort ^{121 122 123 124}	R	
Family amenity score in childhood up to age 10 years (presence of hot water tap and bathroom in family home, whether they shared a bedroom, car ownership)	British Regional Heart Study, longitudinal ¹⁰⁰	R	
Material standard of living at age 15 years (owner occupied accommodation, owned car, owned summer cottage or second house in the countryside)	Danish 1958 cohort of men ⁵¹	P	
Housing conditions at age 0-19 years (Type of dwelling, status of home ownership, number of persons per room, telephone in dwelling, toilet or bath inside dwelling)	Norway Census data cohort ¹²⁵	P	
Characteristics of place of residence in 1939 including whether area was depressed, population density, percentage of population in manual work, proportion of population in overcrowded housing, unemployment rate in area	Britain Office for National Statistics Longitudinal Study for England and Wales ¹²⁶	P	

P, prospectively; R, retrospectively; SEP, socioeconomic position.

measurement of SEP at a particular age during childhood or adolescence—for example, education of parents, father's occupation and housing conditions when participant was aged 4 years.⁷¹ Measurement of SEP—for example, father's occupation—at several ages^{37 52 114} supports a cumulative life-course model, recognising that information on past occupation of parents and respondents may be as important as current occupation.⁶¹ Existing data sets were sometimes also used opportunistically to examine life-course hypotheses. In these cases, the selection of specific ages for measuring SEP was less likely to be guided by any particular life-course model.

Validity, in terms of expected associations with health outcomes,⁴⁶ has been shown for many indicators of early-life SEP, with lower levels of SEP generally associated with adverse health outcomes. Parental education has been associated with psychosocial and cognitive functioning,^{66 115} dental health,⁶⁴ pulmonary function,⁶² self-reported general health,⁵⁸ cardiovascular mortality⁵³ and risky behaviours during adolescence.⁶¹ Financial situation during childhood has been associated with self-reported general health in adulthood.⁵⁸ Conditions of overcrowding and type of housing material at birth have been associated with poor dental health during adolescence.⁶⁴ Occupational class of the parents, most commonly of the father, has been associated with cardiovascular risk factors,^{88 94 96} risky behaviours during adolescence,⁶¹ self-reported limiting longstanding illness,¹⁰¹ self-reported general health,^{58 104} psychosocial functioning,¹¹⁵ depression,⁵⁹ persistent smoking,⁵² obesity,^{102 110} insulin resistance^{38 97} and diabetes,⁸⁴ and overall,⁷¹ cardiovascular,^{33 37 53} stomach cancer and respiratory mortality.⁸⁹ Growing up in a single-parent household has been associated with behavioural, emotional and physical health problems.¹³³ Residential instability in childhood has predicted an increased risk of lifetime major depression, although it is recognised that simply counting the number of geographical moves during childhood overlooks the context in which the transitions occurred and the resources available at those times.⁶⁰ Geographical relocation to a more advantaged area before the age of 25 years was associated with increased risk of developing diabetes, hypertension, dyslipidaemia and coronary heart disease.¹²⁹ Lifetime exposure to an urban environment was associated with increased body mass index, blood glucose and blood pressure in a Cameroon population survey.¹²⁸

Relevance

Not all indicators of early-life SEP are relevant for all population groups, at all times and in all places. Occupational coding cannot always be used for groups outside the recognised labour force,¹⁰ such as those who are unemployed, students or retired. Using father's occupation alone, without mother's occupation, is less relevant in more recent times in many countries, because women are increasingly likely to be in the work force.^{111 134} In addition, associations between early-life SEP and health outcomes in later life were not always found to be consistent for men and women. For example, parental occupation has been shown to be associated with self-reported limiting longstanding illness at age 50 years¹⁰¹ and cardiovascular risk factors⁹⁴ among men, but not among women.

Although education level of parents is a relatively stable indicator of SEP over the adult life course of people, social norms and meanings of education change over time, and within and between population groups and cultures; hence, caution is required in the interpretation of this indicator in surveillance systems. For example, although completion of high school was not necessary for many trade and professional positions in the first half of the 20th century, it is now

considered to be essential for almost any career or employment, at least in many of the developed countries. This has implications for comparing people in different age cohorts, as those with the same educational level are unlikely to have experienced similar occupational opportunities. The effects of inflation and changing criteria for definitions of poverty also need to be taken into account when comparing the relationship of absolute income during early life with health over time.

Indicators such as whether the family lived on a farm, type of material used to build the house and amenities in the household are also culturally, geographically and historically specific, depend on the level of economic development of the country and would not be universally appropriate measures of early-life SEP. Home and car ownership, for example, have different socioeconomic meanings in different places and at different times. Car ownership was shown to be a stronger marker of advantage in childhood for older than younger cohorts in the UK.¹³⁵ Although home ownership is traditionally considered to be an indicator of advantage, rates of home ownership that are low (eg, in Switzerland) or declining (eg, in New Zealand) are not necessarily indicative of poorer SEP.¹³⁶ Family size and structure are also historically and culturally specific. In Sweden early last century, for example, the more advantaged groups had a higher proportion of families with many children, whereas today, larger families are more common among disadvantaged groups.¹¹⁶

Some indicators of early-life SEP, such as overcrowding and family size, may seem more relevant for health outcomes of certain infectious diseases because they indicate levels of hygiene and ease of transmission of infections.²⁹ Such indicators may still be relevant in chronic disease surveillance systems as indirect measures of social disadvantage that are associated with increased risk of chronic conditions.

Reliability

Previous studies have shown high response rates with retrospective data on childhood social class based on father's occupational class obtained for 86% of all women in a British cohort,⁹⁷ 92% in the Alameda County Study,⁵³ 95% of men in the British Regional Heart Study,¹⁰⁰ 96% in the Kuopio Ischaemic Heart Disease Risk Factor Study¹¹⁵ and 98% of the Boyd Orr cohort.¹²¹ Parental education has also been shown to be well recalled, missing for only 6% of respondents in the study⁶² and 5% in the Kuopio Ischaemic Heart Disease Risk Factor Study.¹¹⁵ Studies have also found recalled information to be accurate, with 83% exact agreement or agreement within 1 unit of difference between recalled and historical records of father's occupation,¹²⁰ and 81% agreement in recall of father's occupation between twin pairs.¹³⁷ Several publications were not explicit about the proportion of respondents with missing data for early-life SEP indicators.^{28 63 73 80 94} Others stated that respondents with missing data on early life were excluded from analyses.^{35 64 65 82 94 138} Respondents with missing data for father's occupation were sometimes classified according to their father's education level instead.³³ Missing data on early-life SEP are not necessarily a problem, unless those with missing data differ systematically from those with complete data. Women with data on both adult and child social class in the British Women's Heart and Health Study were younger, less likely to be current smokers and had smaller waist:hip ratios than those who had missing data.³⁸ In the Whitehall Study, missing data were overall more common among those from the lowest employment grade.³⁵

Using education of parents as an indicator of childhood SEP is advantageous because their education is less likely to change than occupation or income after young adulthood.¹ This may be less true, however, for younger cohorts, and for

women, who may return to study after child bearing. This has implications for the use of different ages when asking questions on early-life SEP. For example, retrospectively asking adult respondents about their mother's education level when they were born, compared with when they were aged 4, 7 or 13 years, may yield different results.

A life-grid method was shown to improve retrospective recall of early-life information. This method includes cross-referencing any changes in SEP with important dates in the respondent's life, such as marriages, births and deaths, and also with important external events such as wars or coronations.¹²²

Deconstruction

Summary measures of early-life SEP, such as the economic distress construct⁷⁴ or childhood household amenities,⁵⁰⁻⁹⁸ can be broken down into their component parts. Although it is important to consider using multiple indicators of SEP, used in their aggregate form, it is difficult to distinguish exactly which components are associated with the health outcome,⁴⁶ which is not helpful for informing specific policy and interventions. Summary indicators may consist of several components but may not incorporate all dimensions of SEP. The economic distress construct, for example, covers income-related disadvantage but does not include any measures related to occupation or education. In addition, single indicators have greater ability than composite indicators in identifying the magnitude of, and trends in, mortality differentials.¹³⁹

CONCLUSION

As surveillance is designed to monitor the prevalence of many different health outcomes among populations of different age and cultural groups, it would be ideal to include as many indicators of early-life SEP as possible. It is recommended that education, income and occupation indicators of early-life SEP, which directly reflect the resource and status-based constructs of SEP be included as priority. If time and space in surveillance questionnaires permit, more proxy indicators of

SEP related to living conditions, family structure and residential mobility could also be included to provide further insight into the pathways between SEP and health over the life course.

Analysis of the relationships between SEP over the life course and health is difficult, because complex socioeconomic factors are reduced to measurable indicators that may only ever produce an approximation of these relationships. As their name suggests, indicators are only indicative of a construct that cannot be measured exactly.⁴⁷ Examination of the theoretical background of the indicators shows that some indicators, such as education, occupation and income, measure the construct of SEP more directly than others, such as family structure and residential mobility. These proxy indicators, however, are correlated with SEP and are shown to be associated with health in later life, sometimes showing a stronger association than occupation.¹¹²

All of the indicators assessed in this review have been used in quantitative studies. There may be other indicators of early-life SEP that could be elucidated from qualitative investigations to provide further insights into the meanings of SEP over the life course and its relationship with health. This review has also focused on individual-level indicators. Apart from the characteristics of area of residence during childhood used in a British study,¹²⁶ no area-level indicators were used in the reviewed studies to measure early-life SEP. Although area-level measures of socioeconomic disadvantage—for example, proportion of people unemployed or families on a low income—may provide contextual explanations for geographical inequalities in health, its measurement in surveillance systems could be problematic owing to the ecological fallacy whereby the area-level SEP does not correspond to the SEP of a person.⁶⁻⁴⁶

Data on SEP during childhood obtained in surveillance systems, either through face-to-face or telephone interviews, must rely on retrospective reports from participants. This relies on the memory of participants, with respondents perhaps reporting an inflated or deflated view of their early-life SEP, or not being able to remember at all. Such

Table 6 Early-life indicators of family structure

Indicator	Location, study design	Indicator of SEP measured	Criteria
Family structure at age 15 years	USA, National Longitudinal Survey of Older Men ⁷³	R	Validity: Family structure, used to distinguish families with two parents from single-parent families, and living conditions in the parental home, such as number of siblings and crowding, may influence adult SEP, and thus health in adulthood ¹¹⁷ Relevance: Historical context and cohort effects need to be taken into account Reliability: More likely to be recalled accurately than categories such as parents' education or occupation Time frame or age within indicator question may affect responses as circumstances may change throughout early life Deconstruction: Not applicable
Family size	1946 British Birth Cohort ¹¹²	P	
	1958 British Birth Cohort ⁷⁸	P	
	Sweden, Level of Living Surveys, longitudinal ⁷⁹	R	
	Sweden, Cross-sectional Stockholm Female Coronary Risk Study ¹¹⁸	R	
	USA, Woodlawn Cohort Study ⁷⁵	P	
Number of younger siblings	USA, longitudinal National Survey of Children ⁶³	P	
Marital status of parents	USA, Longitudinal National Survey of Children ⁶³	P	
Mother's marital status at participant's birth	Sweden, Uppsala Birth Cohort Study ¹¹⁶	P	
Ever in lone-parent family before participant aged 16 years	British Household Panel Survey, cross-sectional ¹¹³	R	
Single parent family when participant aged 11 and 16 years	1958 British Birth Cohort ⁷⁸	P	Deconstruction: Not applicable
Lived with both biological parents (or not) until age 16 years	USA, Cross-sectional National Survey of Midlife Development ⁶⁴	R	
Parental divorce or separation during childhood	Sweden, Level of Living Surveys, longitudinal ⁷⁹	R	
Parental divorce or separation before participant aged 26 years	1946 British Birth Cohort ¹¹²	P	
Parental divorce or death before participant aged 16 years	1958 British Birth Cohort ^{113 127}	P	
Birth order	Brazil, Cross-sectional Cianorte survey of school children ^{64 65}	R	
	1946 British Birth Cohort ^{72 112}	P	
	Sweden, Cross-sectional Stockholm Female Coronary Risk Study ¹¹⁸	R	
	Sweden, Uppsala Birth Cohort Study ¹¹⁶	P	

P, prospectively; R, retrospectively; SEP, socioeconomic position.

Table 7 Early-life indicators of residential mobility

Indicator	Location, study design	Indicator of SEP measured	Criteria
Exposure to urban environment during first 5 years of life	Cameroon, Essential Non-communicable Diseases Health Intervention Project, cross-sectional ¹²⁸	R	<i>Validity:</i> The number of moves may not be an adequate representation of the context in which moving occurred or the resources available at different geographic locations ⁶⁰ <i>Relevance:</i> Culturally and historically specific <i>Reliability:</i> More likely to be recalled accurately than categories such as parents' education or occupation Time frame or age within indicator question may affect responses as circumstances may change throughout early life <i>Deconstruction:</i> Not applicable
Lifestage timing of migration	Hong Kong, Cardiovascular Risk Factor Prevalence Study, cross-sectional ¹²⁹	R	
Number of residential moves since birth when participant aged 7 years	USA, Longitudinal National Collaborative Perinatal Project ⁶⁰	P	
Number of times address changed	USA, Longitudinal National Survey of Children ⁶³	P	
	USA, Woodlawn Cohort Study ⁷⁵	P	
Number of years at current address	USA, Longitudinal National Survey of Children ⁶³	P	

P, prospectively; R, retrospectively; SEP, socioeconomic position.

misclassification may reduce the strength of associations. Early-life socioeconomic circumstances are shown to be recalled with high accuracy and among most respondents. Several studies, however, did not provide details on the proportion of respondents who had missing data on early-life SEP indicators. There may be as much evidence for poor recall of early-life information as there is for successful recall, but it is not as widely published. Simply excluding respondents with missing data on early-life from analyses may introduce bias if this group is different in terms of socioeconomic experience and health characteristics than the group that does not have missing data. A temporal reference system, or life grid,¹²⁰ can improve recall, although this may be difficult to apply in surveillance systems that use computer-assisted telephone interviewing and are limited by restrictions on interview length.

Choice of indicators of early-life SEP for use in surveillance systems need to consider time (position in history) and space (geographical and sociocultural context),⁶³ and also the life-course theories and aetiological pathways relevant to the health outcomes being investigated. For example, measuring early-life SEP at age 10 years may not be as appropriate as

measurement at the time of birth in the critical period model. Application of the cumulative model will include measurement of SEP at several stages across the life course. Indicators of SEP are also likely to be differentially relevant to various health outcomes and different age, sex or ethnic population groups. The continuous data collection feature of surveillance is advantageous for monitoring changes in SEP in the population over time and among different population groups. In addition, as surveillance systems rely on retrospective recall, the indicators chosen will depend on how well they perform in terms of recall and response rates, which may vary between different settings and data collection methods. Whereas some indicators, such as education level of parents, may be valid because they are less likely to change after young adulthood than occupation or income, other indicators, such as occupation of parents or material circumstances during childhood, may be more easily and accurately recalled, and thus may be more appropriate for use in surveillance systems in particular settings, at certain times and for specific population groups.

Using a life-course approach in surveillance brings into focus the notion that economic, social and educational policies targeted at children and young people have health effects that are manifested far into the future.⁷³ Surveillance systems have the potential to monitor these long-term effects. Although information about causal pathways linking early-life SEP, adult SEP and health in adulthood has come predominantly from longitudinal cohort studies, surveillance data can be combined with these insights as a basis for policy making and monitoring the effects of policies and interventions among different population groups, cohorts or generations. For example, comparisons in terms of health over the life course could be made between groups or cohorts who were and were not exposed to certain health, education and economic policies, such as provision of free milk or nutritious lunches at school, a system of free tertiary education or different taxation structures. Surveillance data collected consistently and continuously over the long term to monitor trends also act as a warning system about risk factors and chronic conditions emerging in different population groups. Taking into consideration the historical, geographical and sociocultural context when choosing indicators of early-life SEP for use in surveillance systems will provide useful information on the socioeconomic life journey of people and how this is associated with the changing health of populations over time.

What this paper adds

This paper adds a comprehensive review of early-life socioeconomic position (SEP) indicators that could be considered for use in population health surveillance systems. The review assesses indicators used in previous studies according to validity, relevance, reliability and deconstruction criteria, and suggests that indicators of early-life SEP need to be relevant to the historical, geographical and sociocultural context in which the surveillance system is operating, and able to be measured retrospectively.

Policy implications

Potential to monitor the health effects of economic, social and educational policies over the long term exist if indicators of socioeconomic position over the life course are included in population health surveillance systems.

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