Reporting of Social Determinants of Health in Pediatric Sepsis Studies

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Abstract

Objective: Standardized, consistent reporting of social determinants of health (SDOH) in studies on children with sepsis would allow for: 1) understanding the association of SDOH with illness severity and outcomes, 2) comparing populations and extrapolating study results and 3) identification of potentially modifiable socioeconomic factors for policy makers. We therefore sought to determine how frequently data on SDOH were reported, which factors were collected and how these factors were defined in studies of sepsis in children.

Data selection: We reviewed 106 articles (published between 2005 and 2020) utilised in a recent systematic review on physiologic criteria for pediatric sepsis.

Data extraction: Data were extracted by two reviewers on variables that fell within the World Health Organization's SDOH categories.

Data synthesis: SDOH were not the primary outcome in any of the included studies. Seventeen percent of articles (18/106) did not report on any SDOH and a further 36.8 % (39/106) only reported on gender/sex. Of the remaining 46.2% of articles, the most reported SDOH categories were pre-admission nutritional status (35.8%, 38/106) and race/ethnicity (18.9%, 20/106). However, no two studies used the same definition of the variables reported within each of these categories. Six studies reported on socioeconomic status (3.8%, 6/106), including two from upper-middle income and four from lower-middle income countries. Only three studies reported on parental education levels (2.8%, 3/106). No study reported on parental job security or structural conflict.

Conclusion: We found overall low reporting of SDOH and marked variability in categorizations and definitions of SDH variables. Consistent and standardized reporting of SDOH in pediatric

sepsis studies is needed to understand the role these factors play in the development and severity of sepsis, to compare and extrapolate study results between settings and to implement policies aimed at improving socioeconomic conditions related to sepsis.

Introduction:

Sepsis is one of the leading causes of morbidity and mortality in children worldwide (1), and much research has focused on biological and medical factors related to outcomes. However, there has been renewed focus on the social determinants of health (SDOH) and their impact on multiple issues such as child health (2,3), hospital acquired infections (4), deaths from tuberculosis and pneumonia (5) and risk of readmission after sepsis in adults (6). SDOH are increasingly recognized as significant contributors to the severity and outcome of sepsis in children (3).

As defined by the World Health Organization (WHO), SDOH are as "the non-medical factors that influence health outcomes. They are the conditions in which people are born, grow, work, live, and age and the wider set of forces and systems shaping the conditions of daily life" (7). SDOH contribute significantly to health outcomes, and importantly failure to identify and address SDOH may lead to the perpetuation of discriminatory practises against specific groups of people (e.g., minoritized communities) in both research and service delivery (8). A recent editorial stated the New England Journal of Medicine "has, for years, published studies that simply do not include enough participants from the racial and ethnic groups that are disproportionately affected by illnesses being studied" (9).

Several barriers remain, however, to further understanding the role of SDOH in pediatric sepsis severity and outcomes. The first is that SDOH variables need to be consistently collected and reported for pediatric studies. A recent investigation noted that less than one half of all studies from three high-impact pediatric journals reported SDOH variables (10). Another significant issue is the consistency and context of the definitions used for the SDOH variables

collected. This is especially important for variables such as race/ethnicity. Numerous authors have pointed out the complexity of race/ethnicity in categorizing heterogeneous groups (11,12) while still emphasizing the importance of collecting this data despite its limitations (13). While several authors have suggested frameworks by which to collect meaningful race and ethnicity data (12,13), a standardized approach to such data collection and reporting in published articles does not currently exist (10). In the setting of sepsis in children, the existing literature on SDOH variables including race/ethnicity is limited by small samples sizes, conflicting results and incomplete data (13).

To understand the importance and impact of SDOH in child health including sepsis, it will be necessary to develop standardized infrastructures and systems that enable a consistent reporting of the role of SDOH in human health. This would facilitate the development of 1) an understanding of the association of SDOH with sepsis severity and outcomes, 2) meaningful comparison of study populations and extrapolation of results and 3) identification of potentially modifiable socioeconomic factors. We therefore sought to determine how frequently data on SDOH were reported, which factors were collected and how these factors were defined in studies of the development and outcome of sepsis in children.

Methods:

We conducted a scoping review of the 106 articles included in a recent systematic review on the physiologic criteria for pediatric sepsis (14). The detailed methods, inclusion and exclusion criteria for the systematic review have been previously published (15). For the current work, additional data were collected on the reporting of all included variables in each of the 10

WHO's categories for SDOH (Table 1) (7). The WHO categories included income and social protection; unemployment and job security; food insecurity; early childhood development; structural conflict; education; working life conditions; housing, basic amenities and environment; social inclusion and non-discrimination; and access to affordable health services. All non-physiologic variables reported in the 106 articles included in the original systematic review (14) were assigned to the relevant WHO category (e.g the variable malnutrition was assigned to the food insecurity category, distance from hospital was assigned to access to affordable health services etc. as shown in Table 1). Data on SDOH variables were collected if they were reported in any part of the results section including supplementary material. Our outcomes included 1) percentage of papers in which any SDOH variable was recorded, 2) documentation of which SDOH variables were reported and 3) classifications used for these SDOH variables.

Data extraction, management and synthesis

The additional data from the 106 full-text articles were extracted by two reviewers per citation using a REDcap platform (16) hosted at the Children's Hospital of Eastern Ontario Clinical Research Unit. Conflicts were resolved by discussion. Frequencies and descriptive statistics are provided for study demographics and data reported on SDOH variables from included studies.

Results:

The overall reporting of the WHO SDOH categories is summarized in Table 1 and the geographic distribution of included articles is shown in Table 2. The largest number of studies

were from the United States (19.8%, 21/106), China (12.3%, 13/106), India (9.4%, 10/106), and Brazil (8.5%, 9/106). Of the 106 articles reviewed, 17% of articles (18/106) did not report on any SDOH and a further 36.8 % (39/106) only reported on gender/sex. Race/ethnicity (38.3%, 18/47) was the most reported variable from high income countries whereas nutrition was the most reported variable upper middle income (37.1%, 13/35), lower middle income (60.9%, 14/23) and lower income (1) countries. No study reported on parental unemployment/job security or structural conflict.

The most reported SDOH categories were pre-admission nutritional status (35.8%, 38/106)(17-44,44-51,51,52) and race/ethnicity (18.9%, 20/106)(21,22,25,29,33,42,45,51,53-64) (Table 1). For nutrition, 38 articles reported 24 different measures reflecting nutrition, weight, height or body mass index. No two studies used the same definition for any given nutritional measure (Table 2). Of the 20 articles reporting on race/ethnicity, the largest number (12/20, 60%) were from the United States. However, all 12 studies (22,29,42,45,55,58-63,65) used different categories to classify racially minoritized communities, and none of the studies reported the definition used for these categories or the method by which they were determined (Tables 1 and 3).

Six studies (6/106, 5.7%) reported on childhood immunization status (17-21,53), one from a high-income setting (53), two from upper-middle-income settings (18,21) and three from lower-middle-income settings (17,19,20). Only two studies provided specifics regarding their definition of being considered fully immunized (19,20) and one study reported on immunization status for tuberculosis (19).

Six single-country studies (6/106, 5.7%) provided direct data on SES (19-21,66-68), half of which provided a definition for the reported categories (19,20,66). Of the six studies, four were from lower-middle income (19,20,67,68) and two from upper-middle income (21,66) settings (14). Some studies reporting on SES classified groups into middle and low income but did not provide specific criteria or references for these groupings (21,67,68). Similarly, three studies defined poor SES using different criteria: income levels (19), residence in a slum/tin shaded house (20) and a complex algorithm involving caregiver income, housing, education level and health status (66). Three studies reported on parental education levels (17,18,21): two studies from upper-middle income (18,21) and one from a lower-middle income country (17).

Five studies reported on patient insurance status, three from the United States (58,61,69), one from Colombia (66) and one from Tanzania (17). All three US-based studies reported different insurance categories with one reporting “commercial, Medicaid, uninsured, other” (61), one reporting “Medicaid, Blue-Cross/private, Medicare or self-pay” (58) and one reporting whether or not the patient had public insurance (69).

Nine studies (9/106, 8.5%) reported on place of residence (43,50-52,64,66-68,70) but only one study specified how they classified a patient’s residence setting using the Australian Bureau of Statistics Remoteness Structure (64). The remaining eight studies reported whether the patients were from urban or rural settings but did not elaborate on how they made this determination. Only one study (1/106, 0.9%) assessed home environment (17).

Discussion:

In this analysis of pediatric sepsis studies, we found a low frequency of reporting of SDOH and marked variability in categorizations and definitions of SDOH variables. In addition, the number of variables for which data was collected in our review was considerably lower than recent recommendations for SDOH data collection in adult sepsis (6). Consistent and standardized reporting of SDOH in pediatric sepsis studies is needed to understand the role these factors play in the development and severity of sepsis, to compare and extrapolate study results between settings and to implement policies aimed at improving sepsis outcomes. In this regard, existing pediatric sepsis studies are limited.

Some of these limitations are demonstrated by the variability in how SES was defined in our cohort of pediatric sepsis studies. For example, a study in a low income setting in Tanzania classified SES using availability of household electricity, in home flush/pour toilet, and access to an improved water source, and found it was linked to delayed presentation to definitive care among septic children (71). However, a study in a lower-middle income setting (66), classified SES using a complex algorithm of socioeconomic factors specific to Colombia but similarly found that lower SES was associated with increased mortality. While these measures may improve our understanding of the role of SES in individual settings, they do not permit comparisons or meta-analyses of the association of SES and outcomes between settings.

An additional complexity that arises when collecting SDOH variables is establishing whether a variable is an actual SDOH or a potential surrogate marker. For example, "nutritional status" was included in several studies, with some studies finding an association of poor nutrition with worse outcomes in sepsis (19,20). It could be argued that nutritional status is itself not a SDOH, but rather a consequence of SDOH factors like food insecurity. This dilemma

combined with disparate measures of nutrition and variable consideration of confounders analyzed in these studies makes it difficult to draw definitive conclusions on the role of nutritional status and possible nutritional interventions in sepsis outcomes.

Another important factor in the reporting of SDOH variables is consideration of the context for their inclusion (13). This is particularly relevant for variables such as race/ethnicity. Race/ethnicity may be collected in order to explore presumed biologic links with disease (e.g. Black race and sickle cell disease), because of their presumed socioeconomic association with severity or outcomes of disease (13) and/or as a requirement of granting agencies. Unfortunately, the nature of these links and associations may be complex and vary between contexts. Another complicating factor for race/ethnicity data is the lack of standardization for determination of racial/ethnic categories. Studies reporting data on Black race conducted within the same country used different classifications (Black, African American, African/North African), did not specify how race was determined (systematically or via self-report) and did not provide guidance for mixed-race patients. None of the included studies explicitly stated their rationale for collection of race/ethnicity data, although several examined "race" in their analysis suggesting the authors believe race may be associated with sepsis outcomes.

As reviewed recently, collection of data on variables such as race/ethnicity should incorporate "sufficient detail to allow detection of meaningful results and to minimize the risk of overgeneralising findings" (13). This is particularly challenging in the global context of pediatric sepsis as race/ethnicity are social constructs based on a mix of cultural and other factors (72) (e.g. language, diet, religion, ancestry and physical features) which differ across regions. This is supported by our finding that reporting of race/ethnicity was more common in

studies from high income countries suggesting that individual SDOH may vary considerably across settings and regions. Likewise, trial design should be reviewed to ensure that racially minoritized groups at particular risk of sepsis are included as study participants (8). To avoid simply entrenching current discriminatory research practices it would be important to examine what factors lie behind each variable within SDOH and their possible associations with a given health outcome.

There are several potential barriers to collecting and reporting of SDOH in research studies. Local research ethics boards may impose restrictions on this type of data being collected without clear justifications. Collection of SDOH variables may be time-consuming when added to already large data collection forms and may require prioritization of variables. In addition, many SDOH fields may not be completed due to perceived or realized sensitivities.

Standardized collection and reporting of SDOH variables in sepsis studies would facilitate determination of their association with sepsis outcomes. The use of SDOH modules from standardized terminologies such as LOINC (Logical Observation Identifiers Names and Codes) is one potential solution (73). Another potential solution would be to follow a stepwise approach to developing consensus on specific variables to collect, how these variables are defined and how they are reported in future publications similar to what is being currently done by the Pediatric Sepsis Definition Taskforce of the Society of Critical Care Medicine. This would involve creating a group with broad-based expertise in SDOH (including but not limited to physicians, nurses, pharmacists, nutritionists, economists, social workers, methodologists) to: 1) develop and implement a survey of global stakeholders on which SDOH variables to collect, 2) conduct a systematic review of currently used SDOH tools and embedded SDOH variable definitions in

children and 3) conduct a Delphi process to develop consensus for the SDOH variables and tool(s) for use in pediatric sepsis publications going forward. If an appropriate tool does not already exist or consensus on existing tools cannot be reached, the possibility of developing a new tool can then be brought forward.

Given that numerous studies have documented the importance of SDOH on outcomes of critically ill children across the globe (2,3,5,8,20,23,24,71,74-76), researchers have a collective responsibility to design studies to include SDOH variables so as not to perpetuate implicit and explicit biases regarding minoritized groups and to ensure consistent and standardized collection and reporting of these variables when conducting future studies in pediatric sepsis.

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