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ORIGINAL ARTICLE

The global coverage of prevalence data for mental disorders in children and adolescents

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Aims. Children and adolescents make up almost a quarter of the world's population with 85% living in low- and middle-income countries (LMICs). Globally, mental (and substance use) disorders are the leading cause of disability in young people; however, the representativeness or 'coverage' of the prevalence data is unknown. Coverage refers to the proportion of the target population (ages 5–17 years) represented by the available data.

Methods. Prevalence data for conduct disorder (CD), attention-deficit/hyperactivity disorder (ADHD), autism spectrum disorders (ASDs), eating disorders (EDs), depression, and anxiety disorders were sourced from systematic reviews conducted for the Global Burden of Disease Study 2010 (GBD 2010) and 2013 (GBD 2013). For each study, the location proportion was multiplied by the age proportion to give study coverage. Location proportion was calculated by dividing the total study location population by the total country population. Age proportion was calculated by dividing the population of the country aged within the age range of the study sample by the country population aged 5–17 years. If a study only sampled one sex, study coverage was halved. Coverage across studies was then summed for each country to give coverage by country. This method was repeated at the region and global level, and separately for GBD 2013 and GBD 2010.

Results. Mean global coverage of prevalence data for mental disorders in ages 5–17 years was 6.7% (CD: 5.0%, ADHD: 5.5%, ASDs: 16.1%, EDs: 4.4%, depression: 6.2%, anxiety: 3.2%). Of 187 countries, 124 had no data for any disorder. Many LMICs were poorly represented in the available prevalence data, for example, no region in sub-Saharan Africa had more than 2% coverage for any disorder. While coverage increased between GBD 2010 and GBD 2013, this differed greatly between disorders and few new countries provided data.

Conclusions. The global coverage of prevalence data for mental disorders in children and adolescents is limited. Practical methodology must be developed and epidemiological surveys funded to provide representative prevalence estimates so as to inform appropriate resource allocation and support policies that address mental health needs of children and adolescents.

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Key words: Childhood, adolescence, mental disorders, epidemiology.

Introduction

Children and adolescents aged 5–17 years constitute almost a quarter of the global population (United Nations, 2011). Approximately 85% live in low- and middle-income countries (LMICs) (United Nations, 2011) and UNICEF predicts that Africa will contain 37% of all people aged under 18 years by 2050 (UNICEF, 2014*a*). This proportion of children and adolescents is further predicted to increase to almost half (equating to 1.1 billion children) by 2100. The implications of this trend for LMICs are significant, particularly considering that child and adolescent-specific health services are often very limited in these countries. Ascertaining the unmet health care needs of young

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people at the population level is difficult, particularly in regards to mental health.

Data on the prevalence of mental disorders in children and adolescents are required for generating accurate epidemiological and burden estimates as well as informing the efficient and appropriate allocation of health resources. The Global Burden of Disease Study 2010 (GBD 2010) calculated burden for 291 causes across 187 countries, making it one of the largest research undertakings in the history of global health (Murray *et al.* 2012). As part of burden quantification for GBD 2010, systematic reviews of the epidemiological data were conducted for mental disorders across all ages and countries (Baxter *et al.* 2013*b*, 2014; Charlson *et al.* 2013; Erskine *et al.* 2013; Ferrari *et al.* 2013). These systematic reviews were then updated for GBD 2013, the most recent iteration of the study. Data for mental disorders were sparse, particularly for children and adolescents, LMICs, and disorders occurring predominantly in the younger ages (e.g. conduct disorder (CD)). This resulted in large uncertainty intervals around burden estimates despite mental disorders being found as the leading cause of disability in those aged under 25 years (Erskine *et al.* 2015). Furthermore, lack of empirical data reduces the visibility of mental disorders in comparison with other diseases of childhood (such as infectious diseases, asthma, and diabetes) and makes it difficult to advocate for their inclusion as a priority in health initiatives.

Rather than simply reporting the number of available studies, an alternative and more informative approach is to use study parameters (location, age, and sex) to produce weighted estimates of population 'coverage'. Coverage is defined as the proportion of the population of interest, in this case children and adolescents, represented by the available data. This method has been used previously to estimate coverage of epidemiological data for high and low prevalence mental disorders in adults (Baxter *et al.* 2013*a*) where it was found that prevalence estimates for adult mental disorders were available for approximately one quarter of the adult population globally. Summary estimates of population coverage are useful for identifying strengths and limitations in the available data, and provide a tool for directing future investment in research.

The current study uses data from the series of systematic reviews (Baxter *et al.* 2013*b*, 2014; Charlson *et al.* 2013; Erskine *et al.* 2013; Ferrari *et al.* 2013) conducted for GBD 2010 and GBD 2013 to explore the coverage of the available prevalence data for mental disorders in children and adolescents. It is not intended as a critical review of methodological aspects of prevalence studies beyond those controlled for by the inclusion criteria. Where specific systematic reviews have been published, these include detailed analyses of methodological factors and their impact on reported prevalence estimates (Baxter *et al.* 2013*b*, 2014; Charlson *et al.* 2013; Erskine *et al.* 2013; Ferrari *et al.* 2013; Whiteford *et al.* 2013). In this analysis, we calculated the country-, region- and global-level coverage of prevalence data for six mental disorders in children and adolescents aged 5–17 years: CD; attention-deficit/hyperactivity disorder (ADHD); autism spectrum disorders (ASDs); eating disorders (EDs); depression; and anxiety disorders. This prevalence data was used to inform burden estimates in GBD 2013. We also compared the data available for GBD 2013 with the data originally available in GBD 2010 in order to ascertain whether gaps in the available prevalence data are being addressed by new studies and discuss the implications of differential data coverage and opportunities to progress research in this field.

Method

Case definition and systematic reviews

The prevalence data used in these analyses were drawn from the systematic reviews conducted to inform burden estimates for GBD 2010 and GBD 2013. These systematic reviews and their inclusion criteria adhered to the methodology set by GBD (Whiteford *et al.* 2013) which is described briefly below. More comprehensive explanations of the search methodology specific to each disorder are available in previous publications (Baxter *et al.* 2013*b*, 2014; Charlson *et al.* 2013; Erskine *et al.* 2013; Ferrari *et al.* 2013; Whiteford *et al.* 2013). For the purposes of this analysis, we define children and adolescents as aged between 5 and 17 years of age. This age range was chosen due to the very limited data and questionable diagnostic reliability in the 0–4 years age group, while the 18–24 years age group is generally captured in adult surveys for which coverage has already been reported (Baxter *et al.* 2013*a*).

Mental disorder cases were defined according to the Diagnostic and Statistical Manual of Mental Disorders (DSM) (American Psychiatric Association, 2000) and the International Classification of Diseases (ICD) (World Health Organisation, 1992). ASDs included those meeting criteria for either autism or Asperger's syndrome, EDs included anorexia nervosa and bulimia nervosa, while depression included major depressive disorder and dysthymia. Anxiety disorders included combined estimates of multiple anxiety disorders as per GBD methodology (Whiteford *et al.* 2013). Systematic reviews were conducted for all disorders whereby electronic databases (EMBASE, MEDLINE and PsycINFO) were searched using full text and

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Medical Subject Headings (MeSH) terms. Search strings included disorder names and epidemiological terms including 'epidemiology', 'prevalence', 'incidence', 'remission' and 'mortality'. Grey literature was searched which included but was not limited to government documents, international statistical agencies, and ministries of health. Experts who responded to a call for collaborators, issued by the governing body of GBD, were also consulted for additional information (Institute for Health Metrics and Evaluation, 2015*a*). The reviews were conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher *et al.* 2009). In order to be included, prevalence studies had to represent the general population, have been published since 1980, and have used structured diagnostic instruments with validated crosswalks to DSM/ICD diagnoses. Only point prevalence or past-year prevalence was accepted given recall bias associated with lifetime estimates (Moffitt *et al.* 2010). The initial literature search for GBD 2010 was conducted for the period 1980–2008 with manual searches continuing until 2011. The search was then updated for GBD 2013 which covered the period of 2008–2013 to ensure no studies published between 2008 and 2011 were missed by the manual searches.

Dataset preparation and study counts

Coverage was calculated for ages 5–17 years and studies with age ranges either fully or partially covering this age group were extracted from the main datasets. Table S1 (Supplementary material, available online) lists all the studies from the GBD 2010 and GBD 2013 systematic reviews which were included in the analyses. The number of prevalence studies available by age group for each disorder in data collection periods for GBD 2010 and GBD 2013 are shown in Table S2 (Supplementary material, available online). For each study, the relevant age range was identified (e.g. a study covering ages 4–18 years would have a relevant age range of 5–17 years) along with the sex of the sample. Studies only reporting prevalence for a single sex had coverage calculated accordingly.

Coverage analyses

Coverage for each disorder was calculated separately. First, the age proportion of the 5–17 year age range covered by each study was calculated using United Nations population data (United Nations, 2011). For example, a study surveying ages 15–17 years was considered to cover 26% of the 5–17 years age group in Canada based on population data (United Nations, 2011). The age proportion was then multiplied by the location proportion, i.e. the proportion of the country's population represented by the study. For example, a study representative of Quebec represented of 24% of Canada. Multiplying 26% by 24% gave the study 6% coverage for the 5–17 years age group in Canada. If a study was deemed nationally representative on the basis of its methodology then the proportion of the country's population represented was assumed to be 100% before taking into account the age range sampled. If a study only sampled either males or females, coverage was then halved in order to account for this. For each country, the coverage of all studies was then summed with any overlaps taken into account (e.g. community/regional studies would be discounted in the presence of an overlapping national survey). Region coverage was calculated by first multiplying the country coverage by the proportion of the region population aged 5–17 years accounted for by that country. The results for all countries in the region were then summed to give the overall region coverage. For example, if the total coverage (sum of all study coverage) for Canada was calculated as 22%, this was multiplied by the proportion of High Income North America (aged 5–17 years) accounted for by Canada (8%) equalling 2%. This was then summed with the coverage calculated for the USA (the only other country in the region – 71%) giving High Income North America a total coverage of 73%. Countries were allocated to their corresponding region according to GBD region classification (Institute for Health Metrics and Evaluation, 2015*b*). This methodology was then repeated at the region level in order to ascertain global coverage. For example, High Income North America had 73% coverage which was then multiplied by the proportion of the global population aged 5–17 years accounted for by High Income North America (4%), meaning existing studies in this region contributed 3% to the global coverage. This methodology was applied to all regions and then summed to give the total global coverage. Country, region and global coverage were calculated separately for GBD 2010 and GBD 2013 in order to identify any changes in coverage from the addition of new data.

Results

Table 1 shows the countries for which prevalence data were available for ages 5–17 years. Of 187 countries, 66% (124 countries) had no data available for any of the six disorders. Depression had the greatest geographical spread of data with prevalence data available for 38 countries, while ASDs, EDs, and CD had the lowest number of countries. Despite an overall increase in the number of studies,

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Table 1. *Countries with studies reporting prevalence estimates pertaining to 5–17 years, with underlined countries representing those for which no data were available in GBD 2010*

Disorder	Income grouping	Countries with studies	Number of countries in GBD 2013
CD	HICs	AUS, NZL, FIN, GBR, NLD, NOR, CAN, USA	21 (GBD 2010: 19)
	LMICs	HKG, CHN, TWN, BGD, IND, MYS, PRI, MEX, BRA, ARE, IRQ, YEM, NGA	
ADHD	HICs	JPN, KOR, AUS, NZL, CHE, DEU, ESP, FIN, FRA, GBR, IRL, ISR, ITA, NLD, NOR, SWE, CAN, USA	36 (GBD 2010: 25)
	LMICs	HKG, CHN, TWN, BGD, IND, MYS, THA, PRI, RUS, COL, MEX, VEN, BRA, ARE, IRN, IRQ, YEM, ETH	
ASDs	HICs	JPN, KOR, AUS, DNK, FIN, FRA, GBR, ISL, NOR, SWE, CAN, USA	18 (GBD 2010: 15)
	LMICs	CHN, IDN, VEN, IRN, IRQ, OMN	
EDs	HICs	AUS, NZL, CHE, DEU, ESP, FIN, FRA, GBR, GRC, ITA, NLD, NOR, PRT, USA	20 (GBD 2010: 16)
	LMICs	CHN, HUN, ARE, JOR, TUR, TZA	
Depression	HICs	SGP, AUS, NZL, BEL, DEU, ESP, FIN, FRA, GBR, ITA, NLD, NOR, CHL, CAN, USA	38 (GBD 2010: 31)
	LMICs	CHN, TWN, IND, IDN, LKA, VNM, PRI, TTO, LVA, EST, HND, MEX, BRA, AFG, IRQ, LBN, OMN, TUR, ETH, SDN, UGA, GMB, NGA	
Anxiety	HICs	AUS, NZL, DEU, ESP, FIN, FRA, GBR, IRL, ISR, ITA, NLD, CHL, CAN, USA	31 (GBD 2010: 29)
	LMICs	HKG, TWN, BGD, IND, MYS, VNM, PRI, SRB, BRA, AFG, ARE, IRQ, MAR, ETH, KEN, ZAF, NGA	

NB, Country names shown as per standard ISO 3166-1 alpha-3 (ISO3) codes.

few countries without prevalence studies for GBD 2010 provided additional data by the time of GBD 2013.

Table 2 shows the coverage of prevalence data for GBD 2013 which included all data for GBD 2010 and any additional data found since the original literature search. Averaging across all disorders, global coverage was 6.7%. ASDs had the highest global coverage which was mostly due to a single, nationwide survey of ASDs in China covering the whole 5–17 years age range. The global coverage of depression was the second highest with 6.2% coverage, followed closely by ADHD and CD which had similar levels of coverage with 5.5% and 5.0%, respectively. Figure 1 shows the mean coverage for each region. The collective mean coverage for all HICs was 26.4% (countries in the regions of High Income North America, Western Europe, Australasia, High Income Asia Pacific and Southern Latin America) although coverage for the High Income Asia Pacific region remained the lowest of this group. The mean coverage for all LMICs combined was 4.5%, only one-sixth of the coverage found for HICs. Coverage in regions of Asia, Latin America, and sub-Saharan Africa was exceptionally low or non-existent. For Central sub-Saharan Africa, no studies were available for any disorder resulting in zero coverage. Coverage in the other African regions was based on very small, community-level surveys. Coverage calculations for individual countries based on GBD 2013 data are shown in Table S3 (Supplementary material, available online).

Between GBD 2010 and GBD 2013, the coverage of prevalence data improved across the six disorders with mean global coverage increasing by 4.8%. The largest increase was seen for ASDs due to the addition of the national survey of ASDs in 5–17-year olds from China. Worldwide, the coverage of CD and ADHD doubled while the coverage of EDs increased fourfold. Prevalence data for both depression and anxiety disorders increased but not to the same extent as the other disorders because most new studies were conducted within countries where data on depression and anxiety disorders on those populations already exists. Collectively, mean coverage in HICs increased from 10.1% to over a quarter while mean coverage for LMICs increased fourfold. However, coverage for LMICs remained substantially lower than HICs in both GBD 2010 and GBD 2013. Of the LMIC regions, East Asia demonstrated the greatest increase in coverage while North Africa/Middle East saw increases in coverage for all disorders except CD which had no new data available for GBD 2013. East Asia and Central Latin America were the only regions for which new data were found for GBD 2013 after having no data in GBD 2010. Central Asia, Andean Latin America, Oceania, and Central sub-Saharan Africa had zero coverage for all disorders in children and adolescents for both GBD 2010 and GBD 2013.

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Table 2. *Coverage of prevalence data (%) available for six disorders by region and income region for ages 5–17 years for GBD 2013*

	CD	ADHD	ASDs	EDs	Depression	Anxiety	Mean across disorders
GLOBAL	5.03	5.47	16.05	4.41	6.16	3.21	6.72
High-income regions	**35.59**	**36.47**	**5.47**	**28.14**	**34.54**	**18.27**	**26.41**
Asia Pacific, High Income	–	3.46	0.43	–	1.40	–	0.88
Australasia	76.14	76.14	7.88	3.64	36.04	15.17	35.84
Europe, Western	16.56	17.41	2.95	3.37	40.12	17.14	16.26
Latin America, Southern	–	–	–	–	2.70	26.66	4.89
North America High Income	72.69	72.83	10.89	70.85	48.95	24.96	50.20
Low- and middle-income regions	**1.60**	**2.00**	**17.23**	**1.75**	**3.01**	**1.53**	**4.52**
Asia, Central	–	–	–	–	–	–	–
Asia, East	5.46	6.35	97.63	9.83	2.15	0.66	20.35
Asia, South	1.64	1.63	–	–	1.44	0.46	0.86
Asia, Southeast	0.0004	1.80	0.13	–	14.87	9.99	4.47
Caribbean	7.28	7.28	–	–	8.23	7.28	5.01
Europe, Central	–	–	–	2.02	–	0.39	0.40
Europe, Eastern	–	0.43	–	–	0.47	–	0.15
Latin America, Andean	–	–	–	–	–	–	–
Latin America, Central	1.69	2.24	0.34	–	1.80	–	1.01
Latin America, Tropical	0.10	0.26	–	–	0.10	0.10	0.09
North Africa/Middle East	0.39	0.70	2.70	0.11	5.54	1.87	1.89
Oceania	–	–	–	–	–	–	–
Sub-Saharan Africa, Central	–	–	–	–	–	–	–
Sub-Saharan Africa, East	–	0.01	–	0.08	0.70	0.24	0.17
Sub-Saharan Africa, Southern	–	–	–	–	–	1.34	0.22
Sub-Saharan Africa, Western	0.04	–	–	–	0.13	0.02	0.03

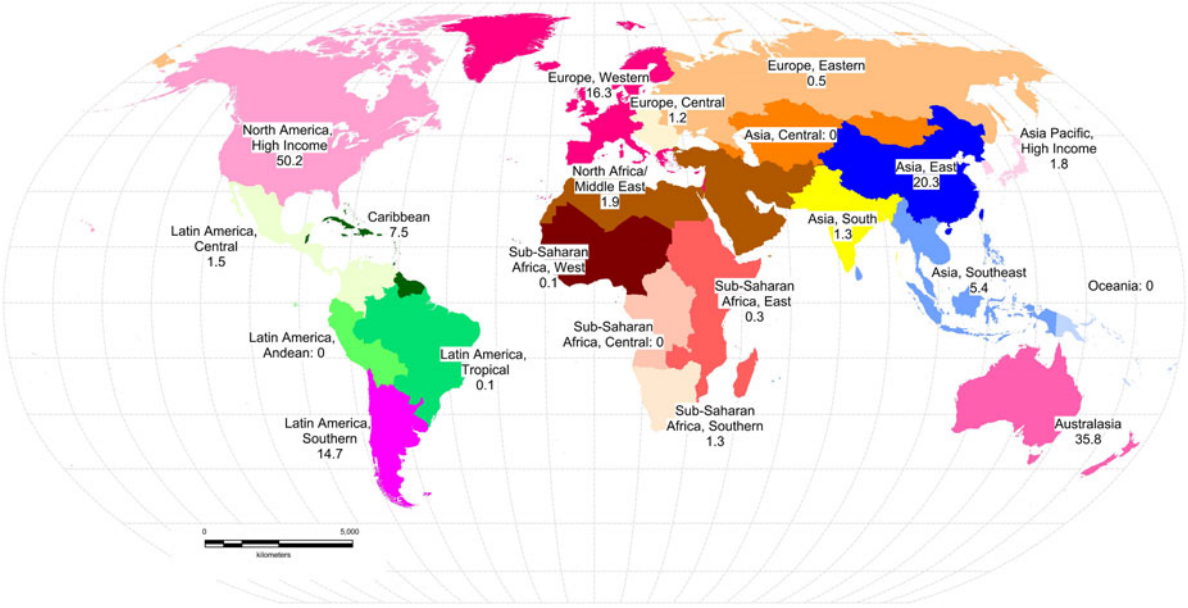

Fig. 1. Map of mean coverage (%) for each region.

Coverage calculations based on GBD 2010 data for individual countries and regions are shown in Tables S3 and S4, respectively (Supplementary material, available online).

Discussion

Despite being the most basic of epidemiological measures, representative prevalence data suitable for informing mental health policy and service provision

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are lacking for children and adolescents. Across disorders, the coverage of the available prevalence data was 6.7%. A simple count of the number of prevalence studies from each country could not yield this information and would have likely overestimated the representativeness of the data. Patterns of low coverage were relatively consistent across disorders although coverage for ASDs was somewhat higher. The majority of high-income regions had some level of coverage for all disorders, although this was not the case for High Income Asia Pacific and not all countries within these regions had data available (Table 1). Coverage of prevalence data in LMICs was even less consistent, with sub-Saharan Africa, Oceania, and parts of Latin America and Asia having virtually no coverage whatsoever. Worryingly, these regions are among those with the highest proportions of children and adolescents. This lack of data prevents an understanding of patterns of mental disorders for the vast majority of 5–17-year olds across the globe.

Relative to coverage for mental disorders across the lifespan, coverage in the child and adolescent years is comparatively low. A recent study by Baxter *et al.* (2013*a*) calculated the coverage of prevalence data available for six mental disorders across ages 18–80 years. Similar to the current study, these data were sourced from the systematic reviews conducted for GBD 2010. Globally, mean coverage was found to be 25.2% (major depressive disorder: 35.4%, dysthymia: 29.4%, anxiety disorders: 44.2%, schizophrenia: 14.2%, bipolar disorder: 12.9%, EDs [anorexia nervosa and bulimia nervosa combined] 15%) and the geographical distribution of studies was similar to that seen for 5–17 years, whereby the majority of data were from HICs (Baxter *et al.* 2013*a*). Direct comparisons between anxiety disorders (18–80 years of age: 44.2% *v.* 5–17 years of age: 2.88% [GBD 2010]) and EDs (18–80 years of age: 15% *v.* 5–17 years: 0.95% [GBD 2010]) demonstrate the markedly lower coverage for children and adolescents when compared with adults.

In their report on adolescent health, the World Health Organization estimated that over half of all cases of mental disorders begin by age 14 and the majority remain untreated well into adulthood (World Health Organisation, 2014). A recent review of the age of onset of mental disorders found 75% of incident cases emerged by age 25 (McGorry *et al.* 2011). Therefore, there is a rationale for preferentially investing in research and intervention for the mental health of children and adolescents. In this context, the poor coverage of prevalence data for mental disorders is especially concerning. These data are essential for understanding the unmet need for mental health care which in turn informs policy and health care planning. Quantifying the impact of intervention programmes or documenting secular changes requires prevalence data. The benefits of monitoring the prevalence of a disease are recognised in regards to infectious diseases, such as HIV (Hien *et al.* 1999; Kilian *et al.* 1999; Calleja *et al.* 2002; Weinstock *et al.* 2004; Ortblad *et al.* 2013); however, mental disorders are yet to be considered in this way. On a more fundamental level, lack of data leaves mental disorders invisible making it difficult to advocate effectively or promote mental health literacy in areas where the impact of mental disorders remains unassessed and unacknowledged.

The current study provides coverage estimates for the prevalence data used in GBD 2013, and demonstrates an increase in coverage by new studies published since GBD 2010. However, it could not take into account the epoch of data collection for included studies. The original systematic reviews included studies published since 1980, meaning that the 'available data' includes prevalence studies published over 30 years ago which cannot represent the current generation of children and adolescents. However, it is difficult to develop a consistent and defendable methodology for deciding when a study is 'too old'. Furthermore, these analyses could also not take into account when studies were repeated on the same sample with such repeated studies needed in order to track changes in prevalence. Changes in prevalence might occur due to intervention policies and it is important to be able to evaluate the effects of such policies. Prevalence may also change as the result of historical changes producing cohort effects. Comparisons across nationally representative British cohorts born in 1974, 1986, and 1999 revealed a historical rise in prevalence for some childhood disorders but not others (Collishaw *et al.* 2004) while a systematic review reported increased levels of internalising symptoms in recent cohorts of adolescent girls (Bor *et al.* 2014). The current study's findings are unable to account for the benefits of repeated studies as studies measuring the same population were not counted twice (e.g. a community- or regionally representative survey would not be included in coverage if a national survey covered the same population). However, there were very few instances of studies repeated on the same populations for any disorder.

To address the dearth of data on child and adolescent mental disorders and the consequently poor global coverage of prevalence data, funding is required for nationally representative epidemiological surveys using the DSM and ICD approach across a range of disorders in young age groups. These surveys and their instruments are logistically demanding, time consuming, and challenging to administer cross-culturally. However, even a single nationally representative survey from a region where no data exists (e.g. Central sub-Saharan Africa) would improve global coverage

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and the understanding of child and adolescent mental disorder epidemiology in LMICs. Case ascertainment approaches are needed which lend themselves to large-scale data collection. It is important that these approaches are cost effective, time conscious, and take into account cultural and language differences, particularly in LMICs. For example, work is currently underway examining whether the PHQ-2, a brief measure of adolescent mental health, could be included in existing global surveys like the Multiple Indicator Cluster Survey (MICS) (UNICEF, 2014*b*) while the Danish government has adopted the SDQ for annual national monitoring of youth mental health. Although they are not diagnostic instruments, understanding the validity coefficients in different cultural contexts has the potential to allow estimates of prevalence as well as monitoring secular trends in mental health at a population level. Directing funding to support high-quality, nationally representative surveys in countries where no data exist and the inclusion of validated dimensional measures of mental illness have the potential to address the poor global coverage of prevalence data for mental disorders in children and adolescents. Without intentional strategies to address the paucity of epidemiological data, poor coverage in both HICs and LMICs will present a major challenge for child and adolescent mental health advocacy and the planning and allocation of the scarce resources available for child and adolescent mental health.

Supplementary material

To view supplementary material for this article, please visit http://dx.doi.org/10.1017/S2045796015001158

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Conflict of Interest

None.

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