Effects of disability on adverse health outcomes and anthropometric deficits among under-five children in South Asian countries: evidence from multiple indicator cluster surveys

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The Lancet Regional Health - Southeast Asia 2024;25: 100401

Published Online 8 April 2024
https://doi.org/10.1016/j.lansea.2024.100401

Summary

Background Children with disabilities face an increased risk of adverse health outcomes and poor anthropometric deficits, although the focus on them is limited in the South Asian context thus far and need newer and more evidence. This study investigates the effects of disability on adverse health outcomes and anthropometric deficits among 2–4 years aged children in South Asian countries.

Methods We analyzed data from 93,180 children aged 2–4 years across Bangladesh, Nepal, Pakistan, and Afghanistan using Multiple Indicator Cluster Surveys (2017–2023). Disability status was the primary exposure, and outcomes included adverse health outcome (acute respiratory infection, diarrhea, fever), anthropometric deficit (stunting, wasting, underweight), and healthcare service sources during adverse health events (care received from skilled healthcare personnel, care received from non-professional personnel, and care received from health facility workers other than skilled healthcare personnel). Using multilevel and multinomial logistic regression models, we examined associations between exposure and outcome variables, adjusting for covariates.

Findings We found average disability prevalence in South Asia was 8.7% (8.3–9.0; n = 8072), varying from 3.4% (3.0–3.8; n = 446) in Bangladesh to 12.3% (11.4–13.3; n = 1259) in Afghanistan. Common health issues included fever (n = 24,982, 26.8%, 26.2–27.4) and diarrhea (n = 14,081, 15.1%, 14.7–15.6), while prevalent poor anthropometric deficits were stunting (n = 39,766, 42.7%, 42.0–43.3) and underweight (n = 22,390, 24.0%, 23.5–24.5). Children with disability had 1.30 (95% CI: 1.21–1.40) to 1.60 (95% CI: 1.47–1.75) times and 1.17 (95% CI: 1.05–1.29) to 1.39 (95% CI: 1.30–1.48) times higher likelihoods of adverse health outcomes and anthropometric deficits, respectively, with variations observed among countries and different disability types. Individuals with disability were 1.16 (95% CI: 1.00–1.35) to 1.26 (95% CI: 1.01–1.58) times more likely to receive healthcare services from skilled healthcare personnel compared to health facility workers other than skilled healthcare personnel.

Interpretation This study findings emphasizes the need for community-level awareness programs to improve anthropometric well-being and healthcare of the children with disability.

Funding This research did not receive any specific funds.

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Keywords: Disability; Adverse health and anthropometric deficits; Healthcare providers; South Asian countries

Introduction

There are over 18 million children with disability (physical, cognitive, sensory, or mental impairment that substantially limits one or more major life activities) under the age of five in South Asia.[1] This represents approximately 36% of the total number of children with

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Research in context

Evidence before this study

Prior research has recognized the substantial challenges posed by disability among children in the South Asian countries and its influence on their socio-economic status. However, the health outcomes and anthropometric status of these children need for newer and more evidence to make comprehensive policies and programs.

Added value of this study

Using representative samples and rigorous methodology, this study identified a higher burden of adverse health outcomes (acute respiratory infection, diarrhea, and fever) and poor anthropometric deficits (stunting, wasting, and underweight) among children with disability. Additionally, the study found that children with disability are more likely to access healthcare services from skilled healthcare personnel and less likely to seek services from non-professional personnel.

Implications of all the available evidence

This study findings enables policymakers to formulate targeted interventions, addressing challenges in the health and anthropometric status of these children. Moreover, contributing to the global disability discourse, the study underscores the significance of context-specific investigations for impactful interventions.

disability under the age of five globally, which is estimated to be around 50 million.[2] In South Asia, this figure is equivalent to 10% of its total population of children under the age of five, surpassing the global prevalence rate of 9%.[1] A wide range of both preventable and treatable conditions including birth defects, premature birth, low birth weight, infections, injuries, neglect, and abuse leads to this higher burden of disability in the region.[3,4] Moreover, as the health services in this region are going through a transition, further reduction in neonatal/infant mortality is likely to give rise to the number of children under the age of five with disability. This projection is attributed to the lack of comprehensive post-neonatal care services in most of the resource limited settings in South Asia, coupled with an increasing number of pregnancies and births due to the higher number of reproductive aged women because of population momentum.[5,6]

Disability can exert a substantial influence on an individual's health and well-being.[2] Within the context of persistent social stigma, disability is frequently perceived as a consequence of parental offenses.[7] Moreover, individuals with disability often encounter neglect from their family and wider community.[8] They are typically marginalized within mainstream society and rely predominantly on governmental support or charity for their sustenance.[9] Essential requirements, such as access to education and healthcare, are frequently disregarded. These factors collectively contribute to a profound impact on their overall health and well-being and often lead to a cycle of poverty among persons with disability.[10]

Lack of education and awareness, stigma and poverty often increase the risk of anthropometric deficit among children with disability, as reported in a multi-county study in Sub-Saharan African and low- and middle-income countries (LMICs) context.[11–13] This has further led to adverse health outcomes, such as the occurrence of acute respiratory infection, diarrhea, and fever. However, field-level exploration of this possibility has remained limited thus far, with need for newer and more evidence.[12,14–16] Moreover, only a few estimates that are available so far reported conflicting associations.[2,17] These gaps present significant challenges in formulating evidence-based policies and programs aimed at ensuring the health and nutrition of children with disability, aligning with the basic focus of the Sustainable Development Goals on leaving no one behind,[18] particularly in relation to health and nutrition-related targets. Therefore, we conducted this study to investigate the effects of disability on health and anthropometric deficits among 2–4 year aged children in South Asia.

Methods

Data source and sampling strategy

Data were extracted from six rounds of the Multiple Indicator Cluster Surveys (MICSs) conducted in four countries in the South Asian region (Afghanistan, Bangladesh, Nepal, and Pakistan) between 2017 and 2023. These countries were selected because of the availability of recent data. Detailed information regarding the sampling procedure of these surveys have been previously published in the respective survey reports.[19–22] Briefly, these surveys were conducted to present updated information on various aspects of maternal and child health, including maternal healthcare services, child health and nutritional status, and healthcare services uptake. The financial and technical support to conduct these surveys was provided by UNICEF in collaboration with other organizations, including UNFPA. The sample in each of these nationally representative cross-sectional household-based surveys was selected using a two-stage stratified random sampling technique. In the first stage, enumeration areas were selected from the list of nationally representative enumerations areas. In the second stage, a fixed number of households were systematically sampled from each of the selected enumeration area.

Eligible mothers or caretakers with children under the age of five who resided in the selected households were included in the survey.

Analytical sample

We analyzed data from 93,180 (weighted) children extracted from the primary surveys. The inclusion criteria for this extraction were as follows: (i) children aged ≥2 years to <5 years, (ii) those whose information regarding their disability status was recorded, and (iii) those whose information regarding health and anthropometric status was recorded. It is important to note that while the survey collected adverse health and anthropometric data for all children <5 years, data on disability was only collected for children aged 2 years or older. As such, we could not analyze data for children aged 0–1 years. A comprehensive description of this sample selection procedure is presented in Supplementary Fig. S1.

Outcome variables

Our primary focus was on adverse health outcomes and child anthropometric deficits. The adverse health outcomes considered were Acute Respiratory Infection (ARI, yes vs. no), diarrhea (yes vs. no), and fever (yes vs. no). The survey we analyzed only contains data on these health-related outcomes for children. Details of the procedure for creating these variables are presented in Supplementary Text S1. For adverse health outcomes, we also explored whether care for adverse health outcomes was sought and classified as from whom healthcare was sought (care received from skilled healthcare personnel, care received from non-professional personnel, and care received from health facility workers other than skilled healthcare personnel). This classification was based on the WHO's International Standard Classification of Occupations (ISCO-08).[23] Details of the procedure for creating this variable are presented in Supplementary Text S2. The anthropometric deficit variables considered were stunting (yes vs. no), wasting (yes vs. no), and underweight (yes vs. no) as well as their severe status, following the guidelines provided by the WHO.[24,25] Details on variable creation are provided in Supplementary Text S3.

Exposure variables

The primary exposure variable of interest was disability status, including the specific types of disability. To assess disability status, the surveys followed the Washington Group on Disability/UNICEF Child Functioning Module (CFM) approach.[26] This comprehensive approach covered all eight domains, which include vision, hearing, walking, fine motor skills, communication, learning, playing, and behavior.[26] These data were collected from the mothers or caregivers of the index child. For each domain, different questions were asked in the following format: "*Compared to children of the same age, does (name) have difficulty in seeing/hearing/walking/dexterity/communicating/learning/playing/controlling behavior at all?*" The response options provided were: (i) no difficulty, (ii) some difficulty (iii) a lot of difficulty, or (iv) unable to see/hear/walk/handle dexterity/communicate/learn/play/control behavior at all. We reclassified these responses to categorized children with a specific form of disability if their responses indicated either "a lot of difficulty" or "unable to function at all." Otherwise, they were considered children without disability. Finally, the overall disability status was determined if the child was classified as disabled in any of the eight domains, following the recommendations of the Washington Group.

Covariates

This study incorporated several covariates, selected through a review of existing literature and their availability within the MICS dataset.[11,12,14,27–29] The covariates considered were as follows: children's age (treated as continuous variable), gender (male, female), mother's education level (pre-primary, primary, secondary, and higher), wealth index (poorest, second, middle, fourth, and richest), and place of residence (urban, rural). The household wealth quintile variable was created by the survey authority through principal component analysis of various variables representing household assets. These variables included ownership of goods, living conditions, water and sanitation facilities, and other assets.[30]

Statistical analysis

Descriptive statistics were used to provide an overview of the characteristics of the respondents. To investigate the association between exposure and outcome variables while adjusting for covariates, multilevel mixed-effects binary logistic regression models were used. The use of such a multilevel mixed-effects binary logistic regression model was recommended due to the nested structure of the MICS data, where individuals were nested within a household, and households were nested within a cluster. All analyses were conducted for the pooled sample and by country. Furthermore, for examining the relationship between disability status and types of healthcare providers for each adverse health outcome considered while adjusting for covariates, a multinomial logistic regression model was used. Throughout all analyses, we took into account the sampling weight. The results were reported as adjusted odds ratios (aOR) or adjusted relative risk ratios (aRRR) where appropriate, accompanied by their corresponding 95% confidence intervals (95% CI). All statistical analyses were performed using Stata software (version 14.0; Stata Corp.org, College Station, Texas, USA).

Ethical considerations

We analyzed de-identified data from six rounds of the Multiple Indicator Cluster Surveys (MICSs) conducted in Afghanistan, Bangladesh, Nepal, and Pakistan. Each of these surveys received ethical approvals from the respective countries' Bureau of Statistics, along with general approval from the technical committee of UNICEF.

Role of the funding source

We did not receive any funding for this study.

Results

Background characteristics of the respondents for pooled sample and across countries are presented in Table 1. The sample size varied, ranging from 4005 children in Nepal to 62,385 in Pakistan. The mean age of the respondents was 42.1 months, with Afghanistan exhibiting a slightly higher mean age of 47.1 months. Gender distribution was nearly equal across all countries, with an overall balanced representation. Approximately 57% of the total children's mothers had pre-primary education, with particularly high percentages in Afghanistan (81.0%) and Pakistan (62.6%). Conversely, in Bangladesh, approximately 49% of mothers reported having received secondary education. Additionally, nearly 71% of the sampled children resided in rural areas, except for Nepal, where this percentage was notably lower at 35.3%.

The distribution of disability, health, and anthropometric deficits are presented in Table 2. The average prevalence of disability across the entire sample was 8.7%, with the highest prevalence observed in Afghanistan (12.3%), followed by Pakistan (9.2%), Nepal (5.5%), and Bangladesh (3.4%). Among specific disability domains, Nepal exhibited the highest prevalence of walking-related disability (4.1%), whereas Afghanistan had the highest prevalence of learning-related disability (3.3%) (Fig. 1). Supplementary Table S1 provides further details on background characteristics of the children with disability, revealing a higher prevalence of disability among rural children, children with mothers of lower educational attainment, and children in the poorest wealth quintile.

Regarding adverse health outcomes, fever was prevalent (26.8%), followed by diarrhea (15.1%) and ARI (9.8%). Approximately 35% of the children reported experiencing at least one of these three adverse health outcomes in the preceding two weeks of the survey. Notable variations in adverse health outcomes were observed across the countries. Afghanistan exhibited the highest rates, with fever affecting 50.2% of children, diarrhea at 33.0%, and ARI at 26.7%. In contrast, Bangladesh consistently had the lowest rates, ranging from 1.8% (ARI) to 21.3% (fever). When considering all three adverse health outcomes collectively, Afghanistan also had the highest prevalence at 11.1%.

Regarding anthropometric deficits, stunting had the highest average prevalence at 42.7%, followed by underweight at 24.0% and wasting at 7.1% (Table 2). Approximately half of the children (48.4%) had at least one of these three poor anthropometric deficits at the

Demographics of children	All combined countries, 2017–2023, % (95% CI)	Bangladesh, 2019, % (95% CI)	Nepal, 2019, % (95% CI)	Afghanistan, 2022–2023, % (95% CI)	Pakistan, 2017–2020, % (95% CI)
Number of children	93,180	13,296	4005	13,494	62,385
Child's age in months, mean (±SD)	42.1 (±10.1)	41.4 (±10.3)	42.0 (±10.3)	47.1 (±6.9)	42.2 (±10.3)
Child's gender					
Male	51.5 (51.1–51.9)	52.0 (51.1–53.0)	52.1 (50.2–54.0)	51.3 (50.1–52.5)	51.4 (51.0–51.9)
Female	48.5 (48.1–48.9)	48.0 (47.0–48.9)	47.9 (46.1–49.8)	48.7 (47.5–49.9)	48.6 (48.1–49.1)
Mother's education					
Pre-primary	56.6 (55.7–57.5)	12.2 (11.4–13.0)	27.8 (24.8–31.0)	81.0 (79.1–82.8)	62.6 (61.6)
Primary	14.7 (14.4–15.2)	24.2 (23.3–25.1)	33.5 (31.1–36.0)	8.9 (7.9–9.9)	12.8 (12.4–13.3)
Secondary	20.1 (19.5–20.7)	49.0 (47.8–50.1)	31.6 (29.1–34.3)	7.8 (6.9–8.9)	15.8 (15.3–16.5)
Higher	8.6 (8.2–8.9)	14.6 (13.9–15.5)	7.1 (5.9–8.6)	2.3 (1.8–2.8)	8.74 (8.3–9.2)
Wealth index					
Poorest	22.7 (22.0–23.5)	22.0 (20.8–23.3)	23.6 (20.3–27.4)	22.6 (20.5–24.9)	22.8 (21.9–23.8)
Second	20.6 (20.0–21.1)	20.1 (19.2–21.1)	20.1 (17.5–23.0)	21.8 (20.1–23.5)	20.4 (19.7–21.1)
Middle	19.6 (19.1–20.1)	18.5 (17.7–19.4)	20.3 (17.8–22.9)	19.8 (18.5–21.2)	19.7 (19.1–20.4)
Fourth	19.4 (18.8–20.0)	19.5 (18.5–20.6)	19.5 (17.2–22.1)	19.0 (17.6–20.5)	19.5 (18.7–20.2)
Richest	17.7 (16.9–18.6)	19.9 (18.5–21.3)	16.5 (13.2–20.4)	16.8 (14.5–19.3)	17.6 (16.6–18.6)
Place of residence					
Urban	28.8 (27.6–30.1)	20.7 (18.9–22.5)	64.7 (59.6–69.4)	21.9 (18.4–26.0)	29.7 (28.2–31.3)
Rural	71.2 (69.9–72.5)	79.3 (77.5–81.1)	35.3 (30.6–40.4)	78.1 (74.0–81.6)	70.3 (68.8–71.8)

Table 1: **Background characteristics of the respondents, MICS, 2017–2023 (weighted sample = 93,180).**

Characteristics	All countries, N (%, 95% CI)	Bangladesh, N (%, 95% CI)	Nepal, N (%, 95% CI)	Afghanistan, N (%, 95% CI)	Pakistan, N (%, 95% CI)
Disability status					
Yes	8072 (8.7, 8.3–9.0)	446 (3.4, 3.0–3.8)	220 (5.5, 4.6–6.5)	1659 (12.3, 11.4–13.3)	5746 (9.2, 8.8–9.7)
Adverse child's health outcomes					
Acute respiratory infection (ARI)	9162 (9.8, 9.4–10.2)	233 (1.8, 1.5–2.0)	82 (2.0, 1.6–2.6)	3607 (26.7, 24.9–28.6)	5241 (8.4, 8.1–8.8)
Diarrhea	14,081 (15.1, 14.7–15.6)	687 (5.2, 4.7–5.6)	335 (8.4, 7.2–9.7)	4449 (33.0, 31.3–34.7)	8610 (13.8, 13.4–14.2)
Fever	24,982 (26.8, 26.2–27.4)	2831 (21.3, 20.4–22.2)	798 (19.9, 18.1–21.9)	6778 (50.2, 48.3–52.2)	14,575 (23.4, 22.8–23.9)
At least one of the above three adverse health outcomes	32,973 (35.4, 34.8–36.0)	3278 (24.7, 23.8–25.6)	1012 (25.3, 23.3–27.3)	8467 (62.8, 60.9–64.6)	20,215 (32.4, 31.8–33.0)
All three adverse health outcomes	2996 (3.2, 3.0–3.4)	19 (0.1, 0.1–0.2)	18 (0.5, 0.3–0.8)	1495 (11.1, 10.1–12.2)	1463 (2.4, 2.2–2.5)
Mean Z-score for anthropometric indicators					
Height for Age, Mean Z-Score (SD)	−1.8 (1.5)	−1.4 (1.3)	−1.6 (1.4)	−2.1 (1.4)	−1.8 (1.6)
Weight for height, Mean Z-Score (SD)	−0.3 (1.3)	−0.7 (1.1)	−0.7 (1.1)	0.2 (1.0)	−0.3 (1.3)
Weight for age, Mean Z-Score (SD)	−1.3 (1.2)	−1.3 (1.1)	−1.4 (1.0)	−1.1 (1.2)	−1.3 (1.2)
Anthropometric deficits					
Stunting	39,766 (42.7, 42.0–43.3)	4040 (30.4, 29.4–31.4)	1425 (35.6, 33.2–38.0)	6828 (50.6, 48.9–52.3)	27,474 (44.0, 43.2–44.9)
Wasting	6634 (7.1, 6.9–7.4)	1261 (9.5, 8.9–10.1)	412 (10.3, 9.0–11.7)	265 (2.0, 1.6–2.4)	4695 (7.5, 7.2–7.9)
Underweight	22,390 (24.0, 23.5–24.5)	3268 (24.6, 23.7–25.5)	1019 (25.5, 23.2–27.8)	2500 (18.5, 17.4–19.7)	15,603 (25.0, 24.4–25.7)
Any of the three poor anthropometric deficits	45,119 (48.4, 47.8–49.1)	5287 (39.8, 38.8–40.8)	1777 (44.4, 41.8–47.0)	7072 (52.4, 50.7–54.1)	30,983 (49.7, 48.8–50.5)
All of the three poor anthropometric deficits	2595 (2.8, 2.6–2.9)	447 (3.4, 3.0–3.7)	131 (3.3, 2.6–4.1)	79 (0.6, 0.4–0.8)	1938 (3.1, 2.9–3.3)
Severe stunted	18,675 (20.0, 19.5–20.6)	1208 (9.1, 8.5–9.7)	529 (13.2, 11.5–15.1)	3404 (25.2, 23.8–26.7)	13,535 (21.7, 21.0–22.4)
Severe wasted	1956 (2.1, 2.0–2.2)	250 (1.9, 1.6–2.2)	87 (2.2, 1.7–2.8)	98 (0.7, 0.5–1.0)	1522 (2.4, 2.3–2.6)
Severe underweight	6026 (6.5, 6.2–6.7)	640 (4.8, 4.4–5.3)	255 (6.4, 5.4–7.5)	571 (4.2, 3.8–4.8)	4559 (7.3, 7.0–7.6)

Table 2: **Distribution of adverse health outcomes and anthropometric deficits, MICS, 2017–2023.**

time of the survey. Around 3% of the total children had reported each of stunting, wasting and underweight (Supplementary Fig. S2). Notable variations across countries were observed, with Afghanistan having the highest prevalence of stunting (50.6%) and Nepal having the highest wasting rate (10.3%). Conversely, Bangladesh had the lowest prevalence of stunting (30.4%). When considering presence any of the three anthropometric deficits, Afghanistan again had the highest prevalence at 52.4%.

We consistently found a higher prevalence of adverse health outcomes and poor anthropometric deficits among children with disability compared to those without disability (Table 3). Furthermore, all forms of adverse health outcomes and poor anthropometric deficits were found more prevalent among children with learning disability compared to those with playing related disability and fine motor skills-related disability, with variations observed across countries (Supplementary Tables S2 and S3).

The association between child health outcomes and anthropometric deficits with disability status are also presented in Table 3. We consistently observed higher odds of adverse health outcomes and poor anthropometric deficits among children with disability compared to those without disability in the overall sample. However, the associations varied slightly at the country level, with some cases reporting insignificant higher odds. For example, Pakistan exhibited significantly higher odds for all considered adverse health outcomes and anthropometric deficits. In Afghanistan, significant associations were found for all three health outcomes and all forms of poor anthropometric deficits except wasting. In Bangladesh, children with disability had higher odds of diarrhea and all forms of anthropometric deficits compared to those without disability. Our segregated analysis of adverse health outcomes and anthropometric deficits across disability types are also consistently revealed higher odds of diarrhea and fever for the total sample and across all countries (Supplementary Tables S4 and S5).

The sources of accessing healthcare services in the event of adverse health outcomes by disability status are presented in Fig. 2. Nearly 29% of the total respondents reported receiving care from skilled healthcare personnel as their source of healthcare, with higher percentages in Afghanistan (32.4%) and Pakistan (31.7%). Overall, children with disability reported higher percentage of healthcare services access from skilled healthcare personnel than children without disability. This percentage was also elevated among children with mothers who had higher education levels (39.3%), those residing in urban areas (35.1%), and households within the middle to fourth wealth quintiles (32.3%–36.7%)

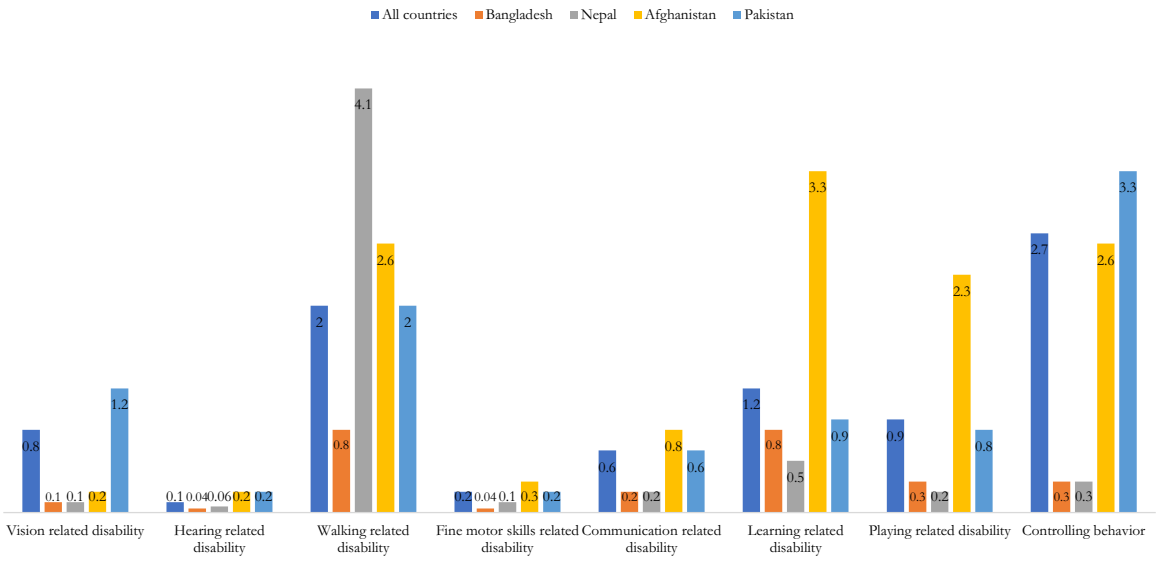


Fig. 1: Distribution of types of disability among children in South Asian countries.

(Supplementary Table S6). Conversely, around 11% of the total sample reported non-professional personnel as their source of healthcare services, with higher percentages in Bangladesh (29.9%) and lower percentages in Nepal (1.1%).

The association between the sources of healthcare services access with adverse health outcomes considered are presented in Table 4. We found children with disability reported 1.42 (95% CI: 1.31–1.53) times higher likelihoods of healthcare services as compared to the children without disability (result not presented in the table). When we considered sources from where healthcare services were accessed, we found that children with disability who had ARI were 1.16 times more likely (95% CI, 1.00–1.35) to receive healthcare services from skilled healthcare personnel and 25% less likely (aRRR, 0.75, 95% CI, 0.58–0.98) to receive healthcare services from non-professional personnel compared to receiving care from health facility workers other than skilled healthcare personnel. A similar association was observed for children with diarrhea. However, no significant association was observed for children with fever. Moreover, when considering all adverse health outcomes together, we found a 1.26 times higher likelihood (95% CI, 1.01–1.58) of receiving healthcare services from skilled healthcare personnel and a 33% lower likelihood (aRRR 0.57, 0.36–0.90) of receiving healthcare services from non-professional personnel as compared to receiving care from health facility workers other than skilled healthcare personnel. The reported associations varied at the country level, with children experiencing fever and diarrhea in Bangladesh (Supplementary Table S7) showing a higher likelihood of receiving care from non-professional sources compared to care from health facility workers. Similarly, children with ARI in Pakistan were more likely to receive care from non-professional personnel compared to care from health facility workers other than skilled healthcare personnel.

Discussion

In this study of 93,180 children aged 2–4 years from four countries in South Asia, we explored the relationship between disability status and adverse health outcomes and anthropometric deficits. The reported prevalence of disability was 8.7%, with notably higher rates in Afghanistan (12.3%) and Pakistan (9.2%), and a lower rate in Bangladesh (3.4%). The most common adverse health outcomes reported were fever (26.8%) and diarrhea (15.1%), while stunting (42.7%) and underweight (24.0%) were the most prevalent anthropometric deficits. A minimum of 35% of all surveyed children reported experiencing some form of adverse health outcomes in the preceding two weeks of the survey, while at least 48% of them reported some form of poor anthropometric deficits. These rates were found further higher among children with disability. We found strong negative effects of disability on adverse health outcomes and anthropometric deficits, both overall and across different countries. Furthermore, although the strength of these relationships varied across different types of disability, the associations remained statistically significant. Children with disability were more likely to seek healthcare services from skilled healthcare personnel and less likely to resort to non-professional personnel, particularly in cases of ARI and diarrhea, although reported association varied across countries.

Adverse health outcomes	All countries, children with disability			Bangladesh, children with disability			Nepal, children with disability			Afghanistan, children with disability			Pakistan, children with disability		
	% (95% CI)	aOR (95% CI)	P-values	% (95% CI)	aOR (95% CI)	P-values	% (95% CI)	aOR (95% CI)	P-values	% (95% CI)	aOR (95% CI)	P-values	% (95% CI)	aOR (95% CI)	P-values
Acute respiratory infection (ARI)	15.0 (14.0–16.1)	1.60 (1.47–1.75)	<0.01	2.8 (1.6–4.6)	1.68 (0.89–3.17)	0.110	4.6 (2.6–7.9)	2.18 (1.09–4.35)	0.027	30.1 (27.0–33.4)	1.17 (0.99–1.38)	0.071	12.0 (11.0–13.1)	1.59 (1.43–1.76)	<0.01
Diarrhea	22.3 (21.0–23.6)	1.57 (1.46–1.70)	<0.01	9.1 (6.5–12.5)	1.80 (1.18–2.74)	<0.01	18.8 (13.4–25.7)	2.34 (1.41–3.90)	<0.01	36.7 (33.8–39.7)	1.12 (0.98–1.29)	0.102	19.3 (17.9–20.7)	1.53 (1.39–1.68)	<0.01
Fever	32.2 (30.6–33.8)	1.30 (1.21–1.40)	<0.01	25.9 (20.4–32.3)	1.24 (0.89–1.71)	0.202	23.9 (18.1–30.9)	1.11 (0.73–1.69)	0.620	51.8 (48.1–55.5)	1.06 (0.89–1.24)	0.521	27.3 (25.6–29.1)	1.28 (1.18–1.40)	<0.01
At least one of the above three adverse health outcomes	44.5 (42.8–46.2)	1.47 (1.37–1.57)	<0.01	30.6 (24.9–30.9)	1.27 (0.93–1.74)	0.132	33.6 (26.4–41.6)	1.29 (0.84–1.98)	0.243	66.1 (62.7–69.4)	1.13 (0.96–1.32)	0.140	39.8 (37.9–41.7)	1.43 (1.33–1.55)	0.01
All three adverse health outcomes	5.6 (4.9–6.3)	1.74 (1.52–1.99)	<0.01	0.2 (0.1–0.6)	0.72 (0.06–8.31)	0.790	1.2 (0.4–3.1)	2.32 (0.64–8.42)	0.200	13.7 (11.7–16.0)	1.25 (1.03–1.52)	0.025	3.8 (3.2–4.6)	1.79 (1.46–2.19)	<0.01
Anthropometric deficits															
Stunting	52.1 (50.6–53.7)	1.39 (1.30–1.48)	<0.01	37.9 (33.0–43.1)	1.36 (1.06–1.73)	0.014	45.4 (37.6–53.4)	1.67 (1.19–2.36)	<0.01	57.0 (53.6–60.3)	1.22 (1.05–1.43)	0.011	52.1 (50.2–54.0)	1.35 (1.26–1.46)	<0.01
Wasting	8.1 (7.8–8.8)	1.17 (1.05–1.29)	<0.01	12.9 (9.6–17.2)	1.54 (1.07–2.21)	0.019	12.3 (8.5–17.5)	1.14 (0.73–1.77)	0.577	2.4 (1.7–3.5)	1.30 (0.89–1.89)	0.168	9.2 (8.3–10.1)	1.24 (1.11–1.39)	<0.01
Underweight	28.9 (27.7–30.2)	1.26 (1.18–1.34)	<0.01	29.8 (25.0–35.0)	1.35 (1.06–1.73)	0.016	32.5 (25.9–39.9)	1.46 (1.03–2.05)	0.032	23.4 (20.9–26.1)	1.35 (1.14–1.60)	<0.01	30.3 (28.8–31.9)	1.29 (1.20–1.39)	<0.01
Any of the three anthropometric deficits	57.4 (55.8–58.8)	1.37 (1.28–1.46)	<0.01	49.4 (44.0–54.7)	1.50 (1.19–1.90)	<0.01	53.4 (45.1–61.5)	1.55 (1.10–2.18)	0.012	58.6 (55.2–61.8)	1.22 (1.04–1.42)	0.012	57.8 (55.9–59.6)	1.36 (1.26–1.47)	<0.01
All of the three anthropometric deficits	3.9 (3.5–4.5)	1.44 (1.26–1.65)	<0.01	5.0 (3.1–7.9)	1.54 (0.89–2.67)	0.126	5.6 (3.4–9.3)	1.77 (0.94–3.34)	0.078	1.1 (0.6–2.1)	2.05 (1.02–4.12)	0.044	4.6 (4.0–5.3)	1.51 (1.30–1.75)	<0.01
Severe stunted	27.6 (26.3–29.0)	1.45 (1.35–1.55)	<0.01	13.5 (10.4–17.5)	1.58 (1.11–2.24)	0.011	22.2 (15.8–30.3)	2.23 (1.40–3.54)	<0.01	31.7 (28.6–34.8)	1.34 (1.14–1.57)	<0.01	27.7 (26.1–29.4)	1.39 (1.28–1.51)	<0.01
Severe wasted	3.0 (2.5–3.5)	1.42 (1.19–1.69)	<0.01	3.1 (1.6–5.8)	1.80 (0.89–3.64)	0.102	4.3 (2.3–8.0)	2.01 (1.00–4.05)	0.051	1.2 (0.7–2.1)	2.11 (1.03–4.32)	0.042	3.4 (2.8–4.1)	1.42 (1.18–1.72)	<0.01
Severe underweight	9.4 (8.6–10.2)	1.47 (1.34–1.62)	<0.01	5.9 (3.8–8.9)	1.15 (0.69–1.92)	0.579	12.0 (7.9–17.7)	2.13 (1.33–3.42)	<0.01	6.5 (5.2–8.1)	1.56 (1.18–2.07)	<0.01	10.4 (9.5–11.4)	1.48 (1.34–1.65)	<0.01

Notes: Models were adjusted with child's age, child's sex, mother's education, wealth index, and place of residence. aOR: adjusted odds ratio. CI: Confidence interval. All percentages are presented as row percentages.

Table 3: **Results from multi-level mixed-effects logistic regression model in assessing the relationship of adverse health outcomes and anthropometric deficits among children with disability.**

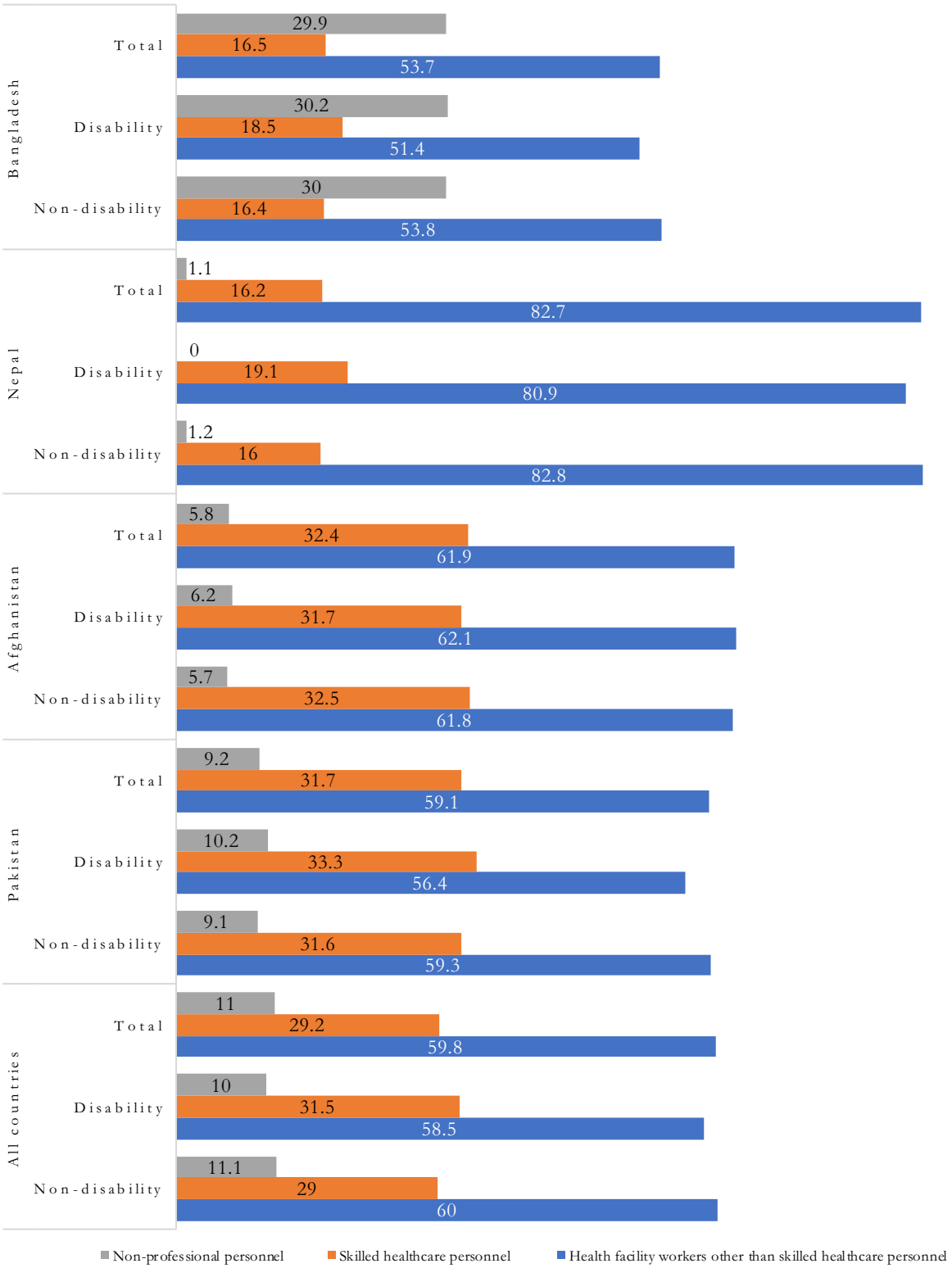


Fig. 2: Sources of accessing healthcare services in event of adverse health outcomes across disability status of children.

Adverse health outcomes	Care received from skilled healthcare personnel		Care received from non-professional personnel	
	aRRR (95% CI)	P-values	aRRR (95% CI)	P-values
Unadjusted association				
Acute respiratory infection (ARI)	1.16 (1.00–1.35)	0.041	0.67 (0.52–0.87)	<0.01
Diarrhea	1.18 (1.00–1.39)	0.044	0.61 (0.46–0.82)	<0.01
Fever	1.08 (0.96–1.22)	0.191	0.94 (0.79–1.12)	0.468
At least one of the above three adverse health outcomes	1.08 (0.96–1.21)	0.186	0.89 (0.76–1.06)	0.187
All three adverse health outcomes	1.27 (1.02–1.59)	0.034	0.51 (0.32–0.79)	<0.01
Adjusted association[a]				
Acute respiratory infection (ARI)	1.16 (1.00–1.35)	0.038	0.75 (0.58–0.98)	0.034
Diarrhea	1.19 (1.00–1.40)	0.042	0.67 (0.49–0.90)	<0.01
Fever	1.08 (0.96–1.21)	0.225	1.01 (0.85–1.21)	0.889
At least one of the above three adverse health outcomes	1.08 (0.96–1.21)	0.199	0.96 (0.81–1.26)	0.671
All three adverse health outcomes	1.26 (1.01–1.58)	0.041	0.57 (0.36–0.90)	0.015

Notes: Base outcome: care received from health facility workers other than skilled healthcare personnel. Disability status (vs. non-disabled). aRRR: adjusted relative risk ratio. CI: Confidence interval. [a]Adjusted for country, child's age, child's gender, mother's education, wealth index, and place of residence.

Table 4: **Results from multinomial regression model in assessing the association between healthcare provider and Acute Respiratory Infection (ARI), diarrhea and fever among children with disability in South Asian Countries, 2017–2023.**

These findings highlight a higher burden of disability in South Asia, particularly in Afghanistan and Pakistan, with consistently detrimental effects of disability status on adverse child health outcomes and anthropometric deficits. These results underscore the importance of addressing healthcare issues among children with disability to achieve the goal of ensuring health and well-being for all, as outlined in the SDGs to be achieved by 2030.

The reported average prevalence of disability stands at 8.7%, a figure that surpasses the recently reported 7% disability rate in sub-Saharan Africa but falls below the global level of 12.5% among children aged 0–5.[2] It is worth noting that this rate is notably influenced by the estimates from Pakistan and Afghanistan, where disability rates stand at 9% and 12%, respectively, in line with previous estimates for these countries.[2,31] The higher prevalence of disability in Asia, particularly in Afghanistan and Pakistan, is the result of a complex interplay of multiple factors. Socioeconomic challenges, limited access to quality healthcare services, and inadequacies in healthcare infrastructure are prominent contributors.[10,32] Prolonged conflicts and insecurity in Afghanistan have led to increased injuries and trauma, which can result in disability. Additionally, poverty, malnutrition, and limited access to clean water and sanitation in various regions exacerbate developmental delays and health issues that heighten the risk of disability.[33] Furthermore, cultural and social stigmas surrounding disability may impede early identification and intervention efforts. Addressing these multifaceted challenges is paramount for improving the well-being and prospects of children with disability in the region.[34]

The study reveals that the causes of disability are indeed linked to a higher prevalence of adverse health outcomes and anthropometric deficits, a finding consistently observed across various countries included in our study and supported by previous country-level analyses.[8] The association between disability and adverse health outcomes and anthropometric deficits may stem from various pathophysiological mechanisms.[35] These mechanisms include reduced mobility and functional limitations, which can lead to inflammation and metabolic dysregulation, thereby promoting poor health and nutritional conditions.[36] Underlying health conditions commonly associated with disabilities may also increase susceptibility to infections and metabolic disturbances, further exacerbating adverse health outcomes and anthropometric deficits.[35,36]

It is also vital, however, to recognize that additional contributing factors to these adverse outcomes exist, stemming from individual characteristics, genetic characteristics, community dynamics, and healthcare facility-level variables. For instance, children with disabilities are more prevalent among comparatively disadvantaged groups, including rural areas and lower socio-economic quintiles, factors that may independently contribute to poor health and anthropometric deficits.[37] Additionally, certain genetic disorders, such as those affecting the musculoskeletal system, may result in mobility impairments, leading to a higher risk of secondary health issues and poor nutritional outcomes.[38] Community characteristics, such as negative perceptions and stigmatization of disability can sometimes lead parents to underestimate their disabled child's potential and needs.[17] In certain cases, this underestimation results in neglect, where children with disability are placed in unhygienic living conditions and provided with inadequate care. This neglect extends to healthcare, leading to delayed or insufficient medical

attention and missed appointments.[8,11] These attitudes and behaviors are often rooted in societal misconceptions, including disability being associated with curses, punishment and bad luck. There is also a lack of awareness at the community level regarding the importance of adequate care and healthcare services access of the children with disability. Moreover, negligence in nutritional practices often restricts meeting dietary requirements. This, in turn, leads to malnutrition, as reported in this study and previous research in LMICs.[11] It is especially critical for children under the age of five, as during their crucial growth stages, such negligence hampers physical and cognitive development, resulting in lasting impairments and disabilities.

Moreover, healthcare facilities in LMICs are frequently not disability-friendly, characterized by overcrowding and long waiting times, which hinder individuals with disability from accessing essential healthcare services.[39] Additionally, individuals with disability often require accompaniment by a family member, which can be challenging when societal attitudes perceive them as burdens. Together these contribute to the underestimate the healthcare services need of the children with disability, leading them to access healthcare services from traditional healers, religious leaders and un-qualified doctor as reported in studies of sub-Saharan African countries.[14]

However, this study findings of children with disability are more inclined to seek healthcare from skilled healthcare personnel and less likely to turn to non-professional personnel when experiencing ARI and diarrhea are opposite of this common community practice. Although this trend was not observed for fever and were not consistent across the countries we analyzed. Similar studies in sub-Saharan Africa have reported that children with disability who had ARI and fever are more likely to access healthcare services from trained healthcare facilities, but not necessarily for diarrhea.[14] One possible explanation for this different patterning is that parents of children with disability may recognize the increased vulnerability of their children to certain health conditions, such as ARI and diarrhea, and thus prioritize seeking professional medical care. This is in line with the governmental priority of treating these conditions considering their higher effects of child mortality in LMICs, particularly in South Asia, in line with the focus of SDGs target of improving child health and reducing child mortality.[2] However, there may be a perception among parents that fever is a more common and less severe ailment that can be managed at home or with over-the-counter remedies.[14]

However, whether the reasons are, these findings depict an optimistic scenario, suggesting that parents tend to consider skilled healthcare personnel if they know about the adverse effects of particular healthcare conditions and when their children face health issues. They are possibly driven by the parent' strong sense of responsibility and care for their child's well-being which lead them to make more informed and cautious decisions regarding healthcare seeking behaviors, opting for the expertise and assurance provided by skilled healthcare providers.[7] These attitudes are likely rooted in the cultural norms prevalent in the region regarding the strong family bonding and suggest a way to improve health status of the children with disability.[8]

This study presents several strengths along with a few limitations. Notably, it is the first study in South Asia to provide regional-level estimates of the burden of disability among children and its association with adverse health outcomes and anthropometric deficits. The analysis of nationally representative survey data is comprehensive, considering a wide range of confounding variables. Furthermore, the study accounts for clustering and sampling weights, as well as country-level differences in disability, enhancing the robustness of the findings. The survey collected data on disability, adverse health, and anthropometric deficits using internationally recognized procedures, adding to the credibility of the results, which can inform national-level policies and program development.

However, despite our intention to include all South Asian countries in the analysis, only four countries had the most recent data; consequently, they were included in the analysis. We could not include the other four countries because MICS was never conducted in Sri Lanka, the last MICS in India was conducted in 2000, Bhutan's MICS took place in 2010, and the Maldives had its last MICS in 1995. Additionally, despite MICS using a standard and similar questionnaire to report disability in all four countries, there is a possibility that disability status is underreported, especially for communication, behavioral, and early learning-related disability. Moreover, the surveys we analyzed are cross-sectional in nature, indicating that the findings are correlational rather than causal. Moreover, the nature of survey we analyzed also restricted us to explore the directionality of the reported associations. Additionally, while anthropometric data are based on direct measurements at the time of the survey, other data, such as information on adverse healthcare services, were collected retrospectively through respondent reports (or from parents/caregivers for children under five years old), leaving room for potential recall bias. Moreover, socio-cultural norms and perceptions related to disability and adverse health outcomes and poor anthropometric deficits can influence children's access to healthcare services, as can the availability and accessibility of healthcare services when needed. Unfortunately, these factors could not be included in the analysis due to the lack of relevant data in the surveys. Understanding their healthcare and other needs requires a comprehensive exploration, necessitating a mixed methods study on this topic that encompasses both quantitative and qualitative components.

The reported prevalence of disability in South Asia averaged 8.7%, with higher rates notably observed in Afghanistan (12.3%) and Pakistan (9.2%). Fever and diarrhea were the most frequently reported adverse health outcomes, while stunting and underweight were the prevailing anthropometric deficits. A minimum of 35% of all surveyed children reported experiencing adverse health outcomes within two weeks of the survey, and at least 48% reported anthropometric deficits. We observed significant negative effects of disability on adverse health outcomes and anthropometric deficits, both overall and across different countries. These associations remained statistically significant, albeit varying in strength across different types of disability. Notably, children with disability were more likely to seek healthcare from skilled healthcare personnel and less likely to turn to non-professional personnel, particularly in cases of ARI and diarrhea. These findings underscore the vulnerability of children with disability in South Asia. It is recommended to implement community-level awareness-building programs to address the heightened risk of adverse health outcomes and anthropometric deficits among children with disability in the region. Increasing parental knowledge about the dietary requirements of children with disabilities, as well as providing them with nutritional foods, is also crucial for reducing the nutritional burden they may face.

Contributors

MNK, MBA, and SJK designed the study concept. MBA and SJK conducted the formal analysis with the help of MNK. MBA, SJK and MSR drafted the manuscript. MNK, MAK, GK reviewed the first manuscript. MNK supervised all works. All authors critically reviewed and approved the final version of this manuscript.

Data sharing statement

The datasets used and analyzed in this study are available from the UNICEF MICS Archive website: https://mics.unicef.org/surveys.

Declaration of interests

The authors have no conflicts of interest to declare.

Acknowledgements

We would like to acknowledge the support of Department of Population Science, Jatiya Kabi Kazi Nazrul Islam University, Bangladesh, where the study was conducted.

Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.lansea.2024.100401.

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