OPEN ACCESS

Verbal autopsy instruments for 'causes and circumstances' surrounding drowning deaths in low–and middle–income countries: a scoping review

Nibedita S Ray-Bennett ,[1,2] Lasith Dissanayake ,[3,4] Winifred Ekezie,[5,6] Lauren MacLeod,[3] Thomas Mecrow ,[7,8] Colleen Saunders ,[9] Rebecca Sindall ,[7] Frederick Oporia ,[10] Aminur Rahman ,[11] Nimra Iqbal Choudhary,[12] Racheal Margaret Nantume,[13] Azukaego Nwando Nnaji ,[14] Srashta Chowdhury,[15] Biswajit Paul,[16] Eleanor Buckett,[7] Isha Biswas,[17] Shahidul Hoque ,[13] Madhulika Sahoo [18]

► Additional supplemental material is published online only. To view, please visit the journal online (https://doi.org/10.1136/ip-2025-045685).

For numbered affiliations see end of article.

Correspondence to
Professor Nibedita S Ray-Bennett; nsrb1@le.ac.uk

Received 8 February 2025
Accepted 26 June 2025

Check for updates

To cite: Ray-Bennett NS, Dissanayake L, Ekezie W, *et al*. *Inj Prev* Epub ahead of print: [*please include* Day Month Year]. doi:10.1136/ip-2025-045685

ABSTRACT

Background Understanding the causes and circumstances surrounding drowning events is vital to inform context-specific interventions. Verbal autopsy (VA) instruments have been used to improve the identification of drowning deaths in low-income and middle-income countries. However, the challenges and opportunities of using VA to understand the causes and circumstances surrounding fatal drowning deaths are unknown.
Objective To explore the extent to which causes and circumstances surrounding fatal drowning data are captured by the studies that use VA instruments, what challenges are faced, and what opportunities lie in improving this instrument.
Methods A scoping review, including publications from January 2012 to September 2023, was conducted using 14 electronic databases, 3 academic search engines and 10 grey literature sources. Data were analysed using frequency counts. Five experts were engaged to corroborate the review findings.
Results 11 457 publications were identified, and 9 were included after eligibility screening. Only one study captured the causes and circumstances of fatal drowning using VA instruments. Challenges regarding the VA instruments were reporting and recall bias, misclassification of cause of death and missing records. Opportunities include: optimising the 'open narrative' section, creating a drowning-specific module for VA instruments and complementing the instrument with social autopsy tools and qualitative methods.
Conclusions Findings indicate a severe gap in evidence, with implications for global organisations which develop VA instruments, to update their VA instruments with questions that can report the circumstances of a drowning death. It is anticipated that this could accelerate the action on global drowning prevention for sustainable development.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ The WHO urged Member States to improve drowning data, to understand its full extent and circumstances, target interventions and evaluate their effectiveness.
⇒ In the absence of a vital registration system in low-income and middle-income countries (LMICs), fatal drownings may be captured by studies using a verbal autopsy (VA) instrument, but little is known about the extent to which this instrument captures the circumstances surrounding fatal drowning.
⇒ Lack of information on circumstances prevents the development of effective interventions.

WHAT THIS STUDY ADDS

⇒ After reviewing 11 457 records, only one study captured the causes and circumstances of fatal drowning, despite there being a 103-fold increase in the number of drowning-related publications from 1995 to 2020, per a recent bibliometric analysis.
⇒ Review identified five variants of VA instruments currently used by drowning prevention researchers and practitioners. From these instruments, reviewers narrowed down 24 variables that can report the causes and circumstances surrounding fatal drowning.
⇒ Including these variables as a guide for the open narrative questionnaire of the VA instrument will increase the quality of data and intervention design and accelerate positive action for global drowning prevention.

INTRODUCTION

Drowning is preventable, and yet hundreds of thousands of people die each year. According to the WHO's first-ever Global Status Report on Drowning Prevention,[1] in 2021 alone, there were 300 250 drowning deaths globally, 43% of which were among children aged 14 years or younger. Further analysis of drowning deaths by country-income level shows that 93% of drowning deaths occur in low, lower-middle and upper-middle-income countries (LMICs).[1]

Drowning is a neglected public health issue, emphasised by the WHO's first Global Report on Drowning—Preventing a Leading Killer in 2014.[2] Before 2014, a plethora of studies demonstrated the neglect of drowning in LMIC settings, including the

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

- ⇒ There is a need to expand research on the circumstances surrounding fatal and non-fatal drowning to understand the actual burden of intentional and unintentional injury death.
- ⇒ There is a need for public health and epidemiology experts to collaborate with sociology and social science qualitative researchers to improve the quality of VA data.
- ⇒ There is a need for global organisations to combine efforts to accelerate action for global drowning prevention in LMICs by generating comparable datasets with sufficient detail to inform intervention design.

seminal 2011 International Life Saving Federation World Conference on Drowning Prevention[3]; research on the emergence of drowning reduction as a priority within Bangladesh and the position it held on the national policy agenda from 1999 to 2017[4]; research on the risk of drowning by different bodies of water in and near the home of children aged 1–4 years in Mexico[5]; and the necessity for water safety education among primary school children in Grenada.[6] The WHO's Global Report on Drowning is crucial because it catalysed increased advocacy, research and programmes.[7] This report provides a drowning prevention framework to understand who is most affected, where and how the burden of drowning can be tackled. More concretely, the framework focuses on four pertinent questions:

(1) What are the risks? The risk factors are lack of physical barriers between people and water; lack of (or inadequate) supervision of young children; uncovered or unprotected water supplies and lack of safe water crossings; lack of water safety awareness and risky behaviour around water; travelling on water, especially on overcrowded or poorly maintained vessels; flood disasters, whether from extreme rainfall, storm surges, tsunamis or cyclones; (2) Who is at risk? Children under 5 and males under 25 years of age are considered high-risk groups; (3) Where are the risks? Circumstances that lead to exposure to water, especially in LMICs, include collecting water, living near water, travelling on water, working on or around water, flood disasters and where assistance is limited; and (4) How can the threat of drowning be reduced? Through 10 actions to prevent drowning, improved community infrastructure, public awareness, appropriate policies and legislation, and research.

To translate this framework into action, the WHO also called for improving drowning data in countries 'to understand the full extent and circumstances (our emphasis) of drowning to target interventions and evaluate their effectiveness'.[2] Following this report, the United Nations (UN) General Assembly approved the first UN Resolution on Drowning Prevention (hereafter UN Resolution) (A/75/L.76) on 28 April 2021. The UN Resolution provides a global framework for drowning prevention,[1] by recognising (1) the association between drowning and development in LMICs; (2) drowning as a matter of social equity because it disproportionally affects children and adolescents in rural areas; (3) drowning has a connection with social determinants of health including vulnerabilities to the effects of climate change, particularly flood events, which are predicted to increase in severity and frequency and (4) drowning prevention cross-cuts major global frameworks, including the Paris Protocol, the Sendai Framework for Disaster Risk Reduction and the New Urban Agenda. Water-related disasters, especially flooding, affect more people than any other natural hazard, and drowning is the leading cause of death during floods. Therefore, working at the interface with these global frameworks and collaborating with relevant actors will contribute towards achieving the UN's 2030 Sustainable Development Goals.[8] In 2023, the World Health Assembly passed a resolution on 'Accelerating Action on Global Drowning Prevention', which also called for improvements in drowning research and a multisectoral response.[9]

These are welcoming developments towards drowning prevention, particularly in reporting the 'causes and circumstances' surrounding drowning deaths, which is the focus of this study. The UN Resolution urged the Member States to 'Include drowning within civil registration and vital statistics (CRVS) registers and aggregate all drowning mortality data into national estimates'.[1 8] Following this Resolution, a Delphi study on identifying strategic priorities for drowning prevention found that LMIC participants (n=51, 38.6%) ranked strengthening capacity for data systems to measure, map and monitor drowning burden at all levels as the highest priority.[10] The authors also noted that investments in drowning data surveillance, using verbal autopsy (VA), have contributed insights in Bangladesh, India, Vietnam, Ghana, Tanzania and Uganda, where studies show drowning rates higher than previously reported (see below for detailed discussion). However, despite this progress, according to the WHO's Global Status Report, 65% of UN Member States reported collecting drowning data through CRVS, indicating that 35% are not doing so.[1]

VA instruments are often used in LMIC settings where the civil registration and death certification systems are weak and where many people die at home without having had contact with the health system.[11 12] The main objective of the VA is to describe the causes of death at the community or population levels,[11] as part of large-scale household surveys or within geographically specific health and demographic surveillance systems.[13] The physician review VA approach, where a physician independently determines the cause of death based on the VA narrative, is the most common method for interpreting VA data in LMICs.[14 15]

Improving local-level data collection in LMICs is paramount to capturing more accurate data on the burden of drowning. In such settings, there are varying degrees of reference to drowning and the associated risk at the time of disaster and different perceptions of who is at risk, as shown in the disparity between global and national estimates.[16] Consequently, data are often missing or not collected because drowning deaths frequently occur outside the formal health system and are not reported for recording in the country's CRVS.[17 18]

In this regard, the VA instrument offers an opportunity to identify injury deaths.[19] A study carried out in Bavi district, Vietnam, in 1999 used VA for the first time to determine causes of death in adults of all ages.[20] This led to an initial analysis of the mortality pattern in the area. Authors posited that VA gave more precise causes of death than those reported at death registration. To understand the actual burden of suicide rates in Kerala, India, the VA was used to determine the cause of death from a cohort of 132 000 (age 35 years and above) from 1990 to 2005.[21] The findings were vital to overcoming the under-reporting of suicides in the civil registration system because the dataare often incomplete, and suicide deaths were poorly reported in Kerala. In the absence of a vital registration system in Bangladesh in 1993/94, a study used VA interviews to determine the cause of child death since these data were lacking then.[22] The Bangladesh Health and Injury Survey also used the VA and verbal diagnosis form to determine the magnitude and distribution of unintentional injuries among Bangladeshi children (<18 years).[23] Similarly, a study on traditional rescue practices performed on drowning children in Matlab, Bangladesh, reported VA data of 10 years (1996–2005) on the circumstances of childhood drowning (under 5 years).[24] A study investigated the ill-defined causes of death in the Mortality Information System of Brazil, using the VA method to estimate injury-specific mortality fraction in small municipalities and found the potential of VA to improve the data quality for planning.[25] A recent policy analysis on drowning prevention reported that the VA has high sensitivity and specificity and overcomes the disincentives to reporting drowning to authorities (eg, government and other medical charges), at the community level over other methods.[26]

There are different versions of VA instruments, which are discussed in the Results section. WHO's standardised VA instrument is the most widely recognised and standardised tool for ascertaining all causes of death. The latest version of WHO VA instruments 2022 includes a variety of questions on specific variables such as Demographic and Socio-economic Information, Symptoms and Clinical History (specific symptoms experienced by the deceased during the illness leading to death), Circumstances of Death (where the death occurred), Maternal and Perinatal Deaths (questions tailored for deaths of maternal, newborns or infant deaths), Injury-Related Deaths (deaths caused by injuries or accidents) and Open-Ended Questions (narrative questions allowing the respondent to provide additional information and context).[27] The total number of questions depends on the age group of the deceased. Except for the Open-Ended Questions, all other questions are closed-ended. Therefore, the open-ended or open narrative section of the instrument could be used to determine the circumstances surrounding the death, leading to better narratives and data accuracy.[28]

To aid the open narrative section, the 'minimum parameters' are required to support the data collection related to the circumstances of deaths. Minimum parameters are understood as the common variables consistently used by the authors,[29] or drowning prevention researchers and practitioners using the VA instrument to capture the cause of death. In this light, a scoping review complemented by expert engagement was designed to explore how the VA instruments capture causes and circumstances surrounding fatal drowning and the minimum parameters that the drowning prevention researchers and practitioners use. The review also sought to identify the challenges and opportunities in using the VA instrument to collect context-specific and modifiable risk factors for drowning deaths in LMIC settings.

METHODS

The study was conducted in two phases: a scoping review (September 2023–March 2024) and expert consultations (April–May 2024).

Phase 1: scoping review

The scoping review was designed according to the methodological framework of Arksey and O'Malley,[30] and the Joanna Briggs Institute Manual for Evidence Synthesis guidelines.[31] The Population/Participants, Concept and Context (PCC) framework was followed to develop the research question and eligibility criteria (table 1).[32] The Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR)[33] was used as the guide for reporting the review's results.

Table 1 Inclusion and exclusion criteria

Inclusion criteria		Exclusion criteria
Population	People at risk of fatal drowning in LMICs	1. Studies conducted in settings other than LMICs 2. Publications not reporting drowning-related data 3. Secondary studies (Reviews) 4. Publications not in the English language and published before 1 January 2012
Concept	Fatal drowning, risk	
Context	Primary studies published in the English language, regardless of study design, from 1 January 2012 to 31 September 2023* Considering the accessibility and time restrictions, the grey literature was limited to Bangladesh, South Africa and Uganda. The collaborators from these three LMICs had access to grey literature sources, and the relevant records were included.	

*Study collaborators determined the seminal 2011 International Life Saving Federation World Conference on Drowning Prevention,[3] as being a suitable cut-off for inclusion. Therefore, records published from 1 January 2012 were reviewed. Furthermore, the reliability of evidence changes with time; thus, the last 12 years from the search date were considered an appropriate time frame.
LMICs, low-income and middle-income countries.

Inclusion and exclusion criteria

Search strategy and selection criteria

The search terms were grouped into three categories: risk groups (eg, children, fishers), conditions (eg, drowning) and outcomes (eg, death). Risk groups were removed from the search strategy to avoid narrowing the search outputs and missing key studies, thus ensuring a broader range of relevant studies could be identified (see online supplemental file 1). A medical librarian also assisted in creating the final search strategy for each database.

Four bibliographic databases (Medline, EMBASE, Web of Science, Social Sciences Citation Index), 10 websites and databases of international organisations (eg,WHO, UN, UNICEF, CDC) and 3 academic search engines and collections (Google Scholar, ResearchGate and Academia) were searched. Also, 10 grey literature sources from Bangladesh, South Africa, and Uganda were searched to obtain unpublished literature. Mendeley Reference Manager Software was used to manage and find duplicates of the obtained results.

Screening and study selection

10 reviewers (LD, NIC, SC, IB, RMN, BP, ANN, SH, EB and MS) used the Rayyan Systematic Review tool to screen the 'title and abstract' of the records. The World Bank's 'country classifications by income level' was used to determine whether the study had been conducted in an LMIC setting or not.[34] The main reviewer (LD) and the project lead (NSR-B) resolved the conflicts of decision. If consensus could not be reached, the record was included for full-text review. The full-text publications were uploaded to the Rayyan Systematic Review tool and reviewed independently by five reviewers (LD, LM, TM, RS and WE). The conflicts of decisions were resolved by the main reviewer (LD), the project lead (NSR-B) and another member of the team (CS) in an open discussion.

Data extraction

Considering the review questions, the team selected 25 information categories (see online supplemental file 2). The standard data extraction sheet was developed using Microsoft Excel, and the main reviewer (LD) carried out the data extraction. The project lead (NSR-B) cross-checked the extracted data before the analysis phase.

Collating, summarising and reporting the results

The extracted data were collated according to the review objectives and analysed using frequency counts. An improvised micro-meso-macro analytical framework was followed for the extended analysis.[35] The publications were also mapped and categorised according to the setting, type of VA instrument and other vital information such as minimum parameters, identified strengths and limitations. The results were reported using tables, figures and descriptive formats to align with the study objectives. The institutions and experts/authors that developed/used VA instruments were listed and invited for the second phase of the study.

Phase 2: community involvement and engagement: expert consultations

Three organisations with expertise in developing VA instruments were found from the included studies in phase 1: the Public Health Foundation of India,[36] the INDEPTH Network[37] and the Centre for Injury Prevention and Research, Bangladesh.[38] Five experts from these organisations were contacted for a consultation, and they were engaged using Microsoft Teams in May 2024, with each engagement lasting 45–60 min. Two experts/authors were from the Public Health Foundation of India, and one from the Centre for Injury Prevention and Research, Bangladesh. The remaining two experts were from the INDEPTH Network but were not authors of the included publications. Authors from the INDEPTH Network were unavailable. These experts were obtained through a LinkedIn search and word of mouth. Both experts from the INDEPTH Network were part of the Health and Demographic Surveillance Systems and had experience in using the VA instrument. Therefore, two groups of drowning prevention experts were engaged: authors of the included studies from phase 1, and other experts from the INDEPTH Network identified online.

Consultations with the authors from phase 1 centred on three areas: individual articles included for this study, their data-gathering experience and the challenges and opportunities of using VA instruments. The two experts' engagement processes were the same, except for focusing on a specific article.

Data synthesis and integration

The extracted data were analysed using frequency counts. Where relevant, the scoping review findings were presented alongside the data from the consultations using a 'side-by-side analysis.'[39]

RESULTS

The search resulted in 11 457 records. A total of 4004 duplicates were excluded, and 7453 publications were screened. 490 publications were selected for full-text screening. 127 records met the PCC eligibility criteria, including four reports identified from the grey literature sources. Only nine publications (seven peer-reviewed articles[14 15 17 40–43] and two reports)[44 45] met the VA eligibility criteria and were included in this review (see figure 1).

The nine publications included were from six different LMICs (see table 2). Two studies focused on specific high-risk groups (children and people with convulsive epilepsy), while the rest focused on the general population. Seven studies recorded that the cause of death was unintentional; one study each by Ding *et al*[41] and Rahman *et al*[44] did not report this information. Only two publications reported the source of water for drowning. Four publications used newly developed study-specific VA instruments, and one each used the WHO standardised VA instrument 2016,[45] the WHO standard child VA questionnaire (CVAQ),[40] the Population Health Metric Research Consortium

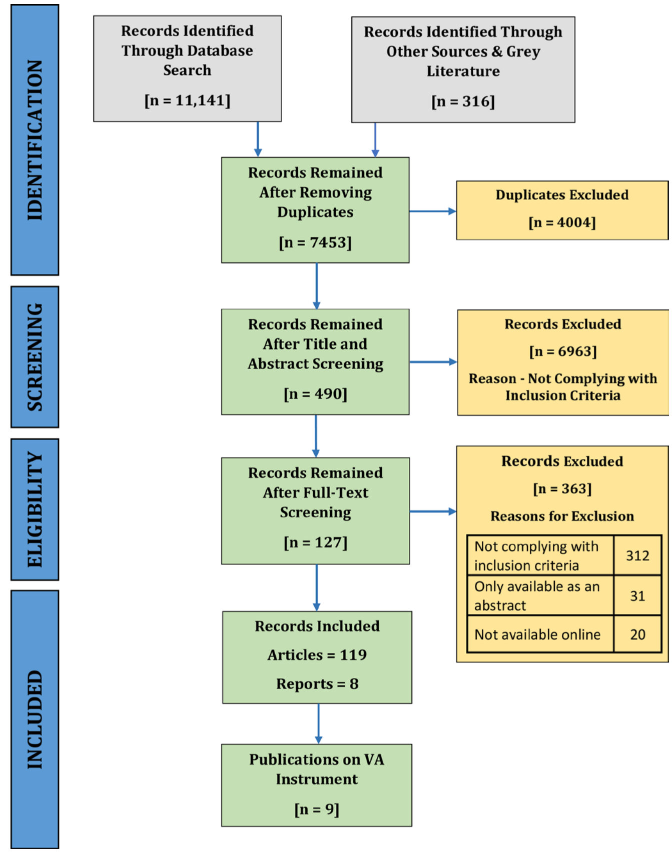

Figure 1 PRISMA flow chart—criteria for selecting the records. PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses; VA, verbal autopsy.

(PHMRC) shortened VA,[17] an adapted version of the standard VA instrument from the WHO and the INDEPTH Network,[14] and an adapted version of the Bangladesh Health Injury Survey questionnaire[44] (see table 2).

Minimum parameters

The included publications reported various common variables related to the background, sociodemographics and other supporting data. Three minimum parameters were found:

Background information

Five studies[14 17 40–42] reported the setting (rural/urban) of the drowning incident, and two studies[14 45] captured the 'time to collect data' after drowning has occurred (between 2 weeks and 6 weeks for fatal drowning) and the 'time taken to gather data' from a minimum of 30 min and a maximum of 3 hours.

Sociodemographic details

All the selected studies consistently collected data on age and gender variables. Two studies each[14 42] collected additional information, including educational level, civil status and occupation, while one study[42] collected the socioeconomic quintile.

Other information

Six studies[15 17 40 42 43 45] collected medical records. Three studies[14 15 42] captured the place of the incident and survival status. Four studies[15 17 40 45] used the open-ended questions/narrative variables. In addition to the VA questionnaire, one

Table 2 Details of the nine included publications

No.	Publication	Country	Income category	Population group in focus	Cause of death	Source of water	Type of VA instrument
1	Ding *et al*, 2013[41]	China	Upper-middle-income country	People with convulsive epilepsy	Not reported	Not reported	Newly developed VA Instrument
2	Razzak *et al*, 2013[40]	Pakistan	Lower-middle-income country	Children under 5 years	Unintentional	Not reported	WHO Standard Child VA Questionnaire
3	Weldearegawi *et al*, 2013[14]	Ethiopia	Low-income country	Children	Unintentional	Not reported	Adapted version of the Standardised VA Questionnaire from WHO and INDEPTH Network
4	Rahman *et al*, 2016[44]	Bangladesh	Lower-middle-income country	General population	Not reported*	Not reported	Adapted version of the VA instrument from the Bangladesh Health Injury Survey 2003
5	Alonge *et al*, 2017[42]	Bangladesh	Lower-middle-income country	General population	Unintentional	Ponds	Newly developed VA Instrument
6	Gelaye *et al*, 2018[15]	Ethiopia	Low-income country	General population	Unintentional	Not reported	Newly developed VA Instrument
7	Dandona *et al*, 2019[17]	India	Lower-middle-income country	General population	Unintentional	River, pond, well, canal, tank, sewer, water pit	Population Health Metric Research Consortium shortened the VA Instrument
8	SAMRC, 2020[45]	South Africa	Upper-middle-income country	General population	Unintentional	Not reported	WHO VA Instrument—2016
9	Jin *et al*, 2022[43]	China	Upper-middle-income country	People with convulsive epilepsy	Unintentional	Not reported	Newly developed VA Instrument

*During the consultation with the first author, it was reported that all fatal drownings below the age of 10 years were 'unintentional'.
VA, verbal autopsy.

study[44] collected information on the external cause of injury death using an 'Injury Mechanism Form.'

Based on these studies, 29 different variables were identified as minimum parameters, which are: (1) details of responder/s; (2) time for data collection (between 2 weeks and 6 weeks after the incident); (3) place of data collection; (4) age; (5) gender; (6) educational level; (7) ethnicity; (8) religion; (9) occupation; (10) vulnerability of the deceased; (11) study setting or area of the house; (12) place of incident; (13) time of the incident; (14) season of the year; (15) survival status; (16) cause of injury death; (17) natural hazard disaster; (18) water source; (19) distance of water source; (20) swimming ability; (21) medical history; (22) received medical care; (23) details of the accompanying person; (24) activity before drowning; (25) presence of caregiver; (26) number of children; (27) alcohol or substance use; (28) presence of early warnings and (29) healthcare service availability.

Of these 29 variables, three are about the data collection process (1–3), two are about the demographics of the victim (9–10) and the remainder (24) are about the causes and circumstances of fatal/non-fatal drowning.

Challenges and opportunities

Of the nine publications, only three studies (Razzak *et al*; Rahman *et al*; Dandona *et al*)[17 40 44] used the VA instrument to study fatal drowning, whereas the other studies reported all causes of death as a combined variable. Furthermore, only the study by Dandona *et al*[17] reported the causes and circumstances of the fatal drowning. The nine included studies demonstrate that the drowning prevention researchers and practitioners use different variants of VA instruments. Two pertinent challenges and opportunities related to the design and data for these instruments were noted. These findings, along with our consultations with experts, are presented below.

Fatal drowning studies: Razzak *et al* used the CVAQ in Pakistan and reported two major challenges: recall and reporting bias, and misclassification of cause of death.[40] The authors mentioned that the specific question in the instrument, "Did he/she die from injury or accident?" is likely to identify the immediate deaths due to injuries and will miss injury deaths occurring up to 30 days postevent, which is the current definition of injury mortality. Despite this, the authors still considered the VA as the most reliable method in the absence of a functioning vital registration and validation system in Pakistan. VA instruments perform well for injury deaths as one broad category, with high sensitivity, specificity and positive predictive value compared with hospital records and death certificates.[40] Rahman *et al* used the adapted VA instrument from the Bangladesh Health Injury Survey—2003 to record the external causes of fatal and non-fatal injury deaths, including drowning.[44] However, the authors did not provide any information about challenges and opportunities for this study-specific VA instrument.

Causes and circumstances study: Dandona *et al* used the PHMRC shortened VA questionnaire in India.[17] However, the instrument was not designed to capture context or risk factors for drowning deaths, and this has been a significant limitation of the VA questionnaire, according to the authors. This was reiterated during our engagement with two leading authors of this study. Despite this, the study highlighted that the circumstances surrounding the drowning event could provide a starting point for prevention and intervention opportunities. This study used the open narrative part to capture three different types of contextual information surrounding the fatal drowning of children aged 1–14 years, and these contexts were death while playing in the water, death while bathing in water and death while defecating. The contexts indicate three unique yet interconnected areas where interventions are crucially needed. Furthermore,

Table 3 Challenges using the VA instrument

Challenge	Reason	Publication
Validation bias	▶ VA instrument for people with epilepsy	Ding *et al*, 2013[41]
Reliability bias	▶ Physicians have more difficulties arriving at diagnoses for deaths caused by injury of undetermined intent. ▶ A physician's review can be affected by local epidemiology.	Weldearegawi *et al*, 2013[14]
Recall and reporting bias	▶ Questions related to clinical details could be intimidating and inappropriate for the respondents to recall and report accurately.	Alonge *et al*, 2017[42]
Information bias	▶ Minor injuries are difficult to diagnose ▶ The VA instrument for epilepsy is not descriptive ▶ The VA instrument is not designed to capture context or risk factors for drowning ▶ Difficulties in extracting data items of injuries covered in the open narratives of the VA instrument	Alonge *et al*, 2017[42] Ding *et al*, 2013[41] Gelaye *et al*, 2017[15]
Misclassification bias	▶ Due to the variations in subjective interpretation ▶ Misclassification of cause of death	Alonge *et al*, 2017[42]
Missing records	▶ Missing records for fatal drowning outcomes affect the estimated rates with precision and accuracy	Alonge *et al*, 2017[42]
Time consumption	▶ The VA instrument is long and time-consuming. When there is a death certificate, the interview time increases (up to 3 hours).	SAMRC, 2020[45]

VA, verbal autopsy.

during the engagement process, the two leading authors recommended using a social autopsy (SA) tool to aid the open narrative to record circumstantial information.

Design challenges and opportunities: The VA instruments are designed to report the cause of death based on the International Classification of Diseases 10,[46] but they are not intended for collecting 'circumstances' surrounding fatal and non-fatal drowning. This is one of the significant challenges of the VA instrument.[47 48] However, as mentioned above, the VA instruments have an open narrative section where the circumstances surrounding fatal drowning can be captured. Only one study captured contextual circumstances,[17] thus indicating the underutilisation of the open narrative section of the questionnaire. During our consultation with two experts from the INDEPTH Network, we learnt that although open narrative data are collected, they are often filtered out during publications due to a lack of in-house qualitative analysts. Therefore, vital information on the circumstances of drowning is lost. Circumstantial information is vital to developing case reports, which can provide a starting point for prevention and intervention opportunities.[2 17]

Data challenges and opportunities: Five publications (see table 2) that used VA for the general population, children and people with convulsive epilepsy identified seven data-related challenges. These include validation, reliability, recall and reporting, information, misclassification biases, missing records and time consumption (see table 3).

DISCUSSION

This review identified seven peer-reviewed and two grey publications reporting drowning-related data in LMICs, of which only three used the VA instrument to study fatal drowning. Of these three studies, only one captured the causes and circumstances surrounding fatal drowning among children. The selected studies[41 43] also revealed that 'people with convulsive epilepsy' are also a high-risk group, and they are not identified as per the WHO's drowning prevention framework's second component: Who is at risk?.[13 49 50] A structured analysis of the results from the review identified several minimum parameters that can guide data collectors to determine useful contextual factors surrounding drowning, and challenges and opportunities to improve the quality of VA data. By doing so, the results highlight relevant knowledge gaps and underscore future research priorities.

A bibliometric analysis by Scarr and Jagnoor demonstrated that drowning publications increased 103-fold over 25 years (1995–2020).[51] This implies that despite the significant increase in drowning publications, there has been no increase in research on the causes and circumstances of fatal drowning using VA instruments. Interestingly, a scoping review by Scarr and Jagnoor found significant growth in research on the causes and circumstances of fatal drowning, with a total of 65% of studies providing either drowning within another health study (32%) or drowning-specific (33%), while the remaining 34% focusing on contextual interventions.[7] Nevertheless, our results indicate a limited use of VA specific to drowning.

This review identified 29 different variables, which can be used to inform intervention development for general populations or tailored to a specific high-risk group. These are consistent with the second and third components of the WHO's drowning prevention framework: Who is at risk? Where are the risks? The findings provide an additional layer of understanding to these components because they include the seasonality of the risk (time of the year). This has implications for disaster preparedness for climate-related disasters.[1] This is consistent with the findings of a scoping review by Scarr and Jagnoor. They found increased research mapping intersections with key public health and disaster risk reduction.[7] A Delphi study by the same authors also noted interesting findings in this regard, as the study conceived a new definition for drowning, reinforcing the importance of drowning risk—the consequence of the interaction between a hazard, the characteristics that make people vulnerable to drowning, and their exposure (context, frequency of occurrence and duration) to a drowning hazard.[10] The basis for this conceptualisation is the Sendai Framework and the Intergovernmental Panel on Climate Change.[52 53] According to these authors, reframing drowning prevention and aligning with the language and concepts used in disaster risk reduction and climate resilience sectors may assist with integration and help facilitate the identification of co-benefits and complementary interventions.[10]

WHO, INDEPTH Network and PHMRC mainly lead the five different variants of VA instruments. Therefore, these findings provide an opportunity for these global organisations to encourage drowning prevention researchers and practitioners to ensure that qualitative data from the open narrative section of the VA instruments is suitably coded and analysed. Opportunities also lie for others to use this component for broader qualitative research studies.

Of the 29 variables mentioned above, 24 can act as useful variables to collect and report on the circumstances surrounding fatal and non-fatal drowning. Opportunities lie for PHMRC to use our suggested variables in the form of structured questions that might add context, and for WHO to create a drowning-specific module for their VA instruments. Furthermore, these organisations can also explore complementing their VA with SA instruments, as recommended by the technical experts/authors from the Public Health Foundation of India and the Centre for Injury Prevention and Research, Bangladesh, during our consultation. Once the cause of death is determined through a VA tool, drowning prevention researchers and practitioners can then administer the SA to the deceased family members to record detailed circumstances surrounding fatal drowning. The variables identified in this study can lead to the development of structured or unstructured questions for the SA instrument for drowning.

The SA instrument identifies the social, behavioural and health systems determinants of a particular cause of death.[54 55] The SA instrument has been primarily used to identify factors related to maternal mortality, health promotion[55] and neonatal and child mortality[56 57] but has not been used for fatal drowning (see online supplemental file 3). As such, there is scope for these global organisations and others to develop SA instruments to capture non-biological causes of fatal drowning using qualitative research methods such as interviews (key informant and in-depth),[58 59] focus group discussions, community walkthroughs, photo voice and structured observation (among others).[60] The in-depth interviews, in particular, should offer an opportunity to be reflective and cognisant of cultural factors when deploying SA in a social context.

Five out of six publications identified seven data-related challenges for the VA instruments (see table 3). Given the VA instruments' vital role in the countries where the CRVS is weak, these findings indicate an opportunity for drowning prevention researchers and practitioners to overcome the challenges to improve the data quality of the VA instrument. These challenges (biases,[61] missing records[62] and time consumption)[63] are not unique to VA instruments only. To overcome these challenges, the research team can include the promotion of 'reflective practices' within the research process and design through mindfulness, debriefing workshops/conferences and organisational learning loops (data collectors, data analysts, etc),[64] and missing data approaches[62] to tackle study-specific reliability, recall, reporting and information biases and appropriate mechanisms, along with relevant experts and technology, to overcome missing records.

The strengths of this review include a broad search strategy, a wide range of databases and search engines, the application of a comprehensive methodological framework and the engagement with drowning experts. The review also used a robust search methodology, including an extensive search strategy and reporting the review process in line with the PRISMA-ScR reporting guidelines, limiting the potential for bias and enhancing its reproducibility.

This study has some limitations. The search only included peer-reviewed English language primary publications, time-restricted from 2012, search restricted to VA and grey literature only from three selected LMICs. This may have excluded relevant publications in other languages, suitable injury publications before 2012, publications that applied community or household surveys to identify causes and circumstances of deaths and any other grey literature. As such, the results and analysis may not be entirely representative. However, considering that WHO introduced the first international technical standards and guidelines for VA in 2007, and the first simplified VA instrument was published in 2012,[65] it is unlikely any relevant studies were missed due to the timeline restrictions.

CONCLUSIONS

The scoping review found a severe evidence gap in capturing the causes and circumstances of fatal drowning. 24 variables were identified. They have the potential to inform a questionnaire or a module that can capture circumstantial data. Seven data-related challenges were identified from the existing VA instruments, and reflective practices within the project context are proposed to overcome them. The findings indicate the need for developing a more robust open narrative within VA instruments for drowning, either through a structured questionnaire, a separate drowning module or an SA tool—informed by our 24 variables. There is perhaps value in all these options to enhance the quality of VA instruments. It is recommended that relevant global organisations update their respective VA Instruments and advocate for increased prioritisation of recording information related to circumstances of drowning deaths to accelerate action on global drowning prevention as envisaged by the UN Resolution.

Author affiliations
[1]School of Business and Institute for Environmental Futures, University of Leicester, Leicester, UK
[2]Avoidable Deaths Network, Leicester, UK
[3]Institute for Environmental Futures, University of Leicester, Leicester, UK
[4]Faculty of Life Sciences and Education, University of South Wales, Pontypridd, UK
[5]Centre for Health and Society, Aston University, Birmingham, UK
[6]College of Life Sciences, University of Leicester, Leicester, UK
[7]Royal National Lifeboat Institution, Poole, UK
[8]Faculty of Health, Wellness and Life Sciences, Leeds Trinity University, Horsforth, UK
[9]Division of Emergency Medicine, University of Cape Town, Cape Town, South Africa
[10]Department of Disease Control and Environmental Health, Makerere University School of Public Health, Kampala, Uganda
[11]International Drowning Prevention and Research Division, Center for Injury Prevention and Research, Bangladesh, Dhaka, Bangladesh
[12]School of Public Health and Interdisciplinary Studies, Auckland University of Technology, Auckland, New Zealand
[13]School of Business and Institute for Environmental Futures, Avoidable Deaths Network, University of Leicester, Leicester, UK
[14]Faculty of Psychology & Neuroscience, Maastricht University, Maastricht, Netherlands
[15]Department of Geography, Salesian College, Darjeeling, India
[16]Department of Geography and Applied Geography, University of North Bengal, Darjeeling, India
[17]School of Medicine, University of Nottingham, Nottingham, UK
[18]Department of Anthropology, Maa Manikeshwari University, Kalahandi, Odisha, India

Acknowledgements We thank the Royal National Lifeboat Institution (RNLI) for funding this scoping review. Thanks are also due to the Institute for Environmental Futures for providing additional funds. We would like to thank the technical experts from the Public Health Foundation of India (Professor Rakhi Dandona and Dr Anil Kumar, INDEPTH Network (Dr Dan Kajungu and Ms. Marylene Wamukoya), and the Centre for Injury Prevention and Research, Bangladesh (Dr Aminur Rahman), for taking the time to speak with us. We would like to thank all the Research Assistants of the Department of Disease Control and Environmental Health and the Makerere University School of Public Health for providing the grey literature from Uganda. Last but not least, we would like to thank all three reviewers for their invaluable comments to improve the quality and content of this article.

Contributors NSR-B and TM: study conceptualisation and funding acquisition. NSR-B, WE, TM, RS, CS and FO developed the scoping review framework. LD, NIC, SC, IB, RMN, BP, ANN, SH, EB and MS conducted title and abstract screening. LD, LM, TM, RS and WE performed the full-text screening. NSR-B and LM carried out the consultations with technical experts. NSR-B and LD wrote the manuscript with inputs from LM, WE, TM, RS, CS, FO and AR. All authors reviewed and approved the final manuscript. NSR-B is the guarantor of the overall study, taking full responsibility for the work and/or the conduct of the study, had full access to the data and controlled the decisions for publication.

Funding The project was funded by the Royal National Lifeboat Institution, UK.

Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request.

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

ORCID iDs
Nibedita S Ray-Bennett http://orcid.org/0000-0001-8448-5567
Lasith Dissanayake http://orcid.org/0000-0002-3609-4358
Thomas Mecrow http://orcid.org/0000-0001-7392-0172
Colleen Saunders http://orcid.org/0000-0001-7956-9619
Rebecca Sindall http://orcid.org/0000-0002-1731-7042
Frederick Oporia http://orcid.org/0000-0001-6280-8919
Aminur Rahman http://orcid.org/0000-0001-8084-9239
Azukaego Nwando Nnaji http://orcid.org/0009-0005-2309-9693
Shahidul Hoque http://orcid.org/0009-0006-3165-6784
Madhulika Sahoo http://orcid.org/0000-0002-2852-8566

REFERENCES

1 WHO. Global status report on drowning prevention - 2024, 2024. Available: https://www.who.int/publications/i/item/9789240103962
2 *Global report on drowning: preventing a leading killer*. World Health Organisation, 2014. Available: https://www.who.int/water_sanitation_health/diseases-risks/risks/global-report-on-drowning/en/%0Ahttp://www.who.int/violence_injury_prevention/global_report_drowning/en/
3 Scarr J, Beerman S, Sharp M, *et al*. *World conference on drowning prevention 2011: impacts and legacies*. Berlin, Heidelberg: Springer, 2014.
4 Dodd M, Zwi A, Rahman A, *et al*. Keeping afloat: a case study tracing the emergence of drowning prevention as a health issue in Bangladesh 1999-2017. *Inj Prev* 2021;27:300–7.
5 Celis A. Home drowning among preschool age Mexican children. *Inj Prev* 1997;3:252–6.
6 Solomon R, Giganti MJ, Weiner A, *et al*. Water safety education among primary school children in Grenada. *Int J Inj Contr Saf Promot* 2013;20:266–70.
7 Scarr JP, Jagnoor J. Identifying opportunities for multisectoral action for drowning prevention: a scoping review. *Inj Prev* 2022;28:585–94.
8 UNGA. Global drowning prevention - resolution adopted by the general assembly on 28 april 2021. 2021 Available: https://digitallibrary.un.org/record/3925005
9 WHO. 76th World Health Assembly adopts first ever resolution on drowning, 2023. Available: https://www.who.int/news/item/29-05-2023-76th-world-health-assembly-adopts-first-ever-resolution-on-drowning-prevention
10 Scarr JP, Jagnoor J. Identifying strategic priorities for advancing global drowning prevention: a Delphi method. *BMJ Glob Health* 2023;8:e013303.
11 WHO. Verbal autopsy standards: the 2016 who verbal autopsy instrument. 2016. Available: https://www.who.int/publications/m/item/verbal-autopsy-standards-the-2016-who-verbal-autopsy-instrument
12 WHO. Verbal autopsy standards. 2023. Available: https://www.who.int/standards/classifications/other-classifications/verbal-autopsy-standards-ascertaining-and-attributing-causes-of-death-tool
13 WHO. Civil registration: why counting births and deaths is important. Media Centre; 2024. Available: https://www.who.int/news-room/fact-sheets/detail/civil-registration-why-counting-births-and-deaths-is-important
14 Weldearegawi B, Ashebir Y, Gebeye E, *et al*. Emerging chronic non-communicable diseases in rural communities of Northern Ethiopia: evidence using population-based verbal autopsy method in Kilite Awlaelo surveillance site. *Health Policy Plan* 2013;28:891–8.
15 Gelaye KA, Tessema F, Tariku B, *et al*. Injury-related gaining momentum as external causes of deaths in Ethiopian health and demographic surveillance sites: evidence from verbal autopsy study. *Glob Health Action* 2018;11:1430669.
16 WHO. Drowning deaths decline globally but the most vulnerable remain at risk. 2024. Available: https://www.who.int/news/item/13-12-2024-drowning-deaths-decline-globally-but-the-most-vulnerable-remain-at-risk
17 Dandona R, Kumar GA, George S, *et al*. Risk profile for drowning deaths in children in the Indian state of Bihar: results from a population-based study. *Inj Prev* 2019;25:364–71.
18 Hsiao M, Morris SK, Bassani DG, *et al*. Factors associated with physician agreement on verbal autopsy of over 11,500 injury deaths in India. *PLoS One* 2012;7:e30336.
19 Hsiao M, Malhotra A, Thakur JS, *et al*. Road traffic injury mortality and its mechanisms in India: nationally representative mortality survey of 1.1 million homes. *BMJ Open* 2013;3:e002621.
20 Byass P. Applying verbal autopsy to determine cause of death in rural Vietnam. *Scand J Public Health* 2003;31:19–25.
21 Sauvaget C, Ramadas K, Fayette JM, *et al*. Completed suicide in adults of rural Kerala: rates and determinants. *Natl Med J India* 2009;22:228–33.
22 Baqui A, Sabir A, Begum N, *et al*. Causes of childhood deaths in Bangladesh: an update. *Acta Paediatr* 2001;90:682–90.
23 Chowdhury SM, Rahman A, Mashreky SR, *et al*. The horizon of unintentional injuries among children in low-income setting: an overview from Bangladesh Health and Injury Survey. *J Environ Public Health* 2009;2009:435403.
24 Borse NN, Hyder AA, Streatfield PK, *et al*. Childhood drowning and traditional rescue measures: case study from Matlab, Bangladesh. *Arch Dis Child* 2011;96:675–80.
25 França E, Campos D, Guimarães MDC, *et al*. Use of verbal autopsy in a national health information system: Effects of the investigation of ill-defined causes of death on proportional mortality due to injury in small municipalities in Brazil. *Popul Health Metr* 2011;9:1–9.
26 Scarr JP, Buse K, Norton R, *et al*. Tracing the emergence of drowning prevention on the global health and development agenda: a policy analysis. *Lancet Glob Health* 2022;10:e1058–66.
27 WHO. WHO verbal autopsy standards v 1.0. 2022. Available: https://cdn.who.int/media/docs/default-source/classification/other-classifications/autopsy/2022-va-instrument/verbal-autopsy-standards_2022-who-verbal-autopsy-instrument_v1_final.pdf?sfvrsn=c8cf2dda_8
28 Loh P, Fottrell E, Beard J, *et al*. Added value of an open narrative in verbal autopsies: a mixed-methods evaluation from Malawi. *BMJ Paediatr Open* 2021;5:e000961.
29 Peden AE, Franklin RC, Clemens T. Exploring the burden of fatal drowning and data characteristics in three high income countries: Australia, Canada and New Zealand. *BMC Public Health* 2019;19:794.
30 Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol* 2005;8:19–32.
31 Aromataris E, *et al*. *JBI manual for evidence synthesis*. JBI, 2024.
32 Pollock D, Peters MDJ, Khalil H, *et al*. Recommendations for the extraction, analysis, and presentation of results in scoping reviews. *JBI Evid Synth* 2023;21:520–32.
33 Tricco AC, Lillie E, Zarin W, *et al*. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med* 2018;169:467–73.
34 WB. New world bank country classifications by income level: 2022-2023. new world bank country classifications by income level: 2021-2022 2021–2022. 2021. Available: https://blogs.worldbank.org/opendata/new-world-bank-country-classifications-income-level-2022-2023
35 Dopfer K, Foster J, Potts JM. Micro-meso-macro. *J Evol Econ* 2004;14:263–79.
36 PHFI. Public health foundation of india (phfi). 2024. Available: https://phfi.org/
37 INDEPTH Network. INDEPTH network | better health information for better health policy. 2024. Available: https://www.indepth-network.org/
38 CIPRB - Home, 2024. Available: https://www.ciprb.org/
39 Creswell WJ. *Research design: qualitative, quantitative, and mixed methods approaches*. 6th edn. SAGE Publications vol.SAGE Publications Inc, 2022.
40 Razzak JA, Khan UR, Zia N, *et al*. A child an hour: burden of injury deaths among children under 5 in Pakistan. *Arch Dis Child* 2013;98:867–71.
41 Ding D, Wang W, Wu J, *et al*. Premature mortality risk in people with convulsive epilepsy: long follow-up of a cohort in rural China. *Epilepsia* 2013;54:512–7.
42 Alonge O, Agrawal P, Talab A, *et al*. Fatal and non-fatal injury outcomes: results from a purposively sampled census of seven rural subdistricts in Bangladesh. *Lancet Glob Health* 2017;5:e818–27.
43 Jin Y, Liu Y, Xu X, *et al*. Mortality and causes of death among people with convulsive epilepsy in northwestern China. *Epilepsy Behav* 2022;127:108492.
44 Rahman A, *et al*. Bangladesh health and injury survey 2016 (bhis 2016): summary report. 2016. Available: https://research.bond.edu.au/en/publications/bangladesh-health-and-injury-survey-2016-bhis-2016-summary-report

45 SAMRC. South african national cause-of-death validation - 2020. 2020. Available: https://www.samrc.ac.za/research-reports/south-african-national-cause-death-validation
46 WHO. 2016. International statistical classification of diseases and related health problems, 10th revision (icd-10). World Health Organization vol. 1 (World Health Organization, 2016.
47 Bailo P, Gibelli F, Ricci G, *et al*. Verbal Autopsy as a Tool for Defining Causes of Death in Specific Healthcare Contexts: Study of Applicability through a Traditional Literature Review. *Int J Environ Res Public Health* 2022;19:11749.
48 Serina P, Riley I, Stewart A, *et al*. A shortened verbal autopsy instrument for use in routine mortality surveillance systems. *BMC Med* 2015;13:302.
49 Mateen FJ, Shinohara RT, Alam N, *et al*. Injury deaths among people with epilepsy in rural Bangladesh: a retrospective population-based study. *Epilepsy Behav* 2012;23:291–3.
50 Chasimpha S, McLean E, Chihana M, *et al*. Patterns and risk factors for deaths from external causes in rural Malawi over 10 years: a prospective population-based study. *BMC Public Health* 2015;15:1036.
51 Scarr JP, Jagnoor J. Mapping Trends in Drowning Research: A Bibliometric Analysis 1995-2020. *Int J Environ Res Public Health* 2021;18:4234.
52 IPCC. IPCC — intergovernmental panel on climate change. 2025. Available: https://www.ipcc.ch/
53 UNDRR. Sendai framework for disaster risk reduction 2015-2030. 2019. Available: https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030
54 Waiswa P, Kalter HD, Jakob R, *et al*. Increased use of social autopsy is needed to improve maternal, neonatal and child health programmes in low-income countries. *Bull World Health Organ* 2012;90:403–403A.
55 Mahato PK, Waithaka E, van Teijlingen E, *et al*. Social autopsy: a potential health-promotion tool for preventing maternal mortality in low-income countries. *WHO South East Asia J Public Health* 2018;7:24–8.
56 Koffi AK, Mleme T, Nsona H, *et al*. Social autopsy of neonatal mortality suggests needed improvements in maternal and neonatal interventions in Balaka and Salima districts of Malawi. *J Glob Health* 2015;5:010416.
57 Johns Hopkins University. Verbal autopsy and social autopsy studies (vasa) - institute for international programs - centers and institutes - research - johns hopkins bloomberg school of public health. 2024. Available: https://publichealth.jhu.edu/institute-for-international-programs/our-work/verbal-autopsy-and-social-autopsy-studies-vasa
58 Kushitor MK, Bour H, Nyame P, *et al*. Context of boat drowning in Ghana: a mixed qualitative research study. *Inj Prev* 2023;29:8–15.
59 Guevarra JP, Franklin RC, Basilio JA, *et al*. Child drowning prevention in the Philippines: the beginning of a conversation. *Int J Inj Contr Saf Promot* 2015;22:243–53.
60 Al-Mamun Md, Alam M, Hossain MdJ, *et al*. Child drowning and associated risk factors: Findings from a qualitative study in Bangladesh. *Health Science Reports* 2023;6:e1380.
61 Hammersley M, Gomm R. Bias in Social Research. *Sociol Res Online* 1997;2:7–19.
62 Marino M, Lucas J, Latour E, *et al*. Missing data in primary care research: importance, implications and approaches. *Fam Pract* 2021;38:200–3.
63 Silverio S, Hall J, Sandall J. Time and Qualitative Research: Principles, Pitfalls, and Perils. 2020.
64 Ray-Bennett NS, Masys A, Shiroshita H, *et al*. Reactive to proactive to reflective disaster responses: introducing critical reflective practices in disaster risk reduction. In: *Hazards, risks and, disasters in society*. Academic Press, 2015.
65 WHO. Review of the who verbal autopsy (va) instruments. 2011. Available: https://www.who.int/publications/m/item/review-of-the-who-verbal-autopsy-(va)-instruments