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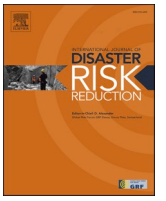

WASH recommendations for improving disaster preparedness and recovery in schools in Indonesia

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ABSTRACT

Access to functional and clean toilets which maintain privacy and dignity and support girls' Menstrual hygiene management (MHM) plays a crucial role to getting girls back to school post-disaster. This could also help in managing feelings of shame and disgust experienced when using toilets in schools in post disaster settings. In this paper, we report on our assessment of water, sanitation and hygiene (WASH) facilities in schools three-years post the 2018 multi-hazard event in Indonesia. We used a mixed-methods approach using visual observations, interviews with school principals, surveys with schoolgirls and focus group discussions with schoolgirls and teachers to understand the lived experiences of students using toilets at school. Our results highlight that across schools descriptive and injunctive social norms were supportive of littering, inadequate toilet facilities for girls to manage their menstruation and bullying and antisocial behaviour by opening toilet doors while the facilities were occupied. Based on these results, we developed two types of interventions, physical and behavioural, piloted in three schools to increase WASH and MHM awareness and the safety of sanitation facilities. Our interventions showed that approaches for WASH interventions in schools can only be designed if we understand the local barriers to carrying out interventions that integrate maintenance plans. We provide recommendations to support practitioners in mitigating risk and improving circumstances for girls in schools in Indonesia, which have the potential to address SDG 4 on inclusive and equitable education and SDG 5 on gender equality and girls' empowerment.

1. Background

On 28 September 2018, a 7.4 Richter scale earthquake in the north-western part of Central Sulawesi in Indonesia triggered a multi-hazard event including a tsunami, liquefaction and landslides which killed over 2100 people and affected 1.9 million people (UNICEF, 2018a, 2018b). The multi-disaster caused devastating physical damage to school buildings, with 1299 schools affected as of December 2018 in Central Sulawesi and 53 % of schools in the area assessed as heavily damaged [1,2]. During the early post-disaster phase, 152,

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000 people were identified in need of water, sanitation and hygiene (WASH) support, with access to clean water and toilets reported as the main priority and many females avoiding using toilet facilities at night due to lack of lighting [3]. In response to the damage caused to schools and WASH facilities by the multi-hazard event, the federal and provincial governments in coordination with non-governmental organisations began humanitarian assistance and rehabilitation efforts, and by the end of 2019, UNICEF assessed that access to education had mostly returned to pre-earthquake levels [4]. It was found, nonetheless, that many children had not attended school even before the disaster, which may be attributed to 'underlying issues beyond school repair' [4]. The pervasive poor condition of WASH and menstrual hygiene management (MHM) in schools was illustrated by the 2016 and 2017 Government Basic Education Data (*dapodik*) which showed that 2 out of 3 schools in Indonesia had inadequate toilets [5].

Inadequate WASH facilities may exacerbate young people's experiences of psychological distress after a disaster [6], with girls likely to experience additional emotional barriers to returning to school due to WASH-related obstacles [7]. Lack of water availability, non-working or dirty sanitation facilities and no provision of menstrual hygiene products can negatively impact schoolgirls as a result of societal and biological factors [7,8]. Responding to MHM, especially in emergencies, requires consideration of the needs of girls [9]. These include the need for basic materials and supplies to safely and adequately manage WASH needs, practical information on basic hygiene and menstrual hygiene practices, safe facilities in good condition, addressing harmful cultural norms, disrupt taboos and encourage a supportive environment.

The Resilient School Hubs project, funded by the UKRI-ESRC, sought to develop resilient recovery to disasters, particularly in displaced communities, and enhance natural hazard preparedness. The project was carried out in collaboration between UCL EPI-Centre, UCL Engineering for International Development (EFID) Centre, University of Syiah Kuala's Tsunami and Disaster Mitigation Research Centre (TDMRC) and Tadulako University located in Central Sulawesi. The project aimed to develop interventions that targeted psycho-social disaster support, WASH and the safety of the physical environment that centres on schools as hubs for fostering community empowerment. This paper focuses on the WASH component of the project, which used mixed-methods to understand the lived experiences of female students using toilets at school, assessing the WASH facilities at schools and how adequate recovery interventions had been, and eliciting suggestions for how to improve upon what had or had not been done. This paper reports on the recommendations that arose from the mixed-methods exploration and pilot interventions carried out for the resilient recovery around water, sanitation and hygiene of schools three years post-disaster.

2. Methods

We used mixed-methods to assess the condition and perceptions of water, sanitation and hygiene (WASH) facilities in schools three years post disaster. Primary data was collected through structured observations in 18 schools (14 state schools and 4 private schools) to assess the built environment for hygiene and safety, semi-structured interviews with 26 school Principals (in 22 state schools and 4 private schools), surveys with 49 female students (in 3 schools) and 14 focus group discussions (FGDs) in 7 schools with a total of 27 female students and 26 teachers. The methods were applied sequentially, with two sets of methods applied simultaneously, as shown in Fig. 1 below. Data collection was managed and conducted by the Indonesian research partners at the University of Syiah Kuala's Tsunami and Disaster Mitigation Research Centre (TDMRC) and at Tadulako University located in Central Sulawesi. Following the collection of data and suggestions by respondents on how to develop a resilient recovery around WASH, we implemented interventions that were responsive to their needs and conducted a small follow-up survey of the interventions' efficacy. The study was approved by UCL Research Ethics Committee in the UK (0525/001) and also in Indonesia (111/EA/FK-RSUDZA/2021). Study details were explained to participants in the local language Bahasa. Written consent was provided in the official letter from the Education Department to the school principals and further oral consent was obtained from all participants in Bahasa.

The methods aimed to.

(i) Understand the lived experiences of students using toilets at school (FGDs and surveys).
(ii) Objectively assess the WASH facilities at schools (structured observations).
(iii) Understand how schools were managing WASH, how they had managed WASH after the tsunami and amidst COVID19, how they had been assisted by government and NGOs and where there were gaps (structured Principal interviews).
(iv) Understand how adequate the recovery interventions had been and elicit suggestions for how to improve upon what had or had not been done.

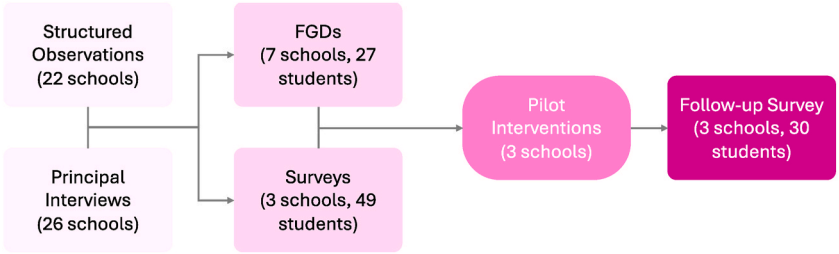

Fig. 1. Flowchart of methods (Figure by the main author).

2.1. School selection

The schools for data collection were selected through a mix of purposive and convenience sampling as data collection took place at the time where official COVID-19 protocols posed restrictions on data collection and data collectors' movements from visiting our first choice of schools.

Schools were selected from three regions: Palu, the capital of Central Sulawesi, and the regencies of Sigi and Donggala (see Fig. 2), due to their differing geographies and experiences of the tsunami, with Palu experiencing the earthquake, Sigi experiencing liquefaction and Donggala facing extreme tidal events as well as the earthquake. We were interested in junior high schools (SMPs) in order to both assess the suitability of facilities for post-menarche girls. For the surveys, three schools were purposely selected due to the variation of their toilet conditions: one school with toilets in good condition, one school with toilets with minor damage and one school with toilets with major damage. The interventions were carried out in the same three schools where the surveys took place. We used a small non-representative sample of 30 girls in 3 schools (10 girls per school) to evaluate whether our interventions were effective. For the FGDs, in addition to those three schools, one school each in Palu and Sigi were also selected because of known UNDP and Save the Children interventions at those schools and an additional two schools that aligned with the methods carried out by another work package of the project looking at structural damage of schools. Fig. 1 above shows the narrowing sampling stages per method until the selection of three schools for interventions.

2.2. Methods description

Structured observations: The structured observations captured visual data on the WASH conditions of schools (see [10]). Pictures and field notes were systematically taken on the availability and condition of drinking water stations, handwashing stations (including soap and source of water), toilet locations and conditions and presence of litter and solid waste disposal provision. Data was collected between July and August 2021 by a team of in-country researchers.

Semi-structured interviews with Principals: The observations were complemented with semi-structured Principal interviews to better understand the management of facilities, access resources, any external interventions and elicit memories of how the 2018 earthquake affected the school and the adequacy of the response (see [10]). The interviews took place on the same day that observations were captured.

Focus group discussions (FGDs): The FGDs had an average of 4 participants per FGD and convenience sampling was used to recruit participants. Teachers that were present at school at the time of visit were asked to participate and were also asked to select students between 13 and 15 years of age that had had their period. These students were then asked if they wished to participate, with teachers acting as guardians for consent. The discussions were held on classrooms selected by school staff within the school premises

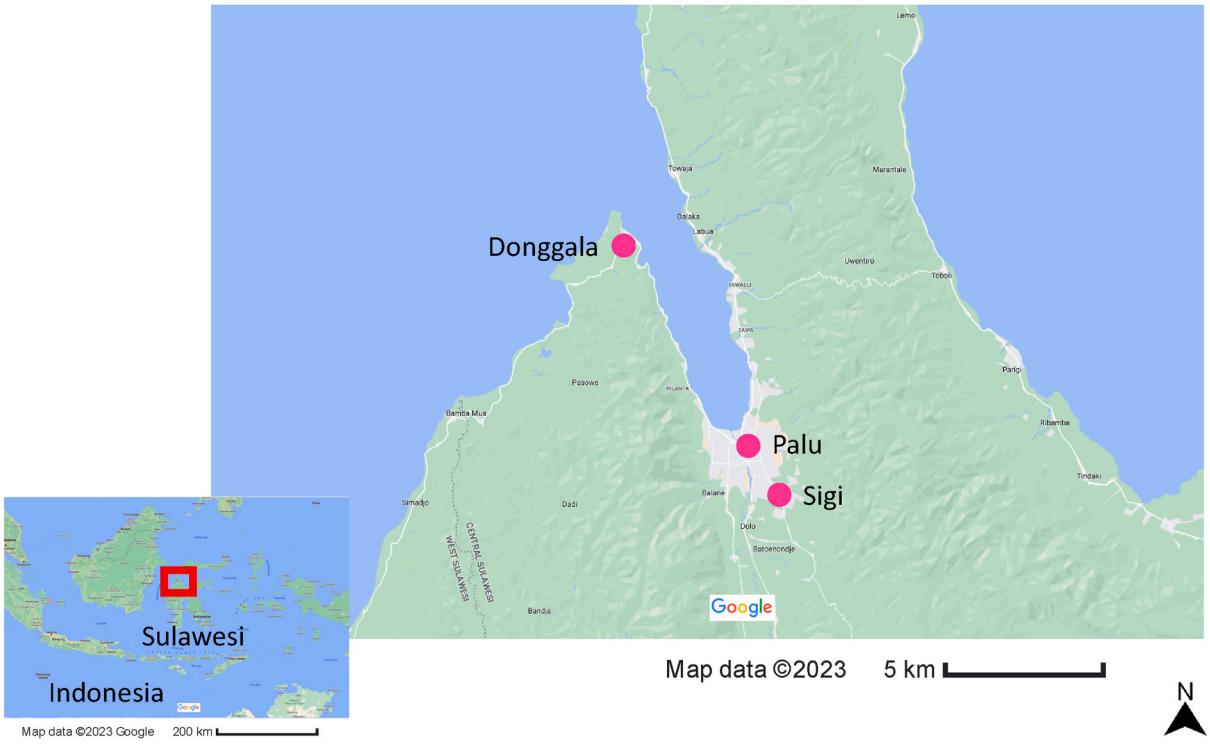

Fig. 2. Areas of school selection (Figure by the main author with Google Maps images of the area).

and took an average of 30 min. Teachers and students participated in separate discussions, and teachers were not allowed in the room while the discussion took place with students [11,12]. The discussions were conducted in July and August 2021, almost 3 years after the earthquake. Only first names (or nicknames) were recorded and in the case of students their age was also recorded. Data collection was managed and carried out by the in-country research partners. Recordings and notes were taken by the research team conducting the discussions. The notes were checked against the recordings and were transcribed and translated from Indonesian to English by the in-country research team. The notes were then analysed thematically through a mix of selective and open coding [13] by the main author. Themes were identified through an iterative process of inductive-deductive coding, where the themes explored in the FGD were listed as coding categories and were modified iteratively as the coding took place. The coding categories and content were presented to the Indonesian team to review for accuracy.

Student surveys: The surveys were applied to students over 15 years of age and were designed to supplement the qualitative understanding derived from FGDs, providing quantitative data to some of the themes, as well as comparing the WASH experiences of students at home with those at school. A total of 48 surveys in 3 schools were conducted by the in-country research team. The survey instrument was managed by another work package of the overarching project, which looked into the psychosocial resilience in schools. The survey integrated questions of post-menarche girls' menstrual hygiene management practices, impressions of pre- and post-earthquake school WASH facilities and comparisons with their home facilities. Univariate descriptive analysis was used to analyse the survey to understand frequency and percentage of response distributions.

Follow-up survey: We designed a short intervention follow-up survey aimed at understanding whether and if the interventions had had any impact on schoolgirls in particular. Our evaluation results gave us an idea of whether girls noticed the interventions occurred, whether the schools announced the interventions took place or whether the schools implemented or maintained the interventions.

3. Findings

We combined the findings from all the methods to understand the overall picture of water, sanitation and hygiene of the schools and use the insights to develop interventions. The findings are presented accordingly, to set the backdrop of the designed interventions.

Table 1 shows the number of participants and median age of the FGD and the survey. All participants identified as female. As for other sociodemographic information, this was not asked in the FGDs, and 92 % of the survey participants were Muslim and the remaining 8 % were Christian. For details of the results of the structured observations and Principal interviews, please see Ahmed et al. [10].

3.1. Menstrual hygiene management (MHM) and sanitation

During the observations, it was found that bins were missing in most schools' toilets (2/17 schools), with no bins with lids observed, and more than half of the toilets (8/18 schools) lacked sufficient lighting. Four of 14 state schools' toilets doors did not lock, 3 of 17 schools' paths were muddy or broken and mosquitoes were noted in more than half of schools' toilets (11/17 schools). This was corroborated by FGD participants, who reported issues with the toilet doors and locks (3/7 schools), paths (1/7 schools), flushing (1/7 schools), lighting (3/7 schools), the number of working toilets (2/7 schools) and type of toilets. Some of these issues included insufficient lighting inside toilet stalls if doors were closed (1/7 schools), doors that could not be closed properly (2/7 schools), flushing issues such as high tide or water availability (4/7 schools), muddy paths where puddles collect after rain (3/7 schools) or the number of working toilets (3/7 schools).

Toilet paper is not a common cleaning practice in Indonesia, instead ablution is practiced, which can be challenging if there is no water availability (4/7 schools). In the absence of toilet paper and levered flushes, jugs for water were available for students to wash themselves and to manually flush, but water was observed to be lacking at 3 schools.

With regards to menstruation, girls in most FGDs stated learning about the topic through their siblings, mothers or parents and friends (5/7 schools). Some mentioned that they are taught in school (4/7 schools), but they had conflicting views on whether boys were aware of the topic (1/7 schools). Some thought boys had an understanding about menstruation (2/7 schools) but others did not think boys were aware of it (1/7 schools).

During the FGDs, it was disclosed that girls are allowed to go home if they have a menstrual accident while in school, making many girls miss school days, as they do not return to school afterwards, especially if their home is far away (5/7 schools). The majority of surveyed girls stated that the products they use to manage their menstruation are menstrual pads (90 %, 44/49) and a minority use cloths (14 %, 7/49). 41 % of survey participants stated that they feel slight or some shame and 21 % felt considerable or extreme shame towards their menstruation. Additionally, a third of participants feel some or considerable fear and some or considerable disgust towards their menstruation.

FGD participants stated that they are targets of "playful silly jokes" (2/7 schools), such as pointing and teasing when they get menstruation stains (P3, S4), male students turning off the toilet lights (1/7 schools), locking doors from outside (1/7 schools), knocking on doors and peeking (1/7 schools) while they are using the toilet.

3.2. Water

Fifteen of 22 state schools reported unreliable drinking water supply. The observations showed that the most common sources of drinking water were bottles, gallons of water or boreholes. This was corroborated by students in the FGDs, where all students

Table 1
Number of participants and median age.

		Palu			Sigi			
		School 1	School 2	School 3	School 4	School 5	School 6	School 7
FGDs	No. Participants	4	4	3	4	4	4	4
	Median age	14	14	15	14	14	14	14
Surveys	No. Participants	15	17	–	17	–	–	–
	Median age	14	15	–	14	–	–	–

mentioned they need to plan their access to potable water during school time. Their solutions ranged from tumblers they bring from home, bottled water or cups of water they purchase at the school shop or a shop outside school, to organising with their classroom to purchase gallons of water. Additionally, FGD participants mentioned that water sources for other uses included groundwater wells (5/7 schools), boreholes (an electric pump connected to a deep borehole well; 1/7 schools), either pumped from a deep well (1/7 schools) or by an electric pump connected to an injected or drilled well (3/7 schools).

Two state school principals perceived drinking water to be unsafe due to its colour, smell or was overall perceived to be contaminated. FGDs participants in 2 of 7 schools corroborated this information reporting bad quality of water after the earthquake, stating that "the water source at school is a bit muddy, yellowish in colour, but tasteless" and "not safe for drinking because the water gets mossy easily". However, only 2 state schools and 1 private school tested water from the water authority pipeline. Half of survey participants stated that they felt that the quality of water during a natural disaster was the same as in their home, but alarmingly, another 40 % felt that water quality was less reliable at school during a natural disaster. Key issues identified related to the tsunami and earthquake included difficulties getting water (1/7 schools); broken pipelines and clogging that causes water to be less accessible (1/7 schools); a completely damaged pipeline that created a "worse condition for washing hands because water is often not running" (1/7 schools); and the water in one of the wells becoming murky due to the earthquake (1/7 schools).

Seven of 12 state principals and two of 4 private principals said their schools experienced water outages to hand wash stations. To cope with mains water outages, principals of 10 schools reported using water supplied by trucks, gallon water, well water and one school used river water. Nine of 15 schools were observed to use water containers, either in addition to (6/15) or instead of piped water (3/15). This information was corroborated with FGD participants, where participants in all schools stated that handwashing stations were available in the toilets. Surveyed girls stated that they wash their hands after urinating (67 %, 33/49), defecating (71 %, 35/49), playing outside (59 %, 29/49), while performing wudu[1] (49 %, 24/49), after disposing menstrual products (73 %, 36/49) and before eating (94 %, 46/49) and the most common hand washing methods are with water (84 %, 41/49) and soap (90 %, 44/49) with some girls also using hand sanitiser (45 %, 22/49).

3.3. Rubbish and rubbish collection

Fourteen of 18 schools were observed to have issues with littering, in spite of a number of bins available to students throughout the school, suggesting descriptive and injunctive social norms related to littering in school [14]. This information was corroborated by the FGDs, where 6/7 schools, students mentioned a culture of littering.

4. Identified challenges: designing interventions

The results of our visual observations, interviews with school principals, surveys with schoolgirls and FGDs with schoolgirls and teachers showed that across schools descriptive and injunctive social norms were supportive of littering [14], toilets that were inadequate to support schoolgirls' menstrual needs, antisocial behaviour and bullying by opening toilet doors while the facilities were occupied. A need to increase awareness on the importance of toilet cleanliness and MHM was also identified. Tackling these issues would go some way to helping teenage girls to manage their feelings of shame and disgust experienced while using toilets at school during the period of menstruation.

To address the identified WASH-related challenges, we designed 2 types of interventions to be tested in 3 schools: physical and behavioural interventions. The first school was located in an earthquake-prone and densely populated urban area of Central Palu City, the second school was located in an earthquake- and liquefaction-prone area in the rural district of Sigi and the third school was located in an earthquake- and tsunami-prone coastal area of rural Palu City.

The aim of our WASH interventions was to foster a supportive and private environment where schoolgirls feel safe to use the toilets and to change menstrual products at school, stopping antisocial behaviour such as opening doors while people are inside as well as discouraging littering around school. These measures are a part of resilient recovery from the disruption of disasters as well as being needed in an ongoing way.

[1] Wudu is a Muslim washing ritual performed in preparation for praying and worship.

4.1. Physical interventions for the schools

We provided the schools with lidded bins and locks to install inside the toilet doors, as this was the most cost-efficient and easy to implement intervention that schools could carry out. The locks were intended to provide additional safety against bullying through physically preventing doors to be opened. Lidded bins were provided to ensure safe disposal of menstrual products and encourage privacy for girls to feel safe to change menstrual products at school. Including lidded bins or similar disposal mechanisms within the cubicles of school toilets could help reduce missed school days [15]. Building on existing work in the field (e.g. [9]), the lidded bins need to be installed inside each cubicle for privacy in disposing of menstrual products' and there should be attention paid to the shame that surrounds menstrual hygiene in all messaging. The bins, however, were provided without an additional waste disposal plan (beyond the existing systems used), due to COVID-19 restrictions and a change in staff of in-country partners and which led to limited availability to conduct visits to the schools.

4.2. Behavioural interventions for schoolgirls

We designed workshops to create posters for awareness on school littering and cleanliness, anti-bullying around toilet use and provide information on menstrual hygiene management. The workshops were held between 31 May and 2 June 2022 with a total of 38 girls and two boys in 7th and 8th grade (14 girls in urban Palu, 14 girls in rural Sigi and 10 girls and 2 boys in rural Palu). The participants were asked to create a poster on each of the topics in groups and to present their poster to the larger group, in the hope of starting conversations and raising awareness among students on these topics (see Fig. 3).

5. Evaluating the physical and behavioural interventions

Our evaluation results gave us an idea of whether girls noticed the interventions occurred, whether the schools announced the interventions took place or whether the schools implemented or maintained the interventions. This is all useful to understand how best to conduct interventions in the future.

From our evaluation, it seems that only in one school the girls noticed that latches were installed and suggested feeling considerably safer because of this. Even though only 20 % of girls noticed the bins, a positive outcome was that most of the girls that noticed stated using the bins after their installation.

The intention of the posters made by students was to display them somewhere in the school, as part of raising awareness of issues of shame and disgust around menstruation, safety in toilets and littering around school. We found, however, that only one school displayed the posters. We are unsure if this is because of the poster images that the girls made were felt to be too shameful to put up or if other school dynamics were at play (for example, the school not being aware that the agreement was for the posters to be displayed).

In the school that displayed the poster (which also installed locks in toilets doors), girls reported higher levels of shame, fear and disgust that those reported in the pre-intervention survey. So, we need further research on whether higher levels of awareness of menstrual hygiene management leads to higher self-reported feelings of shame, fear and disgust, whether there was something else in the school environment that led to girls feeling this way or if this particular cohort had higher levels of shame, fear and disgust despite the interventions.

Fig. 3. Girls in the poster-making sessions.

6. Discussion

Our study results, including those from the post-intervention evaluation, point to further follow up with schools if interventions are to be carried out. Better approaches for WASH interventions in schools can only be designed if we understand the barriers for interventions, including incorporating maintenance plans which are sustainable within existing school practices and capabilities, as well announcing interventions to students. Some examples including having a WASH coordinator teacher or selecting girl role models to communicate with teachers whether the interventions are being maintained or the status of the cleanliness of the toilets. There needs to be a thorough evaluation of WASH intervention processes to understand how girls feel about making the posters, whether they learn the information intended for the session (in this case, awareness of MHM, littering and bullying) and if the poster-making session and subsequent display of the poster has an impact on their feelings of shame and disgust. Given the gaps identified through the results of our methods and the shortcomings we faced when carrying out the interventions, we put together recommendations and learnings from the field which will be presented thematically, to align with the overall results from the study.

6.1. Menstrual hygiene management and sanitation

The removal of the taboo surrounding menstruation in schools requires a multi-faceted approach, combining policy reform, physical improvements to school infrastructure and behavioural changes in the way menstruation is discussed and understood within the school community [7]. In order to effectively support women and girls regarding their WASH needs, researchers and practitioners must consider the potentialities and challenges presented by the physical environments of the community members with whom they work. Research has shown that the three key components for an effective humanitarian WASH and MHM response that is inclusive of girls' needs include [9].

- supportive facilities,
- materials and supplies, and
- information.

Supportive facilities include safe and private toilets with water and waste management systems which provide convenient and safe disposal methods [16]. It is critical that toilets are designed to be segregated, have locks inside the doors, functioning lighting, doors that discourage peeking and are appropriately maintained to ensure there are no cracks on gaps in the walls [8]. Pathways must be kept clean, without obstacles and are maintained to avoid areas that collect water. School staff and, ultimately, principals must ensure that all toilets are so equipped. Ensuring that schools can meet these infrastructural and educational needs requires strong policy support from the government and local education authorities. Girls are less likely to attend school if the infrastructure does not support their needs during menstruation. Addressing this issue ensures that girls can stay in school for longer periods, thereby reducing absenteeism and early dropout rates [17–19].

Appropriate menstrual materials, supportive supplies for storage, washing and drying, as well as demonstrations on how to use them are also essential. Menstrual hygiene management at school is interlinked to toilet conditions, as girls need running water, clean toilets and a safe place to dispose of menstrual materials. Therefore, water availability is essential in all toilets through either a hand bidet or jug for hygiene management [15,20]. To make hygiene management resilient to piped water outages, schools should offer students buckets of water for storing water when it becomes available, as many of them already do. Adding lids to cover the buckets when not in use can cheaply and easily make the water contained safer, reducing the risk of giving rise to vector-borne diseases. Additional interventions to prevent vector-borne diseases could include maintaining mosquito-repelling indoor plants in toilets and treating toilet walls with larvicide, although the implications for human health would need to also be factored in.

Basic menstrual hygiene and health promotion and education and addressing harmful cultural and social norms are needed in addition to the above [21]. Culturally and age-appropriate teaching material must be designed to teach about toilet hygiene and etiquette, but also aim to destigmatise hygiene around menstruation [22]. Incorporating such content in subjects like biology, citizenship or health and wellbeing modules could provide a formal platform for discussion. Classes can be disaggregated in girls and boys, however, it must be ensured that both cohorts learn about the subject in order to better support and manage, in the case of girls, menstruation.

While good practice toolkits like the one developed by Sommer et al. [9] in 2017 as a response to a global review highlighting issues around organisation responses for MHM in emergency, there is still a lack of translation of these key concepts into organisation and sector-specific guidelines, donor community, operational response plans and production of evidence that could support better WASH and MHM delivery for girls [23,24]. Water scarcity, limited access improved sanitation and lack of personal hygiene are still a concern in schools in several regions in Indonesia, including in the province of Central Sulawesi.

6.2. Water

Water is a critical resource for ensuring that girls can safely manage their menstrual hygiene at school [25,26]. However, the reality of unreliable water supply presents significant challenges for many schools [27,28], making it crucial for both administrators and policymakers to address these issues proactively. One of the most pressing concerns in post-disaster setting is the frequent occurrence of water outages, which directly impacts girls' ability to maintain proper menstrual hygiene. School administrators must explore alternatives to piped water to mitigate these disruptions. Options like installing water storage tanks, securing backup generators for

water pumping during power outages or even ordering water in gallons can provide short-term solutions. By ensuring a steady water supply, schools create a supportive environment for menstrual hygiene management [9].

The responsibility for this issue, however, extends beyond individual schools. Water utilities play a key role in ensuring more reliable delivery of piped water and schools should be encouraged to work closely with these utilities to regularly test the water quality. Regular testing could allow schools to quickly identify and report any deficiencies to the relevant authorities, ensuring that water used for hygiene purposes is safe. In 2019, the Ministry of Education and Culture (MoEC) increased the budget for WASH-related improvements and established a dedicated budget line for WASH infrastructure in schools in Indonesia (the School Operational Grant – BOS, Bantuan Operasional Sekolah), including shifting the responsibility of fixing WASH facilities from schools to local governments [27]. For schools to effectively carry out these duties, some of the funding allocated to WASh repairts could be allocated to cover the costs associated with water testing and reporting.

At the policy level, the government could prioritize funding for adequate water supply in schools, particularly in regions where outages are common. With this additional resourcing, school administrations could focus on competitively tendering for the best value-for-money cost-effective water tanks to store water to manage power outages [27]. They could also acquire back-up generators to enable water pumping during power cuts. Gallons of water could also be ordered to ensure that there are not shortages. Cost-sharing models, where parents contribute to water supply initiatives, could be explored as a potential funding option, although this could be challenging for low-income communities where both water access and affordability are already barriers. Careful consideration would be needed to avoid placing undue financial burden on families, particularly in vulnerable areas.

6.3. Rubbish and rubbish collection

Policy, physical and behavioural changes are required to address the littering issues most schools face, which seems endemic to school culture and which was a recurrent topic throughout the FGDs and the poster making workshops. The issue is not always due to bins availability around the schools, as it is in toilets, but a lack of their use. To address the descriptive and injunctive social norms surrounding littering, schools could run programmes to create a culture of anti-littering, waste separation and anti-burning [14,29], leveraging non-government agency resources if necessary. At the physical level, schools that do not yet offer separated waste should do so in accordance with government guidelines for schools [30].

6.4. Limitations

Data collection took place during the COVID-19 pandemic, which brought changes to the data collection plan, including changing selected schools due to government-enforced travel restrictions. Instead, a site that was not intended for study was chosen by the field team. This change meant that schools with non-functional toilets were not included in selection. To counteract this, a school within Palu with non-functional toilets was selected on the ground.

There were budget limitations for carrying out the interventions. It was therefore only possible to implement interventions that required a small budget. There were also a change in staff of in-country partners which limited their availability as well as time constraints and limited capacity to carry out a more in-depth post-intervention survey, which would have yielded richer feedback.

7. Conclusions

We conducted mixed-methods to understand the lived experiences of students using toilets at school, particularly girls, objectively assess the WASH facilities at schools and how adequate recovery interventions had been three-years post disaster. Our results highlighted that across schools descriptive and injunctive social norms were supportive of littering, antisocial behaviour and bullying by opening toilet doors while the facilities were occupied. Based on these results, we carried out two types of interventions, physical and behavioural interventions, tested in three schools. Our interventions showed that approaches for WASH interventions in schools can only be sustainable if local barriers to carrying out interventions that integrate maintenance plans are understood. We faced several limitations to carry out interventions, including COVID-19 restrictions, a limited budget, change in staff of in-country partners and their limited availability. This posed limitations for the creation of waste disposal plans for the bins distributed to schools. Additionally, school administrations, while initially on board, decided to not display the posters designed created with and by schoolgirls. Nonetheless, there is a need to increase awareness on the importance of toilet cleanliness and MHM, to support teenage girls to manage their feelings of shame and disgust experienced while using toilets at school during the period of menstruation. Based on our results, we put forward suggestions that could support the improvement of WASH conditions as well as physical and behavioural interventions at school level which could help improve water availability, safer hygiene and sanitation, which ultimately impacts how girls manage their menstruation while at school. Improving access to safe water and sanitation for girls in menarche age in school settings has the potential to address several targets of the Sustainable Development Goals at once, particularly SDG 4.1 on ensuring all girls complete their secondary education, SDG 4.5 on gender disparities in education and SDG 4.a on upgrading facilities to provide safe and inclusive learning environments as well as SDG 5.1 on ending all forms of discrimination against girls, 5.6 on ensuring universal access to sexual and reproductive health and 5.c on adopting policies for the promotion of gender equality and empowerment of schoolgirls.

CRediT authorship contribution statement

Margarita Garfias Royo: Writing – original draft, Resources, Project administration, Methodology, Investigation, Formal analysis,

Data curation. **Imaduddin Ahmed:** Writing – original draft, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation. **Ella Meilianda:** Validation, Resources, Investigation, Conceptualization. **Priti Parikh:** Writing – review & editing, Supervision, Project administration, Methodology, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijdrr.2024.104924.

Data availability

Data will be made available on request.

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