

Tsunami preparedness of coastal Sri Lankan schools

Jonas Cels¹, Tiziana Rossetto, Professor¹

EPICentre, Department of Civil, Environmental and Geomatic Engineering, UCL, London, UK

Angela W. Little², Professor Emerita

UCL Institute of Education, London, UK

Priyan Dias³, Professor Emeritus

Department of Civil Engineering, University of Moratuwa, Sri Lanka

ABSTRACT

Over 230,000 people across the Indian Ocean lost their lives on December 26th, 2004, as the Boxing Day tsunami swept away entire coastal communities (Pomonis et al., 2006; Rossetto et al., 2007). The tsunami claimed 35,000 victims in Sri Lanka and inflicted a catastrophic blow to the education system. Overall, the tsunami affected over 200,000 students and 3,000 teachers. It destroyed and damaged 182 schools, and affected a further 287 schools, which served as temporary shelters for the hundreds of thousands made homeless (Bitter & Edirisinghe, 2013; The Education Rehabilitation Monitor, 2009). There remains a risk of another tsunamigenic earthquake either along the Sunda Arc, from Northern Andaman to Southern Sumatra, or along the Arakan and Makran seismic zones propagating a tsunami onto Sri Lankan shores (J. Wijetunge, 2010). The question for the highly exposed schools along the Sri Lankan coast is thus – are they prepared for such an eventuality? This paper uses insights from 25 semi-structured interviews with school principals to evaluate whether Sri Lankan schools are better prepared for a tsunami now than in 2004. The interviews reveal that several key measures have been adopted since 2004 but that fundamental gaps in school tsunami preparedness persist. As expressed by the school principals, an oncoming tsunami is the threat they are least prepared for.

Keywords: Tsunami Preparedness, Tsunami and Sri Lankan Schools, Risk Perception

INTRODUCTION

Many of the empty plots of land that scatter the Eastern coast of Sri Lanka still now bear the footprints of buildings that were swept away by the Boxing Day Tsunami in 2004. The tsunami killed an estimated 230,000 people across the Indian Ocean states. In Sri Lanka, the tsunami claimed 35,000 dead or missing victims, a third of whom were children. The disaster is estimated to have destroyed more than 100,000 homes, initially displacing more than one million people. Some 74 schools were destroyed and a further 108 were damaged, which at the time equated to 5% of the country's school infrastructure. In addition to the unquantifiable trauma the event caused, UNICEF reported that the tsunami orphaned 932 children and led to the loss of one parent for 3,477 children (UNICEF Evaluation Office, 2009).

Despite the acute blow, the education system was, by several measures, remarkably resilient. Most affected schools resumed classes by the third week of January 2005 (three and half weeks after the event). By the end of March 2005, 85% of the impacted students were back in a learning environment of some form. By April 2005, the remaining damaged or destroyed schools functioned either through use of temporary shelters or by transferring students to inland schools. The red circles in **Figure 1** depict the damaged and destroyed schools by student population size, whilst the triangles depict the schools that served as Internal Displaced Person

(IDP) camps. Overall, a network of 650 schools took in transferred students or served as IDP centres (UNICEF Evaluation Office, 2009).

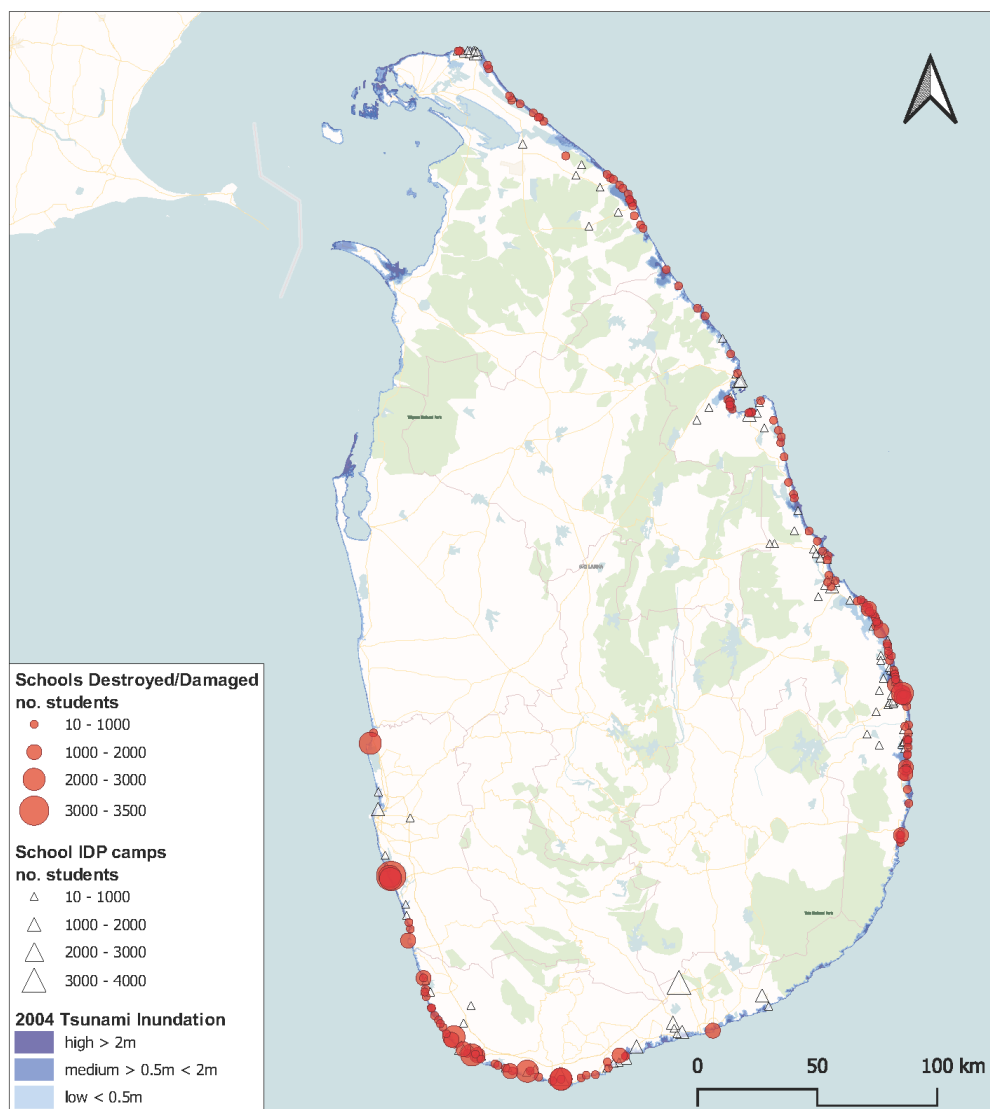


Figure 1. TERM School Database: Destroyed/damaged schools and schools used as IDP camps (Coastal Research and Design et al., 2012; The Education Rehabilitation Monitor, 2009)

The months following the 2004 tsunami saw a concentration of efforts aimed at improving the level of preparedness in Sri Lanka. Notable developments include the Tsunami Sri Lanka Disaster Management Act of 2005, following which the National Council for Disaster Management and the Disaster Management Centre (DMC) were established. The DMC is responsible for operating and coordinating tsunami early warnings and drills. Sri Lanka also joined the Indian Ocean Member States in turning to UNESCO’s Intergovernmental Oceanographic Commission (IOC) to set up a coast-wide tsunami early warning and mitigation system (IOC-UNESCO, 2020). This led to the establishment of an end-to-end tsunami early warning system which became fully operational in 2013 (Haigh et al., 2020).

At school level, the Ministry of Education (MoE) and National Institute of Education (NIE), in partnership with the Sri-Lankan German Agency for Technical Cooperation (GTZ) created the *National Guidelines for School Disaster Safety*. The guidelines outline seven steps in school safety planning, including: establishing the school safety nuclear team; creating awareness among the school community; identifying hazards and resources; establishing and training the school disaster safety team; preparing the school safety plan document; disseminating the plan and conducting mock drills; and evaluating and updating the safety plan (Donga & Bitter, 2008; Ministry of Education and National Institute of Education, 2008).

This paper presents the preliminary results from semi-structured interviews conducted with 25 school principals in the Galle, Ampara and Batticaloa districts of Sri Lanka. The interviews evaluate tsunami risk perceptions and risk awareness. Tsunami preparedness is evaluated by reviewing response protocols, such as early warning procedures and evacuation plans. Since Sri Lanka is far from all potential sources of earthquake-induced tsunamis, it is provided with some time to carry out early warning and evacuation procedures. Tsunami arrival times from seismic events in the Andaman-Myanmar (Arakan), Northern Sumatra-Andaman, Southern Sumatra, and Makran subduction zones are in the range of 130-160, 95, 160-170, and 280 minutes, respectively, following an assessment of potential tsunamigenic seismic hazard to Sri Lanka (J. J. Wijetunge, 2012). The school's capacity to respond to a tsunami is assessed through a) the number of students and school staff with relevant training, and b) the drills and simulations the school conducts. Schools are also asked questions on their post-disaster management plans to assess their ability to continue functional operations and resume classes with minimal disruption.

METHOD

Risk awareness is a necessary first step to engaging with or adopting risk reduction measures (Joffe et al., 2013). Schools are unlikely to engage in efforts to reduce the threat of a tsunami if they do not consider a tsunami a viable or considerable risk. Nevertheless, more is needed to encourage the adoption risk reduction activities than simply being aware of a risk. Limits in capacity, budget, time, agency and other contending demands and risks are all likely to suppress the adoption of risk reduction measures (Becker et al., 2012; Joffe et al., 2013, 2016; Solberg et al., 2010). This is especially so for a hazard such as a tsunami with very long and variable return periods, which in the case of Sri Lanka ranges between hundreds to thousands of years (Jackson et al., 2014).

The tsunami preparedness and disaster management capacity of schools is here gauged through semi-structured interviews with school principals. The semi-structured interview tools are modelled after a UNDP questionnaire directed at school children that assesses student awareness and preparedness to tsunamis and earthquakes (UNDP, 2019).

The interviews are structured around the themes of tsunami risk perception; the ability of the school to manage a tsunami disaster; lessons that can be learned from the school's experience during the 2004 Indian Ocean tsunami; and tsunami preparedness. The interviews gather data on the 2004 tsunami's impact on schools, and how and how long it took them to return to pre-tsunami levels of functionality. To assess whether schools have the necessary awareness, capacity, and practice/experience needed to ensure the safety of students and staff during a tsunami, interviews test schools' ability to receive an early warning and effectively raise the alarm; the number of evacuations and drill simulations; and the identification of safe evacuation routes and refuges. Disaster readiness also requires coordination with the wider community, such as the fire brigade, the police, and parent groups. Schools' organizational and safety capacity are assessed by determining the number of staff and/or students trained in first aid and alarm-raising, as well as the amount of practice drills and evacuations.

The interviews were conducted by a local agency (Vanguard Survey Ltd) using the semi-structured interview tools developed by the research team from July to August 2020. A total of 25 schools were selected for conducting the interviews in the Batticaloa, Ampara and Galle districts as these were some of the most severely hit districts during the 2004 tsunami. Schools were selected based on their proximity to the coast and exposure to tsunami hazard. They were also selected to represent all types of school - Type 1AB – Grade 1-13, offering GCE Advanced Level Science, Arts and Commerce; 1C – Grade 1-13, offering GCE Advanced Level Arts and Commerce; 2 Grade 1-11; 3 – Grades 1-5.

FINDINGS

Overall, the responses of school principals in the 25 schools showed that school tsunami preparedness is low. Principals see tsunami as the hazard they are *least* prepared for, followed by fire and school degradation (several schools have concerning levels of structural roof and column corrosion). The interviews reveal that many of the risk reduction and preparedness responsibilities fall on the shoulders of principals. Principals are responsible for identifying the schools' risk profile and disaster management protocols; raising awareness; and leading the development and execution of tsunami evacuations (drills or otherwise). Less evident is whether

school heads and educators receive the necessary training, support and resources needed to execute these functions. For one, teacher training appears to have progressively slacked after an initial surge in the months and years following the tsunami. Many of the teachers involved in initial training have either left their positions or have simply lost practice. Schools are directed to draw-up their own tsunami evacuation plans yet are not provided with clear guidance nor with tsunami hazard data. As a result, their choice of evacuation refuge might not always be the safest option. It is noted that not all principals provided answers to all questions and are subsequently treated as unknowns.

Tsunami Risk Perception

Figure 2 indicates how many principals considered various hazards as a risk to their school. All 25 principals highlighted tsunami as a potential threat to their school. There appears to be a strong correlation between perceived risks and experience; most school principals that view a hazard as a risk to their school also experienced it at least once in the past ten years (tsunami being an exception as the last tsunami occurred in 2004). Heavy storms featured as the second most frequently perceived threat, with 11 principals considering it so. Fire is considered a risk by only one principal, whose school, the only one surveyed, had experienced fire in the past decade. Similarly, lightning was highlighted by four principals with experience of lightning strikes. Roof and building degradation were hazards raised by seven principals, even though this risk was not featured in the survey. Several principals that highlighted building degradation as a risk also expressed frustration at the lack of resources available to them for remedial repairs. Earthquakes and landslides are not seen to constitute a risk by any of the principals. This is not surprising as Sri Lanka is exposed to low levels of seismicity and none of the schools are in mountainous regions (Rossetto et al., 2019).

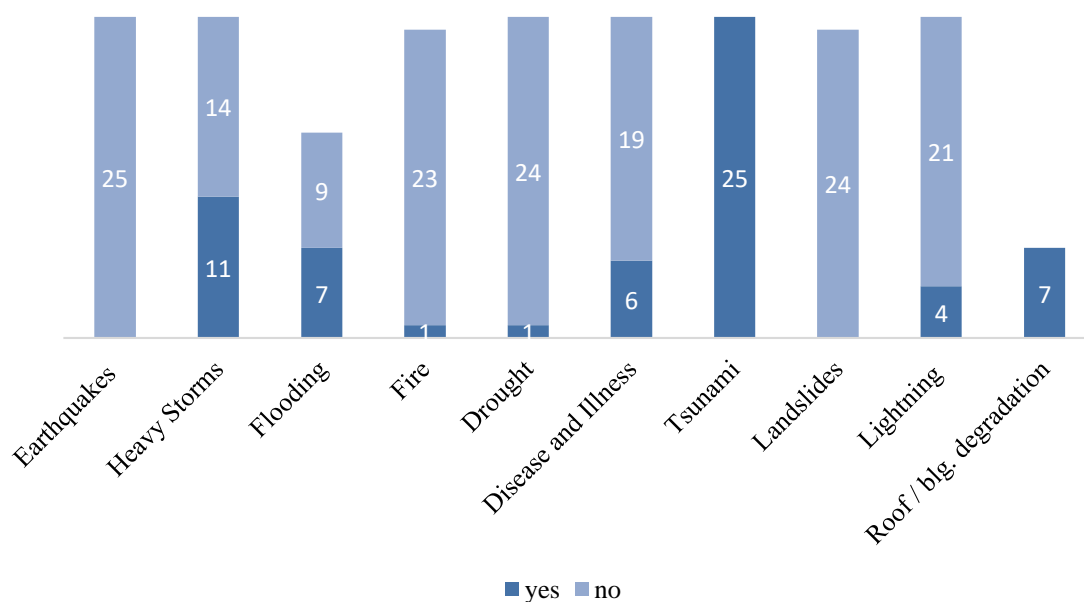


Figure 2. Principal responses on hazards perceived to constitute a risk to their school

Figure 3 depicts the hazards principals consider the most substantial threat to their schools, ranked from one (highest) to three (lower hazard). Overall, tsunami was considered the greatest risk to schools by 20 out of 25 school principals and only one principal did not rate it as one of the top three risks to their school. Tsunami risk is seen through the lens of experience in Sri Lanka. In Ampara and Batticaloa, two heavily hit districts in 2004 (UNHCR, 2004), all but one school selected tsunami as the hazard posing the greatest safety risk. Cyclonic storms, which typically originate from the Bay of Bengal, flooding, and mosquito borne diseases (Dengue & Filaria) are the next three most popular responses. All of these are related to the monsoon seasons in Sri Lanka (Rossetto et al., 2019). These hazards are high frequency cyclical events, a combination of which many principals must contend with on a bi-annual basis, with the southwest monsoon season lasting from May to September and the northeast monsoon from December to February (Rossetto et al., 2019). Nevertheless,

there is a recognition that, because a tsunami can occur at any time and inflict catastrophic losses on a different order of magnitude, they pose the greatest risk.

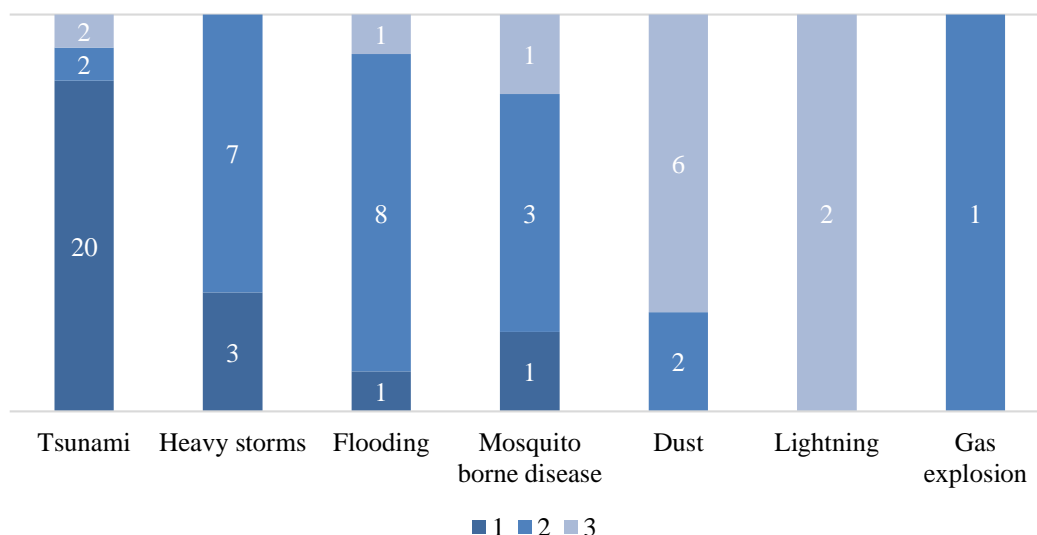


Figure 3. Hazards perceived by principals to present the greatest risk to their schools in ranked order 1-3; 1 – greatest risk

When asked which hazard would cause the greatest *disruption to teaching activities*, however, only two principals selected tsunami. Heavy storms and flooding are considered the hazards most likely to cause class disruption (nine and four principals, respectively). Indicating that high frequency low impact events (relatively), such as storms and floods, are perceived as creating greater overall disruption to teaching activities compared to tsunami, which is a low frequency high impact event. Roof degradation was also highlighted by two principals. Flood-induced access issues are seen as the hazard mostly likely to cause a *drop in student attendance*, as indicated by six school heads. Tsunami followed second, selected by three principals. The remaining principals did not respond about which hazard would result in a drop in attendance.

Impact on the 25 schools from the 2004 Indian Ocean tsunami

The 2004 tsunami claimed the lives of approximately 320 students and six teachers across the 25 schools that were interviewed. Six schools suffered the complete collapse of school buildings and 13 reported damage. Since 2004, only one of the schools was relocated to a new and less exposed location. This highlights some of the difficulties education officials and disaster managers face to “build back better”. The national government initially instated a 100-meter buffer zone around the coast to encourage reconstruction and development further inland. Yet the buffer was soon reduced to the setback distances specified by the Coast Conservation Department based on coastal erosion (Coast Conservation Department, 2021). Communities wanted schools to remain near their homes and livelihoods, so the re-location policy largely failed (De Mel & Sivagnanam, 2021). The procurement and cost of suitable land further inland was also a significant barrier (The Education Rehabilitation Monitor, 2009).

The main objective of the MoE in the immediate aftermath of the tsunami was to return children affected by the tsunami to the classroom as quickly as possible. In a testament to the efforts of the response, classes resumed in January 2005 and by March all the affected schools operated either by transferring students or housing them in temporary facilities. School exams were held as planned that year and school drop-out rates were low (De Mel & Sivagnanam, 2021; UNICEF Evaluation Office, 2009).

School disaster management capacity

Most of the interviewed schools (80%) have safety committees modeled after the *National Guidelines for School Disaster Safety* guidelines. Safety committees are usually made up of the school principal, teachers,

students and in some cases parents. Not all committee members have adequate training, and most principals describe sporadic teacher training with intervals between trainings usually spanning several years. Many of the initial efforts to train teachers in risk reduction and disaster management activities following the 2004 tsunami have slowed down. Several schools report that the teachers that had received training have long since left the school. Of the training that is provided (mostly in Galle) seven out of the 25 schools have reported their teachers participated in disaster response training from the education department and Zonal divisions. Only two schools participate in training on an annual basis, however.

The number of students per staff member responsible for alarm raising varies widely between schools, see Figure 4. Figure 5 depicts the number of students to staff trained in evacuation drills. In the Ampara, Batticaloa and Galle regions the average is 272, 319 and 226 students per member of staff trained in alarm raising, respectively. The duty of alarm raising fell on the principal or a designated teacher in all the surveyed schools, while 70% of the schools also assigned this responsibility to parents and a further three (12%) to school alumni in the community. Despite this, 20 out of 25 schools have not participated in any alarm training drills.

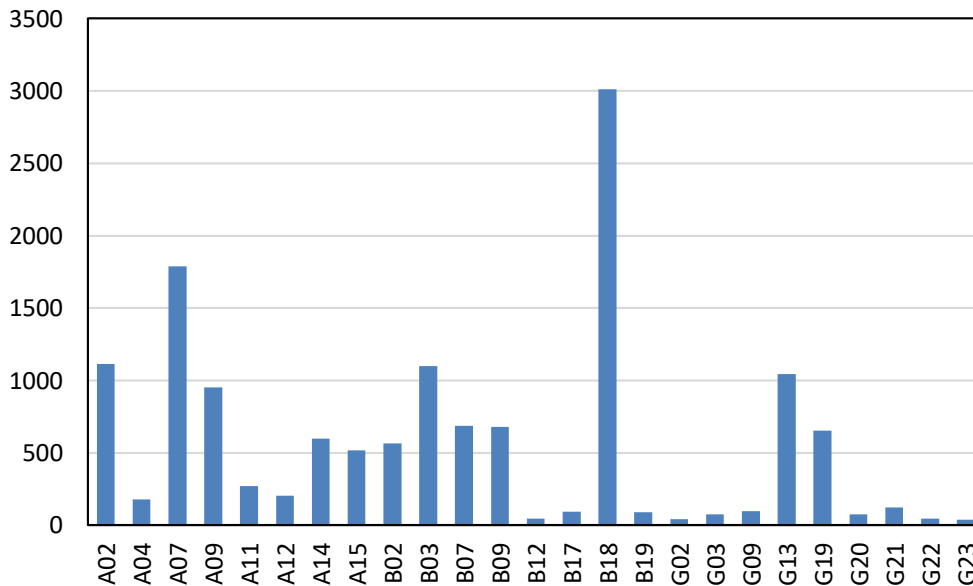


Figure 4. Number of students to staff involved in alarm raising

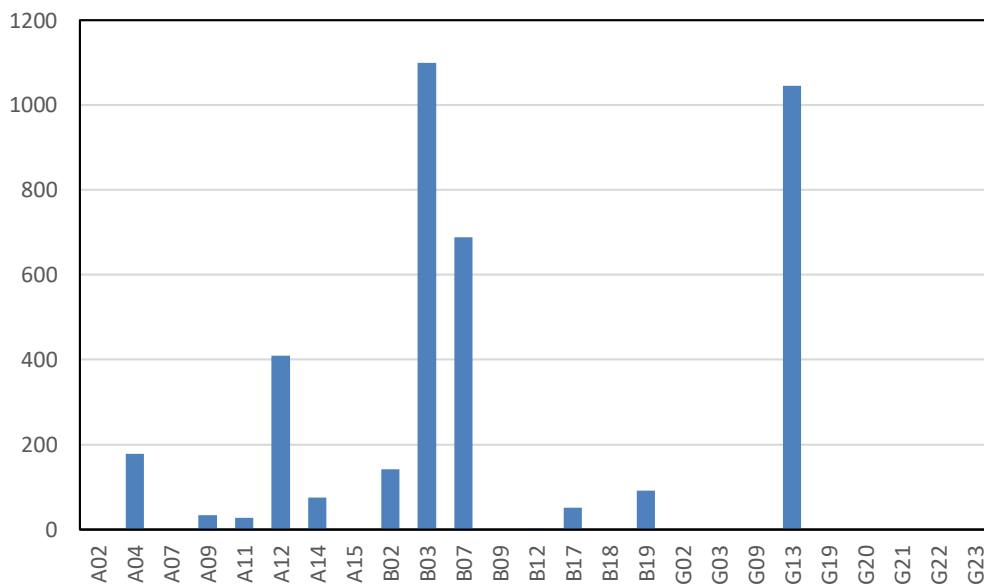


Figure 5. Number of students to staff involved in evacuation drills

All 25 school principals reported tsunami to be the hazard they are least prepared for. Only five of the schools (20% of total) have any form of tsunami response plan, which are usually drawn-up by the school principals with support from parents and/or members of *School Safety Committees* (only two schools indicate involvement from government authorities). Strikingly, only one school has any form of post-disaster management plan. These results highlight the need for the continued support and guidance to formulate school tsunami evacuation protocols and engage them in regular tsunami drill simulations.

When asked how school tsunami preparedness could be improved, the majority expressed the need for evacuation plans. Several highlighted the need to evacuate children to safety zones, including upper storeys of school buildings, but recognized a lack of practice and training. The schools unanimously highlight the underdevelopment of their emergency response protocol, in addition to a lack of established communication channels and support from relevant authorities. Eleven out of 25 schools would improve the preparedness of the school by ensuring plans are in place and ready for implementation. A further seven would make sure to evacuate children to the upper floors of school buildings or other safety zones. The former is worrying given the typically high fragility of Sri Lankan schools to tsunami inundation (Del Zoppo et al., 2021).

CONCLUSIONS

School principals hold much of the responsibility for preparing their schools against tsunami-related threats. These principals are aware of the tsunami hazard facing their schools and acknowledge that tsunami is the hazard their schools are least prepared for. Placing disaster risk reduction responsibilities directly onto schools can lead to greater empowerment and the development of more contextualised solutions. However, the interviews conducted for this research indicate that not all schools are receiving the support and resources required to, for example, draw-up evacuation plans and identify evacuation refuges. Principals are expected to devise the school's evacuation protocol without a clear understanding of the hazard. For example, some principals designate the upper floor of their 2-3 storey school building as the safety refuge, despite the same structure not being structurally designed to resist tsunami loads (Del Zoppo et al., 2021), and being within the 2004 tsunami inundation zone, as defined by the DMC in the only publicly available tsunami inundation map (Coastal Research and Design et al., 2012). Moreover, it is found that few schools participate in regular tsunami drills, that there is a limited awareness of teachers and students and an under-supply of trainings and resources. This suggests there is much scope to improve levels of tsunami preparedness. The presence of safety committees in 80% of schools is positive and can provide a useful conduit through which future risk reduction interventions can be channelled. All schools had at least one member of the safety committee responsible for alarm raising and 12 out of 25 had at least one member responsible for evacuation and drill simulations. Evidently many of the systems at school level needed for preparedness are in place; what is required is more consistent teacher training, making sure they can execute their risk reduction functions, and the targeted, systematic, and regular training of school students and staff in tsunami evacuation drills. Such interventions can potentially save many lives in future tsunami.

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