Preparing schools for future earthquakes in New Zealand: lessons from an evaluation of a Wellington school exercise

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ABSTRACT

The purpose of the present study was to observe and evaluate an earthquake response and evacuation exercise in a Wellington primary school (Years 1-8) comprising 200 pupils and 15 staff. Processes and behaviours were observed by a team of six emergency management personnel who met with teachers at the conclusion of the exercise to discuss the exercise and identify areas requiring modification. Key lessons learnt include the following: frequent, well-learned emergency practices are likely to increase the probability that in a real emergency at school, staff and pupils will respond in an informed and predictable manner, and engage in behaviours that are recognised as best practice, and; schools that have well developed and regularly practised emergency preparedness plans in place send a message to pupils and caregivers alike that in the case of an emergency, the school is prepared to protect the safety of the children. Lessons learnt will inform future hazards preparedness in New Zealand schools, and promote community resilience in the event of a significant earthquake.

Introduction

The city of Wellington is situated at the southern end of the North Island of New Zealand and is the nation's capital city. It is exposed to a wide range of potentially devastating impacts from a range of natural hazards and is situated in one of the most active seismic regions in New Zealand (Cousins et al. 2008, Wallace et al. 2009).

Schools have a responsibility to prepare for emergencies so they can keep children as safe as possible in the event of an earthquake. Educating the children needs to be followed up with regular emergency response practices (safety behaviours and building evacuation) and emergency evacuation exercises (emptying the school by having caregivers collect their children) (Ministry of Civil Defence and Emergency Management, 2009). Preparedness helps reduce fears concerning the possibility of a major earthquake, and can increase the children's ability to respond effectively in a potentially dangerous and stressful situation (Ronan et al., 2008; Ronan and Johnston, 2005).

Schools can provide an important link between children, families and the wider community in preparing for hazardous events. Educating children about hazards is seen as an effective way to encourage their caregivers to improve home-based preparedness (Dufty, 2009; Finnis et al, 2004; Ministry of Civil Defence and Emergency Management, 2009; Ronan, et al., 2008; Ronan and Johnston, 2005), and by involving caregivers in the exercise, families are empowered to prepare.

The Ministry of Education requires every New Zealand school to have documented Health and Safety Policy that complies with relevant legislation such as the Health and Safety in Employment Act 1992, the Fire Service Act 1975 No. 42, and the Building Act 2004 No. 72, and their amendments. Schools are also required to have preparedness plans and evacuation schemes in place for a range of emergencies, including those resulting from natural hazards (Ministry of Education, 2008). Much of the previous research on emergency exercises in schools has focused on the *frequency* of children's participation in drills, rather than on specific content and evaluation (Coomer et al, 2008; Finnis et al, 2004; Ronan and Johnston, 2001). This research sets out to observe school emergency drills and exercises while they are being practised, so the content and processes of the emergency preparation can be evaluated.

Purpose of the study

The purpose of the present study was to observe an earthquake response and evacuation exercise in a Wellington primary school, and to recommend modifications to the exercise for improvement where appropriate. This paper summarizes the key issues presented in the exercise report (Johnston et al. 2010).

Aims

Using the present case as an exemplar, the broad aims of the observation were to:

- Assist schools in their preparedness for an earthquake response and school evacuation;
- Promote community recovery following an earthquake; and
- Inform future hazards preparedness in NZ schools.

Method

The information in this report was gathered through direct observation of one primary school (i.e., Years 1-8) as they conducted their annual emergency response practice and evacuation exercise.

Participants

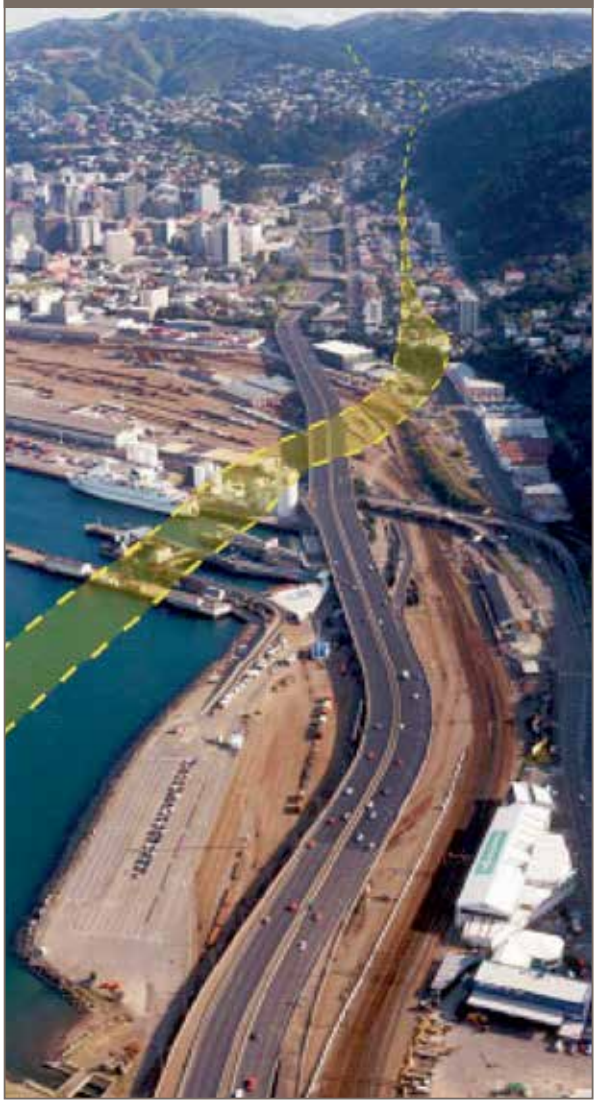
Participants were all 200 children and the 15 teachers and general staff in a decile 9, co-educational, primary school (Years 1-8) in a hill suburb within five kilometres of Wellington City CBD. Children ranged from 5-13 years of age. A caregiver was to collect each child in the evacuation exercise. [A school's decile ranking indicates the extent to which the school draws its students from low socio-economic communities, with decile 1 schools having the highest proportion of students from low socio-economic communities, and decile 10 schools, the lowest (Ministry of Education, 2010)].

The observation team comprised five members: two research staff and a post-graduate student from the Joint Centre for Disaster Research (JCDR) in Wellington, New Zealand; one researcher from GNS Science; and one researcher from a private emergency management consultancy firm. The observers were divided among three classes at the school.

Observation criteria

- Observe the *processes* of the emergency response and evacuation exercise;
- Observe the *behaviours* of staff and children as they undertook the exercise; and
- Observe whether caregivers collected theirchildren from the school in the evacuation phase of the exercise.

FIGURE 1. The Wellington fault running through the centre of the city.



(Photo: GNS Science)

Evaluation criteria

After the conclusion of the evacuation phase of the exercise, the observation team and school staff were to evaluate the exercise. Evaluation criteria were as follows:

- Listen to teachers' perceptions of the exercise and to their suggestions for improvement to procedures;
- Provide feedback to the teachers on observations made during the exercise;
- Clarify with teachers an understanding of what is required of staff, children, and caregivers in an emergency event; and
- Recommend modifications to the exercise that would increase the likelihood of minimising potential impact from a significant earthquake, and help maximise community recovery.

Background

At present, the school undertakes full emergency evacuation exercises once a year (normally in the first term), and fire drills three times a year. The school sends information about their preparedness plans home to caregivers at the start of each school year, and includes reminders about specific exercises in the school newsletter.

The exercise studied was a combination of an emergency response practice for an earthquake (which included use of safety behaviours and a building evacuation), followed by a school evacuation exercise (which required children to be collected from the school by their caregivers).

Prior to the exercise, staff were familiarised with the school's current preparedness plans and requirements of staff and pupils. Classroom teachers then ensured that children were familiar with, and practised, appropriate earthquake safety behaviours, and that children were aware of building evacuation routes.

Findings

For clarity of reporting, the emergency exercise is divided into a series of pre-determined steps within two phases (Emergency response practice; Evacuation practice), as follows:

Phase 1: Emergency Response Practice

Ready to start the emergency response procedures

Prior to the exercise being conducted, all children and staff had been familiarised with the rationale, protocol, and requirements of the exercise. All children and staff were in their usual rooms, ready for the start of the exercise (i.e., there was no one in the playground, and no one placed elsewhere in the school grounds).

Use of safety behaviours

At 2pm, all teachers in the school called *"Earthquake"* to their classes. The children and their teachers immediately sheltered under desks in the classrooms, or adopted the Drop Cover Hold position. While sheltering under the desks, the children held onto the desk-legs and ensured their whole body was covered. A child was seen encouraging others to get further under the desk so they were completely covered. Another child was seen to role-play fear, calling, "Mummy help me," as he sheltered under his desk, though he appeared undisturbed by the practice as he continued to shake the leg of the desk, simulating an earthquake. Everyone remained under the desks until the school bell rang (5 minutes later), this being an all clear message indicating the 'earthquake' was over, and signalling to teachers that it was safe to evacuate the classroom. No teachers or observers reported seeing any emotional disturbance in any of the children at this stage.

Building evacuation

Once the all clear had been given by the class teachers, children immediately left the classrooms by the designated emergency exit doors, and moved away from the buildings in an orderly manner. Teachers were last to leave the classrooms after all their pupils had left (followed by the observers). Teachers then joined their class-groups, and instructed the pupils to move together to a pre-identified area which was a safe distance from the classroom. At this point, teachers checked their class rolls to ensure all children were accounted for. Teachers then moved with their classes to the school's designated assembly area, a large asphalt area a safe distance away from all school-buildings. At the assembly point, the principal accounted for all classes.

FIGURE 2. Children of Ridgway School, Wellington, taking part in their annual earthquake drill (photo D Johnston)

Building safety check

When all classes had assembled, the principal and most of the teachers stayed with the children while several teachers, designated as safety wardens, checked that no one was left in the particular part of the school for which they were responsible, and that there were no "visible hazards" within the school. The wardens then reported their "findings" back to the principal at the assembly area. For the purposes of the practice, no "hazards" were reported, and it was safe for children and staff to return to the buildings.

End of the emergency response procedures

While the school was still assembled outside, the principal concluded the emergency response phase by giving the children feedback on the exercise. She congratulated them on following instructions quickly, behaving sensibly, on listening to staff, and for helping other children. The principal then asked the children to return to their rooms, accompanied by their teachers.

Phase 2: Emergency Evacuation Practice

Start of evacuation procedures

By the time children were back in their classrooms, it was the end of the school day. Children packed their bags and waited to be collected by caregivers. The children behaved normally, and no signs of disturbance were observed in any of the children following the exercise. There was no class-discussion of the exercise at this point, and no observers heard any children discussing the exercise among themselves.

School evacuation

Caregivers came to the classrooms and signed their child out before leaving the school grounds.

Alternate arrangements

A key strength of this exercise was having caregivers make plans for collecting their children from school following the exercise. Caregivers had been advised beforehand of the date and time for the evacuation exercise. They had been asked to provide emergency contact details to the school in advance of the exercise, and to name who would be collecting their child after the exercise (or any alternate arrangements for their child to be collected from school). This requirement communicated the importance of planning for emergencies to both the children and their families, while also providing an opportunity for the school to update emergency contact details for the children.

End of evacuation procedures

After the children had been collected by caregivers, the observation team met with the teachers and other staff to discuss the exercise. The discussion centred around the evaluation criteria described earlier. Conclusions emerging from the discussion and evaluation are reported immediately below, followed by recommended modifications to the exercise.

Conclusions

The process

The present emergency response practice and evacuation exercise was completed as planned and as routinely practised in the school. The children and teachers were well prepared, aware of their particular roles, and there were no instances of any confusion. Staff reported they were satisfied that emergency procedures were well understood by children and staff alike, and that practice- and evacuation-procedures were appropriate for keeping the children as safe as possible in the event of an earthquake.

Following the initial emergency response, children remained in their class-groups, well clear of buildings while class rolls were checked; this is important in case of damaged or weakened structures, or after-shocks. Once the children were all together in the school assembly area, teacher-wardens checked the buildings for "visible hazards" before the children were allowed to return to the classrooms. This is an important part of earthquake emergency procedure, as in an earthquake there may be damage to buildings, or there may be fallen wires, or broken glass, etc. After the children returned to their classrooms, caregivers supported the exercise by signing their children out with the class teacher before the children left the school grounds. Any children still waiting to be collected by caregivers were supervised in an after-school care programme. Thus teachers kept track of, and accounted for, all of the children. The benefit of requiring caregivers to plan for the collection of their children prior to an emergency cannot be overstated. As well as reassuring children that their caregivers were prepared for an emergency, the evacuation exercise also served to update the school's caregiver contact lists. Reuniting caregivers and children after an emergency would be a high priority. Already having the appropriate preparedness plans in place would help to provide reassurance to children and caregivers, especially if there are delays in reuniting families.

Behaviours

The children and teachers demonstrated appropriate safety behaviours, and appeared confident in their ability to respond effectively to the situation. Children and teachers were fully engaged in the exercise, some children appearing quite excited by role-playing the 'earthquake' phase; depending on the layout of the rooms, children either generally enjoyed shaking the desks quite vigorously as they squeezed in together to make sure they were completely covered, or adopted the *Drop Cover Hold* position.

At the end of the emergency response phase of the exercise, the principal spoke to the assembled children and congratulated them on their appropriate behaviour (as described above). The principal's reinforcement of the children's behaviour sent yet another message to the children that this exercise was important in protecting their safety at school.

FIGURE 3. Children and teachers assembling on the school field as part of the 2007 drill. (Photo: D Johnston)

Recommendations for modifications to the exercise

1. During the emergency response phase of the exercise, while the 'earthquake' was continuing, teachers could provide reassurance and ongoing communication with the children.

   For example, teachers could remind children that staying sheltered under their desks was the safest place to be at that time. Children could be reminded to ensure their own and head and legs remained under the shelter of the desks, and to check that children near them were also fully sheltered. In instances where it may not be possible for everyone to get under a desk or table, children could be reassured that remaining in the turtle shape is safest for them.

2. Once the school has assembled in the common area outside, and all classes are accounted for, children could be united with their siblings from other classrooms.

   Many children are likely to be very frightened in a major earthquake, and may benefit from being joined with family members. Similarly, children could be given the opportunity to support and encourage others during an emergency (e.g., holding hands with another child) to provide reassurance and comfort. In instances where children may out of their class group, it is important for teachers to keep track of their classes by keeping a record of who has moved.

3. Teacher-wardens should check not only that buildings are cleared of children after the emergency response phase, but also that buildings appear safe for children and staff to return to after an emergency event, and that there are no hazards such as fallen wires, broken glass, etc.

4. The school could consider potential local hazards that may arise in the event of an earthquake, and plan for how the children might be kept safe in these cases. For instance, power lines may fall on the road, or landslides may occur in a hilly area.

5. At the beginning of the exercise, several children could be placed in the school grounds and in buildings other than their own classroom. This would help to establish a protocol for the children's required behaviour in this case, and generate classroom discussion regarding this scenario.

6. Consideration could be given to allowing older children to play a role in organising or conducting the emergency exercise. Such involvement at school may encourage them to conduct their own practices at home and in the community.

7. Feedback on the exercise could be gathered from children immediately following the completion of the exercise.

   By running the practice at the very end of the school day, an opportunity was missed for children and staff to talk about the exercise together (e.g., for the children to express any fears or concerns, to ask questions, or make suggestions for improving the exercise) while it was 'fresh' in their minds.

8. Greater involvement, enthusiasm and understanding of earthquakes, preparation, and responses may be achieved by integrating the exercise with other areas of the curriculum. There was no evidence of the exercise being linked into any other part of the curriculum in the present case.

9. Following the exercise, caregivers could be given an opportunity to provide feedback from their perspective. Feedback forms could be sent home in the school newsletter. This would likely encourage discussion with the children at home too.

10. Schools could send home material in children's homework to encourage home-based disaster preparedness.

    Such material would require interaction with the whole family, and perhaps neighbours. Using information about different hazard events and scenarios could be used to add variety to take home materials. Homework relating to the school exercises is also an opportunity for families to test their own household plans, such as where family members can meet after an emergency, and for children to become familiar with who will collect them from school.

11. Children could be trained to lead and support other children in an emergency response.

    Such training could be useful in the case of a teacher being injured and unable to care for his/her class. Training could include, for example, administering first aid and positioning the teacher so s/he is comfortable when the shaking is over, going for help when the shaking is over, or leading other children through the next stage of the exercise.

12. The school should have an up-to-date plan for order of staff leaving the school in the event of an earthquake.

    Several teachers raised the difficulty of reconciling their responsibility to care for their pupils in the event of an earthquake, against their need to leave and know if their own families, including their own children, were safe somewhere else around Wellington. After discussion, staff agreed that those with children of their own would be among the first to leave the school after a destructive earthquake. These staff members would leave as soon as appropriate, while the remaining staff cared for children until caregivers arrived, or until teachers who had left earlier were able to return to the school. In a major earthquake, children may need to be cared for at school for several days before they could be reunited with their families.

13. Staff could give some attention to anticipating how they themselves, and the children, might react to a real and frightening event (in comparison to responding in an exercise).

    Ramirez et al. (2009) identify this area of comparison between real and simulated emergencies as in need of research. Human reactions in a traumatic event are not necessarily predictable, or consistent for a particular individual (Dufty, 2009; Ronan et al, 2008). For example, decision-making may be compromised due to reduced cognitive capacity resulting from emotional distraction. However, studies have demonstrated that in areas of high anxiety, rehearsed simulations, drills, and practices increase the likelihood that these behaviours will be enacted in the 'real' event (e.g., Ronan et al., 2008). Thus, staff may benefit by receiving some psycho-educational material that discusses issues that can affect people when exposed to high anxiety, emergencies, or trauma and hazardous events.

14. Full emergency practices are encouraged, on a biennial basis for example. A full emergency practice would involve the wider community (including local emergency and civil defence personnel) and enable a trial and evaluation of a wider ranging emergency scenario.

15. A summary of the present exercise could be made available to other schools to encourage greater preparation in instances where schools conduct only basic drills such as requiring children only to shelter under their desks in case of an earthquake.

Key lessons learnt

- Schools that have well developed and regularly practised emergency preparedness plans in place send a message to pupils and caregivers alike that in the case of an emergency, the school is prepared to protect the safety of the children.
- Before any emergency exercise, all participants must be fully familiar with the required procedures and behaviours. Frequent, well-learned emergency practices are likely to increase the probability that in a real emergency at school, staff and pupils will respond in an informed and predictable manner, and engage in behaviours that are recognised as best practice.
- Involving children in role-playing aspects of an emergency encourages children to engage in the exercise, and better understand possible ramifications of an earthquake.
- Children are likely to perceive emergency practices as important parts of their learning when practices are held regularly during school time, when caregivers are involved, and when feedback from the principal reinforces appropriate responses.
- School emergency exercises that involve caregivers may encourage families to develop home-emergency plans.
- It is important for teachers to maintain contact with children throughout the exercise, staying with them throughout the exercise and ensuring all children leave the school with a caregiver. Such contact with teachers is likely to reassure children that there will be adult care and assistance available to them at all times.
- It is important that teacher-wardens check that buildings are clear of children after the emergency response phase, and that buildings appear safe to re-enter.
- It is necessary to conduct and evaluate emergency response practices and evacuation exercises. An opportunity for staff and outside observers to discuss the exercise at its completion provides an opportunity to evaluate processes and behaviours, and to modify the exercise where appropriate.

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