

University of Groningen

Preparing children for climate related disasters

Seddighi, Hamed; Yousefzadeh Faal Daghati, Sepideh; Lopez Lopez, Monica; Sajjadi, Homeira

Published in:
BMJ paediatrics open

DOI:
[10.1136/bmjpo-2020-000833](https://doi.org/10.1136/bmjpo-2020-000833)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Final author's version (accepted by publisher, after peer review)

Publication date:
2020

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Seddighi, H., Yousefzadeh Faal Daghati, S., Lopez Lopez, M., & Sajjadi, H. (2020). Preparing children for climate related disasters. *BMJ paediatrics open*, 4(1), [e000833]. <https://doi.org/10.1136/bmjpo-2020-000833>

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

Preparing children for climate-related disasters

Hamed Seddighi ^{1,2}, Sepideh Yousefzadeh,³ Mónica López López,⁴ Homeira Sajjadi⁵

To cite: Seddighi H, Yousefzadeh S, López López M, *et al.* Preparing children for climate-related disasters. *BMJ Paediatrics Open* 2020;**4**:e000833. doi:10.1136/bmjpo-2020-000833

Received 11 August 2020
Revised 28 September 2020
Accepted 29 September 2020



© Author(s) (or their employer(s)) 2020. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

¹Student Research Committee, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran

²Research Center for Emergency and Disaster Resilience, Red Crescent Society of Iran, Tehran, Iran

³University Campus Fryslân, University of Groningen, Leeuwarden, Netherlands

⁴Faculty of Behavioural and Social Sciences, University of Groningen, Groningen, Netherlands

⁵Social Determinants of Health Research Center, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran

Correspondence to

Hamed Seddighi, Social Welfare Management, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran; Hseddighi@gmail.com

ABSTRACT

Climate-related disasters affect different dimensions of children's health and well-being both directly and indirectly. Reducing children's vulnerability and exposure to climate-related disasters is crucial to protect them against risks. Children as climate-change agents and future leaders at local, national and international level can obviously contribute to reduce vulnerabilities in families and communities and transfer knowledge to them. Moreover, children can advocate for climate change mitigation. In the long term, participation of children in the climate change mitigation programmes may lead to fewer disasters and, consequently, less risk to their health. As government policies have failed to fully address and respond to the drivers of climate-related disasters, disasters preparedness and education for children should be considered an essential activity to protect children from disaster's risks.

Main factors in shaping children's behaviour and response to disaster are increasing the risk perception and knowledge of the children. When a child perceived likelihood, susceptibility and severity of a disaster (such as earthquake), then they would be able and willing to learn how to prepare for that.

So far, disaster education programmes for children have mostly relied on offline school-based training. Different innovative approaches can be applied to continue education within online and digital formats including virtual reality, digital games and online platforms. However, an advocacy support by influential entities such as companies engaged in entertainment industry is required to raise the awareness of public and particularly the children about disaster preparedness.

CHILDREN, VULNERABILITY AND DISASTERS

Anthropogenic climate change has led to more frequent natural disasters affecting more people in the past few decades.^{1 2} Climate-related disasters such as floods, storms, droughts and heat waves accounted for 91% of total disasters between 1998 and 2017. Climate-related disasters are strongly coupled and act as dominos. For example, drought and heat wave occur together. Drought leads to dry soils and as a result, solar energy evaporation will end to increase surface warming and consequent increased evaporation rate.³ Drought and heatwave will increase the risk of wildfires. Furthermore, sandstorms, haze

Strengths and limitations of this study

- ▶ With the rise of climate-related disasters, children's health is increasingly at risk.
- ▶ Children should be involved in the climate change mitigation programmes.
- ▶ Disaster preparedness programmes should be developed to include all children with different conditions according to their social vulnerabilities and exposures and without discrimination.
- ▶ It must be ensured that available disaster preparedness programmes actually lead to disaster preparedness for children.
- ▶ In addition to traditional disaster education programmes for children, new and innovative methods should be widely used.
- ▶ Involvement of various stakeholders such as family, community, government, civic institutions and industries (including the entertainment industry) is essential in protecting children from disasters.

and water conflicts are other consequences of drought. Disasters are classified into geophysical, hydrological, climatological, meteorological, biological and technological based on their causes.^{4 5} According to the Centre for Research on the Epidemiology of Disaster,⁶ a disaster is a 'situation or event that overwhelms local capacity, necessitating a request at the national or international level for external assistance; an unforeseen and often sudden event that causes great damage, destruction and human suffering'.

Children are one of the most vulnerable groups in situations of climate-related disasters and disasters have different impacts on children including fatalities, injuries, child trafficking, child labour, separation and child abuse in different forms.⁷⁻⁹ Disasters affect different dimensions of children's health and well-being both directly and indirectly. Children under 5 years experienced more diseases related to climate change than others.¹⁰ Children's physical health is in danger as they may be injured or killed immediately during or after disasters due to trauma, malnourishment, diseases and inadequate access to



medical care.^{7 11} Disasters also can lead to mental health problems in children, including depression, sleep disorders, phobias, attachment disorders and anxiety.^{7 12}

While parents, caregivers and the state have primary responsibility to protect children in the face of disasters, reducing children's vulnerability is an important way to protect children in disasters.¹³ Susceptibility of children to injury and their dependency to others for lifesaving, livelihood, decision-making and emotional support results in their vulnerability.¹³ Children are more likely to suffer from exposure to traumatic events because of their physical, physiological and mental characteristics and development.^{13 14} They are more likely vulnerable to challenges like malnutrition, dehydration and exhaustion compared with adult.¹³ As such, they need more protection before, during and after disasters. Such protections are even more crucial for children who are more vulnerable by virtue of their age (ie, infants), living conditions (eg, bad infrastructure or lack of family support), ethnicity, disabilities, chronic diseases or preconditions. Attention to children before disasters should be integrated with disasters preparedness programmes.¹³

The distribution of climate-related disaster's risks is not similar for all children.¹⁵ Intersecting social characteristics (eg, gender, ethnicity or social class), climate change vulnerabilities (eg,) and health vulnerabilities (eg, disability or chronic diseases such as diabetes) will influence the risk and intensity of disasters among children. Climate change, including frequent heatwaves, extreme weather conditions and poor crop yields, exacerbates risk factors for child health due to influencing disease transmission rate, affordability of food and more conflict on food resources.¹⁶ The mentioned risk factors also exacerbate with social inequalities such as income, social status, gender, residence, location, housing, disability and access to healthcare.^{16 17} As a result, climate-related disasters could increase inequalities and as such health outcomes among children.¹⁶

CLIMATE-RELATED DISASTERS' MITIGATION AND ADAPTATION

Efforts to reduce or prevent climate-related hazards such as reducing or preventing greenhouse gas emissions are defined as mitigation.¹² It is necessary for mitigation to use renewable energy, increasing efficiency of energy in older equipment and changing consumer behaviour.¹²

Depending on their age, and levels of development children can be agents of behavioural change for climate change mitigation. As the future leaders at local, national and international level, they can help to reduce vulnerabilities in families and communities and transfer knowledge to their community.¹⁸ It was shown that children's capabilities as agents are determined by their available resources and their environment (caregivers, parents, friend, peers, teachers and community).^{19 20} Parents have a key role in changing children's 'behaviour with activities such as training children on environmental ethics and mitigation strategies, buying green or environmentally

friendly products for children and modelling of pro-environmental behaviour'.¹⁸ Meanwhile, studies show that children can also inspire adults especially their parents toward higher levels of climate concerns.²¹

Children can advocate for climate change mitigation. There are several examples of advocacy action of children and youth around the world, including seven young Portuguese appeal to the European Court of Human Rights to force 47 European countries to stop further extraction of fossil fuels following fires in Portugal in 2017,¹² 15 years old Greta Thunberg in August 2018, asked the Swedish government for more activities on climate change, and more. Following Greta Thunberg's move, millions of children in cities around the world demonstrated climate change.²² In the long term, participation of children in the climate change mitigation programmes may lead to fewer disasters and, consequently, less risk to children's health. In other words, children can contribute to the health of children of different generations and be safe from the disasters caused by climate change.

CHILDREN'S PREPAREDNESS FOR CLIMATE-RELATED DISASTERS

As long as government policies fail to fully address the drivers of climate-related disasters, disasters preparedness and education for children should be considered for protection of children from disaster's risks. The preparedness interventions, need to be considered in relation to the evolving capacities of the child. In other words, the age, levels of abilities as well as cognitive and physical development of the child are crucial components in the discourse of disaster preparedness for children and cannot be taken for granted. Preparedness is 'the knowledge and capacity developed by governments, response and recovery organisations, communities and individuals to effectively anticipate, respond to and recover from the impacts of likely, imminent or current disasters'.²³ The behavioural changes that lead to a child's preparedness for disasters depend more than anything on two factors: increased knowledge and skills and risk perception.

The first factor in shaping children's behaviour and response to disaster is knowledge and education.²⁴ Disaster education plays a major role in enhancing the awareness of children about disasters.²⁴ With an increase in children's awareness on disasters, they can share their knowledge with adults and it may result in adults' preparedness as well.²⁵ Disaster education for children can be conducted in schools, kindergartens, child welfare centres or other child service centres. Schools play a critical role in disaster risk reduction because they facilitate the process of education of children on disaster risk reduction.²⁶ By utilising appropriate policy framework, skilled teachers, textbook and curriculum for learning as well as peer education, schools provide an ideal space for children disasters preparedness.²⁶ Children's opportunities to access these sources of education are crucial factors. Their access could be simply by the

Table 1 Some examples of successful programmes for children in countries with climate-related disasters preparedness

Country	Successful programmes for climate-related disasters preparedness
Chile	National disaster's education through drills for evacuation for major disasters, such as earthquakes and tsunamis. ⁵¹
Cuba	National programme for preparing children for hurricanes through early warning education, evacuation education, enhancing health literacy and awareness, national media active role in hurricane education and early warning and teaching risk-prone area to people including children. ⁵²
Indonesia	National school-based disaster education (lecture, drill, curriculum). ⁵³
Iran	Programmes for children about first aid skills, evacuation drills, curriculum-based teaching resource for disasters education. ⁵⁴
Israel	Disaster education with lecture and drills for children, ⁵⁵ light search and rescue training of high-school students in Israel. ^{56 57}
Japan	Tsunami preparedness via evacuation drills, ⁵⁸ disaster management drill, firefighting frill, acquiring skill of rescue and first aid and curriculum-based teaching resource. ⁵⁹
New Zealand	Shakeout drill (emergency evacuation), ⁶⁰ The What's the Plan, Stan?, a voluntary, curriculum-based teaching resource for children disasters preparedness, ⁶¹ museum-based hazard education programme on students, teachers and parents. ⁶²
Portugal	Using the disaster awareness game for enhancing disasters preparedness, curriculum-based teaching resource, interactive resources. ^{63 64}
Turkey	National programme that was titled 'Are We Prepared for a disaster?' for children ²⁴
USA	Shake out drill in schools and communities (drop, cover and hold on drills for earthquakes and evacuation for tsunamis). ^{62 65 66}

lack of resources such as school, teacher, daycare or the financial means to access them. The access could also be constrained in the presence of resources. For example, child's gender, social class or ethnic background could be some of the hurdles to utilise the existing resources.

The second factor related to children's preparedness is risk perception. Risk perceptions are defined as 'beliefs about potential harm or the possibility of loss. It is a subjective judgement that people make about the characteristics and severity of a risk'.²⁷ When a child perceived likelihood, susceptibility and severity of a disaster (such as earthquake), then they would be able and willing to learn how to prepare.²⁷ For example, risk perception during COVID-19 pandemic in the world was higher than any other hazard. Therefore, people actively explored and learnt protective measures.

Before COVID-19 pandemic, there were many programmes conducted for preparing children in many countries. Some examples are shown in [table 1](#). Most of the examples in various countries were conducted in schools.

INNOVATIVE SOLUTIONS FOR PREPARING CHILDREN FOR CLIMATE-RELATED DISASTERS

There are several ways to prepare children for climate-related disasters, besides traditional school-based methods such as lecture, curriculum and drills. It was shown that isolated school-based programmes increase disaster knowledge, but behavioural change is not forthcoming.²⁸ Virtual reality (VR) is a tool to facilitate disaster education and preparedness for children, its effectiveness

has been proved in many studies.^{29–31} This tool could be used for evacuation drills,^{29 32} firefighting drills,³³ first aid skills³⁴ and other needed skills for disasters preparedness. Moreover, children with disabilities cannot participate in physical drills for climate-related disasters. The VR tools eliminate this inequity and help children with disabilities such as hearing impairment³⁵ and autism spectrum disorder³⁶ to prepare for disasters.

Simulation games are another way to prepare children in different ages for disasters.³⁷ These games can be available via mobile devices and computers.³⁸ The effectiveness of simulation games for disasters preparedness was proved in different studies and for different climate-related disasters such as flood,^{38 39} hurricane⁴⁰ and earthquake.⁴¹ This way preparedness is affordable, accessible and available for many children around the world and will decrease inequity in health and disasters preparedness and social inclusion of groups at risk of social exclusion.^{42 43}

The art is another effective way to prepare children for climate-related disasters⁴⁴ and safety teaching.⁴⁵ This tool is effective especially for preschool children.⁴⁶ It was shown that climate-related disasters' education can improve the quality of preschool children's knowledge.⁴⁷ Disasters' education with art can effectively help preschool children to participate in disasters climate mitigation and disasters preparedness activities.⁴⁷ Researchers in a systematic review found that programmes designed for children 5–11 years old should have some characteristics including the involvement of children's parents, using behavioural modalities (rather than cognitive), and



using interactive methods (play, art, stories and games).⁴⁸ In addition, it was recommended to prepare children with disabilities for disasters with art and storytelling.^{49 50}

To prepare children for climate-related disasters in the time of pandemics, we recommend that:

1. Disasters education for children has so far relied mostly on offline training with physical activities such as drills. During this pandemic, different innovative approaches have been applied to continuing education in online formats. The same approaches could be applied for emergency preparedness. For example, virtual forums are appropriate alternatives to provide educations on different topics, for example, first aid or preparedness for earthquakes, floods and other disasters.
2. Children should be involved in climate change mitigation programmes. They can be agents of climate change mitigation and advocate for that. Their participation will change the behaviour of families and communities and will also have intergenerational effects.
3. The family and the community play a key role in empowering the child to prepare for climate-related disasters especially in the absence of schools, kindergartens and other childcare facilities.
4. Creating required resources, especially interactive resources, for disaster preparedness and removing the constraints to use those researches are other ways to prepare children in different languages especially children 5–11 years old. Countries according to their risk map (hazard-prone places) should produce relevant content and resources for children.
5. Children's risk perception should be increased with the help of media such as TV programmes, video games, physical games, music, storytelling and simulators.
6. Capacity building to train the people around the children including teachers, parents, extended family members, nurses, school drivers or care providers. On the shutdown of many centres, it is the best time to train people who work with children about disasters preparedness. It can be very useful especially when COVID-19 threat has been removed.
7. Preparing marginalised children for disasters is vital. Intersection of childhood and racial and ethnic social class, disability, gender and residence inequalities increases vulnerability and therefore increases disasters' risk for children. One should note that entry points for intervention in such situations are social vulnerabilities.
8. An advocacy support by influential entities such as companies engaged in entertainment industry is required for raising the awareness of public and particularly the children about disasters preparedness.
9. Local and community-oriented policies should be crafted to reach out to parents of younger children, providing them with tools and resources, education and opportunities to prepare themselves and

strengthen their capacities to protect their children during the disasters

Twitter Hamed Seddighi @Seddighi_Hamed and Mónica López López @M_Lopez_RUG

Contributors HaS undertook planning, writing up and was responsible for the overall content. SY, ML and HoS provided content and writing of sections. HoS also provided editorial oversight.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting or dissemination plans of this research.

Patient consent for publication Not required.

Provenance and peer review Commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID ID

Hamed Seddighi <http://orcid.org/0000-0002-6214-4830>

REFERENCES

- 1 Seddighi H. The performance of the Iranian red crescent by launching COVID-19 testing centers: report from the field. *Disaster Med Public Health Prep* 2020.
- 2 WMO. WMO statement on the state of the global climate in 2018; 2019.
- 3 AghaKouchak A, Huning LS, Chiang F, *et al*. How do natural hazards cascade to cause disasters? *Nature* 2018;561:458–60.
- 4 CRED. Disaster General classification. Available: <https://www.emdat.be/classification> [Accessed 31 March, 2020].
- 5 Seddighi H. COVID-19 as a natural disaster: focusing on exposure and vulnerability for response. *Disaster Med Public Health Prep*;2020:1–2.
- 6 Wallemacq P. Economic losses, poverty & disasters: 1998–2017 Centre for Research on the Epidemiology of Disasters, CRED; 2018.
- 7 Kousky C. Impacts of natural disasters on children. *Future Child* 2016;26:73–92.
- 8 Seddighi H, Salmani I, Javadi MH, *et al*. Child abuse in natural disasters and conflicts: a systematic review. *Trauma Violence Abuse* 2019;152483801983597.
- 9 Wood LCN. Child modern slavery, trafficking and health: a practical review of factors contributing to children's vulnerability and the potential impacts of severe exploitation on health. *BMJ Paediatr Open* 2020;4:e000327.
- 10 Sheffield PE, Landrigan PJ. Global climate change and children's health: threats and strategies for prevention. *Environ Health Perspect* 2011;119:291–8.
- 11 Seddighi H, Sajjadi H, Salmani I. Child-Friendly humanitarian logistics in natural disasters: a letter to the editor. *Iran Red Crescent Med J*;21.
- 12 Burke SEL, Sanson AV, Van Hoorn J. The psychological effects of climate change on children. *Curr Psychiatry Rep* 2018;20:35.
- 13 Hoffman S. Preparing for disaster: protecting the most vulnerable in emergencies. *UC Davis L Rev* 2008;42:1491.
- 14 Swenson CC, Saylor CF, Powell MP, *et al*. Impact of a natural disaster on preschool children: adjustment 14 months after a hurricane. *Am J Orthopsychiatry* 1996;66:122–30.
- 15 Chalupka S, Anderko L, Pennea E, *et al*. and Children's Mental Health: A Generation at Risk? *Environmental Justice* 2020;13:10–14.
- 16 Bennett CM, Friel S. Impacts of climate change on inequities in child health. *Children* 2014;1:461–73.
- 17 Font-Ribera L, García-Continente X, Davó-Blanes MC, *et al*. [The study of social inequalities in child and adolescent health in Spain]. *Gac Sanit* 2014;28:316–25.
- 18 Nche GC, Achunike HC, Okoli AB. From climate change victims to climate change actors: the role of eco-parenting in building

- mitigation and adaptation capacities in children. *J Environ Educ* 2019;50:131–44.
- 19 Yousefzadeh S, Biggeri M, Arciprete C, et al. A capability approach to child growth. *Child Indic Res* 2019;12:711–31.
 - 20 Haisma H, Yousefzadeh S, Boele Van Hensbroek P. Towards a capability approach to child growth: a theoretical framework. *Matern Child Nutr* 2018;14:e12534.
 - 21 Lawson DF, Stevenson KT, Peterson MN, et al. Children can foster climate change concern among their parents. *Nat Clim Chang* 2019;9:458–62.
 - 22 Kristof V. Marching for climate and youth's future. *BMJ Paediatr Open* 2019;3:e000477.
 - 23 UNISDR. Terminology on disaster risk reduction. Geneva, Switzerland; 2009.
 - 24 Mermer G, Donmez RO, Daghan S. The evaluation of the education for earthquake preparation addressed to middle school students. *J Pak Med Assoc* 2018;68:1809–15.
 - 25 Sakurai A, Bisri MBF, Oda T, et al. Exploring minimum essentials for sustainable school disaster preparedness: a case of elementary schools in Banda Aceh City, Indonesia. *International Journal of Disaster Risk Reduction* 2018;29:73–83.
 - 26 Bandecchi AE, Pazzi V, Morelli S, et al. Geo-hydrological and seismic risk awareness at school: emergency preparedness and risk perception evaluation. *International Journal of Disaster Risk Reduction* 2019;40:101280.
 - 27 Darker C, Perception RGellman MD, Turner JR, eds. *Encyclopedia of behavioral medicine*. New York, NY: Springer, 2013: 1689–91.
 - 28 Codeanu TA, Celenza A, Jacobs I. Does disaster education of teenagers translate into better survival knowledge, knowledge of skills, and adaptive behavioral change? A systematic literature review. *Prehosp Disaster Med* 2014;29:629–42.
 - 29 Ooi S, Tanimoto T, Sano M. Virtual reality fire disaster training system for improving disaster awareness. *Proceedings of the 2019 8th International Conference on Educational and Information Technology*, 2019.
 - 30 Smith SJ, Farra SL, Ulrich DL, et al. Effectiveness of two varying levels of virtual reality simulation. *Nurs Educ Perspect* 2018;39:1–15.
 - 31 Feng Z, González VA, Amor R, et al. Immersive virtual reality serious games for evacuation training and research: a systematic literature review. *Comput Educ* 2018;127:252–66.
 - 32 D-Y KIM, J-R HUH, J-D LEE, et al. Implementation of virtual reality for interactive disaster evacuation training using close-range image information. *Journal of the Korean Association of Geographic Information Studies* 2019;22:140–53.
 - 33 McAdoo BG, White T, Chen Y, et al. Virtual reality for disaster resilience (VR4DR). *AGUFM* 2019;2019:IN21B–9.
 - 34 Bucher K, Blome T, Rudolph S, et al. VReanimate II: training first aid and reanimation in virtual reality. *Journal of Computers in Education* 2019;6:53–78.
 - 35 Caballero AR, Niguidula JD, Caballero JM. Disaster risk management training simulation for people with hearing impairment: a design and implementation of ASL assisted model using virtual reality. *2019 4th International Conference on Information Technology (InCIT)*, 2019.
 - 36 Fino R, Lin MJ, Caballero A, et al. Disaster awareness simulation for children with autism spectrum disorder using android virtual reality. *Journal of Telecommunication, Electronic and Computer Engineering* 2017;9:59–62.
 - 37 Savova D. AR sandbox in educational programs for disaster. *6th International Conference on Cartography and GIS*, 2016.
 - 38 Tsai M-H, Wen M-C, Chang Y-L, et al. Game-based education for disaster prevention. *AI Soc* 2015;30:463–75.
 - 39 Tsai M-H, Chang Y-L, Kao C, et al. The effectiveness of a flood protection computer game for disaster education. *Visualization in Engineering* 2015;3:9.
 - 40 Abraham B, Jayemane D. Where are all the climate change games? Locating digital games' response to climate change. *Transformations* 2017.
 - 41 Chou Y-S, Hou H-T, M-C Y. Running Tommy©: developing a digital adventure game based on situated learning to promote learners' concepts of earthquake escape. *2012 IEEE Fourth International Conference On Digital Game And Intelligent Toy Enhanced Learning*, 2012.
 - 42 Stewart J, Bleumers L, Van Looy J. The potential of digital games for empowerment and social inclusion of groups at risk of social and economic exclusion: evidence and opportunity for policy Joint Research Centre, European Commission; 2013.
 - 43 Gampell A, Gaillard J, Parsons M, et al. Fostering student participation in disaster risk reduction through disaster video games. *Australian Journal of Emergency Management, The* 2020;35:43.
 - 44 Mangione GR, Pierri A, Capuano N. Emotion-based digital storytelling for risk education: empirical evidences from the Alice project. *Int J Contin Eng Educ Life Long Learn* 2014;24:184–211.
 - 45 Rae A. Tales of disaster: the role of accident storytelling in safety teaching. *Cogn Technol Work* 2016;18:1–10.
 - 46 Hidayati Y. Disaster Risk Reduction Education through Storytelling for Pre-School Children: A Case Study of Storytellers' Local Community in Lombok, West Nusa Tenggara. *International Conference on Early Childhood Education and Parenting 2009 (ECEP 2019)*, 2020.
 - 47 Proulx K, Aboud F. Disaster risk reduction in early childhood education: effects on preschool quality and child outcomes. *Int J Educ Dev* 2019;66:1–7.
 - 48 Brigden A, Parslow RM, Linney C, et al. How are behavioural interventions delivered to children (5–11 years old): a systematic mapping review. *BMJ Paediatrics Open* 2019;3:e000543.
 - 49 Giagazoglou P, Papadaniil M. Effects of a Storytelling Program with Drama Techniques to Understand and Accept Intellectual Disability in Students 6 - 7 Years Old. A Pilot Study. *Advances in Physical Education* 2018;08:224–37.
 - 50 Indriasari FN, Widyarani L, Kusuma PD. Emergency preparedness for children with autism spectrum disorder (ASD) in Yogyakarta. *Jurnal Keperawatan Soedirman* 2018;13:155–62.
 - 51 Vásquez A, Marinkovic K, Bernales M, et al. Children's views on evacuation drills and school preparedness: mapping experiences and unfolding perspectives. *International Journal of Disaster Risk Reduction* 2018;28:165–75.
 - 52 Miranda DS, Choonara I. Hurricanes and child health: lessons from Cuba. *Arch Dis Child* 2011;96:328–9.
 - 53 Adiyoso W, Kanegae H. The effect of different disaster education programs on tsunami preparedness among schoolchildren in Aceh, Indonesia. *Disaster Mitigation of Cultural Heritage and Historic Cities* 2012;6:165–72.
 - 54 Parsizadeh F, Ghafory-Ashtiany M. Iran public education and awareness program and its achievements. *Disaster Prev Manag* 2010;19:32–47.
 - 55 Soffer Y, Goldberg A, Avisar-Shohat G, et al. The effect of different educational interventions on schoolchildren's knowledge of earthquake protective behaviour in Israel. *Disasters* 2010;34:205–13.
 - 56 Bodas M, Peleg K, Shenhar G, et al. Light search and rescue training of high school students in Israel – longitudinal study of effect on resilience and self-efficacy. *International Journal of Disaster Risk Reduction* 2019;36:101089.
 - 57 Peleg K, Bodas M, Shenhar G, et al. Wisdom of (using) the crowds: enhancing disasters preparedness through public training in light search and rescue. *International Journal of Disaster Risk Reduction* 2018;31:750–7.
 - 58 Katada T, Kanai M. Implementation of tsunami disaster education for children and their parents at elementary school. *Solutions to Coastal Disasters* 2008;39–48.
 - 59 Shiwaku K, Shaw R. Disaster resilience of education systems. *Disaster Risk Reduction* 2016.
 - 60 Finnis KK, Johnston DM, Ronan KR, et al. Hazard perceptions and preparedness of Taranaki youth. *Disaster Prevention and Management* 2010.
 - 61 Johnson VA, Ronan KR, Johnston DM, et al. Implementing disaster preparedness education in New Zealand primary schools. *Disaster Prevention and Management* 2014.
 - 62 MacDonald E, Johnson V, Gillies M, et al. The impact of a museum-based hazard education program on students, teachers and parents. *International Journal of Disaster Risk Reduction* 2017;21:360–6.
 - 63 Delicado A, Rowland J, Fonseca S, et al. Children in disaster risk reduction in Portugal: policies, education, and (non) participation. *International Journal of Disaster Risk Science* 2017;8:246–57.
 - 64 Ribeiro AS, Silva I. Drawing on fire: children's knowledge and needs after a wildfire disaster in Portugal. *Children's Geographies* 2019;22:1–13.
 - 65 Johnson VA. An impact evaluation of ShakeOut, an earthquake and tsunami drill in two coastal Washington state school districts. *GNS Science* 2013.
 - 66 Jones LM, Benthien M. Preparing for a “Big One”: The Great Southern California ShakeOut. *Earthquake Spectra* 2011;27:575–95.