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# Preparing children for climate-related disasters during a COVID-19 pandemic



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# How to prepare children for climate-related disasters in time of COVID_19 pandemic

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## Children, vulnerability and disasters

Anthropogenic climate change has led to more frequent natural disasters affecting more people[1 2]. Climate-related disasters such as floods, storms, droughts, and heat waves accounted 91% of total disasters between 1998 and 2017. Disasters are classified into geophysical, hydrological, climatological, meteorological, biological, and technological based on their causes [3,4]. According to the Centre for Research on the Epidemiology of Disasters [5], a disaster is a "situation or event which 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". Climate-related disasters such as floods, storms, droughts, and heat waves accounted for 91% of total disasters between 1998 and 2017.

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 labor, separation and child abuse in different forms[6,7]. United Nations Convention on the rights of the children, defined child as anyone under the age of 18 [8]. Disasters affect different dimensions of children's health and wellbeing both directly and indirectly. 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[6,9]. Disasters also can lead to mental health problems in children[6].

Reducing vulnerability is a way to protect children in disasters[10]. Susceptibility of children to injury and their dependency to others for lifesaving, livelihood, decision making, and emotional support results in their vulnerability[10]. Children are more likely to suffer from exposure to traumatic events because of their circumstances such as physical, physiological and mental development [10 11]. They are more likely vulnerable to challenges like malnutrition, dehydration, and exhaustion compared to adult [10]. As such, they

need more protection before, during and after disasters. Such protections may be even more crucial for children who are more vulnerable by virtue of their age (i.e. infants), living conditions (e.g. bad infrastructure or lack of family support), ethnicity, disabilities, chronic diseases or preconditions. Attention to children before disasters should be an integral part of disaster's preparedness and will reduce their vulnerability[10].

**Children's preparedness for disasters**

Preparedness is "the knowledge and capacities developed by governments, response and recovery organizations, communities and individuals to effectively anticipate, respond to and recover from the impacts of likely, imminent or current disasters"[12]. Behavioral changes which lead to a child's preparedness for disasters depend more than anything upon two factors: increased knowledge and skills & risk perception.

The first factor in shaping children's behavior and response to disaster is knowledge and education[13]. Disaster education plays a major role in enhancing the awareness of children about disasters[13]. 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[14]. Disaster education for children can be conducted in schools, kindergartens, child welfare centers, or other child service centers. Schools play a critical role in disaster risk reduction because they facilitate the process of education of children on disaster risk reduction[15]. By utilizing appropriate policy framework, skilled teachers, textbook and curriculum for learning as well as peer education, schools provide an ideal space for children disaster's preparedness[15].

The second factor related to children's preparedness is risk perceptions. Risk perceptions is defined as "beliefs about potential harm or the possibility of a loss. It is a subjective judgment that people make about the characteristics and severity of a risk"[16]. When a child perceived likelihood, susceptibility, and severity of a disaster (such as earthquake), then s/he would be able and willing to learn how to prepare [16]. For example, risk perception during COVID_19 pandemics in the world was higher than any other hazard. So people actively explored and learned protective measures.

Before COVID-19 pandemic, there were many programs conducted for preparing children in many countries. For example, in Iran, children gained disasters' knowledge via their school textbooks. In addition, humanitarian and emergency organizations (e.g. Red Cross and Red Crescent Societies) in cooperation with Ministry of Education conducted various programs for children of different ages. For instance, children in kindergartens learned how to evacuate and seek shelter during an earthquake. They also became informed about emergency phone numbers they need to know in case of an emergency. They were provided with a special phone number to dial and listen to stories about safety. The International Red Crescent Society

(IRCS) held training programs in schools to acquaint children with first aid skills, emergency evacuation, emergency shelters, and emergency move. Every year, a week is specified for conducting earthquake drills in schools. Almost all emergency preparedness educational activities for children have been suspended due to COVID-19 in many countries including Iran since February 2020. But, an earthquake or any other disaster may happen every day at any spot on the earth. Below are some points proposed for preparing children during this time.

**Preparing children in the time of COVID-19 pandemic**

In order to preparing 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 continue 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, e.g. first aid or preparedness for earthquakes, flood, and other disasters.

2- Creating required resources, especially interactive resources, for disaster preparedness is another way to prepare children in different languages. Countries according to their risk map (hazard-prone places) should produce relevant content and resources for children.

3- Increasing the children's risk perception with the help of media such as TV programs, video games, physical games, music, storytelling, and simulators.

4- Capacity building to train the people around the children including teachers, parents, the extended family members, nurses, school drivers, or care providers. Upon the shutdown of many centers, 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.

5- Preparing marginalized 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 situation are social vulnerabilities.

6- 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.

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# Preparing children for climate-related disasters

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## 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, 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 labor, separation, and child abuse in different forms[7-9]. Disasters affect different dimensions of children's health and wellbeing both directly and indirectly. Children under five 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].

Reducing vulnerability is a 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 to adult [13]. As such, they need more protection before, during, and after disasters. Such protection are even more crucial for children who are more vulnerable by virtue of their age (i.e. infants), living conditions (e.g., bad infrastructure or lack of family support),

ethnicity, disabilities, chronic diseases or preconditions. Attention to children before disasters should be an integrated with disaster's preparedness programs[13].

The distribution of climate-related disaster's risks is not similar for all children[15]. Intersecting social characteristics (e.g., gender, ethnicity, or social class), climate change vulnerabilities (e.g.), and health vulnerabilities (e.g., 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 factor also exacerbate with social inequalities such as income, social status, gender, residence, location, housing, disability, and access to health care[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 behavior[12].

Children can be agents of behavioral 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 capabilities (caregivers, parents, friend, peers, teachers, and community)[19,20]. Parents have a key role in changing children 'behavior with activities such as: training children on environmental ethics and mitigation strategies, buying green or environmentally friendly products for children, and modeling of pro-environmental behavior[18]. Laswon et al. (2019) showed that children can inspire adults especially their parents toward higher levels of climate concerns[21].

Moreover, 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[22], fifteen 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[23]. In the long term, participating children in climate change mitigation's programs leading 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, disaster's preparedness and education for children should be considered for protection of children from disaster's risks. Preparedness is "the knowledge and capacity developed by governments, response and recovery organizations, communities, and individuals to effectively anticipate, respond to, and recover from the impacts of likely, imminent, or current disasters"[24]. The behavioral changes that lead to a child's preparedness for disasters depend more than anything upon two factors: increased knowledge and skills & risk perception.

The first factor in shaping children's behavior and response to disaster is knowledge and education[25]. Disaster education plays a major role in enhancing the awareness of children about disasters[25]. 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[26]. Disaster education for children can be conducted in schools, kindergartens, child welfare centers, or other child service centers. Schools play a critical role in disaster risk reduction because they facilitate the process of education of children on disaster risk reduction[27]. By utilizing appropriate policy framework, skilled teachers, textbook and curriculum for learning as well as peer education, schools provide an ideal space for children disaster's preparedness[27].

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 judgment that people make about the characteristics and severity of a risk"[28]. When a child perceived likelihood, susceptibility, and severity of a disaster (such as earthquake), then s/he would be able and willing to learn how to prepare [28]. For example, risk perception during COVID_19 pandemic in the world was higher than any other hazard. Therefore, people actively explored and learned protective measures.

Before COVID-19 pandemic, there were many programs conducted for preparing children in many countries. It is shown some examples in the Table 1. Most of the examples in various countries were conducted in schools.

*Table 1: some examples of Successful programs for children in climate-related disasters' preparedness countries*

| Country | Successful programs for climate-related disasters' preparedness |
|---|---|
| Cuba | National program 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[29] |
| New Zealand | Shakeout drill (emergency evacuation)[30], The What's the Plan, Stan?, a voluntary, curriculum-based teaching resource for children disaster's preparedness[31], museum-based hazard education program on students, teachers and parents[32]; |
| USA | Shake out drill in schools and communities( drop, cover and hold on" drills for earthquakes and evacuation for tsunamis)[32-34] |
| Turkey | National program that was titled 'Are We Prepared for a disaster?' for children[25] |
| Israel | Disaster education with lecture and drills for children[35], Light search and rescue training of high school students in Israel[36,37] |
| Portugal | Using the disaster awareness game for enhancing disaster's preparedness, curriculum-based teaching resource, interactive resources[38,39] |
| Indonesia | National school based disaster education (lecture, drill, curriculum)[40] |
| Chile | National disaster's education through drills for evacuation for major disasters, such as earthquakes and tsunamies[41] |
| Iran | programs for children about first aid skills, evacuation drills, curriculum-based teaching resource for disasters education[42] |
| Japan | Tsunami preparedness via evacuation drills[43], disaster management drill, firefighting frill, acquiring skill of rescue and first aid, and curriculum-based teaching resource [44] |

## 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. There was shown that isolated school-based programs increase disaster knowledge, but behavioral change is not forthcoming[45]. Virtual reality (VR) is a tool to facilitate disaster education and preparedness for children that its effectiveness was proved in many studies[46-48]. This tool could be used for evacuation drills[46,49], firefighting drills[50], first aid skills[51], 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 children with hearing impairment[52], and children with autism spectrum[53] to prepare for disasters.

Simulation games are another way to prepare children in different ages for disasters[54]. These games can be available via mobile devices and computers[55]. The effectiveness of simulation games for disasters' preparedness was proved in different studies and for different climate-related disasters such as flood[55,56], hurricane[57], and earthquake[58]. 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[59,60].

The Art such as storytelling are other effective ways to prepare children for climate-related disasters[61] and safety teaching[62]. This tool is effective especially for preschool children[63]. It was shown that climate-related disasters' education can improve the quality of preschools children knowledge[64]. Disasters' education with art can effectively help preschool children to participate in disasters climate mitigation and disasters' preparedness activities[64]. Researchers in a systematic review found that programs designed for children 5-11 years old should have some characteristics including the involvement of children's parents, using behavioral modalities (rather than cognitive), and using interactive methods (play, art, stories, and games)[65]. In addition, it was recommended to prepared children with disabilities for disasters with art such as storytelling[66,67].

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, e.g., first aid or preparedness for earthquakes, floods, and other disasters.

2- 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 child care facilities.
3- Creating required resources, especially interactive resources, for disaster preparedness is another way 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.
4- Increasing the children's risk perception with the help of media such as TV programs, video games, physical games, music, storytelling, and simulators.
5- Capacity building to train the people around the children including teachers, parents, extended family members, nurses, school drivers, or care providers. Upon the shutdown of many centers, 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.
6- Preparing marginalized 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.
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# Preparing children for climate-related disasters



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# Preparing children for climate-related disasters

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## Abstract

Climate-related disasters affect different dimensions of children's health and wellbeing 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 climate change mitigation programs 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, disaster's preparedness and education for children should be considered an essential activity to protect children from disaster's risks.

Main factors in shaping children's behavior 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 programs 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.

**Key messages**

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

## 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, 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 labor, separation, and child abuse in different forms[7-9]. Disasters affect different dimensions of children's health and wellbeing both directly and indirectly. Children under five 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 to 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 (i.e. infants), living conditions (e.g., bad infrastructure or lack of family support), ethnicity, disabilities, chronic diseases or preconditions. Attention to children before disasters should be an integrated with disaster's preparedness programs[13].

The distribution of climate-related disaster's risks is not similar for all children[15]. Intersecting social characteristics (e.g., gender, ethnicity, or social class), climate change vulnerabilities (e.g.), and health vulnerabilities (e.g., 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 health care[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 behavior[12].

Depending on their age, and levels of development children can be agents of behavioral 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 'behavior with activities such as: training children on environmental ethics and mitigation strategies, buying green or environmentally friendly products for children, and modeling of pro-environmental behavior[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[22], fifteen 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[23]. In the long term, participating children in climate change mitigation's programs leading 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, disaster's 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 organizations, communities, and individuals to effectively anticipate, respond to, and recover from the impacts of likely, imminent, or current disasters"[24]. The behavioral changes that lead to a child's preparedness for disasters depend more than anything upon two factors: increased knowledge and skills & risk perception.

The first factor in shaping children's behavior and response to disaster is knowledge and education[25]. Disaster education plays a major role in enhancing the awareness of children about disasters[25]. 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[26]. Disaster education for children can be conducted in schools, kindergartens, child welfare centers, or other child service centers. Schools play a critical role in disaster risk reduction because they facilitate the process of education of children on disaster risk reduction[27]. By utilizing appropriate policy framework, skilled teachers, textbook and curriculum for learning as well as peer education, schools provide

an ideal space for children disaster's preparedness[27]. Children's opportunities to access these sources of education are crucial factors. Their access could be simply by the 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 utilize 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 judgment that people make about the characteristics and severity of a risk"[28]. 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 [28]. For example, risk perception during COVID_19 pandemic in the world was higher than any other hazard. Therefore, people actively explored and learned protective measures.

Before COVID-19 pandemic, there were many programs conducted for preparing children in many countries. It is shown some examples in the Table 1. Most of the examples in various countries were conducted in schools.

*Table 1: some examples of Successful programs for children in climate-related disasters' preparedness countries*

| **Country** | **Successful programs for climate-related disasters' preparedness** |
|---|---|
| Chile | National disaster's education through drills for evacuation for major disasters, such as earthquakes and tsunamies[29]. |
| Cuba | National program 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[30]. |
| Indonesia | National school based disaster education (lecture, drill, curriculum)[31]. |
| Iran | Programs for children about first aid skills, evacuation drills, curriculum-based teaching resource for disasters education[32]. |
| Israel | Disaster education with lecture and drills for children[33], light search and rescue training of high school students in Israel[34,35]. |

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|---|---|
| Japan | Tsunami preparedness via evacuation drills[36], disaster management drill, firefighting frill, acquiring skill of rescue and first aid, and curriculum-based teaching resource[37]. |
| New Zealand | Shakeout drill (emergency evacuation)[38], The What's the Plan, Stan?, a voluntary, curriculum-based teaching resource for children disaster's preparedness[39], museum-based hazard education program on students, teachers and parents[40]. |
| Portugal | Using the disaster awareness game for enhancing disaster's preparedness, curriculum-based teaching resource, interactive resources[41,42]. |
| Turkey | National program that was titled 'Are We Prepared for a disaster?' for children[25] |
| USA | Shake out drill in schools and communities (drop, cover and hold on" drills for earthquakes and evacuation for tsunamis)[40,43,44]. |

**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. There was shown that isolated school-based programs increase disaster knowledge, but behavioral change is not forthcoming[45]. Virtual reality (VR) is a tool to facilitate disaster education and preparedness for children that its effectiveness was proved in many studies[46-48]. This tool could be used for evacuation drills[46,49], firefighting drills[50], first aid skills[51], 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 children with hearing impairment[52], and children with autism spectrum[53] to prepare for disasters.

Simulation games are another way to prepare children in different ages for disasters[54]. These games can be available via mobile devices and computers[55]. The effectiveness of simulation games for disasters' preparedness was proved in different studies and for different climate-related disasters such as flood[55,56], hurricane[57], and earthquake[58]. 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[59,60].

The Art is another effective way to prepare children for climate-related disasters[61] and safety teaching[62]. This tool is effective especially for preschool children[63]. It was shown that climate-related disasters' education can improve the quality of preschools children knowledge[64]. Disasters' education with art can effectively help preschool children to participate in disasters climate mitigation and disasters' preparedness activities[64]. Researchers in a systematic review found that programs designed for children 5-11 years old should have some characteristics including the involvement of children's parents, using behavioral modalities (rather than cognitive), and using interactive methods (play, art, stories, and games)[65]. In addition, it was recommended to prepared children with disabilities for disasters with art and storytelling[66,67].

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, e.g., first aid or preparedness for earthquakes, floods, and other disasters.

2- Children should be involved in climate change mitigation programs. They can be agents of climate change mitigation and advocate for that. Their participation will change the behavior 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 child care facilities.

4- Creating required resources, especially interactive resources, for disaster preparedness and removing the constraints to utilize 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 programs, 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. Upon the shutdown of many centers, 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 marginalized 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

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