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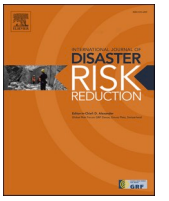

Unravelling dynamics of vulnerability and social media use on displaced minors in the aftermath of Italian earthquakes

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ABSTRACT

The uses of social media technologies in disaster risk management have been increasing in recent years, and a high number of studies have been produced with the purpose to investigate how social media can support disaster risk management processes. However, some criticalities in the use of social media, especially connected to limitations to accessibility, representativeness capacity, and the risks of disinformation and surveillance, have emerged and need to be further investigated. Accordingly, this work offers a critical analysis on how social media can impact post-disaster vulnerability, but also how it can be used as a tool for resilience by vulnerable people. In particular, the paper focuses on the challenges to which displaced minors have to deal with in post-disaster settings, following a series of large earthquakes which struck central Italy in 2016 and 2017. The results show that virtual space, and especially social media, is used by displaced minors to deal with the transformations that occur to the physical spaces of sociality. The virtual space becomes a potential source of resilience to help reconnecting with places and communities and working as a potential space of catharsis. The study is based on a series of semi-structured and in-depth interviews that took place in Italy between 2021 and 2022. The interviews involved participants with experience in disaster risk management in Italy, as well as with direct experience in the response and recovery efforts for the 2016–2017 Italian earthquakes.

1. Introduction

Social media platforms and technologies increasingly play a role in all phases of the disaster management cycle. Disaster affected communities utilise social media to communicate early warnings and hazard risks [1,2], to coordinate and crowdsource information, resources, and volunteers [3–5], and to stay connected and informed within one's community in the aftermath of an emergency [6]. In these processes, social media platforms have the potential to increase community resilience, by reducing vulnerability and empowering local stakeholders, giving them voices and connectivity, even within the most marginalized groups such as those with disabilities, migrants, the elderly, and minors (see e.g., Refs. [7–12]).

However, doing so effectively, requires considerations for associated risks which may further exacerbate vulnerabilities, such as those related to surveillance and the misuse of data and information [13]. It also means taking into account crucial factors in relation to

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the diversity and needs of local actors, such as ways to ensure equitable access and connectivity to the technologies and information (e.g., Refs. [12,14]). Not only must these needs be considered in relation to existing vulnerabilities, but also in light of new (or worsened) physical, social, and political limitations emerging in the aftermath of a disaster.

The interrelations among social media and vulnerability in disasters are complex and multi-faceted. They are underlined by political processes and power relations around the access and uses of technologies and data [15]. In this paper we explore these dynamics from the perspectives of individuals impacted by a series of large earthquakes which struck Central Italy in 2016–2017. The earthquakes left around 300 people dead and caused damages to an estimated 80 thousand real estates across the region. Tens of thousands were forced to evacuate the impacted areas and relocate to reception camps and eventually, for some, to temporary housing for extended periods. This resulted in limitations to movement and the impacts of imposed displacement, such as the loss of social relations and networks, and limitations to access and representation in the decision-making processes.

In this paper, we discuss the roles which social media played in the face of these impacts, both in terms of the risks/problems which emerged, but also how it was used as a tool for empowerment, sometimes in ways which were unanticipated. To do this we place a specific focus on the perspectives of minors impacted by earthquakes in Italy. This choice is based on the results of a literature review [12] which found an absence in studies on how digital technologies, and in particular social media, impact on minors' vulnerability or resilience capacity in post-disaster. Accordingly, this work has the main purpose to provide a first account that could be used as a research basis for future works in other disaster contexts. The results are further based on a series of in-depth semi-structured interviews conducted between 2021 and 2022 with 18 different stakeholders in Italy, with experience in emergency and post-disaster displacement.

Accordingly, the overall aims of this paper are to: 1) examine issues related to post disaster settings for vulnerable groups (namely minors), and 2) to assess and discuss the challenges and opportunities which social media may provide in these settings.

To address the aims in this paper, we adopt as a theoretical framework provided by Liverman [16], which focuses on the distinction between the vulnerability of geographical space and the vulnerability of social space, meaning in our case both virtual and physical spaces, as both coexist and are impacted by disasters. Vulnerability is investigated considering the levels of accessibility, connectivity, and mobility of the spaces object of analysis according to the model presented by Bonati [12]. This model is based on the conception of vulnerability as a dynamic property that is based on the intersectionality approach (see also the work by Orru et al. [17]).

Secondly, we take in account the role of social media in (re)building social and physical places as a tool to produce resilience. While social media can be an enabling tool in relation to resilience, its use can also have unintended – and sometimes intended – consequences for those whose personal data it includes [18]. This topic is related to surveillance, the systematic and long-term collection of personal data for the sake of control of unwanted behaviour [19]. Surveillance is a powerful means to creating and reinforcing social differences as in actual practices surveillance became a form of social sorting, which is a means of verifying identities and assessing the risks assigned to them [20,21]. Such a use of social media data can be a factor of disempowerment in disaster risk management.

In this instance, both physical and virtual surveillance are considered to understand how they can impact the vulnerability of displaced people. For instance, whereas surveillance in relation to social media is often discussed in terms of unethical uses of data to monitor and control citizens in a top-down fashion, it can also be used in developing horizontal relations and to establish contact and exchange services and goods [22]. Hence in this paper we are interested in how social media can also represent a means to escape a state of 'surveillance' endured by minors in traditional post-disaster settlements, where settings are defined by confinement and control.

Overall, the findings of this paper will show how the virtual space, and especially social media, can become a means to deal with the transformations and challenges that occur to the physical spaces of sociality in post-disaster settings, and thereby act as a tool for individual resilience building.

The paper proceeds in the following way. First, we provide a brief overview of the body of literature addressing vulnerability and displaced minors, also in relation to social media use in disasters, as well as the framework of analysis adopted. Thereafter we present the background and details for the case study of the Italian earthquakes and introduce the methodology for the study. In the final sections, we provide the results and discussion, followed by the conclusion which offers some commentary on the broader implications of the findings for the disaster risk management and the disaster risk reduction communities.

2. Theoretical premises and framework of analysis

In this paper, we consider vulnerability as a dynamic property. Vulnerability has been conceptualized as dynamic by social sciences, based on the idea that vulnerability is dependent on multiple factors (e.g., income, gender, race, level of schooling etc.) that change across time and places [17,23–27]. This approach follows studies on intersectionality, according to which within an apparently homogenous group there are diversity factors that produce different responsiveness (e.g., Refs. [28–30]). Thus, each individual could be vulnerable and resilient at the same time and this difference can be understood only if the diversity factors are taken into consideration and their mechanisms are understood.

For instance, while young people are considered among the most vulnerable groups in disasters, many examples in the literature and practice have shown the role that youth can have in improving community resilience e.g., in communicating risk, analysing the strategies to adopt, promoting and developing solutions and ideas, mobilizing resources and people, and building social relations (e.g., Refs. [31–33]). Accordingly, in disaster literature resilience is defined not exclusively as a property to reach the stability of the system (which could also imply the return to the condition of vulnerability [34]), but also as the capacity to adapt the system and modify it [35]. In particular, it is applied in this work to explain the capacity that individuals, especially the most vulnerable, have to adapt and elaborate solutions to deal with risks and disasters [36]. This is viewed from the perspective of social media as a potential means to

facilitating adaptation to new conditions, that for displaced people, and especially minors, is linked to the loss of their social and physical spaces.

2.1. Displacement and minors in post-disasters: an introduction

Evacuation and displacements caused by disasters, have been identified as important sources of trauma [37]. However, few studies take into account the effects that these processes have on minors ([38]; see also [39]). Furthermore, the needs and requirements that are taken into consideration after a disaster rarely take children into account [40]. This is problematic, as between the 20th and 21st centuries, some 66 million to 175 million children have been affected by disasters every year [41,42].

Some studies, as well as the United Nations Office for Disaster Risk Reduction [43], have shown that children and youth represent an extremely vulnerable group in disasters. This is because children, especially in the first years of life, are totally dependent on their parents (physical vulnerability), and older children experience various post-disaster effects linked to the processes of evacuation and displacement. Examples of this include being forced to live in a tent, losing friends and family, no longer going to school, and losing their daily routines and habits (social vulnerability) – all of which may have impacts from a psychological point of view [44] triggering a sense of disorientation and nostalgia [45]. According to Fullilove [46], this can be traced to the psychology of place. The theory is based on the assumption that people seek (need) a sense of belonging that is based on familiarity, attachment and identity, while displacement unhinges these feelings, replacing them with disorientation. This is particularly important for minors as 'children and youth attach to different types of places than adults and use these places for specific developmental tasks and satisfaction of particular psychological needs' ([39]; p. 9). In this regard, some of the effects of displacement on minors are linked to (Ref. [44]):

- Loss of the sense of belonging
- Forced change of the places of sociality
- Feeling of loss

Furthermore, aspects of accessibility (discussed also below) need to be considered in the analysis and in the processes of displacement, as a limited access to resources is usually associated with conditions of vulnerability in pre and post disaster also for minors [47]. However, children are not and do not necessarily represent passive victims during an emergency, as they can participate in disaster preparedness and prevention activities, working with the school and bringing home the lessons and behaviours to be followed in the event of a disaster [48]. In addition, children could be useful during the post-disaster reconstruction processes, as they could have practical and creative ideas. In particular, they could contribute as the first visitors of reconstructed places they use, like schools and playgrounds [48,49].

Overall, the resilience of minors can be improved by increasing their access to information, giving them roles as e.g., spokespersons of the behaviours and procedures to be followed in case of emergencies, making them responsible and encouraging their participation in response activities, providing them with physical and psychological support, and guaranteeing fair behaviour also with adults. Contrariwise, having uninvolved and uninformed children makes them more subject to a possible risk [50].

2.2. Framework of analysis

2.2.1. Kinds of vulnerability: Vulnerability of social and physical spaces

According to Liverman [16], the vulnerability of geographical space refers to where vulnerable people and places are located, while the vulnerability of social space refers to the people who are vulnerable in that place. However, as disaster literature shows, displacement could be a further source of vulnerability [51,52]. Adapting this distinction to our case, we discuss the vulnerability of the geographical space with considerations for:

- The vulnerability of the places hit by a disaster that is at the basis of the following processes of displacement and relocation, and of the constant sense of loss of the displaced people;
- How displacement and relocation could produce further vulnerability as a consequence of the challenges that arise from the place where people are moved, that is depending not only on the location, but also on the physical distance from the hometown and the pre-disaster social relations that are generated with relocation.

In this paper we also discuss vulnerability of social space, referring to the space of social relations and in particular:

- Who is most vulnerable in front of the disruption of the pre-disaster social life;
- How pre-disaster social relations are impacted by displacement and relocation and with which consequences.

As these two categories are related, and the one is dependent on the other, in the analysis of the case study in this paper a clear distinction is not always emerging. However, by adopting this approach, we want to show how the processes of displacement and relocation have a potential strong impact on the lives and social relations of minors, and how social media may be a means of resilience for them in post-disaster conditions. We highlight evacuation and displacement procedures as a particular emphasis on these processes emerged in the interviews and most of them have shown they are particularly challenging to the routines and lives of minors in post-disaster settings.

2.2.2. Variability factors: Social media and surveillance

Communication is a fundamental component in the different phases of the disaster management cycle since it can reduce the impact of the disaster or even prevent it. Social media represent innovative approaches to this kind of communication because they have the potential to increase the capacity of information, reliability, and interactivity among people [53]. The scientific literature on disasters

shows how social media could impact the capacity of people to be informed and act properly in different situations, such as overcoming difficulties (e.g., trauma after a disaster), reconnecting with others, and increasing the resilience of communities [54]. Moreover, these tools are useful before, during and after disasters, to receive information and guidelines, to send and receive help, to quantify the scale of an emergency, and to recreate the relationships among and within the communities that the disaster may have destroyed [8,9]. In addition, they are used by responding organisations and professionals to collect data for improved situational awareness, to create operating pictures and to enrich crisis communication and management (e.g., Refs. [55,56]). Accordingly, social media can work as an agent of resilience, supporting the emergency system but also the affected communities as discussed in this paper.

Secondly, surveillance, which is often recognized as a potential factor of disempowerment when discussed from the perspective of social media, is introduced to this analysis with the purpose to understand if physical and/or virtual surveillance could contribute to the vulnerability of the displaced people and especially minors and eventually how. Surveillance is usually understood as the enduring, systematic collection of data about individuals, their whereabouts and interaction with others in order to control their behaviour [19, 57–59]. While surveillance is used in crisis management and humanitarian actions for collecting data to enable needs-assessment, to shape (common) operational pictures, to create situation awareness and e.g., to surveil the spread of a virus in case of a pandemic, it is also used to monitor the behaviour and movement of individuals and their interaction with other to prevent them from doing unwanted and undesired actions and to violate the status quo [60,61]. The practice of surveillance, in this regards, leads to securitization defined by the thin line between imposing security measures and the curtailment of personal freedoms, and between public accountability and privacy [59]. In the context of disaster and crisis management the systematic collection of data about individuals, their whereabouts and their relationships may provide some certainty and sense of control, but it can also create 'perilous transparency' [62].

The dark side of such practices goes beyond the mere violation of privacy. It is the principle of social sorting, i.e. categorising individuals (often enabled by databases and online platforms) based on their backgrounds, that easily can lead to profiling and discrimination [20,21,63]. It will in particular hit those that are already vulnerable the hardest, for example refugees who strive to remain invisible to powerful authorities and gatekeepers [64]. However, social media is also used by refugees to inform themselves and others. Since refugees are marginalized groups, they cannot or will not always trust information from formal authorities. They consider social media information that originates from their social ties based on personal experiences as more trustworthy [22,65]. As a consequence, they often depend on personal, informal networks for information about for example border control and safe spaces. Social media, in other words, has a dual potential: it is or can be used by formal authorities for surveillance purposes, but it potentially also gives vulnerable groups more agency and the ability to stay connected.

2.2.3. Vulnerability dimensions: Accessibility, connectivity, mobility

This paper adopts three vulnerability dimensions to analyse how displacement can be a source of vulnerability for minors. The three dimensions interact with the diversity of the individuals, according to an intersectional approach, explaining what are potential limitations to and individuals resilience capacity. The dimensions are also used to understand the role that social media can play in producing/reducing vulnerabilities. Furthermore, they are applied both to the physical and social space vulnerability. High levels of accessibility, connectivity, and mobility are interpreted as positive and sign of high levels of resilience. Contrariwise, low levels of these dimensions are connected with higher vulnerability. The three dimensions have been established on the basis of a literature review provided by Bonati [12]. The vulnerability dimensions are used in the analysis of the interviews as criteria to identify situations of vulnerability and resilience (see a summary in Table 1).

By accessibility we mean the ability of accessing and using resources that ensure liveability [66,67]. Access to resources has been defined as a central point of vulnerability according to the starting point perspective [68] that is also dependent on social power relations existing in the different territories [14,69,70]. In relation to social media, accessibility refers to the availability of resources that give people the possibility to be connected (online) and connect with others and it is related to informational vulnerability [56]. In this paper, accessibility depends on the capacity of people to have access to information, aid, and physical locations. It is also related to the capacity to be represented into the society, that means to have access to the resources of the society to the same extent as the others.

Moving to the second dimension, as defined by Foley ([71] p. 257), connectivity is 'the capacity for connection, and how people experience the state of being connected, manifests at different spatial scales and in different forms, both material (e.g., roads, ferries, power and telecommunications infrastructure, etc.) and non material (e.g., familial and cultural links, governance structures, etc.)' (among the others, [72–74]). In this paper, the concept of connectivity is adapted and interpreted as the 'connection' or 'link' between individuals but also between the physical and social spaces, mediated by a technological support/devices.

Table 1
Vulnerability dimensions.

Vulnerability	Physical space vulnerability (depends on)	Social space vulnerability (depends on)
Accessibility	- Access to resources - Access to the territories	- Access to social networks - Access to social, organisational, and political representation
Connectivity	- Material connectivity (e.g. infrastructures efficiency)	- Non-material connectivity/to be connected with communities and networks
Mobility	- Capacity to move from one place to another - Mobility capital - Distance	- Capacity to mobilize people, ideas, resources - Mobility justice

Lastly, mobility can be defined as the physical mobility capacity to move from one place to another and is connected to mobility capital. It opens to considerations about justice and in particular about limits to accessibility, to mobility, and resources to move [75,76]. Furthermore, in relation to social media, mobility can be conceptualized as 'mobilization' ([77]; p. 735), 'a situation where new technologies afford disadvantaged groups opportunities for social participation [78]'. In this paper, mobility emerges especially in relation to accessibility, as the capacity to access alternative solutions to displacement and relocation. However, it is useful to note that part of the scientific literature also talks about mobility in relation to the capacity to mobilize resources, people and ideas, such as to activate experiences of volunteerism that could also be facilitated by social media use (e.g. Refs. [79–81]), and to guide mobilization in post disaster using big data (e.g., Ref. [82]).

Table 1 summaries the three dimensions in relation to physical space vulnerability and social space vulnerability. The table shows, in summary, that social media can facilitate processes of communication and citizens activation in disasters, i.e. intensifying information and ideas/solutions flow, supporting in mobility, and reducing distances.

3. Case study presentation

3.1. Overview of the main Italian earthquakes

Italy is one of the European countries which has a greater risk of disasters that are reflected in high human and economic losses at national level. The most occurring hazards are earthquakes, landslides, and floods [83]. From 1900 to nowadays, more than 30 earthquakes have been verified with magnitude (Mw) > 5.8 in Italy. From 1985 to 2017 Italy has supported over 45 earthquakes with $M_w > 5$. In particular, earthquakes generate extensive damages and deaths and represent one of the most disastrous hazards due to the impossibility to predict them, and the fact that they often impact large populous areas. One of the problems linked to earthquakes is that many people are left homeless, and this is reflected in the emergency management carried out by the civil protection. The most devastating earthquakes occurred in last decades in Italy are the Irpinia earthquake in 1980 with $M_w = 6.9$, Umbria/Marche in 1997 with $M_w = 6.0$, Abruzzo 2009 $M_w = 6.1$, Emilia Romagna in 2012 with two main shakes with $M_w = 5.8$ and 5.6 [84], and the last in Central Italy [85].

3.2. Central Italy earthquakes

The earthquake in Central Italy struck the night of the August 24, 2016 with a first shock of Mw 6.1, which significantly damaged Amatrice and the surrounding communities. This marked the start of the 2016–2017 Central Italy earthquake sequence [86]. Due to the moderate magnitude of the event, during this first shock 299 people died and a similar number of people were injured. Two months later, on 26 October another main-shock with Mw 5.9 struch, and four days later, on 30 October the largest shock of the sequence with Mw 6.5 hit the area in between the two previous events, seriously damaging Norcia and surrounding towns [87]. Fortunately, it caused no deaths, since the population involved had already been cautioned to leave their homes due to the previous tremors, but the number of people left without a home, as well as damage, grew exponentially [88]. Thereafter a Mw 5.5 earthquake with a centre south of Amatrice occurred in January 18, 2017 and it was the last substantial occurrence of the sequence [86]. The towns impacted by these shocks were included in the 'crater area'. The gradual extension of the area is represented in Fig. 1.

3.3. Management of the 2016–2017 central Italy earthquakes

Disaster management efforts began in the first days after the earthquakes with a deliberation of the council of ministers of the August 25, 2016, with reference to the law n.225 of February 24, 1992. The efforts were carried out and coordinated by the Head of the National Civil Protection Department together with the regional civil protection and the various components of the civil protection system, and also included contributions from volunteers. In the two to three months following the earthquakes, people were divided into containers and tents. Forty-three reception areas were set up and temporary solutions provided in multi-purpose facilities that were already present in the affected areas. Two months after the earthquake, most of the population had already found alternative accommodation and only one reception area remained in the territory [89]. After two months, many people were able to take advantage of the Sae (sistemi abitativi di emergenza, emergency housing solutions) directly underwritten by the Italian Civil Protection Department, and structures were set up for citizens whose homes were uninhabitable or in the "red zone" (interdicted to access) until the complete reconstruction of the territory [90,91]. Subsequently, due to the arrival of winter and the seismic events at the end of October that generated more than 32,000 people with the need for assistance by the Italian Civil Protection, it was decided to move the population into hotel facilities on the coast or in nearby towns (e.g., Lake Trasimeno for Umbrian people and the Adriatic costs for people from Marche, Abruzzo and Lazio regions). This was done so that the population could in some way resume their lives and activities, and the children could go back to school and resume the daily routine that had been lost with the earthquake and in the emergency camps [92]. The reconstruction process is still ongoing, as in the first post-earthquake years the process was carried out extremely slowly, and since 2020 it has been further slowed down by the COVID-19 emergency. In the first months of 2022, the last emergency housing solutions in many of the disaster areas were removed, which is a first step towards a possible return to normality. Accordingly, the state of emergency in relation to the earthquakes has been extended until December 31, 2022.

4. Methodology

The results presented in this paper are based on interviews collected during fieldwork activities. In particular, 17 semi-structured and in-depth interviews (with 18 interviewees) were conducted between 2021 and 2022 (for the framework used for structuring the interviews, see Nielsen et al. [93]; for in-depth interviews method see Baxter and Eyles [94]). The structure of the interviews has been

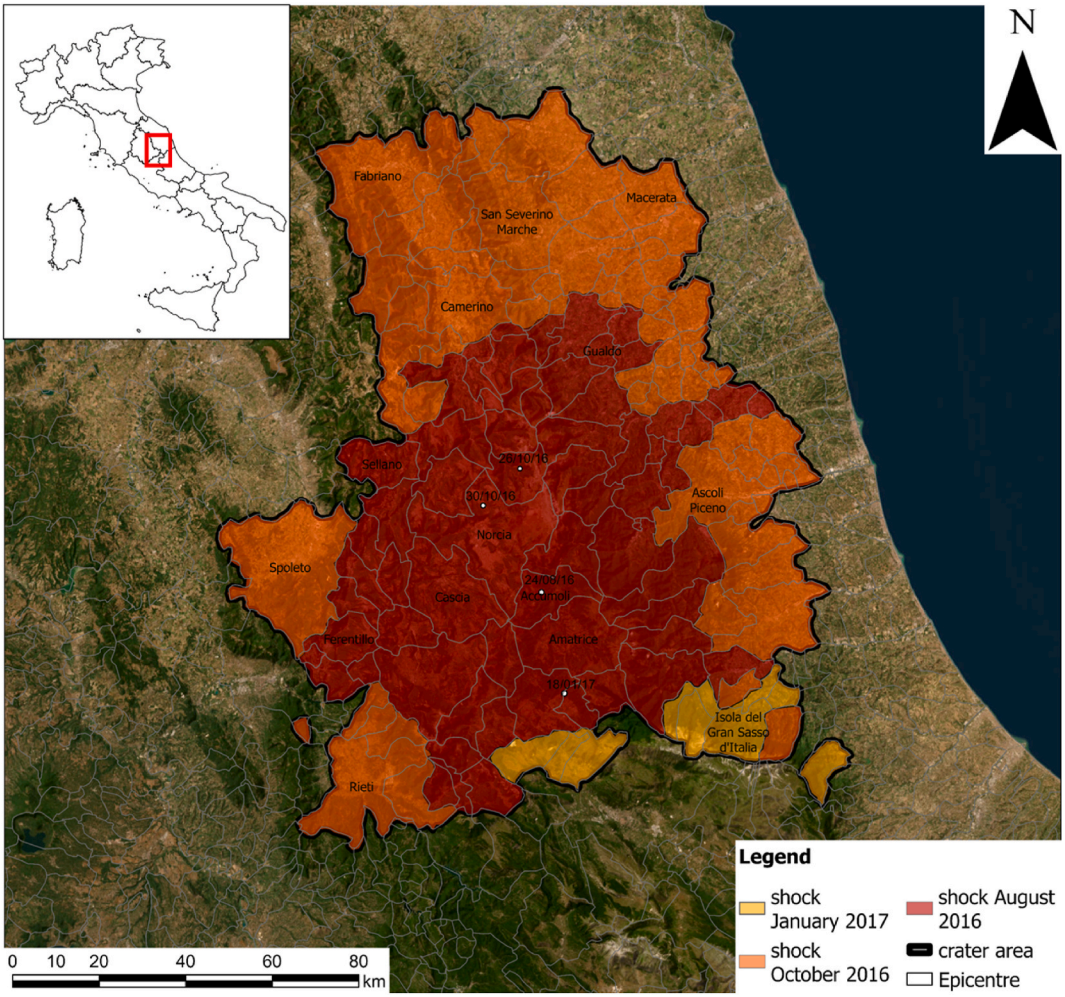

Fig. 1. Map of the crater area divided in three main zones according to the towns affected after the four shocks: August 24, 2016 in red, 26th and October 30, 2016 in orange and January 18, 2017 in yellow. Source: Map of the authors based on data from Ufficio Soprintendente Speciale Sisma 2016[21]. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article).

adapted according to the kind of interviewees and their specific field of experience. This paper focuses in particular on vulnerability, with a specific focus on minors, that was one of the topics discussed in the interviews. The main questions related to this topic discussed in this work are:

- Are vulnerable groups using social media and how during the emergency and in the aftermath of the disaster? What about minors? Which are the main social media platforms used?
- When you intervene to respond to a disaster, do you know/do you have information about the vulnerable people living there (who they are, where they live, what kind of support they need)?
- Which are the main challenges vulnerable groups face in the aftermath of the disaster? What are the main requests that vulnerable groups rise?
- What are the main needs of minors during the post-disaster? Which are the main challenges they experience and with which consequences on them e.g., in the tent camps and in the relocation places?

The interview participants were selected according to their experience in disaster risk management, focusing in particular on those who had direct experience of the 2016-17 Central Italy earthquakes. In particular, civil protection operators (8), politicians (3), NGOs operators (3), media (1), scientific community (1), and experts/technicians (1). Participants were selected according to a combined approach, purposeful sampling and snowball sampling [95]. We tried to ensure a gender balance in selecting the interviewees, as the number of males and females is quite similar; however, some differences persist especially among the governmental representatives (4 females and 8 males; a summary of the composition and associated ID for interviewee is presented in Table 2). This is reflecting a structural difference present in the organisations we consulted, especially if considering the managerial levels. When possible, the interviews were conducted in person, paying particular attention to the location, making sure there were no risks of being conditioned.

Table 2
Number of interviewees by gender, organisation type, and with interview ID.

ID	Organisation type	Gender	Number of Interviewees
ID2, ID7, ID8, ID10, ID11, ID12, ID13, ID15	Governmental Organisation	Male	10
ID3	Non-Governmental Organisation (NGO)		
ID16	Other		
ID1	Media	Female	8
ID4, ID17	Non-Governmental Organisation (NGO)		
ID5	Scientific Community		
ID6, ID8, ID9, ID14	GOV		

Furthermore, as interviewers, we applied disciplined subjectivity [96] and bracketing [97].

All the interviews were recorded and the participants' informed consent were collected. The average time for the interviews was about 1 h. In some cases, the duration went to 1h30 owing to the choice of the interviewees and to avoid interrupting them. The interviews were automatically transcribed with the support of NVivo software and a textual analysis was applied by the two authors involved in the case study analysis. The analysis was conducted with the following method: identification of the main topics emerged in the interviews and how many times they were mentioned; the topics were initially coded according to the main vulnerability dimensions and a more detailed coding process was applied when necessary; lastly an in-depth analysis of the meanings was done. For the coding phase, we started using the following: vulnerability, accessibility, mobility, connectivity, social media, surveillance, physical space, social space, pre-disaster, emergency, post-disaster; then we identified the interconnections between some of these topics, and also further codes emerged in the interviews (adultization, representativeness, physical accessibility/mobility, social accessibility/mobility, physical/social connectivity, political/organisational accessibility/mobility, physical/virtual surveillance, short-term displacement, long-term displacement). To conclude, a peer debriefing was done during data analysis.

5. Results

In the following section, we present the results from the interviews in two parts. First, we discuss the impacts of short-term displacement on those evacuated and relocated after the earthquakes, and thereafter we cover the impacts of long-term displacement and relocation in temporary shelters. In both instances, we focus on the impacts on minors and the challenges and opportunities which social media generate for them.

5.1. Short-term displacement: From the evacuation to the reception camps

In this section, the use and role of social media are discussed in relation to the physical and social space disruptions that follow a disaster with a focus on minors. This section is divided in 7 sub-topics that emerged as most relevant in the analysis. These include:

- Physical space vulnerability and social space vulnerability
- Emerging roles of social media: mobilizing information and re-connecting with the lost
- Information accessibility
- Relief/Organisational accessibility[3]
- Mobilization of minors and processes of adultization
- Access to youth friendly spaces
- Lack of privacy; surveillance.

5.1.1. Physical space vulnerability and social space vulnerability

Some of the families evacuated were transferred to tent camps waiting for relocation. Most of the challenges identified in the interviews in this phase of the post-disaster were connected to physical space vulnerability [16] and confinement especially in relation to the damaged places and the reception camps, which emerged as the main spaces for shaping vulnerability. However, this does not exclude the vulnerability of the social space [16] that equally emerged as relevant as long as it was connected to the loss of people such as the loss of contact and information about relatives, friends, and members of the community. As a consequence of the loss of the physical spaces, displaced minors are also losing those places where they could cultivate their social relations. On the topic, an interviewee said:

> *When a reception area is created, when you are looking for a place to make a tent camp, nine times out of 10 they offer you a sports field that effectively has all the characteristics to be used for this because it is fenced, with light, with energy, etc. However, there is the problem that if you have to keep people in the tent for a long time, the sports field is no longer used to play football and so what about the children/youngsters?* (GOV Id2)

As observed, the first response is not always considering the potential time that displaced people could spend in the camps,

[2] https://uss-sisma2016.beniculturali.it/ufficio-soprintendente-speciale-sisma-2016/.

[3] With relief/organisational accessibility we mean how the existing political and social organisational system works to include people in the decision-making process promoting e.g., processes of participation.

forgetting to re-create the social space that especially minors require to get their routine back. This is also connected to the lack of voice of minors in the decision-making process, as discussed below (relief/organisational accessibility).

5.1.2. Emerging role of social media: mobilizing information and re-connecting with the lost

Into this scenario, the messaging about the fragility of the territories dominated social media immediately in the aftermath of the disaster, as this communication way emerged as relevant in this phase:

> *2016 was the best example of emergency communication precisely because at that moment practically everyone was there on social networks, including institutions and administrations, Civil Protection and citizens. And the first thing I remember from August 24, 2016 is silence. There were only tweets from all citizens or institutions outside the area hit by the earthquake.* (MED Id1)

Similarly, as one of the interviewees explained (NGO Id17), it became important for the displaced people to check for news and updates about the situation of the places they left and the people that were part of their social networks. The vulnerability of the damaged places that was at the basis of the bleak post-disaster scenario, combined with the potential conditions of vulnerability generated by the amount of information shared immediately after the earthquake. In particular, the interviewee told:

> *In the response to the earthquake in central Italy we realised how central these technologies were especially in the response phase; how much these negatively or positively influenced the sharing of useful information concerning the lives of children and young people (and also the reference adults), in conveying truthful information, how much these could keep the directly affected population in real and immediate communication.* (NGO Id17)

Furthermore, the loss of social space emerged in the interviews as being apparently bridged by social media (virtual space) that could work as a place to escape and to rebuild a routine, and also to overcome the trauma. As an interviewee (NGO Id17) explained, technologies became a substitute for what has been lost and a means to talk about the experiences of the disaster. Accordingly, the virtual space could become an important source of resilience for minors, giving them the possibility to escape from the confined reality of the tent camps and to reconnect with previous social life or working to create a new one. However, although social media could, as told, support the process of catharsis (on this see e.g. Veer et al. [10]), on the other hand minors need to be guided to avoid the risks of abuse of these platforms that were used to take control of what happened:

> *After about two months we have seen empirically how much the boys/girls and preteens went to view, review and stay glued mainly to YouTube as a social channel (it was the most used) but also to other channels, to go to see and relive the seismic event and subsequent seismic events.* (NGO Id17)

Thus, the role of visual communication that is empowered by social media (images and videos in particular), emerged as important in this phase. Minors were not only focused on looking for but also sharing pictures and/or videos of their destroyed places (houses, school etc.) as a way to reconnect with what was lost.

5.1.3. Information accessibility

In general, information sharing was identified by most of the interviewees as one of the central points connected to this phase, in and out of social media, that could affect both adults and minors opening to concerns about the accessibility of information. The sharing of information was challenged by the access to information, for lack of both systems to receive quality information and target communication (discussed under 'institutional accessibility'). In the first case, the communication systems could have been damaged during the disaster or people could not have adequate technological support devices or knowledge to select the received information [98]. Furthermore, the rescue system could have difficulties to receive information about the aspects of vulnerability of the hosted community. As one of interviewees declared:

> *I have to assist the population so I have to know in my field those people I can let in and those people I cannot let in. I can't let everyone in, not because I'm bad, but because if there are people with certain problems, it's much better for them to be immediately transferred to a hospital, because living in a tent during an emergency could be extremely complicated and difficult* […]. *It might also seem like "segregation" but it is just a different use of my means for people who have difficulties* […] *A whole range of people who need dedicated assistance compared to others.* (GOV Id15)

This also points towards a problem of data management that seems to represent a potential obstacle to the management of the tent camps. As emerged in the interviews, this is related to the command-and-control approach, according to a hierarchy system between the different stakeholders involved in the response, that is translated also in an informational hierarchy that could affect the transparency of the process and the circulation of information.

5.1.4. Relief/organisational accessibility

In the second area of accessibility, communication towards minors was identified by some of the interviewees (NGO Id3 and Id17) as lacking: minors should have the same right to be informed on what happened and what is happening to them in the different phases of the post-disaster. This challenge is also related to issues of underrepresentation or invisibility into the response and recovery system and it is connected to what some of the interviewees have described as the need to be recognized as minors, children, adolescents. This opens issues about the accessibility at the social, political, and organisational level, that can be translated in terms of representativeness of all the social groups. This has not a direct relapse in relation to social media communication, however, it is a relevant point as long as it could be related to the lack of targeted communication, in favour of a unique communication, designed exclusively for adults. Although some interviewees recognized the need for targeted communication for minors (e.g., GOV Id12), there is not

significant evidence that this was done; most of the time the communication is not considered to be received by minors (directed to them) but to inform the responsible adults about what concerns minors.

5.1.5. Mobilization of minors and processes of adultization

This lack of attention towards minors could furtherly incentivize processes of exclusion, as well as the adultization of minors, especially adolescents, as already taking place like in Amatrice. As noted by the interviewees, in Amatrice adolescents and youth were the first to assist their relatives and members of their community as they were for the most out of the houses when the earthquake happened. This is because the earthquake struck on a summer night, out of the school time. Similarly, those who lost relatives or parents, had to react immediately, for example taking care of their brothers and sisters, or in some cases making important and quick decisions to survive. Even in the reception camps the process of adultization emerged as relevant as parents were usually busy to understand what to do and what about the future of their family. Thus, frequently minors could be left alone, taking care of the other children or simply facing the grim conditions alone.

5.1.6. Access to youth friendly spaces

Another important point, loss of personal space, emerged in the interviews as equally related to the obstacles to minors' growth processes and especially adolescents (on this see also [99]). As one of the interviewees told, referring to adolescents:

> *Their primary need is to have their own space because, even more than children, the earthquake reception camp is devastating for adolescents. Not only have they lost their bedroom, but they can't close the door* […] *We worked a lot on finding space that is also separate from that of the little ones. Youth friendly space.* (NGO Id3)

As the scientific literature shows, the room has an important role in identity building in adolescents, as it is the place where they can express their personality, gaining independence [100]. This is a place from which adults are usually excluded, creating a boundary that prevents adults from controlling the process of signification of this space. To support this point, the declaration provided by one of the assisted families by Save the Children Italy in one of the tent camps and published on their website states:

> *The night of the earthquake Roberta didn't notice anything, I woke her up. She did not suffer the earthquake itself but is now suffering the consequences of the earthquake. The house we lived in is no longer there, she no longer has her bedroom, she no longer has her toys, she no longer has anything: now we sleep in tents, here in one of the Amatrice tent cities. There are eight of us in the tent: me, my husband, Roberta, my parents, my sister and another person who is not a family member.* (from Ref. [101] [4])

Minors are those that mainly suffer from the lack of personal spaces where they can grow as individuals and spend their time alone. The lack of personal space should be associated with the temporality of the accommodation in the tent camps that, however, in some cases extends for long periods (around two/three months in 2016 Italian Earthquake). Furthermore, this situation could persist also in long-term displacement and is associated with limited accessibility to resources that ensure a family to identify an alternative solution for their accommodation. In this context, social media emerged as potential tools to escape from the confinement they were forced into, and to re-create a place (although virtual) of privacy.

5.1.7. Lack of privacy, and surveillance

The lack of space opens issues of conflict between the need for privacy and independence coming especially from adolescents and the need for control of the response system that is dominant in the short-term displacement in Italy. Indeed, the reception areas are borne as controlled spaces [102]. However, the dimension of control in this case is not particularly related to the checking-points per se but to surveillance and securitization, i.e. the sense of being controlled, as the lack of privacy that characterises the tent camps and that could generate the sense of being constantly under observation. As explained by the interviewees, usually more than one family shares the same tent and there are no private toilets or rooms. On the other hand, after the first days the checking point system in the camp could start failing. In this case, the lack of safe and secure access point to the camp could represent a challenge for the minors, that, as told before and emerged in some interviews, are usually left alone also as a confident reaction to the alleged security of the place, and for the emotional state of the parents and the particularly hectic situation.

To conclude, Table 3 synthetizes the results about short-term displacement. In this phase, especially accessibility is emerging as a central issue, although also aspects of connectivity and mobility have been raised.

5.2. Long-term displacement: Relocation in temporary shelters

Although the information collected in our interviews about the long-term displacement were limited in comparison with the short term due to the kind of interviewees we selected and the main purposes of our research, the information that was collected emerged to be important especially in relation to the potential role of social media in bridging people. This is discussed under four interrelated topic areas which emerged from the interviews:

- Vulnerability of the social space: need for connectivity
- Mobility as participation
- Re-connecting people/(re)building relations and communities
- (Re)connecting with places/(re)building places of sociality.

[4] https://www.savethechildren.it/blog-notizie/ad-amatrice-i-bimbi-tornano-giocare-nello-spazio-misura-di-bambino.

Table 3
Challenges for the short-term displacement and social media role.

Vulnerability	Physical space vulnerability	Social space vulnerability	Social media role
Accessibility	Limitations to access to resources and places (e.g., home) due to the damages of the disaster. Loss of private/personal space, loss of youth friendly spaces.	Possible lack of means to communicate and keep in touch/know what happened to friends, relatives, members of their community (*information accessibility*). Lack of targeted information (*relief/organisational accessibility)*. Need to process the disaster.	Means to be connected with community members to maintain social networks, to relive the disaster and share information. Excessive use of social media to relive the disaster (es. YouTube).
Connectivity	Loss and lack of spaces for socialising and leisure.	Loss of people, friends, families, social networks.	Social networks as a place where to spend time and meet people. Cathartic power of social media.
Mobility	Loss of freedom to move due to confinement in closed and surveilled spaces.	Risk of adultization of minors (mobilization of minors in emergencies).	Social networks as a place where to escape and create private spaces.

5.2.1. Vulnerability of the social space: Need for connectivity

In the long-term displacement, what emerged as most relevant was the vulnerability of the social space, that was challenged by the difficulties to stay in touch, to be connected, with their community/network, where connectivity has a strong spatial dimension, represented by the degree to which places and people are connected at different levels throughout the space. Furthermore, the role of the physical distance created by the relocation and the need to adapt to a new environment for a not well-defined time was identified as equally relevant. About this it was said:

> *Before they* [displaced people] *were moved to containers, with people who stayed inside for years and years, now you have to move them from the tent to the house but in my opinion it is impossible. You have to decide to move people far but they don't want to go because they completely lose contact with the community, the aggregation, the society. Even when you put people in tents you tend to put people close to their neighbours.* (GOV Id2)

The issue of the time of the post-disaster becomes central, as post-disaster relocation usually loses the dimension of temporality it should have due to the long time required by reconstruction. In Italy the reconstruction phase started in 2018, two years after the 2016 event occurred, and it is still going on. People were housed in prefabricated buildings, hotels, rural emergency modules, municipal facilities, containers, or rented housing [103]. This has strong implications on the social life and networks, producing de facto a total uprooting of people from their lives. Indeed, the physical distance generated by the relocation, produced a final dismemberment of the community, as displaced people were moved in different and far places. This is, for example, the case of displaced people in Marche region, e.g., habitants of Arquata del Tronto. Most were moved on the coast, which is (at the closest point) at about 60 kms from the affected area (and could require around 1 h by car). In addition, also the time of the reconstruction (that is still going on) facilitated the social dispersion.

5.2.2. Mobility as participation

This opens a point about the need for participation in the reconstruction process considering moving from the traditional top-down approach, applied in Italy, to a bottom-up model as frequently also auspicated in the disaster literature (e.g., Refs. [102,104–106]). As another interviewee explained:

> *People were not adequately involved in rethinking their territory. People did not have the opportunity to say their opinion on the recovery and reconstruction of their territories. So much attention was given to material reconstruction, to physical construction, without thinking to a 360-degree reconstruction, which starts from the acquisition of the communities.* (NGO Id4)

This is furtherly evident considering the needs of minors, who already are victims of invisibility and exclusion of short-term displacement, and are among the most impacted in the process of relocation. However, this point is in general connected with the need to consider the implications that the time of the reconstruction has on people lives and thus how they should be involved in the decisions related to the long-term displacement.

5.2.3. Re-connecting people/(re)building relations and communities

In this situation, the need for re-connecting with the others, both members of the previous community and the new one, could and should become a priority. In this scenario, the virtual world could play an important role to supply to the system shortcomings as the case study and the literature on social media showed. In particular, technologies could work in reducing spatial distances [7,107] and in reconnecting with others, e.g., to share common worries and, as [108] stated and was observed in the previous section, to pass on information. Furthermore, the Internet could become a therapeutic platform where emotions and experiences can be shared, 'as a means for victims to both access information as well as bring a community closer together through residents sharing their experiences' [10]; n. p.). In the specific scenario, social media gave minors the possibility to reconnect and maintain relations over time, using these tools to find their friends, connect with them, see how they are and what they do, exchange information, and support each other.

5.2.4. (Re)connecting with places/(re)building places of sociality

As discussed in the previous section, the dynamic of the disaster was fresh in the minds of the displace and it was difficult to move ahead. However, the focus in this phase was not simply to forget what had happened, but rather to restart with life, creating

relationships into and with the new places:

> *They* [displaced minors] *had created their meeting place in this new area of the city and this was their new centre because the impossibility of having their park in Amatrice, their wall where these teenagers met, often returned. There was always and always the melancholy, the nostalgia, the lack of that past and now destroyed place.* (NGO Id17)

Thus, the purpose of the recovery phase (interpreted as personal recovery to empower communities as anticipated in the introduction) was also to help minors to move their attention from representing the past, what happened, to representing their present, e.g., where they live now, what they do etc. They left something and they need to physically take possession of the place where they are living now (human agency). This is in line with the scientific literature discussing orientation and disorientation in post-disasters and the role of place in the recovery phase (e.g. Refs. [109,110]; in Refs. [111,112,[113]). Humans are embodied beings, oriented and situated into places, and as Casey [114] says, the body works as a bridge to link places and selves. Accordingly, the role of bodies becomes central, as physical and social occupation of the space, to produce emotional attachment to the new house and reduce risks of disorientation in post-disaster. As emerged in some of the interviews, social media could work as mediators in this transition, tangibly confirming, for example through the use of sharing photographs, the relationship established with the place and proving its physical occupation as well as sharing the new meanings place acquires in the process. But social media could work also in a preliminary phase, in exploring and discovering places. Thus, social media were used both to receive information and learn about places and to create linkages with them.

Below, Table 4 shows the summary of the main challenges associated to long-term displacement and what is the use of social media identified in the interviews. In this case, accessibility, that was the most relevant in short-term, does not appear here. This is not because it is not anymore present as challenge but because it acquires a secondary role in this case, where connectivity becomes central and it is associated with the need to mobility/mobilize to change the situation and create connections.

6. Discussion

On the basis of the analysis, a systematization of the main challenges identified can be provided here. Most of these challenges are connected to the loss of identity places, involving both the physical and the social space, with implications on the use of social media that are intrinsically connected with aspects of accessibility, connectivity, and mobility capacity of the displaced people, and in particular:

- Loss or limit to the access to information, home, school, meeting, and leisure places (also in terms of physical mobility)
- Loss of personal space and privacy
- Loss of family, friends, and social relations (be disconnected from the community)
- Exclusion from the process of recovery and reconstruction.

The first point is particularly characterising the places close to the epicentre of the earthquake and with higher level of susceptibility, as most of the buildings could have been destroyed or under serious damages and thus forbidden to access. This could be translated also in reduced capacity to access information in real time due to e.g., the disruption of the infrastructures. In some cases, the damaged areas end up under the surveillance of military forces, as happened for example in Accumuli, without any possibility for people to access their own assets. This approach is associated to a command-and-control system that focuses on the capacity of the system to control people and their movements and to not give space to spontaneous initiatives [102]. This opens also to risks associated to the loss of the sense of belonging [46] and of the places of sociality, producing the feeling to be lost [44]. Furthermore, the command-and-control model could have repercussions on the communication strategy adopted during emergencies, for instance efforts by authorities to control the flow of information during all the phases of the disaster. However, social media are usually escaping the control practices, producing amounts of (dis)information that could require high levels of work and resources to address the impacts of spreading of disinformation and fake news. This could have consequences also on the trust that people have in the official information flow and their level of situational awareness [56].

The second point refers to the loss of personal space, both at home and outside the home. This is another consequence of the displacement and relocation processes, as families are losing their homes and usual places and need, especially for the first phase of the post-disaster, to adapt their lives to new spaces, like tent camps or makeshift housing. This situation could persist as long as they are transferred to temporary shelters, like hotels, relatives or friends' houses, but also during the reconstruction phase, as long as people are accepting to live in temporary houses waiting for their home to be rebuilt. The forced mobility is particularly exacerbated for those families that have no alternative solutions like second houses or relatives able to host them in the aftermath of the disaster and that are forced to accept top-down relocation processes. Furthermore, this was identified as a really important point in minors' life and especially adolescents who are living a phase of conquest of their independence. This is a consequence of the social and geographical differences [14], such as power disparities that exist in a territory and that create social hierarchies in the emergency [47,69]. Accordingly, the access to social networks in this phase become a need. As observed, the access to internet and e.g., to a smartphone could become important factors for affected people to re-establish their social networks.

This is connected to the third point that is related both to the loss of people who lost life during the disaster and to the process of displacement that produces the dispersion of communities and families. Both in the second and third point, social media could represent a supportive tool, as they can give minors the possibility to:

- feel newly part of a community (reconnect with the past and access to a new community [71]);

Table 4
Challenges for relocation phase and social media role.

Vulnerability	Physical space vulnerability	Social space vulnerability	Social media role
Connectivity	Need to adapt to a new environment. Need to be connected with the new home.	Removal and dismemberment of communities. Need to be connected with people.	Means to discover and adapt to the new places.
Mobility	Physical distance with the hometown and friends; difficulties to reach them. Need to identify new sociality places.	Lack of participation in the recovery phase. Need to rebuild communities.	Means to reduce distances and rebuild sociality.

- help in rebuilding and taking physical possession of places (mobilizing for change [77]).

Thus, what emerged in the analysis is that social media represent a potential space for sharing and catharsis also for the minors, as already discussed for other vulnerable groups [10]. Although all displaced people experience challenges associated with displacement, what is evident is that those who have limited accessibility present higher levels of vulnerability in front of them, confirming what the literature about disasters states [47]. In particular, their benefits are dependent on the following aspects of accessibility:

- Availability of resources, like technologies, gigas, etc.
- Availability of infrastructures that support adequately the online traffic
- Availability of solutions to reduce the risks of data sharing.

The last point is about the exclusion-invisibility that especially minors could experience during the post-disaster and reconstruction phase where they are usually not considered in the decision-making process, for example not receiving adequate information on what will happen to their future. Accordingly, three levels of loss and control are emerging, introducing also the issues about surveillance in the analysis: the physical, the social, and the political, meaning with the first, the physical limitations to movement or displacement imposed (mobility capacity), with the second the loss of social relations and networks (connectivity capacity), with the third, the limitations to access and to be represented in the decision-making process (accessibility capacity). In this case, the sense of representation and belonging is also associated to the capacity to communicate and social media represent one of the means for this scope, such as to continue to feel part of a community or a social network.

6.1. Future work

This paper represents the first documentation of the role of social media in defining vulnerability in post disaster settings, in relation to displaced minors. We observed a lack of studies that discuss the use of social media done by displaced minors in post-earthquake. We believe that social media plays an important role that needs to be further investigated in the future both for increasing and reducing vulnerability in displaced people. This consideration is based on the idea that the opportunities and challenges that social media have offered in relation to this specific context could be equally identified in other risk and disaster scenarios, especially in those situations that force displacement.

As this analysis was based on a specific case study, the aftermath of an Italian earthquake, further studies are needed in other geo-socio-cultural contexts and in different hazard scenarios. Further studies could also be useful to provide further evidence on how social media could support the recovery process, not only as a physical process but especially as a social one. The role of social media in facilitating participation and inclusiveness and rebuilding relationships between places, distances, and bodies should be further investigated.

Furthermore, although not significant, aspects of technological surveillance did emerge in the analysis, and we have observed that surveillance is an important point to consider and one that could be further investigated in terms of:

- The growing demand for information and data, as well as the need to control populations and the mechanisms at the basis of the top-down approaches which could pose problems in the future;
- Surveillance is dominating the mobility capacity of people in post-disaster scenarios, especially homeless people, opening issues about place attachment and disorientation, as well as giving space to situations of social conflict related to confinement and interdiction;
- The absence of control over how minors' uses of social media could expose them to new risks, especially during the convulsive phases of the post-emergency when the attention from adults can be reduced;
- Social media is a potential tool to escape from the condition of 'physical surveillance' dominating evacuation and relocation processes.

7. Conclusion

This paper has set out to 1) examine issues related to post disaster settings for vulnerable groups, specifically minors, and 2) assess and discuss the challenges and opportunities which social media may provide in these settings.

Using a framework that considers vulnerability as a dynamic property across both physical and social spaces, we identified issues related to post disaster setting. For short term displacements, this included a need for information and relief/organisational accessibility for minors, forced process of adultization, and absences in child friendly spaces and privacy. Here social media provided windows of opportunity to (re)connect with others and with lost places, discuss shared trauma and experiences, and find escape through

virtual spaces. In long term relocation, social media also has the potential to (re)connect people and mobilization participation in the rebuilding of both communities and physical places. Moreover, social media may also provide agency and privacy for minors (and other vulnerable groups) in conditions defined by top-down control and even physical surveillance.

What emerges is that social media can offer a "virtual space" to bridge the gaps left in physical and social spaces following disasters. Indeed, social media can help those impacted by disasters reconnect over and even rebuild physical spaces. Furthermore, it can be used to reduce the level of isolation to which some people, especially minors, are confined and to share their circumstances with others in post disaster settings. In this context, minors cannot be solely confined to the condition of vulnerability, as they showed resilience capacity and that social media can support them on this. However, also in this case, accessibility becomes a key-word, as it is important to ensure that all minors have the same possibility to access these communication systems.

Importantly, the analysis does not want to obscure, but rather highlight, the fragility of post-disaster management. Social media may become a means to escape from the stressful situation, unable however to not solve the basic problems of displacement and relocation, such as the challenges associated with pre-disaster vulnerability. For example, social media can become a danger for minors who are exposed not only to the well-known risks, i.e. of solicitation of minors, fake news, fake identities, but also to the risks of 'replacing' real life with a virtual one to remain anchored to their lost past. This means that social media could be a useful tool if they are used into a protected space, where minors are guided in their use by specialised personnel that could help to avoid the risk of the online as, for example, happened in some of the camps in 2016 Earthquakes thanks to the work of local NGOs.[5]

To conclude, this work has provided the first direction towards research on social media potentials in post-disasters, especially focusing on displaced minors. Further works on the topic are required to unravel the challenges associated with these topics, such as on the ways technologies could divert attention or highlight the fallacious mechanisms of the post-disaster response system.

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Authors' contributions

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Declaration of competing interest

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

Data availability

The data that has been used is confidential.

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