## EARTHQUAKE RISK PERCEPTION, COMMUNICATION AND MITIGATION STRATEGIES ACROSS EUROPE

Piero Farabollini, Francesca Romana Lugeri, Silvia Mugnano Editors











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Editors





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# 8. Food management in disasters: the case study of the earthquakes of 24 august 2016 in Central Italy

Fausto Marincioni<sup>1</sup>, Eleonora Gioia<sup>2</sup>, Mirco Zoppi<sup>3</sup>, Elena Vittadini<sup>4</sup>

#### Abstract

Access to safe food in the aftermath of a disaster is pivotal to ensure the survival and well-being of victims and rescuers. This study investigates food management in the case of the earthquakes of 24 August 2016 in Central Italy, assessing survivors' ability to access food (food security) and the field kitchens practices to ensure hygiene and avoid food-borne disease outbreak (food safety). The study was carried out administering questionnaires one month after the events, to field kitchens users (population hit by the earthquake and volunteer workers) and operatives. Five field kitchens located in the municipalities of Accumoli and Amatrice, in the Lazio Region, and in the municipality of Arguata del Tronto in the Marche Region, were examined. Results suggest that the food quantity, quality and the waiting time at the dining area were overall satisfactory. Almost all interviewed population and volunteer workers declared easy access to proper and abundant meals. Field kitchens operatives claimed both access to fresh ingredients, in quantities far exceeding the needs of the served communities, and availability of the necessary resources (technical and human) to guarantee controlled and safe conditions during preparation and distribution of food. The results of this study are synthesized in a model describing the various aspects that need to be address in order to properly manage food services during a disaster.

Keywords: Food emergency management; Field kitchen; Earthquake disaster; Italy

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#### 1. Introduction

After a disaster hits a certain area, besides providing temporary accommodation to the survivors, rescuers must arrange also for food assistance for the immediate aftermath and for the recovery periods. This particular kind of food management can be divided into three phases: (i) immediate; (ii) sustained; (iii) long-term (U.S. National Mass Care Strategy, 2015). The immediate phase includes the first 72-96 hours after the occurrence of the event. Here, the organizations responsible for dealing with the food emergency are activated and intervene using their own and available local resources, providing the food necessary to ensure survival, such as water, sandwiches, pre-packaged foods, etc. In the second phase, the sustained one, all the infrastructures necessary to provide an adequate nutritional response are set up. The goal is to prepare and distribute cooked meals, snacks and drinks to the population, using fixed or mobile field kitchens. Finally, in the long-term phase, the focus is to restore the utilities which allow the population to start preparing their own food independently.

There are international guidelines on emergency food management aimed to develop universal humanitarian intervention standards to support populations affected by disasters (e.g. Sphere Association, 2018). According to these guidelines, the two basic aspects to comply during a post-disaster food preparation and distribution are food safety and food security. The term "food safety" indicates the set of conditions that guarantee the good quality of food or drink, from a hygienic-sanitary point of view, during all stages of the food chain (FAO, 2006). The term "food security" indicates the set of conditions that ensure the availability of sufficient quantities of food to provide adequate nutrition (*ibid*).

There is abundant bibliography that covers food safety and security in humanitarian crises and disasters in the developing countries (Pingali et al., 2005; Rukundo et al., 2014; Tsuboyama-Kasaoka and Purba, 2014; Sonnino et al., 2016; Wrabel and Caiafa, 2019). This line of research attempts to understand the local conditions that led to the food emergency, in order to better define the short- and long-term strategies necessary to overcome the state of crisis (Marincioni, 2015). However, to the authors knowledge, little has been done for analyzing the food management in the aftermath of a disaster in the developed countries.

In Italy, food management following a disaster is mostly carried out by volunteer organizations, which has been previously identified and selected by the Civil Protection, as set in the Decree Law 1/2018 named "Civil Protection

Code". This study analyzed the management of the food services after the 24 August 2016 earthquakes, which involved several regions of central Italy (Lazio, Abruzzo, Marche and Umbria). Data collection was carried out through the administration of questionnaires, one month after the events, to two target groups: (i) the population hit by the earthquakes and the volunteer workers who used the services of the field kitchens, and (ii) the volunteers operating the field kitchen. Five campgrounds and related field kitchens located in the municipalities of Accumoli and Amatrice, in the Lazio Region, and in the municipality of Arquata del Tronto in the Marche Region, had been examined. The aim was to evaluate the food management in the aftermath of the earthquakes, by verifying if the conditions of food safety and security had been respected during the immediate and sustained phases of the emergency. Users' experience with the field kitchen services was investigated assessing, inter-alia, the quantity, the serving temperature and the waiting times for food distribution.

#### 2. Case study: the earthquakes of 24 august 2016 in Central Italy

#### 2.1. The seismic events

On 24 August 2016 two significant earthquakes hit Central Italy, a Mw = 6.0 event with an epicenter in the municipality of Accumoli, Lazio Region, recorded at 3.36 (UTC + 2), and a Mw = 5.4 event with an epicenter in the municipality of Norcia, Umbria Region, recorded at 4.33 (UTC + 2) (Pucci *et al.*, 2016). The ensuing infrastructural collapses killed 299 people and injured 365 others, while 4807 had been displaced requiring temporary assistance from the Civil Protection (Italian National Civil Protection Department, 2016a). The most affected municipalities were Arquata del Tronto (Marche Region), Accumoli and Amatrice (Lazio Region) (Pucci *et al.*, 2016). A total of 29 campgrounds were set up: 17 in Accumoli and Amatrice (Lazio Region) and 12 in Arquata del Tronto (Marche Region).

#### 2.2. The response phase

The emergency response system was activated in the very early phases following the quakes. Reception camps and field kitchens were set up in the following days, and voluntary civil protection personnel on site was guaranteed. The Region with the highest number of displaced people was Marche, where within a week after the earthquake 2776 persons were assisted, either in the 12 reception camps or in the hotels along the Adriatic coast (not damaged). The municipalities most affected in the Marche Region were: Acquasanta Terme, Amandola, Arquata del Tronto, Castelsantangelo sul Nera, Montegallo, Montemonaco and Montefortino. Many governmental and volunteer organizations worked with the national and regional civil protection departments (e.g. the National Association of Public Assistance - ANPAS, the fire department, the Carabinieri corps, the Red Cross, etc.). The Marche Region civil protection department coordinated 50 full time workers and about 350 specialized volunteers operating across the affected areas; half of them were employed in Arquata del Tronto, dealing also with the distribution of meals to the displaced population and to the civil protection volunteer.

In the Lazio Region, 17 reception camps and 3 "micro-camps" were set up and managed by the Lazio Civil Protection, the Italian Red Cross, the Friuli Venezia Giulia, the Molise and the Tuscany Regions as well as various voluntary associations. The municipalities most affected in Lazio were Amatrice and Accumoli. As of 29 August 2016, in the municipality of Amatrice a total of 526 displaced persons and 210 volunteers and Civil Protection workers were hosted in four main reception camps and three "micro-camps" (hosting 20 people each). In Accumuli three reception camps hosted a total of 134 displaced persons and about 80 volunteers and civil protection workers.

#### 3. Methodology

In order to verify if the conditions of food safety and security had been respected during the immediate and sustained phases of the emergency, questionnaires were administered to victims, emergency workers and volunteers of five field kitchens set up in the various reception camps (Table 1).

The studied field kitchens were selected among those active at the time of the surveys, carried out from 23 September to 1 October 2016. The reason of this specific timing for the survey is that after one month it was possible to evaluate both the immediate and the sustained phases of the emergency, because the former was over and the latter with its food supply chain was fully established.

For the sampling, an accidental non-probabilistic technique (Sarantakos, 2005) was used. Through this technique, each individual met during meal times at the field kitchens canteen was considered valid unit for the purposes of the investigation (Bird & Dominey-Howes, 2008).

#### 3.1. The field kitchens

Two of the five studied field kitchens were located in the Marche Region, in the municipality of Arquata del Tronto (hereafter "Arquata 1" and "Arquata 2"), managed respectively by the Citizen's Club Enrico Mattei, and by the Marche Region Committee of ANPAS. The other three studied field kitchens were located in the Lazio Region; one in the municipality of Accumoli, managed by the Tivoli Radio-Rescue Volunteers Association -AVRST (hereafter "Accumoli"), and two in the municipality of Amatrice (hereafter "Amatrice 1" and "Amatrice 2") managed respectively by the Lazio Region Civil Protection and by the national coordination of ANPAS. Table 1 lists the field kitchens surveyed, Figure 1 shows their locations and Figure 2 shows a collage of some pictures taken during the surveys.

Field	D1	Managing	N° of Questionnaires		
kitchen ID	Flace	association	Population	Volunteers	Operatives
Arquata 1	Arquata del Tronto	CB Club Enrico Mattei	90	-	5
Arquata 2	(Marche Region)	ANPAS (Marche Region)	-	12	5
Accumoli	Accumoli (Lazio Region)	AVRST	-	-	5
Amatrice 1	Amatrice (Lazio Region)	Lazio Region Civil Protection	92	-	5
Amatrice 2		ANPAS	-	15	5

182 27 25

Table 1 - List of the five field kitchens selected for the study, their location, the managing volunteer associations and the number of collected questionnaires in each of these field kitchen's precincts.



Figure 1 - Map displaying the location of the five field kitchens selected for the study



Figure 2 - Pictures of the surveyed campgrounds and field kitchens: (a) the dining area in Amatrice 2, (b) the field kitchen in Amatrice 1, (c) campground in Arquata 1, and (d) example of menu in Amatrice 1 (copyrights of the Authors).

#### 3.2. Structure of the questionnaires and survey

Two questionnaires had been developed to collect data. Questionnaire 1 was calibrated and administered to the population and the civil protection volunteers who used the dining service, whereas Questionnaire 2 was designed for the field kitchen operatives.

Questionnaire 1 consisted of 19 questions, mostly multiple choice and open-ended types, divided into 4 sections: (i) availability of food resources after the earthquake (questions 1-5); (ii) quality and quantity of food provided

by the field kitchen (questions 6-7); (iii) overall experience with the field kitchen services (questions 8-13); (iv) demographic data, such as age, sex, and family status (questions 14-19). Specifically, in the first section the focus was on the time elapsed from the earthquake event to the first access to drinking water and food (questions 1 and 2) before the field kitchen was set up (question 3), and before the dining services were activated (question 4). Furthermore, it was asked how long had passed before it was possible to independently gain access to food and drinks (e.g. shops, farms, relatives, etc.) (question 5). In the second section, the adequacy of the quantity (question 6) and the serving temperatures (questions 7a, 7b and 7c) of the food were evaluated. The third section investigated the waiting times for food distribution (question 8), the cleaning of the field kitchen areas and utensils (questions 9 and 10) and the possible onset of illnesses due to the food served (questions 11a and 11b). Then it was asked to evaluate the overall experience with field kitchen services (questions 12 and 13).

Questionnaire 2 consisted of 30 questions, mostly multiple choice and open-ended types, divided into 6 sections: (i) installation and operation of the field kitchen (questions 1-5); (ii) menus and users (questions 6-7 and questions 17-20); (iii) equipment (questions 8-11); (iv) type and availability of food (questions 12-16); (v) hygiene and controls (questions 21-22); (vi) demographic data, regarding the role of the interviewees and their organization (questions 24-30). Specifically, in the first section were investigated how much time has passed, after the earthquake, before the field kitchen started working (question 1), before drinking water (question 2), electricity, and gas (question 4) were available, and whether this availability was adequate to the situation (questions 3 and 5). In the second section, it was investigated how many meals were served on average for breakfast, lunch and dinner (question 6) and who were the main users (question 7). Responders were asked to provide examples of daily or weekly menus served (question 17), or requests of special diets (e.g.: low-calorie diets, diets for celiac) (question 18). In this section field kitchen volunteers were also asked to describe the relationship with the people they served / field kitchen's users (question 19). In the third section, it was asked whether the equipment for food preservation (question 8), cooking and processing (question 9), distribution (question 10) and for cleaning food and utensils (question 11) were suited for the emergency use. In the fourth section, it was asked if the type of ingredients (question 12) and quantity (question 13) were enough. The qualitative aspect of the food, namely if it was sufficiently fresh (question 14) and accessible (question 15), was also investigated. Furthermore, it was considered the quantity, type and utility of donated food (question 16). The fifth section of the questionnaires assessed the hygienic conditions of the field kitchens (question 21). Lastly, the interviewees could report their own considerations, experiences with the field kitchen and provide recommendations to enhance the services (question 23).

#### 4. Results and discussions

A total of 234 individuals answered the questionnaires; 182 residents, 27 volunteers, and 25 field kitchens operatives (Table 1).

The demographic statistics of Questionnaire 1, administered to local population and volunteers, are summarized in Table 2. The various categories of respondents had been evenly distributed between women and men, except for the volunteers in Amatrice. Four age groups were also defined: <25-year-olds (youngsters), 25-year-olds to 45-year-olds (young adults); 46-year-olds to 60- year-olds (adults), and >60-year-olds (senior citizens). All the age groups were well represented, especially among the population, while most of the volunteers were young adults (58% in Arquata and 47% in Amatrice). The population interviewed were mostly employees (39% and 48%), freelancer (20% and 19%), students (10% and 15%), and retirees (22% and 11%). A similar distribution was obtained among the volunteers in Amatrice. Half of the interviewed were married, except for the volunteers in Amatrice the majority of which (87%) were not married. Finally, most of the respondents had neither underage (>58%) nor adult (>53%) children.

The analysis of the availability of food resources after the earthquake (Table 3), pertaining to the immediate phase of the emergency, shows that most of the population of Arquata (92%) and Amatrice (73%) had drinking water within 6 hours and food within 12 hours (94% and 74% respectively) after the earthquake. As for the setting up of the field kitchen, the population of Amatrice waited less than 12 hours (57%), while in Arquata had to wait more than 2 days (57%). An interesting finding was that 71% of the population of Arquata stated that they could access/obtain food/drink independently since the first week after the earthquake, while in Amatrice the percentage is 59%. In Amatrice, the social fabric of the city had been destroyed, thus inhibiting the population to get food from other sources. Over time, as the social interaction begun to function again, along with the opportunities to obtain food externally of the field kitchens. In the context of Arquata the surrounding countries have continued to function, making quite

simple to obtain food, especially vegetables from the local farmers. Conversely, the volunteers working both in Arquata or Amatrice reported difficulties to access food outside of the field kitchen even a month after the earthquake (92% and 93% respectively), probably because they did not have a good knowledge of or ties with the local territory.

In terms of quality and quantity of food provided by the field kitchen (Table 3), pertaining to the sustained phase of the emergency, in Arquata 70% of the population stated that the quantity of the meals was proper and 58% of the volunteers consider it abundant. Food was abundant also in Amatrice (for 54% of the population and 53% of the volunteers). Almost all the interviewees declared that the serving temperature of food, both hot or cold types, was adequate for a correct conservation. This finding shows that the field kitchen had adequate facilities for food conservation.

In Arguata a small part of the population declared that they had waited for meals as long as 15-30 minutes (4%) or even higher than 30 minutes (4%), while the majority reported short waiting times: less than 5 minutes (49%) to a max of 15 minutes (43%). The experience accounted by the volunteers was slightly better, as their waiting time was shorter; 6-15 minutes (75%) or less (25%). In the case of Amatrice most of the population maintained that they usually waited between 6-15 minutes (73%), and never more than half an hour. Here the volunteers accounted for very brief waiting times; 5 minutes or less (60%). It is likely that the volunteers used the field kitchens service at different times compared to the population. Furthermore, all the interviewees agreed on the good or excellent cleanliness of the dining areas. When asked about the possibility of sickness related to food eaten in the field kitchen, only a few individuals of Arguata claimed that they had a stomachache due to custard pies (2%) or vegetables (1%). The rest of the population attributed stomachache problems to stress (6% Arquata and 2% Amatrice). None of the volunteers declared sickness related to food eaten in the field kitchen.

In general, the population rated the field kitchen experience as good (68% Arquata and 50% Amatrice) or excellent (20% Arquata and 46% Amatrice) (Table 3). The evaluation of the volunteers was excellent (50% Arquata and 67% Amatrice) or good (50% Arquata and 33% Amatrice). However, in spite of the fact that most of the respondents have been satisfied with the service (17% people Arquata and 13% people Amatrice), the kindness and availability of the operatives (7% Arquata), a certain dissatisfaction emerged about the variety of the proposed menus (10% Arquata and 5% Amatrice). The interviewees of Arquata (3%) proposed to replace the pasta with soup, minestrone or rice and to reduce the use of cream and butter. The interviewees

of Amatrice (7%) requested more vegetables and the possibility to have more than one choice for the first and second courses. Some elderly, both in Arquata (2%) and Amatrice (3%) complained that the dining areas were too cold in the evening. Others lamented the impossibility to cook for themselves, missing a certain independence to choose what to eat (2% Arquata and 1% Amatrice). A common response across the various field kitchens (6% Arquata and 2% Amatrice) was the change of procedures and menus from one shift of volunteers to the next (a shift generally lasted one week).

	Population		Volunteers	
-	Arquata 1	Amatrice 1	Arquata 2	Amatrice 2
_	N(%)	N(%)	N(%)	N(%)
-	90(100%)	92 (100%)	12 (100%)	15 (100%)
Demographic data				
14) Gender:				
Male	46(51%)	43(47%)	5(42%)	11(73%)
Female	44(49%)	49(53%)	7(58%)	4(27%)
15) Age:				
< 25	16(17%)	18(20%)	2(17%)	5(33%)
26 - 45	23(26%)	32(35%)	7(58%)	7(47%)
46 - 60	28(31%)	30(32%)	2(17%)	1(7%)
> 60	23(26%)	12(13%)	1(8%)	2(13%)
16) Occupation:				
Employee	35(39%)	44(48%)	0(0%)	9(60%)
Freelance	18(20%)	17(19%)	0(0%)	2(13%)
Student	9(10%)	14(15%)	0(0%)	4(27%)
Retiree	20(22%)	10(11%)	0(0%)	0(0%)
Medical/nursing staff	0(0%)	2(2%)	0(0%)	0(0%)
Housewife	2(2%)	5(5%)	0(0%)	0(0%)
Unemployed	6(7%)	0(0%)	0(0%)	0(0%)
Volunteer	0(0%)	0(0%)	12(100%)	0(0%)
17) Married				

Yes	51(57%)	45(49%)	6(50%)	2(13%)
No	39(43%)	41(44%)	6(50%)	13(87%)
No answer	0(0%)	6(7%)	0(0%)	0(0%)
18) Number of underage	children:			
0	66(73%)	57(62%)	7(58%)	13(87%)
1	15(17%)	17(19%)	2(17%)	0(0%)
2	9(10%)	14(15%)	3(25%)	0(0%)
3	0(0%)	4(4%)	0(0%)	2(13%)
19) Number of adult child	lren:			
0	48(53%)	61(66%)	10(84%)	11(73%)
1	21(23%)	9(10%)	1(8%)	1(7%)
2	21(23%)	17(19%)	1(8%)	2(13%)
3	2(1%)	3(3%)	0(0%)	1(7%)
4	0(0%)	2(2%)	10(84%)	11(73%)

 Table 2 - Questionnaire 1: Demographic statistics of the interviewed population and volunteers who used the field kitchens of Arquata del Tronto and Amatrice.

Population		Volunteers	
Arquata 1	Amatrice 1	Arquata 2	Amatrice 2
IMMEDIATE PH	ASE		
Availability of foc	od resources after the ea	rthquake	
Drinking water in 73%)	less than 6h (92% and	-	-
Access to food in (94% and 74%)	n less than 12 hours	-	-
Field kitchen set up in more than 2 days (57%)	Field kitchen set up (57% and 100%)	p in less than 12 hours	Field kitchen set up in 1 day (93%)
Daily use of the k and 80%)	titchen services (87%	Occasional or 1 week use of the kitchen services (84%)	1 week use of the kitchen services (93%)
Independent access the first week (71% and	ss to food/drinks from nd 59%)	No independent (92% and 93%)	access to food/drink

SUSTAINED PHASE					
Quality and quantity of food provided by the field kitchen					
Enough food served (70%) Plentiful food served (54%, 58%, and 53%)					
Adequate serving temperature for hot foods (82%, 100%, 100%, and 100%)					
Adequate serving temperature for cold foods (73%, 83%, 83%, and 100%)					
Overall experience with the field kitchen services					
Less than 5 minutes of waiting for food distributionLess than 5 minutes of waiting 					
Clean or very clean field kitchen areas (100%, 98%, 100%, and 100%)					
Clean or very clean utensils used in the field kitchen (100%, 100%, 100%, and 100%)					
Suffering of stomachache after eating in the field kitchen (9%, 3%, 0%, and 7%)					
Stomachache attributable to food eaten in the field kitchen (3%, 0%, 0%, and 0%) Good or excellent experience with the field kitchen services (88%, 96%, 100%, and 100%)					

 Table 3 - Comparison of Questionnaire 1 answers across all the field kitchen surveyed.

 Response rates are given in brackets.

The demographic statistics of Questionnaire 2, administered to the operatives of all studied field kitchens, are summarized in Table 4. Although not all figures composing the organizations structure were reached in all field kitchens, the deputy manager, the cook, the cook assistant, the manager and operatives of food distribution have been contacted. In Arquata 1 and 2, Accumoli and Amatrice 2, the cooks were professionals who did the same job in their regular life. Almost all the interviewees maintained that they had obtained certification for food safety, except for some of the managers and operatives of Arquata 2, Accumoli, and Amatrice 2. Moreover, most of the organizations had already deployed from 4 to 6 shifts in the studied campgrounds, and all the members of their organization had been employed in the field kitchen. Finally, all respondents had previous experience in operating a field kitchen during an emergency.

For what concern the immediate phase, the time required to set up the field kitchens (Table 5) varied a bit among the various campgrounds. Arquata 2 and Amatrice 1 had their field kitchen set up and ready in less than 12 hours. In Accumoli and Amatrice 2 the field kitchens were ready after 1 day, whereas in Arquata 1 it was necessary 2 days. All operatives declared that

they had immediately access to adequate volume of drinking water, electricity and gas within the 12 hours succeeding the earthquake, except for the operatives of Arquata 1 who declared full availability within 2 days, in line with the kitchen installation times.

Regarding the management of the sustained phase, at the time of the surveys the number of meals served by the kitchens of Arguata 1 and Amatrice 1 and 2 was around 300-400, while that of Arguata 2 and Accumoli was around 100 (Table 5). All field kitchens recorded peaks of attendance at lunch. The meals were served to population, volunteers, and institutional emergency staff, except for Arguata 2 whose recipients were only voluntary rescue personnel. The daily menus for lunch and dinner offered: 1 first course (mainly pasta), 1 second course, 1 side dish, and fruit or dessert. These menus offered no alternatives to the proposed first, second or side dish. Only the kitchen of Accumoli offered, at times, a second choice for the first and second courses, but only for lunch. All field kitchens operatives claimed to have been prepared to respond to special dietary needs, such as low-calorie régimes, allergies (e.g. celiac disease), or food for infants. In regard to the use of leftovers, the interviewees of the kitchens of Arguata 1 and Amatrice 1 declared to re-propose them at the following meals, those of Arguata 2 and Amatrice 2 threw leftovers away (depending on the situation), while those of Accumoli transformed leftovers (e.g. meatloaf, omelet, sauces, etc) and offered them in the next meal.

In terms of kitchen equipment (Table 5), positive or very positive comments have been reported by the operatives on the available tools for cleaning and preparing ingredients, preserving, cooking, transforming and distributing food as well as for the washing and sanitizing utensils and tableware. Some negative comments were expressed by the operatives of the field kitchen of Arquata 1, which although designed to serve 100 people, did in fact prepare meals for more than 350 users since the beginning of the emergency. However, all field kitchens have been subjected to health checks by the authorities in charge of public health (Table 5).

The variety and quality of food were generally considered adequate or very adequate, except for a specific issue referring to the suitability of food for the field kitchen of Amatrice 2 (Table 5). Due to a bureaucratic hindrance, the ingredients arrived on site with a delay of 3-4 days from the time of order; eventually the regulatory process was bypassed in order to timely get what the needed ingredients. All respondents agreed on the quantity and freshness of food. A large amount of fresh and canned ingredients came from donations, both from individuals or corporations, e.g.: pasta, peeled tomatoes, biscuits

and brioche, but also coffee, canned food, water and milk. In some cases, this over-abundance of donated food led to logistical problems. In the end, to avoid waste of perishable food, the donated fresh ingredients that were in surplus were re-routed to non-profit organizations that deal with assistance to people in need in Italy (National Department Civil Protection, 2016b).

	Arquata 1	Arquata 2	Accumoli	Amatrice 1	Amatrice 2	
Demographic data						
How many	people in your	organization we	ere employed in	this emergency	?	
People	23	12	12	10	65	
How many	people are nee	ded for effective	ly managing thi	is field kitchen?		
People	23	12	12	6	25	
What is you	r role in the fi	eld kitchen?				
Cook	1	1	1	1	1	
Cook assistant	1	1	1	1	0	
Distributor and table	2	2	2	3	2	
manager Other: Coordinator Other:	1	1	0	0	0	
Deputy manager of the field kitchen	0	0	1	0	0	
Other: Field kitchen manager	0	0	0	0	1	
Reception camp manager	0	0	0	0	1	
How many	How many shifts did your organization perform in this emergency?					
Shifts	4	4	6	4	6	

 Table 4 - Questionnaire 2: Demographic information from the interviewed operatives

 who worked in the field kitchens of Arquata del Tronto, Accumoli, and Amatrice.

Arquata 1	Arquata 2	Accumoli	Amatrice 1	2	Amatrice
IMMEDIATE	PHASE				

Installation an	d operation of the	field kitchen		
Set up in 2 days (100%)	Set up in less than 12 hours (100%)	Set up in 1 day (100%)	Set up in less than 12 hours (100%)	Set up in 1 day (100%)
Drinking water in 2 days (100%)	Drinking wa 100%)	ater in less than 12	2 hours (100%, 100	0%, 100%, and
Adequate drin 100%)	king water for the	e need of the kitche	n (100%, 100%, 10	0%, 100%, and
Electricity and	l gas in less than 1	12 hours (100%, 10	0%, 100%, 100%, a	and 100%)
Adequate elec and 100%)	tricity and gas for	r the need of the ki	tchen (100%, 100%	6, 100%, 100%,
SUSTAINED	PHASE			
Menus and rec	cipients			
350-400	100-170	100-170	200-300	400-450
meals served	meals served	meals served	meals served	meals served
Population,	Valenteene	Population,	Population,	Populatio
Volunteers,	volunteers	Volunteers,	Volunteers,	n, Institutions
I eftovers re-	Leftovers	Leftovers	I eftovers re-	Leftovers
proposed	thrown away	transformed	proposed	thrown away
(100%)	(100%)	(100%)	(100%)	(60%)
Equipment				
Adequate food storage facilities (80%)	Very adequa and 100%)	ite food storage fac	ilities (60%, 80%,	Adequate food storage facilities (100%)
Inadequate cooking and food processing facilities (20%)	Very adequ facilities (100%	nate cooking and , 100%, and 60%)	food processing	Adequate cooking and food processing facilities (100%)
Adequate for facilities (80% and	od distribution d 100%)	Very adequate food distribution facilities (100%) Very	Adequate foo facilities (100% a	od distribution nd 60%)
Adequate cle (60% and 60%)	aning facilities	adequate cleaning facilities (80%)	Adequate clear (100% and 60%)	aning facilities
Type and avai	lability of food			

Adequate variety	of -	Very adequate variety of ingr	edients (60%, 60%,	Inadequat e variety of
ingredients		and 100%)		ingredients
(80%)				(20%)
Adequate				Adequate
quantity	of	Very adequate quantity of	ingredients (60%,	quantity of
ingredients		100%, and 100%)		ingredients
(60%)				(100%)
Fresh ingredients available (100%, 100%, 100%, 100%, and 100%)				
Satisfactory ingredients available (100%, 100%, 100%, 100%, and 80%)				
Food donation (100%, 100%, 100%, 100%, and 100%)				
Hygiene a	and co	ntrols		
Appropriate hygienic conditions (60%, 60%, and Excellent hygienic conditions				
80%) (100% a			(100% and 80%)	
Hygienic checks by authorities in charge (100%, 100%, 100%, 100%, and 100%)				

 Table 5 - Comparison of Questionnaire 2 answers across all the field kitchen surveyed.

 Response rates are given in brackets

#### 5. Food management model

The above described findings in spite of portraying relatively functional food management services during the emergency, highlighted the need of standardized procedures to handle the various aspects of food in disasters. Figure 3 visualizes a proposed "Food management model in disasters" that we think adaptable to any type of emergency and rescue organization. Indeed, in the immediate aftermath of a disaster, the focus should be ensuring survival needs to the population (water and basic nourishment). Once an adequate assistance is provided in terms of basic nutrition needs, the model envisions a second phase in which the field kitchens has been set up. In this phase, called the sustained phase, the key elements to monitor are the food and the field kitchen operatives. Regarding the food, its security and safety must be continuously verified and monitored. If the food quantity is adequate, then "food security" is achieved. Conversely, if food quantity is inadequate, a request of help from the regional, national or international levels should be activated. The other aspect that must be verified is that the available food should not be contaminated microbiologically, chemically or physically to prevent food-borne illness. If this condition is true, then "food safety" is achieved. If not, the food cannot be served to avoid health issues in the campground, and menus, ingredients and food preparation procedures have

to be reviewed. Attention should also be paid to issues related to food intolerances (e.g. celiac disease), as well as cultural and religious dietary precepts (e.g. vegetarians). The other key element to monitor in the sustained phase, are the field kitchen's operatives. They must be knowledgeable and respectful of the rules and procedures to avoid food contamination. Operatives of a field kitchen should have all the necessary training and certifications. Furthermore, to guarantee a smooth transition in terms of modus operandi and menus, from a shift of filed kitchen operatives to the next, it may be necessary to set some standards and foresee the presence of a transitional manager that guarantees continuity. The third and last phase of the proposed food management model, concerns the long-term phase in which the population should be helped to return to a normal condition of independent food preparation and consumption.



Figure 3 - Food management model in disasters.

#### 6. Conclusions

This study investigated the management of food services for the population affected by the earthquake of 24 August 2016 in Central Italy. The analysis focused on the immediate phase, including the first 72-96 hours from the event, and the sustained phase, in which the main objective of the

organizations is to prepare and distribute meals using field kitchens. Field surveys were carried out in five field kitchens located in the municipalities of Accumoli and Amatrice, in the Lazio Region, and in the municipality of Arquata del Tronto in the Marche Region. Data was collected by administering two questionnaires one month after the event. The first questionnaire focused on the users of the field kitchens (residents and the volunteer workers), while the second focused on the field kitchen operatives.

Results showed that the food services were provided without major problems in terms of hygienic-sanitary conditions or food shortage. "Food safety" was easily achieved because the Italian regulations requires that those who works in close contact with food, such as cooks and assistant cooks, must have previously obtained certification for food safety as well as undergone sanitary tests. Similarly, the studied field kitchen had to be equipped with adequate tools and facilities dedicated to properly clean and process food. Also important were the repeated controls of the field kitchens by the authorities in charge of the hygienic-sanitary conditions. "Food security" was also easily achieved because, in spite of the large extension of the damage area, the surrounding territories (including the national scale) kept functioning and were able to provide support to the less fortunate areas. Food shortage during this emergency was never a problem.

Overall, interviewed residents and volunteers that used the field kitchen services were generally satisfied. The quantity, the service temperature of the food and the waiting time in food distribution was deemed good. Similarly, all the studied kitchens were prepared to deal with particular dietary requests (e.g. celiac) or food practices (e.g. vegetarians). Also, the field kitchens operatives were satisfied with the resources (structures and personnel) available, which eased the management of the food emergency created by the earthquake. Kitchen modules were promptly equipped with basic services such as water, electricity and gas, and with adequate structures suitable for storage, cooking / processing and food distribution.

It is worth mentioning here the suggestions that emerged from the population, namely the request for greater variety of the proposed menus. Among the possible ways to ease this problem could be working with the untouched leftovers; rather than re-proposing them as they are or throwing them away, cooks could imagine creative ways to transform leftovers into new tasty dishes. Possibly a menu for leftovers transformation should be assembled and distributed to the field kitchens.

In conclusion, the proposed food management model in disaster, distilling the lesson learned during the 2016 seismic emergency in Central Italy, provides a rational approach to manage effectively food services in the aftermath of a disaster.

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Increasingly, socio-natural risks and disasters represent the result of an unsustainable interaction between human beings and environment. The current scientific debate has generally agreed on the idea that the impact of natural hazards needs to take into account the social vulnerabilities and exposures to risk of the affected population. The most recent earthquakes have unequivocally shown the complexity of the phenomena and their multi-scale dynamics. Indeed, the territory is the combination of natural, social and cultural environment and only by exploring its anatomy and physiology, it will be possible to manage and protect it in the best way.

This volume collects a quite wider range of national and international case studies, which investigate how socio-natural risks are perceived and communicated and which strategies the different communities are implementing to mitigate the seismic risk. This publication has been possible thanks to a fruitful discussion that some scholars had at the 36th General Assembly of the European Seismological Commission held in Malta from 2 to 7 September 2018.

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