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INCIDENCE AND RISK FACTORS FOR POST-TRAUMATIC STRESS DISORDERS (PTSDS) IN A POPULATION AFFECTED BY FLOOD AND LANDSLIDES IN NYARUGENGE DISTRICT, RWANDA

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Abstract

Introduction: Disasters lead to trauma that may affect both mental and physical health of those affected. Post-Traumatic Stress Disorders (PTSD) are among chronic traumatic events that affect people as a result of disasters. This study focused on flooding and landslides disasters, which cover more than 80% of all natural disasters globally, and Rwanda in particular. It aims at determining incidence, risk factorsfor PTSD and psychosocial support provided in a population affected by floods and landslides in high-risk zones of Nyarugenge District, Kigali City, Rwanda

Methods:A descriptive cross-sectional design using quantitative method was used. Proportionate sampling was used to select two hundred and twelve participants where 209 participants had agreed to participate in the study. Data were analyzed by descriptive and inferential statistics, relationship between demographic variables, incidence of PTSD were reported by chi-square test at the level of significance < or = to 0.05 and confidence intervals.

Results: The results reported that the incidence of PTSD among people affected by flooding and landslides is high. The study found out that 108(52%) out of 209 participants reported the symptoms of PTSD while only 101(48%) did not report any symptom of PTSD. The results of bivariate analysis revealed that gender of the participants [P=0.05], education level [P=0.029], family income [P=0.02], ubudehe category [P=0.021], and destruction of the property [P=0.012] were the factors associated with the development of PTSDs among the studied population. On the other hand, PTSD was report to be associated with health related factors such whether flooding caused health problem to them or to the family [P<0.001], flooding caused death problem to you directly or to your family member [P= 0.005] and family displacement [P<0.001]. The multivariate analysis reported that only two variables remained significantly associated with incidence of PTSD when entered into multivariate analysis; family income between 100,001 and 200,000 Rwf was a protector to develop PTSD though its likelihood was low (AOR= 0.063; 95% CI=0.004- 0.882**;** P= 0.040) while those who fall ubudehe category 2 were more likely to develop PTSD (AOR= 0.281; 95% CI=0.095- 0.829;P= 0.021).

Conclusion: The results showed a high incidence of PTSDs among people affected by flooding and landslides in Nyarugenge district and interventions done to support those in need should also consider psychosocial support, therefore, interventions tailored to support people affected by disasters are encouraged to shift from the current situation. Further studies can be conducted to comparerural versus urban areas.

Key words: Incidence, Risk factor, Posttraumatic Disorder, Rwanda

Background

Natural or human-made disasters are responsible for traumatic incidents that impact the affected populations' psychosocial conditions. PTSD is a psychological disease that is attributed to a traumatic event that happened such as a natural disaster among others (Lancaster, Teeters, Gros, & Back, 2016), and it is the common mental disorder widely (Neria, Nandi, & Galea, 2008). There are relatively common traumatic events, and they pose a public health problem. Generally, almost two thirds of the World's population is estimated to have exposed to an event that leads to trauma in their lifetime (Galea, Nandi, & Vlahov, 2005). In the United States of America, fifth of individuals are likely to have exposed to trauma in a year (Galea *et al*., 2005).

Disasters are among the most cause of trauma due to its adverse impacts which remain high. In 2014 only, at a global scale, 324 natural disasters were responsible for 7823 deaths(Ejeta, Ardalan, Paton, & Yaseri, 2016); where floods and landslides were reported to be the most common cause of fatalities worldwide(Doocy, Daniels, & Kirsch, 2013).

Flooding alone affects eighty percent of the World's population where a third of the land is exposed to flooding (Dilley *et al*., 2005). Over 100,000 lives were taken off as a result of flooding in the 20th century and the approximately 1.4 billion people are affected and face challenges related to flooding (Jonkman, 2005).

A large proportion of the individuals affected are vulnerable to chronic health conditions, morbidities and disabilities that eventually impair their quality of life following natural disasters. Grief, drug abuse, incidents of domestic violence and violent conduct are the major negative effects(Fontalba-navas, Lucas-borja, Gil-aguilar, & Arrebola, 2016)

In addition to causing economic damage, floods and landslides cause human health effects. Floods alone are the single severe disasters registered in Malaysia(Chan, n.d.). Poverty was registered as the leading factor for people to occupy the risks zone to natural disasters including mountains, valleys and non-occupied lands a results of population migration (Few, 2003; Khan & Khan, 2008).

Most of people affected by natural disasters get support from government's entities, non-governmental organizations, family members, friends, colleagues to recover, but their effects on relationship with others and welfare remains extensive and sustained for long period for affected people, especially on psychosocial and mental health aspects that cause trauma(Stanke, Murray, Amlôt, Nurse, & Williams, 2012).

The estimates on the prevalence of PTSD vary in different populations and range between 20-40% in area where disasters is more prevalent but it is reported to be as low as between 3-

5% Worldwide (Bromet *et al*., 2017). It is highlighted in the worldwide mental health surveys that a prevalence range from 0.0 to 3.8 among studied adults. From the same survey, the mostly reported factors that lead to people vulnerabilities in the lens of the disasters are population education level, injuries or death of close relatives, people displacement and other pre-existing vulnerabilities (Bromet *et al*., 2017).

In the USA , among mental health disorders, PTSDs constitute the major conditions that affect people after natural disasters; where the prevalence and long term morbidities such as prolonged anxiety and mood disorders accounted for 3.7 % (Kessler, Petukhova, Sampson, & Zaslavsky, 2012).

Posttraumatic stress disorders epidemiological studies in Africa are accumulated in other diseases like HIV AIDS population and post conflict areas rather than after natural disasters(Olley *et al*., 2005).

An analysis of the literature on countries status as far as the prevalence of PTSDs is concerned in sub-Saharan Africa revealed a prevalence of 25%. Conflict-free regions showed a low prevalence of 8% and while conflict regions had a prevalence of 30 percent (Id et al., 2020). The study that was specifically conducted to report on global risk and analysis of natural disasters hot spots of 2005 estimated that 14.2of Rwandan population were at risk of multiple disasters(Dilley *et al*., 2005).In addition, the existing evidence on Rwanda to report studies conducted in diverse population on PTSD in people exposed to genocide, and the prevalence was 21.6% (18.1%– 25.5%)(Fodor, Pozen, Ntaganira, Sezibera, & Neugebauer, 2015); another study on socio-demographic determinants of PTSD and its association among Rwandan population 14 years after Genocide reported a prevalence of 26.1% among studied population (Munyandamutsa, Mahoro, & Eytan, 2012); and 31.0% compared to 33.0 % post conflict studied population in Kosovo(Eytan, Munyandamutsa, Mahoro, & Gex-fabry, 2015).

Attempt was made to study on traumatic episode and associated factors with exposure to trauma caused by Genocide against the Tutsi of 1994 in Rwanda in a population of 20–35 years old argued that socio demographic factors such as gender differences, age, in exposure to traumatic episodes were among the factors to develop trauma among affected people (Rugema, Mogren, Ntaganira, & Krantz, 2015). Another study in Rwandan context that was assessing trauma levels and likelihood of the development of PTSD as a result of exposure to genocide against Tutsi of 1994 and people' attitudes towards justice and reconciliation and found out that the likelihood to develop PTSD symptom were high: 1.43 (95% CI, 1.33-1.55) (Pham, Weinstein, & Longman, 2004).

The available literature on PTSD in Rwanda is accumulated in post genocide experiences (Eytan *et al*., 2015; Fodor *et al*., 2015; Munyandamutsa *et al*., 2012; Pham *et al*., 2004; Rugema *et al*., 2015); while the evidence shows that PTSD can be a result of any traumatic event (Lancaster *et al*., 2016; Neria *et al*., 2008).

The World Health Organization warns countries that aftermath of the natural disasters such as flooding, landslides, tsunami among others, there is a likelihood of increase of infectious diseases outbreak and non-communicable diseases to include psychosocial problems(Wilder-Smith, 2005); and the risk to develop psychological distress among people affected by disasters and emergencies is high although the majority recover over time. The WHO in this regards recommends that interventions be available from basic, to sophisticated services in post-traumatic event.

In Rwanda, efforts to address effects of flooding and landslides that affected the country ranged from distribution of basic needs to the affected families, relocation from the affected areas, and distribution of hygiene materials (washing soap and buckets) and sensitization of the communities on proper use of mosquito nets (IFRCRCS, 2016), but psychosocial aspects are

overlooked. In this regards, community health interventions to screen for possible cases of PTSD can strengthen the efforts by the government to mitigate the long-term impacts of floods and landslides in affected regions.

The screening of PTSD conducted in African countries, such as Kenya showed a prevalence of 10.6% of probable PTSD in a studied population(Jenkins, Othieno, Omollo, Ongeri, & Sifuna, 2015), in Ethiopia; the incidence of PTSDS was 37.3% (Asnakew, Shumet, Ginbare, Legas, &Haile, 2019), in RDC; among 998 study participants, 50.1 of them had met symptom criteria for PTSD (Jenkins *et al*., 2015). In Rwanda, studies had shown that the prevalence of PTSD was 26.1 % of the 962 among Rwandan 14 years after the genocide (Munyandamutsa *et al*., 2012). Other studies in Rwanda shaded on probable factors likely to result into the development of PTSD in communities in post-conflict and genocide. (Fodor *et al*., 2015; Rugema *et al*., 2015). The existing evidence on the topic especially in Rwandan context is accumulating in population mostly post conflict while the literature shows that PTSD can occur as results of multitude of factors including natural calamities and human made factors.

The present study focuses on flooding and landslides disasters, which covers more than 80% of all natural disasters in the World and Rwanda in particular. It aims determining incidence and risk factors for PTSD in people affected by floods and landslides as well as psychosocial support provide to affected communities in high risk zones of Nyarugenge District, Kigali City, Rwanda.

Methods

Study design

A cross-sectional studs design using quantitative approach was used to determine incidence and risk factors for PTSD in a population affected by floods and landslides in Nyarugenge District.

Study setting and population

The study was conducted at in Nyarugenge District, Kigali, Rwanda in its 3sectors namely Kimisagara, Nyamirambo and Gitega. The three sectors were selected based on the fact to have high rate of natural disasters in Kigali City.

Sample size determination

The sample size was calculated using the formula of Taro Yamane:

$$n = \frac{N}{1 + N(e)2}$$

With

n: sample size

N: Total population

e: margin error (0.05%)

Therefore,

$$\boldsymbol{n = \frac{453}{1 + 453(0.05 * 0.05)} = 212.4 \approx 212}$$

Using this above information, the calculated sample size is n= 212 subjects

Data collectiontools

The data were collected by the means questionnaire adapted from a questionnaire validated from other studies that measure stress disorders(Cloitre et al., 2018; Fontalba-navas et al., 2016).

The validated questionnaire is composed by socio-demographic data relevant variables under study, the second section constitute 18 items that the relevant self-report questions useful in determining incidence of PTSDS.The first 9 items describe questions related to traumatic or stressful life events reported on a likert scale as follow: 0: Not at all, 1: A little bit, 2: Moderately, 3: Quite a bit, 4: Extremely.

The second 9 questions constitute symptoms experienced by individuals that have witnessed traumatic incidents and participants are asked to refer to what they usually do, thought in themselves and why they usually interact with everyone.

The tool wasadapted to fit the context of Rwanda especially on factors associated with the development of PTSD. In addition to the experience of flood and landslides, the variables were broadened to fit the purpose of the present research, and variables such as age, gender, socio-economic status (Level of education, family income, destruction of property,) health (Injury, death to family members), experience with previous disasters were added to the questionnaire. Other variables remained as there are but translated in the local language.

Data analysis

The data were entered into SPSS version 21. The data were cleaned and then analyzed using descriptive statistics. Bi-variate analysis with chi-square test was used to assess associations between sociodemographic, key variables and incidence of PTSD. A significance level of 0.05 set at 95 CI was considered in multivariate analysis. The incidence was measured by calculating scores of all variables related to the symptoms of PTSD.

Ethical considerations

Data collection approval was obtained from the Mount Kenya University. In addition, the permission was sought from Nyarugenge district. Sectors provided access to the study site. All selected participants signed a written consent form before their participation in the study. There was no renumeration to participate in the study.

Study limitations

The study was limited in scope where study site in Kigali city was not enough to generalize the findings to the whole country.

Results

Demographic characteristics

A total of 209 participants participated in the study out of 212 predetermined sample. This response rate is equivalent to 98%.

The results in table 1 reveal that the participants who fall between 18 and 25 years old dominated the majority of the participantswhere 27% of the participants fall in this group while participants above 58 years old constitute the minority. Female participants dominated where 126(60%) responded to the questionnaire. The majority of the participants 64(31%) completed secondary studies while 137(66%) have family income below 50,000 Rwf a month. The results indicated that the majority 189(90%) had the property destroyed by the flooding and landslides.

Table 1. Socio-demographic variables

Variables		Frequency	%
Gender of the participants	Male	83	40
	Female	126	60
Age of the participants	18-25	57	27
	26-33	43	21
	34-41	36	17
	42-49	34	16
	50-57	21	10
	58 and above	18	9
Education level	Primary	45	22
	TVET	52	25
	Secondary	64	31
	University	24	11
	None	23	11
	Others	1	0
Family Income	Below 50,000 Rwf	137	66
	Between 50,001and 100,000 Rwf	55	26
	100,001-200,000 Rwf	13	6
	>200,001 Rwf	4	2
Ubudehe Category	Category 1	52	25
	Category 2	77	37
	Category 3	80	38
Destruction of the property	No	20	10

Yes	189	90

Participants' health (Injury, death to family members)

The results in table 2 show that 126(60%) of the participants has indicated that landslides or flooding caused health problems to them or to the members of their families; while only 8(4%) mentioned that disasters have caused death to their families. Incidence of Post-Traumatic Stress Disorders.

Table 2. Participants' health (Injury, death to family members)

Variables	Yes	No	Total
Have landslides or flooding caused health problem to you directly or to your family member?	126(60%)	83(40%)	209(100%)
Have landslides or flooding caused death to your immediate relative?	8(4%)	201(96%)	209(100%)
Have you had any experience with previous disasters?	67(32%)	142(68%)	209(100%)
Have you been displaced as result of land slides and flooding in the last year?	117(56%)	92(44%)	209(100%)

Incidence of Post-Traumatic Stress Disorder

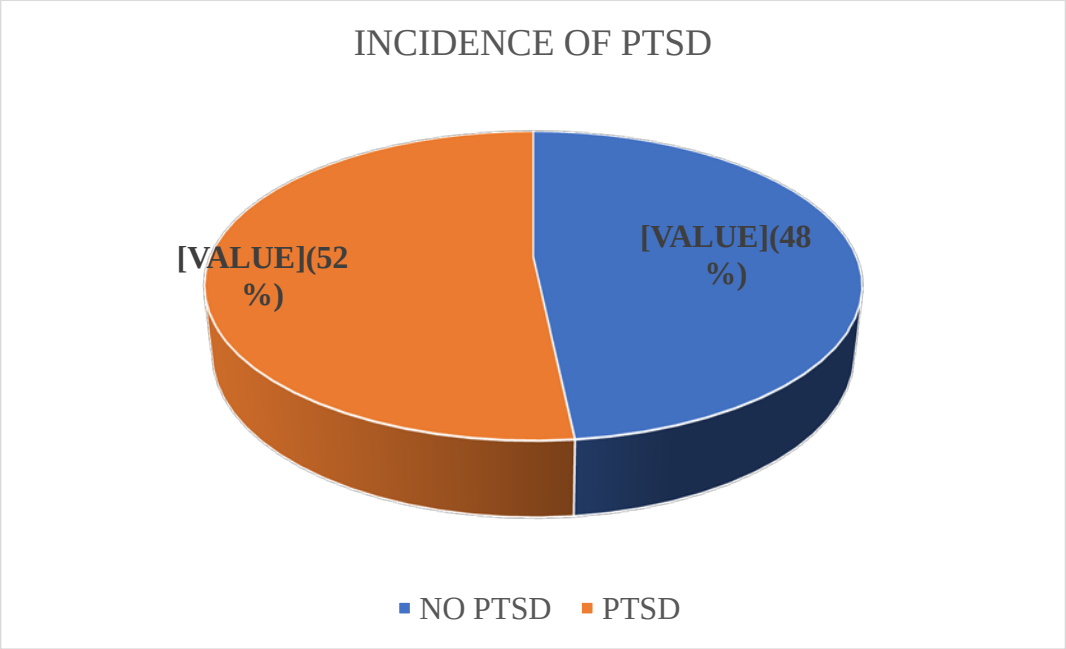
The incidence of Post-Traumatic Stress Disorders is measured when the participants fulfill all criteria on three dimesion measuring incidence of PTSD. The scores on re-experiencing in the here and now, avoidance scores, and finally sense of current threat scores. The three scores altogether have a mean score which is used to report whether participants have the symptoms of PTSD.

The incidence of PTSD is confirmed when the criteria for both Re-experiencing the event happened in the here and now (Re_dx) is met and the avoidance (Av_dx) critetia met at the same

time, sense of current threat (Th_dx) criteria is met altogether. In addition, one of the criteria for PTSD functional impairment (PTSDFI) should also be met.

These criteria are met when adding the total scores of all itemized likert scale measuring PTSD and coming up with a composite score. In order to confirm that participants have PTSD, the mean score for the total scores should be equal or greater than two (≥) (Cloitre et al., 2018).

Figure1 .Incidence of PTSD



The results in figure 1 indicated that out of 209 participants, 108(52%) reported the symptoms of PTSD while only 101(48%) did not report any symptom of PTSD.

Factors associated with the development of PTSD after severe flooding and landslides

The results on association between incidence of PTSD, demographic factors and health related factorsshow that gender, level of education, family income, ubudehe category and the destruction of the property are associated with the development of PTSD among the study participants [P≤0.05]. It is again reported that health related factors such as whether landslides or flooding caused health problems or death to direct family member of the participant as well as family displacement are associated with the development of PTSD among the study participants

[P≤0.05]. The results of the present study revealed that gender of the participants[P=0.05], education level [P=0.029], family income[P=0.02], ubudehe category[P=0.021], and destruction of the property[P=0.012] were the factors associated with the development of PTSDs among the studied population. On the other hand, PTSD was report to be associated with health related factors such whether flooding caused health problem to them or to the family [P= 0.000], flooding caused death problem to you directly or to your family member [P= 0.005] and family displacement [P=0.000].

Table 3. Relationship between Incidence of PTSD, demographic factors and health related factors

Variables		INCIDENCE OF PTSD		Total	P- value
		NO PTSD	PTSD		
Gender of the participants	Male	50	33	83	
	Female	51	75	126	**0.05**
Total		101	108	209	
Age of the participants	18-25	25	32	57	0.217
	26-33	24	19	43	
	34-41	19	17	36	
	42-49	18	16	34	
	50-57	11	10	21	
	58 and above	4	14	18	
Total		101	108	209	
Education level	Primary	17	28	45	**0.029**
	TVET	31	21	52	
	Secondary	24	40	64	
	University	16	8	24	
	None	13	10	23	
	Others	0	1	1	
Total		101	108	209	
Family Income	Below 50,000 Rwf	54	83	137	**0.02**
	Between 50,001 and 100,000 Rwf	34	21	55	
	Between 100,001 and 200,000 Rwf	11	2	13	
	Above 200,001 Rwf	2	2	4	
Total		101	108	209	

Ubudehe Category	Category 1	28	24	52	
	Category 2	44	33	77	**0.021**
	Category 3	29	51	80	
Total		101	108	209	
Destruction of the property	No	15	5	20	
	Yes	86	103	189	**0.012**
Total		101	108	209	
Have landslides or flooding caused health problem to you directly or to your family member	No	66	17	83	
	Yes	35	91	126	**<0.001**
Total		101	108	209	
Have landslides or flooding caused death to your immediate relative?	No	101	100	201	
	Yes	0	8	8	**0.005**
Total		101	108	209	
Have you had any experience with previous disasters	No	75	67	142	
	Yes	26	41	67	0.059
Total		101	108	209	
Have you been displaced as result of land slides and flooding in the last year	No	57	35	92	
	Yes	44	73	117	**<0.001**
Total		101	108	209	

Multivariate analysis of factors associated with the development of PTSD after severe flooding and landslides

Among the variables entered in multiple logistic regression model, only two were reported to be significant. Family income between 100,001 and 200,000 Rwf has contributed not to develop PTSD though its likelihood was low (AOR= 0.063; 95% CI=0.004- 0.882**;** P= 0.040). Participants who fall ubudehe category 2 were more likely to develop PTSD (AOR= 0.281; 95% CI=0.095- 0.829**;** P= 0.021).Other variables remained not significant.

Table 4. Multivariate analysis of factors associated with the development of PTSD after severe flooding and landslides

		INCIDENCE OF PTSD		
		95% C.I.		
Variables	AOR	Lower	Upper	P-Value

Gender				
Male	.863	.428	1.737	.679
Female	Ref			
Education level				
Primary	Ref			
TVET	146317270.331	0.000		1.000
Secondary	526715367.602	0.000		1.000
University	216027930.312	0.000		1.000
None	50869523.502	0.000		1.000
Others	319528114.241	0.000		1.000
Family income				
Below 50,000 Rwf	Ref			
Between 50,001 and 100,000 Rwf	.560	.045	6.972	.652
Between 100,001 and 200,000 Rwf	.063	.004	.882	**.040**
Above 200,001 Rwf	.226	.013	3.809	.302
Ubudehe Category				
Category 1	Ref			
Category 2	.281	.095	.829	**.021**
Category 3	.901	.383	2.117	.811
Destruction of the property				
No	.894	.281	2.849	.850
Yes	Ref			
Health problems in family				
No	.564	.247	1.284	.172
Yes	Ref			
Death of family member				
No	.265	.045	1.550	.141
Yes	Ref			
Family displacement				
No	.633	.304	1.322	.224
Yes	Ref			

Psychosocial support services provided to communities post severe flooding and landslides

People affected by flooding and landslides did not get support needed in due time where almost all highlighted support was not given as report by the majority of the study participants. 14 % of

the participants scored that they did not receive support at all. Government support was the main provided (62%) while NGO was the least to provide support (2%).

Table5. **Psychosocial support provided**

Variables		N	%
Counseling	No	159	76%
	Yes	50	24%
Family support	No	140	67%
	Yes	69	33%
Peer support	No	147	70%
	Yes	62	30%
Neighbor visits	No	137	66%
	Yes	72	34%
Support from the nearest health center	No	188	90%
	Yes	21	10%
Government support	No	79	38%
	Yes	130	62%
NGOs support	No	204	98%
	Yes	5	2%
None	No	180	86%
	Yes	29	14%
Others		209	100%

Relationship between Psychosocial support and incidence of PTSD

The results show that support from the nearest health center was associated with the development of PTSD(P=0.005) government support(P=0.001). Other social support are not associated with the development of PTSD. The fact that only two variables are significant, no multivariate analysis is possible.

Table 6. Relationship between Psychosocial support and incidence of PTSD

		INCIDENCE OF PTSD			
Variables		NO PTSD	PTSD	Total	P-Value
Counseling	No	79	80	159	
	Yes	22	28	50	0.483
Total		101	108	209	

Family support	No	72	68	140	
	Yes	29	40	69	0.201
Total		101	108	209	
Peer support	No	77	70	147	
	Yes	24	38	62	0.071
Total		101	108	209	
Neighbor visits	No	68	69	137	
	Yes	33	39	72	0.601
Total		101	108	209	
Support from the nearest health center	No	97	91	188	
	Yes	4	17	21	**0.005**
Total		101	108	209	
Government support	No	50	29	79	
	Yes	51	79	130	**0.001**
Total		101	108	209	
NGOs support	No	100	104	204	
	Yes	1	4	5	0.200
Total		101	108	209	
None	No	83	97	180	
	Yes	18	11	29	0.111
Total		101	108	209	
Others		101	108	209	
Total		101	108	209	

DISCUSSION

Social demographic characteristics

The present study revealed that the participants who fall between 18 and 25 years old dominated the majority of the participantswhere 27% of the participants fall in this group while participants above 58 years old constitute the minority. Age group in this category is dominated by young population which is highly represented in Rwandan population.

Female participants dominated where 126(60%) responded to the questionnaire. The majority of the participants 64(31%) completed secondary studies while 137(66%) have family income below 50,000 Rwf a month. The results indicated that the majority 189(90%) had the property destroyed by the flooding and landslides. The descriptive data on the demographics data of the participant's reveal that the development of PTSD differ across the different age range as well as

the gender of the participants, family income as well as education levels also are factors not to be undermined in the reports related to PTSDs(Fincham, 2008). The details are provided in the factors affecting the development of PTSDs.

Participants' health (Injury, death to family members)

The results in the present study comfirmed that the majority of the participants 126(60%) indicated that landslides or flooding caused health problems to them or to the immediate family members; while only 8(4%) mentioned that disasters have caused death to their families. These results concur with the reported studies which reports that landslides and flooding cause human and material losses for those affected one, displacement and destroy social fabric, especially when it comes to natural disasters in general (Fincham, 2008). In order to mitigate the effect caused by natural disasters, interventions have to immediately target those in need so that the consequences are minimized.

Incidence of Post-Traumatic Stress Disorders

The study measured incidence ofPost-Traumatic Stress Disorders in a population affected by severe flooding and landslides and found out that out of 209 participants, 108(52%) reported the symptoms of PTSD while only 101(48%) did not report any symptom of PTSD. The reported incidence is high and in the lens of similar studies whereby by depending on geographical areas, it ranged from 20 to 40%, but higher than the incidence that was reported in the general population which was believed to be between 3 and 5% elsewhere (Bromet *et al*., 2017). The present results again are higher than the results reported in the global survey conducted to report on the prevalence and other factors which might be associated with natural which reported a prevalence range from 0.0 to 3.8 among studied adults and higher than the incidence of 3.7 % which was reported in the United States of America (Kessler *et al*., 2012). The present results concur with the results found in African contexts whereby in Kenya the reported prevalence of PTSD was 48% in studied population(Jenkins *et al*., 2015), while it is close to the one found in

Democratic Republic of Congo(DRC), whereby factors such sexual abuse, human rights violation of citizens of particular Eastern DRC territories, including information on basic needs, access to health care, and physical and mental health, coupled with PTSD were reported and revealed that 50.1 of the 998 study participants met PTSD symptom criteria (Jenkins *et al*., 2015). The results are also higher than the one found in Ethiopia whereby among the studied population, 37.3% of the them had symptoms of PTSD (asnakew *et al*., 2019). The reported incidence of PTSD of 52 % in the studied population again concur with the results of a quite similar study conducted to examine mental health and related factors with exposure to trauma during the 1994 genocide against Tutsi in Rwandan men and women aged 20–35years which reported the incidence of PTSD to be 26.1 percent of the 962 studied population (Fodor et al., 2015; Rugema et al., 2015).

The reasons behind the higher incidence reported in the present study can be attributed to the fact that this study was conducted in a very homogenous population which was exposed to the same event in the same period, therefore, the likelihood of the effect is very high. It is again believed that the reported high incidence can be attributed to the close spatial distribution of the participants who were only in the city without taking into account the remote areas who might have other strategies to mitigate the effect of severe flooding and landslides.

Factors associated with the development of PTSD after severe flooding and landslides

The results from bivariate analysis reported that gender, level of education, family income, ubudehe category and the destruction of the property were associated with the development of PTSD among the study participants [P≤0.05]. It is again reported that health related factors such as whether landslides or flooding caused health problems or death to direct family member of the participant as well as family displacement are associated with the development of PTSD among the study participants [P≤0.05]. The results are in line with prior literature which highlights factors associated with the development of PTSD. The results of the present study revealed that

gender of the participants[P=0.05], education level [P=0.029], family income[P=0.02], ubudehe category[P=0.021], and destruction of the property[P=0.012] were the factors associated with the development of PTSDs among the studied population. On the other hand, PTSD was report to be associated with health related factors such whether flooding caused health problem to them or to the family [P<0.001], flooding caused death problem to you directly or to your family member [P= 0.005] and family displacement [P<0.001].

Age and gender of the participants

Age and gender of the participants was reported by prior studies to play an a pivotal role in the development of PTSD, the results reported that gender is associated with the development of PTSD among the study participants[P=0.05], the present study is in line with the study on combined effect of gender and age on post-traumatic stress disorder whether men and women show differences in the lifespan distribution of PTSD which found out that the highest prevalence of PTSD is seen in the early 40s for men and in the early 50s for women, while the lowest prevalence for both genders was in the early 70s. Women had an overall twofold higher PTSD prevalence than men(Ditlevsen & Elklit, 2010). The results concur with the study conducted in Rwanda on factors associated to the development of PTSD in Rwanda post genocide where being women compared with men of the same age group, predispose to a risk to develop PTSD , person vulnerability to rape and abuse were related to all of these conditions with high risks in women relative to men in the same age group (Rugema et al., 2015) which is was not studied in the present study.

Family income, ubudehe category, the destruction of the property and family displacement

Socio-economic factors such family income[P=0.02], ubudehe category[P=0.021], and destruction of the property[P=0.012] were the factors associated with the development of PTSDs among the studied population; this is in line with prior studies which confirmed that economic

factors such as homelessness, lack of employment, less income following a stressful event and family income structures are the main factors that influence the development of PTSD among the affected ones (Asnakew et al., 2019; Guay, Billette, & Marchand, 2006). The results from multiple logistic regression analysis showed that family income between 100,001 and 200,000 Rwf has contributed not to develop PTSD though its likelihood was low (AOR= 0.063; 95% CI=0.004- 0.882**;** P= 0.040). Participants who fall ubudehe category 2 were more likely to develop PTSD (AOR= 0.281; 95% CI=0.095- 0.829**;** P= 0.021).

The results are concur with the results from the interview conducted in Ethiopia on 830 participants to report on factors associated with the development of PTSD among the survivors of Koshe landslide which highlighted that demographic factors played a big role in the development of PTSD whereby being female, family separation, serious physical trauma, drug addiction background, familial history of depression, negative affect and perceived higher tension were found to be among the factors associated with PTSD (Asnakew *et al*., 2019). The results are quite different from the one found in the DRC whereby conflicts were reported to be main factors behind the development of PTSD which indicated that among people prone to disasters where regions without conflicts reported a lower prevalence of 8% compared to regions in conflicts 30% (Id et al., 2020).

Another study by (Munyandamutsa et al., 2012) revealed that having to live in severe poverty, witnessing the assassination of a family member in 1994, being divorced or wedded, missing both family and residing in the South Province in between ages of 25 and 34. Depression and alcohol dependency were most common in participants who met the diagnostic criteria for PTSD than respondents without PTSD in the same study population (Munyandamutsa *et al*., 2012).

It was emphasized that lack of social support its self is a risk which might lead to a predictor to develop PTSD among people affected by the stressful event(Guay et al., 2006)

Health related factors

The results indicated that factors associated with whether participants have had experience of death of one of the family members, and displacement from where they live had an impact on whether people develop PTSD or not [P≤0.05]. These results concur with prior scholarship at the global scale that factors ranging from the death of someone close to the victim, severe injury or forced relocation from home, and pre-existing vulnerabilities are factors influencing onset of PTSD among people affected by natural disasters (Bromet et al., 2017).

No attempts done to discuss the results on incidence of chronic Post-Traumatic Stress Disorders because the results did not confirm it.

Psychosocial support services provided to communities post severe flooding and landslides

The results in the present study showed that people affected by flooding and landslides did not get enough support as needed in due time where almost all highlighted support was not given as reported by the majority of the study participants. 14 % of the participants scored that they did not receive support at all. Government support was the main source of support (62%) while NGO was the least to provide support (2%). Only 24% get counselling services among other services. It is very crucial to get support after a traumatic event. It is important to know what are the types of social support people for people affected by natural disasters depending on their causes. The results from bivariate analysis between social support received and incidence of PTSD showed that support from the nearest health center was associated with the development of PTSD(P=0.005) government support(P=0.001). Other social support are not associated with the development of PTSD.

Lack of social enough support is likely to be a factor to develop PTSD among people affected by stressful event, therefore, it is important to know what are the types of social support people affected are in need so that they are helped not to permanently live with the condition.

The results of the present study have shown that the support provided was not as enough as it was required considering the scholarship that, people affected by natural disasters get support from government's entities, non-governmental organizations, family members, friends, colleagues to recover, but their effects on relationship with others and welfare remains extensive and sustained for long period for affected people, especially on psychosocial and mental health aspects that cause trauma(Stanke et al., 2012). In relation to the reported literature, the support provided to people affected by disasters in other settings get social support emotional, practical, affective, instrumental governmental and non-governmental spouse support, appraisal support, belongingness support, availability of help or support from others to fulfill specific needs (e.g. love, advice about a crisis (Guay et al., 2006). In addition, mental health psychosocial support provided to people affect by the disasters range from provision of cognitive-behavioral therapy, narrative exposure therapy, psychotherapy, and psycho-education(Bangpan, Felix, & Dickson, 2019). The present study did not attempt to deepen and explore support given to people affected by the natural disasters. It is of a need to conduct a separate study taking into account the support provided in this area.

Conclusion

The incidence of PTSD reported in the present study is high as a significant percentage of 108(52%) out of 209 participants reported the symptoms of PTSD while only 101(48%) did not report any symptom of PTSD.

The reported main factors associated with the development of PTSD are gender, education level, family income, ubudehe category, and destruction of the property. Health related factors are directly associated with the development of PTSD such as health problem to them or to the family flooding caused death problem to you directly or to your family member and family displacement, therefore the following recommendations can guide to shift from the current

situation.To have a family income was a protector to develop PTSD while those who fall ubudehe category 2 were more likely to develop PTSD.

AUTHORS CONTRIBUTION

C.N.: Conceptualized the research idea, contributed to the methods, and collected the data and its analysis as well as manuscript writing.
J. D. I: Supervised the work from research idea conceptualization, data management as well as manuscript writing.
J. K. K.: Supervised the work from research idea conceptualization, data management as well as manuscript writing.

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CONFLICT OF INTEREST

All authors declare that no conflict of interest involves in this manuscript

REFERENCES

Asnakew, S., Shumet, S., Ginbare, W., Legas, G., & Haile, K. (2019). *Prevalence of post-traumatic stress disorder and associated factors among Koshe landslide survivors , Addis Ababa , Ethiopia : a community-based , cross-sectional study*. 1–8. https://doi.org/10.1136/bmjopen-2018-028550

Bangpan, M., Felix, L., & Dickson, K. (2019). Mental health and psychosocial support programmes for adults in humanitarian emergencies : a systematic review and meta-analysis in low and middle- income countries. *BMJ Global Health*, *4*. https://doi.org/10.1136/bmjgh-2019-001484

Bromet, E. J., Atwoli, L., Kawakami, N., Piotrowski, P., King, A. J., Alonso, J., … Kessler, R. C. (2017). Post-traumatic stress disorder associated with natural and human-made disasters

in the World Mental Health Surveys. *Psychol Med.*, *47*(2), 227–241. https://doi.org/10.1017/S0033291716002026.Post-traumatic

Chan, N. W. (n.d.). *Impacts of Disasters and Disaster Risk Management in Malaysia : The Case of Floods*. 239–265. https://doi.org/10.1007/978-4-431-55022-8

Cloitre, M., Shevlin, M., Cr, B., Ji, B., Np, R., & Maercker, A. (2018). *The International Trauma Questionnaire : development of a self-report measure of ICD-11 PTSD and complex PTSD*. 1–11. https://doi.org/10.1111/acps.12956

Dilley, M., Chen, R. S., Deichmann, U., Lerner-Lam, A. L., Arnold, M., Agwe, J., … Yetman, G. (2005). *Natural Disaster Hotspots A Global Risk*. Washington DC.

Ditlevsen, D. N., & Elklit, A. (2010). The combined effect of gender and age on post traumatic stress disorder : do men and women show differences in the lifespan distribution of the disorder ? *Annals of General Psychiatry*, *9*(32), 1–12.

Doocy, S., Daniels, A., & Kirsch, T. D. (2013). *The Human Impact of Floods : a Historical Review of Events 1980-2009 and Systematic Literature Review*. 8171.

Ejeta, L. T., Ardalan, A., Paton, D., & Yaseri, M. (2016). Pedictors of community preparedness for flood in Dire-Dawa town, Eastern Ethiopia: Appling adapted version of Health Belief Model. *International Journal of Disaster Risk Reduction*, *19*(September), 341–354. https://doi.org/10.1016/j.ijdrr.2016.09.005

Eytan, A., Munyandamutsa, N., Mahoro, P., & Gex-fabry, M. (2015). *Long-term mental health outcome in post-conflict settings : Similarities and differences between Kosovo and Rwanda*. https://doi.org/10.1177/0020764014547062

Few, R. (2003). *Flooding , vulnerability and coping strategies : local responses to a global threat*. https://doi.org/10.1191/1464993403ps049ra

Fincham, J. E. (2008). Response Rates and Responsiveness for Surveys , Standards , and the Journal. *Americak Journal of Pharmaceutical Education*, *72*(2), 2–4.

Fodor, K. E., Pozen, J., Ntaganira, J., Sezibera, V., & Neugebauer, R. (2015). Journal of Anxiety Disorders The factor structure of posttraumatic stress disorder symptoms among Rwandans exposed to the 1994 genocide : A confirmatory factor analytic study using the PCL-C. *Journal of Anxiety Disorders*, *32*, 8–16. https://doi.org/10.1016/j.janxdis.2015.03.001

Fontalba-navas, A., Lucas-borja, M. E., Gil-aguilar, V., & Arrebola, J. P. (2016). Incidence and risk factors for post-traumatic stress disorder in a population affected by a severe flood.

Public Health, *144*, 96–102. https://doi.org/10.1016/j.puhe.2016.12.015

Galea, S., Nandi, A., & Vlahov, D. (2005). *The Epidemiology of Post-Traumatic Stress Disorder after Disasters*. *27*, 78–91. https://doi.org/10.1093/epirev/mxi003

Guay, S., Billette, V., & Marchand, A. (2006). Exploring the Links Between Posttraumatic Stress Disorder and Social Support : Processes and Potential Research Avenues. *Journal OfTraumatic Stress*, *19*(3), 327–338. https://doi.org/10.1002/jts.

Id, L. C. N., Id, A. S., Kalapurakkel, S. S., Id, C. H., Seedat, S., Id, B. H., … Id, K. C. K. (2020). *PLOS MEDICINE National and regional prevalence of posttraumatic stress disorder in sub-Saharan Africa : A systematic review and meta-analysis*. (1), 1–30. https://doi.org/10.1371/journal.pmed.1003090

International Federation of Red Cross and Red Crescent Societies. (2016). *Emergency Plan of Action Final Report Rwanda : Floods*.

Jenkins, R., Othieno, C., Omollo, R., Ongeri, L., & Sifuna, P. (2015). *Probable Post Traumatic Stress Disorder in Kenya and Its Associated Risk Factors : A Cross-Sectional Household Survey*. 13494–13509. https://doi.org/10.3390/ijerph121013494

Jonkman, S. N. (2005). *Global Perspectives on Loss of Human Life Caused by Floods*. 151–175.

Kessler, R. C., Petukhova, M., Sampson, N. A., & Zaslavsky, A. M. (2012). *Twelve-month and lifetime prevalence and lifetime morbid risk of anxiety and mood disorders in the United States*. *21*(August), 169–184. https://doi.org/10.1002/mpr

Khan, H., & Khan, A. (2008). *Natural hazards and disaster management in Pakistan*.

Lancaster, C. L., Teeters, J. B., Gros, D. F., & Back, S. E. (2016). *Posttraumatic Stress Disorder : Overview of Evidence-Based Assessment and Treatment*. https://doi.org/10.3390/jcm5110105

Munyandamutsa, N., Mahoro, P., & Eytan, M. G. A. (2012). *Mental and physical health in Rwanda 14 years after the genocide*. https://doi.org/10.1007/s00127-012-0494-9

Neria, Y., Nandi, A., & Galea, S. (2008). Post-traumatic stress disorder following disasters: a systematic review. *Psychol Med*, *38*(4), 467–480. https://doi.org/10.1017/S0033291707001353.Post-traumatic

Olley, B. O., Zeier, M. D., Stein, D. J., Town, C., Africa, S., Clinic, I. D., … Stein, D. J. (2005). *AIDS Care : Psychological and Socio- medical Aspects of AIDS / HIV Post-traumatic stress disorder among recently diagnosed patients with HIV / AIDS in South Africa*. (February

2014), 37–41. https://doi.org/10.1080/09540120412331319741

Pham, P. N., Weinstein, H. M., & Longman, T. (2004). Trauma and PTSD Symptoms in Rwanda. *JAMA*, *292*(5).

Rugema, L., Mogren, I., Ntaganira, J., & Krantz, G. (2015). *Traumatic episodes and mental health effects in young men and women in Rwanda , 17 years after the genocide*. (Cmd). https://doi.org/10.1136/bmjopen-2014-006778

Stanke, C., Murray, V., Amlôt, R., Nurse, J., & Williams, R. (2012). The effect of flooding on mental health: outcomes and recommendations from a review of the literature. *PloS Currents*, *4*. https://doi.org/http://dx.doi.org/10.1371/4f9f1fa9c3cae

Wilder-Smith, A. (2005). Tsunami in South Asia : What is the Risk of Post-disaster Infectious Disease Outbreaks ? *Ann Acad Med Singapore*, *34*(10), 625–631.