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Exposure to conflict and disaster: A national survey on the prevalence of psychotic experiences in Sri Lanka

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ABSTRACT

Recent research conducted in high-income countries suggests psychotic experiences are common in the general population, but evidence from low- and middle-income countries (LMIC) remains limited. Sri Lanka is a LMIC affected by three decades of civil conflict and, in 2004, a devastating tsunami. This study aimed to investigate the prevalence of psychotic experiences in a general population sample in Sri Lanka and associations with conflict- and tsunami-related trauma. This is a first National Mental Health Survey conducted in Sri Lanka. A cross-sectional, multi-stage, cluster sampling design was used to estimate the prevalence of psychotic symptoms. Data on socio-demographic characteristics, conflict- and tsunami-related trauma, and psychotic experiences were collected using culturally validated measures in a sample of 5927 participants. The weighted prevalence of psychotic symptoms was 9.7%. Exposure to one or more conflict-related events (adj. OR 1.79, 95% CI 1.40–2.31, $p < 0.001$) and loss or injury of a family member or friend through conflict (adj. OR, 1.83, 95% CI 1.42–2.37, $p < 0.001$) were associated with increased odds of reporting psychotic experiences. Psychotic experiences were more common in individuals directly exposed to tsunami disaster (adj. OR, 1.68, 95% CI 1.04–2.73, $P = 0.035$) and in those who had a family member who died or was injured as result of tsunami (adj. OR, 1.42, 95% CI 1.04–1.94, $p = 0.029$). Our findings suggest that psychotic experiences are common in the Sri Lankan population. Exposure to traumatic events in armed conflicts and natural disasters may be important socio-environmental factors in the development of psychotic experiences.

1. Introduction

Substantial evidence has accumulated that low-level psychotic experiences, such as fleeting and non-distressing hallucinations, strange experiences and delusions, are common in the general population (Johns and van Os, 2001). Findings from large population surveys suggest that the prevalence of psychotic experiences (PE) ranges from 5%–20% (Verdoux and van Os, 2002; Johns et al., 2004; King et al., 2005; Scott et al., 2006; Morgan et al., 2009). Further, in a considerable proportion of individuals, subclinical PE persist over time, which, in turn, is associated with an increased risk of psychotic disorder (Linscott and van Os, 2013). There is also evidence that socio-environmental risk factors are shared across PE and psychotic disorder (Morgan et al., 2009).

To date, most research on PE has come from high-income countries, with only a small number of studies conducted in low- and middle-income countries (LMICs) (Soosay et al., 2012). The reported prevalence in LMICs ranges from 4% in Tanzania (Jenkins et al., 2010) to 12% in Timor Leste (Soosay et al., 2012). An even greater variation in prevalence (0.8%–31.4%) was found in the WHO cross-national World Health Survey conducted in 52 countries (Nuevo et al., 2012), which reported a prevalence of PE of only 2.4% in Sri Lanka. Studies investigating this issue in LMICs are frequently beset by methodological shortcomings, such as having a representative sample and small sample size, which may account for variation in the prevalence of PE reported to date.

Several factors have been shown to be associated with PE (Spauwen et al., 2006; Campbell and Morrison, 2007; Hides et al., 2009). However, only a small number of studies have examined the role of exposure to trauma of armed conflict in relation to PE (Soosay et al., 2012; Amone-P'olak et al., 2013; Lindley et al., 2014). Exposure to natural disasters may increase risk of developing a mental disorder (Meewisse et al., 2011; Ekanayake et al., 2013; Dorrington et al., 2014), but no study that we are aware of has investigated the association between natural disasters and PE.

Sri Lanka is one of the few countries that simultaneously faced war and natural disaster, in which the relative impact of each can be

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Table 1
Prevalence of positive responses on Psychosis Screening Questionnaire (PSQ).

PSQ Items		
Initial probe Secondary questions	'Yes" responses	'Yes' responses (weighted[a])
	n	%
Hypomania		
Over the past year, have there been time when you felt very happy indeed without a break for days on end?	1886	29.56
Was there an obvious reason for this?	175	2.61
Did your relatives or friends think it was strange or complain about it?	4	0.00
Thought insertion		
Over the past year, have you ever felt that your thoughts were directly interfered with or controlled by some outside force or person?	166	2.75
Did this come about in a way that many people would find hard to believe, for instance through telepathy?	45	0.85
Paranoia		
Over the past year, have there been times when you felt that people were against you?	729	11.87
Have there been times when you felt that people were deliberately acting to harm you or your interests?	497	8.18
Have there been times when you felt that a group of people was plotting to cause you serious harm or injury?	163	2.74
Strange experiences		
Over the past year, have there been times when you felt that something strange was going on?	136	2.23
Did you feel it was so strange that people would find it very hard to believe?	79	1.37
Hallucinations		
Over the past year, have there been times when you heard or saw things that other people could not?	151	2.55
Did you at any time hear voices saying quite a few words or sentences when there was no-one around that might account for it?	76	1.23
Any psychotic-like experiences excluding hypomania		
Yes to one or more initial probe questions	889	14.58
Yes to the secondary questions	571	9.54
Any psychotic-like experience		
Yes to one or more of the initial probe question(s)	2408	38.71
Yes to one or more of the secondary question(s)	572	9.68

[a] Weighted for household size and sex.

compared and studied in relation to psychosis. The country has experienced three armed conflicts that have arisen out of ethnic tensions (Siriwardhana and Wickramage, 2014). It is estimated that up to 70,000 people died as a consequence of the most recent conflict between the majority Sinhalese and minority Tamil population and many thousands more were displaced (Siriwardhana et al., 2013a, Siriwardhana and Wickramage, 2014). In addition, Sri Lanka was hit by a tsunami on 26th December 2004, devastating almost two thirds of the island's coastline and resulting in an estimated death toll of 40,000 (Siriwardhana et al., 2012). Against this background, we sought to investigate the association between PE and exposure to traumatic events of prolonged conflict and a devastating natural disaster in a large community-based sample. Specifically, our aims were to: 1) estimate the prevalence of PE in the Sri Lankan population; and 2) assess whether a) exposure to conflict-related traumatic events and/or b) exposure to tsunami-related traumatic events were associated with a higher prevalence of PE.

2. Method

The National Mental Health Survey was a community based cross-sectional survey in Sri Lanka. Full details of the methods used are provided in previous reports (Institute for Research and Development, 2007).

2.1. Sample

The inclusion criteria used in the study were as follows: 18–65 years of age; living in an included district for at least six months prior to inclusion; and sufficient knowledge of Sinhala, Tamil, or English. The ratio of women to men was higher in the current sample than in a recent national census. Therefore, analyses were weighted for sex to account for the oversampling of women.

A multi-stage cluster sampling method used the Grama Niladari divisions (GND), i.e. the lowest-level administrative unit in Sri Lanka, for cluster selection. GND clusters were chosen to be the primary sampling unit, identifying 36 clusters from 17 districts and 10 respondents from each cluster. Ethical approval was obtained from the Ethics Review Committee, University of Sri Jayewardenepura, Sri Lanka.

2.2. Data collection

Structured questionnaires were used for collecting data on socio-demographic characteristics.

To assess PE in the past year, the Psychosis Screening Questionnaire (PSQ) (Bebbington and Nayani, 1995) was administered. The PSQ is divided into 5 sections with questions on hypomania, thought insertion, paranoia, strange experiences, and hallucinations. Each section has secondary questions to establish the presence (i.e., endorsement of one or more secondary question(s)) of PE.

Exposure to the conflict and tsunami was measured using the Brief Questionnaire on War and Tsunami (Siriwardhana et al., 2013b; Dorrington et al., 2014), which consists of 16 items and allows for computing separate indices for conflict- and tsunami-related traumatic events. One or more positive responses to items on this questionnaire indicated the degree to which participants were affected by conflict- and/or tsunami-related traumatic events (including injury, death, and displacement). Items were grouped by type of event to create indices of a) direct exposure to combat or tsunami (i.e. participation or injury through conflict/in area or injured during tsunami), b) loss/injury of family/friends, and c) displacement/loss of property. Instruments were translated into Sinhala and Tamil, both of which are official languages spoken in Sri Lanka. Items were further summarized into a binary (no event, 1 or more events) index to assess the impact of linked and cumulative exposure to conflict- or tsunami-related trauma.

2.3. Statistical analysis

Statistical analyses were conducted using STATA 12 (StataCorp., 2011). All analyses were weighted for household size and sex to account for oversampling of women and participants from larger households. The weighted prevalence of PE was calculated in the whole sample. Logistic regression was used to examine associations between socio-demographic characteristics, conflict- and tsunami-related exposures and the binary outcome of presence or absence of PE, while controlling for potential confounders. Finally, we examined whether there was evidence that exposure to conflict-related traumatic events combined synergistically with exposure to tsunami-related events by testing for interaction on an additive scale (i.e., for departure from additivity) using interaction contrast ratios (ICR), with departure from additivity (i.e., interaction) being indexed by an ICR greater than 0. The nlcom procedure was used to generate confidence intervals and p-values for ICRs (Morgan et al., 2014).

Table 2
Socio-demographic characteristics by absence or presence of psychotic experiences (PE).

Variable	No PE (n = 5355)	Any PE (n = 572)	Unadj. OR (95% CI)†	p
	n (%)†	n (%)†		
Gender				
Male	2028 (50.7)	223 (49.3)	1.00	–
Female	3327 (49.3)	349 (50.7)	1.06 (0.87–1.29)	0.572
Age[a]				
18–30	1493 (26.7)	143 (24.9)	1.00	–
31–39	1259 (21.4)	126 (19.4)	0.97 (0.73–1.29)	0.860
40–50	1353 (24.6)	182 (32.7)	1.42 (1.09–1.85)	0.009
51–75	1249 (27.4)	120 (22.9)	0.89 (0.67–1.21)	0.478
Marital status[b]				
Married	4225 (76.1)	446 (74.9)	1.00	–
Widowed	269 (5.9)	32 (6.4)	1.11 (0.69–1.77)	0.675
Separated/divorced	63 (2.2)	8 (2.3)	1.08 (0.42–2.79)	0.880
Never married	787 (15.8)	85 (16.5)	1.06 (0.79–1.42)	0.714
Ethnicity[c]				
Sinhala	4584 (85.9)	525 (91.0)	1.00	–
Other ethnic groups‡	766 (14.0)	47 (8.9)	0.60 (0.42–0.88)	0.008
Religion[d]				
Buddhist	4319 (80.8)	499 (86.1)	1.00	–
Other§	1023 (19.2)	71 (13.9)	0.68 (0.49–0.92)	0.013
Employment (current)[c]				
Employed	2174 (47.47)	249 (49.7)	1.00	–
Unemployed	3178 (52.53)	321 (50.3)	0.92 (0.75–1.12)	0.390
Educational status[e]				
Higher (grade 12 to university)	2036 (36.8)	212 (38.3)	1.00	–
School (grade 1 to O-levels)	3145 (59.6)	344 (59.4)	0.96 (0.78–1.18)	0.689
No qualifications	157 (3.6)	16 (2.3)	0.61 (0.34–1.09)	0.097
Affected area				
Not affected	3181 (59.9)	291 (52.9)	1.00	–
War affected	1262 (24.2)	139 (24.5)	1.15 (0.89–1.46)	0.276
Tsunami affected	912 (15.8)	142 (22.6)	1.62 (1.27–2.06)	<0.001
Family in debt at present [f]				
No	3301 (64.8)	284 (52.6)	1.00	–
Yes	1957 (35.3)	277 (47.4)	1.66 (1.35–2.03)	<0.001

Note: Missing: [a]2, [b]12, [c]5, [d]15, [e]17, [f]50.
†Weighted for household size and sex.
‡Tamil, Muslim, Burgher, Malay and other.
§Hindu, Islam, Roman Catholic, other Christian.

3. Results

3.1. Prevalence of PE

A total of 6120 participants were successfully recruited for the survey. Of these, 5927 participants completed the PSQ and were included in the analyses. The 193 participants who did not take part were more likely to be women (65.3% vs 34.7%, $p < 0.001$) and from younger age group (37.4%, $p = 0.015$). Of the 5927 participants who completed the PSQ, 572 endorsed at least one of the secondary questions. This yielded a weighted prevalence of PE of 9.7%. The most commonly endorsed secondary question was paranoia (8.2%), followed by thought insertion (2.8%), strange experiences (1.4%), and hallucinations (1.2%) (Table 1).

3.2. Socio-demographic characteristics and PE

Socio-demographic characteristics by PE are shown in Table 2. PE were slightly more common in participants aged 40–50 than in participants aged 18–30. Compared with Sinhalese, participants from other ethnic groups were less likely to endorse PE. Also, PE were more common in participants living in tsunami affected areas and less common in participants in debt.

3.3. Exposure to conflict and tsunami and PE

Table 3 presents findings on conflict-related trauma and PE. Participants who lost a close friend or family member as a result of conflict were more likely to endorse PE compared with those who did not lose a friend or family member (unadjusted odds ratio [OR] 2.26, $p < 0.001$). Similarly, participants whose close friend or family member was injured as a result of conflict were more likely to report PE (OR 1.99, $p = 0.004$).

Table 4 presents findings on tsunami-related trauma and PE. PE were more common in people who suffered injuries from the tsunami (OR 4.05, $p = 0.004$). Similarly, PE were more common in participants with a friend or family member lost (OR 1.99, $p < 0.001$) or injured (OR 2.25, $p = 0.002$) as a result of the tsunami. Also, loss of property due to the tsunami was associated with an increased odds of reporting one or more PE (OR 1.88, $p = 0.049$).

We next examined the association between PE and grouped and cumulative indices of exposure to conflict- and tsunami-related trauma (see Table 5). Using the grouped index of conflict-related trauma, loss or injury of family or friends a result of conflict were associated with PE (adjusted OR [aOR], 1.93, $p < 0.001$). This association held when adjusting further for loss or injury of family members or friends a result of tsunami (aOR, 1.83, $p < 0.001$). Using the cumulative index of exposure to conflict-related trauma, participants exposed to one or more traumatic event(s) were more likely to report PE than those not exposed (aOR, 1.86, $p < 0.001$). The association between exposure to conflict-related traumatic events and PE held when further adjusting for exposure to tsunami-related events (aOR 1.79, $p < 0.001$).

PE were more common in individuals directly exposed to the tsunami disaster (aOR, 1.69, $p = 0.003$). The association between direct exposure to the tsunami and PE held when adjusting further for direct

Table 3
Exposure to conflict-related trauma by absence or presence of psychotic experiences (PE).

Variable	No PE (n = 5355) n (%)[a]	Any PE (n = 572) n (%)[a]	Unadj OR (95% CI)[a]	p
Direct exposure to conflict				
Sustained injury as a result of conflict				
Yes	44 (0.95)	6 (1.11)	1.18 (0.48–2.90)	0.725
No	5306 (99.05)	566 (98.89)	1.0	–
Direct participation in conflict				
Yes	53 (1.17)	8 (1.46)	1.25 (0.56–2.80)	0.584
No	5290 (98.83)	564 (98.54)	1.00	–
Loss/injury of family/friends				
Lost a close family member as a result of conflict				
Yes	130 (2.40)	16 (2.53)	1.06 (0.60–1.86)	0.847
No	5216 (97.60)	555 (97.47)	1.00	–
A close family member got injured as a result of conflict				
Yes	121 (2.29)	18 (2.94)	1.29 (0.73–2.29)	0.377
No	5224 (97.71)	554 (97.06)	1.00	–
Lost a friend or other family member as a result of conflict				
Yes	391 (6.79)	84 (14.19)	2.26 (1.71–3.00)	<0.001
No	4956 (93.21)	488 (85.81)	1.00	–
A friend or other family member injured as a result of conflict				
Yes	192 (3.41)	35 (6.59)	1.99 (1.25–3.19)	0.004
No	5155 (96.59)	537 (93.41)	1.00	–
Displacement/loss of property				
Displaced as a result of conflict				
Yes	29 (0.55)	6 (1.14)	2.07 (0.81–5.32)	0.131
No	5316 (99.45)	566 (98.86)	1.00	–
Lost property as a result of conflict				
Yes	42 (0.80)	6 (1.14)	1.43 (0.57–3.58)	0.448
No	5303 (99.20)	566 (98.86)	1.00	–

[a] Weighted for household size and sex.

exposure to conflict (aOR, 1.68, p = 0.035). Loss or injury of family members and friends as a result of the tsunami was associated with PE (aOR, 1.62, p = 0.002). This association remained significant when adjusting for conflict-related loss or injury of family members and friends (aOR, 1.42, p = 0.029). PE were more common in individuals exposed to one or more traumatic event(s) of the tsunami disaster (aOR, 1.48, p = 0.010). However, this association was attenuated and ceased to be statistically significant at conventional levels when further adjusting for exposure to conflict-related events (aOR 1.28, p = 0.108).

Finally, we examined evidence for synergistic effects of exposure to conflict- and tsunami-related events using interaction contrast ratios. There was no evidence of departure from additivity: the aOR for

Table 4
Exposure to tsunami-related trauma by absence or presence of psychotic experiences (PE).

Variable	No PE (n = 5355) n (%)[†]	Any PE (n = 572) n (%)[†]	Unadj OR (95% CI)[†]	p
Direct exposure to tsunami disaster				
At the time in an area affected by tsunami				
Yes	156 (2.91)	31 (5.65)	1.99	0.003
No	5193 (97.09)	540 (94.35)	(1.27–3.14)	
Suffered injuries from tsunami				
Yes	10 (0.19)	4 (0.77)	4.05 (1.16–14.15)	0.029
No	5335 (99.81)	565 (99.23)	1.00	–
Loss/injury of family/friends				
Lost a close family member as a result of tsunami[a]				
Yes	45 (0.81)	8 (1.16)	1.44 (0.64–3.24)	0.383
No	5300 (99.01)	563 (98.62)	1.00	–
A close family member got injured as a result of tsunami				
Yes	45 (0.82)	7 (0.12)	1.46 (0.61–3.49)	0.391
No	5300 (99.18)	564 (98.80)	1.00	–
Lost a friend or other family member as a result of tsunami				
Yes	286 (5.05)	62 (9.61)	1.99 (1.44–2.78)	<0.001
No	5056 (94.95)	509 (90.39)	1.00	–
A friend or other family member injured as a result of tsunami				
Yes	96 (1.72)	24 (3.80)	2.25 (1.36–3.71)	0.002
No	5248 (98.28)	547 (96.20)	1.00	–
Displacement/loss of property				
Displaced as a result of tsunami				
Yes	53 (0.89)	7 (1.09)	1.23 (0.52–2.92)	0.638
No	5291 (99.11)	564 (98.91)	1.00	–
Lost property as a result of tsunami				
Yes	81 (1.38)	16 (2.56)	1.88 (1.00–3.53)	0.049
No	5260 (98.62)	555 (97.44)	1.00	–

Note: Missing: [a]11, †Weighted for household size and sex.

Table 5
Association between exposure to conflict- and tsunami-related trauma and psychotic experiences (PE).

Variable	No PE n (%)[a]	Any PE n (%)[a]	Unadj OR[a] (95% CI)	p	Adj. OR[a,b] 95% CI	p
Conflict exposure						
Grouped, by type of event						
Direct exposure to conflict						
None	5269 (98.40)	561 (97.97)	1.00	–	1.00	–
Participation/injury	73 (1.60)	11 (2.03)	1.27 (0.64–2.54)	0.491	1.07 (0.53–2.16)	0.847
Loss/injury of family/friends						
None	4665 (88.11)	444 (77.29)	1.00	–	1.00	–
Injury/loss	678 (11.89)	127 (22.71)	2.18 (1.70–2.78)	<0.001	1.93 (1.50–2.48)	<0.001
Displacement/loss of property						
None	5295 (99.09)	564 (98.39)	1.00	–	1.00	–
Displacement/loss	48 (0.91)	8 (1.61)	1.78 (0.80–3.97)	0.159	1.99 (0.89–4.45)	0.094
Cumulative index						
No events	4606 (86.99)	439 (76.16)	1.00	–	1.00	–
1 or more traumatic events	729 (13.01)	132 (23.84)	2.09 (1.64–2.66)	<0.001	1.86 (1.45–2.38)	<0.001
Tsunami exposure						
Grouped, by type of event						
Direct exposure to tsunami disaster						
Not present	5193 (97.09)	540 (94.35)	1.00	–	1.00	–
In area/injury	156 (2.91)	31 (5.65)	1.99 (1.27–3.14)	0.003	1.69 (1.05–2.72)	0.003
Loss/injury of family/friends						
None	4976 (93.47)	497 (88.30)	1.00	–	1.00	–
Injury/loss	356 (6.53)	74 (11.70)	1.89 (1.40–2.56)	<0.001	1.62 (1.19–2.20)	0.002
Displacement/loss of property						
None	5291 (99.11)	564 (98.91)	1.00	–	1.00	–
Displacement/loss	53 (0.89)	7 (1.09)	1.23 (0.52–2.92)	0.638	1.11 (0.45–2.73)	0.819
Cumulative index						
No events	4915 (92.59)	493 (87.83)	1.00	–	1.00	–
1 or more traumatic events	418 (7.41)	76 (12.17)	1.73 (1.29–2.33)	<0.001	1.48 (1.09–2.00)	0.010

[a] Weighted for household size and sex.
[b] Adjusted for age, ethnicity, religion, area and debt.

those exposed to conflict-related events only was 1.77 (95% CI 1.33–2.34), for those exposed to tsunami-related events 1.23 (95% CI 0.83–1.81), and for those exposed to both conflict- and tsunami-related events 2.63 (95% CI 1.66–4.17) (ICR 0.63, 95% CI −0.68–1.95, p = 0.344).

4. Discussion

This is the first study to investigate the population prevalence of PE in the Sri Lankan population, and associations with conflict- and tsunami-related trauma. This yielded a prevalence of PE of 9.7% in a national sample in Sri Lanka. There was also evidence that exposure to conflict-related trauma is associated with PE. Specifically, PE were more common in individuals who reported loss or injury of family or friends; and cumulative exposure to one or more conflict-related traumatic events as a result of a conflict. This is consistent with evidence that multiple trauma experiences increase the likelihood of psychotic symptoms (Shevlin et al., 2008). PE were also more common in individuals who reported loss or injury of family or friends as a result of the tsunami, and in those directly exposed to this disaster. However, the association between cumulative exposure to tsunami-related traumatic events and a higher prevalence of PE no longer held when controlling for cumulative exposure to conflict-related trauma. Further, no evidence was found that exposure to conflict-related traumatic events combined synergistically with exposure to tsunami-related traumatic events to increase odds of PE. Research on prevalence of, and factors associated with, PE may deliver insights on how to delay or prevent the onset of clinical psychotic disorder (Yung et al., 2009; Kirkbride and Jones, 2011; Hui et al., 2013) before individuals develop a need for care (Bak et al., 2005). PE tend to co-occur with depression and anxiety; and are associated with later risk of depressive and anxiety disorders (Wigman et al., 2012) which means targeting those with PE may prevent a number of subsequent adverse outcomes.

4.1. Methodological considerations

A number of methodological limitations need to be considered when interpreting the findings from this study. Due to the armed conflict, 8 of the 25 districts in the northern part of the country were not surveyed, as they were unsafe for researchers to operate in due to breakout of hostilities and war during the study period. Further, certain populations, such as prisoners, homeless, hospital inpatients and displaced individuals were not included in the sampling frame. This may have affected generalisability of findings to these districts and populations. While analyses accounted for oversampling of women and participants from larger households, these did not control for clustering or non-response due to other factors such as socio-economic status or ethnicity. Selection bias may have also arisen from those with PE being less likely to participate in the survey (Knudsen et al., 2010). In addition, this study did not include any measures of genetic risk and other important environmental exposures such as cannabis use and childhood trauma. While these factors may have contributed to the development of PE independent of, or in synergy with, conflict-/tsunami-related trauma, we cannot rule out the possibility of unmeasured confounding by these factors. Moreover, the nature of cross-sectional studies prevents us from making causal inferences (Morrison et al., 2003). Further, while the PSQ was translated and adapted into local languages for this survey, some aspects of its cross-cultural validity (including the use of screening criteria for psychotic disorder such as history of admission to a psychiatric hospital/ward for psychosis or taking anti-psychotic medication in a country like Sri Lanka where mental health services are not developed) have not yet been formally tested. This may have led to potential misclassification. When interpreting our findings it is important to note that we did not use 'presence of a psychotic disorder' as an exclusion criteria for selecting our sample. Therefore, some of the participants with PE may have met criteria for a diagnosis of psychotic disorder. Nonetheless, this study was one of the largest cross-sectional surveys conducted to date in a LMIC, providing epidemiological data on the

prevalence of reported PE and overcoming several methodological shortcomings of previous surveys including small sample sizes or not having a representative sample.

4.2. Comparison with previous research

The findings of this study add to the literature on the prevalence of PE in the general population and the impact of exposure to conflict or natural disasters such as the tsunami on such experiences. The prevalence of 9.7% found in this study is in line with findings from previous studies on the prevalence of PE in the general population in the west (Johns et al., 2004; Morgan et al., 2009). Some studies that have used alternative methods for measuring the prevalence of PE, found higher prevalence rates (Nuevo et al., 2012). Interestingly, the prevalence of PE found in this study is higher than that reported in the WHO 52 Country Survey for Sri Lanka (Nuevo et al., 2012) possibly due to the use of different tools, weights and sampling methods.

Very few previous studies have examined how exposure to conflict or to natural disasters affects prevalence of PE. Soosay et al. (2012), in a post-conflict area in Timor Leste, found that trauma was associated with a higher prevalence of PE. These authors further reported that PSQ screen positive cases endorsed high levels of potentially traumatic events including, consistent with our findings, loss of family members. Other studies on conflict-related trauma examined PE in relation to PTSD and common mental disorders and found, for example, that severity of PE was greater in those with combat exposure (Lindley et al., 2014). With regard to natural disasters, the literature reports only general effects on mental health (van der Velden et al., 2013) and not specifically on prevalence of PE.

Studies examining the impact of exposure to conflict or tsunami have not explored in detail events such as loss or injury of other family members due to these adverse events. This finding is consistent with studies that suggest parental death is associated with an increased risk of psychotic disorder (Morgan et al., 2007). One reason why findings on an association between conflict-/tsunami-related loss of a family member fell short of statistical significance at conventional levels may be that these events were much less common/prevalent than conflict-/tsunami-related loss or injury of other family members or friends. Hence, there may have been insufficient power to detect these (small) effects in this sample. The results of this study also suggest linked and cumulative exposure to conflict-related traumatic events including exposure to interpersonal violence and threat is associated with PE. Integrated models of psychosis have posited a number of putative biological and psychological mechanisms that may underlie the association between trauma and psychosis (Bentall et al., 2014; Howes and Murray, 2014; Morgan et al., 2010; Reininghaus and Morgan, 2014). For example, Morgan et al. (2010) proposed that sensitization of the mesolimbic dopaminergic system, elevated stress sensitivity, and enhanced threat anticipation may be putative mechanisms through which repeated exposure to social adversity (especially interpersonal violence and threat) may increase risk of psychosis (especially paranoia). While to date there is only some limited evidence on the role of these putative mechanisms (Egerton et al., 2016; Reininghaus et al., in 2016), they may have potentially operated on individuals along the pathway from exposure to conflict-related trauma to the development of PE.

5. Conclusions

Findings from this study support the hypothesis that cumulative exposure to conflict-related trauma and exposure to specific traumatic events of natural disasters are associated with a higher prevalence of PE. They are consistent with the proposition that PE are common in the general population. Given PE can be distressing and may contribute to the development of diagnosable psychotic disorder (DeVylder et al., 2014), these findings are important in that they provide prevalence estimates of PE for a LMIC and, therefore, may inform potential prevention strategies in these countries. These findings underscore the need of assessing and targeting the presence of PE in populations exposed to traumatic events such as conflict or natural disasters. Future research should examine the possible pathways to psychotic disorders through exposure to traumatic events such as armed conflicts or natural disasters.

Conflict of interest

All authors declare that they have no conflicts of interest.

Contributors

AS and CS contributed to conception and design of the study. AH and UR analysed the data and jointly drafted the article with CM. All authors contributed to interpretation of data, revised the article for important intellectual content, and provided approval of the version to be published.

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References

Amone-P'olak, K., Jones, P.B., Abbott, R., et al., 2013. Cohort profile: mental health following extreme trauma in a northern Ugandan cohort of affected youth study (the WAYS study). SpringerPlus 2, 300.
Bak, M., Myin-Germeys, I., Delespaul, P., et al., 2005. Do different psychotic experiences differentially predict need for care in the general population? Compr. Psychiatry 46, 192–199.
Bebbington, P., Nayani, T., 1995. The Psychosis Screening Questionnaire. Int. J. Methods Psychiatr. Res. 5, 11–19.
Bentall, R.P., de Sousa, P., Varese, F., et al., 2014. From adversity to psychosis: pathways and mechanisms from specific adversities to specific symptoms. Soc. Psychiatry Psychiatr. Epidemiol. 49, 1011–1022.
Campbell, M.L., Morrison, A.P., 2007. The relationship between bullying, psychotic-like experiences and appraisals in 14–16-year olds. Behav. Res. Ther. 45, 1579–1591.
DeVylder, J.E., Oh, H.Y., Corcoran, C.M., et al., 2014. Treatment seeking and unmet need for care among persons reporting psychosis-like experiences. Psychiatr. Serv. 65, 774–780.
Dorrington, S., Zavos, H., Ball, H., et al., 2014. Trauma, post-traumatic stress disorder and psychiatric disorders in a middle-income setting: prevalence and comorbidity. Br. J. Psychiatry 205, 383–389.
Egerton, A., Valmaggia, L., Howes, O., et al., 2016. Effect of childhood adversity on brain dopamine function in adulthood. JAMA Psychiatry (in press).
Ekanayake, S., Prince, M., Sumathipala, A., et al., 2013. "We lost all we had in a second": coping with grief and loss after a natural disaster. World Psychiatry 12, 69–75.
Howes, O.D., Murray, R.M., 2014. Schizophrenia: an integrated sociodevelopmental-cognitive model. Lancet 383, 1677–1687.
Hides, L., Lubman, D.I., Buckby, J., et al., 2009. The association between early cannabis use and psychotic-like experiences in a community adolescent sample. Schizophr. Res. 112, 130–135.
Hui, C., Morcillo, C., Russo, D.A., et al., 2013. Psychiatric morbidity, functioning and quality of life in young people at clinical high risk for psychosis. Schizophr. Res. 148, 175–180.
Institute for Research and Development, 2007. National Survey on Mental Health in Sri Lanka. Institute for Research and Development, Sri Lanka.
Jenkins, R., Mbatia, J., Singleton, N., et al., 2010. Prevalence of psychotic symptoms and their risk factors in urban Tanzania. Int. J. Environ. Res. Public Health 7, 2514–2525.
Johns, L.C., Cannon, M., Singleton, N., et al., 2004. Prevalence and correlates of self-reported psychotic symptoms in the British population. Br. J. Psychiatry 185, 298–305.
Johns, L.C., van Os, J., 2001. The continuity of psychotic experiences in the general population. Clin. Psychol. Rev. 21, 1125–1141.
King, M., Nazroo, J., Weich, S., et al., 2005. Psychotic symptoms in the general population of England—a comparison of ethnic groups (the EMPIRIC study). Soc. Psychiatry Psychiatr. Epidemiol. 40, 375–381.
Kirkbride, J.B., Jones, P.B., 2011. The prevention of schizophrenia—what can we learn from eco-epidemiology? Schizophr. Bull. 37, 262–271.
Knudsen, A.K., Hotopf, M., Skogen, J.C., et al., 2010. The health status of nonparticipants in a population-based health study: the Hordaland Health Study. Am. J. Epidemiol. 172, 1306–1314.

Lindley, S.E., Carlson, E.B., Hill, K.R., 2014. Psychotic-like experiences, symptom expression, and cognitive performance in combat veterans with posttraumatic stress disorder. J. Nerv. Ment. Dis. 202, 91–96.
Linscott, R.J., van Os, J., 2013. An updated and conservative systematic review and meta-analysis of epidemiological evidence on psychotic experiences in children and adults: on the pathway from proneness to persistence to dimensional expression across mental disorders. Psychol. Med. 43, 1133–1149.
Meewisse, M.L., Olff, M., Kleber, R., et al., 2011. The course of mental health disorders after a disaster: predictors and comorbidity. J. Trauma Stress 24, 405–413.
Morgan, C., Kirkbride, J., Leff, J., et al., 2007. Parental separation, loss and psychosis in different ethnic groups: a case–control study. Psychol. Med. 37, 495–503.
Morgan, C., Fisher, H., Hutchinson, G., et al., 2009. Ethnicity, social disadvantage and psychotic-like experiences in a healthy population based sample. Acta Psychiatr. Scand. 119, 226–235.
Morgan, C., Charalambides, M., Hutchinson, G., et al., 2010. Migration, ethnicity, and psychosis: toward a sociodevelopmental model. Schizophr. Bull. 36, 655–664.
Morgan, C., Reininghaus, U., Fearon, P., et al., 2014. Modelling the interplay between childhood and adult adversity in pathways to psychosis: initial evidence from the AESOP study. Psychol. Med. 44, 407–419.
Morrison, A.P., Frame, L., Larkin, W., 2003. Relationships between trauma and psychosis: a review and integration. Br. J. Clin. Psychol. 42, 331–353.
Nuevo, R., Chatterji, S., Verdes, E., et al., 2012. The continuum of psychotic symptoms in the general population: a cross-national study. Schizophr. Bull. 38, 475–485.
Reininghaus, U., Morgan, C., 2014. Integrated models in psychiatry: the state of the art. Soc. Psychiatry Psychiatr. Epidemiol. 49, 1–2.
Reininghaus, U., Kempton, M.J., Valmaggia, L., et al., 2016. Stress sensitivity, aberrant salience, and threat anticipation in early psychosis: an experience sampling study. Schizophr. Bull. http://dx.doi.org/10.1093/schbul/sbv190 (in press).
Scott, J., Chant, D., Andrews, G., et al., 2006. Psychotic-like experiences in the general community: the correlates of CIDI psychosis screen items in an Australian sample. Psychol. Med. 36, 231–238.
Soosay, I., Silove, D., Bateman-Steel, C., et al., 2012. Trauma exposure, PTSD and psychotic-like symptoms in post-conflict Timor Leste: an epidemiological survey. BMC Psychiatry 12, 229.
Spauwen, J., Krabbendam, L., Lieb, R., et al., 2006. Impact of psychological trauma on the development of psychotic symptoms: relationship with psychosis proneness. Br. J. Psychiatry 188, 527–533.
Shevlin, M., Houston, J.E., Dorahy, M.J., et al., 2008. Cumulative traumas and psychosis: an analysis of the national comorbidity survey and the British Psychiatric Morbidity Survey. Schizophr. Bull. 34, 193–199.
Siriwardhana, C., Hewage, S., Deshabandu, R., et al., 2012. Psychosocial and ethical response to disasters: a SWOT analysis of post-tsunami disaster management in Sri Lanka. Asian Bioethics Rev. 4, 171–182.
Siriwardhana, C., Adikari, A., Pannala, G., et al., 2013a. Prolonged internal displacement and common mental disorders in Sri Lanka: the COMRAID study. PLoS One 8, e64742.
Siriwardhana, C., Pannala, G., Siribaddana, S., et al., 2013b. Impact of exposure to conflict, tsunami and mental disorders on school absenteeism: findings from a national sample of Sri Lankan children aged 12–17 years. BMC Public Health 13, 560.
Siriwardhana, C., Wickramage, K., 2014. Conflict, forced displacement and health in Sri Lanka: a review of the research landscape. Confl. Health 8, 22.
StataCorp., 2011. Stata Statistical Software: Release 12 College Station TSL.
van der Velden, P.G., Wong, A., Boshuizen, H.C., et al., 2013. Persistent mental health disturbances during the 10 years after a disaster: four-wave longitudinal comparative study. Psychiatry Clin. Neurosci. 67, 110–118.
Verdoux, H., van Os, J., 2002. Psychotic symptoms in non-clinical populations and the continuum of psychosis. Schizophr. Res. 54, 59–65.
Wigman, J.T., van Nierop, M., Vollebergh, W.A., et al., 2012. Evidence that psychotic symptoms are prevalent in disorders of anxiety and depression, impacting on illness onset, risk, and severity—implications for diagnosis and ultra-high risk research. Schizophr. Bull. 38, 247–257.
Yung, A.R., Nelson, B., Baker, K., et al., 2009. Psychotic-like experiences in a community sample of adolescents: implications for the continuum model of psychosis and prediction of schizophrenia. Aust. N. Z. J. Psychiatry 43, 118–128.