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A comparative analysis of psychological trauma experienced by children and young adults in two scenarios: evacuation after a natural disaster vs forced migration to escape armed conflict

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ABSTRACT

Objectives: Little is known about the psychological trauma experienced by children and young adults (CYAs) following displacement after natural disasters vs migration from conflict zones. In both instances, the decision to leave is usually cast by the family, and the life of CYAs is suddenly disrupted by external circumstances.
Study design: An anonymous survey.
Methods: The same survey instrument, provided by the National Child Traumatic Stress Network (NCTSN), was used to survey self-reported health needs among CYAs during the aftermath of Hurricane Katrina (Health Survey for Children and Adolescents After Katrina) in October 2005–February 2006 and again during the peak of refugee arrivals in Berlin between October 2015 and March 2016. A weighted index to measure cumulative exposure to traumatic stresses during migration was developed along with an unweighted psychological impact score based on the 22-item NCTS psychological impact questionnaire. Spearman's correlation coefficient (rho) was used to assess the correlation between age and the two psychological impact indices. The two-tailed t-test was used to investigate differences in trauma experienced and psychological impact by gender. Logistic regression was used to investigate differences in types of traumatic stress experienced and psychological impact among CYAs displaced because of Hurricane Katrina and those seeking asylum in Berlin.
Results: The Katrina cohort included a total of 1133 CYAs, the Berlin cohort, a total of 405 CYAs. The median age in the Katrina cohort was 6.73 years (standard deviation [SD] 5.67, range 0–24; 50.13% males) compared with 17.64 years (SD, range 0–24; 83% males) in the Berlin cohort. Comparative analyses were adjusted to age and gender and revealed significant differences between the two cohorts, both with regards to the amount of trauma experienced and the psychological impact. A statistically significant and moderate positive

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correlation was observed between trauma experienced and psychological impact of migration in the refugee population (rho = 0.4955, $P < 0.001$); the correlation was less pronounced but still significant in the Katrina cohort (rho = 0.0942, $P = 0.0015$). Free-text responses revealed that in addition to common concerns about health, housing and safety, refugees were also pre-occupied with language acquisition and the adaptation to a new culture.

Conclusions: The observed differences in the experience and the consequences of trauma in displaced CYAs warrant additional investigation. It was replicated that human-made disaster seems to show more traumatising potential than natural disaster. Stakeholders need to be aware of the potential medium and long-term consequences of migration/evacuation and allocate resources accordingly.

Introduction

Reports by United Nations High Commissioner for Refugees (UNHCR) indicate that international migration and displacement have reached record numbers in recent years.[1] Increasing numbers of refugees and internally displaced individuals are children and young adults (CYAs). In Germany, in 2015, the proportion of refugees who are children, adolescents and young adults had approached 60% (<16 years: 27%, 16–18 years: 5%, 18–25 years: 25%).[2] The reasons for migration are complex, including poverty, armed conflict, environmental hazards and natural disasters.

Little is known about the long-term impact of displacement and forced migration on the psychological health of CYAs. Evidence thus far has been predominantly anecdotal, presented in position papers and editorials.[3–6] Concerns about post-traumatic symptoms and mental health impairment are frequently mentioned but objective data are sparse. The available literature suggests that the type of trauma seems to be relevant; although 5–60% of survivors of natural disasters develop post-traumatic stress disorder (PTSD), the percentage seems to be higher (25–75%) among survivors of human-made disasters, suggesting that human-made violence may be more detrimental than accidental trauma.[7] Thus, comparisons between different groups of disaster victims are of special interest.[8]

While child and adolescent health specialists have called for increased attention to the mental health of young migrants and refugees,[9] most studies to date have been focussed on physical health and infectious disease prevention.[10] This is in part due to a lack of standardisation in mental health outcome measures and the logistics of applying psychometric instruments during a highly volatile situation of mass migration or displacement from natural disasters. Furthermore, it may be difficult to prioritise mental health needs at all in settings of compromised access to basic survival needs (e.g. food, shelter, etc.). The timely acquisition of reliable health data will provide public health agencies with the information they need to take action.

A recent workshop on 'Long-term Disaster Epidemiology: Problems and Resilience 10 Years after Katrina' at the 48th Annual Meeting, Society for Epidemiological Research in Denver, Colorado, discussed the development in methodologies surrounding mass casualties and disaster settings.[11] The National Child Traumatic Stress Network (NCTSN) developed a standardised instrument to capture trauma experienced and impact of hurricanes on children and adolescents. This tool was used in a survey project assessing approximately 1200 CYAs during the immediate aftermath of Hurricane Katrina.[12,13] The same survey instrument was again used during the peak of refugee arrivals to Berlin, Germany, in 2015/2016, allowing the analysis of both cohorts along the same criteria.

We present comparative analyses of psychological trauma exposure and post-traumatic symptoms experienced by CYAs in two scenarios: evacuation after a natural disaster vs forced migration to escape armed conflict. Although it is plausible to expect that exposure to human-made disaster is associated with more severe symptoms compared with exposure to natural disaster, in this exploratory study, no specific hypotheses were formulated and tested.

Methods

Data source

We accessed data from two cross-sectional surveys: the first was administered to a convenience sample of 1133 CYAs aged 0–24 years and/or their parents/guardians, attending healthcare facilities post Hurricane Katrina in the metropolitan New Orleans area from October 2005 to December 2005 (Health Survey for Children and Adolescents After Katrina [HSCAAK]).[12,13] The section of the survey on child trauma, which is the subject of this comparative analysis, was a prevalidated instrument provided by the NCTSN (www.nctsn.org)[11–13] and is in line with the *NCTSN Hurricane Assessment and Referral Tool for Children and Adolescents-Revised*.[14,15] The New Orleans Survey in 2005/2006 was provided on paper and filled by parents/caretakers and children while waiting for administrative or healthcare appointments. Additional questions in the HSCAAK dealt with environmental exposures, missed medical appointments and acute and chronic health issues and are published elsewhere.[12,13] No personally identifying information was obtained, and

participation was entirely anonymous, confidential and voluntary. Survey questions could be skipped at any time. All instruments and modifications were approved before implementation by the governing institutional review boards (Children's Hospital, Tulane Hospital, George Washington University and Ochsner Hospital and Clinic), and written informed consent was waived for the purpose of an anonymous health survey.[12,13] In Berlin, Germany, between 7 October 2015 and 15 March 2016, the same survey instrument was made available in English, Arab, Russian and Farsi and placed on a mobile app to be administered to a convenience sample of 405 CYAs (0–24 years) and/or their parents/guardians seeking asylum in Germany while they waited for registration at the Regional Office for Health and Social Welfare (LAGeSo). Again, the survey was entirely anonymous, confidential and voluntary. Parents and children worked together as they felt comfortable responding to the survey. Recruitment, information and administration of the interviews and assistance during the survey were provided by postgraduate students of psychology and supervised by B.R. and F.J. The section on child trauma report used in this comparative analysis was identical (in English or translated by professionals to be as close to the original as possible) following the same validated instrument as used in the HSCAAK and developed by the NCTSN (www.nctsn.org).[11–13]

Trauma and psychological indices

From each positive response on 14 NCTS questions on traumatic stress (with higher scores indicating exposure to greater traumatic stress before or during evacuation/migration), a weighted trauma score was calculated by assigning weights of 3, 2 and 1 to various NCTS questions (see Appendix 1); these weights were determined in consultation with psychology experts.

Similarly, an unweighted psychological impact sum score was calculated from the 22-item NCTS psychological impact questionnaire that was answered by the parent/guardian with the CYAs present or the CYAs alone if ≥18 years with 0 = 'no impact', 1 = 'some impact' and 2 = 'much impact'; see Appendix 2.

Statistical analyses

A descriptive analysis was conducted to estimate the percentage prevalence of types of traumatic stress experienced and psychological impacts and symptoms reported. Spearman's correlation coefficient (rho) was used to assess the correlation between age and the two psychological impact indices. The two-tailed *t*-test was used to investigate differences in trauma experienced and psychological impact by gender. Logistic regression was used to investigate differences in types of traumatic stress experienced and psychological impact among CYAs displaced because of Hurricane Katrina and those seeking asylum in Berlin. Results of the logistic regression are presented as unadjusted and adjusted odds ratios (ORs) and 95% confidence intervals (CIs) with adjustment carried out for age and sex. Finally, thematic analysis was used to identify key themes from the free-text responses on concerns relating to living in Germany as refugees.[16] All statistical analyses were conducted using Stata, version 14 (StataCorp Ltd., Texas).

Results

The Katrina cohort included a total of 1133 CYAs (aged 0–24 years). The mean age (SD; range) was 6.73 years (5.67; 0–24 years), while the median age (interquartile range [IQR]) was 5 years (2–11 years). There were 568 (50.13%) males and 565 (49.87%) females.

The Berlin cohort on the other hand included 405 CYAs (median age 19 years, IQR: 12–22 years; mean age 17.64 years, SD 6.14 and range: 0–24 years), of whom 83.9% were male and 16.2% were female (missing data on 3.7%).

The percent of survey participants was 62.5% from Syria followed by 9.1% from Afghanistan, 8.2% from Iraq and 6.2% from Pakistan. Religious background and socio-economic status had not been assessed. About 72.8% completed the questionnaire themselves, while in 15.6% of the cases, the responses were provided solely by a parent or a guardian; 18.3% were able to complete the questionnaire without assistance from a translator or interviewer.

Traumatic stress experienced during the hurricane and evacuation

First, the two cohorts were compared with regards to trauma and stress experienced during and after migration or evacuation. As evident from Table 1, refugees reported higher exposure to traumatic events according to the NCTS 14-item exposure score, predominantly due to higher endorsement of items with greater weight. Refugees were significantly more likely to have been separated from family or to have witnessed family, friends or strangers having been injured or killed. Refugee children were also more likely to have been separated from family. All 14 comparisons with percent and unadjusted and adjusted ORs are listed in Table 1.

In the Katrina cohort, no significant association between stress exposure and age or gender was found. In the Berlin cohort, small but statistically significant effects were found with higher stress exposure in higher age groups (Spearman's correlation coefficient [rho] = 0.2439, $P < 0.0001$) and male gender (with males showing higher scores [mean 11.13 {95% CI: 10.60–11.66}]) as compared with females (mean 8.11 [95% CI: 6.89–9.34]), Fig. 1.

Psychological symptoms and impact in CYAs after traumatic exposure during forced migration and/or evacuation

Second, the two cohorts were compared with regards to symptoms and impacts during and after migration or evacuation. Refugees reported higher values according to the NCTS 22-item psychological impact score (Berlin cohort rho = 0.4955, $P < 0.001$ vs Katrina cohort rho = 0.0942, $P = 0.0015$). Again, this was due to more severe ratings, for example, loss of fun and interest PSY (= psychological) item 6 with answer 'much/most' in Berlin cohort was 27.4% and in Katrina cohort was 10.9% (adjusted OR = 1.75, 95% CI: 1.10–2.79), or feeling jumpy or

Table 1 – Traumatic stress experienced during the hurricane and evacuation ($n = 1538$).

Type of traumatic stress	Katrina cohort ($n = 1133$) number (%; 95% CI)	Berlin cohort ($n = 405$) number (%; 95% CI)
NCTS1: Serious injury to CYA		
Yes	6 (0.53; 0.24–1.18)	95 (23.5; 19.6–27.9)
No	897 (79.17; 76.70–81.44)	284 (70.1; 65.5–74.4)
Do not know	9 (0.79; 0.41–1.52)	3 (0.7; 0.2–2.3)
Missing	221 (19.51; 17.30–21.92)	23 (5.7; 3.8–8.4)
Unadjusted OR (95% CI)	50.01 (21.68–115.35); $P < 0.001$	
Adjusted OR (95% CI)	24.37 (9.19–64.63); $P < 0.001$	
NCTS2: Family/friend injured or killed		
Yes	99 (8.74; 7.23–10.53)	239 (59.1; 54.1–63.7)
No	779 (68.76; 66.00–71.39)	136 (33.6; 29.1–38.3)
Do not know	31 (2.74; 1.92–3.87)	5 (1.2; 0.5–2.9)
Missing	224 (19.77; 17.55–22.20)	25 (6.2; 4.2–9.0)
Unadjusted OR (95% CI)	13.83 (10.28–18.61); $P < 0.001$	
Adjusted OR (95% CI)	10.56 (7.07–15.77); $P < 0.001$	
NCTS3: Witnessed people getting hurt/killed		
Yes	74 (6.53; 5.23–8.13)	222 (54.8; 49.9–59.6)
No	822 (72.55; 69.87–75.08)	153 (37.8; 33.2–42.6)
Do not know	8 (0.71; 0.35–1.41)	3 (0.7; 0.2–2.3)
Missing	229 (20.21; 17.97–22.66)	27 (6.7; 4.6–9.6)
Unadjusted OR (95% CI)	16.12 (11.77–22.08); $P < 0.001$	
Adjusted OR (95% CI)	6.85 (4.56–10.31); $P < 0.001$	
NCTS4: Separation from family		
Yes	165 (14.56; 12.62–16.74)	183 (45.2; 40.4–50.1)
No	734 (64.78; 61.95–67.52)	193 (47.7; 42.8–52.5)
Do not know	5 (0.44; 0.18–1.06)	5 (1.2; 0.5–2.9)
Missing	229 (20.21; 17.97–22.66)	24 (5.9; 4.0–8.7)
Unadjusted OR (95% CI)	4.22 (3.24–5.49); $P < 0.001$	
Adjusted OR (95% CI)	2.27 (1.58–3.25); $P < 0.001$	
NCTS5: Home badly destroyed/damaged		
Yes	382 (33.72; 31.02–36.53)	181 (44.7; 39.9–49.6)
No	516 (45.54; 42.66–48.46)	182 (44.9; 40.1–49.8)
Do not know	9 (0.79; 0.41–1.52)	17 (4.2; 2.6–6.7)
Missing	226 (19.95; 17.72–22.38)	25 (6.2; 4.2–9.0)
Unadjusted OR (95% CI)	1.34 (1.05–1.72); $P = 0.018$	
Adjusted OR (95% CI)	1.38 (0.99–1.92); $P = 0.059$	
NCTS6: Witnessed neighbourhood badly damaged		
Yes	484 (42.72; 39.86–45.62)	206 (50.9; 46.0–55.7)
No	420 (37.07; 34.30–39.93)	161 (39.8; 35.1–44.6)
Do not know	6 (0.53; 0.24–1.18)	14 (3.5; 2.1–5.8)
Missing	223 (19.68; 17.47–22.10)	24 (5.9; 4.0–8.7)
Unadjusted OR (95% CI)	1.11 (0.87–1.42); $P = 0.401$	
Adjusted OR (95% CI)	1.08 (0.78–1.50); $P = 0.640$	
NCTS7: Pet left behind/hurt/lost/killed		
Yes	154 (13.59; 11.71–15.72)	80 (19.8; 16.1–23.9)
No	740 (65.31; 62.49–68.03)	282 (69.6; 65.0–73.9)
Do not know	5 (0.44; 0.18–1.06)	14 (3.5; 2.1–5.8)
Missing	234 (20.65; 18.39–23.11)	29 (7.2; 5.0–10.1)
Unadjusted OR (95% CI)	1.36 (1.01–1.85); $P = 0.045$	
Adjusted OR (95% CI)	1.22 (0.78–1.85); $P = 0.365$	
NCTS8: Belongings/clothes/toys destroyed		
Yes	441 (38.92; 36.12–41.80)	239 (59.0; 54.1–63.7)
No	457 (40.34; 37.51–43.23)	134 (33.1; 28.7–37.8)
Do not know	4 (0.35; 0.13–0.94)	7 (1.7; 0.8–3.6)
Missing	231 (20.39; 18.14–22.84)	25 (6.2; 4.2–9.0)
Unadjusted OR (95% CI)	1.85 (1.44–2.37); $P < 0.001$	
Adjusted OR (95% CI)	1.80 (1.29–2.51); $P = 0.001$	
NCTS9: Time to get ready when evacuating/migrating		
Yes	613 (54.10; 51.19–56.99)	178 (44.0; 39.2–48.8)
No	287 (25.33; 22.88–27.95)	196 (48.4; 43.5–53.3)
Do not know	1 (0.09; 0.01–0.63)	4 (1.0; 0.4–2.6)
Missing	232 (20.48; 18.22–22.93)	27 (6.7; 4.6–9.6)
Unadjusted OR (95% CI)	0.43 (0.33–0.54); $P < 0.001$	
Adjusted OR (95% CI)	0.47 (0.33–0.65); $P < 0.001$	

Table 1 – (*continued*)

Type of traumatic stress	Katrina cohort ($n = 1133$) number (%; 95% CI)	Berlin cohort ($n = 405$) number (%; 95% CI)
NCTS10: Left alone when getting out		
Yes	28 (2.47; 1.71–3.56)	81 (20.0; 16.4–24.2)
No	874 (77.14; 74.60–79.50)	290 (71.6; 67.0–75.8)
Do not know	3 (0.26; 0.09–0.82)	5 (1.2; 0.5–2.9)
Missing	228 (20.12; 17.89–22.56)	29 (7.2; 5.0–10.1)
Unadjusted OR (95% CI)	8.72 (5.56–13.67); $P < 0.001$	
Adjusted OR (95% CI)	3.50 (1.86–6.56); $P < 0.001$	
NCTS11: Dependence on others when evacuating/migrating		
Yes	162 (14.30; 12.38–16.46)	253 (62.5; 57.6–67.1)
No	739 (65.23; 62.40–67.95)	123 (30.4; 26.1–35.0)
Do not know	1 (0.09; 0.01–0.63)	3 (0.7; 0.2–2.3)
Missing	231 (20.39; 18.14–22.84)	26 (6.4; 4.4–9.3)
Unadjusted OR (95% CI)	9.38 (7.13–12.35); $P < 0.001$	
Adjusted OR (95% CI)	14.37 (9.50–21.74); $P < 0.001$	
NCTS12: Witnessed violence or looting		
Yes	130 (11.47; 9.74–13.47)	210 (51.9; 47.0–56.7)
No	769 (67.87; 65.09–70.53)	169 (41.7; 37.0–46.6)
Do not know	2 (0.18; 0.04–0.70)	1 (0.3; 0.0–1.7)
Missing	232 (20.48; 18.22–22.93)	25 (6.2; 4.2–9.0)
Unadjusted OR (95% CI)	7.35 (5.58–9.68); $P < 0.001$	
Adjusted OR (95% CI)	4.83 (3.33–7.01; $P < 0.001$	
NCTS13: Volunteered/helped others with evacuation/migration		
Yes	94 (8.30; 6.82–10.05)	187 (46.2; 41.3–51.1)
No	799 (70.52; 67.79–73.11)	187 (46.2; 41.3–51.1)
Do not know	7 (0.62; 0.29–1.29)	4 (1.0; 0.3–2.6)
Missing	233 (20.56; 18.31–23.02)	27 (6.7; 4.6–9.6)
Unadjusted OR (95% CI)	8.50 (6.33–11.41); $P < 0.001$	
Adjusted OR (95% CI)	3.59 (2.41–5.36); $P < 0.001$	
NCTS14: Family members volunteered/helped others with evacuation/migration		
Yes	221 (19.51; 17.30–21.92)	105 (25.9; 21.9–30.4)
No	653 (57.63; 54.73–60.49)	251 (62.0; 57.1–66.6)
Do not know	23 (2.03; 1.35–3.04)	21 (5.2; 3.4–7.8)
Missing	236 (20.83; 18.56–23.30)	28 (6.9; 4.8–9.8)
Unadjusted OR (95% CI)	1.24 (0.94–1.63); $P = 0.130$	
Adjusted OR (95% CI)	1.70 (1.17–2.46); $P = 0.005$	
NCTS15: Lost job due to evacuation/migration		
Yes	260 (22.95; 20.59–25.49)	137 (33.8; 29.4–38.6)
No	632 (55.78; 52.87–58.65)	235 (58.0; 53.1–62.8)
Do not know	4 (0.35; 0.13–0.94)	1 (0.3; 0.0–1.7)
Missing	237 (20.92; 18.64–23.39)	32 (7.9; 5.6–11.0)
Unadjusted OR (95% CI)	1.42 (1.10–1.83); $P = 0.007$	
Adjusted OR (95% CI)	0.79 (0.55–1.12); $P = 0.185$	
NCTS16: Parent/caregiver lost job due to evacuation/migration		
Yes	339 (29.92; 27.32–32.66)	139 (34.3; 29.8–39.1)
No	544 (48.01; 45.11–50.93)	222 (54.8; 49.9–59.6)
Do not know	12 (1.06; 0.60–1.86)	12 (3.0; 1.7–5.2)
Missing	238 (21.01; 18.73–23.48)	32 (7.9; 5.6–11.0)
Unadjusted OR (95% CI)	1.00 (0.78–1.29); $P = 0.971$	
Adjusted OR (95% CI)	1.90 (1.34–2.68); $P < 0.001$	
NCTS17: Been with family/friends during evacuation/migration		
Yes	770 (67.96; 65.18–70.62)	243 (60.0; 55.1–64.7)
No	124 (10.94; 9.25–12.90)	128 (31.6; 27.2–36.3)
Do not know	1 (0.09; 0.01–0.63)	4 (1.0; 0.4–2.6)
Missing	238 (21.01; 18.73–23.48)	30 (7.4; 5.2–10.4)
Unadjusted OR (95% CI)	0.31 (0.23–0.41); $P < 0.001$	
Adjusted OR (95% CI)	0.67 (0.45–1.01); $P = 0.056$	
NCTS18: Has the CYA been in another hurricane before/migrated before?		
Yes	333 (29.39; 26.81–32.12)	68 (16.8; 13.4–20.8)
No	566 (49.96; 47.04–52.87)	304 (75.1; 70.6–79.1)
Do not know	6 (0.53; 0.24–1.18)	4 (1.0; 0.4–2.6)
Missing	228 (20.12; 17.89–22.56)	29 (7.2; 5.0–10.1)
Unadjusted OR (95% CI)	0.38 (0.28–0.51); $P < 0.001$	
Adjusted OR (95% CI)	0.32 (0.22–0.48); $P < 0.001$	

(*continued on next page*)

Table 1 – (continued)

Type of traumatic stress	Katrina cohort ($n = 1133$) number (%; 95% CI)	Berlin cohort ($n = 405$) number (%; 95% CI)
NCTS19: Any acquaintance ever been hurt/killed before Hurricane Katrina/migration		
Yes	171 (15.09; 13.12–17.30)	286 (70.6; 66.0–74.9)
No	707 (62.40; 59.54–65.18)	84 (20.7; 17.1–25.0)
Do not know	22 (1.94; 1.28–2.93)	5 (1.2; 0.5–2.9)
Missing	233 (20.56; 18.31–23.02)	30 (7.4; 5.2–10.4)
Unadjusted OR (95% CI)	14.08 (10.48–18.91); $P < 0.001$	
Adjusted OR (95% CI)	6.27 (4.36–9.01); $P < 0.001$	

CI, confidence interval; OR, odds ratio, CYA, child and young adult; NCTS, National Child Traumatic Stress Survey item.
All comparisons include the Katrina cohort as a reference group; adjustment for age and gender.

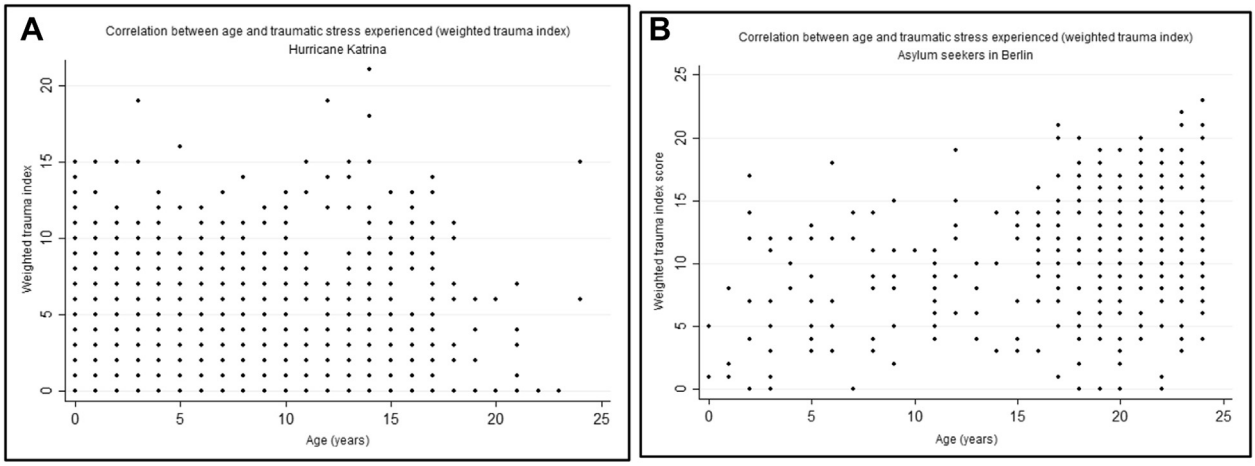

Fig. 1 – Correlation between age and traumatic stress experienced (weighted trauma index), Katrina (A) vs Berlin (B) cohort.

nervous (item PSY8) with answer 'much/most' in Berlin cohort was 23.2% and in Katrina cohort was 7.9% (adjusted OR = 2.52, 95% CI: 1.52–4.18). All 22 comparisons with percent and unadjusted and adjusted ORs are listed in Table 2.

Correlation between trauma experienced and psychological impact

Third, the association between trauma experienced and psychological impact was determined in both cohorts. A statistically significant but weak positive correlation was observed in the Katrina cohort between trauma experienced (weighted trauma index) and psychological impact of evacuation (Spearman's correlation coefficient [rho] = 0.0942, $P = 0.0015$; Fig. 2A). In the Berlin cohort, this correlation was markedly higher (Spearman's correlation coefficient [rho] = 0.4955, $P < 0.001$; Fig. 2B).

Thematic analysis of free-text responses relating to other concerns expressed after evacuation/migration

Finally, survey participants had the opportunity to express any major thoughts or concerns in a free-text format. A total of 155 participations in the Katrina cohort and 247 in the Berlin cohort made use of this option. Thematic analysis shows that in addition to general concerns about health, housing, education and safety, CYAs in the Berlin cohort reported additional worries related to language barriers, adjustments to a foreign culture and fear of deportation.

Discussion

To our knowledge, this is the first study directly comparing (using the same instrument) the trauma experienced by CYAs evacuating from natural disaster with young migrants escaping war and conflict. This work became possible through use of the same NCTSN standardised survey instrument in the context of two public health emergencies: during the immediate aftermath of Hurricane Katrina in 2005/2006 in New Orleans, Louisiana, USA, and during the peak of refugee arrivals to Berlin, Germany, 10 years later. Both groups had witnessed near complete destruction of their original home and environment. By asking the same questions and after adjustment for differences in age and gender, we could compare exposure to traumatic events and impact and symptoms related to disaster.

The refugee cohort reported more exposure to stressful situations and more severe symptoms. Furthermore, the association between exposure and symptoms was much more pronounced in the Berlin cohort.

The survey was anonymous and does not allow any form of individual 'clinical diagnosis' of PTSD or related mental health issues. It became obvious that CYAs in either group reported considerable rates of exposure to potentially traumatising situations and—among refugees in particular—substantial correlations to psychological consequences and symptoms. This is not surprising considering that most affected children and adolescents had undergone a sudden and significant disruption of their accustomed lives and surroundings. The groups were

Table 2 – Psychological assessment of child/young adult ($n = 1538$).

Feelings/thoughts on evacuation/migration	Katrina cohort ($n = 1133$) n (%)	Berlin cohort ($n = 405$) n (%)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
PSY1: Does the CYA get upset, afraid or sad when something makes them think of the hurricane/evacuation/migration?				
None	223 (19.7)	68 (16.8)	1.00	1.00
Little-some	286 (25.2)	125 (30.9)	1.43 (1.02–2.02)	1.12 (0.71–1.78)
Much-most	213 (18.8)	174 (43.0)	2.68 (1.91–3.75)	2.07 (1.29–3.30)
Do not know	66 (5.8)	7 (1.7)	–	–
Missing/not applicable	345 (30.5)	31 (7.6)	–	–
P value for trend			<0.001	0.001
PSY2: Does the CYA have bad dreams or nightmares about what happened?				
None	478 (42.2)	179 (44.2)	1.00	1.00
Little-some	128 (11.3)	119 (29.4)	2.48 (1.83–3.36)	2.10 (1.38–3.22)
Much-most	86 (7.6)	68 (16.8)	2.11 (1.47–3.03)	1.94 (1.14–3.30)
Do not know	90 (7.9)	6 (1.5)	–	–
Missing/not applicable	351 (31.0)	33 (8.2)	–	–
P value for trend			<0.001	0.001
PSY3: Does the CYA have upsetting thought or pictures that come to their mind about what happened?				
None	331 (29.2)	113 (27.9)	1.00	1.00
Little-some	229 (20.2)	131 (32.4)	1.68 (1.24–2.27)	1.12 (0.74–1.71)
Much-most	138 (12.2)	117 (28.9)	2.48 (1.79–3.44)	1.43 (0.89–2.30)
Do not know	79 (7.0)	11 (2.7)	–	–
Missing/not applicable	356 (31.4)	33 (8.2)	–	–
P value for trend			<0.001	0.148
PSY4: Does the CYA try not to think about or talk about the hurricane/evacuation/migration?				
None	355 (31.3)	127 (31.4)	1.00	1.00
Little-some	197 (17.4)	117 (28.9)	1.66 (1.22–2.25)	1.28 (0.83–1.96)
Much-most	130 (11.5)	115 (28.4)	2.47 (1.79–3.41)	1.50 (0.95–2.38)
Do not know	84 (7.4)	11 (2.7)	–	–
Missing/not applicable	367 (32.4)	35 (8.6)	–	–
P value for trend			<0.001	0.076
PSY5: Does the CYA stay away from places, people or things that make him/her think of the hurricane/evacuation/migration?				
None	454 (40.1)	190 (46.9)	1.00	1.00
Little-some	154 (13.6)	79 (19.5)	1.23 (0.89–1.69)	1.22 (0.78–1.92)
Much-most	77 (6.8)	83 (20.5)	2.58 (1.81–3.67)	1.55 (0.92–2.63)
Do not know	78 (6.9)	17 (4.2)	–	–
Missing/not applicable	370 (32.7)	36 (8.9)	–	–
P value for trend			<0.001	0.085
PSY6: Since the hurricane/evacuation/migration, especially in the past four weeks, do you feel that nothing is fun for the CYA any more or that they are just not interested in anything?				
None	421 (37.2)	129 (31.9)	1.00	1.00
Little-some	155 (13.7)	122 (30.1)	2.57 (1.89–3.50)	1.92 (1.26–2.94)
Much-most	124 (10.9)	111 (27.4)	2.92 (2.11–4.04)	1.75 (1.10–2.79)
Do not know	69 (6.1)	7 (1.7)	–	–
Missing/not applicable	364 (32.1)	36 (8.9)	–	–
P value for trend			<0.001	0.006
PSY7: Does the CYA have difficulty falling asleep at night, or wake up in the middle of the night because of what has happened?				
None	487 (43.0)	149 (36.8)	1.00	1.00
Little-some	115 (10.2)	113 (27.9)	3.21 (2.34–4.41)	2.58 (1.66–4.02)
Much-most	98 (8.7)	101 (24.9)	3.37 (2.41–4.70)	1.86 (1.13–3.05)
Do not know	71 (6.3)	6 (1.5)	–	–
Missing/not applicable	362 (32.0)	36 (8.9)	–	–
P value for trend			<0.001	0.001
PSY8: Does the CYA often feel jumpy or nervous?				
None	466 (41.1)	138 (34.1)	1.00	1.00
Little-some	132 (11.7)	131 (32.4)	3.35 (2.46–4.56)	2.71 (1.77–4.16)
Much-most	89 (7.9)	94 (23.2)	3.57 (2.52–5.04)	2.52 (1.52–4.18)
Do not know	72 (6.4)	6 (1.5)	–	–
Missing/not applicable	374 (33.0)	36 (8.9)	–	–
P value for trend			<0.001	<0.001
PSY9: Does the CYA find it harder than usual to concentrate or pay attention to things?				
None	415 (36.6)	180 (44.4)	1.00	1.00
Little-some	179 (15.8)	94 (23.2)	1.21 (0.89–1.64)	0.78 (0.51–1.19)
Much-most	103 (9.1)	76 (18.8)	1.70 (1.21–2.40)	0.84 (0.51–1.40)
Do not know	64 (5.7)	16 (4.0)	–	–

(continued on next page)

Table 2 – (*continued*)

Feelings/thoughts on evacuation/migration	Katrina cohort ($n = 1133$) n (%)	Berlin cohort ($n = 405$) n (%)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Missing/not applicable	372 (32.8)	39 (9.6)	–	–
P value for trend			0.003	0.351
PSY10: Since the hurricane/evacuation/migration, especially in the past four weeks, does the CYA worry about what is going to happen to family and friends?				
None	289 (25.5)	43 (10.6)	1.00	1.00
Little-some	197 (17.4)	45 (11.1)	1.54 (0.97–2.42)	1.06 (0.60–1.85)
Much-most	211 (18.6)	274 (67.7)	8.73 (6.05–12.60)	3.22 (2.04–5.10)
Do not know	63 (5.6)	7 (1.7)	–	–
Missing/not applicable	373 (32.9)	36 (8.9)	–	–
P value for trend			<0.001	<0.001
PSY11: Does the CYA often feel irritable or grouchy?				
None	344 (30.4)	151 (37.3)	1.00	1.00
Little-some	209 (18.5)	130 (32.1)	1.42 (1.06–1.90)	1.29 (0.86–1.94)
Much-most	146 (12.9)	75 (18.5)	1.17 (0.83–1.64)	0.88 (0.55–1.42)
Do not know	62 (5.5)	10 (2.5)	–	–
Missing/not applicable	372 (32.8)	39 (9.6)	–	–
P value for trend			0.171	0.851
PSY12: Does the CYA often feel sad, down or depressed?				
None	361 (31.9)	94 (23.2)	1.00	1.00
Little-some	228 (20.1)	149 (36.8)	2.51 (1.85–3.41)	2.10 (1.37–3.20)
Much-most	104 (9.2)	115 (28.4)	4.25 (3.00–3.41)	2.29 (1.40–3.75)
Do not know	66 (5.8)	7 (1.7)	–	–
Missing/not applicable	374 (33.0)	40 (9.9)	–	–
P value for trend			<0.001	<0.001
PSY13: Has the CYA been more or less interested in eating since the hurricane/evacuation/migration?				
None	426 (37.6)	164 (40.5)	1.00	1.00
Little-some	155 (13.7)	117 (28.9)	1.96 (1.45–2.65)	1.94 (1.26–2.99)
Much-most	93 (8.2)	79 (19.5)	2.21 (1.56–3.13)	1.62 (0.96–2.72)
Do not know	75 (6.6)	6 (1.5)	–	–
Missing/not applicable	384 (33.9)	39 (9.6)	–	–
P value for trend			<0.001	0.010
PSY14: Since the hurricane/evacuation/migration, especially in the past four weeks, has the CYA had more aches and pains (stomach or headaches)?				
None	388 (34.3)	219 (54.1)	1.00	1.00
Little-some	178 (15.7)	84 (20.7)	0.84 (0.61–1.14)	0.66 (0.42–1.02)
Much-most	120 (10.6)	54 (13.3)	0.80 (0.56–1.14)	0.43 (0.26–0.72)
Do not know	69 (6.1)	7 (1.7)	–	–
Missing/not applicable	378 (33.4)	41 (10.1)	–	–
P value for trend			0.149	0.001
PSY15: Has the CYA had less energy than usual?				
None	425 (37.5)	176 (43.5)	1.00	1.00
Little-some	157 (13.9)	100 (24.7)	1.54 (1.13–2.09)	1.16 (0.74–1.82)
Much-most	93 (8.2)	81 (20.0)	2.10 (1.49–2.97)	0.88 (0.54–1.44)
Do not know	80 (7.1)	3 (0.7)	–	–
Missing/not applicable	373 (33.4)	45 (11.1)	–	–
P value for trend			<0.001	0.781
PSY16: If in school: Does the CYA find it harder to get schoolwork done?				
None	410 (36.2)	96 (23.7)	1.00	1.00
Little-some	126 (11.1)	11 (2.7)	0.37 (0.19–0.72)	0.24 (0.11–0.52)
Much-most	87 (7.7)	5 (1.2)	0.25 (0.10–0.62)	0.16 (0.06–0.44)
Do not know	97 (8.6)	135 (33.3)	–	–
Missing/not applicable	413 (36.5)	158 (39.0)	–	–
P value for trend			<0.001	<0.001
PSY17: Does the CYA worry about something bad happening to family/friends?				
None	357 (31.5)	39 (9.6)	1.00	1.00
Little-some	198 (17.5)	39 (9.6)	1.80 (1.12–2.90)	1.83 (1.04–3.24)
Much-most	110 (9.7)	268 (66.2)	22.30 (14.98–33.21)	9.95 (6.12–16.18)
Do not know	78 (6.9)	17 (4.2)	–	–
Missing/not applicable	390 (34.4)	42 (10.4)	–	–
P value for trend			<0.001	<0.001
PSY18: Since the hurricane/evacuation/migration, especially in the past four weeks, does the CYA have a harder time getting along with family/friends?				
None	489 (43.2)	177 (43.7)	1.00	1.00
Little-some	131 (11.6)	101 (24.9)	2.13 (1.56–2.91)	1.55 (0.99–2.41)
Much-most	65 (5.7)	56 (13.8)	2.38 (1.60–3.54)	1.25 (0.70–2.21)
Do not know	70 (6.2)	28 (6.9)	–	–

Table 2 – (continued)

Feelings/thoughts on evacuation/migration	Katrina cohort ($n = 1133$) n (%)	Berlin cohort ($n = 405$) n (%)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Missing/not applicable	378 (33.4)	43 (10.6)	–	–
P value for trend			<0.001	0.165
PSY19: If in a new school: is the CYA having a hard time making new friends?				
None	462 (40.8)	94 (23.2)	1.00	1.00
Little-some	71 (6.3)	11 (2.7)	0.76 (0.39–1.49)	0.60 (0.25–1.47)
Much-most	52 (4.6)	11 (2.7)	1.04 (0.52–2.07)	0.55 (0.24–1.30)
Do not know	103 (9.1)	133 (32.8)	–	–
Missing/not applicable	445 (39.3)	156 (38.5)	–	–
P value for trend			0.817	0.107
PSY20: Is the CYA finding it harder to enjoy activities that he/she used to enjoy?				
None	445 (39.3)	144 (35.6)	1.00	1.00
Little-some	130 (11.5)	122 (30.1)	2.90 (2.13–3.96)	2.06 (1.33–3.21)
Much-most	84 (7.4)	79 (19.5)	2.91 (2.03–4.17)	1.24 (0.74–2.06)
Do not know	78 (6.9)	17 (4.2)	–	–
Missing/not applicable	396 (35.0)	43 (10.6)	–	–
P value for trend			<0.001	0.098
PSY21: How bothered is the CYA by these questions?				
None	450 (39.7)	221 (54.6)	1.00	1.00
Little-some	123 (10.9)	105 (25.9)	1.74 (1.28–2.36)	1.22 (0.78–1.89)
Much-most	80 (7.1)	26 (6.4)	0.66 (0.41–1.06)	0.38 (0.20–0.70)
Do not know	86 (7.6)	8 (2.0)	–	–
Missing/not applicable	394 (34.8)	45 (11.1)	–	–
P value for trend			0.777	0.027
PSY22: Has the CYA used drugs or alcohol since the hurricane/evacuation/migration?				
None	624 (55.1)	267 (65.9)	1.00	1.00
Little-some	38 (3.4)	78 (19.3)	4.80 (3.17–7.25)	1.52 (0.83–2.78)
Much-most	15 (1.3)	13 (3.2)	2.03 (0.95–4.32)	0.99 (0.35–2.83)
Do not know	67 (5.9)	4 (1.0)	–	–
Missing/not applicable	389 (34.3)	43 (10.6)	–	–
P value for trend			<0.001	0.392

CI, confidence interval; OR, odds ratio, CYA, child and young adult; PSY, psychological item.
All comparisons include the Katrina cohort as a reference group; adjustment for age and gender.

not large enough to investigate differences between age groups, but it became obvious that a sense of security had vanished, resulting in anxiety and clingy behaviours.

The Berlin cohort was significantly more likely to have experienced violence and death compared with the Katrina cohort, which had experienced a sudden but brief interruption to their sense of safety.

Most of the CYAs in the Katrina cohort were able to return to their home town within months after the disruptive event (Hurricane Katrina) and were thus less concerned about what may happen to their family and friends in the near future. This was also evident from the free-text section of the survey, where refugees voiced additional concerns about language acquisition, adaptation to a new culture and worries about those left behind in the home country.

The present study adds an important perspective to previous work published elsewhere. By use of the same standardised NCTSN survey instrument and methodology, it became possible to obtain 'snapshot' assessment during two very distinct historical moments and from two groups affected by

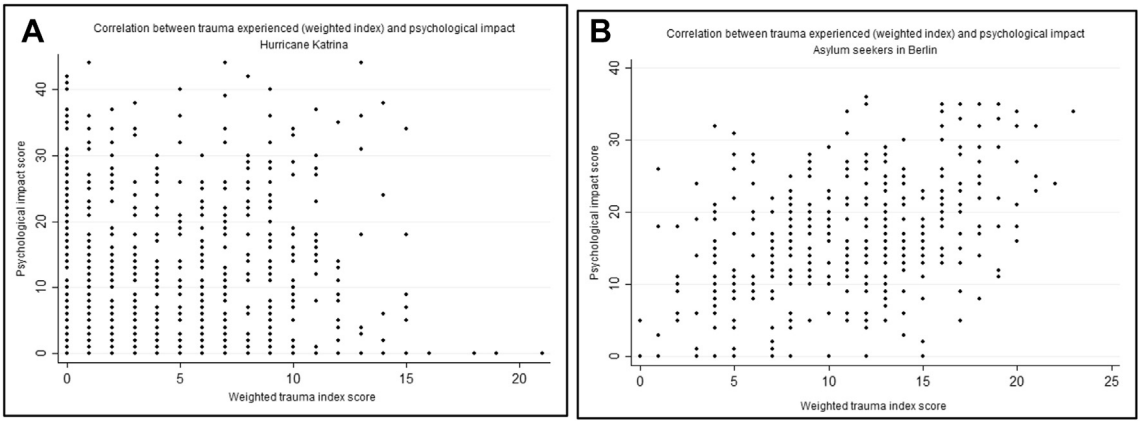

Fig. 2 – Correlation between trauma experienced and psychological impact, Katrina (A) vs Berlin (B) cohort.

suffering different types of challenge. Hurricane Katrina represented the impact of a sudden and unexpected disruption on the health of CYAs, affecting vulnerable subpopulations and children with chronic illness disproportionately.[13,17] Healthy CYAs were less severely affected.[13,17] Clearly, other types of natural disaster (such as earthquakes, flooding or tsunamis) and natural disasters in other parts of the world may result in different health outcomes.

The Berlin cohort on the other hand can be viewed as exemplifying immediate health needs after extended periods of migration and uncertainty, war and conflict followed by migration across multiple countries. The specifics may vary from family to family and are, in their complexity, much harder to grasp in numbers. The standardised survey instrument, however, helped to capture the similarities and the differences. It is evident that families had been separated in a majority of cases and this seemed to trigger on-going stress, even after a safe haven had been reached. The result that psychological stress was higher in refugees coming from war zones and witnessing more violence is plausible and corresponds to the finding from PTSD research that human-made traumatic events have a higher potential to cause stress disorders compared with natural or accidental disaster.[18]

Because of the urgency of the matter and the challenges ahead, refugee health has been declared a priority in the WHO Regional Office for Europe (WHO/Europe).[19] A recent study in the Netherlands among treatment-seeking refugees explored the impact of trauma exposure on refugee health.[20] Studies on forcibly displaced children[21] and refugees arriving in Australian Detention Centers[22] encourage further in-depth research and the critical evaluation of multimodal treatment options. Health needs should be assessed consistently and objectively to identify, including during volatile situations, those groups or individuals who may be most likely to benefit from targeted programmes and interventions.[23]

For effective interventions to be implemented, more public health research is needed. A 2017 review provided a first attempt in this direction outlining a number of digital aids that may help researchers to collect public health data in crisis settings. The digital revolution may help to gather timely data on exposure to violence, food security and nutrition, physical and mental health outcomes and the availability of public health resources.[24]

The present work shows several strengths and limitations. The NCTSN-validated and standardised survey instrument, developed by child trauma experts, provided highly granular data for systematic analysis and evaluation. The timeliness of the survey project provided unique insight into health needs during times of acute crisis. Meanwhile, the situation for evacuees and refugees may have improved—or declined—over time. Future research should include follow-up assessments in regular time intervals, including both cross-sectional and longitudinal formats. Evidence has been developed indicating that many external factors may influence the rate of trauma recovery, including family support and school- and group-based interventions.[2]

In the present cross-sectional survey, which was entirely voluntary and anonymous, the rate of missing data (3%) was remarkably low, expressing a strong interest on the side of survey participants to make their voices heard, even under adverse circumstances. The voluntary nature of the survey determined the size and composition of the convenience sample. As with any convenience sample, selection bias is inevitable. As discussed in previous publications for the HSCAAK, it cannot be ruled out that individuals, who did not volunteer to participate in the survey, may have been affected less—or more—adversely compared with survey participants who did wish to participate.[12,13] In the Berlin cohort, language issues may have created a barrier to participation for some migrants: to maximise access, the survey was offered in English, Arab, Farsi and Russian languages. The translations were performed by professional translators and tested with native speakers before we used them. In any case, the target population was not homogeneous in culture, language or ethnicity; therefore, it would have been difficult to devise an instrument that would perfectly address this heterogeneity. Additional languages and validations will be introduced in the future. Gender differences including sexual violence were not addressed in detail in this survey instrument and may require additional attention in the future.[25]

The implications for practice and policy are complex. Volunteerism and engagement of civil society were strong both in Berlin and in New Orleans after Hurricane Katrina, but some risk groups may require individual attention and professional help.[26] An anonymous survey is evidently not the right format to cure disease or help with individual health needs. Future research will also need to address the long-term effects of repeated trauma over time and the various stressors experienced by displaced CYAs.[27] It will be crucial to explore possible interventions involving nurses, social workers and mental health professionals.[28]

Finally, the number of refugees who had been left alone at some point during migration was significant; many young refugees needed to rely on the help of strangers to get to safety. Little is known about the differences in health outcomes among unaccompanied minors and those who were able to flee together with their families. Diagnostic instruments will need to be developed further allowing mental health professionals to support individual patients in a professional, therapeutic context.[29,30] In a therapeutic (non-anonymous) context, it will then become possible to design culturally sensitive interventions that are reliable and still meet individual needs.[31–33]

With numbers of young refugees and unaccompanied minors on the rise, the attention may shift from physical needs to addressing the psychological trauma and the potential long-term impact of displacement and migration.[34] Specific research is needed addressing vulnerabilities in different parts of the world. Medical systems in the home country may be undergoing rapid transition generating new needs and new questions in the affected population after migration. Also, illness beliefs and language barriers may need to be overcome.[31,35]

The Health Survey mobile application used in the Berlin cohort will be developed into a multimodal, multilingual digital tool to be made available *pro bono* to CYAs 'on the move' in any part of the world. It is hoped that the resulting anonymous data will help to inform public and mental health stakeholders in real-time helping with the timely allocation of resources to those most in need.

Self-reporting via mobile applications may help to tailor mental health programmes and interventions to the specific types of trauma experienced by CYAs, who are familiar with the use of smartphones to convey needs and messages. Timely public health data are critical in the potentially chaotic circumstances of mass evacuation and migration.

New Orleans had become a medically underserved community after Hurricane Katrina, with a profound lack of mental healthcare providers.[36] It took nearly a decade to rebuild urban resilience and appropriate healthcare infrastructure.[37] In Berlin, mental health services for CYAs were already strained before the peak of refugee arrivals in 2015/2016.[38] To raise awareness, the European Psychiatric Association provided guidance regarding the unique mental health needs of CYAs after migration.[39] The International Society for Social Paediatrics and Child Health recently published a joint statement asking for specific training initiatives for paediatricians involved in migrant care.[40] One of the few available controlled studies suggested that school- and group-based interventions may be effective.[23] To avoid stigmatisation, mental health care should be embedded as a natural component of well-child visits and adolescent health care in community settings, where paediatricians and family medicine specialists work hand in hand with mental health professionals and trained translators.

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Competing interests

None declared.

REFERENCES

1. UNHCR. *Worldwide displacement hits all-time high as war and persecution increase*. 2015 [updated June 2015; cited 2016 May 1]; Available from: http://www.unhcr.org/news/latest/2015/6/558193896/worldwide-displacement-hits-all-time-high-war-persecution-increase.html.
2. BAMF. *Das Bundesamt in Zahlen 2015 – Asyl, migration und integration*. Berlin, Germany: BAMF; 2016 [updated January 2018; cited 2017 November 20]; Available from: https://www.bamf.de/SharedDocs/Anlagen/DE/Publikationen/Broschueren/bundesamt-in-zahlen-2015.pdf?__blob=publicationFile.
3. Ullmann E, Barthel A, Tache S, Bornstein A, Licinio J, Bornstein SR. Emotional and psychological trauma in refugees arriving in Germany in 2015. *Mol Psychiatry* 2015;**20**:1483–4.
4. Tsiamis C, Terzidis A, Kakalou E, Riza E, Rosenberg T. Is it time for a refugees' health unit in Greece? *Lancet* 2016;**388**:958.
5. Thomas L. The lost souls: how Australia's asylum seeker policy is damaging children. *Aust Nurs Midwifery J* 2016;**23**:16–21.
6. The L. Migrant and refugee children need our actions now. *Lancet* 2016;**388**:1130.
7. Galea S, Nandi A, Vlahov D. The epidemiology of post-traumatic stress disorder after disasters. *Epidemiol Rev* 2005;**27**:78–91.
8. Lieber M. Assessing the mental health impact of the 2011 Great Japan earthquake, tsunami, and radiation disaster on elementary and middle school children in the Fukushima Prefecture of Japan. *PLoS One* 2017;**12**:e0170402.
9. Zamani M, Zarghami A. The refugee and immigration crisis in Europe: urgent action to protect the mental health of children and adolescents. *J Adolesc Health Off Publ Soc Adolesc Med* 2016;**58**:582.
10. Yun K, Matheson J, Payton C, Scott KC, Stone BL, Song L, et al. Health profiles of newly arrived refugee children in the United States, 2006–2012. *Am J Public Health* 2016;**106**:128–35.
11. Rath B. Lessons learnt from the Health Survey for Children and Adolescents after Katrina (HSCAAK). In: Rath B, editor. *48th Annual Meeting, Society for Epidemiological Research (SER)*. Denver, CO, USA: Society for Epidemiological Research; 2015 June. p. 16–9.
12. Rath B, Young EA, Harris A, Perrin K, Bronfin DR, Ratard R, et al. Adverse respiratory symptoms and environmental exposures among children and adolescents following Hurricane Katrina. *Public Health Rep* 2011;**126**:853–60.
13. Rath B, Donato J, Duggan A, Perrin K, Bronfin DR, Ratard R, et al. Adverse health outcomes after Hurricane Katrina among children and adolescents with chronic conditions. *J Health Care Poor Underserved* 2007;**18**:405–17.
14. Kronenberg ME, Hansel TC, Brennan AM, Osofsky HJ, Osofsky JD, Lawrason B. Children of Katrina: lessons learned about postdisaster symptoms and recovery patterns. *Child Dev* 2010;**81**:1241–59.
15. Osofsky HJ, Osofsky JD, Kronenberg M, Brennan A, Hansel TC. Posttraumatic stress symptoms in children after Hurricane Katrina: predicting the need for mental health services. *Am J Orthopsychiatry* 2009;**79**:212–20.
16. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol* 2006;**3**:77–101.
17. Zoraster RM. Vulnerable populations: hurricane Katrina as a case study. *Prehosp Disaster Med* 2010;**25**(1):74–8.
18. Neria Y, Nandi A, Galea S. Post-traumatic stress disorder following disasters: a systematic review. *Psychol Med* 2008;**38**:467–80.
19. Jakab Z, Severoni S, Ostlin P, Verschuuren M, Stein CE. Refugee and migrant health: a priority in the WHO European Region. *Lancet* 2015;**386**:2477–8.
20. Knipscheer JW, Sleijpen M, Mooren T, Ter Heide FJ, van der Aa N. Trauma exposure and refugee status as predictors of mental health outcomes in treatment-seeking refugees. *BJPsych Bull* 2015;**39**:178–82.
21. Tam SY, Houlihan S, Melendez-Torres GJ. A systematic review of longitudinal risk and protective factors and correlates for posttraumatic stress and its natural history in forcibly displaced children. *Trauma Violence Abuse* 2015 Dec 30. https://doi.org/10.1177/1524838015622437 [Epub ahead of print].
22. Young P, Gordon MS. Mental health screening in immigration detention: a fresh look at Australian government data. *Australas Psychiatry* 2016 Feb;**24**(1):19–22.
23. Ooi CS, Rooney RM, Roberts C, Kane RT, Wright B, Chatzisarantis N. The efficacy of a group cognitive behavioral

therapy for war-affected young migrants living in Australia: a cluster randomized controlled trial. *Front Psychol* 2016;**7**:1641.
24. Checchi F, Warsame A, Treacy-Wong V, Polonsky J, van Ommeren M, Prudhon C. Public health information in crisis-affected populations: a review of methods and their use for advocacy and action. *Lancet* 2017;**390**(10109):2297–313. https://doi.org/10.1016/S0140-6736(17)30702-X.
25. Keygnaert I, Guieu A. What the eye does not see: a critical interpretive synthesis of European Union policies addressing sexual violence in vulnerable migrants. *Reprod Health Matters* 2015;**23**:45–55.
26. Balaam MC, Kingdon C, Thomson G, Finlayson K, Downe S. 'We make them feel special': the experiences of voluntary sector workers supporting asylum seeking and refugee women during pregnancy and early motherhood. *Midwifery* 2016 Mar;**34**:133–40.
27. McGuinness TM, Durand SC. Mental health of young refugees. *J Psychosoc Nurs Ment Health Serv* 2015;**53**:16–8.
28. Tomita A, Kandolo KM, Susser E, Burns JK. Use of short messaging services to assess depressive symptoms among refugees in South Africa: implications for social services providing mental health care in resource-poor settings. *J Telemed Telecare* 2016 Sep;**22**(6):369–777.
29. Rassenhofer M, Fegert JM, Plener PL, Witt A. Validated instruments for the psychological assessment of unaccompanied refugee minors – a systematic review. *Prax Kinderpsychol Kinderpsychiatr* 2016;**65**:97–112.
30. Raghavan SS, Rosenfeld B, Rasmussen A. Measurement invariance of the brief symptom inventory in survivors of torture and trauma. *J Interpers Violence* 2015 Dec 27. https://doi.org/10.1177/0886260515619750 [Epub ahead of print].
31. Uribe Guajardo MG, Slewa-Younan S, Santalucia Y, Jorm AF. Important considerations when providing mental health first aid to Iraqi refugees in Australia: a Delphi study. *Int J Ment Health Syst* 2016;**10**:54.
32. Powers A, Fani N, Cross D, Ressler KJ, Bradley B. Childhood trauma, PTSD, and psychosis: findings from a highly traumatized, minority sample. *Child Abuse Negl* 2016;**58**:111–8.
33. Phillips C. Beyond resettlement: long-term care for people who have had refugee-like experiences. *Aust Fam Physician* 2014;**43**:764–7.
34. Tay AK, Rees S, Kareth M, Silove D. Associations of adult separation anxiety disorder with conflict-related trauma, ongoing adversity, and the psychosocial disruptions of mass conflict among west Papuan refugees. *Am J Orthopsychiatry* 2016 Mar;**86**(2):224–35.
35. Ben Taleb Z, Bahelah R, Fouad FM, Coutts A, Wilcox M, Maziak W. Syria: health in a country undergoing tragic transition. *Int J Publ Health* 2015;**60**(Suppl. 1):S63–72.
36. Wang PS, Gruber MJ, Powers RE, Schoenbaum M, Speier AH, Wells KB, et al. Mental health service use among hurricane Katrina survivors in the eight months after the disaster. *Psychiatr Serv* 2007;**58**:1403–11.
37. Springgate BF, Wennerstrom A, Meyers D, Allen 3rd CE, Vannoy SD, Bentham W, et al. Building community resilience through mental health infrastructure and training in post-Katrina New Orleans. *Ethn Dis* 2011;**21**. S1-20-9.
38. Mundt A, Kliewe T, Yayla S, Ignatyev Y, Busch MA, Heimann H, et al. Social characteristics of psychological distress in disadvantaged areas of Berlin. *Int J Soc Psychiatry* 2014;**60**:75–82.
39. Bhugra D, Gupta S, Schouler-Ocak M, Graeff-Calliess I, Deakin NA, Qureshi A, et al. EPA guidance mental health care of migrants. *Eur Psychiatry J Assoc Eur Psychiatr* 2014;**29**:107–15.
40. ISSOP. ISSOP position statement on migrant child health. *Child Care Health Dev* 2018;**44**:161–70.

Appendix

Appendix 1 – The adapted National Child Traumatic Stress Network Trauma questionnaire.

Type of traumatic stress	Weights ascribed for calculation of the weighted trauma index
NCTS1: Serious injury to child/young adult	3
NCTS2: Family/friend injured or killed	3
NCTS3: Witnessed people getting hurt/killed	2
NCTS4: Separation from family	2
NCTS5: Home badly destroyed/damaged	2
NCTS6: Witnessed neighbourhood badly damaged	2
NCTS7: Pet left behind/hurt/lost/killed	1
NCTS8: Belongings/clothes/toys destroyed	1
NCTS9: Time to get ready when migrating	1
NCTS10: Left alone when getting out	2
NCTS11: Dependence on others when evacuating/migrating	1
NCTS12: Witnessed violence or looting	1
NCTS13: Volunteered/helped others with evacuation/migration	Not included in the trauma index
NCTS14: Family members volunteered/helped others with evacuation/migration	Not included in the trauma index
NCTS15: Lost job due to evacuation/migration	1
NCTS16: Parent/caregiver lost job due to evacuation/migration	1
NCTS17: Been with family/friends during evacuation/migration	Not included in the trauma index
NCTS18: Has the child/young adult attempted evacuation/migration before	Not included in the trauma index
NCTS19: Any acquaintance ever been hurt/killed before evacuation/migration	Not included in the trauma index

NCTS, National Child Traumatic Stress.
An unweighted index to measure cumulative exposure to traumatic stresses during evacuation/migration was created by assigning a score of 1 to each positive response on questions 1–12 and 15–16 (therefore, a maximum score of 14 was allowable, and a higher score meant exposure to greater traumatic stress before or during evacuation/migration). A weighted trauma score was calculated by assigning a weight of 3 to questions 1 and 2; a weight of 2 to questions 3–6, 10 and 12 and a weight of 1 to questions 7–9, 11, 15 and 16. A maximum score of 24 was allowable on this index with a higher score indicating greater traumatic stress experienced during evacuation/migration.

Appendix 2 – Calculation of the psychological impact indices.

Feelings/thoughts on evacuation/migration
PSY1: Does the child/young adult (CYA) get upset, afraid or sad when something makes them think of the evacuation/migration?
PSY2: Does the CYA have bad dreams or nightmares about what happened?
PSY3: Does the CYA have upsetting thought or pictures that come to their mind about what happened?
PSY4: Does the CYA try not to think about or talk about the evacuation/migration?
PSY5: Does the CYA stay away from places, people or things that make them think of the evacuation/migration?
PSY6: Since the evacuation/migration, especially in the past four weeks, do you feel that nothing is fun for the CYA any more or that they are just not interested in anything?
PSY7: Does the CYA have difficulty falling asleep at night, or wake up in the middle of the night because of what has happened?
PSY8: Does the CYA often feel jumpy or nervous?
PSY9: Does the CYA find it harder than usual to concentrate or pay attention to things?
PSY10: Since the evacuation/migration, especially in the past four weeks, does the CYA worry about what is going to happen to family and friends?
PSY11: Does the CYA often feel irritable or grouchy?
PSY12: Does the CYA often feel sad, down or depressed?
PSY13: Has the CYA been more or less interested in eating since the evacuation/migration?
PSY14: Since the evacuation/migration, especially in the past four weeks, has the CYA had more aches and pains (stomach or headaches)?
PSY15: Has the CYA had less energy than usual?
PSY16: If in school: Does the CYA find it harder to get schoolwork done?
PSY17: Does the CYA worry about something bad happening to family/friends?
PSY18: Since the migration, especially in the past four weeks, does the CYA have a harder time getting along with family/friends?
PSY19: If in a new school: is the CYA having a hard time making new friends?
PSY20: Is the CYA finding it harder to enjoy activities that he/she used to enjoy?
PSY21: How bothered is the CYA by these questions?
PSY22: Has the CYA used drugs or alcohol since the evacuation/migration?
A 22-item questionnaire was used to assess psychological impact with each item rated using a Likert scale (0 = none, 1 = little, 2 = some, 3 = much, 4 = most; separate category for not applicable). The items in Table 2 were recategorised such that responses indicating 'little' or 'some' impact were categorised into 'some impact' and responses indicating 'much' or 'most impact' were categorised into 'much impact'. A score of 0 was awarded for 'no impact', 1 for 'some impact' and 2 for 'much impact'. Scores across all items were added to give a combined continuous psychological impact score, with a higher score indicating higher psychological impact due to evacuation/migration.