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# Refugee Health: A Global and Multidisciplinary Challenge

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## ABSTRACT

The ongoing war and evolving humanitarian crisis in Ukraine have forced millions of women, children, and elderly people to flee the war zones and relocate across Poland, other European countries, and elsewhere in the world. As a result, numerous health issues have emerged in the host countries, ranging from the refugees' low immunization coverage to psychological distress and multimorbidities. Humanitarian support and multidisciplinary approach to the issues may help to improve the refugees' health and well-being. Involving relocated medics in rehabilitation and medical care of their compatriots may offer psychosocial and health benefits.

**Keywords:** Refugees; Relief Work; Psychological Distress; Mental Health; Child; Women; Aged; Reproductive Health; Rehabilitation; Vaccination; Ukraine; Sustainable Development

## INTRODUCTION

The ongoing war and evolving humanitarian crisis in Ukraine have stretched the limits of all civil activities in the country and far beyond its borders. The unprecedented mass migration of Ukrainian women, children, and elderly subjects in a short time and their relocation abroad have created numerous humanitarian and healthcare issues in Poland, other European countries, and elsewhere in the world. Although Ukrainian refugees are well accepted by host governmental institutions and volunteers and treated with compassion, they still need a better organized humanitarian aid.<sup>1,2</sup> The adult refugees are in a dire need for coronavirus disease 2019 (COVID-19) vaccinations and boosters while children require age-related vaccinations against measles, poliomyelitis, diphtheria, tetanus, and pertussis.<sup>3,4</sup>

The anti-vaccine movement and refusal of some Ukrainian parents to vaccinate their children against measles, poliomyelitis, pertussis, and diphtheria have increased epidemiological risks in Poland and other countries accepting most refugees.<sup>5,6</sup>

Experts suggest to raise healthcare workers' awareness in host countries for carefully processing medical history and vaccination status of Ukrainian children, arranging all required vaccinations, and organizing advanced screening for tuberculosis, hepatitis B and C,

and human immunodeficiency virus.<sup>7</sup> Host countries are also alerted of the refugees' needs for specialist care in oncology, hematology, nephrology, endocrinology, and other resource-consumption fields.<sup>3</sup>

The United Nations High Commissioner for Refugees (UNHCR) preliminary estimates have indicated that 8.3 million Ukrainians would receive refugee status.<sup>8</sup> The same source predicted that 90% of refugees outside Ukraine would be women and girls, and Poland would accept most of them. Another approximate estimation predicted mass migration of Ukrainians older than 60 years with pulmonary, cardiovascular, musculoskeletal, and genitourinary diseases.<sup>9</sup> The accumulating statistical records are increasingly important for developing healthcare strategies and mobilizing resources for targeted care in host countries.<sup>10</sup>

As of January 10, 2023, 7,968,510 refugees from Ukraine are recorded in Europe, and the largest number (1,563,386) is registered in Poland for Temporary Protection or similar national protection schemes.<sup>11</sup> Importantly, between May and November 2022, the UNHCR interviewed 43,571 Ukrainian refugees in Poland and other European countries to analyze their profiles, needs and intentions.<sup>11</sup> Most of the respondents were females (85%), aged 35–59 (47%), holding higher levels of education (46% with university or higher degrees), with diverse professional backgrounds (education 14%, healthcare 9%). Before leaving Ukraine, 73% of them were employed, 14% were retired, and 2% were students.

## PSYCHOLOGICAL DISTRESS IN ADULTS

The evolving refugee crisis in the time of the ongoing COVID-19 pandemic, local and regional military conflicts, immeasurable losses, and increasing burden of mental health issues will have lasting global effects.<sup>12</sup> Repetitive exposure to COVID-19 among Ukrainian refugees has already exhausted their immune reserves and lowered thresholds of psychological distress.<sup>13</sup> The energy crisis, imminent threats of bombings, destructions, losses of family and relatives have all resulted in several waves of mass migrations from Ukraine to Poland and other neighbouring countries. The refugees who flee the war and seek temporary shelters and means for survival suffer from severe psychological trauma. Some of them develop post-traumatic and cultural syndromes mimicking psychoses and requiring specialist diagnostic workup and interventions.<sup>14</sup>

A nationwide survey of 2,000 civilians registered with a Ukrainian online panel between 7 and 15 April 2022 demonstrated that elevated risk of post-traumatic stress disorder (PTSD) was present in 616 (31%) respondents and that displacement was significantly associated with PTSD symptoms, particularly in those who had children under the age of 16 and wounded relatives.<sup>15</sup>

Importantly, the absolute majority of Ukrainian refugees are middle-aged, well-educated women accompanied by one or more family dependants. Most of them are capable of coping with stress by communicating with their hosts in neighbouring countries, networking, and maintaining phone connection with their family members left in Ukraine.<sup>16</sup> A recent survey of 352 refugees in Przemysl, Poland demonstrated that 15–26% of them presented with severe and very severe anger, anxiety, depression, and sleep disturbance.<sup>17</sup> Most psychological symptoms were associated with hardships of relocation and separation from their family and loved ones left in Ukraine. Creating sense of 'new family' and supportive network of caring friends turned a single helpful solution to maintain resilience of the refugees.<sup>17</sup> Experts also

suggested to periodically organize psychotherapeutic interventions to cope with the sense of demoralization and maintain meaning-in-life values.<sup>18</sup>

## MENTAL HEALTH IN CHILDREN

The influence of war-inflicted stress on children is the most powerful. According to the UNICEF, 4.3 mln Ukrainian children were displaced during the first month of the war.<sup>19</sup> A large number of Ukrainian children who witnessed destruction, violence, displacement, and forced separation from their parents have been profoundly affected by PTSD, depression, anxiety, and other emotional and behavioural reactions.<sup>20</sup> Importantly, children in host countries who witness Ukrainian refugees' hardships and psychological sufferings also develop peritraumatic dissociative symptoms, anxiety, and present with better understanding of the ongoing war threats.<sup>21</sup>

Overall, refugees' support by accompanying parents and hosts may ease their stress.<sup>22</sup> However, psychological distress presented with sleep disorders, nightmares, anxiety attacks, mutism, and depression would require more serious attention from parents and caregivers and psychological interventions.<sup>23</sup> Some of the expert-recommended group interventions may include dance and art therapies for children accommodated in a safe environment, free from any noise triggers.<sup>24</sup>

## SEXUAL AND REPRODUCTIVE HEALTH

Ukrainian women and girls who flee the war zone may experience sexual violence, requiring specialist inquiry to counter psychological consequences of trauma and treat sexually transmitted infections.<sup>25,26</sup> The confidential nature of gender-based violence may deter the refugees from sharing sensitive information, thus compounding the essential specialist care.<sup>27</sup> A recent survey of displaced Ukrainian women demonstrated that about 20% of them may have experienced gender-based violence perpetrated by armed men.<sup>28</sup>

The refugee women separated from their partners may also experience unintended pregnancies and face serious risks for their reproductive health.<sup>29,30</sup> The World Health Organization (WHO) predicted that at least 15% of Ukrainian refugee women might require emergency obstetric care.<sup>31</sup> Moreover, Polish medical records in February–June 2022 listed 578 Ukrainian women and documented a high percentage of subjects hospitalized due to diseases related to pregnancy, childbirth, and the puerperium (228 [39%]).<sup>32</sup> This study pointed to a high risk of neonatal morbidity and mortality among immigrant Ukrainian women. Subsequently, securing the refugees' rights for effective contraception and safe abortion may save their lives and improve family planning during and after the war.<sup>33</sup>

## MULTIMORBIDITIES IN OLDER ADULTS

Relocated Ukrainian older subjects require comprehensive assessment of all organ systems since most of them present with at least two chronic non-communicable diseases affecting the heart, gastrointestinal tract, lungs, and genitourinary system, including those requiring emergency care.<sup>9</sup> Preliminary estimates of the demographics of the migration flows to

European countries by the UN Refugee Agency point to an alarmingly high number of subjects with serious chronic diseases.<sup>34</sup> Supposedly, half a million of migrants suffer from chronic kidney disease and require blood pressure monitoring along with regular laboratory health check-ups.<sup>34</sup>

An analysis of Polish official records of 624,690 older refugees reveals that 4,578 of them have newly diagnosed tuberculosis.<sup>9</sup> The number of older refugees with multi-drug resistant tuberculosis is also high.<sup>35</sup> An official statement of the Division of Country Health Programmes for WHO Europe in March 2022 revealed that 1,400 Ukrainian adult refugees were in need of treatment for tuberculosis, including third of them for multidrug-resistant tuberculosis.<sup>36</sup>

Frailty and physical disabilities make the elderly refugees particularly vulnerable in the face of forced migration and adaptation to the new conditions. Anxiety, depression, sleep disturbances, and disruptions in regular drug therapies may exacerbate chronic diseases and heighten the risk of severe complications.<sup>31,37,38</sup> Disruptions in antidiabetic therapies due to their short supply and inaccessibility may particularly result in diabetic emergencies in the elderly refugees.<sup>39</sup>

## UNMET NEEDS

Ukrainian refugees are real people with their unique psychosocial issues, sets of chronic non-communicable diseases, and needs for prevention of various infections. Most of them have left behind or lost their relatives, friends, and colleagues. Most have lost their homes, possessions, jobs, access to education, and appeared in culturally and linguistically distinct environments.<sup>40,41</sup> Their adaptation to the new conditions largely depends on humanitarian support, rehabilitation, and care. All these measures can be well perceived and accepted by Ukrainian refugee women and elderly people most of whom are well educated and motivated toward the best social and healthcare services.

While Ukrainian refugees' health and well-being is now a global issue, the scale of the issue and shortage of resources have created inequalities in immunization and medical care in host countries.<sup>42-44</sup> Inadequate surveillance and immunization in host countries may pose threats for these countries and affect the refugees' adaptation.<sup>44</sup>

Another challenge for the refugees' health and adaptation is the language barrier in host countries that can be resolved by active hiring of refugee doctors and nurses and involving them in clinics offering services to their compatriots.<sup>45</sup>

Finally, the complexity of refugee health issues and inability to solve them by narrow specialist approaches justify the need for multidisciplinary teams responsible for psychological and medical care.<sup>46</sup> On a global scale, multisectoral policies and interventions are warranted to meet the most vulnerable refugees' needs.<sup>47</sup> Individual, institutional, and governmental measures may help ease sufferings of millions and eventually achieve the United Nations Sustainable Development Goals,<sup>48</sup> which have been put to the test in the face of the evolving global crisis. Host countries need to address numerous issues related to refugees' nutrition, health, well-being, education, and decent employment. Above all, extra efforts are warranted to secure peace and preserve lives of innocent civilians who may contribute more toward global sustainable development.

## REFERENCES

1. Domaradzki J, Walkowiak D, Bazan D, Baum E. Volunteering in the front line of the Ukrainian refugee crisis: a brief report from Poland. *Front Public Health* 2022;10:979751.  
[PUBMED](#) | [CROSSREF](#)
2. Karakiewicz-Krawczyk K, Zdziarski K, Landowski M, Nieradko-Heluszkó A, Kotwas A, Szumilas P, et al. The opinions of Poles about the need to provide humanitarian aid to refugees from the area covered by the Russian-Ukrainian war. *Int J Environ Res Public Health* 2022;19(20):13369.  
[PUBMED](#) | [CROSSREF](#)
3. Fatyga E, Dziągiewska-Gęsiak S, Muc-Wierżgoń M. Organization of medical assistance in Poland for Ukrainian citizens during the Russia-Ukraine war. *Front Public Health* 2022;10:904588.  
[PUBMED](#) | [CROSSREF](#)
4. Vuorio A, Sajantila A, Kovanen PT, Budowle B. Maleficent comrades: war in Ukraine and COVID-19. *Disaster Med Public Health Prep* 2022;1-3.  
[PUBMED](#) | [CROSSREF](#)
5. Rzymiski P, Falfushynska H, Fal A. Vaccination of Ukrainian refugees: need for urgent action. *Clin Infect Dis* 2022;75(6):1103-8.  
[PUBMED](#) | [CROSSREF](#)
6. Pachnia A, Drop B, Polz-Dacewicz M. The epidemiological situation in Ukraine in terms of the implementation of preventive vaccinations according to the Protective Vaccination Program. *Curr Issues Pharm Med Sci* 2022;35(2):75-9.  
[CROSSREF](#)
7. Spielberg B, Pfeil J, Assaad K, von Both U, Janda A, Kitz C, et al. Care of infectious diseases in underage refugees exemplified by Ukraine. *Monatsschr Kinderheilkd* 2022;170(12):1103-12.  
[PUBMED](#) | [CROSSREF](#)
8. UNHCR. Ukraine regional refugee response plan and flash appeal summary - April 2022. <https://data.unhcr.org/en/documents/details/92258>. Updated 2022. Accessed December 15, 2022.
9. Piotrowicz K, Semeniv S, Kupis R, Ryś M, Perera I, Gryglewska B, et al. Disease burden in older Ukrainian refugees of war: a synthetic reanalysis of public records data. *Lancet Healthy Longev* 2022;3(10):e667-73.  
[PUBMED](#) | [CROSSREF](#)
10. Spiegel PB. Are the health systems of EU countries hosting Ukrainian refugees ready to adapt? *Lancet Healthy Longev* 2022;3(10):e639-40.  
[PUBMED](#) | [CROSSREF](#)
11. UNHCR. Ukraine refugee situation. <https://data.unhcr.org/en/situations/ukraine>. Updated 2023. Accessed January 13, 2023.
12. Kalaitzaki AE, Tamiolaki A. Russia-Ukraine war: jeopardizing the mental health gains already been obtained globally. *Asian J Psychiatr* 2022;78:103285.  
[PUBMED](#) | [CROSSREF](#)
13. Su Z, McDonnell D, Cheshmehzangi A, Ahmad J, Šegalo S, Pereira da Veiga C, et al. Public health crises and Ukrainian refugees. *Brain Behav Immun* 2022;103:243-5.  
[PUBMED](#) | [CROSSREF](#)
14. Shoib S, Zharkova A, Pal A, Jain N, Saleem SM, Kolesnyk P. Refugees and mental health crisis in Ukraine. *Asian J Psychiatr* 2022;74:103169.  
[PUBMED](#) | [CROSSREF](#)
15. Ben-Ezra M, Goodwin R, Leshem E, Hamama-Raz Y. PTSD symptoms among civilians being displaced inside and outside the Ukraine during the 2022 Russian invasion. *Psychiatry Res* 2022;320:115011.  
[PUBMED](#) | [CROSSREF](#)
16. Oviedo L, Seryczyńska B, Torralba J, Roszak P, Del Angel J, Vyshynska O, et al. Coping and resilience strategies among Ukraine war refugees. *Int J Environ Res Public Health* 2022;19(20):13094.  
[PUBMED](#) | [CROSSREF](#)
17. Rizzi D, Ciuffo G, Sandoli G, Mangiagalli M, de Angelis P, Scavuzzo G, et al. Running away from the war in Ukraine: the impact on mental health of internally displaced persons (IDPs) and refugees in transit in Poland. *Int J Environ Res Public Health* 2022;19(24):16439.  
[PUBMED](#) | [CROSSREF](#)
18. Costanza A, Amerio A, Aguglia A, Magnani L, Huguelet P, Serafini G, et al. Meaning-centered therapy in Ukraine's war refugees: an attempt to cope with the absurd? *Front Psychol* 2022;13:1067191.  
[PUBMED](#) | [CROSSREF](#)
19. UNICEF. More than half of Ukraine's children displaced after one month of war – UNICEF. <https://www.unicef.org.uk/press-releases/more-than-half-of-ukraines-children-displaced-after-one-month-of-war-unicef/>. Updated 2022. Accessed January 13, 2023

20. Awuah WA, Ng JC, Mehta A, Yarlagadda R, Khor KS, Abdul-Rahman T, et al. Vulnerable in silence: paediatric health in the Ukrainian crisis. *Ann Med Surg (Lond)* 2022;82:104369.  
[PUBMED](#) | [CROSSREF](#)
21. Maftai A, Dănilă O, Măirean C. The war next-door—a pilot study on Romanian adolescents' psychological reactions to potentially traumatic experiences generated by the Russian invasion of Ukraine. *Front Psychol* 2022;13:1051152.  
[PUBMED](#) | [CROSSREF](#)
22. Bürgin D, Anagnostopoulos D, ; Board and Policy Division of ESCAP, Vitiello B, Sukale T, Schmid M, et al. Impact of war and forced displacement on children's mental health-multilevel, needs-oriented, and trauma-informed approaches. *Eur Child Adolesc Psychiatry* 2022;31(6):845-53.  
[PUBMED](#) | [CROSSREF](#)
23. Jaeger FN, Berger C, Buettcher M, Depallens S, Heininger U, Heller Y, et al. Paediatric refugees from Ukraine: guidance for health care providers. *Swiss Med Wkly* 2022;152:w30200.  
[PUBMED](#) | [CROSSREF](#)
24. Izuakor CF, Nnedom OA. Expert recommendations for frontline mental health workers caring for children in the Russian-Ukraine conflict. *Asian J Psychiatr* 2023;80:103328.  
[PUBMED](#) | [CROSSREF](#)
25. Boesten J. Sexual violence as a weapon of war in Ukraine. *BMJ* 2022;377:o1172.  
[PUBMED](#) | [CROSSREF](#)
26. Maggioni A, Gonzales-Zamora JA, Maggioni A, Peek L, McLaughlin SA, von Both U, et al. Cascading risks for preventable infectious diseases in children and adolescents during the 2022 invasion of Ukraine. *Int J Environ Res Public Health* 2022;19(12):7005.  
[PUBMED](#) | [CROSSREF](#)
27. Armitage R. Conflict-related sexual violence in Ukraine: insight from the field. *Lancet* 2022;400(10354):730-1.  
[PUBMED](#) | [CROSSREF](#)
28. Capasso A, Skipalska H, Chakrabarti U, Guttmacher S, Navario P, Castillo TP. Patterns of gender-based violence in conflict-affected Ukraine: a descriptive analysis of internally displaced and local women receiving psychosocial services. *J Interpers Violence* 2022;37(23-24):NP21549-72.  
[PUBMED](#) | [CROSSREF](#)
29. Neal S, Cox P, March-McDonald J, Hutchinson A. A place of safety? Protecting the sexual and reproductive health and rights of Ukrainian sanctuary-seeking women and young people. *BMJ Sex Reprod Health* 2022;48(4):243-5.  
[PUBMED](#) | [CROSSREF](#)
30. Cioffi A, Cecannecchia C, Cioffi F. Violation of the right to abortion at the time of the war in Ukraine. *Sex Reprod Healthc* 2022;33:100738.  
[PUBMED](#) | [CROSSREF](#)
31. Murphy A, Fuhr D, Roberts B, Jarvis CI, Tarasenko A, McKee M. The health needs of refugees from Ukraine. *BMJ* 2022;377:o864.  
[PUBMED](#) | [CROSSREF](#)
32. Lewtak K, Kanecki K, Tyszko P, Goryński P, Kosińska I, Poznańska A, et al. Hospitalizations of ukrainian migrants and refugees in Poland in the time of the Russia-Ukraine conflict. *Int J Environ Res Public Health* 2022;19(20):13350.  
[PUBMED](#) | [CROSSREF](#)
33. Hiam L, Mateescu I, Spiegel P. Improving access to contraception and abortion in Romania in the context of the conflict in Ukraine. *Lancet* 2022;400(10362):1497-8.  
[PUBMED](#) | [CROSSREF](#)
34. Piccoli GB, Brunori G, Gesualdo L, Kalantar-Zadeh K. The impact of the Russian-Ukrainian war for people with chronic diseases. *Nat Rev Nephrol* 2022;18(7):411-2.  
[PUBMED](#) | [CROSSREF](#)
35. Aljadeeah S, Michielsen J, Ravinetto R, Hargreaves S, Wirtz VJ, Razum O, et al. Facilitating access to medicines and continuity of care for Ukrainian refugees: exceptional response or the promise of more inclusive healthcare for all migrants? *BMJ Glob Health* 2022;7(8):e010327.  
[PUBMED](#) | [CROSSREF](#)
36. Ravelo JL. WHO, stop TB seek permits for MDR-TB medicines for Ukraine refugees. <https://www.devex.com/news/who-stop-tb-seek-permits-for-mdr-tb-medicines-for-ukraine-refugees-102918>. Updated 2022. Accessed January 13, 2022.
37. Piotrowicz K, Semeniv S, Gaşowski J. How the war in Ukraine affects older persons. *Rev Esp Geriatr Gerontol* 2022;57(3):137-8.  
[PUBMED](#) | [CROSSREF](#)



38. Shkodina AD, Zhyvotovska AI, Boiko DI. Sleep and armed conflict: future complications of war in Ukraine. *Rev Neurol (Paris)* 2022;178(9):869-71.  
[PUBMED](#) | [CROSSREF](#)
39. Tsagkaris C, Shkodina A, Matiashova L. The war in Ukraine and diabetic foot care: challenges, recommendations. *Diabetes Metab Syndr* 2022;16(10):102618.  
[PUBMED](#) | [CROSSREF](#)
40. Armitage R, Pavlenko M. Medical education and war in Ukraine. *Br J Gen Pract* 2022;72(721):386.  
[PUBMED](#) | [CROSSREF](#)
41. Boglaienko D. The meaning of home. *Science* 2022;377(6612):1354.  
[PUBMED](#) | [CROSSREF](#)
42. Cukier A, Vogel L. Ukraine crisis highlights inequities in refugee care. *CMAJ* 2022;194(22):E779-80.  
[PUBMED](#) | [CROSSREF](#)
43. Didkowska JA, Barańska K, Wojciechowska U, Tyczyński JE. War in Ukraine creates challenges for the cancer care system in Poland. *Lancet Oncol* 2022;23(10):1239-40.  
[PUBMED](#) | [CROSSREF](#)
44. Lewtak K, Kanecki K, Tyszko P, Goryński P, Bogdan M, Nitsch-Osuch A. Ukraine war refugees - threats and new challenges for healthcare in Poland. *J Hosp Infect* 2022;125:37-43.  
[PUBMED](#) | [CROSSREF](#)
45. Babicki M, Mastalerz-Migas A. Providing care for those fleeing war: challenges and solutions for Polish doctors looking after refugees from Ukraine. *BMJ* 2022;377:o1440.  
[PUBMED](#) | [CROSSREF](#)
46. Klas J, Grzywacz A, Kulszo K, Grunwald A, Kluz N, Makaryczew M, et al. Challenges in the Medical and psychosocial care of the paediatric refugee-a systematic review. *Int J Environ Res Public Health* 2022;19(17):10656.  
[PUBMED](#) | [CROSSREF](#)
47. Spiegel PB. Responding to the Ukraine refugee health crisis in the EU. *Lancet* 2022;399(10341):2084-6.  
[PUBMED](#) | [CROSSREF](#)
48. Gasparyan AY, Kumar AB, Yessirkepov M, Zimba O, Nurmashev B, Kitas GD. Global health strategies in the face of the COVID-19 pandemic and other unprecedented threats. *J Korean Med Sci* 2022;37(22):e174.  
[PUBMED](#) | [CROSSREF](#)