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Overview

A 25 Year Retrospective Review of the Psychological Consequences of the Chernobyl Accident

E.J. Bromet *, J.M. Havenaar †, L.T. Guey ‡

* Departments of Psychiatry and Preventive Medicine, Stony Brook University, Stony Brook, New York, USA
† Altrecht Institute for Mental Health Care, Utrecht, The Netherlands
‡ New England Research Institute, Watertown, Massachusetts, USA

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Abstract

The Chernobyl Forum Report from the 20th anniversary of the Chernobyl nuclear power plant disaster concluded that mental health effects were the most significant public health consequence of the accident. This paper provides an updated review of research on the psychological impact of the accident during the 25 year period since the catastrophe began. First responders and clean-up workers had the greatest exposure to radiation. Recent studies show that their rates of depression and post-traumatic stress disorder remain elevated two decades later. Very young children and those *in utero* who lived near the plant when it exploded or in severely contaminated areas have been the subject of considerable research, but the findings are inconsistent. Recent studies of prenatally exposed children conducted in Kiev, Norway and Finland point to specific neuropsychological and psychological impairments associated with radiation exposure, whereas other studies found no significant cognitive or mental health effects in exposed children grown up. General population studies report increased rates of poor self-rated health as well as clinical and subclinical depression, anxiety, and post-traumatic stress disorder. Mothers of young children exposed to the disaster remain a high-risk group for these conditions, primarily due to lingering worries about the adverse health effects on their families. Thus, long-term mental health consequences continue to be a concern. The unmet need for mental health care in affected regions remains an important public health challenge 25 years later. Future research is needed that combines physical and mental health outcome measures to complete the clinical picture.

Key words: Chernobyl; cognitive; epidemiology; mental health; psychological; radiation

Statement of Search Strategies Used and Sources of Information

This report builds on our previous review of the psychological effects of the Chernobyl nuclear power plant disaster covering the first 20 years after the accident [1]. We searched both PubMed and Google Scholar for articles published in English peer-reviewed journals since 1986, but with a particular emphasis on research published from 2005 to 2010. The key words used were Chernobyl, ionising radiation, neuropsychology, depression, anxiety, post-traumatic stress disorder, cognitive, neuropsychology, risk perceptions and health perceptions. We also reviewed studies cited in the papers we identified as well as reports published by the World Health Organization.

Introduction

The psychological consequences of natural and technological disasters, and more recently terrorism, have been studied extensively [2–4]. Overall, the excess psychological morbidity attributable to such events is 20% on average over the first 12 months [5]. After technological disasters, the prevalence of post-traumatic stress disorder (PTSD), characterised by symptoms such as flashbacks, nightmares, hypervigilance and avoidance of reminders of the event, ranges from 15 to 75% [3] depending on the gravity, severity and level of threat from the disaster, the risk population and the timing of the study. Events containing a threat to health as a result of toxic exposures are most likely to produce long-term mental health consequences [6]. Among them,

Author for correspondence: E.J. Bromet, Departments of Psychiatry and Preventive Medicine, Stony Brook University, Putnam Hall-South Campus, Stony Brook, NY 11794-8790, USA. Tel: +1-631-632-8853; Fax: +1-631-632-9433.

E-mail address: Evelyn.bromet@stonybrook.edu (E.J. Bromet).

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the Chernobyl catastrophe, which began on 26 April 1986, was one of the world's most devastating and complex disasters, producing extreme ecological and social disruption. The threat to health is one of its most unique and unresolved sequela, and thus its psychological impact, as expected, has been protracted and prolonged.

Across disasters, the risk factors that increase the likelihood of mental health consequences are the severity of the disaster (e.g. the extent of death and destruction, the length of exposure, evacuation, proximity to the epicentre), the post-disaster circumstances (e.g. the adequacy of practical or emotional support, access to professional interventions, receipt of compensation and benefits) and personal vulnerabilities (being female, having young children, having a history of psychiatric problems). After toxic disasters, such as the atomic bombing of Hiroshima and Nagasaki, survivors are often stigmatised and discriminated against economically and socially, adding to the stressfulness of the post-disaster environment. Like the A-bomb survivors, the Chernobyl evacuees found themselves stigmatised when they were resettled in cities like Kiev because of fears of contamination by the general population and even the medical community.

The Chernobyl disaster encompassed a complex array of physical and psychosocial exposures that are all but impossible to untangle. This includes radiation exposure and the subsequent deaths among the first responders, the high rate of thyroid cancer in exposed children, the chaotic evacuation, challenges in securing residency permits for the communities where evacuees were resettled, misleading disclosures by authorities, contradictory media reports about the health effects of radiation, difficulty obtaining legislated benefits and entitlements, and indiscriminant attribution by the medical community that Chernobyl was the cause of illness and disease regardless of the scientific evidence [7].

The socio-economic problems stemming from Chernobyl were compounded by the turmoil that ensued when the Soviet Union broke apart in 1991. From the perspective of mental health research, on the other hand, the collapse of the Soviet Union created opportunities for transparent, epidemiological investigations of the psychological impact of Chernobyl, which had been difficult to achieve during the initial 5 years after the accident. Western concepts of representative sampling, reliable measurement and psychiatric nosology were introduced, epidemiology and psychiatry textbooks were translated into Russian, and open collaborations sprang up in Belarus, Ukraine, Russia and other newly formed republics.

Three groups have been the target of research on the mental health consequences of Chernobyl: (1) clean-up workers; (2) children exposed *in utero* or as young infants; and (3) adult populations with varying levels of exposure. This review focuses on these three groups.

Clean-up Workers

An estimated 600 000 clean-up workers, or liquidators, both civilian and military personnel, were recruited from throughout the Soviet Union. As noted in our previous review [1], there have been two lines of psychological research on clean-up workers, one focused on potential radiation-related cognitive impairment and the other examining the psychiatric effects of exposure-related stress. The studies described below are summarised in Table 1.

Four studies conducted in Kiev provide suggestive evidence of measurable cognitive or neuropsychiatric effects of radiation exposure in highly exposed clean-up workers. Two studies by Loganovsky and colleagues [8,9] were based on evaluations of liquidators who were patients at the Research Center for Radiation Medicine. These reports showed an elevated rate of schizophrenia spectrum disorders (5/10 000 versus an estimate of 1.1/10 000 in Ukraine) [8] as well as differences in electroencelphalogram (EEG) features in liquidators assessed 9–10 [8] and 10–15 years [9] after the explosion. A third study from the Institute of Gerontology in Kiev investigated 'accelerated aging' [10]. Based on a composite created from a psychological and cardiovascular test battery, the authors reported that 86% of highly exposed workers sent to the site during the months immediately after the disaster met criteria for accelerated aging as compared with 59% of men who first worked on the site after September 1986. The authors described their data as providing evidence for a 'radiation progeroid syndrome'. A fourth report from a collaboration of American and Ukrainian researchers was based on a neuropsychological test battery administered annually from 1995 to 1998 to 127 volunteers from throughout Ukraine [11]. The subgroup of 36 liquidators performed significantly worse than the remainder of the sample. Although consistent and suggestive, the results of the four reports must be viewed in the context of their methodological limitations, which include convenience samples, lack of data on the reliability of the procedures and measures, and the failure to adjust for confounders, such as age, education, and alcoholism and binge drinking, which have a high prevalence in Ukrainian men [12,13]. Thus, there is a need for more reliable research to confirm the reports of cognitive and EEG impairments in highly exposed liquidators.

The emotional consequences of working as a liquidator, especially for individuals recruited in the first few months after the explosion, are clearer. The most compelling research to date found a significant excess suicide mortality rate in the liquidators from Estonia ($n = 5000$), both for the period 1986–1993 (standardised mortality ratio = 1.52; 95% confidence interval = 1.01–2.19) [14] and when the follow-up was extended to 2002 [15]. Another study of a large sample of Latvian liquidators reported that 43.6% had an ICD-9 mood or psychosomatic disorder (although there was no unexposed comparison group) [16]. The length of time working at the site and working on the reactor roof were significant risk factors. A recent study conducted 18 years after the accident in four regions of Ukraine compared the rates of diagnosable psychiatric disorders in 295 liquidators and 397 matched controls assessed with the Composite International Diagnostic Interview [17]. This study found significantly higher rates of depression, suicide ideation and PTSD in liquidators compared with controls. In addition, liquidators with

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Table 1
Summary of key mental health studies of clean-up workers (liquidators)

Reference	Sample	Years since event	Outcomes	Key findings
[8]	300 outpatients treated at the Research Center for Radiation Medicine in Kiev and 20 controls	9–10	Schizophrenia; EEG abnormalities	Relative risk of schizophrenia in liquidators greater than in general population (2.4 for 1986–1997 and 3.4 for 1990–1997); 72% of liquidators had EEG abnormalities.
[9]	Patients at the Research Center for Radiation Medicine in Kiev with confirmed ($n = 92$) and unconfirmed ($n = 86$) acute radiation sickness	10–15	EEG markers	Various EEG markers differentiated patients with confirmed versus unconfirmed acute radiation sickness
[10]	300 patients at the Institute of Gerontology in Keiv sent to Chernobyl area 1986–1992; 378 'random sample' controls	Not given	Accelerated aging defined by biomarkers such as blood pressure, heart and pulse rate, memory, self-rated health, depression, etc.	81% of exposed men and 77% of exposed women met criteria for accelerated aging. Rates greater in liquidators sent in the first months compared with after September 1986.
[11]	127 volunteers from Ukraine, including 36 liquidators	9–12	Cognitive functioning on neuropsychological test battery administered annually	Liquidators had poorer performance on all tests at each of the four testings
[14,15]	~4800 men from Estonia	7 [14]; 17 [15]	Suicide mortality	At 7 years, 1.5-fold increased risk compared with general population. At 17 years, standardised mortality ratio of suicide = 1.32
[16]	1412 of 4665 male liquidators in outpatient care in Latvia	8	'Mixed mental-psychosomatic disorder' based clinical ICD-9 diagnoses of depression and psychosomatic disorders	Prevalence rate = 43.6%. Length of work in the 10 km radius and work on the reactor roof were significant risk factors.
[17]	295 male liquidators from four regions on the State Registry of Ukraine who worked at Chernobyl from 1986 to 1990; 397 age-matched local controls from Ukraine – World Mental Health survey	18	DSM-IV psychiatric disorders since 1986 and in the past year; severe headaches; post-traumatic stress symptoms	Liquidators more depression, anxiety disorders, post-traumatic stress disorder, suicide ideation and severe headaches; more work days lost in liquidators with disorder than other men; dose–response relationship of exposure severity with post-traumatic stress disorder symptoms

EEG, electroencelphalogram.

depression and PTSD reported substantially more days lost from work in the month before the interview than controls with these disorders or men without these disorders. Those with the greatest level of exposure had significantly more PTSD symptoms.

Thus, the evidence about the psychological impact of Chernobyl work exposure is compelling. Further research is needed to test additional risk factors, such as perceptions about the health impact of their exposures and synergistic effects of stress and the degree of radiation exposure. Given the high rates of disorder compared with unexposed controls, future studies should be embedded in treatment effectiveness protocols aimed at reducing the severity of the symptoms experienced by this cohort.

Cognitive Impairment and Emotional Wellbeing of Exposed Children

In light of the increased rate of severe mental retardation among *in utero* A-bomb survivors [18], substantial concern arose about the developing brain of exposed children who were *in utero* or infants when the Chernobyl accident occurred, even though the highest exposure was well below the lowest level linked to mental retardation in A-bomb survivors [1]. The first systematic study of neurocognitive functioning was the International Pilot Study of Brain Damage In-Utero, designed by the World Health Organization [19]. This project involved neuropsychological assessments of exposed children from the three affected republics

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at the age of 7 years and demographically matched controls. The findings of this study were never published because of concerns about the integrity of the field work. However, in an unpublished report, the World Health Organization concluded that the cognitive and behavioural functioning of the exposed and unexposed children did not differ significantly [19]. Subsequently, research groups in Belarus and Ukraine conducted additional examinations at age 7 years and follow-up assessments at ages 10–12 years (Table 2). The Belarus study found different decrements in the intellectual functioning and higher rates of ICD-10 developmental and childhood psychiatric disorders in exposed compared with unexposed children [20,21]. However, no dose–response effects were detected, and the authors attributed their findings to social and cultural differences between exposed and unexposed children rather than to radiation exposure. Ukraine investigators reported significantly higher rates of borderline intelligence, mental retardation and emotional problems in exposed children, many of whom resided in contaminated villages, compared with controls from metropolitan Kharkov [22]. They also showed a dose–response effect of radiation exposure and increased EEG abnormalities in a subgroup of exposed versus control children who had been selected for additional testing. The findings were attributed to the radiation exposure. These results must also be considered cautiously because of questions about sample selection, lack of clarity about procedures and inter-rater reliability, lack of statistical adjustment for parental intelligence and education and the influence of different educational experiences of students in contaminated villages compared with students in Kharkov.

Two independent studies of children in Ukraine and Belarus found no significant differences between exposed and unexposed children on neuropsychological performance. The first involved a neuropsychological test battery assessing IQ, memory and learning administered to 300 randomly selected evacuee children at age 11 years who came to Kiev as infants or *in utero* and 300 gender-matched classmates [23]. No significant differences were found, including for the *in utero* subsample. There were also no differences between evacuees and classmates on a range of mental health symptom measures [24]. Concerns were raised about the adequacy of the neuropsychological test battery, the lack of clinical diagnostic indicators and the classmate controls, as this group was also exposed to radiation, albeit at lower levels. A follow-up of the sample was conducted at age 19 years using a broader neuropsychological battery and diagnostic measures; at that time, a representative population-based control sample from metropolitan Kiev was also assessed. The follow-up results were consistent with the original findings. That is, no significant differences were detected in neuropsychological test performance [25] or subclinical or clinical indicators of mental health [26]. However, the evacuee adolescents rated their health as less satisfactory and reported more medical diagnoses than the comparison groups, although the study groups had similar findings on physical examination and blood tests [27]. The second study assessed children, exposed before age 4 years, whose families emigrated to Israel from higher (Gomel), lower (Kiev; Mogilev) and unexposed areas [28]. This study also found no association of exposure with neuropsychological test performance and with a measure of attention.

Three recent reports from Kiev, Finland and Norway have added intriguing evidence to the debate about the psychological impact on children. The Kiev study evaluated prenatally exposed children evacuated from Pripyat and classmate controls [29]. On measures involving formal assessment (e.g. diagnostic interview, EEG, IQ testing), the evacuee children had poorer outcomes, although the IQ of both groups was at the high end of the normal range. However, no differences were found on a scale based on maternal reports of the children's behavioural symptoms. The Finnish study compared the rates of psychiatric symptoms and disorders in 232 prenatally exposed and 572 unexposed twins assessed at age 14 years [30]. Exposure to Chernobyl radiation from the second trimester forward was associated with a more than two-fold increase in depression and symptoms of attention deficit hyperactivity disorder. However, the authors interpreted the findings as confirming hypotheses about the adverse effects of prenatal exposure to stress rather than to radiation exposure. It should be noted that the study had no measures of maternal anxiety or level of radiation exposure during pregnancy. The third study assessed the cognitive functioning of 84 adolescents from 'the most contaminated areas of Norway' and 94 controls from uncontaminated areas [31,32]. This study found a significant difference in verbal IQ (but not non-verbal IQ) in adolescents exposed before gestational week 16. The authors were careful to enumerate the study limitations, including the small sample size, the fact that the exposed group was from a more rural area than the controls and the possibility that other unmeasured differences between the regions and the samples could explain the findings.

Thus, the evidence regarding the neuropsychiatric and cognitive impact of Chernobyl in infancy is not consistent, the gestation findings appear contradictory and the story is not resolved. Nonetheless, the prenatally exposed cohort is now 25 years old, and many have become parents themselves. The uncertainty surrounding their psychological health is important to resolve. This uncertainty is best viewed in the context of lingering concerns about their physical health and risk of thyroid cancer. Baverstock and Williams [33] stressed that the health and wellbeing of this cohort are important to monitor for the rest of their lives. This type of monitoring should include reliable indicators of physical health, neurocognitive outcomes, psychological wellbeing, and social and occupational functioning.

Population-based Morbidity Studies

A handful of surveys have been conducted on the mental health of adult populations in the affected regions (Table 3). The earliest investigation was conducted by the International Atomic Energy Agency in 1990 in contaminated and

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Table 2
Summary of key mental health studies of exposed children

Reference	Sample	Years since event	Outcomes	Key findings reported by authors
[20,21]	250 prenatally exposed and 250 controls from Belarus assessed at ages 6–7 and 10–12 years	6–7, 10–11	Neuropsychological and psychiatric evaluations	Lower IQ among exposed at age 6–7 years but not at 10–11 years (as reported for partial sample); exposed more childhood onset emotional disorders than controls. No thyroid dose–response association with IQ.
[22]	544 prenatally exposed (evacuees[a] and children living in contaminated regions) and 759 controls from Kharkov, age 6–8 years.Substudy of 50 exposed and 50 matched controls at age 9–10 years	6–89–10	IQ measures and behavioural symptom scales (age 6–8); psychiatric evaluation and EEG in substudy sample	Age 6–8 years: lower IQ among exposed; 45% of exposed and 29% of controls had high behaviour problem scores; significant correlation between radiation exposure and IQ ($r = 0.3$).Age 9–10 years: 72% of exposed versus 28% of controls had ICD-10 psychiatric disorders; 74% versus 10% had abnormal EEG patterns.
[23,24]	300 evacuees[a] who were *in utero* or up to 15 months old when accident occurred: ~80% from Pripyat; 300 gender-matched classmates, age 11 years	11	IQ, memory, learning, school grades [23], psychological symptoms [24]	No differences on cognitive or psychological measures, including in prenatally exposed subsample
[25–27]	265 evacuees, 261 classmates, 327 population controls from Kiev metropolitan area, age 19 years (follow-up of evacuees and classmates in [23,24])	19	IQ, memory, learning [25], psychological symptoms, DSM-IV depression and generalised anxiety [26].Self-rated health [27]	No differences on cognitive, psychological, or psychiatric measures. Evacuees rated their health as less satisfactory and reported more health problems and medical diagnoses than comparison groups. No significant differences were found on physical examinations and blood tests.
[28]	1629 who moved to Israel from higher, lower, and non- contaminated areas	12–15	Cognitive ability and attention	No differences among the groups
[29]	100 prenatally exposed (evacuees from Pripyat) and 50 unexposed classmates	11–13	Clinical psychiatric assessment; IQ testing; behavioural symptoms; EEG	71% of exposed versus 34% of controls had psychiatric disorders; exposed had lower IQ and abnormal EEG; no differences on symptom scale completed by the mothers

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Table 2 (*continued*)

Reference	Sample	Years since event	Outcomes	Key findings reported by authors
[30]	232 prenatally exposed and 572 unexposed old twins in Finland at age 14 years	14	DSM-III-R psychiatric disorders and symptoms	Adolescents exposed after the second trimester had more than two-fold increased risk of clinical depression and attention deficit hyperactivity disorder symptoms
[31,32]	84 prenatally exposed (exposed born up to 18 months after the accident) and 94 controls in Norway	20	Neuropsychological tests of verbal working memory, verbal memory and executive functioning; IQ	Exposed adolescents performed more poorly on verbal tasks; differences remained significant after controlling for full-scale IQ. Within exposed group, differences most pronounced in those exposed before gestation week 16.

EEG, electroencelphalogram.
[a] Doses in evacuee infants = estimated ~0.03–2 Sv [33].

uncontaminated (by radiation) villages in Belarus, Ukraine and Russia (summarised in Ref. [7]). This study included items about psychological distress and disturbances and found higher rates of psychological distress and concerns about health in exposed villagers compared with residents in nearby unexposed villages.

The first systematic studies of mental health were conducted 6–7 years after the accident. The first study to appear in a Western peer-review journal compared the mental health of a representative sample of adults in Bryansk (Russia), a highly contaminated village, with that of controls from an uncontaminated village in the same region [34]. Mental health was assessed with the 12-item version of the General Health Questionnaire (GHQ-12) [35], a measure of distress that is widely used in disaster and primary care research. The rate of 'minor psychological disorder' (defined as scoring above a specified threshold) was significantly higher in exposed women compared with female controls (48% versus 34%), but no difference was found for men. The second study was conducted by Havenaar and colleagues [36–38] in Gomel (Belarus) and compared a large population-based adult sample with controls from Tver (Russia) on the GHQ-12 and other measures. The Gomel residents were significantly more symptomatic and concerned about their health than the residents of Tver. In addition, mothers with young children were found to be a particularly high-risk group. A subsample with high and low GHQ scores was re-interviewed by psychiatrists with a standardised diagnostic interview, but no significant differences were found with respect to diagnosable mood or anxiety disorders, including PTSD.

Given the concern about mothers of young children raised by Havenaar and colleagues and the long-term effects of the Three Mile Island nuclear power plant accident on this group [39], the mental health of the mothers of the evacuee children in Kiev described earlier [23–26] was also evaluated. Compared with mothers of their children's classmates, the evacuee mothers were twice as likely to have major depression and PTSD 11 and 19 years after the accident [40,41]. The evacuee mothers were also more likely to rate their physical health as poor and to be concerned about the health effects of the radiation [42].

The major factor that accounts for the substantial differences between the exposed and unexposed mothers is their fear about the adverse effects of Chernobyl on their health and their children's health [42]. This concern contributed to the decision by many families to emigrate to Israel in the late 1980s and later to the USA. A study of Russian immigrants in Israel in 1990, 1 year after their arrival, found that Chernobyl was significantly associated with current distress [43], although 5 years later proximity to Chernobyl was no longer a significant risk factor [44]. In a convenience sample of immigrants tested for radiation exposure at Beer Sheva Medical Center, a greater proportion of the most exposed participants had PTSD 8 and 10 years after the accident compared with immigrants with little or no exposure [45]. A third study in Israel also found that Chernobyl 'survivors' had higher rates of depression than other Russian immigrants [46]. In the USA, a study of a volunteer sample of

Table 3
Summary of key mental health studies of general population adults remaining in the former Soviet Union

Reference	Sample	Years since event	Outcomes	Key findings reported by authors
[7]	263 adults born in 1950 (age 40 years) and 1930 (age 60 years) living in contaminated villages and 236 adults in nearby uncontaminated villages in Ukraine, Belarus and Russia	4	Clinical examinations and symptom checklist	Exposed adults more psychological distress, sleep disturbance, fatigue upon wakening, concern that they had a radiation-related illness
[34]	325 exposed from Bryansk (Russia); 278 unexposed controls living nearby	7	12-item GHQ assessing 'minor mental disorder'	Higher rate in exposed women (48%) than controls (34%); no differences among men
[36–38]	1617 exposed from Gomel (Belarus); 1427 controls from Tver (Russia)	6.5	GHQ and other symptom scales; self-rated health; psychiatric diagnoses on subsample (265 Gomel; 184 Tver)	Gomel sample: more rate health fair/poor (64.8% versus 48.1% of controls), have high GHQ scores (74.5% versus 56.5%). No differences in rate of DSM-III-R psychiatric disorders (35.8% versus 37.1% with 'any' disorder). PTSD rates = 2.4% in Gomel and 0.4% in Tver.
[40–42]	300 evacuee mothers in Kiev and 300 mothers of their children's classmates at age 11 years; 254 evacuee and 239 classmate mothers when children were 19 years	11 and 19	Depression and PTSD, psychological symptoms, self-rated health, sick days	At 11 years, evacuees more lifetime depression (44.0% versus 29.7%), symptom scores, poor self-rated health (38.5% versus 28.2%), and ≥7 sick days in past year (54.5% versus 43.0%).At 19 years, evacuees more current Chernobyl-related PTSD (19.7% versus 7.5%), past year major depression (29.1% versus 18.8%), and high distress (26.8% versus 13.4%)

GHQ, General Health Questionnaire; PTSD, post-traumatic stress disorder.

Russian immigrants found an association of Chernobyl exposure with depression and anxiety 15 years after the event [47]. Although it is difficult to generalise from immigrant samples, particularly the convenience samples studied in three of the four reports, the findings from this line of research supports the long-term psychological legacy of the Chernobyl disaster.

Discussion

Chernobyl was a massive catastrophe that impacted millions of people in the former Soviet Union and beyond. The ongoing public debate and uncertainty about the medical repercussions of the accident in the media and in official and unofficial reports have meant that the event is very much current for the affected populations [48]. There is no doubt that Chernobyl had an effect on the mental health of adults directly affected by the event, especially the liquidators and women with young children, which is why the 2006 Chernobyl Forum Report regarded mental health as the major public health consequence [49]. Although Chernobyl led to a series of stressors that continue to the present day, the scope and magnitude of the mental health effects cannot be specified with the data at hand. Given the magnitude of this trauma and its many tentacles, there is a need for more epidemiologically sound mental health research to clarify the long-term psychological and psychiatric consequences.

A recent editorial in *The Lancet* remarked on the contradictory findings regarding the health effects of Chernobyl [50]. The author attributed the lack of clarity to the inadequate epidemiological research infrastructure and a lack of sustained funding for long-term health research. We would add that such studies should be combined with primary and secondary interventions aimed at reducing the psychological morbidity stemming from the accident. In Western settings, a variety of post-disaster mental health interventions have been designed, implemented and tested [51]. These methods can be modified and tailored for other cultures and potentially implemented to the benefit of exposed populations in the former Soviet Union.

The infrastructure for mental health interventions is beginning to develop under the auspices of organisations

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such as the Ukrainian Psychiatric Association [52], UNESCO [48] and other international agencies or foreign governments. In Ukraine, the most common locus of professional care for common mental disorders is the primary care sector, yet physicians receive almost no training in the recognition and treatment of these conditions [12,52]. Their understanding of the psychological impact of Chernobyl and their own role in aggravating the situation by attributing illnesses to radiation exposure without scientific evidence, combined with their potential ability to reduce the level of psychological morbidity stemming from Chernobyl, means that physicians too should be a primary target for educational intervention.

In conclusion, the mental health findings support the need to develop a research infrastructure that examines the people directly affected by this tragedy, rather than a singular focus on specific physical or psychiatric outcomes. To date, mental and physical health studies of Chernobyl have been conducted in parallel. A parsimonious approach to advancing our understanding of the mental health impact is to integrate epidemiological cohort studies of cancer and other health outcomes with mental health research. In particular, if mental health measures were included in studies of thyroid and other forms of cancer in liquidators and high-risk children, the combined approach would provide a unique opportunity to more fully advance our understanding of the health legacy of Chernobyl.

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