PSYCHOSOCIAL CONSEQUENCES OF THE CHERNOBYL DISASTER.

A survey of psychological and physical well-being in an exposed and a non-exposed population sample.

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Abstract. The importance of psychological factors in the aftermath of industrial disasters is being recognized increasingly. Two field studies (total N=3084) were conducted in two regions of the former Soviet Union, to investigate the long-term psychosocial consequences of the Chernobyl nuclear power plant disaster in 1986. A subsample of the respondents (N=449) was studied using a standardized physical and psychiatric examination. The first study took place in the Gomel region (Belarus) in the direct vicinity of the damaged nuclear plant. A control study was conducted in the Tver region (the Russian Federation), about 250 km north-west of Moscow. The results of the study indicate significantly higher levels of psychological distress, poorer subjective health and higher medical consumption in the exposed population. These findings were most prominent in risk groups such as evacuated people and mothers with children. No significant differences in overall levels of psychiatric or physical morbidity were found. Radiation related diseases could not account for the poor health perception in the investigated sample. These results indicate that psychological factors following the Chernobyl disaster had a marked effect upon psychological well being, on perceived health and on subsequent illness behaviour. Fears about future health play a key role in determining this response. The provision of adequate information to the public as well as to the public health services may be important to counteract these fears.

1. Introduction

Although the nature and extent of the physical health damage caused by the Chernobyl disaster continues to be a subject of considerable debate [1-4], there seems to be a consensus that the psychosocial consequences are substantial [5]. So far, however, hardly any studies providing solid evidence to document this have been published in the international scientific literature [6]. In this paper we describe a comparative study about the long term psychosocial consequences of 'Chernobyl'. The study was conducted in 1992-1993 in two regions in the former Soviet Union, one in the direct vicinity of the partly destroyed nuclear plant at Chernobyl and one approximately 1000 km to the north-

east well outside of the range of significant fall-out deposits.

The first survey was conducted in the in the Gomel region (Republic of Belarus), one of the most seriously contaminated regions. The survey was set up as the assessment phase of a Belarussian-Dutch humanitarian aid project ('The Gomel project'). It served to provide a solid epidemiological basis for the development of psychosocial and health education services in the region [7]. A second survey was conducted 6 months later in the Tver region (the Russian Federation) about 250 km north-west of Moscow as a control study. The Tver region was selected because of its comparable socio-economic structure and population size. Just as in Gomel, there is a nuclear power plant at about 100 km distance of the regional capital. The Tver region has not significantly been contaminated by fall-out from Chernobyl.

The aim of the study is to test the hypothesis that, in contrast to convictions generally held by the inhabitants of the exposed region, their symptoms and complaints cannot be explained by exposure to ionizing radiation, but rather to psychological distress and subsequent changes in illness behaviour.

2. Methods

2.1. Subjects

Because no reliable records of the inhabitants of the regions were available, it was not possible to draw random samples of the population. As an alternative, we started by taking a sample of employed inhabitants of the exposed region, supplemented with a sample of students and retired or unemployed people. In this way we obtained a broad sample in which all strata of the population were represented (at the time, according to official statistics, more than 99% of the adult population was either employed, retired or student). The study was conducted using a two-phase sampling design [8]. During the first phase the population samples described above were examined using a self-report questionnaire. From these samples stratified subsamples were drawn for participation in the second phase of the study, which consisted of standardized clinical examination. For the recruitment for this second phase, respondents from the population samples were divided into three strata according to their level of psychological distress as measured using the General Health Questionnaire (GHQ; see below). Respondents with high or medium GHQ-scores were given a higher selection rate for phase-2 in order to study respondents with high levels of distress in greater detail. A detailed description of study design and sample characteristics has been published elsewhere [9]. A schematic description of sampling schemes and response rates is given in table 1.

Table 1. Schematic representation of study design and sampling fractions

Phase 1 Screening of population sample using the GHQ-12 and MOS-SF		
	Gomel	**Tver**
Sampled for phase 1	1763	1620
Participated in phase 1	1617 (91.7%)	1427 (88.1%)
Stratified sampling for phase 2		
GHQ-12 score: 0,1	1:10 sampled	1:10 sampled
2-7	1:5 sampled	1:4 sampled
8-12	1:3 sampled	1:2 sampled
Phase 2 Standardized physical and psychiatric examination (ICD9-CM and DSM-R diagnoses)		
Sampled for phase 2	322	284
Participated in phase 2	265 (82.2%)	184 (64.8%)

2.2. Instruments

The phase 1 respondents (N=3084) were examined using a self-report questionnaire to assess psychological well-being, subjective health and health-related behaviours. Psychological well-being was studied using the General Health Questionnaire, 12-item version (GHQ-12), which is a widely used self-report questionnaire for psychological distress [10,11]. Subjective health was assessed using a single item derived from the Medical Outcomes Study questionnaire, Short Form (MOS-SF). This single item, in which the respondent is asked to rate his or her general health on a 5-point scale ranging from excellent to poor, has been shown to be a valid measure for health-related quality of life in a number of studies [12,13]. The phase 1 questionnaire further contained items concerning the number of visits to doctors and the use of prescription drugs during the previous month.

The clinical examination conducted during the second phase of the study (N=449), consisted of a standardized examination by a Dutch physician specialized in internal medicine, who administered a standardized full medical history, evaluation of current complaints, and a physical and basic laboratory examination, including whole blood count, hepatic, renal and thyroid function tests. In addition to establishing clinical diagnoses according to ICD9-CM, the physicians rated the overall health of the respondents on the same 5-point scale ranging from excellent to poor, that was administered to the respondents in phase 1. Using performance status as a guideline,

patients with a score of 4 (fair health: good performance status, but with a disorder demanding medical attention) or a score of 5 (poor performance status and clinically ill) were counted as 'clinical case'.

A psychiatric examination was performed by specially trained Byelorussian and Russian psychiatrists, who administered a semi-structured interview for making DSM-III-R diagnoses (the Munich Diagnostic Checklist for DSM-III-R) [14,15]. For all questionnaires a time frame of one month (last four weeks) was used.

2.3. Statistical analysis

In order to reverse the effects of over-sampling of cases with high GHQ scores, prevalence estimates for phase 2 parameters were estimated by weighting the results back to phase 1 proportions, using the observed sampling fractions as weights (i.e. corrected for non-response). Univariate odds ratio's (OR) were calculated to estimate the relative risk associated with living near Chernobyl for the health indices measured in the study. Multivariate logistic regression was performed to calculate adjusted odds ratio's (AOR), correcting for potential confounding by sex, age, civil status and education. The effects of weighting on standard errors were corrected by using the PCCARP computer programme [16]. Bonferroni-Holm correction was performed to correct for the effects of multiple pairwise comparisons [17].

In addition the relative risk for psychological distress was estimated for a number of potential risk factors within the exposed sample. These risk factors were: living in a moderately or severely contaminated zone (resp. > 185 kBq $^{137}Cs/m^2$ and > 555 kBq $^{137}Cs/m^2$), having been evacuated, having participated in clean-up activities following the disaster ('liquidators'), being a mother with children younger than 18 years old living at home.

3. Results

Table 2 shows the health indices in Gomel and Tver as they were found in both phases of our study. It is apparent that the general health status of both samples is rather poor. There are high rates for all self-reported and clinical health indices collected in our study.

Table 2. Self-reported and clinical health indices in Gomel and Tver

Self-reported health	Prevalence		Univariate OR		Adjusted OR*	
	Gomel	Tver	OR	95% CI	AOR	95% CI
Psychological distress (GHQ-12)	64.8	48.1	**1.93**	1.69-2.22	**2.03**	1.75-2.37
Health 'fair' or 'poor' (MOS-SF)	74.5	56.5	**2.25**	1.96-2.58	**2.80**	2.35-3.34
Visited doctor last 4 weeks	47.7	41.1	**1.31**	1.14-1.50	**1.38**	1.18-1.61
Used medication last 4 weeks	69.9	60.4	**1.52**	1.30-1.78	**1.55**	1.33-1.84
Clinical status						
Any ICD-9CM physical diagnosis	63.7	55.1	1.43	0.94-2.17	1.57	0.99-2.49
Any DSM-III-R psychiatric diagnosis	35.8	37.1	0.95	0.64-1.41	1.08	0.70-1.67

* Adjusted OR (AOR): odds ratio adjusted for sex, age, marital status and education.
All statistically significant OR's and AOR are typed in bold face.

Around 50% or more of the respondents report unsatisfactory health or psychological well-being. A similar proportion has consulted a doctor and/or used medication during the previous month. More than a third of the sample suffers from a diagnosable medical or psychiatric condition. As may be observed, all self-reported health indices showed substantially higher rates in the exposed population, especially the variable MOS-SF, our measure of subjective health, and the GHQ, our measure of psychological distress ($p < .001$). For the parameters that indicate medical service utilisation and use of medication differences were less dramatic, but still statistically significant ($p < .001$).

For the parameters of clinical health, collected in the second phase of the study, differences did not reach statistical significance at a 5% level. There was a trend towards more physical illness in the Gomel sample. This was especially the case with respect to obesity, hypertension, angina pectoris, anaemia and non-malignant thyroid abnormalities. None of these differences reached statistical significance at a 5% level. Importantly, no differences were observed for diseases which could be attributed to the effects of ionizing radiation. Somewhat contrary to expectations, no differences could be demonstrated in the prevalence of psychiatric disorders.

In table 3 the results of the analysis of risk-factors for psychological distress in the Gomel sample are shown. As may be seen, there is no statistical relation between level of contamination of the area of residence and psychological distress. An increased risk for having a high sore on the GHQ was predicted by two risk factors: being a mother with one or more children under 18 years living at home and having been evacuated after the disaster, the latter being only statistically significant after adjusting for sample composition (AOR). No increased risk was observed in the group of liquidators.

Table 3. Risk-factors for psychological distress in the Gomel region

Risk factor	Gomel	Univariate OR		Adjusted OR	
	%	OR	95% CI	AOR	95% CI
Overall	64.8				
living in area > 185 kBq $^{137}Cs/m^2$	67.8	1.25	1.00-1.55	1.26	0.99-1.59
living in area > 555 kBq $^{137}Cs/m^2$	71.6	1.49	0.88-2.53	1.54	0.89-2.66
evacuated	72.0	1.42	0.85-2.36	**1.45**	1.17-1.80
liquidator	66.9	1.11	0.78-1.57	1.21	0.83-1.75
mother with child < 18 yrs.	73.2	**1.80**	1.34-2.42	**1.88**	1.37-2.57

All statistically significant OR's and AOR are typed in bold face.
* Adjusted OR (AOR): odds ratio adjusted for sex, age, marital state and education.

4. Discussion

Perhaps the most striking finding of this study is the fact that more than 50% of a presumably healthy and active sample of adults living in the former Soviet Union perceive it's health to be less than satisfactory. The percentage of respondents with a high GHQ-score (64.8% and 48.1%) has only been matched under extreme conditions, such as in the immediate aftermath of a natural disaster [18]. The alarming prevalence figures for medical conditions in terms of ICD-9CM (more than 50%), are consistent with recent health statistics published by WHO [19]. Over the past 15 years all former Soviet republics have witnessed increasing levels of morbidity and diminishing life expectancy. A prevalence of more than 35% of the population suffering from diagnosable psychiatric illness, meeting internationally accepted criteria, is the highest reported in the literature [20,21].

The results of this study indicate that people in the exposed region report more psychological distress, poorer health related quality of life and higher medical consumption. Our study provides evidence that, even though the people in the Gomel area experience their health as substantially worse than people from in a non-exposed area, these differences may not be attributed to radiation induced diseases, as is their widely held conviction. Rather, it appears that psychosocial factors are responsible for these differences. In this respect, it appears that mothers with young children and to a lesser extent evacuees are the most vulnerable groups.

The psychological distress and the loss of health related quality of life are not merely 'subjective' epiphenomena of a disaster, which in other aspects turned out not as bad as was initially feared. Also, as was clearly demonstrated in this study, people's worries and distress concerning the disaster are not a form of mental disturbance or 'radiophobia'

[22], because psychiatric morbidity was equally high in both regions. Instead, the public distress is a reality with a direct relevance for policy makers. It should be a central focus in national and international relief programmes set up in the area, such as for example the 'Gomel project' [7] and the UNESCO Chernobyl programme [23].

The psychological stress induced by the disaster has profoundly changed health related behaviour patterns in the affected population. In the perception of the population, minor everyday symptoms have become potential heralds of serious radiation induced disease, which needs to be thoroughly examined by a doctor. In this respect the role of the local health professionals is a crucial one. In an earlier study in the Gomel region we have demonstrated that most doctors perceive 'Chernobyl' as the most important threat to health, thereby fuelling their patient's worries and anxieties [24]. Further development of services, which can provide psychosocial support and health education programmes to the public as well as to health professionals is needed.

Acknowledgements

1. This study was conducted in the framework of a Belarussian-Dutch humanitarian aid project to alleviate the consequences of the Chernobyl disaster. The project was sponsored by the government of The Netherlands and executed by the National Institute of Public Health and Environmental Protection in cooperation with the University Hospital, Utrecht, The Netherlands.

2. The authors wish to thank W van den Brink, T Wohlfarth and MWJ Koeter for their valuable advice and practical support in the analysis of these data.

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