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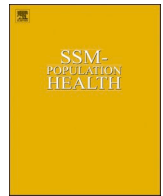
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## Worry about crime and loneliness in nine countries of the former Soviet Union

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### ABSTRACT

Worry about crime has been linked to several detrimental outcomes including worse mental health. However, there has been little research on the association between worry about crime and loneliness, even though loneliness is increasingly being recognised as a serious public health issue. To address this deficit, this study examined the association between worry about crime and loneliness in nine countries of the former Soviet Union (FSU - Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, and Ukraine), using data from 18,000 respondents aged 18 and above that were collected during the Health in Times of Transition (HITT) survey in 2010/11. Results from a pooled logistic regression analysis showed that compared to those who reported no worry about crime, individuals with a high level of worry had significantly higher odds of loneliness (odds ratio [OR]: 1.43, 95% confidence interval [CI]: 1.17–1.75). Sex- and age-stratified analyses further showed that the association was observed in women with a mid (OR: 1.37, 95%CI: 1.10–1.71) and a high level (OR: 1.70, 95%CI: 1.33–2.17) of worry about crime but not in men, and that a high level of worry about crime was linked to loneliness in adults aged 35–59 (OR: 1.39, 95%CI: 1.02–1.91) and 60 and above (OR: 1.64, 95%CI: 1.12–2.40) but not in those aged 18–34. High levels of worry about crime are associated with loneliness in the FSU countries. Reducing crime and its associated worries may have important public health benefits in these countries.

### 1. Introduction

Worry about crime is common in many societies. An earlier study of over 40,000 respondents in 23 European countries, collected in Round 3 of the European Social Survey in 2006, found that between 20 and 30% of individuals had a ‘damaging’ level of worry about crime (Jackson & Kuha, 2014), while more recent research from Sydney, Australia, reported that 49% (199/409) of respondents had past-year crime-related worries and that 13% experienced these worries every week (Lee et al., 2020). Although it has been suggested that worry about crime can be functional, motivating individuals to take precautions to protect themselves, it is dysfunctional for many people, with negative quality of life consequences (Jackson & Gray, 2010). In particular, worry about crime has been linked to poorer mental health (psychological distress, anxiety

and depression) (Roberts et al., 2012; Stafford et al., 2007), worse self-reported health and physical functioning (Gray et al., 2011; Stafford et al., 2007), and reduced quality of life, life satisfaction and happiness (Krucichová, 2018; Stafford et al., 2007).

This study will examine the association between worry about crime and loneliness. An earlier qualitative study argued that worry is integral to the experience of loneliness (Theeke et al., 2015), and it is possible that worry about crime might be linked to loneliness in various ways. For example, research on worry about (or fear of) crime has tended to highlight the role of vulnerability (Hale, 1996). In particular, an early study identified three main dimensions of vulnerability – exposure to non-negligible risk of victimisation, having few possibilities for defence or escape, and anticipation of serious consequences from the experience in question. Within this framework social, situational and physical

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factors further delineate those who are vulnerable, with women, the elderly and physically infirm all regarded as being possibly more vulnerable (Killias, 1990). Subsequent research has also highlighted the role of economic vulnerability (poverty) as a cause of increased fear of crime (Pantazis, 2000), while suggesting that differential vulnerability may be more relevant in explaining differences in worry about crime by sex than across age groups (Jackson, 2009). In terms of the current study, vulnerability may be important as individuals who feel they have a risk of victimisation, are unable to defend themselves, and worry about more severe consequences of victimisation might also be expected to engage in avoidance behaviours i.e. to reduce their movements outside the home and undertake fewer social activities, with reduced social activity also possibly leading to an increased risk for loneliness (Dahlberg et al., 2022). In relation to this, although an earlier study from Switzerland found that vulnerability was linked to taking precautions (avoidance behaviours) while walking in the neighbourhood after 10 p. m. (Killias & Clerici, 2000), to the best of our knowledge, as yet, there has been little research that has directly examined the association between vulnerability and avoidance behaviours. Nonetheless, within the worry about/fear of crime literature – where sex and age are commonly used as proxies for vulnerability (Jackson, 2009) – research has linked fear of crime to avoidance behaviours in both women (May et al., 2010) and the elderly (Whitley & Prince, 2005). Another pathway may link worry, defined as “an aversive emotional experience that arises alongside repetitive unpleasant thoughts about the future” (Sweeny & Dooley, 2017) with anxiety, of which it is often conceived as a cognitive component (Borkovec, 1985). More specifically, some research has shown that worry predicts anxiety (Gana et al., 2001), and that (social) anxiety predicts loneliness (Lim et al., 2020).

Several previous studies have linked worry about crime to an increased risk of loneliness. A recent study from Singapore among 1266 adults aged 60 and above found an association between worry about different forms of criminal victimisation and increased loneliness, with the association stronger in men than women (Lee et al., 2021). This mirrors results from earlier studies that have examined the association between fear of crime (feeling afraid, unsafe) and loneliness among older adults. For example, fear of crime was linked to loneliness among 372 low income urban Black adults aged 62 years and above in New Orleans, United States (Bazargan, 1994), while a study from West Flanders, Belgium that analysed data from 4747 men and women aged 60 and above found a strong association between fear of crime and loneliness (De Donder et al., 2005). However, a study using data from 531 adults in Winnipeg and Edmonton, Canada, found no significant association between fear of crime and loneliness among either men or women, but this study differed markedly from the others in that participants were much younger, with an average age of 43 (Silverman & Kennedy, 1985).

There is, thus, a continuing need for more research in different settings and, especially among adults of all ages to help elucidate the association between worry about crime and loneliness and determine whether it differs among different groups within the population. In particular, although there is some evidence that levels of loneliness may be similar for men and women across the life course (Maes et al., 2019), women have been found to express greater fear of crime (Acierno et al., 2004; De Donder et al., 2005) although it has been suggested that this may just reflect men being less willing to express their fears (Sutton & Farrall, 2005) or adopt avoidance strategies (Lee et al., 2019).

The current study will extend previous research by examining this association among all-age adults in nine countries of the former Soviet Union (FSU). Several factors motivate this research. First, there is reason to suspect that worry about crime may be higher in the FSU countries compared for example, to most countries in Western Europe. An earlier study that used data from Round 3 of the European Social Survey in 2006 showed that 10% and 11% of respondents in Ukraine and Russia were frequently/persistently worried about crime, respectively (Jackson & Kuha, 2014). Second, loneliness is known to be prevalent in FSU

countries (Stickley et al., 2015a; Stickley et al., 2013). This is important as, third, loneliness is increasingly being recognised as a serious public health problem (Cacioppo & Cacioppo, 2018). More specifically, it has been associated with poorer physical and mental health (Erzen & Cikrikci, 2018; Richard et al., 2017) as well as an increased risk of mortality (Holt-Lunstad et al., 2015), with mechanisms such as poorer health behaviours, reduced sleep quality and excessive stress reactivity possibly being involved in the loneliness-poor health association (Hawkey & Cacioppo, 2003, 2010). Indeed, earlier research has shown that loneliness is also linked to worse health in the FSU countries (Stickley et al., 2015a; Stickley et al., 2013). In light of these findings, determining the association between worry about crime and loneliness may have important implications for public policy, especially in the context of growing calls for public health and law enforcement to work more closely together (Van Dijk et al., 2019). Finally, by examining the worry about crime-loneliness association, this study will build on and extend an earlier study, which showed that worry about crime was associated with psychological distress in the FSU countries (Roberts et al., 2012).

Thus, this exploratory study has three main aims: (i) to examine the association between worry about crime and loneliness in nine FSU countries; (ii) to determine whether there are sex and/or age differences in the worry about crime-loneliness relationship; (iii) to ascertain whether there are differences in the worry about crime-loneliness association for different types of crime.

## 2. Method

### 2.1. Study participants

We analysed data from the Health in Times of Transition (HIT) survey. This cross-sectional survey collected data in nine FSU countries: Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Moldova, Russia, and Ukraine in 2010 and from Kyrgyzstan in the following year (because of political troubles there). Multi-stage random sampling with stratification by region and settlement type (urban/rural) was performed in each country to obtain samples that were nationally representative. Households were selected from within the primary sampling units (PSUs) (approximately 100–200 per country) using random route procedures. From within each selected household one person aged 18 or above was randomly chosen to participate (determined by the nearest birthday date). Data were collected by trained interviewers who undertook face-to-face interviews in the participants’ homes using a standard questionnaire. In every country interviewees had the choice to respond in either their own national language or Russian except for in Russia and Belarus, where only Russian was used. Individuals were excluded from participating if they were institutionalised, hospitalised, incarcerated, homeless, in the military, or intoxicated at the time of the survey.

In total, 18,000 respondents were included in the study across the nine countries. In six countries, the sample size was 1800 respondents. However, in the countries with larger and more regionally diverse populations i.e., Russia and Ukraine, the sample sizes were increased to 3000 and 2000 persons, respectively. In addition, due to the need to make the sample more representative, a 400 person booster survey was undertaken in Georgia towards the end of 2010, which meant that the final sample size in that country was 2200 persons. Survey response rates varied across the countries from 47% in Kazakhstan to 83% in Georgia (Roberts et al., 2013). The ethics committee at the London School of Hygiene and Tropical Medicine gave permission for the study, undertaken in accordance with the 1964 Helsinki Declaration and subsequent revisions. Each respondent provided informed consent.

## 2.2. Measures

### 2.2.1. Loneliness

The subjective feeling of loneliness was assessed with a single-item question that asked, “How often do you feel lonely.” There were four response options – often, sometimes, rarely, never. Following the lead of an earlier study that examined loneliness in this context (Stickley et al., 2013), in the current study all those who responded ‘often’ were categorised as being lonely.

### 2.2.2. Worry about crime

Respondents’ perceptions of the possibility of experiencing crime were examined with a five-item question that inquired about their worries about crime. Respondents were given the prompt, “Are you worried about any of these things?” and then presented with five possible crime scenarios: (i) Having things stolen from your house; (ii) Being harassed or threatened on the street; (iii) Being robbed on the street; (iv) Being sexually molested; (v) Suffering abuse because of your nationality. There were four response options, ‘Not worried at all’ (Scored 1); ‘Not really worried’ (2); ‘Rather worried’ (3); and ‘Very worried’ (4). In this study, this variable was examined in two ways. First, the response options were recoded so that Not worried was scored 0, Not really worried was scored 1, while Rather worried was scored 2 and Very worried, 3. Responses were then combined across the five items to create a total worry scale score that could range from 0 to 15. The scale had an acceptable level of reliability (Cronbach’s alpha was 0.72). This was then divided into four categories: score 0 = No (None) worry about crime (N = 5301 [30.7%]), score 1–5 = Low worry about crime (N = 4810 [27.9%]), score 6–10 = Mid worry about crime (N = 4362 [25.3%]), score 11–15 High worry about crime (N = 2776 [16.1%]). Second, the individual response categories were also used to examine the association between worry about each form of crime and loneliness.

### 2.2.3. Covariates

Previous studies examining factors associated with both worry about crime and loneliness were used to guide our choice of covariates (Helfgott et al., 2020; Stickley et al., 2013). Information was collected on sex (male, female) and age, which was divided into three categories (18–34, 35–59 and 60 and above). Education level was also divided into three categories, Low – incomplete secondary education or below; Mid – completed secondary/secondary special education; High – completed/non-finished higher education. For marital status respondents were categorised as being either Married/cohabiting, Never married (single), Divorced/widowed. Respondents were categorised as living in either urban or rural locations. Household financial status was derived from responses to the question “How would you describe the economic situation of your household at the present time?”, with the response options, very good, good, average, bad and very bad. These responses were combined into three categories, Good/very good, Average, Bad/very bad. To identify those individuals who were living alone, respondents were asked, “Including you, how many people constantly live in this household (including children and adults)?” All those respondents who answered ‘one’ were categorised as living alone. Self-rated health status was categorised as either ‘Good/very good’, ‘Fair’, or ‘Poor/very poor’. Psychological distress was assessed using a scale that has performed well in previous studies in this region (Roberts et al., 2012; Stickley et al., 2021). It comprises twelve items which inquire about phenomena such as insomnia, exhaustion/fatigue, stress, problems concentrating etc. One item on loneliness was removed which meant that scores could range from 0 to 11 with higher scores indicating greater psychological distress. To capture those with the most severe symptoms, individuals in the top 10 percent of scores were categorised as experiencing psychological distress in recent weeks. This scale had a good degree of reliability (Cronbach’s alpha was 0.83). Finally, those who reported that they had been victims of physical violence and/or had something of theirs stolen in the past 12 months were classified as

victims of crime.

### 2.3. Statistical analysis

We initially calculated descriptive statistics for the total sample, stratified by worry about crime status, using Chi-square tests to assess differences between categories. Next, we used logistic regression to examine associations between the worry about crime categories and loneliness in the pooled sample. Four models were used to examine associations. In Model 1 we examined the association between worry about crime and loneliness. Model 2 included sociodemographic variables – sex, age, education, marital status, household financial situation, living alone, and location. In Model 3 we added self-rated health and psychological distress to the variables included in Model 2. The fully adjusted Model 4 included the same variables as in Model 3, plus crime victimisation. To examine if these associations might vary demographically, we next performed a series of sex- and age-stratified logistic regression analyses that used the same model building process described above. Lastly, we used a further set of logistic regression analyses to explore if there were differences in the association between worry about different types of crime and loneliness. This used the same model building process as described previously and the individual worry response categories rather than the worry about crime scale categories. The data were analysed with the Statistical Package for the Social Sciences (SPSS) version 22. All pooled analyses were adjusted for country with the use of dummy variables (Stickley et al., 2015b).

In order to test the robustness of the study findings, we also ran a set of sensitivity analyses. First, we examined the association between worry about crime and loneliness where the worry about crime variable was analysed as a continuous score. Next, as the sexually molested variable might be applicable to women more than men, we ran the main analysis again after removing this crime category. Finally, to determine if missing values and the use of country dummy variables had affected the results we ran the main analyses again after imputing missing variables and used a multilevel logistic regression model (i.e., a random intercept model accounting for multiple individuals nested in each study country). Specifically, multiple imputation was used to generate 20 data sets by using the chained equation method with 200 iterations. We accounted for missing data on loneliness, psychological distress, crime victimisation, living alone status (logistic models), educational attainment, household finances, worry about crime, self-rated health (ordered logit models), and marital status (a multinomial model) and then combined imputation estimates using Rubin’s rule (Rubin, 1987). For these analyses, we used Stata ver.16.0 (College Station, TX, USA).

Results are presented as odds ratios (ORs) with 95% confidence intervals (CI). The level of statistical significance was  $p < .05$  (two-tailed).

## 3. Results

Most respondents reported worry about crime; only 30.7% reported no worry, while 6.8% of the respondents scored 15 i.e. they were very worried about each of the individual forms of crime. Almost one in ten respondents reported often being lonely (9.6%), with the prevalence of loneliness ranging from 4.4% (Azerbaijan) to 17.9% (Moldova) across the countries (data not tabulated). When we stratified the sample characteristics by the worry about crime categories, we found significant differences for every variable except one. Specifically, female sex, younger age, high education, being married/never married, having good household finances, not living alone, urban location, very good/fair self-rated health, being a victim of crime and rarely and often feeling lonely were all linked to High worry about crime, while psychological distress was of borderline statistical significance (Table 1). Looking at the individual countries, the prevalence of a high level of worry about crime was especially elevated in Azerbaijan (34.1%), Moldova (22.2%) and Russia (21.0%).

In Model 1 of the logistic regression analysis High worry about crime

**Table 1**  
 Sample characteristics by worry about crime status.

Variable	Total N	No worry about crime (%)	Low worry about crime (%)	Mid worry about crime (%)	High worry about crime (%)	P-value
<b>Sex</b>						<.001
Men	7516	35.0	30.3	22.4	12.3	
Women	9733	27.5	26.0	27.5	19.0	
<b>Age</b>						<.001
18-34	6546	28.8	27.4	25.7	18.2	
35-59	7464	31.3	27.5	25.1	16.2	
≥60	3239	33.5	29.9	24.9	11.7	
<b>Education</b>						<.001
High	4754	27.1	27.2	28.5	17.3	
Mid	10214	31.3	28.5	24.1	16.1	
Low	2241	36.0	26.4	24.3	13.3	
<b>Marital status</b>						.001
Married/cohabiting	10672	31.3	27.4	25.0	16.3	
Never married	3541	30.0	27.5	25.4	17.1	
Divorced/widowed	2976	29.8	30.2	26.0	13.9	
<b>Household finances</b>						<.001
Good/very good	3876	28.0	26.6	27.2	18.1	
Average	9733	28.7	29.0	26.0	16.3	
Bad/very bad	3474	39.7	26.6	20.7	12.9	
<b>Live alone</b>						<.001
No	15612	30.9	27.3	25.2	16.5	
Yes	1605	28.8	33.4	25.7	12.0	
<b>Location</b>						<.001
Urban	10351	24.5	27.9	28.9	18.8	
Rural	6898	40.1	27.8	19.9	12.1	
<b>Self-rated health</b>						<.001
Good/very good	7020	30.0	27.8	24.9	17.2	
Fair	7004	28.3	27.9	27.1	16.7	
Poor/very poor	3175	37.6	28.1	21.9	12.4	
<b>Psychological distress</b>						.057
No	14796	31.3	27.6	25.3	15.7	
Yes	1413	31.4	25.7	24.6	18.3	
<b>Victim of crime</b>						<.001
No	15990	31.8	28.0	24.4	15.7	
Yes	1139	16.1	26.3	36.3	21.3	
<b>Loneliness</b>						<.001
Never	8073	36.5	26.5	22.0	15.0	
Rarely	3599	24.6	30.8	27.1	17.5	
Sometimes	3751	25.0	27.8	30.5	16.7	
Often	1633	29.3	27.7	25.8	17.1	
<b>Country</b>						<.001
Armenia	1759	36.2	26.6	21.2	16.0	
Azerbaijan	1621	24.2	25.8	15.9	34.1	
Belarus	1778	25.9	41.8	27.1	5.3	
Georgia	2165	68.8	23.4	6.5	1.4	
Kazakhstan	1763	28.6	33.0	24.2	14.2	
Kyrgyzstan	1760	32.3	17.7	34.5	15.5	
Moldova	1755	18.3	25.9	33.6	22.2	
Russia	2764	19.9	25.2	33.9	21.0	
Ukraine	1884	20.2	33.4	29.1	17.3	

**Table 2**

Association between the extent of worry about crime and loneliness in nine countries of the former Soviet Union (N = 15690).

	Model 1	Model 2	Model 3	Model 4
	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)
Worry about crime				
None	Ref.	Ref.	Ref.	Ref.
Low	1.08 (0.93–1.26)	1.12 (0.95–1.32)	1.10 (0.94–1.30)	1.09 (0.93–1.29)
Mid	1.11 (0.95–1.29)	1.24 (1.04–1.48)*	1.22 (1.02–1.45)*	1.19 (1.00–1.42)
High	1.26 (1.06–1.51)**	1.54 (1.27–1.88)***	1.45 (1.19–1.78)***	1.43 (1.17–1.75)***
Sex (Female)		1.35 (1.18–1.54)***	1.20 (1.05–1.37)**	1.21 (1.05–1.38)**
Age				
18–34		Ref.	Ref.	Ref.
35–59		1.18 (0.99–1.40)	0.98 (0.81–1.18)	0.98 (0.82–1.18)
≥60		1.52 (1.24–1.87)***	1.10 (0.88–1.37)	1.12 (0.89–1.39)
Education				
High		Ref.	Ref.	Ref.
Mid		1.23 (1.05–1.43)*	1.16 (0.99–1.36)	1.16 (0.99–1.36)
Low		1.33 (1.09–1.64)**	1.15 (0.93–1.42)	1.15 (0.93–1.42)
Marital status				
Married/cohabiting		Ref.	Ref.	Ref.
Never married		1.51 (1.24–1.85)***	1.57 (1.28–1.92)***	1.56 (1.27–1.91)***
Divorced/widowed		3.45 (2.94–4.05)***	3.33 (2.83–3.92)***	3.33 (2.83–3.92)***
Household finances				
Good/very good		Ref.	Ref.	Ref.
Average		1.44 (1.19–1.75)***	1.32 (1.08–1.60)**	1.32 (1.08–1.60)**
Bad/very bad		3.39 (2.76–4.16)***	2.47 (2.00–3.07)***	2.46 (1.98–3.05)***
Live alone		3.40 (2.87–4.02)***	3.57 (3.00–4.24)***	3.56 (2.99–4.23)***
Location (Rural)		1.12 (0.99–1.28)	1.11 (0.97–1.26)	1.10 (0.96–1.26)
Self-rated health				
Good/very good			Ref.	Ref.
Fair			1.29 (1.09–1.52)**	1.28 (1.08–1.52)**
Poor/very poor			1.80 (1.47–2.20)***	1.78 (1.46–2.18)***
Psychological distress			3.00 (2.56–3.52)***	2.97 (2.53–3.49)***
Crime victimisation				1.32 (1.06–1.64)*
Nagelkerke R <sup>2</sup>	.03	.25	.28	.28

OR: Odds ratio; CI: Confidence interval; Ref: Reference category.

\*\*\*p < .001, \*\*p < .01, \*p < .05. All models were adjusted for country.

was associated with significantly higher odds for loneliness compared with no (None) worry about crime (Table 2). Adjusting the analysis for sociodemographic variables increased the odds ratios in all categories so that both Mid and High worry about crime were significantly associated with loneliness. Further adjustment for physical and mental health and criminal victimisation slightly reduced the odds in all categories so that in the fully adjusted Model 4, High worry about crime was associated with 43% higher odds for loneliness (OR: 1.43, 95%CI: 1.17–1.75), while Mid worry about crime was of borderline statistical significance (OR: 1.19, 95%CI: 1.00–1.42).

In the stratified analyses there were clear differences in the association between worry about crime and loneliness within this population. In the sex-stratified analyses an association between worry about crime and loneliness was only seen in women (Table 3). Specifically, in the fully adjusted Model 4, a Mid level of worry about crime (OR: 1.37, 95% CI: 1.10–1.71) and High level of worry about crime (OR: 1.70, 95%CI: 1.33–2.17) were associated with loneliness among women. When the analysis was stratified by age, High worry about crime was associated with significantly higher odds for loneliness in all of the age groups in Model 1. However, when the analysis was adjusted for sociodemographic variables the association became non-significant in the youngest age group. In the fully adjusted Model 4, High worry about crime was associated with 39% higher odds for loneliness in the 35–59 age group (OR: 1.39, 95%CI: 1.02–1.91) and 64% higher odds for loneliness in the 60 and above age group (OR: 1.64, 95%CI: 1.12–2.40).

Being Very worried about crime was associated with significantly higher odds for loneliness for all of the specific forms of crime, with ORs ranging from 1.25 (having things stolen from the house and suffering abuse because of nationality) to 1.43 (being sexually molested) in the fully adjusted Model 4 (Table 4).

When the worry about crime variable was analysed as a continuous score for the pooled sample in a sensitivity analysis, it was also significantly associated with loneliness (OR: 1.02, 95%CI: 1.01–1.04). Similarly, when the sexually molested variable was removed from this analysis the result remained statistically significant (OR: 1.03, 95%CI: 1.01–1.05) (data not tabulated). When we ran all of the analyses again using imputed variables in multilevel models the results remained essentially the same with very small changes in the ORs (see online Appendices 1–3).

#### 4. Discussion

This study used data from 18000 adults aged 18 and above in nine FSU countries to examine the association between worry about crime and loneliness. Crime-related worries were common in this survey population with more than two-thirds of the participants reporting some degree of worry. We found that women, but not men, who worried about crime were significantly more likely to experience loneliness, while the association was also observed in middle-aged and older adults, but was absent in the youngest (18–34) age group. In addition, a high level of worry about crime was linked to loneliness for each of the individual forms of crime.

Until now there has been comparatively little research on the association between worry about crime and loneliness. Nonetheless, our finding of associations in some groups accords with a recent study among older adults in Singapore, where a summed worry scale score was significantly related to loneliness (Lee et al., 2021). Other studies among older adults that have examined associations between fear of crime and feeling unsafe and loneliness have also found significant associations (Bazargan, 1994; De Donder et al., 2005). However, consistent with our

**Table 3**  
Sex- and age-specific associations between the extent of worry about crime and loneliness in nine countries of the former Soviet Union.

	Model 1	Model 2	Model 3	Model 4
	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)
Worry about crime				
<b>Sex</b>				
Men (N = 6869)				
None	Ref.	Ref.	Ref.	Ref.
Low	1.04 (0.82–1.33)	1.15 (0.88–1.49)	1.12 (0.85–1.46)	1.10 (0.84–1.44)
Mid	0.85 (0.65–1.13)	1.02 (0.75–1.38)	0.93 (0.68–1.26)	0.89 (0.65–1.21)
High	0.77 (0.54–1.11)	1.04 (0.71–1.54)	0.99 (0.67–1.47)	0.97 (0.66–1.43)
Women (N = 8821)				
None	Ref.	Ref.	Ref.	Ref.
Low	1.08 (0.89–1.30)	1.13 (0.92–1.39)	1.12 (0.90–1.38)	1.11 (0.90–1.38)
Mid	1.10 (0.91–1.34)	1.38 (1.11–1.71)**	1.39 (1.11–1.73)**	1.37 (1.10–1.71)**
High	1.27 (1.03–1.58)*	1.82 (1.43–2.31)***	1.71 (1.34–2.19)***	1.70 (1.33–2.17)***
<b>Age groups</b>				
18-34 (N = 6033)				
None	Ref.	Ref.	Ref.	Ref.
Low	1.28 (0.92–1.78)	1.29 (0.92–1.82)	1.27 (0.90–1.79)	1.24 (0.87–1.75)
Mid	1.26 (0.90–1.76)	1.30 (0.91–1.85)	1.30 (0.91–1.86)	1.24 (0.87–1.78)
High	1.45 (1.01–2.08)*	1.44 (0.99–2.11)	1.34 (0.91–1.98)	1.30 (0.88–1.91)
35-59 (N = 6814)				
None	Ref.	Ref.	Ref.	Ref.
Low	1.22 (0.96–1.55)	1.18 (0.92–1.53)	1.19 (0.91–1.54)	1.17 (0.90–1.53)
Mid	1.11 (0.86–1.43)	1.11 (0.84–1.46)	1.10 (0.83–1.45)	1.08 (0.81–1.43)
High	1.48 (1.11–1.95)**	1.48 (1.09–2.01)*	1.41 (1.03–1.93)*	1.39 (1.02–1.91)*
≥60 (N = 2843)				
None	Ref.	Ref.	Ref.	Ref.
Low	0.93 (0.73–1.18)	0.97 (0.74–1.28)	0.93 (0.71–1.23)	0.93 (0.71–1.23)
Mid	1.18 (0.91–1.52)	1.34 (0.99–1.79)	1.28 (0.95–1.73)	1.31 (0.96–1.77)
High	1.48 (1.07–2.04)*	1.77 (1.22–2.56)***	1.63 (1.12–2.38)*	1.64 (1.12–2.40)*

OR: Odds ratio; CI: Confidence interval; Ref: Reference category.

Model 1 examined the association between worry about crime and loneliness; Model 2 was adjusted for age (except in the age-specific analysis), sex (except in the sex-specific analysis), educational level, marital status, household financial status, living alone and location; Model 3 was adjusted for the variables in Model 2 and self-rated health and psychological distress; Model 4 was adjusted for the variables in Model 3 and crime victimisation.

\*\*\*p < .001, \*\*p < .01, \*p < .05.

All models were adjusted for country.

finding that any association is weak or absent at younger ages, a much earlier Canadian study in community-based samples with a broader age range (where the average age was 43 years old), found only insignificant associations and concluded that being lonely was not necessarily related to fear of crime (Silverman & Kennedy, 1985). Our study builds on and extends this earlier research by showing that in a pooled population sample of adults aged 18 and above from nine FSU countries higher levels of worry about crime were associated with loneliness and that low levels of worry were not associated with significantly higher odds for loneliness in any of the analyses. This is in line with the claim made previously that not all worry about crime is necessarily damaging (Jackson & Gray, 2010).

As mentioned previously, it is possible that various mechanisms might underlie the association between worry about crime and loneliness. It has been speculated, for example, that fear or worry might result in feelings of distrust and alienation from social life (Garofalo, 1981). More specifically, worry about crime can have detrimental psychological effects and result in constrained and avoidance behaviours, such as spending more time at home, and avoiding socially beneficial activities that might be perceived as dangerous, such as using public transport or attending some types of public entertainment. In some cases this may result in individuals hardly ever leaving their homes (Hale, 1996). A

previous study using data from the Whitehall II study of over 10,000 London-based civil servants showed, for example, that those reporting higher levels of worry about crime saw friends less often and participated less in social activities (Stafford et al., 2007).

We were not able to ascertain causality but, from first principles, it seems likely that the relationship is bi-directional. Thus, it has been suggested that there is a risk of mutually reinforcing harm where fear/worry constrains social behaviour which in turn, further increases fear/worry (Liska et al., 1988). It is also possible that these relationships may be indirect. For instance, worry about crime may act as a stressor that has detrimental consequences for health (Jackson & Stafford, 2009). In particular, research has linked it to worse mental health outcomes such as depression (Golovchanova et al., 2021; Stafford et al., 2007), while depression has also been shown to predict increased loneliness (McHugh Power et al., 2020). It should be noted however, that in this study we found an association between worry about crime and loneliness even after adjusting for mental health (psychological distress).

Worry about crime was associated with loneliness in women but not men. This result conflicts with the finding from a recent study among older adults in Singapore, which showed that the association between worry about crime and loneliness was stronger in men than in women (Lee et al., 2021). It is uncertain what underlies this difference and

**Table 4**  
Association between worry about different forms of crime and loneliness in nine countries of the former Soviet Union.

	Model 1	Model 2	Model 3	Model 4
	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)
Worry about ...				
Having things stolen from the house (N = 16144)				
Not worried at all	Ref.	Ref.	Ref.	Ref.
Not really worried	0.87 (0.74–1.02)	0.85 (0.71–1.02)	0.86 (0.72–1.03)	0.86 (0.72–1.03)
Rather worried	0.96 (0.82–1.13)	0.99 (0.83–1.18)	1.01 (0.84–1.21)	0.99 (0.83–1.19)
Very worried	1.27 (1.10–1.47)**	1.34 (1.14–1.57)***	1.27 (1.08–1.50)**	1.25 (1.06–1.48)**
Being harassed/threatened on the street (N = 16145)				
Not worried at all	Ref.	Ref.	Ref.	Ref.
Not really worried	0.88 (0.75–1.04)	0.89 (0.75–1.07)	0.90 (0.75–1.07)	0.89 (0.74–1.07)
Rather worried	0.99 (0.85–1.16)	1.08 (0.91–1.29)	1.08 (0.91–1.30)	1.07 (0.90–1.28)
Very worried	1.33 (1.15–1.54)***	1.51 (1.28–1.78)***	1.42 (1.20–1.68)***	1.39 (1.18–1.65)***
Being robbed on the street (N = 16116)				
Not worried at all	Ref.	Ref.	Ref.	Ref.
Not really worried	0.98 (0.84–1.15)	1.02 (0.86–1.21)	1.03 (0.87–1.23)	1.03 (0.86–1.22)
Rather worried	0.95 (0.81–1.12)	1.07 (0.90–1.28)	1.08 (0.90–1.30)	1.07 (0.89–1.28)
Very worried	1.28 (1.11–1.49)**	1.46 (1.24–1.73)***	1.39 (1.17–1.64)***	1.36 (1.15–1.62)***
Being sexually molested (N = 15843)				
Not worried at all	Ref.	Ref.	Ref.	Ref.
Not really worried	0.96 (0.83–1.13)	0.98 (0.82–1.16)	0.97 (0.81–1.16)	0.97 (0.81–1.15)
Rather worried	0.85 (0.70–1.04)	1.04 (0.83–1.29)	1.05 (0.84–1.31)	1.04 (0.83–1.30)
Very worried	1.14 (0.97–1.34)	1.51 (1.26–1.80)***	1.45 (1.20–1.74)***	1.43 (1.19–1.72)***
Suffering abuse because of nationality (N = 16093)				
Not worried at all	Ref.	Ref.	Ref.	Ref.
Not really worried	0.97 (0.83–1.14)	0.89 (0.75–1.06)	0.87 (0.73–1.04)	0.87 (0.73–1.05)
Rather worried	1.11 (0.88–1.39)	1.06 (0.83–1.36)	1.10 (0.86–1.41)	1.09 (0.85–1.41)
Very worried	1.29 (1.07–1.54)**	1.34 (1.10–1.64)**	1.26 (1.03–1.54)*	1.25 (1.02–1.53)*

OR: Odds ratio; CI: Confidence interval; Ref: Reference category.

Model 1 examined the association between worry about crime and loneliness; Model 2 was adjusted for age, sex, educational level, marital status, household financial status, living alone and location; Model 3 was adjusted for the variables in Model 2 and self-rated health and psychological distress; Model 4 was adjusted for the variables in Model 3 and crime victimisation.

\*\*\*p < .001, \*\*p < .01, \*p < .05; All models were adjusted for country.

whether it relates to methodological, social and/or cultural differences etc., although our finding seems to concur with earlier research which showed that women were more likely to have a high level of worry about crime than men (Allen, 2006), which may be related to a range of factors including women's greater physical and social vulnerability and differences in socialisation (Hale, 1996; Henderson & Bialeschki, 1993), and that women are more likely to engage in avoidance behaviours (Hale, 1996). Indeed, in line with a number of studies that have highlighted the predominance of crime-related avoidance behaviours in women (Kujala, 2022), it has been suggested that such constraints may become internalised and normalised with potentially detrimental consequences for some women (Lorent et al., 2012) – including possibly an increased risk of loneliness.

High worry about crime was also associated with loneliness in middle-aged and older adults. This finding in part, accords with previous research linking worry about crime and fear of crime and loneliness in older adults (Bazargan, 1994; De Donder et al., 2005; Lee et al., 2021). Interestingly, in this study, high levels of worry about crime were lower in middle-aged and especially older adults – a finding which accords with earlier research that has questioned the strength of the older age-fear of crime association (Hale, 1996), but which seemingly conflicts with more recent research from the World Health Organisation's Study on Global AGEing and Adult Health (SAGE), which found that among six countries, levels of fear of crime in adults aged 50 and above

were comparatively high in the Russian Federation (Lloyd-Sherlock et al., 2016). As with women, it has been suggested that physical vulnerability may influence older adults' worry about crime (Hale, 1996), especially as the consequences of crime-related injury may be especially debilitating at older ages (Greve, 1998). Indeed, this might help explain the finding that if older adults experience fear of crime, they suffer more than younger people (Greve, 1998). In particular, research has highlighted the detrimental effects of fear and worry about crime on older adults' activity and mobility patterns (Pain, 2000) including place avoidance (Kujala, 2022) and limiting movement after dark (Whitley & Prince, 2005). This might be important for loneliness among older adults in our study countries – especially in the context of other factors. For example, it is possible that high levels of distrust in the police in countries such as Russia (Stickley et al., 2009) might not only partly underlie high levels of worry about crime, but also result in greater avoidance behaviours and thus increased loneliness.

This study has several limitations that should be mentioned. First, the data were cross-sectional so it was not possible to determine the directionality of the observed associations. As mentioned earlier, it is possible that the association may be bi-directional and that therefore loneliness might also result in increased worry/fear of crime. Second, information on worry about crime was self-reported and therefore we cannot discount the possibility of reporting bias. For example, it has been suggested that men might underreport worry about crime, as to do



so would conflict with the image of male invulnerability (Pain, 2000), something that may be especially relevant in some of these FSU countries given the predominance of patriarchal views (Martsenyuk, 2015). Third, in this study we examined the intensity of worry about crime. However, it has been proposed that to better understand worry about crime it might also be necessary to combine data about both the intensity and frequency of worry as there is some evidence that individuals who report that they are worried about crime might not be currently worrying about it (Gray et al., 2011). Finally, given the limited literature on worry about crime and loneliness, we discussed our findings in the context of studies that have examined the effects of both worry about crime and fear of crime. However, as Hough has previously pointed out, worry is not synonymous with fear, and while the latter is a mental event, the former is a mental state (Hough, 2004). Thus, more research on the association between worry about crime and loneliness is needed in order to better contextualise the association.

In conclusion, this study builds on earlier research by showing that high levels of worry about crime are linked to higher odds for loneliness in nine FSU countries and that the association seems to be stronger in women and middle-aged and older adults. Given the absolute number of people who, based on our findings are experiencing a high level of worry about crime (about one in six of the adult population) and the size of the ORs (indicating an increase in the odds for loneliness of between 40 and 70% in different analyses), it is possible the population impact of worry about crime is substantial, given that loneliness is now recognised as a major determinant of poor mental and physical health (Ong et al., 2016) and of reduced longevity (Holt-Lunstad et al., 2015). Longitudinal research is now warranted to better understand the nature and directionality of this association and the specific factors that link high levels of worry about crime to loneliness in these countries, so that interventions can be formulated to reduce both worry about crime and its association with loneliness.

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#### Ethical statement

Permission for the study, which was undertaken in accordance with the 1964 Helsinki Declaration and subsequent revisions, was obtained from the ethics committee at the London School of Hygiene and Tropical Medicine. Informed consent was obtained from each participant before their inclusion in the study.

#### Author contributions

AS: Conceptualization, Formal analysis, Roles/Writing – original draft; MM: Project administration, Investigation, Roles/Writing – original draft; NK, YI, MK, SK, YA: Writing – review & editing.

#### Declaration of competing interest

None.

#### Data availability

Data will be made available on request.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ssmph.2022.101316>.

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