



*Citation for published version:*

Roberts, B, Gilmore, A, Stickley, A, Kizilova, K, Prohoda, V, Rotman, D, Haerpfer, C & Mckee, M 2013, 'Prevalence and psychosocial determinants of nicotine dependence in nine countries of the former Soviet Union', *Nicotine & Tobacco Research*, vol. 15, no. 1, pp. 271-276. <https://doi.org/10.1093/ntr/nts100>

*DOI:*

[10.1093/ntr/nts100](https://doi.org/10.1093/ntr/nts100)

*Publication date:*

2013

*Document Version*

Peer reviewed version

[Link to publication](#)

This is a pre-copy-editing, author-produced PDF of an article accepted for publication in *Nicotine & Tobacco Research* following peer review. The definitive publisher-authenticated version Roberts, B., Gilmore, A., Stickley, A., Kizilova, K., Prohoda, V., Rotman, D., Haerpfer, C., & Mckee, M. (2013). Prevalence and psychosocial determinants of nicotine dependence in nine countries of the former Soviet Union. *Nicotine & Tobacco Research*, 15(1), 271-276, is available online at: <http://dx.doi.org/10.1093/ntr/nts100>

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**Title: Prevalence and psychosocial determinants of nicotine dependence in nine countries of the former Soviet Union**

**ARTICLE TYPE: SHORT REPORT**

**Short title:** Nicotine dependence in the former Soviet Union

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## **Abstract**

**Introduction:** Despite the high prevalence of smoking in the former Soviet Union, particularly among men, there is very little information on nicotine dependence in the region. The study aim was to describe the prevalence of nicotine dependence in nine countries of the former Soviet Union and to examine the psychosocial factors associated with nicotine dependence.

**Methods:** Cross-sectional, nationally representative surveys using multi-stage random sampling were conducted in 2010 with men and women aged 18 years and over in Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, and Ukraine. The main outcome of interest was nicotine dependence using the Fagerström Test for Nicotine Dependence. Multivariate regression analysis was then used to explore the influence of a range of psychosocial factors on higher nicotine dependence.

**Results:** Mean nicotine dependence among men in the region as a whole was 3.96, with high dependence ranging from 17% in Belarus to 40% in Georgia. Among women, mean dependence was 2.96, with a prevalence of high dependence of 11% for the region. Gender (men), younger age of first smoking, lower education level, not being a member of an organisation, bad household economic situation, high alcohol dependence, and high psychological distress showed significant associations with higher nicotine dependence.

**Conclusions:** High nicotine dependence among men was recorded in a number of study countries. Findings highlight the need for tobacco programmes to target early age smokers and less educated and poorer groups, and suggest common ground for programmes seeking to reduce nicotine dependence, harmful alcohol use and psychological distress.

## **Title: Prevalence and psychosocial determinants of nicotine dependence in nine countries of the former Soviet Union**

### **Introduction**

Rates of smoking among men in countries of the former Soviet Union (fSU) were traditionally high as cigarettes were easily available in the Soviet era (Cockerham, Snead, & Dewaal, 2002). The situation worsened in the early 1990s with the entry of transnational tobacco companies who engaged in aggressive and sophisticated marketing campaigns (A. B. Gilmore & McKee, 2004). This resulted in further increases in the prevalence of male smoking, marked increases in female smoking, and earlier age of initiation (Andreeva & Krasovsky, 2007; A. Gilmore et al., 2004; Perlman, Bobak, Gilmore, & McKee, 2007). Consequently, levels of tobacco-related disease and associated premature mortality among men in the fSU are among the highest in the world (Ezzati & Lopez, 2003; Peto R, Lopez AD, Boreham J, Thun M, & Heath Jr C, 1994) .

There is little information on patterns of nicotine dependence in the fSU, with only one study identified that examined nicotine dependence and its determinants (Ukraine) (Webb et al., 2007). Nicotine dependence is not only a consequence of its intrinsically addictive neurobiological effects, but is also influenced by a combination of genetic and psychosocial factors. The psychosocial risk-factors for tobacco use commonly involve links between social and economic factors (including from childhood), behavioural factors such as alcohol and drug dependence, and poor mental health (Breslau, Kilbey, & Andreski, 1991; Farrell et al., 2001; Fergusson, Horwood, Boden, & Jenkin, 2007; McKenzie, Olsson, Jorm, Romaniuk, & Patton, 2010; Siahpush, Borland, & Yong, 2007; Tyas & Pederson, 1998). Determining the psychosocial correlates of nicotine addiction in the fSU is particularly pertinent given the region's high levels of alcohol use, social and psychological distress (Brainerd, 2001; Jenkins, Klein, & Parker, 2005; Leon & Shkolnikov, 1998; Leon, Shkolnikov, & McKee, 2009). The aims of this paper were to describe levels of nicotine dependence in nine fSU countries and to examine the psychosocial factors associated with dependence.

### **Methods**

We used data from the Health in Times of Transition (HITT) study ([www.hitt-cis.net](http://www.hitt-cis.net)). Nationally representative cross-sectional household surveys were conducted with respondents aged 18+ years in Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, and Ukraine. Multi-stage random sampling with stratification by region and rural/urban settlement type was applied. Within each primary sampling unit

(about 100–200 per country), households were selected by random route procedures and one person then randomly chosen

The surveys were conducted in March-May 2010 (with the data collection in Kyrgyzstan delayed until April-May 2011 due to the political violence there in 2010). There were 1800 respondents per country, except Russia (3000) and Ukraine (2200) to reflect their larger and more regionally diverse populations, and Georgia (2200) where a booster survey of 400 additional interviews was undertaken in November 2010 to ensure a more representative sample. Response rates varied from 47% in Kazakhstan to 83% in Moldova. The research was approved by the ethics committee of the London School of Hygiene and Tropical Medicine.

The questionnaire was translated into each of the national languages in which it was administered. Except in Russia and Belarus (where all interviews were conducted in Russian) respondents were given the choice of answering in Russian or a national language, with fieldworkers fluent in either language.

Nicotine dependence was measured using the Fagerström Test for Nicotine Dependence (FTND) which has been widely used and validated (Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991). FTND consists of 6 items with scores attached to the response options. The higher the FTND score, the more intense is the person's physical dependence on nicotine.

The psychosocial health variables included the following. Education level; urban/rural living location; employment status; experiencing distressful events within the last year (death of a relative, assault, robbery); self-rated household economic situation; and age of starting smoking as this can reflect childhood social factors and influence later nicotine dependence (Fergusson, et al., 2007). Social capital variables related to membership of an organisation (e.g. religious group, trade union, sports club, social club), levels of emotional social support from family/friends, trust, sense of control, general satisfaction, and neighbourhood safety and support (as described elsewhere (d'Hombres, Rocco, Suhrcke, & McKee, 2010)). Behavioural aspects were indicated through alcohol dependence using the CAGE screening instrument which consists of 4 items with a yes(1)/no(0) response producing a total score range 0-4 with higher scores indicating higher alcohol dependence (Ewing, 1984). Psychological health was measured through 12 items relating to stress, loneliness, insomnia, inability to concentrate, inability to overcome difficulties, losing self-confidence, shaking/trembling, frightening thoughts, and exhaustion/fatigue; with yes(1)/no(0) responses

to produce a score range 0-12 which was then categorised (0-2, 3-6, 7-9, 10-12 symptoms) (as described elsewhere (Cockerham, Hinote, & Abbott, 2006; Roberts B, Abbott P, & McKee M, 2010)).

### Analysis

The analysis was limited to current tobacco users only (i.e. smoking at least one cigarette, papirossi, pipe, cigar etc daily). The mean FTND scores and prevalence of high nicotine dependence (FTND score  $\geq 6$ ) were firstly analysed by country and gender.

Linear regression analysis was then used to examine the relationship between the psychosocial factors and increasing nicotine dependence, with the FTND score a continuous outcome variable. This was conducted for the region as a whole to provide greater statistical power. Separate analyses were not conducted for men and women given the small numbers of women smokers, but data were adjusted for gender. The analysis incorporated country-specific variables to control for any country-level influences, with Russia used as the reference category as it is the most populous country and felt to provide a more meaningful reference point as understanding on tobacco use is greater there. Bivariate regression analysis was firstly conducted to measure unadjusted coefficients. The variables which showed a significant association ( $P < 0.05$ ) with increasing dependence were then entered into a multivariate analysis in order to adjust for the influence of the other included variables. The variables which continued to show significant associations ( $P < 0.05$ ) after a stepwise regression procedure were then kept in the final model. Tests for colinearity and interaction were conducted but no significant results were observed. All data were adjusted for the cluster survey design.

### **Results**

Of the 18000 respondents, 57% were men and 43% were women (respondents characteristics are described elsewhere (Balabanova, Roberts, Richardson, Haerper, & McKee, 2011)). Out of these, 4643 (26%) were currently smoking (48% of men, 8% of women). Of the 4643 current smokers, 3499 gave responses for all the FTND items (this figure excludes respondents who gave don't knows and refusals for any individual items). The mean FTND scores and prevalence of high nicotine dependence among these 3499 respondents are shown in Table 1. For the region as a whole, mean FTND were higher for men (3.96) than for women (2.96). High nicotine dependence among men ranged from 17% in Belarus to 40% in Georgia with most countries in the 20-29% range. Among women, the number of respondents is low and so data need to be treated cautiously for individual countries but the prevalence of high nicotine dependence was 11% for the region.

Of the two items that contribute most to the overall FTND score (cigarette consumption and time to first cigarette), a much greater proportion of men than women were in the higher scoring categories (i.e. contributing to a higher dependence score). The distribution of responses among just men for these two items were broadly similar across countries, with the exceptions of Azerbaijan and Georgia where a higher proportion of men were in the highest scoring categories.

The psychosocial factors significantly associated with increasing levels of nicotine dependence are shown in Table 2. After controlling for the influence of country and gender and the other factors in the multivariate analysis, respondents who started smoking aged <15 years showed an association with higher nicotine dependence compared with those who started smoking when they were 20+ years (coeff. 0.40). Respondents with less than secondary education showed an association with increasing dependence compared with those who had completed higher education (coeff. 0.38). Among the range of social capital related factors, only not being a member of an organisation showed an association with increasing dependence (coeff. 0.24). A bad household economic situation showed an association with increasing dependence (coeff. 0.56). For the behavioural variable, high alcohol dependence showed an association (coeff. 1.00). Respondents with higher levels of psychological distress were also associated with higher dependence.

## **Discussion**

The study has a number of limitations. Only 75% of current smokers completed all the FTND items. However, analysis of the non-respondents indicated no significant differences by gender, country or other key variables for the individual FTND items or the overall summary score. The limited sample size prevented using regression analysis for the individual countries. Psychosocial factors included elsewhere such as work related stress and family factors were not included in our study. The psychological distress score was not validated but showed good internal reliability for this study (0.82). Lastly, the cross-sectional study design means it cannot explain temporal relationship between the factors and nicotine dependence.

Despite the limitations, the study provides the first comparative analysis of nicotine dependence in the fSU. The mean scores recorded in this study are within the upper range of mean scores recorded in a review of other studies using FTND which varied from 2.8 to 4.6 (Fagerstrom & Furberg, 2008). The findings on high dependence compare to 16% (men) and 11% (women) in Spain (Perez-Rios et al., 2009), 21% (men) and 13% (women) in Italy

(Gallus et al., 2005), and 30% in Greece (men and women combined) (Margaritis & Mamai-Homata, 2010).

This study observed significant links between nicotine dependence, harmful alcohol use and poor mental health, reflecting findings from other studies (Farrell, et al., 2001; Fergusson, et al., 2007; John, Meyer, Rumpf, & Hapke, 2003; Morissette, Tull, Gulliver, Kamholz, & Zimering, 2007; Pedersen & von Soest, 2009). These factors may be particularly pertinent given the high levels and impact of alcohol use and stress observed in the region (Leon & Shkolnikov, 1998; Leon, et al., 2009). Evidence from elsewhere suggests that smoking and alcohol use may be a form of self-medication to ameliorate symptoms of poor mental health (Breslau, et al., 1991; Fergusson, et al., 2007). Other studies have also indicated an opposing pathway in which smoking and harmful alcohol use increase susceptibility to poor mental health (Klungsoyr, Nygard, Sorensen, & Sandanger, 2006).

The study findings on the influence of social risk-factors with nicotine dependence reflect evidence from other settings (Breslau, et al., 1991; Edwards, Maes, Pedersen, & Kendler, 2011; Fergusson, et al., 2007; Jefferis, Graham, Manor, & Power, 2003; Pedersen & von Soest, 2009). The study also showed associations with younger age of starting smoking with high nicotine dependence and this could plausibly relate to the psychosocial influences on children and young people which have been shown to strongly influence adult smoking patterns later in life (Fergusson, et al., 2007; Jefferis, et al., 2003; Lynch, Kaplan, & Salonen, 1997). The issue of early age of smoking is particularly pertinent in the region given that age of uptake has fallen since transnational tobacco companies have entered the markets of the fSU (A. B. Gilmore & McKee, 2004). A key recommendation is therefore that tobacco prevention and cessation programmes should be targeted and scaled up for young people.

The study highlights how respondents with high levels of dependence were poorer and less educated. This supports a recommendation that prevention and cessation interventions for nicotine dependence should target poorer socio-economic groups in particular. Such interventions may include price increases on tobacco products which a recent review has shown to be the most promising intervention in reducing inequalities in smoking because disadvantaged smokers were relatively more likely to respond to price increases (Thomas et al., 2008), although this is made challenging by counterfeit and smuggled cigarettes in the region. Finally, the observed comorbidity between nicotine dependence, harmful alcohol use and psychological distress suggests that programmes aimed at reducing the health burden from these individual conditions may also have an indirect effect in reducing the burden from the others conditions too and that joint programmes may prove particularly effective.



**Declaration of interests**

All the authors declare no conflicts of interest.

**Funding**

This work was supported by the European Union's 7th Framework Program, project HEALTH-F2-2009-223344. The European Commission cannot accept any responsibility for any information provided or views expressed.

**Acknowledgements**

We are grateful to all members of the Health in Times of Transition (HITT) study who participated in the co-ordination and organization of data collection for this paper.

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**Table 1: Nicotine dependence levels for men and women, by country (N=3499)**

	Men			Women			All		
	N	Mean	[95% CI]	N	Mean	[95% CI]	N	Mean	[95% CI]
<b>Armenia</b>									
Mean score	423	3.88	[3.68; 4.09]	15	1.93	[0.70; 3.16]	438	3.82	[3.61; 4.02]
% high dependence*	102	24.11	[20.02; 28.21]	1	6.67	[-7.63; 20.97]	103	23.52	[19.53; 27.50]
<b>Azerbaijan</b>									
Mean score	291	4.15	[3.93; 4.37]	5	3.60	[2.18; 5.02]	296	4.14	[3.93; 4.35]
% high dependence	75	25.77	[20.72; 30.83]	0	0.00	[0.00; 0.00]	75	25.34	[20.35; 30.32]
<b>Belarus</b>									
Mean score	269	3.42	[3.19; 3.66]	115	2.78	[2.44; 3.12]	384	3.23	[3.04; 3.43]
% high dependence	45	16.73	[12.24; 21.22]	10	8.70	[3.47; 13.92]	55	14.32	[10.80; 17.84]
<b>Georgia</b>									
Mean score	270	4.83	[4.57; 5.08]	62	3.68	[3.15; 4.21]	332	4.61	[4.38; 4.85]
% high dependence	107	39.63	[33.76; 45.50]	11	17.74	[7.96; 27.52]	118	35.54	[30.37; 40.72]
<b>Kazakhstan</b>									
Mean score	383	3.78	[3.57; 3.99]	78	2.56	[2.12; 3.01]	461	3.57	[3.38; 3.77]
% high dependence	89	23.24	[18.99; 27.49]	4	5.13	[0.12; 10.13]	93	20.17	[16.50; 23.85]
<b>Kyrgyzstan</b>									
Mean score	287	3.68	[3.45; 3.92]	44	3.25	[2.61; 3.89]	331	3.63	[3.41; 3.84]
% high dependence	58	20.21	[15.54; 24.88]	5	11.36	[1.60; 21.12]	63	19.03	[14.78; 23.28]
<b>Moldova</b>									
Mean score	204	3.74	[3.45; 4.02]	30	2.37	[1.62; 3.11]	234	3.56	[3.29; 3.83]
% high dependence	45	22.06	[16.32; 27.80]	2	6.67	[-2.81; 16.14]	47	20.09	[14.91; 25.26]
<b>Russia</b>									
Mean score	441	4.15	[3.96; 4.35]	212	3.20	[2.92; 3.49]	653	3.85	[3.68; 4.01]
% high dependence	126	28.57	[24.34; 32.80]	31	14.62	[9.83; 19.42]	157	24.04	[20.76; 27.33]
<b>Ukraine</b>									
Mean score	267	3.91	[3.65; 4.16]	103	2.76	[2.39; 3.12]	370	3.59	[3.37; 3.80]
% high dependence	64	23.97	[18.82; 29.12]	10	9.71	[3.89; 15.52]	74	20.00	[15.91; 24.09]
<b>All countries</b>									
Mean score	2835	3.96	[3.88; 4.03]	664	2.96	[2.82; 3.12]	3499	3.76	[3.70; 3.84]
% high dependence	711	25.08	[23.48; 26.68]	74	11.14	[8.74; 13.54]	785	22.43	[21.05; 23.82]

\*High nicotine dependence categorised as an FTND score of  $\geq 6$ .

Table 2: Regression analysis for factors associated with higher nicotine dependence score, all countries combined

	N	Bivariate			Multivariate				
		Coeff.	[95% CI]		P	Coeff.	[95% CI]		P
<b>Country</b>									
Russia	653	Ref				Ref			
Armenia	438	-0.03	[-0.34; 0.28]	0.85	-0.19	[-0.53; 0.15]	0.27		
Azerbaijan	296	0.29	[-0.03; 0.62]	0.08	0.08	[-0.27; 0.43]	0.66		
Belarus	384	<b>-0.61</b>	<b>[-0.92; -0.31]</b>	<b>&lt;0.01</b>	<b>-0.63</b>	<b>[-0.93; -0.34]</b>	<b>&lt;0.01</b>		
Georgia	332	<b>0.77</b>	<b>[0.46; 1.08]</b>	<b>&lt;0.01</b>	<b>0.62</b>	<b>[0.29; 0.95]</b>	<b>&lt;0.01</b>		
Kazakhstan	461	-0.27	[-0.56; 0.02]	0.07	<b>-0.33</b>	<b>[-0.62; -0.03]</b>	<b>0.03</b>		
Kyrgyzstan	331	-0.22	[-0.52; 0.08]	0.16	<b>-0.39</b>	<b>[-0.70; -0.08]</b>	<b>0.02</b>		
Moldova	234	-0.29	[-0.64; 0.07]	0.12	<b>-0.49</b>	<b>[-0.81; -0.18]</b>	<b>&lt;0.01</b>		
Ukraine	370	-0.26	[-0.54; 0.02]	0.07	<b>-0.44</b>	<b>[-0.73; -0.16]</b>	<b>&lt;0.01</b>		
<b>Gender</b>									
Women	664	Ref			Ref				
Men	2835	<b>0.98</b>	<b>[0.81; 1.16]</b>	<b>&lt;0.01</b>	<b>0.85</b>	<b>[0.65; 1.04]</b>	<b>&lt;0.01</b>		
<b>Age first smoked</b>									
20 and above	833	Ref			Ref				
17 to 19 years	1027	0.09	[-0.11; 0.29]	0.37	0.06	[-0.14; 0.26]	0.58		
15 and 16 years	791	<b>0.32</b>	<b>[0.11; 0.52]</b>	<b>&lt;0.01</b>	<b>0.28</b>	<b>[0.06; 0.49]</b>	<b>0.01</b>		
Less than 15 years	754	<b>0.56</b>	<b>[0.35; 0.78]</b>	<b>&lt;0.01</b>	<b>0.40</b>	<b>[0.16; 0.63]</b>	<b>&lt;0.01</b>		
<b>Educational level</b>									
Completed higher education	724	Ref			Ref				
Vocational/some higher education	1038	<b>0.25</b>	<b>[0.04; 0.45]</b>	<b>0.02</b>	<b>0.30</b>	<b>[0.08; 0.51]</b>	<b>0.01</b>		
Secondary or less	1731	<b>0.55</b>	<b>[0.36; 0.74]</b>	<b>&lt;0.01</b>	<b>0.38</b>	<b>[0.18; 0.58]</b>	<b>&lt;0.01</b>		
<b>Membership</b>									
Not a member	535	Ref			Ref				
Member	2948	<b>0.54</b>	<b>[0.34; 0.74]</b>	<b>&lt;0.01</b>	<b>0.24</b>	<b>[0.04; 0.44]</b>	<b>0.02</b>		
<b>Household economic situation</b>									
Good/very good	787	Ref			Ref				
Average	2024	<b>0.55</b>	<b>[0.36; 0.73]</b>	<b>&lt;0.01</b>	<b>0.45</b>	<b>[0.26; 0.64]</b>	<b>&lt;0.01</b>		
Bad/very bad	663	<b>0.98</b>	<b>[0.75; 1.21]</b>	<b>&lt;0.01</b>	<b>0.56</b>	<b>[0.31; 0.81]</b>	<b>&lt;0.01</b>		
<b>Harmful alcohol use</b>									
Cage score 0	1662	Ref			Ref				
Cage score 1	578	-0.03	[-0.24; 0.19]	0.79	-0.08	[-0.29; 0.13]	0.47		
Cage score 2	464	<b>0.29</b>	<b>[0.08; 0.50]</b>	<b>0.01</b>	0.14	[-0.08; 0.35]	0.22		
Cage score 3	372	<b>0.33</b>	<b>[0.10; 0.57]</b>	<b>0.01</b>	0.19	[-0.05; 0.43]	0.13		
Cage score 4	246	<b>1.30</b>	<b>[1.03; 1.57]</b>	<b>&lt;0.01</b>	<b>1.00</b>	<b>[0.70; 1.29]</b>	<b>&lt;0.01</b>		
<b>Psychological distress</b>									
0-2 symptoms	1769	Ref			Ref				
3-6 symptoms	1160	<b>0.21</b>	<b>[0.04; 0.38]</b>	<b>0.01</b>	<b>0.22</b>	<b>[0.05; 0.39]</b>	<b>0.01</b>		
7-9 symptoms	293	<b>0.64</b>	<b>[0.38; 0.91]</b>	<b>&lt;0.01</b>	<b>0.49</b>	<b>[0.22; 0.76]</b>	<b>&lt;0.01</b>		
10-12 symptoms	106	<b>0.48</b>	<b>[0.01; 0.96]</b>	<b>0.04</b>	0.45	[-0.01; 0.92]	0.05		

CI, confidence interval; Coeff, coefficient.

Data highlighted in bold statistically significant at P<0.05.