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# Economic fluctuations and long-term trends in depression: a repeated cross-sectional study in Estonia 2004–2016

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**ABSTRACT****Background** In the 2000s, the Baltic countries experienced unprecedented credit-driven economic growth that was followed by a deep recession. This study examined the impact of profound macroeconomic changes on population mental health in Estonia in 2004–2016.**Methods** Data on 17 794 individuals in the 20–64 age group were obtained from seven nationally representative cross-sectional surveys. The prevalence of past 30-day depression was calculated for men and women further stratified by sociodemographic characteristics. Multivariable regression analysis was used to assess whether these characteristics were associated with the yearly variation in depression.**Results** In 2006, the adjusted prevalence ratio for depression was 0.77 (95% CI 0.64 to 0.93) for men and 0.85 (95% CI 0.74 to 0.97) for women as compared with 2004; in 2010, the prevalence ratio as compared with 2008 for both men and women was 1.22 (95% CIs 1.04 to 1.43 and 1.09 to 1.37, respectively). Among men, the increase in the prevalence of depression in 2008–2010 was statistically significant for 35–64 year olds, ethnic Estonians, those who were married, mid-educated or were employed, whereas among women, a significant increase was observed in 50–64 year olds, Estonians and non-Estonians, those who were not-married, were highly educated or mid-educated, in the mid-income group or were employed.**Conclusions** Population mental health is responsive to macroeconomic changes. In less wealthy high-income countries, the greater impact of recession on depression among advantaged groups may relate to a higher debt burden coupled with job insecurity.

impact on mental health has been one of the most consistent research findings.<sup>8</sup> For example, higher suicide rates during the recession have been mostly attributed to increased unemployment where the effect has generally been stronger among men<sup>9</sup> and in countries with the least generous social protection.<sup>10</sup> Several studies have also indicated increased levels of psychosocial stress and common mental disorders as a consequence of the recession,<sup>11–13</sup> although as yet, there is no consensus across studies regarding which population subgroups suffered the most.<sup>14</sup>

Despite growing scientific evidence that the recent recession had a negative effect on mental health, there have been relatively few studies that have examined long-term trends in this context.<sup>15</sup> This is an important omission which makes it difficult to separate recession-related changes from preceding trends or assess the duration of the detrimental effects of recession on health. Moreover, it is unknown whether the period of strong economic growth that preceded the recession in some regions had a positive impact on mental health. For instance, the Baltic countries experienced huge macroeconomic changes in the 2000s: per capita gross domestic product (GDP) more than doubled in 2004–2008, but decreased sharply following the global financial crisis. With >20% average reduction in per capita GDP from 2008 to 2009, these countries were among the most affected in Europe.<sup>16</sup> Although there is evidence that the recession interrupted the positive trend in self-rated health in Estonia and Lithuania,<sup>17</sup> its impact on mental health outcomes has remained little researched in this setting.<sup>18</sup> Understanding the relation between economic processes and mental health is important for addressing the high burden of mental health disorders prevalent in eastern parts of Europe.<sup>19</sup>

Given this, the purpose of this study was to examine the long-term trends in population mental health in one of the Baltic countries, Estonia, in the context of macroeconomic changes in 2004–2016 (figure 1). The study had two main aims: (1) to assess whether macroeconomic changes had any impact on the prevalence of depression and whether the impact was similar in men and women according to their demographic and socioeconomic status; and (2) to explore to what extent the changes in depression between study years were accounted for by demographic and socioeconomic characteristics.

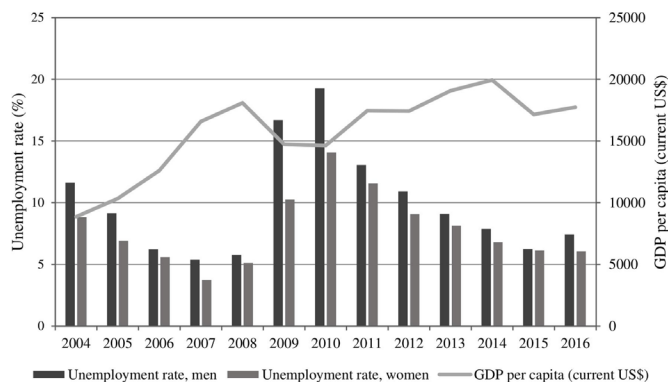
**INTRODUCTION**

Depression is the most prevalent mental health disorder that substantially impairs an individual's ability to function in different settings or cope with daily life.<sup>1</sup> At the individual level, there is a strong connection between mental health and socioeconomic factors.<sup>2</sup> Specifically, economic stressors such as unemployment, job insecurity, poverty and indebtedness can have a substantial impact on people's lives and mental well-being.<sup>3–6</sup> It is possible that macroeconomic contractions might also affect mental health at the population level through their impact on job opportunities and reduced public budgets.<sup>7</sup> The economic crisis in the late 2000s was one of the deepest recessions globally since the Great Depression. Its negative



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**Figure 1** Macroeconomic changes in Estonia, 2004–2016. GDP, gross domestic product. Source: The World Bank Open Data 2018.<sup>16</sup>

## METHODS

### Data sources

Data for this study were retrieved from seven successive nationally representative cross-sectional ‘Health Behaviour among the Estonian Adult Population’ postal surveys. All surveys were approved by the Tallinn Medical Research Ethics Committee. As a part of the Finbalt Health Monitor cooperative study,<sup>20</sup> the surveys used harmonised methodology and questionnaires to enable comparability across years. Questionnaires were mailed between March and April in every survey year, while in 2016, it was also possible to complete the questionnaire online. Stratified random samples of 5000 people in the 16–64 age group were drawn from the Population Registry. The response rate varied between 53% (2014) and 63% (2004). To compensate for non-response that was generally higher among men and in younger age groups, probability weights based on the sex and age distribution of the Estonian population were calculated for each study year. In this study, only respondents in the 20–64 age group were included to avoid potential misclassification bias regarding the socioeconomic status of younger respondents. Item non-response remained between 0% and 1% for most study variables, being somewhat higher for income (2.9%) and depression (1.4%). Respondents with missing information for any of the study variables ( $n=1013$ ) were excluded from the analytical sample ( $n=17794$ ).

### Measures

Depression in the past 30 days was measured with the question “In the past 30 days, have you been depressed, unhappy?” Respondents were categorised into two groups, those who were depressed a lot or somewhat more than before (1), and those who were depressed not more than before or not at all (0).

Past 30-day depression was assessed in relation to variables previously associated with depressive symptoms in Estonia, that is, age, marital status, ethnicity, education, income and economic activity.<sup>21</sup> For marital status, respondents were classified as (1) married/cohabiting, (2) single and (3) divorced/separated or widowed. Ethnicity data were based on self-reports with respondents being categorised as (1) ethnic Estonians and (2) other ethnic groups. Education was assessed by the highest level of completed education and categorised as (1) high, referring to university-level education, (2) mid, covering those with an upper secondary education and (3) low level, referring to lower secondary or less education. To determine household average net income per household member respondents had to mark one of 12–13 (depending on the year) income categories. Based on the overall frequency distribution in each survey year,

respondents were classified as belonging to the (1) high-income (covering 23%–34% of respondents depending on the study year), (2) mid-income (32%–42%) or (3) low-income group (25%–38%). Economic activity was divided into three categories: (1) employed, (2) non-active and (3) unemployed. The non-active category consisted of respondents who were either studying, homemakers or retired.

### Statistical analysis

Descriptive statistics of the sample characteristics and their association with past 30-day depression were initially calculated, with the latter being assessed by prevalence ratios using pooled data and Poisson regression with robust variance.<sup>22</sup> Macroeconomic variation was determined by study year. The 2004–2006 period was selected to represent a time of economic expansion, whereas the 2008–2010 period denoted recession in this study. For all study years, the prevalence of depression was calculated for men and women, further stratified by age group, ethnicity, marital status, education, income and economic activity. To assess the changes in prevalence compared with the preceding study year, prevalence ratios were calculated for the total population and for population subgroups using Poisson regression analysis.<sup>22</sup> Multivariable analysis with four models was used to examine the impact of demographic and socioeconomic variables on the change in the prevalence of depression for the total population as compared with the preceding study year: model 1 was unadjusted, model 2 was adjusted for age, ethnicity and marital status, model 3 was adjusted for education, income and economic activity and model 4 was adjusted for all demographic and socioeconomic variables. Prevalence ratios (PRs) are presented with 95% CIs and/or p values. Statistical analyses were conducted using STATA V.14.2 (StataCorp, College Station, Texas, USA). Population-based probability weights were applied in all analyses.

## RESULTS

The sample characteristics and their association with depression are presented in [table 1](#). A total of 7277 men and 10 517 women were included in the analysis. The percentage of older people, ethnic Estonians, those who were married or had a higher education increased over the study years. The percentage of unemployed respondents was highest in 2010. Respondents who were not married/cohabiting, were non-Estonians (only for women), had lower education or income or were not employed had a higher prevalence of past 30-day depression with stronger associations observed among men.

In 2004, 20.2% (95% CI 17.9 to 22.6) of men and 24.6% (95% CI 22.4 to 26.8) of women reported being depressed a lot or somewhat more than before during the past 30 days ([figure 2](#)). The prevalence of depression decreased substantially in 2006 but returned to the 2004 level in 2008. By 2010, the prevalence increased to 26.8% (95% CI 24.2 to 29.5) among men and to 30.5% (95% CI 28.3 to 32.8) among women. After 2010, the prevalence of depression declined in both men and women, and in 2016 it was 18.6% (95% CI 16.3 to 21.2) among men and 23.1% (95% CI 21.1 to 25.4) among women.

Trends in the prevalence of depression by sociodemographic covariates are presented in [table 2](#). With few exceptions among women (those in the 50–64 age group, who were highly or low educated, or were in the high-income group), the prevalence of depression dropped in all population subgroups in 2006. Between 2008 and 2010, the prevalence of depression increased in all subgroups except men who were divorced or widowed,

**Table 1** Sample characteristics and their association with past 30-day depression

|                                |                  | n=7277          | n=10517         | Depression in the past 30 days |                        |
|--------------------------------|------------------|-----------------|-----------------|--------------------------------|------------------------|
|                                |                  | Men %†          | Women %†        | Men PR (95% CI)‡               | Women PR (95% CI)‡     |
| Age group (years)              | 20–34            | 37 (38, 37, 35) | 33 (33, 33, 33) | 1                              | 1                      |
|                                | 35–49            | 34 (35, 35, 35) | 33 (35, 33, 32) | 1.03 (0.92 to 1.15)            | 1.03 (0.94 to 1.12)    |
|                                | 50–64            | 29 (27, 28, 30) | 34 (32, 34, 35) | 1.05 (0.94 to 1.17)            | 1.07 (0.98 to 1.16)    |
| Ethnicity                      | Estonian         | 72 (69, 72, 73) | 69 (67, 68, 73) | 1                              | 1                      |
|                                | Other            | 28 (31, 28, 27) | 31 (33, 32, 27) | 0.91 (0.82 to 1.01)            | 1.08 (1.00 to 1.16)*   |
| Marital status                 | Married          | 69 (68, 68, 70) | 67 (65, 66, 72) | 1                              | 1                      |
|                                | Single           | 23 (22, 24, 23) | 16 (15, 15, 14) | 1.34 (1.21 to 1.50)***         | 1.10 (1.00 to 1.21)*   |
|                                | Divorced/widowed | 8 (10, 8, 7)    | 17 (20, 19, 14) | 1.87 (1.64 to 2.12)***         | 1.28 (1.18 to 1.39)*** |
| Education                      | High             | 22 (15, 21, 27) | 32 (23, 32, 40) | 1                              | 1                      |
|                                | Mid              | 62 (67, 63, 55) | 59 (66, 61, 51) | 1.44 (1.26 to 1.64)***         | 1.14 (1.06 to 1.23)**  |
|                                | Low              | 16 (18, 16, 18) | 9 (11, 7, 9)    | 1.71 (1.46 to 2.00)***         | 1.41 (1.26 to 1.59)*** |
| Income                         | High             | 35 (35, 39, 35) | 28 (27, 31, 28) | 1                              | 1                      |
|                                | Mid              | 36 (35, 29, 39) | 40 (38, 33, 42) | 1.16 (1.03 to 1.31)*           | 1.14 (1.04 to 1.24)**  |
|                                | Low              | 29 (30, 32, 26) | 32 (35, 36, 30) | 1.76 (1.57 to 1.98)***         | 1.50 (1.37 to 1.64)*** |
| Economic activity              | Employed         | 78 (78, 70, 78) | 72 (71, 67, 73) | 1                              | 1                      |
|                                | Non-active       | 13 (13, 14, 15) | 23 (24, 25, 22) | 1.74 (1.56 to 1.95)***         | 1.11 (1.03 to 1.21)**  |
|                                | Unemployed       | 9 (9, 16, 7)    | 5 (5, 8, 5)     | 2.32 (2.07 to 2.60)***         | 1.55 (1.37 to 1.74)*** |
| Depression in the past 30 days | No               | 80 (80, 73, 81) | 75 (75, 69, 77) | na                             | na                     |
|                                | Yes              | 20 (20, 27, 19) | 25 (25, 31, 23) | na                             | na                     |

Statistically significant difference: \*p<0.05, \*\*p<0.01, \*\*\*p<0.001.

†Weighted average proportion in 2004–2016 and point estimates in 2004, 2010 and 2016 in parentheses.

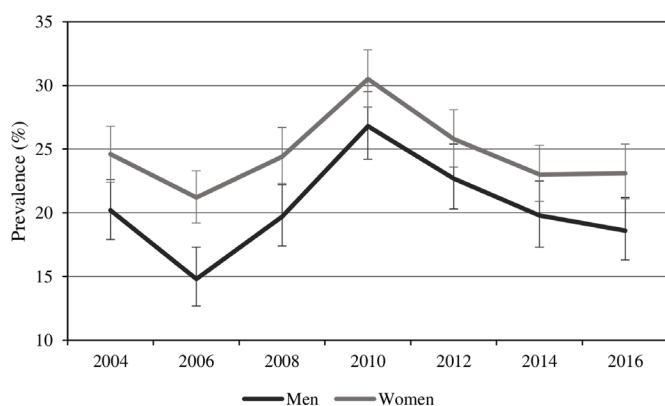
‡Unadjusted PR with 95% CIs.

PR, prevalence ratio; na, not applicable.

or were not employed. When the effect of all other covariates was controlled for, the prevalence ratio in 2006 as compared with 2004 among men was statistically significantly lower for 50–64 year olds, ethnic Estonians, those who were single, were low educated or in the mid-income group or were unemployed. Among women, a statistically significant improvement was observed for those aged 35–49 years, those who were divorced or widowed, were mid-educated or in the low-income group or were employed. The statistically significant increase in the prevalence of depression in 2010 as compared with 2008 after adjustment for all covariates occurred among men who were in the 35–64 age group, were ethnic Estonians, were married, mid-educated or were employed. Among women, a statistically significant increase in depression was observed among those aged 50–64 years, both ethnic groups, those who were not married, were highly educated or mid-educated or in the mid-income

group or were employed. From 2012, the prevalence of depression declined strongly in nearly all subgroups in both men and women and did not differ in statistically significant terms from the prevalence in 2004 (data not shown).

The impact of demographic and socioeconomic covariates on yearly change in the prevalence of depression in the total population was assessed using multivariable regression analysis (table 3). In the unadjusted baseline model 1, the prevalence ratio for past 30-day depression was statistically significantly lower in 2006 as compared with 2004 with a stronger impact seen in men (PR 0.74, 95% CI 0.61 to 0.89) than in women (PR 0.86, 95% CI 0.75 to 0.98). A statistically significant reversal followed in 2008, with the prevalence ratio being 33% higher in men and 15% higher in women as compared with 2006. In 2010, the prevalence ratio of past 30-day depression was 36% (in men) and 25% (in women) higher as compared with 2008. A statistically significant decline of 15% occurred in both men and women in 2012, with a slight and statistically insignificant improvement occurring in each of the following study years (except for women in 2016 where it remained the same as in 2014). Demographic covariates (model 2) had relatively little effect on the yearly changes in past 30-day depression, with the exception of 2008 when they explained 15% of the increase for men as compared with 2006. The impact of socioeconomic covariates (model 3) was stronger over all study years. In 2006, they explained 8% of the improvement in men as compared with 2004, whereas in women, after adjustment for socioeconomic variables, the improvement in 2006 was 7% larger compared with the baseline model. The impact of socioeconomic covariates was even larger during the recession, when they explained 42% of the increase between 2008 and 2010 among men. Among women, socioeconomic variables explained 12% of the increase



**Figure 2** Prevalence (%) of past 30-day depression with 95% CIs.

**Table 2** Prevalence (%) of past 30-day depression by sociodemographic characteristic and study year, and prevalence ratios comparing study years

|                   |                  | Prevalence of past 30-day depression (%) |        |        |         |       |        | Prevalence ratio† |                    |                    |
|-------------------|------------------|--|--------|--------|---------|-------|--------|-------------------|--------------------|--------------------|
|                   |                  | 2004                                     | 2006   | 2008   | 2010    | 2012  | 2014   | 2016              | 2006 vs 2004 (ref) | 2010 vs 2008 (ref) |
| <b>Men</b>        |                  |  |        |        |         |       |        |                   |                    |                    |
| Age group (years) | 20–34            | 18.6                                     | 14.5   | 21.0*  | 22.9    | 21.0  | 19.0   | 23.1              | 0.78               | 1.03               |
|                   | 35–49            | 20.1                                     | 16.5   | 17.7   | 28.2**  | 23.6  | 19.2   | 17.7              | 0.96               | 1.36*              |
|                   | 50–64            | 22.4                                     | 13.2** | 20.6*  | 30.1**  | 23.9  | 21.3   | 14.2*             | 0.62**             | 1.39*              |
| Ethnicity         | Estonian         | 19.7                                     | 14.1** | 20.5** | 27.8**  | 23.4* | 20.7   | 19.6              | 0.74*              | 1.23*              |
|                   | Other            | 21.1                                     | 16.4   | 17.6   | 24.1    | 20.9  | 17.3   | 15.9              | 0.82               | 1.20               |
| Marital status    | Married          | 16.6                                     | 13.4   | 14.5   | 25.5*** | 21.2  | 18.8   | 14.6*             | 0.84               | 1.55***            |
|                   | Single           | 26.1                                     | 17.0*  | 26.0*  | 26.1    | 23.3  | 20.7   | 27.5              | 0.63*              | 0.93               |
|                   | Divorced/widowed | 30.9                                     | 23.5   | 42.1*  | 38.9    | 36.0  | 28.0   | 28.4              | 0.78               | 0.92               |
| Education         | High             | 12.7                                     | 10.6   | 15.6   | 18.0    | 19.1  | 15.2   | 11.9              | 0.85               | 1.06               |
|                   | Mid              | 19.8                                     | 16.0   | 18.6   | 28.7*** | 24.0* | 20.8   | 20.2              | 0.85               | 1.38**             |
|                   | Low              | 28.0                                     | 15.6** | 29.5** | 30.9    | 22.9  | 25.6   | 23.8              | 0.53**             | 0.92               |
| Income            | High             | 15.7                                     | 10.1*  | 16.9*  | 21.1    | 17.3  | 15.2   | 13.4              | 0.69               | 1.24               |
|                   | Mid              | 20.2                                     | 13.1*  | 15.7   | 23.8**  | 20.7  | 18.1   | 19.4              | 0.70*              | 1.32               |
|                   | Low              | 25.3                                     | 20.4   | 29.4*  | 36.3    | 31.9  | 30.2   | 24.3              | 0.84               | 1.16               |
| Economic activity | Employed         | 15.5                                     | 12.9   | 15.0   | 22.5*** | 18.9  | 17.1   | 16.4              | 0.85               | 1.50***            |
|                   | Non-active       | 30.6                                     | 23.3   | 38.2*  | 29.2    | 32.1  | 29.1   | 23.7              | 0.72               | 0.89               |
|                   | Unemployed       | 45.7                                     | 24.1*  | 49.5** | 43.4    | 40.8  | 27.3   | 32.9              | 0.52*              | 0.88               |
| <b>Women</b>      |                  |  |        |        |         |       |        |                   |                    |                    |
| Age group (years) | 20–34            | 24.6                                     | 21.7   | 22.8   | 28.5*   | 22.2* | 22.1   | 25.8              | 0.88               | 1.22               |
|                   | 35–49            | 25.6                                     | 18.1** | 27.6** | 28.8    | 27.4  | 24.4   | 19.9              | 0.67**             | 0.99               |
|                   | 50–64            | 23.4                                     | 23.8   | 22.8   | 34.1*** | 27.7* | 22.5*  | 23.6              | 1.03               | 1.48***            |
| Ethnicity         | Estonian         | 24.4                                     | 21.1   | 24.4   | 29.4*   | 25.6* | 21.6*  | 22.2              | 0.86               | 1.18*              |
|                   | Other            | 25.0                                     | 21.4   | 24.5   | 32.9**  | 26.2* | 26.3   | 25.7              | 0.83               | 1.33**             |
| Marital status    | Married          | 22.3                                     | 19.7   | 23.8*  | 27.7*   | 23.1* | 23.7   | 22.3              | 0.87               | 1.13               |
|                   | Single           | 25.1                                     | 24.8   | 22.6   | 33.5**  | 26.9  | 21.4   | 24.1              | 0.98               | 1.45*              |
|                   | Divorced/widowed | 31.7                                     | 23.3*  | 28.8   | 37.9*   | 35.0  | 21.9** | 26.4              | 0.70*              | 1.32*              |
| Education         | High             | 20.4                                     | 20.6   | 21.3   | 28.0*   | 21.5* | 21.1   | 21.3              | 0.98               | 1.29*              |
|                   | Mid              | 26.0                                     | 20.6** | 25.4*  | 30.6*   | 27.2  | 22.9*  | 22.8              | 0.78**             | 1.17*              |
|                   | Low              | 24.7                                     | 26.9   | 29.3   | 40.3    | 34.9  | 35.1   | 32.8              | 1.09               | 1.39               |
| Income            | High             | 18.6                                     | 19.9   | 20.7   | 25.4    | 20.8  | 17.8   | 18.4              | 1.07               | 1.23               |
|                   | Mid              | 22.6                                     | 18.5   | 21.8   | 30.1**  | 26.3  | 23.2   | 20.0              | 0.83               | 1.37**             |
|                   | Low              | 31.4                                     | 24.6*  | 31.2*  | 35.1    | 30.2  | 29.2   | 32.1              | 0.77**             | 1.11               |
| Economic activity | Employed         | 24.0                                     | 20.1*  | 24.4*  | 29.5**  | 25.0* | 21.1*  | 20.0              | 0.81*              | 1.21**             |
|                   | Non-active       | 24.6                                     | 24.4   | 24.2   | 29.2    | 25.7  | 26.3   | 28.6              | 1.03               | 1.21               |
|                   | Unemployed       | 32.0                                     | 23.6   | 28.5   | 42.8    | 34.2  | 36.5   | 47.3              | 0.68               | 1.45               |

Statistically significant prevalence ratio as compared with preceding study year: \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

†Adjusted for age, ethnicity, marital status, educational level, income and economic activity.

in depression during the recession. In 2012, after adjustment for socioeconomic variables the decline in depression among men became statistically insignificant. After adjustment for all covariates (model 4), the prevalence ratio for past 30-day depression in 2010 was 1.22 for both men and women (with the respective 95% CIs being 1.04 to 1.43 and 1.09 to 1.37) as compared with 2008.

## DISCUSSION

This study assessed the long-term trends in past 30-day depression in Estonia in a period of profound macroeconomic change in 2004–2016. Results showed that while mental health improved during economic expansion, a significant deterioration occurred abruptly after the onset of recession, however, the effect was rather temporary and the prevalence of depression

had already fallen strongly by 2012. Among men, the increase in the prevalence of depression in the recessionary period between 2008 and 2010 was statistically significant in 35–64 year olds, ethnic Estonians, those who were married, mid-educated or were employed, while among women, a significant increase was observed in 50–64 year olds, both ethnic groups, those who were not married, were highly educated or mid-educated, in the mid-income group or were employed.

The major strengths of this study include the use of a long and nationally representative data series and standardised survey methodology ensuring data comparability across time. Despite this, the study also has several limitations. First, the long-term trends in depression were assessed with a single-item measure of depression. This measure is not comparable to a clinical diagnosis, however, as one symptom of major depression, it is

**Table 3** Association between study year and past 30-day depression

|       | Period             | Model 1                | Model 2                | Model 3               | Model 4               |
|-------|--------------------|------------------------|------------------------|-----------------------|-----------------------|
|       |                    | PR (95% CI)            | PR (95% CI)            | PR (95% CI)           | PR (95% CI)           |
| Men   | 2006 vs 2004 (ref) | 0.74 (0.61 to 0.89)**  | 0.75 (0.62 to 0.92)**  | 0.76 (0.63 to 0.92)** | 0.77 (0.64 to 0.93)** |
|       | 2008 vs 2006 (ref) | 1.33 (1.09 to 1.62)**  | 1.28 (1.05 to 1.55)*   | 1.38 (1.14 to 1.68)** | 1.34 (1.10 to 1.63)** |
|       | 2010 vs 2008 (ref) | 1.36 (1.16 to 1.59)*** | 1.36 (1.17 to 1.59)*** | 1.21 (1.03 to 1.41)*  | 1.22 (1.04 to 1.43)*  |
|       | 2012 vs 2010 (ref) | 0.85 (0.73 to 0.98)*   | 0.85 (0.74 to 0.99)*   | 0.90 (0.78 to 1.04)   | 0.90 (0.78 to 1.04)   |
|       | 2014 vs 2012 (ref) | 0.87 (0.73 to 1.03)    | 0.87 (0.74 to 1.04)    | 0.90 (0.76 to 1.06)   | 0.90 (0.76 to 1.07)   |
|       | 2016 vs 2014 (ref) | 0.94 (0.78 to 1.13)    | 0.93 (0.77 to 1.12)    | 0.92 (0.77 to 1.11)   | 0.91 (0.76 to 1.10)   |
| Women | 2006 vs 2004 (ref) | 0.86 (0.75 to 0.98)*   | 0.86 (0.76 to 0.99)*   | 0.85 (0.74 to 0.97)*  | 0.85 (0.74 to 0.97)*  |
|       | 2008 vs 2006 (ref) | 1.15 (1.01 to 1.32)*   | 1.16 (1.01 to 1.32)*   | 1.18 (1.04 to 1.36)*  | 1.19 (1.04 to 1.36)*  |
|       | 2010 vs 2008 (ref) | 1.25 (1.11 to 1.40)*** | 1.24 (1.11 to 1.40)*** | 1.22 (1.09 to 1.38)** | 1.22 (1.09 to 1.37)** |
|       | 2012 vs 2010 (ref) | 0.85 (0.76 to 0.95)**  | 0.85 (0.76 to 0.95)**  | 0.86 (0.76 to 0.96)** | 0.85 (0.76 to 0.96)** |
|       | 2014 vs 2012 (ref) | 0.89 (0.78 to 1.02)    | 0.89 (0.78 to 1.01)    | 0.91 (0.80 to 1.03)   | 0.91 (0.80 to 1.03)   |
|       | 2016 vs 2014 (ref) | 1.01 (0.88 to 1.15)    | 1.01 (0.88 to 1.16)    | 0.98 (0.86 to 1.12)   | 0.98 (0.86 to 1.12)   |

Model 1: unadjusted; model 2: adjusted for age, ethnicity and marital status; model 3: adjusted for education, income, economic activity; model 4: adjusted for age, ethnicity, marital status, education, income, economic activity.

Statistically significant difference: \*p<0.05, \*\*p<0.01, \*\*\*p<0.001.

PR, prevalence ratios.

included in most diagnostic instruments and indexes for depression.<sup>23</sup> Single-item measures have accurately identified depression in patients<sup>24</sup> and in the general population<sup>25</sup> and have been used in comparative population-based studies.<sup>26</sup> Nevertheless, we may have underestimated the prevalence of past 30-day depression by classifying those who were depressed not more than before as not depressed, although this is unlikely to have affected trends. Second, response rates were relatively low (53%–63%) across surveys. Although we applied weights to compensate for non-response, there may be systematic differences between respondents and non-respondents regarding depression that could have affected our results. An earlier study using Finbalt survey data did not find systematic differences in prevalence estimates for self-rated health between respondents and late-respondents, suggesting minimal response bias if late respondents serve as proxies for non-respondents.<sup>27</sup> Third, although we studied changes over time, macroeconomic measures were not directly included in the analysis. Even though the longer time period covered in this study affords us greater certainty when attributing observed changes in depression to macroeconomic processes, we cannot exclude the possibility of confounding due to other temporal changes. Finally, we were limited to using repeated cross-sectional data that did not allow us to track individuals over time to establish causal associations or the direction of the observed associations.

In 2000–2007, Estonia’s economic output grew faster than in most European countries with the per capita GDP annual growth rate peaking at 10.9% in 2006.<sup>16</sup> The unprecedented growth was driven by a massive credit and investment boom mostly in residential housing and the construction sector financed by large capital inflows from foreign lenders.<sup>28</sup> Exceptionally low unemployment and strong wage growth contributed to private consumption and considerably improved household living standards. By 2007, Estonia was one of the most overheated economies with a high current account deficit, high inflation rate and high private credit burden.<sup>28</sup> This domestic bubble burst in early 2008 when the credit supply decelerated and banks started tightening credit conditions, and this situation was further exacerbated by the global financial crisis that resulted in the country going into a deep recession in 2009.<sup>29</sup> With a 19% drop in economic output and unemployment tripling between 2008 and

2010, Estonia was one of the countries in Europe most affected by the recession.<sup>16</sup> The Estonian government responded to the recession with fiscal retrenchment including extensive budgetary cuts and tax increases in order to fulfil the eurozone entry criteria by 2011.<sup>30</sup> The achievement of this goal was facilitated by the availability of government financial reserves accumulated during the economic boom, by the massive use of the European Union (EU) structural funds for employment support measures, and no less importantly, by the willingness of society to accept painful austerity measures in the hope of long-term returns.<sup>29</sup> In 2010, the economy started to recover, with GDP growth resuming in 2011.<sup>29</sup> Considering the well-established association between unemployment, wealth and psychological health at the individual level,<sup>3,4</sup> these large-scale macroeconomic changes are likely to explain at least some part of the fluctuations observed in the prevalence of depression in 2004–2016 in Estonia. Although the symbolic value of EU and the North Atlantic Treaty Organization accession in 2004 and joining the eurozone in 2011 may also have contributed to positive mental health developments, these events do not explain the sudden increase in the prevalence of depression in 2010. Our results thus seem to provide support for previous findings that the recent recession had a substantial negative impact on population mental health.<sup>12 13 31 32</sup> As both the recession and its impact on depression seem to have been relatively brief in Estonia, it might explain why Reibling *et al*<sup>18</sup> did not find any increase in depression in Estonia in 2012 and 2014 compared with 2006 in their multicountry study.

Compared with women, the changes in the prevalence of depression were larger among men during this period of macroeconomic fluctuation and were probably related to employment changes in the construction and manufacturing sectors that were most affected during this boom-bust cycle, and where men have traditionally had a larger share of jobs.<sup>33</sup> However, when individual socioeconomic characteristics were accounted for, the impact of the recession on depression was similar in men and women. This result conflicts with the findings from previous studies that showed either a lower or no effect of recession on the mental health of women<sup>13 31 34</sup> and might possibly be explained by the very high employment rate of women in Estonia. At the same time, the larger effect of socioeconomic variables in explaining the increase in the prevalence of depression in 2010 among men,

indicates that economic stressors may have a greater impact on men's mental health at times of economic contraction.<sup>35</sup> Men's traditional role as the family breadwinner might also explain why married men were particularly at risk for depression during the crisis.<sup>36</sup> An earlier study by Artazcoz *et al*<sup>37</sup> similarly found that unemployment increased the risk for poor mental health among married men in manual occupations as a result of their family responsibilities, whereas among unemployed women, being married acted as a buffer and those who were single were at greater risk for poor mental health. In contrast to a majority of the previous research,<sup>14</sup> the deterioration in mental health observed during the recession was not larger in the most vulnerable groups even though on average they were at a much higher risk of experiencing poor mental health compared with better-off people. Instead, the statistically significant increase in the prevalence of depression observed among the employed might be explained, at least partly, by increased job-insecurity and fear of losing employment during the recession,<sup>31 38</sup> especially among workers in precarious jobs,<sup>6</sup> as well as the emergence of forced part-time work in a contracting labour market<sup>39</sup> that resulted in considerable wage cuts. On the other hand, at times of high aggregate unemployment, the well-being of the unemployed may decrease less because of generous unemployment benefits.<sup>40</sup> However, this is unlikely to explain why the prevalence of depression did not increase among unemployed men in Estonia where unemployment benefits were very low and limited by strict eligibility criteria and a short entitlement period.<sup>33</sup> The stronger increase in depression among unemployed women (statistically insignificant) may be related to women's increased risk of impoverishment compared with men.<sup>32</sup> This could also explain why depression increased among single and divorced/widowed women but not men during the recession. In addition, the huge credit-driven economic growth in the mid-2000s led to an enormous increase in household debt, especially in high-income households<sup>28</sup> that qualified for mortgages and other loans. Indebtedness is a powerful predictor of common mental disorders and suicide<sup>5</sup> and its negative effect remains independent of socioeconomic status.<sup>41</sup> The higher debt burden is thus another possible explanation for why higher socioeconomic groups, ethnic Estonians (men only), married men and the middle-aged

and older individuals had an increased risk for depression during the recession.

## CONCLUSION

This is the first study to examine long-term trends in population mental health in Estonia in a time of profound macroeconomic changes in 2004–2016. While past 30-day depression decreased during the economic expansion, a statistically significant but brief increase occurred in relation to economic recession. The negative consequences of recession were not larger among the most deprived population groups. In less wealthy high-income countries, a higher burden of household debt coupled with job insecurity might possibly explain the stronger increase in depression observed among advantaged groups during the recession.

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### What is already known on this subject

- ▶ One of the most consistent findings regarding the recent recession has been its negative effect on mental health.
- ▶ There is no consensus regarding which population groups were affected most during the recession in terms of mental health outcomes.
- ▶ The Baltic countries experienced large-scale macroeconomic fluctuations in the 2000s, yet, little is known about how these changes affected the mental health of the population.

### What this study adds

- ▶ In Estonia, both economic expansion and contraction had a substantial impact on population mental health.
- ▶ In less wealthy high-income countries, the larger impact of recession on depression among advantaged groups may relate to their higher debt burden coupled with job insecurity.

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