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## Self-rated Health in the Baltic Countries, 1994-1999

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### 1. Introduction

The decrease in life expectancy in the former Soviet Union, and in particular in the Baltic States, during the last decade of the 20<sup>th</sup> century has been well documented, not only in terms of mortality levels and trends for all causes of death, but also by medical cause of death: see for instance Meslé and Hertrich (1999) and for the previous decade Zvidrins and Krumins (1993). Numerous studies have also considered the possible determinants of these changes, *i.e.* the *causes* of the causes of death. On the other hand, fewer studies have considered the health and morbidity of the populations concerned during this period of significant political, economic, and social changes. A comprehensive overview of the studies dealing with the three Baltic countries for the period considered in this article is given in Stankuniene, Jasilionis, and Krumins (1999). As Monden (2005) and Vågerö (2010) among others have pointed out, the reforms carried out after independence in the Baltic States have had a profound effect on most aspects of life: labour market, pension system, health care system, child support, economic growth, etc... These dramatic changes have also had an impact on mortality and on health (Stankuniene et al. 1999; Carlson 2004; Helasoja et al. 2006).

In the present paper, we examine the levels and determinants of *self-rated health*, *i.e.* self-assessed, perceived, or self-reported health, using data from the Norbalt surveys held in the three Baltic countries (Estonia, Lithuania, and Latvia) in 1994 and 1999. Self-rated health is the status perceived by the individual, as opposed to objective health which is the condition diagnosed by the expert (for a discussion, see *e.g.* Gourbin and Wunsch 2006). Some descriptive results of the Norbalt surveys in the Baltic countries have been published for each of the three countries (Aasland et al. 1996; Knudsen 1996; Dietz et al, 1996). Concerning self-rated health in particular, Monden (2004, 2005) studied its association with different socioeconomic variables. The objectives of this paper are to examine the prevalence and changes in self-assessed health during the period, and especially to estimate the impact of some major possible determinants of self-rated health by way of a causal model, *i.e.* a structural equation model (SEM), taking into account existing background knowledge.

## 2. Background

The first attempts at explaining the mortality/morbidity crisis affecting mainly adult-aged males, focusing mainly on Russia, are very evasive and have been reconsidered one after the other, whereas other elements of explanation appear to be important. The role of poor *environmental conditions* has been refuted because of the age of the population group concerned (Chen et al. 1996), but also because the levels of industrial pollution decreased (Shkolnikov et al. 1998). The hypothesis of a collapse of the *health care system* does not seem adequate, again because children were not affected by the crisis (Chen et al. 1996), but also because the short-term impact of curative medicine on cardiovascular and violent mortality (the main medical causes of death concerned) is limited. While the health care system has not in fact collapsed, privatization of the health sector could, however, have restricted access to health care (Shkolnikov et al. 1998; Becker and Bloom 1998). *Alcohol* has played a considerable role in Soviet mortality and morbidity, including in the Baltic States (Stankaitis 1982; McKee et al. 2000; Brunovskis and Ugland 2003; O'Connor and Bankauskaite 2008), due to high levels of consumption. Tentative comparisons of trends and levels of alcohol intake between the three Baltic countries and Russia can be found in Reitan (2000). Explanations related to *economic impoverishment* are hardly supported by evidence (Shapiro 1997; Walberg et al. 1998; Brainerd 1998). Nevertheless, concomitantly with the growth of the private sector, *income inequalities* in the Baltic countries increased (Leinsalu et al. 2009). These inequalities act on mortality and most probably on health via not only material deprivations but also via one's *personal environment*: one's position in society, social cohesion and social network, confidence and hope in the future (Bobak et al. 2000; Leinsalu 2002; Carlson 2004). *Psychosocial stress* may mediate between inequalities and mortality (Chen et al. 1996; Leinsalu et al. 2009).

This hypothesis of stress as a risk factor seems to be appropriate both for the Russian and Baltic cases, on the one hand because these countries experienced significant socio-economic upheavals which contributed to increasing social pressure, and on the other hand because psychological factors have an influence on cardiovascular and violent mortality. According to Shapiro (1997), stress could explain a large part of the abrupt rise of mortality: individuals are not able to cope with stress because they have no adaptation strategy or because the socio-economic situation is so chaotic that the choice of a strategy is difficult. The labour market transformations have plunged a part of the population into a state of confusion and uncertainty as regards the future (Shkolnikov et al. 1998). Stress can increase unhealthy behaviours, such as alcohol consumption or smoking. In addition, it can activate the evolution of diseases, especially coronary diseases, via the nervous system (Fontaine et al. 1996). In an attempt to explain health and mortality, individuals' relational networks appear to be another important factor. It is more and more generally accepted that, at the individual level, *social support* acts as a regulator of stress (Fontaine et al. 1996) and that, at the macro level, social cohesion is a determining factor of public health (Kennedy et al. 1998).

## 3. Data

In the very disturbed context of the 1990s, the *Norbalt Living Conditions Project* is an invaluable source of information for apprehending levels and trends of the principal health indicators. Though other surveys such as *Finbalt* have been held, Norbalt is the only survey related to living conditions carried out simultaneously in the three Baltic countries during the period considered. The first round of Norbalt goes back to 1994, the second to 1999. In Lithuania, an initial survey was held just before independence in 1990, but the questionnaire was very different from the following ones and people were not asked to evaluate their health; therefore these data could not be used in a comparative perspective (Hernes and Knudsen 1991). The Norbalt Living Conditions Survey I and II are the result of collaboration between Fafo (Institute for Applied Social Science) in Oslo and local institutions in the Baltic countries. Both rounds have been designed using Scandinavian methodology for living conditions analysis developed in the 1960s; these types of surveys are routinely carried out in Nordic countries (Aasland and Tyldum 2002). Through the various stages of the project, the same topics were approached and a large number of questions were identical from one survey to the other. It is thus possible to make comparisons in time and space. The first part of each questionnaire collects

information on the household and its different members; the second part is addressed to a randomly selected individual within the household.

In each country, the sample was stratified according to urban and rural characteristics and also to the size of towns and municipalities. In large towns, the sample was constructed as a one-stage stratified random sample. In rural areas, two-stage stratified sampling was adopted. At the last stage, individuals were drawn from population registers. As people were sometimes not living at the address given in the register, the sample should be regarded as a sample of addresses rather than of individuals. Non-response rates due to frame imperfections (non-existing or vacant buildings) were between 2 and 6 percent (Aasland and Tyldum 2002). The surveys were conducted by interview, interviewers being those of the three statistical offices trained by Fafo for the initial survey. The questions dealing with health were only answered by one member of each household aged over 18, *i.e.* in Estonia a total of 4,455 people in 1994 and 4,726 in 1999, in Latvia respectively 3,132 and 3,044, and in Lithuania 2,411 and 2,743. The samples are weighted according to inclusion probabilities. The weights were stratified according to age, gender and region. The response rates are high: from 85.9% to 91.2% according to the round and the country, and the samples can be considered as representative of the populations concerned (Aasland and Tyldum 2002). Nevertheless, when we compare results across time and across countries, it should be understood that we are comparing samples and not whole populations.

#### **4. Conceptual and operational model**

##### ***A causal modelling approach***

In this section a causal model is developed, based on the prior information on the factors of self-rated health in the Baltic countries during the time-period considered and on their plausible interrelations; additional references to the literature are given in Gaumé (2009). A causal model represents the possible *mechanism* linking causes to effects, *i.e.* the relevant variables and their organisation<sup>1</sup>, built to increase our understanding of the cause-effect relations (Psillos 2004). A common view is that cross-sectional studies assess both putative causes and effects simultaneously and therefore temporal causal relations cannot be shown. If this is the case, no causal inferences could be drawn from the Norbalt surveys, as they are cross-sectional. This view can be challenged, however (Wunsch, et al. 2010). To put it briefly, the longitudinal approach suffers from various problems which do not arise to the same extent in the cross-sectional approach. Furthermore, as Cox (1992) had already pointed out, subject-matter knowledge may be used in a cross-sectional study to establish the presumed causal ordering of variables. In this paper, one can check *e.g.* if physical health or social support have an impact on self-rated health, as one can assume that the causal relation usually goes from physical health and social support to self-rated health and not vice versa. The same can possibly be said for locus of control, another probable factor of self-rated health. The case is even stronger for such variables as gender, ethnicity, or education, which are permanent or quasi-permanent properties of the individuals. On the other hand, the impact of drinking on self-rated health is more difficult to assess from a cross-sectional survey. The causal relation could indeed be reversed: rating one's health as poor could lead one to drink. Having no longitudinal data, we have not considered such possible reverse causation effects.

##### ***Variables, paths, and indicators***

The outcome variable in this study is *self-rated general health*. As it is a self-assessed measure, not all respondents necessarily use the same frame of reference (Leinsalu 2002). In particular, males and females evaluate their health differently. Self-rated general health is measured by the single and classical question: "How would you characterize your health in general?". It is assessed on a 5-point interval scale, and then converted here into 3 categories: good, average and bad. It has been shown that whatever the exact wordings and response options of self-rated health questions, the measures

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<sup>1</sup> A mechanism is therefore more than the sum of its parts due to the organisation of the latter.

represent parallel assessments of the same phenomenon and present basically concordant answers (Jyhlä 2009).

WHO has defined health as “a state of complete physical, mental, and social well-being” (WHO 1958, p.459). We assume in this model that self-rated health subsumes these three components of health. We have therefore assumed a causal path between self-reported *physical health* and self-rated general health. Moreover, physical impairments can have an impact on one’s mental health. We also assume that physical impairments might lead some to drink, as a coping strategy. Our indicator of physical health is an index based on a question relating to whether or not respondents were suffering from any illness or incapacity of a prolonged nature, or any affliction due to an injury or a disability, and on information about limitations in daily activities caused by these health problems, as declared by the respondent. This indicator is divided into three categories: persons without illness and disability, persons with mild limitations, and persons with severe limitations (see Gaumé 2009). As the indicator of physical health relies on the respondent’s evaluation of his/her own health, it does not capture diseases that may not yet be diagnosed and does not necessarily fully reflect the severity of illness.

Concerning mental health, our model is focused on stress, taking into account the particular context of this study. The data available do not however allow for measuring stress via stressful life events per se. With the information existing in the two rounds of the Norbalt surveys, we have focused our analysis on *psychological distress* as a proxy of stress. It refers to “an adverse mental state involving marked depression and anxiety that falls short of clinical mental illness and is characterized by negative moods and malaise” (Cockerham et al. 2006a, p. 2381). Recent reviews analyzing studies on the link between stress and affective disorders conclude to an association between life stress events and the occurrence of depressive and anxious episodes. Bobak and Marmot (1996) have proposed that psychosocial stress may have a direct effect on health and may also be mediated by alcohol consumption, smoking, unhealthy diet and violent behaviour<sup>2</sup>. Psychological distress is measured here via symptoms linked to depression or anxiety or both. People were asked if different symptoms bothered them during the week before the survey, and to what extent. The following symptoms were mentioned: suddenly scared for no reason, nervousness or shakiness inside, feeling tense or keyed up, headaches, feeling depressed, worrying too much about things, and feelings of worthlessness. A sum index was constructed indicating whether the person suffered from mild psychological distress, moderate distress, or severe psychological disturbance.

In our model, *alcohol consumption* is considered as part of the mechanism linking psychological distress and physical health on the one hand, to self-rated health on the other hand, since drinking is a possible response to poor health. The rapid and profound economic, social, and political transformations during the 1990’s could have increased the general level of psychological distress of the population, and alcohol could have been used by some to benefit from its stress-reducing effect. In most circumstances, alcohol will reduce the level of stress, and people under stress or anticipating stress will consume alcohol to profit from this effect. Today, it is clearly established that drinking and stressful life events are associated, but the direction of the causal link is still an open question. Under certain circumstances, some people could drink to cope with stress, but alcohol itself is a stressor. In addition, psychological distress is not the only motivation to drink. Especially in the former socialist countries, drinking is “a normative pattern of male socializing” (Cockerham et al. 2006b). This is probably the reason why these authors did not find any association between psychological distress and alcohol consumption.

We assume a causal relation between alcohol consumption and self-rated general health. Drinking is connected with more than 60 health conditions, and most of the time the impact of alcohol on health is negative. Not only the volume of alcohol but also the type of consumption and particularly heavy

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<sup>2</sup> In this paper, tobacco consumption is not included in the model, as only current smoking data are available and current smoking does not have an immediate effect on self-rated health. No data are available in the surveys on diet and on violent behaviour.

irregular (binge) drinking, determine the extent of the diseases (Chenet et al. 2001). Concerning cardiovascular diseases, epidemiological research focusing on the link between alcohol and coronary diseases conclude to a J-shape relationship: a low consumption of alcohol has beneficial effects. As far as cerebrovascular diseases are concerned, results are less clear. Chronic alcoholism as well as binge drinking episodes are risk factors for cerebrovascular diseases; on the contrary, positive effects of moderate consumption are not supported by enough scientific evidence. Unfortunately, the Norbalt data do not allow us to take binge drinking into account. The questions concerning the number of glasses drunk were not exactly the same at both rounds of the survey<sup>3</sup>. In 1999, this question refers specifically to the last time the respondents drank, while in 1994, they are asked to report average consumption. To keep comparisons possible, alcohol consumption was measured by the number of days people drank alcohol during the two preceding weeks. This question was identical at the two rounds of Norbalt. The index is composed of the following categories: abstinent, drinking 1 day, 2 or 3 days, 4 days or more. However, the frequency of alcohol consumption and the number of glasses drunk seem related: the proportion of modest drinkers (1 to 3 glasses) are significantly higher and the proportion of heavy drinkers (6 glasses or more) significantly lower among those who drink rarely (1 or 2 days in 2 weeks) than among those who drink frequently (4 days or more). Those who reported the highest frequency of alcohol consumption also reported the highest amount of alcohol drunk. Taking into account either frequency or amount of alcohol in the model could give different results, but we are not able to test the impact of binge drinking over time due to dissimilar questions in the two surveys.

The social well-being component of the WHO definition of health is taken here as meaning *social support*. It can be defined as “an exchange of resources between at least two individuals perceived by the provider or recipient to be intended to enhance the well-being of the recipient” (Shumaker and Brownell 1984). Recent research tends to demonstrate that socially isolated individuals are in worse physical and mental health than the others, and especially that there is a link between infrequent social contacts and the onset of depression. In explaining the mechanisms relating social support to mental health, Kawachi and Berkam (2001) suggest that social support can buffer the negative effects of stressful life events. Harpham et al. (2002) go further in hypothesizing that social support could reduce risk exposure to factors causing psychological distress. In our model, we assume that this variable has an impact on self-rated general health via psychological distress; an individual with a high level of social support can evaluate the stressful life events he has to face less negatively and can find better ways of coping with the situation. Social support, which is only evaluated in 1999 for reasons of data availability, is a sum index of three questions asking respondents if they have any relative or other close person who is there for them if they fall ill, if they need company, if they need someone to talk to about personal problems. The indicator created is an ordinal variable with four categories, varying from always affirmative answers to always negative answers.

*Locus of control* is a personal belief of the individual concerning whether or not life events depend on his/her behaviour. Subjects with an internal locus of control believes that what is happening to them depends upon themselves, whereas subjects with an external locus consider that life events are the results of external factors such as luck, fate, chance, or other people. Like social support, an internal locus of control can act as a moderator of perceived stress and thus can play a role on psychological distress. We also assume a direct impact of locus of control on self-rated general health. Kirkcaldy *et al.* (2002) explain the link between locus of control and health: individuals with an internal locus of control would be more sensitive to health messages and keener to enhance their physical health. In the Norbalt surveys, respondents were asked if they agreed or not with three assertions: “There is no point in planning the future because nothing is ever a success.”, “Politics is so complex that it is difficult for people like me to understand what it is about.” and “Your success in life depends on your family.” The indicator of *locus of control* was created by adding the answers,

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<sup>3</sup> Both take into account the type of alcohol drunk: beer, wine, or liquor.

leading to a 4-point ordinal scale varying from a complete external control to a complete internal one<sup>4</sup>.

We assume that level of *education* influences the type of locus, people with a higher education believing more frequently that they have control over their life than the less educated. We also consider that the level of education has an effect on alcohol consumption, especially among women: those with a higher education may drink more than the others (Helasoja et al. 2007). Questions on *level of education* are to some extent different in 1994 and 1999. Although each time the variable is composed of three categories: primary or less, secondary, and higher education, it is not possible to strictly compare prevalence rates from one round to the other.

Unfortunately, because of lack of data, *access to health care* is not a concept included in our model. A causal relation linking access to the health care system to self-rated general health seems obvious: people who cannot afford to visit the doctor when they are ill will possibly rate their health worse than the others. But the only question asked in the Norbalt surveys was whether or not the respondent is covered by any kind of health insurance. This indicator is not adequate during this transition period as the health system was under transformation, and people without insurance did not necessarily have to pay the full fee to the medical system. Moreover, the health system is evolving differently from one country to another, making geographical comparisons impossible.

*Indicator reliability*

We have assessed the reliability (or internal consistency) of multiple-item indicators using both Cronbach’s *alpha* and multiple correspondence analysis. As a rule of thumb, the indicators are consistent if *alpha* is 0.70 or higher (Spector 1992). For all multiple-item variables except for locus of control, Cronbach’s alphas are above 0.70, indicating a good consistency among indicators (see table 1). The case of locus of control has been examined above.

Table 1: Cronbach’s alpha

	Estonia				Latvia				Lithuania			
	1994		1999		1994		1999		1994		1999	
	M	F	M	F	M	F	M	F	M	F	M	F
Limitations in daily activity	0.72	0.74	0.71	0.73	0.88	0.91	0.79	0.86	0.91	0.92	0.82	0.80
Psychological distress	0.81	0.82	0.84	0.80	0.79	0.81	0.80	0.83	0.82	0.83	0.93	0.90
Locus of control	0.44	0.42	0.53	0.46	0.32	0.27	0.30	0.31	0.37	0.31	0.41	0.39
Social support			0.77	0.80			0.76	0.72			0.73	0.83

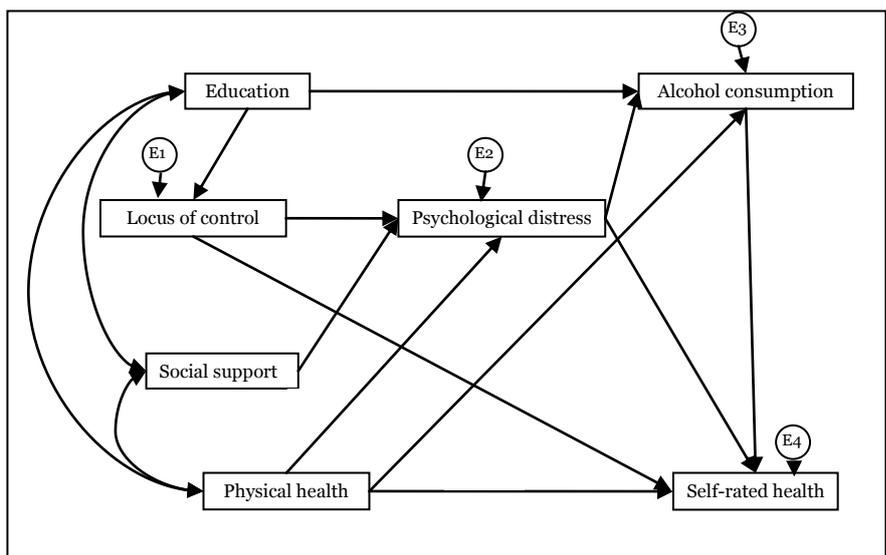
*Causal model and graph*

The *directed acyclic graph* (DAG) corresponding to the conceptual model is presented in figure 1. The vertices or nodes in the DAG represent variables while the directed edges or links between nodes represent assumed causal relations. The E<sub>i</sub> variables in the DAG denote “error” terms, *i.e.* latent or unknown explanatory variables that have not been taken into account, plus measurement error. The

<sup>4</sup> As Cronbach’s alphas are relatively low, in order to explore more thoroughly the consistency of this indicator, multiple correspondence analysis has been performed. The second dimension is mostly explained by the item “Your success in life depends on your family”, and the first one by the other two items. The second dimension representing the nominal two-category variable relating to the family can not be taken *per se* into account because fitting our structural equation model requires interval or ordinal scales. We ran the model with two or three items for locus of control. No major differences were found except for the fact that in a few cases (especially for males) education level has a slightly stronger influence on locus of control when the three variables are taken into account. These results, added to the fact that the number of relevant variables are only three and dichotomous, has led us to keep all three items for measuring locus of control by an ordinal scale.

DAG is recursive, *i.e.* acyclic, meaning without feedback effects or mutual causation. As age/birth-cohort, gender, and ethnicity may have an impact on most other exogenous variables and on the endogenous ones too, age/birth-cohort, gender, and ethnicity have not been introduced specifically into the model's structure but the model has been fitted for four age groups (18-29, 30-44, 45-59, 60+), for both genders, and for autochthons and other (mainly Russians). Detailed tables are given in Gaumé (2009). We do not present results by marital status as no significant differences have been found.

Figure 1. The DAG of the conceptual structural model.



### 5. The statistical model

In an attempt to measure the impact of some possible determinants of self-rated general health in the Baltic countries during the 1990s, we use a *structural multiple-equation model* (SEM) taking into account the direct and indirect paths leading from the various possible determinants (or exposures) to the effect (or outcome). In the associated graph, a causal effect is measured by a regression weight indicating the impact of the variable at the base of each directed edge on the variable at the head of the link. Single-equation models have the disadvantage of mixing together covariates and confounders, controlling for all variables even when control is not always required or is even damageable, such as in the case of intervening variables. A single-equation model leaves the causal structure largely unspecified and is therefore too theory-parsimonious. On the contrary, a major advantage of SEM is that it gives a precise picture of one's hypothetical causal structure, distinguishing the network of paths among variables, both direct and indirect, and separating confounders from intervening variables. As regards causality, in addition to being identified and fitting the data adequately, a SEM should be congruent with background knowledge and structurally stable (Mouchart et al. 2009). As the analysis is restricted to the data available in the Norbalt surveys, latent confounders may however be present and bias the results. Moreover, as no longitudinal data are available, we cannot use a time fixed effects regression model controlling for omitted variables which do not change over time.

The linear recursive SEMs developed in this paper have been fitted using the AMOS software (Version 7.0) for the analysis of moment structures (Arbuckle and Wothke 1999). A problem with AMOS is that it does not take sampling weights into account. We have therefore estimated the model on the unweighted sample data. Though unweighted sample results are not adequate for inferring descriptive statistics for the whole population, it has been shown that failure to use sample weights will not bias regression weights, if the model is correctly specified of course (Bloom and Idson 1992).

An issue with the classical SEM approach is that it uses methods such as maximum likelihood estimation (MLE) which require continuous variables. Ordinal variables such as those used here do not always behave like continuous ones. In this case, alternatives to MLE are required, especially if the ordinal variables have few categories, are highly skewed, or are not assumed to reflect underlying continuous variables. In this paper, we have used *Bayesian inference* to estimate the parameters of the models. Bayesian methods are more flexible than classical ones and are thus better suited to deal with ordinal variables than MLE or least squares estimation techniques. In particular, asymptotic assumptions are not needed. Bayesian inference uses Bayes' theorem to combine prior information with the new information contained in the data set. One starts by specifying firstly *prior distributions* (prior probabilities) for each of the model unknowns and secondly the likelihood of the data (data probabilities). As a mathematical solution for the *posterior distributions* (posterior probabilities) is usually too complex, the latter are actually obtained from the data and priors iteratively, using a Markov Chain Monte Carlo (MCMC) procedure. For more information on the methodology of Bayesian structural equation modelling using MCMC, see *e.g.* Dunson et al. (2005) and at a more advanced level, Lee (2007).

For the structural equation modelling of the data from the 1994 survey, we have used *non-informative* priors, as we have no (prior) opinion about the parameters being studied. In this case, a uniform distribution for each parameter has been chosen. For the 1999 data on the other hand, *informative* priors have been taken as the posterior distributions of the parameters obtained from the previous 1994 models. From a causal point of view, it seems reasonable to opt for informative priors when available, taking pre-existing evidence and background knowledge into account, rather than for uninformative priors. In small samples however, informative priors may tend to dominate the posterior distribution results (Scheines et al. 1999). As we hypothesize possible differences between the 1994 and 1999 results, due to changing political and socio-economic contexts, taking the 1994 posteriors as informative priors for the 1999 models might conceal the changes in the parameters over time. We have therefore also used non-informative priors for the 1999 models and compared the results between both approaches. Concerning populations by sex and country, the samples are large enough (between 1196 to 2867 individuals) to avoid the dictate of informative priors: differences between posterior distributions using informative priors and non-informative ones are always very small. But when the size of the dataset decreases, as when age groups are considered, the impact of the evidence provided by the data diminishes and the influence of prior information grows. We consequently decided to use uniform prior distributions for populations by age-groups.

In the AMOS MCMC procedure, 500 initial samples are generated and discarded. Convergence is accepted once the convergence statistic becomes less than 1.002, but we have also checked the posterior distributions, the trace plots and the autocorrelation plots (see Arbuckle 2006, chapter 26). For each parameter  $\theta$ , a Bayesian 95% *credible interval* has been computed such that  $\text{Prob}(a \leq \theta \leq b) = 0.95$ , meaning in Bayesian inference that one is 95% sure that the true value of  $\theta$  lies between  $a$  and  $b$ .

## 6. Results

### *Prevalence rates*

In a descriptive approach, we first consider the *prevalence rates* for each of the variables, meaning here the proportions of the population per category (see Annex). Weighted sample data have been used for correct statistical inference to the whole population. Differences are significant at the .05 probability level. Concerning the *time trend* firstly, self-rated general health improves in all three countries during the five-year period, except for Latvian males. Physical health improves too: the prevalence of good physical health increases as the percentage of populations suffering from long-term illness with severe daily limitation decreases (except for Latvian males). There is also a significant decrease in psychological distress, except for Latvian males once again. An increase in non-drinkers is observed in all three Baltic countries and especially in Lithuania. Regarding locus of control, the proportion of persons declaring their locus as 'internal' increases slightly in Estonia and

for Latvian females but it decreases in Lithuania. Finally, the higher-educated groups increase everywhere.

Concerning *gender differences*, women are less well-off whatever the country and period: they have a higher prevalence of poor physical and self-rated health compared to males, a higher prevalence of external locus of control, and are more distressed. Regarding this last variable, gender differences are especially wide: the proportion of females suffering from no or very few psychological disorders is twice as low as that for males. On the other hand, females drink less and have a higher level of education than males (particularly in 1999).

Talking about *ethnic differences*, in the three countries, Baltic populations tend to report a better self-rated health and a more internal locus of control than other ethnicities (mainly Russians). In some cases, autochthon populations also rate their physical and psychological health better than the allochthons do. The Latvian male population presents specific ethnic characteristics: ethnic Latvians reported worse physical and psychological health than the non-titular ethnicities. Ethnic differences are rare in Lithuania where the Lithuanian population of non-titular ethnicity is small.

Turning to *inter-country differences*, self-rated health is generally less often good in Latvia than in the other two countries. It has to be pointed out that whatever the year or the sex considered, Estonians always declare having a better physical condition on average than their Latvian or Lithuanian counterparts. While in 1994, Estonians of both sexes were the more distressed, their situation had improved greatly five years later. On the contrary, Lithuanians were the least distressed. In 1999, there are fewer non-drinkers (both sexes) in Estonia than in Latvia or Lithuania. On the other hand, locus of control is better (*i.e.* internal) for the latter than for the Latvians and especially the Lithuanians. Regarding level of education, Estonian males in 1999 as well as Estonian females at both dates have a higher diploma than the others.

Finally, taking *age effects* into account, there are fewer male and female non-drinkers at both dates in the two younger age groups compared to the older ages. Some age effects are obvious, such as the deterioration in physical and self-rated health with age. This age pattern is less clear, however, for psychological distress, though the younger age group is always better-off than the others. An interesting observation is the increase by age at both dates in the proportion of males and females having an external locus of control. Gender effects do not vary much across age groups: whatever the age, women are usually more distressed, have poorer self-rated health, drink less, and have a more external locus of control than males, at both periods of time.

### **SEM results**

A causal model does not only have to fit well<sup>5</sup> and have statistically significant parameters, in our case a 95% Bayesian credible interval not overlapping zero. It must also be structurally stable, *i.e.* invariant to interventions and changes of context. Figures 2 to 4 present the *directed acyclic graphs* (DAGs) corresponding to the SEM regression equations relating to 1999; the graphs for 1994 are available in Gaumé (2009). Statistically significant parameter values are starred on the graphs. To avoid presenting too many figures, graphs by age-groups and ethnicity are not presented in the paper but the major findings are given. Whatever the country, year, gender, ethnicity, or age group, there are striking similarities between the signs and the parameter values of the DAGs, even though the contexts are different. In all cases, there are strong positive relations between physical health, psychological distress, and self-rated general health. Bad physical health is directly associated with poor self-rated general health and also indirectly via psychological distress. The relation linking psychological distress and alcohol consumption is not often significant, but when it is, it seems to vary a lot among the age groups: the relation is positive for the 18-34 age group (the most distressed

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<sup>5</sup> A very good fit is confirmed by the *posterior predictive p-values* (Meng 1994), which are the Bayesian counterparts of classical (frequentist) p-values, and by the frequency polygon, trace, and autocorrelation plots.

drinking the most often) and negative for the 60+ age group (the most distressed drinking the least often).

The frequency of alcohol consumption is related to self-rated general health, especially for women, but the relationship is not the expected one, higher alcohol consumption being associated with better subjective health (the more one drinks, the better one feels!). The possible reasons for this paradoxical result are discussed in section 7. Moreover, alcohol consumption is related to physical health, those not suffering from any illness or disability drinking more than the others. Poikolainen et al. (1996) using Finnish data for 1992, found a U-shaped pattern between alcohol intake and sub-optimal health. The same U-pattern is generally observed in the Baltic countries: the non-drinkers and the heavy drinkers reported poorer health than the moderate drinkers.

Locus of control slightly influences psychological distress, especially for women: a good personal internal control over one's life leads to less psychological distress. The type of locus also has a significant direct impact on self-rated health (even higher than on psychological distress), an internal locus being associated with better self-rated health. Education has a very strong effect on locus of control; the less one is educated, the more one's locus is external. The level of education is also related to alcohol consumption (except for Latvian males): respondents with low education drink less often than their more educated counterparts. This causal relationship is much stronger for women than for men. The relationship between education and alcohol consumption is broadly similar in each age group and by sex, both for 1994 and 1999, showing no particular cohort effect. Finally, social support has a significant impact on psychological distress in the Latvian and Lithuanian female populations only (data for 1999 only).

Though the model is particularly stable, some slight differences are nevertheless observed. The values of the parameters change significantly over time in only one case: for Lithuanian males, the influence of physical health on self-rated health increased between 1994 and 1999. Regression weights for females are generally higher than those for males in the relations linking education to alcohol consumption and also for the one linking alcohol consumption to self-rated health. On the contrary, male self-rated health is more influenced by physical health than is the case for females. Inter-country differences are also observed: in Estonia, physical health always has the highest impact on self-perceived health and, most of the time, the same is true for level of education on locus of control. There are a few other differences among female populations, one of them concerning the relation between social support and psychological distress, which is stronger in Latvia compared to Estonia. Finally, the major ethnic difference is observed in 1994 in Estonia and Latvia: physical health is a higher determinant of self-rated health among ethnic Balts than among other ethnicities.

Figure 2a: SEM results for Estonia. Males 1999.

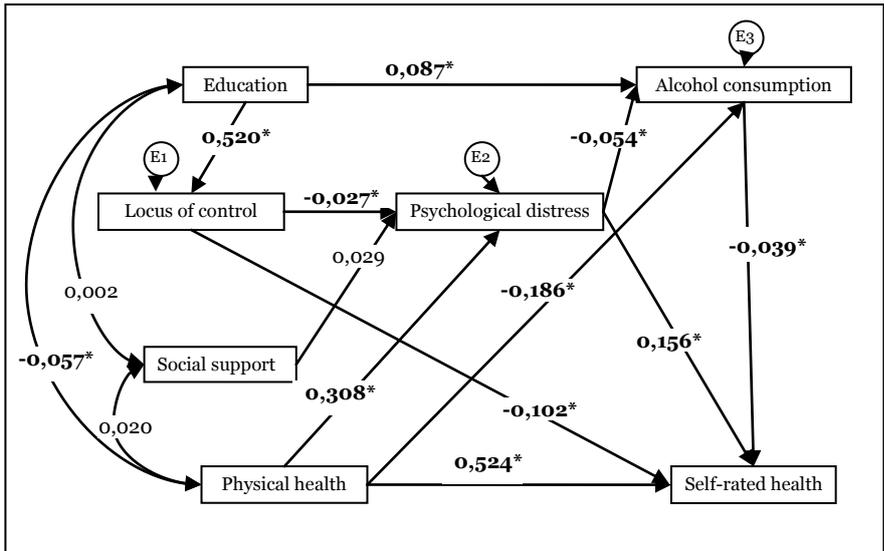


Figure 2b: SEM results for Estonia. Females 1999.

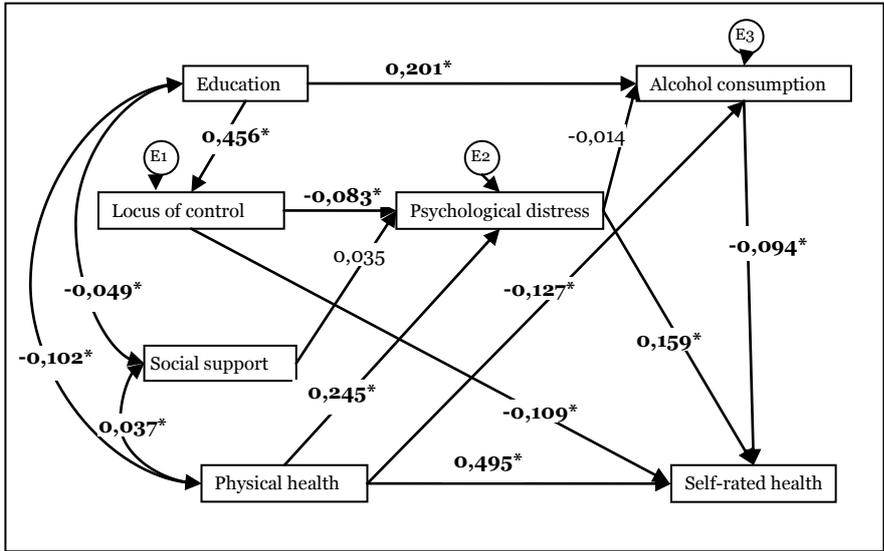


Figure 3a: SEM results for Latvia. Males 1999.

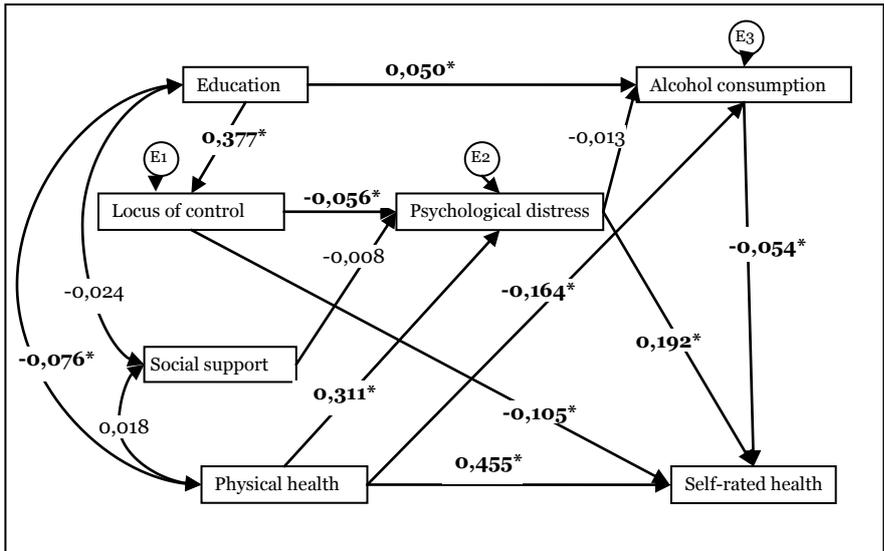


Figure 3b: SEM results for Latvia, Females 1999.

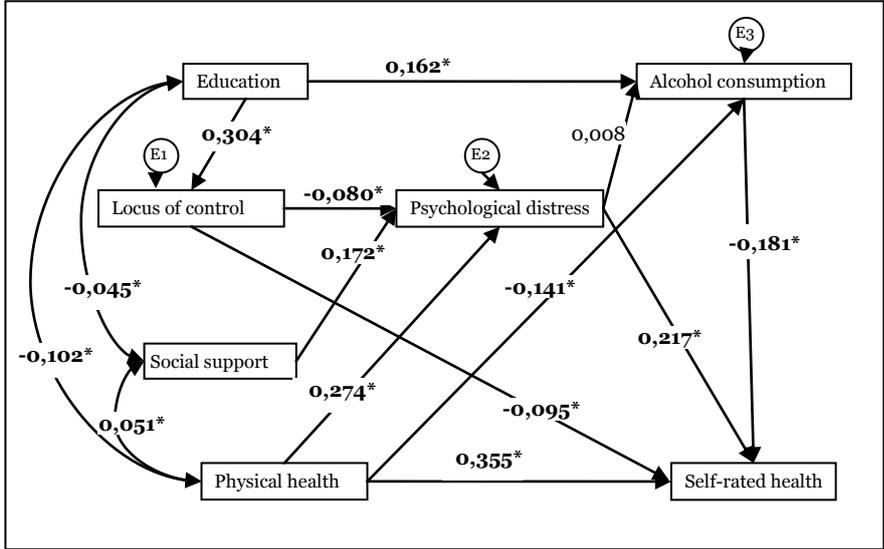


Figure 4a: SEM results for Lithuania, Males 1999.

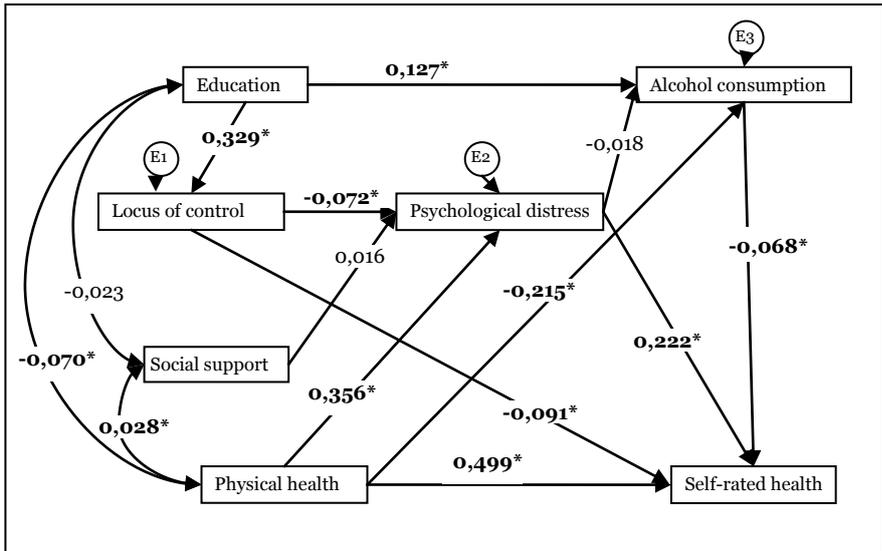
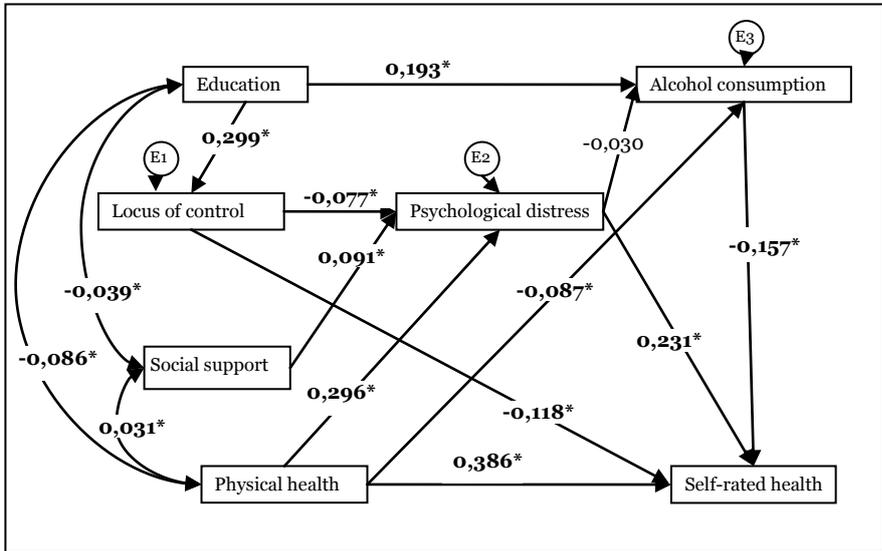


Figure 4b: SEM results for Lithuania, Females 1999.



**7. Conclusions and discussion**

Before discussing the results, the limitations of the data must be considered again. Because the surveys were primarily designed to collect information on living conditions, questions on health-related behaviours were rather basic. In particular, the operationalisation of the concept ‘locus of control’ would require better indicators, and psychological distress a longer reference period. All these measures also refer to the present situation of the persons interviewed: nothing is known about their past conditions or their health behaviours. Concerning drinking, it was impossible to have a unique measure of alcohol intake at both dates of the study, nor a measure of binge drinking, so the frequency of drinking was used. Feunekes et al. (1999) have shown, however, that compared to other methods of measuring alcohol consumption, the most realistic level of alcohol intake is obtained when the question addresses frequency and type of alcohol consumed (beer, wine, liquor), as is the case in the Norbalt surveys.

Though in many studies categorical responses are collapsed into a dichotomous variable, as pointed out by Manor, Matthews and Power (2000) it may be that the categories of self-rated health represent an arbitrary classification of underlying continuous phenomena; alternatively the categories may represent intrinsically distinct health states possibly predicted by different factors (Smith, Shelley and Dennerstein, 1994). Moreover, dichotomization involves loss of information and may lead to a reduction in efficiency in the statistical analysis. Finally, more than two categories per indicator are

also required by the SEM approach used here. For these various reasons, we preferred to use three categories or more for the indicators in the study. Finally, the translation of the questionnaire from one language to the other could have led to different interpretations of the questions in the three countries; it is also possible that for example, the question on self-rated health was differently understood from one country to another.

A major result of the study is the remarkable stability of the SEM parameters whatever the country, year, gender, ethnicity, or age group. Some relations could be presumed of course, such as the strong positive relations between physical health, psychological distress and self-rated general health. Concerning the role of psychological distress on alcohol consumption, the relationship is generally negative but non-significant. By age-group, this relationship is often positive at young ages and negative at older ages, but the results are rarely statistically significant at the 0.05 level. As to the relationship between alcohol consumption and self-rated general health, it is always negative and stronger for females. Therefore, in the case of psychological distress, both the direct path and the indirect path through alcohol consumption seem to be positively related to self-rated general health, but we have to take account of the fact that the negative relation between psychological distress and alcohol consumption is mostly non-significant.

Locus of control weakly influences psychological distress; its impact on self-rated general health is slightly greater. Locus of control is highly dependent upon educational level. Social support has an impact on self-rated general health, especially important for Latvian females but also significant for Lithuanian females. Among the slight differences that have been observed, one can point out the greater impact of education on alcohol consumption and the latter's greater influence on self-rated health among females compared to males, and the temporal increase of the impact of physical health on self-rated general health in Lithuania.

Concerning prevalence rates, there is a slight improvement in self-rated health in the three countries for both sexes except for Latvian males. The same is true for psychological distress and for physical health except in this last case for Latvian males again. One should also point out the absence of improvement in locus of control for Lithuania, the country which is the worst off in this respect. As to gender differences, women are less well-off than males in physical and self-rated health, in psychological distress, and in locus of control, but they drink less than males. Concerning age effects, we point out the increase by age in the proportions having an external locus of control for both sexes and periods.

It is interesting to point out that Latvian males, who experience the highest mortality, are also those for whom self-rated and psychological health have not improved over the period considered. This situation is also related to the stability of the prevalence of other determinants (physical health, locus of control, and to some extent alcohol consumption) and to the stability of the regression weights linking the various determinants to self-rated health. If we compare this case to the situation in Lithuania for example, the slight improvement in self-rated general health in the latter country can be related in our model to a small increase in the prevalence of good physical health, to a decrease in the prevalence of psychological distress and to a much higher regression weight linking physical health to self-rated health as well as a decreasing influence of locus of control on self-rated health. The intermediate situation is Estonia where the prevalence of poor self-rated health has slightly decreased, which can be linked to a decrease in poor physical health and psychological distress. Contrary to Lithuania, the impact of physical health on self-rated health has not changed, however.

Another point we would like to make concerns alcohol consumption, the latter having been linked to excess male mortality in several studies. In this study, good physical and self-rated health are associated with more alcohol consumption instead of less. This finding is congruent with the Kaunas-Rotterdam Intervention Study: Lithuanian males who drank a lot of alcohol rated their health better than the others (Appels et al., 1996). Finbalt surveys reach almost the same conclusions (Kasmel, 2004). In most cases, psychological distress is not significantly related to drinking. Cockerham et al. (2006b) have suggested that "habitual drinkers may not be distressed because they drink habitually",

convivial drinking promoting feelings of well-being. At the youngest ages, there is, however, a weak positive association between distress and alcohol consumption which could also be due to an opposite relation, drinking leading to worse mental health. We would need longitudinal data to clarify the direction of causation. The data also show that education is related to drinking for females but not for males, suggesting that drinking is a normative pattern for males but not for females.

Though the positive relations between physical health, self-rated health, and the frequency of alcohol consumption may comfort those who like a good drink, they may also be due to the fact that many heavy drinkers have already died before the surveys or are participating less in the surveys. Another reason could be that heavy drinkers under-report their drinking behaviour contrary to others, in the face of social opprobrium. A third reason could be that persons in poor health do not drink or have stopped drinking. We have examined this last reason by running the model on drinkers only (those who had at least one drink during the past two weeks). In this sub-population, the association between the quantity of alcohol consumed and self-rated general health disappears at both dates for all three countries and for both sexes (except for Lithuanian females); the same happens with the association between physical health and alcohol consumption. It seems therefore that the favourable relation between alcohol consumption and health results from the fact that those in bad physical and self-rated health do not drink or have stopped drinking; nevertheless, those who drink often perceive their health to be as good as those who drink less. On the contrary, for drinkers, the impact of psychological distress on alcohol consumption is generally positive and greater than for the whole population, those in poor mental health drinking more often.

Lastly, the question of ethnicity is of particular importance in Estonia and Latvia where, respectively, 32 % and 42 % of the population consider themselves to be of a different ethnic group, mainly Russian, from that of their country of residence, according to the 2000 and 2001 censuses in Estonia and in Latvia. In 1994 for males and at both dates for females, ethnic Estonians and ethnic Latvians rated their health slightly better than other ethnic groups. Ethnic Baltic groups always benefit from a more internal locus of control but are less educated than other ethnic populations. In most of the cases, ethnic Estonians and ethnic Latvians also have better physical health. Concerning the models' parameters, minor significant differences are only observed in 1994: level of education has a stronger influence on locus of control in ethnic Baltic populations than in non-ethnic ones; the same is true concerning the impact of physical health on self-rated health in some cases. This would mean that though locus of control is influenced by education, other unobserved determinants also play an important role.

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## **Annex: Prevalence rates**

### **Table 1: Self-rated health**

	Estonia				Latvia				Lithuania			
	Males		Females		Males		Females		Males		Females	
	1994	1999	1994	1999	1994	1999	1994	1999	1994	1999	1994	1999
<b>Good</b>	37	37	30	29	34	32	19	22	40	43	23	26
<b>Average</b>	47	50	48	52	48	50	51	48	45	46	53	54
<b>Poor</b>	16	13	22	19	18	18	30	30	15	11	24	20
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 2: Psychological distress

	Estonia				Latvia				Lithuania			
	Males		Females		Males		Females		Males		Females	
	1994	1999	1994	1999	1994	1999	1994	1999	1994	1999	1994	1999
<b>Light</b>	37	50	20	33	48	51	23	31	53	61	27	36
<b>Moderate</b>	40	37	38	45	35	33	39	38	34	30	41	41
<b>Heavy</b>	23	13	42	22	17	16	38	31	14	9	32	23
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 3: Frequency of alcohol consumption (last two weeks)

	Estonia				Latvia				Lithuania			
	Males		Females		Males		Females		Males		Females	
	1994	1999	1994	1999	1994	1999	1994	1999	1994	1999	1994	1999
<b>Abstinent</b>	27	32	50	55	33	39	59	62	29	36	54	66
<b>1 day</b>	39	32	39	32	46	39	37	32	34	32	36	25
<b>2 or 3 days</b>	24	23	9	11	16	15	4	5	25	22	8	7
<b>4 days or more</b>	10	13	2	2	5	7	0	1	12	10	2	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 4: Physical health

	Estonia				Latvia				Lithuania			
	Males		Females		Males		Females		Males		Females	
	1994	1999	1994	1999	1994	1999	1994	1999	1994	1999	1994	1999
<b>No illness</b>	59	66	49	60	68	73	64	70	73	88	65	81
<b>Illness with mild limitations</b>	31	27	37	29	21	19	20	18	15	7	18	10
<b>Illness with severe limitations</b>	10	7	14	11	11	8	16	12	12	5	17	9
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 5: Locus of control

	Estonia				Latvia				Lithuania			
	Males		Females		Males		Females		Males		Females	
	1994	1999	1994	1999	1994	1999	1994	1999	1994	1999	1994	1999

<b>Complete external</b>	19	17	27	21	26	24	38	32	40	49	49	57
<b>External</b>	29	24	34	31	34	33	38	38	33	27	34	28
<b>Internal</b>	31	30	26	29	33	35	20	24	22	22	15	13
<b>Complete internal</b>	21	29	13	19	7	8	4	6	5	2	2	2
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%