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Psychosocial factors and multiple unhealthy behaviours in 25- to 64-year-old Belgian citizens

by

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Abstract

Background: *Correlations between lifestyles and health have been well-demonstrated. However, multiple unhealthy behaviour patterns and their determinants have been less studied. Do unhealthy behaviours occur independently, or do they exhibit clustering? What are the psychosocial, socioeconomic, and demographic determinants that may contribute to this clustering? How do multiple unhealthy behaviours relate to general health status?*

Aim: *The aim of the present study was to analyse the distribution of multiple unhealthy behaviours and their association with psychosocial factors and health status indicators in the 25- to 64-year-old Belgian population.*

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Method: *A secondary analysis of the 1997 Belgium Health Survey was performed. Associations between 5 selected unhealthy behaviours were analysed: smoking, heavy drinking, inactivity, non-use of a seat belt, and unhealthy diet. Psychosocial factors were derived from the data set. Confounding was controlled for socioeconomic status, sex, and age. Health status was assessed by self-rated health, functional health, and morbidity.*

Results: *The 5 selected unhealthy behaviours do not occur independently, but aggregate. Marital status, social network, self-efficacy (as assessed by proxy), employment status, and religion membership are all significantly associated with the clustering of unhealthy behaviours and unhealthy clusters are related to poor health status. Relationships between psychosocial factors, health-related behaviours, and health status are discussed.*

Conclusions: *Public health policies and interventions should acknowledge the aggregated pattern of unhealthy behaviours and the important links between multiple unhealthy behaviours and psychosocial factors.*

Keywords

Behaviours, psychosocial, health, cluster.

Introduction

Correlations between lifestyles and health have been extensively investigated and reported in the epidemiological literature. Cigarette smoking (1) and physical inactivity (2) have been consistently associated with coronary heart disease, as has been the heavy use of alcohol with stroke (2), the non-use of a seat belt with severe injuries (3), and more recently inadequate fruit and vegetable consumption with cancer (4) and cardiovascular disease (5). However, 2 important issues have been less frequently addressed in the literature concerning unhealthy lifestyle behaviours: the way they combine in individuals and the determinants of such combination.

Several pair-wise associations between behaviours have been reported. For example, inadequate seat belt use was shown to be associated with smoking, binge drinking, drug use, and inactivity (3, 6, 7). Physical inac-

tivity has been associated with smoking (8) as well as with a diet high in fat and poor in fruits and vegetables (9) and with the failure to wear a seat belt (9). The inter-relationships between smoking and alcohol drinking (10) and between smoking and diet (11, 12) are well-documented. However, specific associations between more than 2 risk behaviours have not been studied, although this is of crucial importance from an epidemiological point of view: the health risk related to some unhealthy lifestyle behaviours would be underestimated without consideration of the other associated unhealthy behaviours. It is also important to know how health behaviours may co-vary to develop preventive strategies appropriate for interrelated behaviors.

The determinants of several lifestyle behaviours have been investigated by various researchers. Among the most consistently reported findings was that the socioeconomic status (SES) was inversely related to unhealthy behaviours (13-15). Thus a prominent hypothesis is that the elevated mortality risk associated with low levels of income and education is primarily due to the higher prevalence of unhealthy behaviours among people who are poor and/or have low educational achievement (16). However, in recent years, several authors have proposed looking at a broader range of explanatory risk. Being unmarried or living alone (17-21), poor social support (22, 23), low self-efficacy (11, 24), unemployment (8, 16, 25), and low church attendance (17, 26, 27) were all shown to be significantly associated with some unhealthy lifestyle behaviours, perhaps through the underlying process of social isolation. But to our knowledge no studies showed whether these were specific determinants of multiple unhealthy behaviours. A better understanding of potential determinants of risk habits, especially of multiple risk habits, could be extremely valuable in designing and targeting preventive health policies.

The aim of the present study was to analyse the distribution of multiple unhealthy behaviours and their association with psychosocial factors and health status indicators in the 25- to 64-year-old Belgian population. Smoking, heavy drinking, inactivity, non-use of a seat belt, and unhealthy diet were 5 unhealthy behaviours well-addressed in the survey. These were investigated in this study because their detrimental effect on health has been well-documented in the scientific literature and because of the important proportion of the Belgian population they concern. Specifically, this study addressed 3 questions concerning health-related behaviours: Do unhealthy behaviours occur independently, or do they show clustering? What are the psychosocial, socioeconomic, and demographic factors that may contribute to this clustering? How do multiple unhealthy behaviours relate to general health status?

Materials and methods

Study population

This study constitutes a secondary analysis of data derived from the first Belgian nationwide cross-sectional survey, conducted in 1997 by the Scientific Institute of Public Health-Louis Pasteur (Brussels). The final sampling scheme of households and respondents used a combination of stratification, multistage sampling, and clustering. In order to ensure that the sample was geographically representative, the population was stratified at the regional and provincial levels. As such, Belgium was subdivided into 12 strata. Then, within each stratum, units were selected using a 3-step process: first the municipalities, second the housholds, and third individuals in the selected households. Of the 589 municipalities, 144 were selected. 7,967 households listed from the national register of population were selected through a non-self-weighting multi-stage sampling frame. 4,664 households (participation rate: 60.5%) participated in the survey, including 10,221 participants. The participation rate was lower when the head of household was an old person or a man (56%), or of a nationality other than Belgian (57%) (28). However, when compared to the National Census (29), the survey sample adequately represented the national population (Table 1).

Only participants over 15 years old were asked to complete the self-administered questionnaire (n = 8,564).

We restricted our analysis to participants aged 25 to 64 years (n = 5,651) as we intended to explore how the clustering of unhealthy behaviours was associated with a common group of factors, some of which were not applicable to the 15-24 years category (marital status, final level of education) (30) or the ≥ 65 years category (employment status).

Complete data on all variables were available on 80% of our study population (n = 4,394).

However, to be able to generalise our results, we re-tested the associations on all participants (except current students) without taking into account the employment status. Results obtained were similar.

Selected unhealthy behaviours

Data on health were gathered using 3 questionnaires: a self-administered health questionnaire, a face-to-face health questionnaire, and a

TABLE 1
Socio-demographic characteristics: comparison of the total survey population (N = 10221) to the National Belgian Population (29)

Socio-demographic characteristics	National Health Survey 1997 Proportion* (N = 10221)	National Census Belgium 1991 Proportion
Age (%)		
0-14 years	16.1	17.7
15-24 years	13.4	12.3
25-34 years	17.6	14.9
35-44 years	17.0	15.3
45-54 years	14.7	13.1
55-64 years	9.6	10.2
65-74 years	7.5	9.7
> 75 years	4.0	6.8
Sex (%)		
Female	50.0	48.9
Male	49.9	51.1
Nationality (%)		
Belgian	91.2	91.1
No Belgian	8.8	8.9
Civil status (%)		
Married/Cohabiting	55.4	47.8
Divorced	5.5	5.3
Widow	4.3	7.2
Single	34.8	39.6
Status in household (%)		
Head of household	41.5	41.0
Partner of head	26.8	22.4
Parent of head	1.6	0.5
Child of head	28.6	30.6
Other family relation	0.9	1.1
No relationship	0.4	3.0
Unknown	0.2	1.2

* Weighted proportion to take account of selection probability.

face-to-face household questionnaire. All the variables were self-reported. The self-administered questionnaire contained 147 questions about health habits, subjective health, well-being, social life, and knowledge and attitudes about health. The face-to-face health questionnaire investigated the presence of diseases and handicaps, as well as nutritional status and food consumption and the utilisation of health services. Copies of the questionnaires can be found at the following electronic address: http://www.iph.fgov.be/epidemio/epien/index000.htm. The questionnaires were conceived following the WHO recommendations (31, 32) on methods and instruments for health interview surveys.

We investigated 5 unhealthy behaviours. Each of them was considered in the analysis as a binary variable.

a. *Smoking status:* non-smoker vs. current smoker. Regular and occasional smokers were combined in the same category. Ex-smokers were included in the non-smoker category.

b. *Heavy drinking:* consumption of 6 alcoholic drinks or more a day less than once a month vs. at least once a month. This information was based on reported alcohol consumption during the 6 months preceding the survey.

c. *Inactivity:* practice of some physical activity weekly (from soft training < 4h/week to hard training > 4h/week) vs. practice of no physical activity weekly.

d. *Use of seat belt:* used always/sometimes vs. never used.

e. *Unhealthy diet:* more than 1 portion of fruit or vegetables daily vs. 1 or less than 1 portion of fruit or vegetables daily. This is a conservative measure, as the international recommendations are to eat at least 3 servings of vegetables and 2 servings of fruit daily (5). Fruit and vegetable consumption was assessed as part of a brief food frequency questionnaire included in the survey.

A summary variable was created to reflect the clustering of unhealthy behaviours. It was dichotomised as low (no more than 2 unhealthy behaviours reported) and high (3 to 5 unhealthy behaviours reported) and it was called *unhealthy cluster*. The underlying assumption is that people cumulating several unhealthy behaviours form a specific sub-population with an increased risk of diseases and a particular psychosocial profile in comparison with the rest of the population.

Potential determinants of clustering

We investigated 3 categories of determinants.

a. Psychosocial variables: 5 measures were used.

– Marital status (binary): married/cohabiting vs. unmarried/non-cohabiting (single, widower, divorced).

– Social support (binary): high social support vs. low social support. This indicator was built from 3 variables: appreciation of social relationships,

number of social relationships, and functional content of social relationships. Social support was considered high if all 3 variables were rated high and low if at least 1 of the variables was rated low.

– Self-efficacy (binary): high self-efficacy vs. low self-efficacy. Self-efficacy has repeatedly been a good predictor of health behaviour (24). In the absence of a specific measure of self-efficacy in the Health Survey, a proxy was built up from the answers to the following 6 questions derived from the General Health Questionnaire-12 (GHQ-12), a screening instrument used to assess mental health (33). "Recently felt playing a useful part in things?", "Recently been able to face up to one's problems?", "Recently felt capable of making decisions?", "Recently felt couldn't overcome one's difficulties?", "Recently been losing confidence in one's self?", and "Recently been thinking of one's self as a worthless person?". Self-efficacy was considered high if the answers to all 6 questions were high and low if the answer to at least 1 question was low.

– Unemployment status (binary): employed vs. unemployed.

– Religious affiliation (binary): religious affiliation vs. no religious affiliation. People were classified as not belonging to any religion if they reported themselves as unbelieving or liberal.

b. Socioeconomic variables: 2 SES measures were used.

– Education (4 categories): post-secondary, completed secondary, some secondary, primary school or less.

– Family income (3 categories): high (> 60,000 BEF), intermediate (30,000-60,000 BEF), low (< 30,000 BEF). Family income was defined using data on total household income divided by the number of inhabitants and was attributed to each member of the household. High and low categories fit approximately with upper and lower quintiles.

c. Demographic variables: 2 demographic variables were treated as potential confounders in all the analyses: age as a continuous variable and gender.

Health status

Health status was evaluated by 3 indicators:

a. *Subjective health* (binary): reasonable to very good vs. bad to very bad. Self-rated health has been shown to be a valid indicator of mortality (34, 35).

b. *SF 36 (Short Form 36) for physical activities* (binary): SF36 score > 75 vs. SF36 score ≤ 75. A score of 75 was the cut-off point for the lowest quartile. This health utilities index (functional status) is based on the answers to 10 questions about functional limitations. The highest score is 100 and means there are no functional limitations. The SF36 has been shown to be a useful tool for measuring health status (22, 36).

c. *Morbidity* (binary): low morbidity vs. high morbidity. This indicator is based on the answers (yes-no) to 23 questions concerning common health complaints such as back pain, frequent cough, or headache (the list of questions can be found at the electronic address mentioned above). Morbidity was considered low if 2 complaints or fewer were reported and high if more than 2 complaints were reported. A score of 2 complaints was the cut-off point for the lowest quartile of the distribution.

Statistical analysis

The statistical analysis was performed using the Stata 5.0 statistical package. Since the design of the Health Interview Survey followed a complex multistage probability sampling scheme, post-stratification weights were applied to take account of the non-self-weighting sampling frame (37). The final individual sampling weight was provided with the data set. Computations may be found in Annex 1 (28). Results were also adjusted to take account of the design effect (cluster at the household level). Preliminary analyses showed that design effect due to clusters at the municipality level was negligible (28).

All analyses were done using logistic regression modeling. Age (as a continuous variable) and sex were 2 variables entered in each statistical model because they are very likely to confound the associations of health behaviours with psychosocial factors and health status. Effect modifications by age and sex were tested using a likelihood ratio test for the entire collection of interactions term (38). For reasons explained above, the sampling weight and the design effect were also included in every regression model. Models for univariate analysis included only the dependent variable (unhealthy cluster) and the “exposure” variable. For multivariate analysis, all variables significantly ($p < 0.01$) associated with the dependent variable in the univariate analysis were included in the final model.

For the analysis of the association of an unhealthy cluster with health status, 3 sets of models were built up, each of them having as dependent

variable one indicator of the health status: self-rated health, functional health and morbidity. In each model, the association between unhealthy cluster and health status was adjusted for the confounding effect of the psychosocial variables. To determine which variable was to be kept in the final model, a stepwise backward procedure was used. Removal of variables was at $\alpha > 0.05$ for the likelihood ratio test.

The presence of multicollinearity and other numerical problems in regression analyses was appraised by verifying the presence of high estimated standard errors for the regression estimates (39).

Results

Description of the Sample Population

Table 1 presents the demographic characteristics of the sample compared with those of the general Belgian population according to the 1991 National Census. The sample adequately represents the general population overall. Participants in the age group 0-14 years are slightly under-represented due to the sampling design (a maximum of 4 people per household was selected including compulsorily the head of household and his/her partner). Participants aged over 65 years are under-represented as well, because their participation rate was lower than in other age groups (52.8% vs. 60.5%) (28). Men are slightly under-represented for the same reason. As the participation rate is related to the size of the household (40), married and cohabiting people are over-represented (55.4% vs 47.8%).

Description of the Study Population

Twenty per cent of the 25-64 years age group were excluded from the analysis because of some missing values in the variables of interest. Individuals who were excluded tended to be more sedentary, used their seat belts less often, and reported more religious attachment than people kept in the analysis. They were also less educated and had a lower family income. But overall, the differences were modest when comparing characteristics of the study population to those of the survey population (Table 2).

Table 2 presents which proportion of the study population reported single unhealthy behaviours. Among the 4,394 participants, more than

TABLE 2
*Description of participants and comparison of subjects included to those excluded from analysis because of some missing values**

Variables		Survey Population (25-64 years)	Study Population	Excluded from analysis	p value
All variables	(%)	100.0	80.0	20.0	
	Basis	*5651*	*4394*	*1257*	
Smoking					
	No (%)	67.3	67.0	68.6	
	Yes (%)	32.7	33.0	31.4	p = 0.47
	Basis	*5471*	*4394*	*1077*	
Heavy drinking					
	No (%)	80.2	79.9	82.0	
	Yes (%)	19.8	20.1	18.0	p = 0.27
	Basis	*5395*	*4394*	*1001*	
Sedentarity					
	No (%)	68.8	70.0	61.5	
	Yes (%)	31.2	30.0	28.5	p = 0.001
	Basis	*5227*	*4394*	*833*	
Never use seat belt					
	No (%)	92.3	92.7	89.9	
	Yes (%)	7.7	7.3	10.1	p = 0.039
	Basis	*5394*	*4394*	*1000*	
Unhealthy diet					
	No (%)	45.0	44.4	47.3	
	Yes (%)	55.0	55.6	52.7	p = 0.25
	Basis	*5606*	*4394*	*1212*	
Reporting ≥ 3 unhealthy beh.	No (%)	81.7	82.0	80.0	
	Yes (%)	18.3	18.0	20.0	p = 0.45
	Basis	*4990*	*4394*	*556*	
Living alone					
	No (%)	89.2	88.9	90.3	
	Yes (%)	10.8	11.1	9.7	p = 0.23
	Basis	*5651*	*4394*	*1257*	
Unmarried					
	No (%)	77.5	78.4	74.0	
	Yes (%)	22.5	21.6	26.0	p = 0.014
	Basis	*5651*	*4394*	*1257*	
Social support					
	High (%)	77.1	77.1	77.1	
	Low (%)	22.9	22.9	22.9	p = 0.98
	Basis	*5439*	*4394*	*1045*	
Self efficacy					
	High (%)	77.8	78.0	76.6	
	Low (%)	22.2	22.0	23.4	p = 0.46
	Basis	*5444*	*4394*	*1050*	
Unemployed					
	No (%)	91.7	91.4	92.7	
	Yes (%)	8.3	8.6	7.3	p = 0.24
	Basis	*5540*	*4394*	*1146*	

TABLE 2 (Continued)
*Description of participants and comparison of subjects included to those excluded from analysis because of some missing values**

Variables	Survey Population (25-64 years)	Study Population	Excluded from analysis	p value
Religion				
Yes (%)	72.5	71.7	78.0	
No (%)	27.5	28.3	22.0	p = 0.001
Basis	*5192*	*4394*	*798*	
Education				
Post-secondary (%)	37.7	38.5	34.7	
Complet. secondary (%)	34.3	34.9	31.6	
Some secondary (%)	17.1	17.3	16.0	
Primary or less (%)	10.9	9.2	17.7	p < 0.001
Basis	*5614*	*4394*	*1220*	
Family Income				
High (%)	16.3	16.6	14.8	
Middle (%)	60.4	61.5	54.4	
Low (%)	23.4	21.9	30.8	p = 0.001
Basis	*5400*	*4394*	*1006*	
Sex				
Female (%)	48.5	48.6	48.2	
Male (%)	51.5	51.4	51.8	p = 0.87
Basis	*5651*	*4394*	*1257*	
Age				
25-34 (%)	29.9	29.7	30.6	
35-44 (%)	28.9	28.8	29.4	
45-54 (%)	24.9	25.1	24.1	
55-64 (%)	16.3	16.4	15.9	p = 0.57
Basis	*5651*	*4394*	*1257*	

* Weighted proportion adjusted for design effect.

half reported an unhealthy diet, one-third smoked, and 1 in 5 were heavy drinkers.

The descriptive analysis of the independent variables indicates that more than 1 in 5 respondents had low social support or expressed a feeling of poor self-efficacy. 8.6% were unemployed. One in 5 participants rated his or her health as being bad to very bad. The mean age of the participants was 42.1 years (95% confidence interval (CI): 41.7; 42.6) and 51.4% of them were male.

Clustering of unhealthy behaviours

16.7% of the participants reported 3 or more unhealthy behaviours, 20.9% reported none, and only 0.5% reported all 5. Table 3a shows how the unhealthy behaviours are distributed: smoking with heavy drinking and unhealthy diet, and smoking with inactivity and unhealthy diet are the 2 most prevalent combinations among people reporting 3 unhealthy behaviours or more.

TABLE 3a
Distribution and frequencies of the various combinations of unhealthy behaviours (N = 4394)*

	Diet	Sedentar	Smoking	Heavy drinking	Seat belt	Frequency by type of combination (%)	Cumulative Frequency by level of cluster (%)
Cluster 0	–	–	–	–	–	20.9	20.9
Cluster 1	+	–	–	–	–	18.7	35.7
	–	+	–	–	–	9.2	
	–	–	+	–	–	4.5	
	–	–	–	+	–	2.6	
	–	–	–	–	+	0.6	
Cluster 2	+	+	–	–	–	9.4	26.7
	+	–	+	–	–	7.1	
	+	–	–	+	–	3.3	
	+	–	–	–	+	1.0	
	–	+	+	–	–	2.4	
	–	+	–	+	–	0.8	
	–	+	–	–	+	0.7	
	–	–	+	+	–	1.5	
	–	–	+	–	+	0.3	
	–	–	–	+	+	0.2	
Cluster 3	+	+	+	–	–	5.1	12.8
	+	+	–	+	–	1.2	
	+	+	–	–	+	0.9	
	+	–	+	+	–	3.4	
	+	–	+	–	+	0.8	
	+	–	–	+	+	0.3	
	–	+	+	+	–	0.6	
	–	+	+	–	+	0.3	
	–	+	–	+	+	0.1	
	–	–	+	+	+	0.1	
Cluster 4	+	+	+	+	–	1.8	3.4
	+	+	+	–	+	0.8	
	+	+	–	+	+	0.1	
	+	–	+	+	+	0.6	
	–	+	+	+	+	0.1	
Cluster 5	+	+	+	+	+	0.5	0.5

* Weighted frequencies adjusted for design effect.

TABLE 3b
Odds radios for the likelihood of the association between unhealthy behaviours, adjusted for age and sex (N = 4394)*

Unhealthy Behaviours	Sedentarity	Smoking	Heavy drinking	No seat belt
Diet	1.46 (1.21; 1.75)	1.77 (1.48; 2.12)	1.42 (1.15; 1.75)**	1.71 (1.21; 2.41)***
Sedentarity		1.95 (1.62; 2.35)	1.12 (NS)	2.16 (1.59; 2.91)
Smoking			2.33 (1.90; 2.88)	2.77 (2.05; 3.76)
Drinking				1.81 (1.30; 2.51)

* Weighted odds ratios adjusted for design effect.
** p = 0.001, *** p = 0.002, all other associations with p < 0.001.

All but 1 of the studied unhealthy behaviours are significantly associated with the others considered one by one (Table 3b). The pair-wise association is particularly strong between smoking and heavy drinking, smoking and seat belt use, and inactivity and seat belt use. Heavy drinking is not significantly associated with inactivity.

The probability of reporting 1 of the unhealthy behaviours is associated with the presence of others and this probability increases with the number of unhealthy behaviours reported (Table 4). For the increase of 1 joint unhealthy behaviour the probability of smoking increases by 97% (95% CI: 1.78; 2.17), that of heavy drinking by 51%, that of inactivity by 31%, that of not using a seat belt by 83% and that of unhealthy diet by 49%. Thus each unhealthy behaviour is a significant risk factor for an additional one and this risk increases with the number of additional unhealthy behaviours considered. Clearly, unhealthy behaviours tend to cluster.

Potential determinants of clustering

The dependent variable in the subsequent regression models described *is unhealthy cluster* (low = 0 to 2 unhealthy behaviours vs. high = 3 to 5 unhealthy behaviours).

People with unhealthy clusters tend to aggregate within households (r = 0.40, SD = 0.002).

The univariate analysis shows that being unmarried, having poor social support, expressing poor self-efficacy, being unemployed, and not belonging to any religion were all factors very significantly associated with the presence of multiple unhealthy behaviours. Low educational achievement and low family income were also highly related to the presence of unhealthy clusters. Being male was also a significantly related factor (OR = 2.26).

TABLE 4

Odds ratios for the likelihood of 0, 1, 2, 3 or 4 additional unhealthy behaviors by single unhealthy behaviours, adjusted for age and sex (N = 4394)*

Unhealthy behaviour	Number of additional unhealthy behaviours OR (95% CI)						
	+0	+1	+2	+3	+4	Overall	P-value for trend
Smoking	1	1.91 (1.51; 2.41)	3.66 (2.84; 4.71)	8.50 (5.98; 12.07)	11.48 (3.95; 33.36)	**1.97** (1.78; 2.17)	p < 0.001
Alcohol	1	1.54 (1.14; 2.08)	2.33 (1.71; 3.18)	3.56 (2.48; 5.10)	4.49 (2.27; 8.88)	**1.51** (1.36; 1.67)	p < 0.001
Sedentarity	1	1.34 (1.07; 1.67)	1.80 (1.39; 2.32)	2.27 (1.65; 3.12)	2.35 (1.25; 4.41)	**1.31** (1.20; 1.43)	p < 0.001
No seat belt	1	2.12 (1.10; 4.08)	3.81 (1.99; 7.29)	7.51 (3.84; 14.70)	10.15 (4.63; 22.27)	**1.83** (1.60; 2.11)	p < 0.001
Unhealthy diet	1	1.47 (1.22; 1.77)	2.10 (1.67; 2.63)	3.53 (2.27; 5.49)	7.59 (2.79; 20.65)	**1.49** (1.36; 1.63)	p < 0.001

* Weighted odds ratio adjusted for design effect.

After adjusting for socioeconomic factors, sex, and age, all the previous associations remained significant except for the association with family income. In the final model (including all variables), not being married (OR = 1.61), expressing poor self-efficacy (OR = 1.67), being unemployed (OR = 1.82), not belonging to any religion (OR = 1.55), having a low educational level ($p < 0.001$), and being male (OR = 2.40) remained significantly associated with the presence of 3 or more unhealthy behaviours (Table 5). No effect modification by sex or age was detected.

Association between unhealthy clustering and health status

We used self-rated health, functional health status, and morbidity as measurements of health status. The presence of at least 3 unhealthy behaviours was associated with low subjective health (OR = 1.57, 95% CI: 1.18; 2.08) after adjusting for social support, self-efficacy, educational achievement, family income, sex, and age (Table 6). Concurrently, educational achievement and family income, as well as social support and self-efficacy, were strong independent determinants of self-rated health, even when adjusting for unhealthy behaviours.

The presence of an unhealthy cluster was also a significant risk factor for poor functional health status (OR = 2.67) and high morbidity (OR = 1.73). Low social support (for high morbidity only) and low self-efficacy were significantly related to these 2 health indicators.

Discussion

Our results suggest that the 5 selected unhealthy lifestyle behaviours do not occur independently but that they tend to aggregate in the adult population of Belgium. The probability of reporting 1 particular unhealthy behaviour increases linearly with the number of other unhealthy behaviours reported. This is consistent with other studies (8, 13), although it is the first time to our knowledge that probabilities have been computed for more than 2 unhealthy behaviours at a time. Actually, the clustering of unhealthy behaviours ranges beyond the variables studied. For instance, having 3 or more unhealthy behaviours is also a significant risk factor for using sleeping pills or tranquilizers, for inadequate knowledge on HIV transmission/contamination routes, or for inadequate breast cancer screening (analysis not reported here) (41). However, it is notable that unhealthy behaviour patterns are mixed in the population: only 20.9% of

TABLE 5

Odds ratios for the likelihood of "unhealthy" clusters by psychosocial determinants (N = 4394)*

Socio-economic variable	Unhealthy Cluster		Unadjusted		Adjusted for socioecono. & demo.		Adjusted for all variables	
	Low (0-2) (%)	High (3-5) (%)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
All variables	82.0	18.0						
Marital status			p < 0.001		p < 0.001		p < 0.001	
Married/Cohab.	80.5	68.9	1.00		1.00		1.00	
No married/Cohab.	19.5	31.1	1.94	(1.54; 2.44)	1.84	(1.45; 2.34)	1.61	(1.27; 2.04)
Social support			p = 0.002		p = 0.015		p = 0.13	
High	78.5	70.9	1.00		1.00		1.00	
Low	21.5	29.1	1.50	(1.17; 1.92)	1.39	(1.07; 1.81)	1.24	(0.94; 1.64)
Self efficacy			p < 0.001		p < 0.001		p < 0.001	
High	80.0	69.2	1.00		1.00		1.00	
Low	20.0	30.8	1.77	(1.39; 2.25)	1.89	(1.46; 2.41)	1.67	(1.29; 2.17)
Unemployed			p < 0.001		p < 0.001		p < 0.001	
No	92.8	85.0	1.00		1.00		1.00	
Yes	7.8	15.0	1.72	(1.37; 2.18)	2.04	(1.48; 2.80)	1.82	(1.31; 2.51)
Religion			p < 0.001		p < 0.001		p < 0.001	
Yes	73.8	62.0	1.00		1.00		1.00	
No	26.2	38.0	2.27	(1.68; 3.07)	1.66	(1.30; 2.11)	1.55	(1.21; 1.99)
Education**			p < 0.001		p < 0.001		p < 0.001	
Post-secondary	41.0	27.3	1.00		1.00		1.00	
Complet. secondary	34.3	37.8	1.66	(1.27; 2.16)	1.61	(1.20; 2.17)	1.63	(1.21; 2.20)
Some secondary	15.8	24.2	2.31	(1.70; 3.13)	2.42	(1.71; 3.44)	2.34	(1,64; 3.33)
Primary or less	8.9	10.7	1.80	(1.23; 2.65)	1.92	(1.22; 3.03)	1.82	(1.16; 2.85)
Family Income**			p = 0.005		p = 0.26		p = 0.24	
High	17.8	11.0	1.00		1		1	
Intermediate	61.1	63.2	1.68	(1.15; 2.46)	1.38	(0.91; 2.10)	1.41	(0.93; 2.12)
Low	21.1	25.8	1.99	(1.32; 3.00)	149	(0.91; 2.43)	1.30	(0.80; 2.12)
Sex			p < 0.001		p < 0.001		p < 0.001	
Female	52.1	32.5	1.00		1.00		1.00	
Male	47.9	67.5	2.26	(1.84; 2.77)	2.37	(1.93; 2.90)	2.40	(1.95; 2.96)

* Weighted odds ratio adjusted for design effect.

** Overall p-value for all the levels of the variables.

TABLE 6

Odds ratios for the likelihood of poor self-rated "subjective health", low "SF36 score" and "morbidity" by "cluster of unhealthy behaviours", with adjustement for socio-economic variables, age and sex (backward procedure)*

Behavioural and socio-economic determinants		**Subjective health** (very bad/ reasonable vs good/very good)		**Functional health** (SF 36 low vs SF 36 high)		**Morbidity** (≤ 2 vs > 2 health complaints)	
N = 4394		OR	95% CI	OR	95% CI	OR	95% CI
Unhealthy Behaviours		p = 0.002		p < 0.001		p < 0.001	
(≥ 3 UB)	No	1		1		1	
	Yes	1.57	(1.18; 2.08)	2.67	(1.73; 4.12)	1.73	(1.35; 3.21)
Social support		p = 0.003		p = 0.18		p = 0.02	
	High	1		1		1	
	Low	1.48	(1.14; 1.92)	1.33	(0.87; 2.03)	1.41	(1.06; 1.87)
Self efficacy		p < 0.001		p < 0.001		p < 0.001	
	High	1		1		1	
	Low	3.40	(2.67; 4.33)	2.29	(1.60; 3.28)	3.95	(2.83; 5.51)
Education		p < 0.001		p < 0.001			
	Post-secondary	1		1			
	Complet. secondary	1.12	(0.81; 1.55)	1.38	(0.88; 2.16)	–	–
	Some secondary	1.71	(1.19; 2.45)	2.06	(1.30; 3.27)	–	–
	Primary or less	2.10	(1.33; 3.31)	4.38	(2.50; 7.67)	–	–
Family Income		p < 0.001				p = 0.08	
	High	1		–	–	1	
	Middle	2.02	(1.30; 3.13)	–	–	1.42	(1.04; 1.95)
	Low	2.66	(1.64; 4.30)	–	–	1.43	(0.99; 2.06)
Sex		p < 0.001		p < 0.001		p < 0.001	
	Female	1		1		1	
	Male	0.64	(0.51; 0.81)	1.07	(1.05; 1.09)	0.56	(0.45;0.67)

* Weighted odds ratio adjusted for design effect.

the participants reported none, while 0.5% reported all 5. Clearly, the population cannot be dichotomized as "healthy" people on the one hand, and "risky" people on the other. Rather, the vast majority of people fall between these 2 extremes, showing that even if unhealthy behaviours statistically tend to aggregate, the bigger the aggregate, the smaller the group of people concerned. But still, 16,7% of the respondents reported at least 3 unhealthy behaviours. This finding is important from an epidemiological point of view as it shows that in some individuals the health risk related to an unhealthy behaviour will be increased because of the aggregated pattern of unhealthy behaviours. It might have important programmatic implications in the health promotion field too: health campaigns taking into account this aggregated pattern could be more adequate than interventions targetting one specific behaviour.

Marital status, social network, self-efficacy, employment status, and membership in a religion are all significantly associated with clustering of unhealthy behaviours. This remains true after adjustment for SES, gender, and age (except for social network). With regard to one's perception of a network, the measure of satisfaction with its size was the strongest predictor of unhealthy clusters (26, 42). Analysed on their own, the number of social relationships and their functional content failed to show a significant association with unhealthy clusters (analysis not reported here).

There is also a familial component leading to clustered unhealthy behaviours (43). This very strong convergence of psychosocial factors emphasizes the importance of social environment in determining health-related behaviours (21).

Regarding SES predictors of clustering, the most important factor appears to be educational achievement (44, 45). However, this effect is not linear (likelihood test for departure from linearity, $p = 0.0004$), as people in the lowest category show a risk of an unhealthy cluster similar to those who completed secondary school (46). The effect of family income status on unhealthy behaviours disappeared after adjustment for educational level (table5). This is in agreement with other studies (30, 47) although there is no clear consensus on that point in the literature (4, 7). Education can be considered a fairly accurate and more stable indicator over one's lifetime than income, as income is considered a more sensitive issue and thus more prone to information bias (30, 47). Moreover, in this study family income was estimated with a single question and this could have led to some inaccuracy in the indicator.

Gender is also a strong predictor of unhealthy behaviours. This is consistent with other studies (22, 21). No interactions were detected between sex and the other determinants considered.

The analysis of the association with health status shows that unhealthy clusters are significantly related to poor self-rated health, a low health utilities index, and high morbidity. But social support (for subjective health and morbidity), self-efficacy, educational achievement (for subjective and functional health), and family income status (for subjective health) are also significantly associated with health status. These results suggest 2 important considerations. First, feeling one's health is poor does not appear to be a key element in leading one to modify his health behaviours (48), although the data here do not allow a causal interpretation. This somehow underlines indirectly the importance of factors external to individuals in the process of health-related choices. Second, the psychosocial environment seems to be related to the health status both directly (table 6) and through its influence on the behavioural determinants of health (table 5). In fact, there is no general consensus in the literature on how psychosocial factors affect health. The 3 main hypotheses are the following: a direct effect of social environment on health (49, 50), the well-known "buffer hypothesis", which assumes that people who have a high level of social support are protected from the adverse effects of stress (43), and an effect mediated through unhealthy behaviours (23). The present study tends to show that behavioural habits are certainly relevant to health, but so is the social environment in which they are imbedded. However, the relationship with stress was not considered here.

All the above-mentioned associations are statistically significant with a high degree of confidence. It can be inferred that the associations would be even stronger if people with multiple unhealthy behaviours were compared to the group reporting no unhealthy behaviour, although the objective of the study was not to compare extremes but to describe how people with unhealthy clusters differ from the rest of the population.

Thus it is not likely that these associations occurred by chance. Most of the frequently reported confounding factors were integrated into the final model. However, residual confounding remains possible as additional determinants not studied here could partly explain the variability of clustering of unhealthy behaviours among individuals. For instance, health beliefs, health value, locus of control, social control, and stress are factors which have been cited as potential determinants of unhealthy behaviours, but have not been investigated much in large epidemiological studies (24, 48, 51).

There are some limitations to our study. First, there could have been some selection bias due to non-participation in the survey or to exclusion at the analysis stage because of missing values. People who were unmarried, had low educational achievement, fell in the low-income category,

were sedentary, and never used a seat belt were under-represented in our study population. As participants in these categories were more likely than the others to report multiple unhealthy behaviours, it is possible that the strength of the associations analysed was underestimated. This does not contradict our conclusions, however.

Second, the findings of our study are limited by the fact that they represent self-reported, and hence unverified, data. But the literature on the accuracy of self-reported health behaviours suggests that, although most people honestly report behaviours that are not illegal, the biases that do exist are in the direction of underreporting negative health behaviours (3, 52). Thus, the result of bias in the reporting of health behaviours would likely be an underestimation of their determinants and of their effects. However, there could be a differential information bias if there are systematic differences in reporting among categories of participants. For instance, a systematic difference in the interpretation of what constitutes a serving of fruit or vegetables could have occurred across the SES groups (15), or social desirability could have led participants in upper socioeconomic categories or women to underreport their unhealthy behaviours. Another possible limitation of such a study is related to the necessary use of standardized indicators to understand some very personal items. The understanding of what good health is may vary a lot among social classes, for instance. Ideally, a large-scale study on health-compromising behaviours such as the present one should be followed by a smaller in-depth study of these behaviours and their determinants.

Third, the study used secondary analysis of existing data. This has clear advantages both economically and methodologically, allowing the examination of a large data set to answer pertinent questions regarding a broad-based population. However, the scope of the study is limited to items that were included in the original instrument. For instance, existing tools developed to measure social support or self-efficacy were not available in the Health Survey (24, 48). Thus the validity of some of the indicators we derived from these items might not be fully guaranteed. This could have resulted in some measurement bias. However, there is no general consensus in the literature on the specific indicators to be used (42, 51, 53). On the other hand, as our findings are consistent with those of other studies, it is less likely that this type of bias occurred.

Another important limitation comes from the cross-sectional design of our study. It cannot provide evidence of a causal relationship between SES/psychosocial variables and unhealthy behaviours. For instance, it could be argued that multiple risk behaviours lead to a poor social network or to unemployment and not the opposite (17).

Finally, as the sample consisted of persons aged 25 to 64 years, the generalisability of our findings is limited to this age group. However, the analysis performed on the whole sample without considering employment status gave similar results.

Conclusions and recommendations

This study illustrates 2 major points concerning selected unhealthy behaviours in the Belgian 25- to 64-year-old population. First, the clustering of different health practices has implications for health promotion and disease intervention programs. Health education models of intervention and treatment should employ a multifactorial, integrated approach directed at co-varying behaviours, rather than trying to modify or promote one behaviour at a time (41, 54). Second, the study demonstrates that health behaviours are not only a matter of personal choice but are also linked to educational achievement, gender, marital status, social support, self-efficacy, employment status, and religion involvement.

The analysis of health status also suggests that both health behaviours and socioeconomic factors are strongly associated with health status. Thus the problem of lifestyle and health is not just one of inadequate education or income, and the problem of socioeconomic differentials in health is not just a problem of lifestyle choices (13, 55). Public health policies and interventions should acknowledge the aggregated pattern of unhealthy behaviours and the importance of its psychosocial determinants.

Further studies are needed for a better understanding of the mechanisms by which psychosocial factors affect health and health-related behaviours. Prospective studies integrating a genuine societal approach should be designed to assess temporality and dynamics of psychosocial determinants (48). Community intervention studies (e.g., visits by social assistants) could also be very useful to assess the effectiveness of public health actions, integrating the psychosocial components of health and health-related behaviours.

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Résumé

Introduction: La corrélation entre styles de vie et état de santé a été bien démontrée. Cependant les comportements à risque multiples et leurs déterminants ont été moins étudiés. Les comportements à risque sont-ils indépendants les uns des autres, ou ont-ils tendance à être associés? Quels sont les facteurs psychosociaux, socioéconomiques et démographiques qui pourraient expliquer cette association? Les comportements à risque multiples influent-ils sur l'état général de santé?

Objectif: Le but de cette étude était d'analyser la distribution des comportements à risque multiples, ainsi que leur association avec des déterminants psychosociaux et des indicateurs de l'état de santé, dans la population belge âgée de 25 à 64 ans.

Méthode: Une analyse secondaire des données de l'Enquête de Santé Belge, 1997, a été réalisée. L'association entre 5 comportements à risque a été analysée: consommation de tabac, abus d'alcool, inactivité physique, non utilisation de la ceinture de sécurité, alimentation non équilibrée. Les facteurs psychosociaux ont été dérivés à partir de la base de données. L'analyse tenait compte de l'effet confondant du statut socioéconomique, du sexe et de l'âge. L'état de santé était évalué par la perception subjective de la santé, les limitations fonctionnelles, et la morbidité.

Résultats: Les 5 comportements à risque considérés ne surviennent pas indépendamment mais tendent à être associés entre eux. Le statut marital, le réseau social, le sentiment de pouvoir influer sur sa propre vie *(self-efficacy)*, le fait d'avoir un emploi et l'appartenance à une religion sont autant de facteurs psychosociaux associés de façon significative avec la présence de plusieurs comportements à risque. Les comportements à risque multiples sont associés à un état de santé défavorable. La discussion porte sur le lien entre facteurs psychosociaux, modes de vie et état de santé.

Conclusions: Les politiques de santé publique, ainsi que les programmes d'intervention, devraient tenir compte du regroupement des conduites à risque, et des liens importants entre ce type de profil comportemental et les facteurs psychosociaux.

Samenvatting

Inleiding: De correlatie tussen levensstijl en gezondheidstoestand is goed aangetoond. Toch werden vele risicogedragingen en hun determinanten weinig bestudeerd. Doen risicogedragingen zich onafhankelijk voor of hebben ze de neiging om in groepjes voor te komen? Welke zijn de psychosociale, de socio-economische en de demografische elementen die deze associatie kunnen verklaren? Beïnvloeden de vele risicogedragingen de algemene gezondheidstoestand?

Doel: Het doel van de huidige studie was zowel de verdeling van de vele risicogedragingen als hun associatie met psychosociale elementen en indicatoren van gezondheidstoestand, binnen de Belgische bevolking tussen 25 en 64 jaar oud, te analyseren.

Methode: De gegevens van de Enquête van de Belgische Gezondheid van 1997 werden opnieuw geanalyseerd. De associatie tussen 5 risicogedragingen werd geanalyseerd: roken, alcoholmisbruik, gebrek aan lichaamsbeweging, geen gebruikmaking van de veiligheidsgordel, onevenwichtig samengestelde voeding. De psychosociale elementen werden uit basisgegevens afgeleid. De analyse hield rekening met socio-economische status, geslacht en leeftijd alsco-factoren. De gezondheidstoestand werd geëvalueerd door een subjectieve gezondheidswaarneming, functionele beperkingen, en morbiditeit.

Resultaten: De 5 geselecteerde risicogedragingen komen niet onafhankelijk voor, maar verenigen zich. De huwelijkstoestand, het sociale netwerk, het gevoel van in controle te zijn over zijn eigen leven „self-efficacy", het feit van een job te hebben, en het behoren tot een godsdienst zijn psychosociale elementen die op significante wijze verenigd zijn met de aanwezigheid van de verscheidene risicogedragingen. De aanwezigheid van meerdere risicogedragingen verhogen de kans op ongunstige gezondheidstoestand. De band tussen de psychosociale factoren, de levensstijl en de gezondheidstoestand staat ter discussie.

Conclusie: Zowel het volksgezondheidsbeleid als interventieprogramma's moeten rekening houden met de het feit dat risicofactoren gegroepeerd voorkomen en met de observatie dat er belangrijke banden zijn met het gedragsprofiel en psychosociale factoren.

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Annex 1

A stratum (p, a, s, h, q) is defined as a combination of the levels of the following variables:

- Province p = 1, ..., 12,
- Age a = 1, ..., 8,
- Sex s = 1, 2
- Household size h = 1, ..., 4,
- Quarter (in which the interview took place) q = 1, 2, 3, 4.

Every sampled subject in stratum (p, a, s, h, q) has weight:

$$W_{i,fin} = W_i\ (N_{pas}\ (N_{ph}/N_p)\ 0.25)/n_{pashq}{}^{e})$$

where

W_i = individual weight within the household. Is always = 1 for the reference for the head of household and his/her partner
N_{pas} = the population size of province *p*, with age *a* and sex *s*
N_{ph} = the population size of province p, living in a household of size h
N_p = the population size of province p
$n_{pashq}{}^{e}$ = the number of information entities in stratum (p, a, s, h, q)

This weighting scheme reflects the following design aspects:

– disproportional stratification at the regional level
– proportional stratification over provinces
– the oversampling of the German community
– spread in time

Furthermore, the weights take into account post-stratification for the age, sex, and household size.