Health Behav & Pub Health 2013 3(2): 6-19

Health Behaviour & Public Health

www.academyjournals.net

ISSN 2146 9334

Original Article

Risk Health Behavior Patterns in Germany. Results from the GEDA 2009 Survey

Elena VON DER LIPPE[1], Stephan MÜTERS[1], Panagiotis KAMTSIURIS[2]

[1] *Section "Health Interview Surveys and European Cooperation", Department "Epidemiology and Health Monitoring", Robert Koch Institute, Berlin, Germany*

[2] *Section "Health Examination Surveys and Cohort Studies", Department "Epidemiology and Health Monitoring", Robert Koch Institute, Berlin, Germany*

Received: 26.04.2012 ***Accepted: 16.10.2013*** ***Published: 07.12.2013***

Abstract

Objective: Lifestyle-related risks are known to have a strong impact on health. Health outcomes also depend on many other factors, such as environmental pollution and the use of public health services, but another very important factor is lifestyle. In our study we investigate people's health-risk behavior and distinguish between possible behavior patterns in the German population. For our study we make a selection of four human behavior risks and take into account the daily consumption of fruit or vegetables, sporting activity, smoking and risky alcohol consumption.

Data and Methods: The empirical analysis is based on the data from the German Health Update 2009. Our analysis is carried out in two stages. At first we use hierarchical cluster analysis to define the different patterns of health-risk behavior in the German population. At the second stage we use a logistic regression model to determine the factors that most influence the individual's behavior, using the already defined clusters of risk-health behavior.

Results: Five main groups of health-risk behavior are defined with the help of the cluster analysis. Our results showed that individual health-behavior patterns are influenced by many demographic factors, but also by people's state of health and by social factors. People's health-related behavior is driven to a large extend by their state of health – the healthier they feel, the riskier the behavior they tend to adopt. Good state of health and a young age, together with gender are important preconditions for risky health-related behaviors.

Conclusions: Certainly, the health-related behavior is a part of the dynamic and interactive processes of daily living. The changes in a person's individual health-related behavior in the course if his or her life involves looking back over previous experience and anticipating future experience, often in terms of stereotypical realities. The aim of the health preventive programs should be to achieve a high level of health awareness and consciousness among young population and to reduce gender differences in health.

Keywords: cluster analysis, health-related behavior, German health update, risk behavior determinants

Corresponding author: Elena von der Lippe, e-mail: E.vonderLippe@rki.de, phone: +4930187543425, fax: +4930187543513

INTRODUCTION

Lifestyle-related risks are known to have a strong impact on health. Material living conditions and individual behavior patterns can have positive or negative effects on human health (Kistemann and Meyer 2007; Mielck 2000). It is believed that the incidence of chronic diseases can be reduced by leading a healthier life (Kim et al. 2004; Shikany and White Jr 2000). Health outcomes also depend on many other factors, such as environmental pollution and the use of public health services, but another very important factor is lifestyle (Kistemann and Meyer 2007). Cockerham et al. (1997) define health lifestyle as "collective patterns of health-related behavior based on choices from options available to people according to their life chances." The term 'health-related behavior' is defined by many authors. In the Handbook of Health Behavior Research (1997) it is defined as "behavior patterns, actions and habits that relate to health maintenance, to health restoration and to health improvement" (vol. 1, p. 3). When describing health-related

behaviors it is common to distinguish between health-enhancing behaviors and health-impairing behaviors. Health-impairing behaviors have harmful effects on health or otherwise predispose individuals to disease. By contrast, health-enhancing behaviors convey health benefits and protect individuals from disease in other ways.

Public health policies aim at preventing rather than treating diseases. Identifying health-risk behaviors and their relation to a person's state of health is an important step in prevention. Population-based strategies aim to make healthy behavior a social norm, thus lowering risk in the population as a whole. Small shifts in certain risks in the population can translate into major public health benefits (WHO 2002).

In our study we investigate people's health-risk behavior and distinguish between possible behavior patterns in the German population. The research concentrates on investigating patterns and determinants of people's health-related behavior, not their health lifestyle. With the help of exploratory cluster analysis we aggregate individual health-related behaviors in order to identify distinctive behavior patterns. We then examine the respondents' demographic and health features and discuss the possible reasons for the different behavior patterns.

BACKGROUND

Although there are a relatively large number of studies dealing with different aspects of health-risk behaviors, there are no established criteria or definitions on which behaviors should be taken into account when talking about health-risk behaviors. Most existing studies use different measures relating to diet, physical activity, alcohol, smoking and obesity. McCracken et al. (2007) investigate for the US population risk behaviors such as poor eating (fruit and vegetables fewer than five times per day), being physically inactive and smoking. In a study comparing European trends, van der Wilk and Jansen (2005) investigate lifestyle-related risks constructed on the basis of the variables for smoking, alcohol consumption, physical activity, obesity and food consumption. Schneider et al. (2009) use four different measures to identify health-behavior patterns by cluster analysis for the population aged between 50 and 70 in the German federal state of Baden-Württemberg. They also use measures of regular tobacco use, excessive alcohol consumption, unhealthy diet and physical inactivity. Karvonen et al. (2000) study the patterns of health-related behavior among young people in Finland and Switzerland. They use the main 'intake' behaviors – eating, drinking and smoking – as measures of health-related behaviors. They also use cluster analysis and define three patterns – healthy, unhealthy and mixed.

A lifestyle index is constructed most often in the existing studies on risk-health behavior. However, there is no standard index, as researchers usually use different approaches. Kim et al. (2004) have constructed a lifestyle index relating to four major lifestyle factors. They integrate a composite measure of diet quality and an individual component index of physical activity, smoking and alcohol consumption. A study conducted by Kirkegaard et al. (2010) investigates the influence of a healthy lifestyle index on the risk of colorectal cancer. The authors use a lifestyle index based on physical activity, waist circumference, smoking, alcohol intake and diet. Similarly, in a study investigating the connection between education and lifestyle (Drieskens et al. 2010), the authors construct a lifestyle index from dichotomous variables for smoking, high-risk alcohol use, physical activity and a healthy diet. Another study dealing with healthy behaviors and cardiometabolic risk (Kwaśniewska et al. 2010) constructs a lifestyle index based on four elements: non-smoking, healthy weight, adequate fruit and vegetable consumption and a satisfactory level of leisure-time physical activity.

For our study we make a selection of four human behavior risks and take into account the daily consumption of fruit or vegetables, sporting activity, smoking and risky alcohol consumption.

The choice of health-risk behaviors is consistent with previous research and is known to have a strong impact on the health outcomes of individuals. Unhealthy practices like smoking tobacco, high-fat diets, excessive alcohol consumption, lack of exercise, and similar negative health habits are underlying causal factors for many chronic diseases (Cockerham 2007).

WHO (2002) reports that *low fruit and vegetable intake* is estimated to cause about 19% of gastrointestinal cancer, approx. 31% of ischemic heart disease and 11% of strokes worldwide. The data for Germany shows that about 72% of women and only 53% of men in Germany consume fruit every day (Robert Koch-Institut 2011). Daily consumption of vegetables is even lower – 54% of women and 37% of men consume vegetables every day (Robert Koch-Institut 2011).

Physical activity reduces the risk of cardiovascular disease, some cancers and type-2 diabetes (WHO 2002). It may also reduce the risk of colon cancer and breast cancer and can improve musculoskeletal health, control body weight and reduce symptoms of depression. About two thirds of the German population report that they do sport regularly (Robert Koch-Institut 2011). Studies show that there has been an increase in sporting activity by both genders in recent decades, especially in the middle age groups (Lampert et al. 2005).

Smoking causes a substantially increased risk of mortality from lung cancer, upper aerodigestive cancer, several other cancers, heart disease, stroke, chronic respiratory disease and a range of other medical conditions (WHO 2002). In industrialized countries where smoking has been common, it is estimated to cause over 90% of lung cancer in men and about 70% of lung cancer in women. In addition, attributable fractions are 56-80% for chronic respiratory disease and 22% for cardiovascular disease. In 2009 about 34% of men and 26% of women in Germany reported that they were daily or occasional smokers (Robert Koch-Institut 2011).

Apart from the direct effects of intoxication and addiction resulting in *alcohol use disorders*, alcohol is estimated to cause about 20-30% of each of the following worldwide: esophageal cancer, liver cancer, cirrhosis of the liver, homicide, epilepsy, and motor vehicle accidents.

Among males in Eastern European countries (according to the WHO's regional classification, the so-called Eur-C group (WHO 2002, p. 235)), 50-75% of cases of drowning, esophagus cancer, epilepsy, unintentional injury, homicide, motor vehicle crashes and cirrhosis of the liver are attributed to alcohol. However, low-to-moderate alcohol consumption combined with non-binge patterns of drinking has beneficial links with coronary heart disease, stroke and diabetes mellitus (WHO 2002). Results from the survey *German Health Update 2009* showed that about a third of men and a fifth of women consumed alcohol to an extent that could be risky for health (Robert Koch-Institut 2011).

OBJECTIVE

In the current study we aim to analyze the health-risk behavior of the adult population in Germany. We wish to emphasize that we will not study health lifestyles, which are defined as a product of a complex interplay between health-related behavior, orientations and social resources (Abel et al. 1999). We outline risky behavior patterns in the population and investigate the factors that may influence certain behaviors. We describe the characteristics of the people and discuss differences in people's behavior according to demographic and social characteristics, as well as some health variables. We discuss the most important influences on people's health-related behavior and describe the most risky groups in the population. We then discuss the implications of our findings for public health policies and preventative interventions.

DATA AND METHODS

The empirical analysis is based on data from the German Health Update 2009 (*Gesundheit in Deutschland Aktuell*, GEDA 2009), which is a part of a nationwide health monitoring system conducted by the Robert Koch Institute in Berlin (Kurth et al. 2009). The German Health Update was started in 2003 and has been conducted every year since then (Robert Koch-Institut 2005; Robert Koch-Institut 2011). Here, we use data from the GEDA 2009 survey, in which the field work was carried out from July 2008 to June 2009. The sample size consists of 21,262 respondents aged over 18.

The survey contains information on different health aspects of the population, such as chronic diseases, vaccinations, mental health, health-related support and stress, subjective health, and health-related behavior variables. For our analysis we use the data on smoking habits, high-risk alcohol consumption, sporting inactivity and unhealthy nutrition.

Variables

- Smoking habits. We use the information on the population's smoking habits obtained from the question: 'Do you smoke regularly or occasionally?'. The answer categories are: 'Yes, daily', 'Yes, occasionally', 'Not anymore', 'Have never smoked'. We make a dichotomous variable indicating whether the respondent currently smokes (irrespective of whether regularly or occasionally) or does not smoke.
- High-risk alcohol consumption. To define high-risk alcohol consumption, we use the Alcohol Use Disorder Identification Test – Consumption (AUDIT-C) standard first described by Bush et al. (1998). The indicator is constructed from different questions on alcohol consumption, from which a categorical variable is formed indicating never-drinkers, moderate drinkers and risk alcohol consumers. For our analysis we take a binary variable indicating whether the respondent has a high-risk alcohol consumption behavior or not.
- Sporting inactivity. As a measure of sporting activity we use a binary variable indicating whether the respondent has engaged in some sport in the last three months or not.
- Unhealthy nutrition. GEDA 2009 contains information on the respondents' fruit and vegetable consumption compiled from separate questions for fruit and vegetables. For our analysis we form a binary variable indicating whether the person consumes fruit and/or vegetables every day.

Our control variables include gender, age, social support, socio-economic status, living with a partner, children in the household, subjective health, physical limitations, chronic diseases and obesity.

Cluster Analysis

Cluster analysis techniques are concerned with exploring data sets to assess whether or not they can be summarized meaningfully in terms of a relatively small number of groups (or clusters)of objects which resemble each other and differ in some respects from the objects in

Table 1 Distribution of the sample according to the four variables for health-risk behavior

	Total		Women		Men	
	%	N	%	N	%	N
Daily or occasional smoking	29.9	6,223	26.1	3,242	33.9	2,981
High-risk alcohol consumption	27.5	6,124	21.5	2,902	33.8	3,222
Sporting inactivity	36.1	6,450	36.0	3,643	36.2	2,807
Unhealthy nutrition	25.9	5,249	18.0	2,089	34.2	3,160
Total	100	21,262	51.5	12,114	48.5	9,148

Note: The results for percentage distributions are weighted; the total numbers are unweighted.

other clusters (Everitt et al. 2001). In general, cluster analysis is considered to be an exploratory technique of data analysis. Clustering methods are intended largely for generating rather than testing hypotheses. (Everitt 1993): 10).

Our analysis is carried out in two stages. At first we use hierarchical cluster analysis to define the different patterns of health-risk behavior in the German population. The argument for clustering is that combinations of the four most important and prevalent health-risk factors are more detrimental to people's health than would be expected from the addition of the individual effects alone (Poortinga 2007). We use Ward's method, as this is considered to be the most suitable for binary variables (Finch 2005). At the second stage we use a logistic regression model to determine the factors that most influence the individual's behavior, using the already defined clusters of risk-health behavior.

RESULTS

Five main groups of health-risk behavior are defined with the help of the cluster analysis. Table 2 shows how the clusters are defined and which risk-behavior groups are formed.

Cluster 1 – 'Healthy behavior'

The first cluster comprises 28% of our sample. We can define this cluster as the healthy one. All the individuals grouped in this cluster do not smoke, do not have high-risk alcohol consumption, engage in sport regularly and eat fruit or vegetables every day.

Cluster 2 – 'Healthy behavior, but no sporting activity'

A further 15% of our respondents are grouped in Cluster 2. It can be defined as a healthy cluster with no sporting activity. The people classified in this group have a healthy diet, do not smoke and do not have high-risk alcohol consumption; but none of them practice any sport.

Cluster 3 – 'Smoking'

This cluster consists of 12% of the total sample and is the smallest of all the five clusters. All the individuals grouped in this cluster are smokers. In addition, they do not have high-risk alcohol consumption, and all of them have a healthy diet and consume fruit or vegetables daily.

However, about 40% of them do not engage in sports; this figure is close to the German average.

Cluster 4 – 'Unhealthy nutrition and no high-risk alcohol consumption'

About 18% of the respondents in our sample are grouped in Cluster 4. People classified here have unhealthy nutritional habits – they all do not consume fruit or vegetables on a daily basis. In addition, about 45% of them do not do any sports, and about 40% are smokers. Alcohol consumption in this group is not risky; if they drink alcohol it is in moderate quantities. We can also define this cluster as one with multiple risk behaviors: 43% of the people in this cluster have two risk behaviors (unhealthy nutrition and either no sporting activity or smoking). About 20% of them have three risk behaviors simultaneously – they have unhealthy nutrition, do not do sports and smoke.

Cluster 5 – 'High-risk alcohol consumption with other risk behaviors'

Almost 28% of the respondents in the sample are grouped in Cluster 5. The distinguishing feature about this cluster is that all the individuals have high-risk alcohol consumption. In addition, about 40% of the people are also smokers, which is about 10% more than the average for the population as a whole. A relatively high proportion of the cluster also has bad nutrition habits and do not consume fruit or vegetables every day. Furthermore, about 32% of the people in this cluster do not practice any sport. As a whole, this cluster combines the most multiple risk behaviors. About 40% of the people have two risk behaviors and just over 20% have three risk behaviors. Six percent of the respondents have four risk behaviors simultaneously, i.e. they are smokers, have high-risk alcohol consumption, do not do sport and have unhealthy nutrition. Estimated for the whole sample, 1.6% of our respondents have four simultaneous risk behaviors.

Figure 1 describes the clusters in more detail. The five clusters are plotted according to age and sex; the size of the circles corresponds to the size of each cluster. The higher the cluster circle is situated, the more men are in the cluster; the further to the right it is, the more old people are included in the cluster. Plotting in this way makes the relationship between age and gender easily visible within

Table 2 Distribution of the variables within the clusters

Clusters	% of total	Sporting inactivity	Smoking	Unhealthy nutrition	High-risk alcohol consumption
1	28.0%	0.0%	0.0%	0.0%	0.0%
2	14.6%	100.0%	0.0%	0.0%	0.0%
3	12.3%	39.5%	100.0%	0.0%	0.0%
4	17.6%	44.5%	39.5%	100.0%	0.0%
5	27.5%	31.5%	38.6%	29.8%	100.0%
	N=20951				
Total average		36.1%	29.9%	25.9%	27.5%

the different clusters. The 'healthy-behavior' cluster is a 'women's' cluster – about 62% of the people in this group are women. They also come predominantly from the older age groups – people above the age of 45 are overrepresented.

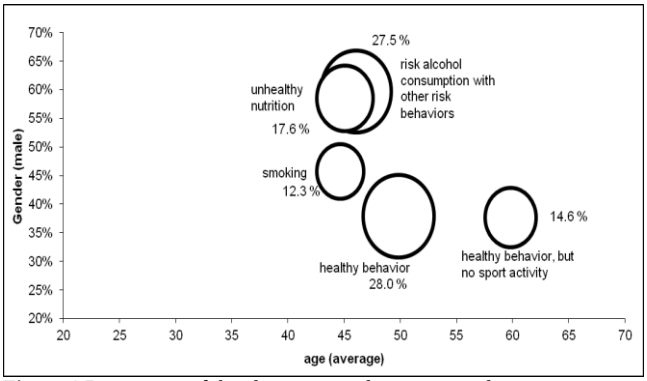

Figure 1 Description of the clusters according to age and sex

The 'healthy-behavior, but no sporting activity' cluster also consists mostly of women (62%) and comes mainly from the older age groups – 51% are aged 65 and above.

The 'smokers' cluster has the most equal gender distribution, about 46% are men and 54% are women. They also come mostly from the middle age groups – the 30- to 65 64-year-olds are overrepresented.

59% of the 'unhealthy nutrition' cluster are men. They are also predominantly younger people and include an above-average percentage of people from the 30-44 age groups.

60% of the 'high-risk alcohol consumption with other risk behaviors' cluster are men. In addition, most of the people in this group are young – about 24% are in the 18 to 29 age group.

We performed logistic regression models to see whether the initial differences between the clusters persisted when controlling for the respondents' other personal characteristics. For each cluster we estimated a separate model with a dependent variable – being within the cluster or not. As independent variables we chose a set of demographic characteristics – age, socio-economic status, social support, living with a partner, having children in the household – and important health variables such as subjective health, chronic diseases, physical limitations and obesity. As we know that health-related behaviors differ considerably according to sex, we performed the regression analysis separately for women and men (Tables 3 and 4).

The results for women (Table 3) show that healthier behavior is closely connected with older age. Women above the age of 45 are most likely to be in the 'healthy-behavior' cluster. The social gradient is also clearly visible: women from the lower social class are 33% less likely to be in this cluster than women from the middle stratum. In addition, women from the higher social class are 31% more likely to be in the cluster than middle-class women. Partnership status also has an influence, since women who live with a partner are more likely to behave healthily. Having children in the household also makes a positive contribution to healthy modes of behavior. Women with children have a 10% greater likelihood of being in this cluster. Social support exerts a significant influence on women's risk-health behavior. Women who receive more social support also tend to lead a healthier life. The results for the health variables show that the better the subjective health is, the better is the chance of behaving in a healthier way. Women who have no chronic diseases are less likely to behave in a healthy way. We do not find any significant influence of the indicators for physical limitation and body mass index in women.

The age gradient is also clearly visible in the 'healthy behavior, but no sporting activity' cluster: women who are 65 or over have about a 2.7 times higher chance of being in this cluster (Table 3). The influence of socio-economic status is again very well defined for women. Women from the lower class are more likely to be in this cluster, while women from the higher class are less likely.Living together with a partner and having children in the household both significantly increase the likelihood of women being in the cluster. Women who have a high level of social support have a significantly lower likelihood of being in the cluster than women with middle or low amounts of social support. No differences are observed between the low and middle support groups. Women who subjectively feel bad or are obese have a significantly higher risk of being in this cluster. We do not find any differences based on having physical limitations or chronic diseases.

The third cluster, 'smoking', is the smallest one. All the people in this cluster smoke, and a high percentage of them do not practice sport. Women from the middle age groups have a higher risk of being in this cluster, while those who are 65 or older have the lowest risk (Table 3). The socio-economic gradient is also clearly visible, and the trend is very similar to the above described results – the higher the social status, the lower the propensity of women to be in this cluster. The family constellation also seems to have important influence. Women who live without a partner in the household have an 11% higher chance of being in this cluster, yet the presence of children in the household does not have any significant influence. Women who have a high or low level of social support are more likely to be in this cluster. The influence of the health indicators is also partly significant. Women who define their subjective health as being bad have an elevated risk of being in this cluster, as do those who have normal weight or are underweight.

The 'unhealthy nutrition' cluster involves several risk-health behaviors, as described above. It predominantly consists of younger people: the highest-risk groups of women are the 18-44 age groups (Table 3), and the lowest is women aged 65 and above. In a similar way to the 'no sport' cluster, here the influence of socio-economic status is very pronounced. The higher the social class, the lower the

Table 3 Odds ratios of being in any of the clusters. Results for women. Separate models including demographic and health characteristics.

	Healthy behavior		Healthy-behavior, but no sporting activity		Smoking		Unhealthy nutrition		High-risk alcohol consumption with other risk behaviors	
	Odds ratios	95 % CI	Odds ratios	95 % CI	Odds ratios	95 % CI	Odds ratios	95 % CI	Odds ratios	95 % CI
Age										
18-29	0.78 [a]	0.69-0.89	0.62 [a]	0.49-0.77	0.85 [c]	0.72-1.02	1.37 [a]	1.15-1.64	1.40 [a]	1.22-1.60
30-44	0.86 [a]	0.77-0.96	1.01	0.86-1.21	0.99	0.85-1.15	1.49 [a]	1.27-1.75	0.92	0.81-1.04
45-64 (ref.)	1		1		1		1		1	
65+	1.26 [a]	1.12-1.42	2.73 [a]	2.35-3.17	0.27 [a]	0.22-0.33	0.52 [a]	0.42-0.63	0.91	0.80-1.05
Socio-economic status										
Low	0.67 [a]	0.59-0.77	1.40 [a]	1.19-1.64	1.25 [a]	1.05-1.48	1.52 [a]	1.30-1.79	0.72 [a]	0.62-0.85
Middle (ref.)	1		1		1		1		1	
High	1.31 [a]	1.20-1.44	0.76 [a]	0.66-0.87	0.63 [a]	0.55-0.73	0.57 [a]	0.49-0.66	1.36 [a]	1.24-1.50
Living with a partner										
Yes	1.22 [a]	1.12-1.34	1.21 [a]	1.07-1.37	0.89 [c]	0.79-1.01	0.84 [a]	0.74-0.95	0.83 [a]	0.75-0.91
No (ref.)	1		1		1		1		1	
Children in the household										
Yes	1.10 [c]	0.99-1.21	1.38 [a]	1.18-1.61	1.04	0.90-1.19	0.96	0.84-1.11	0.77 [a]	0.69-0.86
No (ref.)	1		1		1		1		1	
Social support										
Low	0.86 [b]	0.76-0.97	1.01	0.86-1.18	1.25 [a]	1.06-1.48	1.35 [a]	1.15-1.57	0.81 [a]	0.70-0.93
Middle (ref.)	1		1		1		1		1	
High	1.09 [b]	1.00-1.19	0.82 [a]	0.72-0.93	1.21 [a]	1.07-1.37	0.70 [a]	0.61-0.80	1.08	0.98-1.19
Subjective health										
Good/very good (ref.)	1		1		1		1		1	
Moderate/poor/very poor	0.76 [a]	0.68-0.85	1.54 [a]	1.33-1.79	1.31 [a]	1.12-1.54	1.25 [a]	1.06-1.47	0.74 [a]	0.64-0.84
Chronic diseases										
Yes (ref.)	1		1		1		1		1	
No	0.90 [b]	0.82-0.99	0.98	0.86-1.12	0.98	0.85-1.12	0.98	0.85-1.13	1.18 [a]	1.06-1.32
Physical limitations										
Yes (ref.)	1		1		1		1		1	
No	0.96	0.86-1.07	0.91	0.78-1.05	0.91	0.77-1.06	1.16 [c]	0.98-1.36	1.10	0.97-1.26

Table 3 Odds ratios of being in any of the clusters. Results for women. Separate models including demographic and health characteristics.

(Continued)

Obesity									
Yes	(ref.)	1		1		1		1	
No		1.02	0.90-1.16	0.63 [a]	0.55-0.74	1.21 [b]	1.01-1.44	0.83 [b]	0.70-0.98	1.52 [a]	1.30-1.78
Number of observations		11015		11015		11015		11015		11015	
Log likelihood		-7095.9882		-4079.792		-4120.2779		-3987.5832		-5965.4583	
LR chi2		235.42		589.07		271.73		321.67		378.16	
Probability of chi2		0.000		0.000		0.000		0.000		0.000	
Pseudo R2		0.0163		0.0673		0.0319		0.0388		0.0307	

Note: "a" = p<0.00;; "b" = p<0.05; "c" = p<0.1

propensity of being in this cluster. Living with a partner reduces the risk of being in this cluster, but having children in the household has no influence. Women who believe they have a higher level of social support also have a significantly lower likelihood of being in this cluster. The health characteristics also exert a significant influence among women. Women who subjectively feel bad have an approx. 25% higher risk of being in this group, but there are no differences based on the incidence of chronic diseases. Women who do not have physical limitations and are not obese have an elevated likelihood of being in this cluster.

The final cluster, the 'high-risk alcohol consumption with other risk behaviors' cluster, is also highly dependent on age. Women in the 18-29 age group have about twice the risk of being in this cluster compared to women from the other age groups. The impact of socio-economic status is reversed vis-à-vis the previous three clusters we have described: the lower the women's social status, the lower their risk of being in this group. Living with a partner and having children in the household significantly reduces the risk among women. Women with a lower level of social support have significantly lower risk of being in this cluster than those with a middle or high level of support. The influence of the health variables varies for women. Self-rated health has no influence, while women with no chronic diseases have a higher chance of being in this group. Physical limitations do not show any significant differences, but obese women have a higher risk.

The results for men (Table 4) differ partially from those for women, but there are also many similarities. Being in the 'healthy behavior' cluster is significantly influenced by age, with older men having a greater risk. The influence of social class on being in this cluster varies slightly between men and women. The gradient is not so well defined among men, but there is still a significant difference between men from the higher and the middle social classes: those in the higher social class are twice as likely to be in this cluster as middle-class men. We do not observe any difference between low and middle socio-economic status for men. Living together with a partner and having children in the household also positively influence the propensity for men to be in this cluster. However, social support does not exert a significant influence on the risk-health behavior of men. The results for the health variables show that only self-rated health and obesity have a significant influence. Men who subjectively feel better and are not obese are more likely to be in this cluster. However, we do not find any significant influence of the indicators for chronic diseases or physical limitation.

Regarding the cluster 'healthy-behavior but no sporting activity' we see that for men the influence of age is also highly significant, with men above age 65 having the highest risk of being in this cluster (Table 4). The socio-economic status also plays a significant role among men, with men from the highest social status having the lowest risk of being in this cluster. Living together with a partner has a positive influence on being in this cluster, but living with children in the household does not have any pronounced influence. We observe some differences between men and women in the case of social support. For men, the significant differences are seen in the low support group; they are 42% more likely to be in this cluster. No significant differences are observed between middle and high support groups. Men who subjectively feel bad have a significantly higher risk (43%) of being in this cluster. We do not find any influence of the indicator for chronic diseases, but men who have physical limitations or are obese are more often to be found here.

The 'smoking' cluster consists predominantly of men in the middle-aged group (Table 4). The socio-economic gradient is also clearly visible, and the trend is very similar to the one for women: the higher the social status, the lower the propensity to be in this cluster. Living with a partner or having children in the household does not show any significant influence among men. Men who have a high level of social support are more likely to be in this cluster, as are those who define their subjective health as being bad. The influence of chronic diseases is reversed: men who do not have any chronic disease have a 33% higher risk of being in this cluster. There is no significant influence of physical limitations or obesity among men.

The 'unhealthy nutrition' cluster involves several risk-health behaviors, as described above. It predominantly consists of young or middle aged men: the highest-risk group is 30- to 44-year-olds (Table 4). Men aged 65 and above have about a 50% lower risk of being in this cluster than the younger age groups. Regarding socio-economic status, men who come from the higher social class are less likely to be in this cluster; there is no difference between the low and middle classes. Men living together with a partner are less likely to be found in this cluster. At the same time, we do not find that having children in the household exerts any influence. Social support has a strong influence for men: the less social support they receive, the more likely they are to be in the cluster. Interestingly, none of the health-status indicators show any influence on being in this cluster among men.

The results for the final cluster, 'high-risk alcohol consumption with other risk behaviors', show that men in the 18-29 age group have 64% higher risk of being in this cluster than people from the other age groups (Table 4). The impact of socio-economic status is the reverse of the previous three clusters, and is very similar to the situation among women. Those who come from the high or middle social strata also have the highest risk of being in this group. Living with a partner and having children in the household significantly reduces the risk of being in the cluster among men. In addition, social support also plays a highly significant role. For men, each of the categories is significant and shows the same trend as among the women: the lower the social support level, the lower the risk. The influence of the health variables is significant only for

Table 4 Odds ratios of being in any of the clusters. Results for men. Separate models including demographic and health characteristics.

	Healthy behavior		Healthy-behavior, but no sporting activity		Smoking		Unhealthy nutrition		High-risk alcohol consumption with other risk behaviors	
	Odds ratios	95 % CI	Odds ratios	95 % CI	Odds ratios	95 % CI	Odds ratios	95 % CI	Odds ratios	95 % CI
Age										
18-29	0.86 [c]	0.72-1.03	0.32 [a]	0.22-0.46	0.72 [a]	0.57-0.90	0.87	0.73-1.04	1.64 [a]	1.42-1.89
30-44	0.83 [a]	0.72-0.95	0.77 [b]	0.61-0.97	1.02	0.85-1.22	1.32 [a]	1.15-1.51	0.98	0.87-1.11
45-64 (ref.)	1		1		1		1		1	
65+	1.45 [a]	1.24-1.67	2.55 [a]	2.12-3.08	0.41 [a]	0.32-0.53	0.50 [a]	0.41-0.60	0.91	0.79-1.04
Socio-economic status										
Low	0.93	0.77-1.14	1.06	0.82-1.37	1.28 [b]	1.02-1.61	1.12	0.94-1.34	0.82 [b]	0.70-0.97
Middle (ref.)	1		1		1		1		1	
High	1.50 [a]	1.34-1.67	0.79 [a]	0.67-0.94	0.85 [b]	0.73-1.00	0.76	0.67-0.86	1.00	0.91-1.10
Living with a partner										
Yes	1.34 [a]	1.18-1.53	1.25 [b]	1.03-1.51	0.87	0.73-1.03	0.84 [b]	0.74-0.96	0.89 [b]	0.80-1.00
No (ref.)	1		1		1		1		1	
Children in the household										
Yes	1.15 [b]	1.01-1.31	1.03	0.82-1.28	1.00	0.84-1.18	1.07	0.94-1.22	0.86 [a]	0.77-0.96
No (ref.)	1		1		1		1		1	
Social support										
Low	0.87	0.74-1.03	1.42 [a]	1.16-1.74	0.96	0.77-1.20	1.23 [a]	1.05-1.44	0.81 [a]	0.70-0.93
Middle (ref.)	1		1		1		1		1	
High	0.98	0.88-1.10	0.89	0.74-1.06	1.21 [b]	1.04-1.41	0.79 [a]	0.70-0.89	1.13 [b]	1.03-1.25
Subjective health										
Good/very good (ref.)	1		1		1		1		1	
Moderate/poor/very poor	0.74 [a]	0.63-0.86	1.43 [a]	1.17-1.75	1.37 [a]	1.11-1.69	1.14	0.97-1.35	0.83 [b]	0.73-0.96
Chronic diseases										
Yes (ref.)	1		1		1		1		1	
No	0.94	0.83-1.06	0.89	0.75-1.06	1.33 [a]	1.11-1.59	1.00	0.87-1.14	0.98	0.88-1.10
Physical limitations										
Yes (ref.)	1		1		1		1		1	
No	1.09	0.93-1.26	0.71 [a]	0.59-0.87	0.87	0.71-1.06	1.12	0.95-1.31	1.07	0.94-1.23

Table 4 Odds ratios of being in any of the clusters. Results for men. Separate models including demographic and health characteristics. (Continued)

Obesity									
Yes	(ref.)	1		1		1		1	
No		1.41 [a]	1.19-1.65	0.65 [a]	0.53-0.78	1.07	0.87-1.32	1.14	0.97-1.34	0.85 [b]	0.74-0.97
Number of observations		8399		8399		8399		8399		8399	
Log likelihood		-4470.5491		-2302.6765		-2796.5406		-4177.5672		-5392.0504	
LR chi2		225.60		541.59		101.60		198.73		192.43	
Probability of chi2		0.000		0.000		0.000		0.000		0.000	
Pseudo R2		0.0246		0.1052		0.0178		0.0232		0.0175	

Note: "a" = p<0.00;; "b" = p<0.05; "c" = p<0.1

self-rated health and obesity. Having bad subjective health leads to a lower risk of being in this cluster. Being obese also leads to a higher propensity for men to be in the cluster. Having chronic diseases or physical limitations does not show any significant influence.

DISCUSSION

The definition of the risk-behavior clusters in our analysis largely matches the results of Schneider et al. (2009), who used similar variables and identified five homogeneous health-behavior groups defined as 'No Risk Behaviors', 'Physically Inactives', 'Fruit and Vegetable Avoiders', 'Smokers with Risk Behaviors' and 'Drinkers with Risk Behaviors'. These groups are very similar to the ones we obtained, although the population studied in Schneider et al. (2009) is restricted to adults aged between 50 and 70.

Almost a third of our respondents lead a healthy lifestyle. People with such behavior are predominantly women from the older age groups with very good subjective health, fewer physical limitations, less obesity and a high level of social support.

As the results show, the 'healthy behavior but no sporting activity' cluster is actually a healthy cluster except for the sporting performance. In our analysis we found that people in this cluster have a significantly worse subjective health status, more chronic diseases and more physical limitations. It could be that people in this cluster have healthy lifestyle attitudes but are too physically limited or ill to engage in regular sporting activities. Another possibility is that people who are seriously ill and physically limited cannot afford bad health-related behaviors such as high-risk alcohol consumption or smoking. In addition, the people in this cluster are more often from the older age groups, and it has already been shown that the amount of exercise taken declines with age (Cockerham 2005). In any case, this cluster is an example of the fact that people's behavior can be driven by certain (illness-related) limitations rather than by cultural, traditional or other factors. We believe that people's health status serves as a barrier to physical activity.

Similar conclusions have also made by Rütten et al. (2007). In their cluster analysis they also find that social disadvantage *per se* is not the reason for being inactive when it comes to sport. There are many other factors influencing the engagement in sport, such as having friends, time, or having a disease. In any case, empirical research shows that there are not very many people who regularly exercise and have a bad health status (Robert Koch-Institut 2008).

One of the conclusions we can draw at this stage is that the 'healthy behavior but no sporting activity' cluster can be considered as a cluster without risk behaviors. The respondents here have healthy behavior, but more often have chronic diseases and physical limitations, which reduces their sporting activity. Altogether, this would mean that the first two clusters are actually healthy-behavior clusters.

The other extreme cluster, consisting of the most combinations of risk behaviors, represents about 28% of our sample and also contains a highly selective group of people. This cluster is made up of young men and women from the high social stratum who have a very good health status and few chronic diseases. They have a high level of social support, but do not live with a partner or have children in the household. The direction of the connection between multiple-risk behaviors and social status is rather surprising. Results from other research more often show the opposite connection – i.e. that a low level of education and a low income leads to a higher risk of having multiple-risk behaviors (Drieskens et al. 2010; Pomerleau et al. 1997; Richter 2005; Roberfroid and Pomerleau 2001). Nevertheless, a positive correlation between income status and high alcohol intake is found in some studies (Hapke et al. 2009; Pomerleau et al. 1997). On the other hand, Laaksonen et al. (2001) also finds very small differences in unhealthy behaviors between the socio-demographic groups.

All in all, we believe that people from the cluster of people with multiple-risk behaviors are evidently in good shape, feel healthy and can afford risky health-related behavior. Evidence of such trends and similar results are also found in other studies. Schuit et al. (2002) find a strong relation between smoking and alcohol consumption in the youngest age groups and among subjects who perceive their health as very good or excellent. They attribute these results to a possible high degree of self-confidence among young adults. They also conclude that healthy people do not experience the risks associated with an unhealthy behavior. Furthermore, a study by Backett and Davidson (1995) revealed that young people consider it boring, un-youthful or middle-aged to be so future-oriented as to worry about healthy behaviors and chronic illness.

Regarding the determinants that influence health-risk behaviors, we found that there is a major difference between men and women. Women tend to behave in a healthier way, and more men were found in the multiple-risk behaviors clusters. Such results, i.e. that gender is a strong predictor of unhealthy behaviors, are confirmed by previous research (Chiolero et al. 2006; Denton and Walters 1999; Karvonen et al. 2000; Pomerleau et al. 1997; Umberson 1992). However, the effect of gender is moderated by distinctions between classes (Cockerham 2005). Our results showed that the socio-economic gradient is very steep among women (significant for each cluster and for each status level), while the differences were not so strong among men. Friel et al. (2004) found that in the case of dietary habits, the socio-economic factors were the only ones that matter for women. They found that the picture was more complex for men, with socio-economic, demographic and social-context factors interweaving with each other at different stages. Another very strong determinant of health-risk behavior is age. The results

showed that among both men and women there is a significant difference in the risk of showing a certain health-related behavior according to age – with the youngest age groups more often having exhibiting multiple-risk behaviors. These results are also consistent with those of other studies (Cockerham 2005; Colzani et al. 2010; Pomerleau et al. 1997). It is commonly held that people tend to take better care of their health, and thus change their health-related behavior, as they grow older.

We found that both for men and women living together with a partner has a positive influence on healthy behaviors. The positive influence of marriage on health is also well documented in literature. Cockerham et al. (2006) found a positive connection between marital status and frequent drinking and a healthy diet. By contrast, marital status showed no influence on smoking. Some studies show that men gain a greater health advantage from being married than women (Blaxter 1990; Schuit et al. 2002). Our results also show that the influence of having children in the household has a similar protective effect to marriage. Living with children leads to healthy behavior among men and especially women and is shown to have strong effects in the healthy clusters and the multiple-risk cluster. Being married and living with children is usually a stage in life where people become more aware of their health and try more consciously to lead a healthier life (Backett and Davidson 1995). Because of the responsibilities of bringing up children and family obligations, individuals drink alcohol only moderately, avoid smoking and eat more regularly and 'sensibly'.

Another important influence on the health-risk behavior of men and women is the level of social support. Social support is an indicator of social resources for health and health-related behaviors (Abel et al. 1999). Nevertheless, we found that women and men with low levels of social support have the lowest risk of being in the multiple-risk behavior cluster. As described, 100% of the people in this cluster have risky alcohol consumption. It could be that, in our case, alcohol consumption is connected to the social network a person has – the bigger it is, the more likely a person is to go out more often and drink excessively. In the other risk-behavior cluster, in which an unhealthy diet has the biggest effect, the influence of social support is in the opposite direction; it is significant both for women and for men. The direction in which social support exerts an influence is worth investigating further.

Another aim of our investigation was to determine to what extent healthy risk behaviors are affected by people's health status. Of all the indicators included in the analysis, subjective health status showed the strongest influence on the behavior patterns of men and women. We found that people who report having good subjective health tend to be in either a healthy-behavior cluster or a multiple-risk behavior cluster. For the healthy-behavior group the connection between good health and healthy behavior could be more a causality effect: i.e. people lead a healthy lifestyle and are therefore satisfied with their health status. For the multiple-risk behavior cluster, the relation could be more a selective effect: i.e. that men and women with a good health status and who feel healthy tend more often to have a mixed behavior pattern and to try a more risky lifestyle. There are no health obstacles for them that might otherwise prevent risky behaviors.

The influence of chronic diseases and physical limitations on people's health-related behavior is not as strong as we expected. Chronic illness played a role among women in relation to healthy behavior and multiple-risk behavior. Among men, there was only a significant influence on being in the 'smoking' cluster. Previous research has also shown that healthy lifestyle factors for adults are strongly associated with having no chronic diseases, among other factors (Pronk et al. 2004). The influence of physical limitations was even less pronounced. It seems that people's health-related behavior is driven more by a subjective feeling of one's own health status than by 'objective' measures. The variable indicating obesity was significant mostly for women, but not always for men. Also, the direction of the influence of health-risk behavior was rather vague. The only clear result was that obese people are more likely to be in the 'no sport' cluster.

Despite the interesting results obtained in this study, we have to admit that our analysis also has some important limitations. We already discussed above the problem of cross-sectional data. We are limited by the data at hand in interpreting the causality between people's health behavior and their health status; this also applies to some of the demographic characteristics. The true direction of influence can only be fully studied with the help of longitudinal data, as health status and health behavior are factors that are variable in time. With our data we cannot outline changing behavior patterns. Nor can we show whether a certain behavior is driven by some earlier experiences in life. Furthermore, our analysis is limited to the information we have in explaining certain behavior patterns. There are most likely some unobservable characteristics that we cannot take into account when describing the behavior patterns of people in Germany.

CONCLUSIONS

Our results showed that individual health-behavior patterns are influenced by many demographic factors, but also by people's state of health and by social factors. We argue that people's health-related behavior is driven to a large extent by their state of health – the healthier they feel, the riskier the behavior they tend to adopt. We conclude that a good state of health and a young age, together with gender, are the most important preconditions for risky health-related behaviors. The role of social status is not revealed in the current analysis. When we compare the two riskiest behavior clusters, we see that one of them contains a high percentage of people from the low social status group; however, the other contains a high percentage of people from the high social status group. The impact of

social status, therefore, remains undefined, as it shows mixed patterns.

We assume that people change their risk-health behavior over time. Young people may be less aware, or have less experience, of possible health consequences and 'dare' to adopt unhealthy behavior more often. But as they age, more health problems may appear, or their health awareness may increase. As a result they may change their behavior towards a healthier lifestyle. According to Backett and Davidson (1995), health-related behavior is a part of the dynamic and interactive processes of daily living. The changes in a person's individual health-related behavior in the course of his or her life involve looking back over previous experiences and anticipating future experience, often in terms of stereotypical realities.

Schuit et al. (2002) also argue that people are more likely to change their behavior if it leads to short-term effects, like feeling fit, than if it leads either to intermediate (overweight) or long-term effects (coronary heart disease). Young people often regard their health as a kind of inexhaustible good, because health-risk behaviors usually only lead to certain diseases later in life (Kuntsche 2002).

Based on our results we believe that public health preventive programs should aim at explaining to young populations the long-term consequences that certain risky behaviors may have. In addition, gender-specific health-promotion measures should be implemented (Fekete et al. 2012). The aim of the health preventive programs should be to achieve a high level of health awareness and consciousness among young population and to reduce gender differences in health.

The cluster analysis showed that people's risk-related behavior is not usually defined by only one kind of risk behavior; rather, it is a combination of several risk behaviors. Thus we believe that the preventative and therapeutic programs should not only consider one single risk behavior (e.g. smoking), but several risk behaviors (e.g. smoking combined with risk alcohol consumption). Also integrating physical exercises and information on nutrition into the addiction therapy programs as part of the treatment could contribute to raising people's awareness when several risk behaviors are combined. The need for simultaneous interventions is also recognized in other studies (Schneider et al 2009; Prochaska and Prochaska 2011).

ACKNOWLEDGMENTS

All of the authors listed have contributed significantly to the work. We would like to thank Bob Culverhouse for language editing.

REFERENCES

Abel T, 2007. Cultural capital and social inequality in health. Journal of Epidemiology and Community Health 62: e13

Abel T, Walter E, Niemann S, Weitkunat R, 1999. The Berne-Munich lifestyle panel. Sozial- und Präventivemedizin 44: 91-106

Backett KC, Davidson C, 1995. Lifecourse and lifestyle: The social and cultural location of health behaviors. Social Science and Medicine 40: 629-638

Blaxter M, 1990. Health and Lifestyles. Travistock/Routledge Publication

Bush K, Kivlahan DR, McDonell MB, Fihn SD, Bradley KA, 1998. The AUDIT alcohol consumption questions (AUDIT-C): an effective brief screening test for problem drinking. Ambulatory Care Quality Improvement Project (ACQUIP) Archives of Internal Medicine 158:1789-1795

Chiolero A, Wietlisbach V, Ruffieux C, Paccaud F, Cornuz J, 2006. Clustering of risk behaviors with cigarette consumption: A population-based survey. Preventive Medicine 42: 348 - 353

Cockerham WC, 2005. Health lifestyle theory and the convergence of agency and structure. Journal of Health and Social Behavior 46: 51-67

Cockerham WC, 2007. New directions in health lifestyle research. International Journal of Public Health 52: 327-328

Cockerham WC, Hinote BP, Cockerham GB, Abbott P, 2006. Health lifestyles and political ideology in Belarus, Russia, and Ukraine. Soc Sci Med 62: 1799-809

Cockerham WC, Rütten A, Abel T, 1997. Conceptualizing contemporary health lifestyles: moving beyond Weber. The Sociological Quarterly 38: 321-342

Colzani E, Bonazzi C, Del Corno G, 2010. Healthy life styles and perceived health status in the general population of a Northern Italian health district: a cross-sectional study. Italian Journal of Public Health 7: 235-242

Denton M, Walters V, 1999. Gender differences in structural and behavioral determinants of health: an analysis of the social production of health. Social Science & Medicine 48: 1221 - 1235

Drieskens S, Van Oyen H, Demarest S, Van der Heyden J, Gisle L, Tafforeau J, 2010. Multiple risk behavior: Increasing socio-economic gap over time? European Journal of Public Health 20: 634-639

Everitt BS, 1993. Cluster analysis. London: Edward Arnold

Everitt BS, Landau S, Leese M, 2001. Cluster analysis. London: Hodder Education

Fekete C, Weyers S, Moebus S, Dragano N, Jöckel K-H, Erbel R, Möhlenkamp S, Wege N, Siegrist J, 2012. Age-Specific Gender Differences in Nutrition: Results from a Population-Based Study. Health Behavior and Public Health 2: 10 - 20

Finch H, 2005. Comparison of Distance Measures in Cluster Analysis with Dichotomous Data. Journal of Data Science 3: 85-100

Friel S, Newell J, Kelleher C, 2004. Who eats four or more servings of fruit and vegetables per day? Multivariate classification tree analysis of data from the 1998 Survey of Lifestyle, Attitudes and Nutrition in the Republic of Ireland. Public Health Nutrition 8: 159 - 169

Gochman DS, 1997. Handbook of Health Behavior Research. Personal and Social Determinants

Hapke U, Hanisch C, Ohlmeier C, Rumpf H, 2009. Epidemiologie des Alkoholkonsums bei älteren Menschen in Privathaushalten: Ergebnisse des telefonischen Gesundheitssurvey 2007 Sucht 55: 281-291

Karvonen S, Abel T, Calmonte R, Rimpelä A, 2000. Patterns of health-related behavior and their cross-cultural validity - A comparative study on two populations of young people. Sozial- und Präventivemedizin 45: 35-45

Kim S, Popkin BM, Siega-Riz AM, Haines PS, Arab L, 2004. A cross-national comparison of lifestyle between China and the United States, using a comprehensive cross-national measurment tool of the healthfulness of lifestyles: the Lifestyle Index. Preventive Medicine 38: 160-171

Kirkegaard H, Johnsen NF, Christensen J, Frederiksen K, Overvad K, Tjønneland A, 2010. Association of adherence to lifestyle recommendations and risk of colorectal cancer: a prospective Danish cohort study. British Medical Journal doi: 10.1136/bmj.c5504

Kistemann T, Meyer C, 2007. Handling health risks. Berichte zur Duetschen Landeskunde 81: 215-232

Kuntsche EN, 2002. Gesundheitsbesorgnis und Substanzkonsum unter Jugendlichen von 1986-1998. Zeitschrift für Gesundheitspsychologie 10: 15-22

Kurth B-M, Lange C, Kamtsiuris P, Hölling H, 2009. Gesundheitsmonitoring am Robert Koch-Institut. Sachstand und

Perspektiven. Bundesgesundheitsblatt - Gesundheitsforschung - Gesundheitsschutz 52: 557-570

Kwaśniewska M, Kaczmarczyk-Chalas K, Dziankowska-Zaborszczyk E, Kucharczyk K, Drygas W, 2010. Healthy behaviors, lifestyle index and cardiometabolic risk. The results of the WOBASZ project 2003 - 2005. Polski Przeglad Kardiologiczny 12: 103-108

Laaksonen M, Pratt Ala R, Karisto A, 2001. Patterns of unhealthy behavior in Finland. European Journal of Public Health 21: 294 - 300

Lampert T, Mensink GB, Ziese T, 2005. Sport und Gesundheit bei Erwachsenen in Deutschland. Bundesgesundheitsblatt - Gesundheitsforschung - Gesundheitsschutz 48: 1357-1364

McCracken M, Jiles R, Blanck HM, 2007. Health Behaviors of the Young Adult U.S. Population: Behavioral Risk Factor Surveillance System, 2003. Preventing Chronic Disease Public Health Research, Practice and Policy 4: 1-16

Mielck A, 2000. Soziale Ungleichheit und Gesundheit: empirische Ergebnisse, Erklärungsansätze, Interventionsmöglichkeiten. Bern; Göttingen; Toronto; Seattle: Hans Huber.

Pomerleau J, Pederson LL, Østbye T, Speechley M, Speechley KN, 1997. Health behaviors and socio-economic status in Ontario, Canada. European Journal of Epidemiology 13: 613 - 622

Poortinga W, 2007. The prevalence and clustering of four major lifestyle risk factors in an English adult population. Preventive Medicine 44: 124 - 128

Prochaska JJ, Prochaska JO, 2011. A Review of Multiple Health Behavior Change Interventions for Primary Prevention. American Journal of Lifestyle Medicine 5:208-221

Pronk NP, Anderson LH, Crain AL, Martinson BC, O'Connor PJ, Sherwood NE, Whitebird RR, 2004. Meeting recommendations for multiple healthy lifestyle factors: Prevalence, clustering, and predictors among adolescent, adult, and senior health plan members. American Journal of Preventive Medicine 27: 25 - 33

Richter M, 2005. Gesunheit und Gesunheitsverhalten in Jugendalter. Der Einfluss sozialer Ungleichheit. Wiesbaden: VS Verlag für Sozialwissenschaften.

Roberfroid D, Pomerleau J, 2001. Psychosocial factors and multiple unhealthy behaviors in 25- to 64-year-old Belgian citizens. Arch Public Health 59: 281-307

Robert Koch-Institut, 2005. Erster telefonischer Gesundheitssurvey des Robert Koch-Instituts - Methodische Beiträge. Berlin: Robert Koch-Institut

Robert Koch-Institut, 2008. Lebensführung und Sport. Berlin: Robert Koch-Institut

Robert Koch-Institut, 2011. Daten und Fakten: Ergebnisse der Studie "Gesundheit in Deutschland aktuell 2009". Berlin: RKI

Rütten A, Abu-Omar K, Adlwarth W, Meierjürgen R, 2007. Bewegungsarme lebensstile. Zur klassifizierung unterschiedlicher Zielgruppen für eine gesundheitsförderliche körperliche Aktivierung. Gesundheitswesen 69: 393-400

Schneider S, Huy C, Schuessler M, Diehl K, Schwarz S, 2009. Optimising lifestyle interventions: identification of health behavior patterns by cluster analysis in a German 50+ survey. European Journal of Public Health 19: 271-277

Schuit JA, van Loon AJM, Tijhuis M, Ocke MC, 2002. Clustering of Lifestyle Risk Factors in a General Adult Population. Preventive Medicine 35: 219-224

Shikany JM, White Jr GL, 2000. Dietary Guidelines for Chronic Disease Prevention. Southern Medical Journal 93: 1138 - 51

Umberson D, 1992. Gender, marital status and the social control of health behavior. Social Science & Medicine 34: 907-917

Van der Wilk EA, Jansen J, 2005. Lifestyle-related risks: are trends in Europe converging? Public Health 119: 55-66

World Health Organisation, 2002. Reducing Risks, Promoting Healthy Life. The World Health Report 2002