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Searching for similarities: transfer-oriented learning in health education at secondary schools

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Chapter 3

A REVIEW OF SIMILARITIES BETWEEN DOMAIN-SPECIFIC DETERMINANTS OF FOUR HEALTH BEHAVIORS AMONG ADOLESCENTS¹

Schools are overloaded with health promotion programs that, altogether, focus on a broad array of behavioral domains, including substance abuse, sexuality and nutrition. Although the specific content of programs varies according to the domain focus, programs usually address similar concepts: knowledge, attitudinal beliefs, social influences and skills. This apparent conceptual overlap between behaviors and programs provides opportunities for a transfer-oriented approach which will stimulate students to apply the knowledge and skills they have learned in one domain (e.g. skills for resisting tobacco use) to other domains (e.g. alcohol, sex). A requirement for such an approach is that behaviors share at least some determinants.

This review addresses this issue by examining similarities between domain-specific determinants of smoking, drinking, safe sex and healthy nutrition among adolescents.

Recent empirical studies and reviews were examined. The results show that the following determinants are relevant to all four behaviors: beliefs about immediate gratification and social advantages, peer norms, peer and parental modeling, and refusal self-efficacy. Several other determinants have been found to relate to at least two behaviors, e.g. health risk beliefs and parental norms. These results can be used for the development of a transfer-oriented school health promotion curriculum.

1. INTRODUCTION

Health-compromising lifestyles such as smoking, binge drinking, unsafe sex and insufficient intake of fruit and vegetables are widely prevalent among young people in western societies (Currie et al., 2006; Eaton et al., 2006). Numerous health education programs have been, and continue to be, developed to promote healthful behaviors among adolescents. The majority of adolescent health promotion programs are designed for use in schools and are often supplementary to the regular school curriculum. With a few exceptions, such as substance abuse programs, most projects focus

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on a single health-related behavior. Altogether, these single health promotion programs may overload the school curriculum and teaching staff (Lee, Keung, & Tsang, 2004; Leurs, Jansen, Schaalma, Mur-Veeman, & De Vries, 2005).

1.1 Transfer: looking for similarities

On a conceptual level, many classroom health education programs seem to address similar psychosocial constructs, such as factual knowledge, attitudinal beliefs, social influences and refusal skills (Botvin, Schinke, & Orlandi, 1995; Schaalma, Abraham, Gillmore, & Kok, 2004; Summerfield, 2002). The specific content of these constructs varies with the specific behavioral focus of individual programs as consequences, meanings and contexts of behaviors differ. However, the apparent conceptual overlap between health education programs provides opportunities for more integrative approaches, such as one that is oriented towards promoting transfer (Ten Dam, 2002). In a transfer-oriented approach students are stimulated to apply the knowledge, attitudes and skills they have learned in one domain (e.g., refusal skills with respect to smoking) to other behavioral domains (e.g., refusing alcohol or unsafe sex). The teaching content thus focuses on building bridges between various behavioral domains, by identifying general principles and considering whether and how they can be applied in other domains. This does not mean that domain-specific issues are neglected. On the contrary, the transfer approach is about connecting domain-specific issues to general principles and vice versa. It requires alternate processes of contextualization (learning new skills in one context), decontextualization (deducing a general principle) and recontextualization (examining its application in other contexts) (Elshout-Mohr, Van Hout-Wolters, & Broekkamp, 1999). Thus, domain-specific issues may very well be addressed as contextualizations of general principles. Beliefs are most predictive of a given behavior when they specifically apply to that behavior (Ajzen, 1991), and new, meaningful knowledge can be attained only within the context of specific behavioral contexts.

In theory, a transfer-oriented curriculum can integrate and replace several domain-specific curricula and can produce effects on several behaviors simultaneously while keeping time and effort spent by schools and teachers at an acceptable level. Transfer effects have been reported in various subject domains in the education sector (Alexander, 2006; Mayer & Wittrock, 1996) but, to our knowledge, they have not yet been examined in health education. We aim to fill this gap by developing and empirically testing a transfer-oriented approach in classroom health education in secondary education. The present literature review is one of the first steps in our project and has been conducted to examine opportunities for a transfer-oriented approach and more specifically to identify determinants to be included in a transfer-oriented program. A transfer-oriented approach to different lifestyles is only possible if these lifestyles have at least some determinants in common. Therefore, the purpose of this review is to examine similarities between determinants across several lifestyles. Determinants of various individual health-related behaviors have been studied extensively but, until now, no review has systematically examined which determinants are shared by several behaviors.

Four target behaviors were selected beforehand for this review: smoking, alcohol abuse, safe sex and healthy nutrition. These behaviors were selected because a) they are among the ones most frequently addressed in Dutch secondary schools (Dafesh, 2006), and b) we expect there to be differences in the strength of relations between these behaviors, which may influence the occurrence or ease of transfer effects. We have reviewed studies of relations between the four behaviors elsewhere (Wiefferink et al., 2006) and will address this issue in our empirical study. It is sufficient to mention that the strong clustering relation between tobacco and alcohol use that has often been reported (Wiefferink et al., 2006) might lead to better transfer effects between these two behavioral domains than between domains that are not strongly related.

Since transfer-oriented learning is about discovering general issues in specific factors across domains, the focus of this review is on similarities between domain-specific determinants. The content of domain-specific factors varies with the behavioral domain in question. For instance, attitudinal beliefs about smoking are different from beliefs about condom use, because the behavioral consequences and circumstances of smoking and condom use differ. Domain-specific factors, such as attitudinal beliefs, are commonly addressed in categorical intervention programs. Despite their domain-specific content, such factors may share common ground on a more general level. For instance, the types of behavioral consequences may be similar for several behaviors: immediate physiological consequences, health consequences, and social consequences. This common ground creates opportunities for teaching for transfer.

The focus on domain-specific determinants in this review does not mean that general determinants are insignificant in affecting various behaviors simultaneously. On the contrary, general factors, such as demographic, personality or parenting factors or general social or cognitive skills, are also very important. However, they were not the focus of this review as they have been previously addressed elsewhere (Wiefferink et al., 2006).

1.2 Research question

Which domain-specific determinants correlate with two or more of the following behaviors: smoking, alcohol abuse, safe sex and healthy nutrition?

1.3 Theoretical model

Many theories have been formulated to predict health-related behaviors, which altogether have led to a broad array of determinants (see Petraitis, Flay, & Miller, 1995 for a comprehensive overview). We used the Theory of Triadic Influence (Flay & Petraitis, 1994), which integrates insights from many theories, as a framework for organizing determinants of health behaviors (Wiefferink et al., 2006). Figure 1 shows a simplified version of this theory and our framework. It categorizes determinants in three streams (intrapersonal, interpersonal and cultural) and at three levels of influence (proximal, distal and ultimate). The ultimate level of influence includes determinants that are thought to be predictive of multiple behaviors but are almost

unmodifiable, e.g. personality characteristics or the broader socio-cultural environment. Their influence is mainly indirect, via determinants at the distal and proximal levels. Distal and especially proximal-level determinants have better predictive value, but most are specific to one behavior. In addition, intentions and previous experiences with the behavior are assumed to have the most direct influence, whereas barriers with regard to accessibility and availability may undermine intentional behavior. Although the figure only indicates within-stream influences from the ultimate level to the proximal level, we and others (Flay & Petraitis, 1994) assume that there are also interstream influences. The model also includes feedback loops which are indicated in the figure by the broken lines: experiences from performing a behavior give people feedback regarding, for instance, some of its consequences (Flay & Petraitis, 1994).

Given our focus on domain-specific determinants, the determinants discussed in this review are, for the most part, but not exclusively, proximal determinants, such as attitudinal, social normative and self-efficacy beliefs.

2. METHOD

2.1 *Sample of studies*

The databases Medline and PsycINFO were used to generate the sample of studies. Searching this combination of databases meets criteria for a comprehensive search, as stated in a quality assessment tool for reviews (Thomas, Micucci, Ciliska, & Mirza, 2005) and is an efficient way for locating studies relevant to health promotion (Peersman, Harden, Oliver, & Oakley, 1999). We used the following keywords for determinants: risk-taking, risk factors, risk perception, psychosocial factors, psychology, intention, motivation, personality (characteristics), personality correlates, predisposition, knowledge, attitudes, and practice. We performed searches for every behavior and for multiple behaviors. For every search we added keywords specific to that behavior. For tobacco and alcohol: tobacco, smoking, cigarette, substance use, substance abuse, drug use, drug abuse, alcohol, alcoholic, drinking, binge drinking, alcohol drinking patterns, alcohol drinking attitudes. For safe sex: safe sex, contraception behavior, condoms, Acquired Immunodeficiency Syndrome/prevention and control, aids prevention, sexual risk taking, psychosexual-behavior, AIDS-attitudes. For nutrition: food preferences, diets, feeding practices, eating attitudes, food intake, fruit, fat, vegetables, adolescent nutrition, food habits. For multiple behaviors: generalization-learning, transfer-learning, health compromising behavior, lifestyle, health behavior, problem behavior, risk behavior, behavior problems. In addition, backward searches were conducted by scanning reference lists.

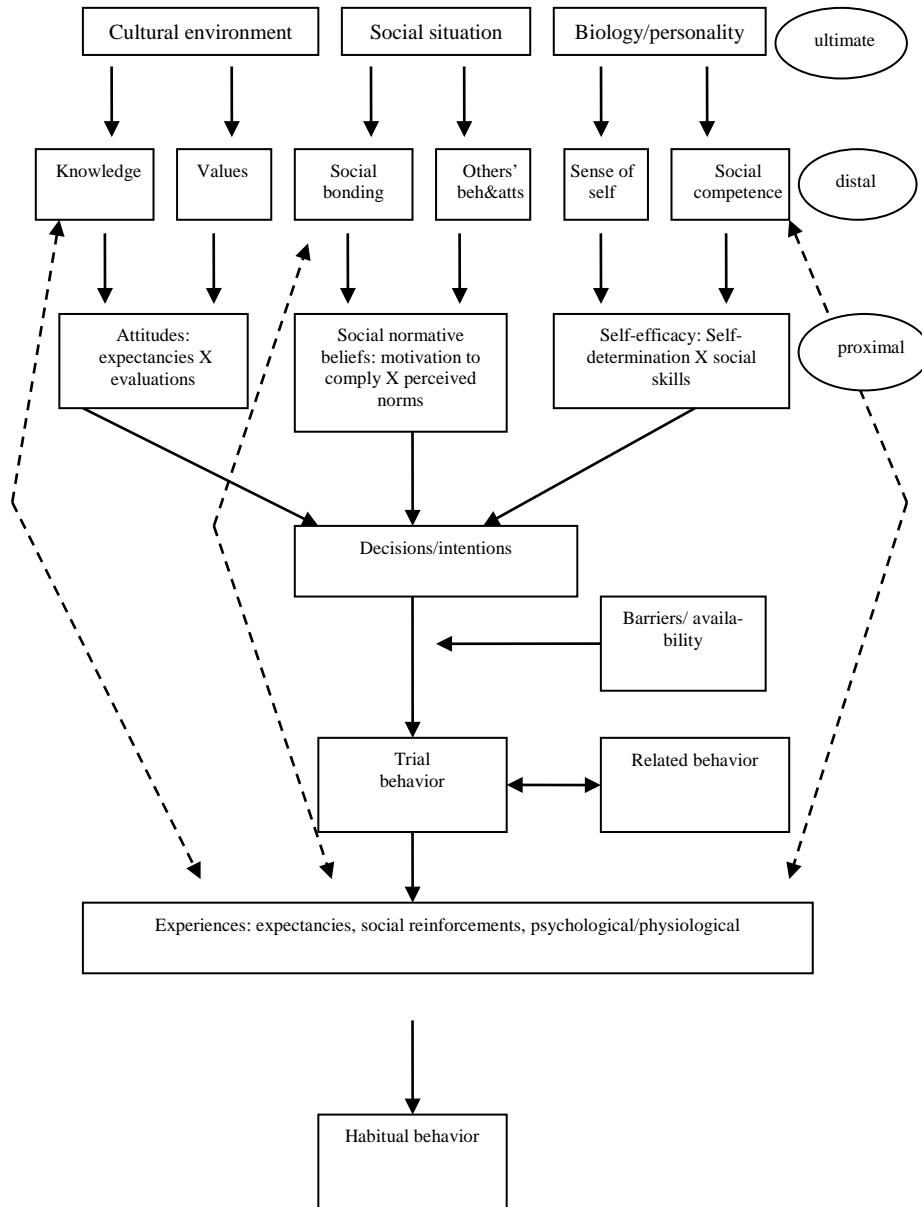


Figure 1. Theoretical framework for organizing determinants of health behaviors,

2.2 *Inclusion criteria*

Studies were included if they met the following criteria:

- 1) Studies on behavior-specific correlates of a measure of (self-reported) behavior or intention with respect to smoking, drinking, sexual behavior or healthy nutrition.
- 2) Correlates were measured at ages 10-18.
- 3) Data collection was carried out in western countries.
- 4) Publications were written in English and published in journals from the Social Science Citation Index list.
- 5) Empirical and review studies were considered. Reviews had to be published between 1995 and 2003 and empirical studies between 2000 and 2003. Because there were so few studies that addressed nutrition, we included empirical studies on nutrition from 1995 to 2003.
- 6) Because of the large numbers of longitudinal studies on tobacco and alcohol use we included only longitudinal studies for these behaviors.

The publication year criterion for empirical studies was strict because of the quantity of material on the four behavioral domains. Reviews were included to account for results of older studies.

Eighty-seven studies were found to satisfy the inclusion criteria: 14 were on multiple behaviors, 26 on smoking, 10 on alcohol use, 17 on safe sex and 20 on nutrition. Some of the studies also discussed other behaviors in addition to the ones of interest here, but results for these additional behaviors were not recorded.

2.3 *Coding and synthesis*

The studies were divided into three groups which were coded by three reviewers: smoking and alcohol use (LP), safe sex and multiple behaviors (CW) and nutrition (FH). Although each behavioral domain was assessed by one reviewer only, several procedures were used to ensure comparability of coding. Firstly, all reviewers were familiar with conducting literature reviews and with research in all four behavioral domains. Secondly, standardized assessment forms (available from the first author) were used for systematically recording study characteristics. Thirdly, coding of studies was discussed in several meetings and any doubts or problems with coding were resolved through discussion after all reviewers had read the relevant portions of the paper in question. For empirical studies the following aspects were recorded: study design (longitudinal, cross-sectional), sample size, participant characteristics (age or grade, gender, ethnicity, socio-economic status, country of residence), measurement of determinants (questionnaire, interview; specific measures recorded; yes/no validated), measurement of behavior or intention (questionnaire, interview, observation, biomedical, other; specific measure recorded; yes/no validated), theoretical basis, statistical analyses used (correlation, regression, other, none) and the relation between each determinant and behavior (positive, negative or null; for total sample or subgroup; strength of relationship in correlation, beta weight or odds ratio). Determinants recorded for focus group studies (only in the domains of safe sex and nutrition: study numbers 21, 42, 58 and 60 in Table 2) mostly pertained to aspects that,

according to the authors of the study, were mentioned frequently in discussion groups. A separate assessment form was used for review studies which contained information on: type of review (meta-analysis, narrative), characteristics of included studies (number of studies, study designs, sample sizes, participant characteristics), review authors' judgment of quality of study designs and instruments and conclusions about relations between determinants and behavior.

After initial data were extracted, determinants were further organized in several steps, which is explained in Table 1.

Table 1. Steps followed in the process of organizing and coding determinants

Steps in categorizing determinants	Example
1. Creating a template table with categories and subcategories, according to theoretical framework used	Category Proximal factors Subcategory Attitude Subcategory Health beliefs
2. Creating four behavior-specific tables from the template, with behavior-specific measures of determinants	Determinant 'Perceived personal risk of cancer' was entered in the subcategory 'Health beliefs' in the tobacco table
3. Combining the four behavior-specific tables into one table, with determinants categorized to a higher level (if possible)	'Perceived personal risk of cancer' (tobacco) and 'perceived personal risk of HIV' (safe sex) were categorized as 'perceived personal health risk'
General: we were conservative in combining determinants, both within and across behavioral domains (steps 2 and 3, respectively)	In step 2: 'Perceived personal risk of cancer from smoking' and 'perceived risk of cancer from smoking among people in general' were treated as separate determinants

Coding of study characteristics was descriptive and studies were not rated for overall methodological quality. However, in data synthesis the type of study was taken into consideration. Results of longitudinal studies were generally rated as being stronger than those of cross-sectional studies because a longitudinal design has better predictive value. Review studies were treated with more caution than empirical studies in our synthesis, especially when evidence was mainly from reviews or when evidence from reviews conflicted with that from empirical studies. This caution is warranted, as using review results may have some disadvantages. Because of their second-hand nature, review results may be less insightful than empirical results. Results of some empirical studies may be overrepresented, as they are perhaps discussed in several reviews. Also, reviews vary in the specificity of the outcome measure and in the number and quality of studies included and sometimes study design or quality is not addressed. Moreover, some reviews only discuss positive findings and do not mention null findings.

3. RESULTS

3.1 *Study characteristics*

Table 2 presents an overview of the characteristics of the studies included. Studies are grouped according to the criterion behavior(s) and according to study design.

The behavioral focus of both the empirical and review studies on multiple behavior, was mainly on alcohol and tobacco use. Sexual and nutrition behaviors were only addressed in some of these studies. Of the 8 empirical multiple behavior studies, 4 were longitudinal and 4 cross-sectional. As for studies that examined only one behavior, empirical studies on safe sex and nutrition were almost exclusively cross-sectional; only one longitudinal nutrition study was located. In the tobacco and alcohol domains, the longitudinal design was much more prevalent, which had led to the decision to include only longitudinal studies for these domains.

Most studies were conducted in the United States. The majority focused on both males and females and on samples with various ethnic composition, with some exceptions especially among safe-sex studies (e.g. black females). The age of the respondents in the empirical studies ranged from 7 to 21 years, with a bottom end mean of 12.7 and a top end mean of 16.6 years (overall mean age 14.7 years). Safe sex studies generally examined somewhat older samples, with a mean age range of 13.7 – 18.3 and an overall mean age of 16.0 years.

The operationalization of the behavioral criterion variables differed considerably. Tobacco use measures included long-term smoking trajectories (e.g., Chassin, Presson, & Sherman, 2000; White, Pandina, & Chen, 2002), established smoking (e.g., 100 cigarettes lifetime, Choi, Ahluwalia, Harris, & Okuyemi, 2002; Choi, Gilpin, Farkas, & Pierce, 2001), daily smoking (e.g., Tucker, Ellickson, & Klein, 2002), ever smoking (e.g., Wills, Sandy, & Yaeger, 2002), and both experimental and regular smoking (e.g., Wang, 2001). Alcohol studies generally examined heavy use or binge drinking. Studies of safe sex commonly addressed (intended) use of condoms or risky sexual behavior in general, but two multiple behavior studies focused on sexual experience. Studies of nutrition behavior showed the largest variation in behavioral outcomes. Some focused on more or less specific outcomes such as consumption of raw vegetables, of selected foods, or of fruit and vegetables in general, whereas others assessed nutrient or food intake or its quality, or even eating behavior in general (e.g., Pirouznia, 2001). Many studies used generally established outcome measures, but specific information about validity and reliability of measures was often not provided.

The operationalization of determinants also showed a high level of variation. Nearly every empirical study used its own measures and some did not give specific accounts of these. Most empirical studies reported on reliability (internal consistency), but information about validity was largely absent. Reviews generally did not go into details of the measures used.

3.2 *Results of studies*

The process of combining the domain-specific determinants into meaningful categories led to a total of 86 determinants. Of these 86 determinants, the majority (51) had been examined for only one behavior and a minority had been examined for two behaviors (25), three behaviors (4) or for all four behaviors (6). Table 3 presents the 35 determinants that were examined for more than one behavior. Since our interest is in discovering similar determinants across different behaviors, we will mainly focus on the results in this table. In line with our theoretical model (see Figure 1), the 35 determinants in Table 3 were categorized as: 4 behavioral factors, 1 barrier/availability factor, 23 proximal factors, 5 distal factors and 2 ultimate factors. The table indicates, for each study, the direction of the determinant-behavior relationship that was found (positive or negative influence or null findings). It does not provide information about the strength of the relationships. Unfortunately, such information was insufficient in many papers (e.g., only significance levels or group means reported) and totally absent in most reviews.

Table 4 displays the 51 determinants that have been measured in one domain only. This table is included to complete the overview of all determinants but will not be addressed frequently.

3.2.1 *Behavioral and availability factors*

As for behavioral factors, similarities between the tobacco and alcohol domains exist since these behaviors are predicted by positive experiences with the substance, previous use of the substance in general and early onset of use. The latter finding corresponds to the evidence in the sexuality domain that lower age of first intercourse correlates negatively with safe sex behavior. Behavioral factors that were only examined for one behavior (see Table 4) mainly pertained to situational characteristics in the nutrition domain and are not discussed here further.

Availability/accessibility factors have been examined recently only in the nutrition and tobacco domains. Evidence in the nutrition domain, mostly from focus group studies and reviews, consistently suggests that such factors impact nutrition behavior. Correspondingly, in the tobacco domain there is some evidence that accessibility of cigarettes is related to smoking.

3.2.2 *Proximal factors*

Attitudes. As expected, most domain-specific factors examined were proximal, consisting mainly of attitudinal and social normative beliefs. General, mixed or unspecified measures of attitudes have been found to relate positively to all four behaviors, although some studies reported null findings. The specific attitudinal beliefs examined pertained mainly to health, physiological and psychological gratification, appearance, performance and social contact. Health-related beliefs have been studied for all behaviors, although there is only one such study on alcohol. Positive associations with the health behaviors prevail, although many studies, including the alcohol study, reported null findings. Personal risk beliefs appear to be better predictors than

general risk beliefs, but correlations were predominantly weak and some studies reported negative associations. Therefore, health beliefs seem to be relevant, though minor, determinants of safe sex, healthy nutrition and non-smoking.

The evidence for the relevance of beliefs related to physiological and psychological gratification is more consistent. Beliefs that the unhealthy behavior contributes to an immediate positive sensation, or that the healthy behavior would obstruct this, are related to unhealthy lifestyles in each of the domains studied but especially in those of nutrition and safe sex. The belief that smoking relaxes or helps reduce negative feelings is a consistent predictor of tobacco use; such belief in the relaxing effects of alcohol has also been reported. Image-related beliefs have only been reported in reviews on tobacco (e.g., smoking makes you feel rebellious, see Table 4) and are therefore not discussed here further.

Whereas most beliefs about gratification were in favor of unhealthy behavior, anticipated regret about a hangover or drunken behavior had a negative association with binge drinking; this regret was not related to smoking.

Beliefs related to physical appearance have only been examined in the nutrition and tobacco domains. The belief that smoking has a favorable effect on weight management is negatively associated with non-smoking, as was reported consistently by one longitudinal study and five reviews, whereas the association between weight management beliefs and healthy nutrition behavior tends to be positive. The evidence in the nutrition domain is weaker than that found in the smoking domain since it is based on one longitudinal study with positive results and one cross-sectional study with null findings. Such contrasts have also been found for performance-related beliefs. The belief that healthy behavior promotes physical or athletic performance is associated positively with healthy nutrition and non-smoking. However, a review in the alcohol domain reported positive alcohol expectancies for mental and motor performance among children of alcoholics who are at risk of developing alcohol or drug problems.

There are relatively few studies on beliefs about social consequences which is surprising, given that social norms and especially modeling behavior have been studied extensively (see below). Nevertheless, beliefs that the unhealthy behavior has social advantages have been found for tobacco and alcohol use and safe sex, although for tobacco use also null findings were reported. A somewhat comparable finding in the nutrition domain was the belief that certain social situations such as parties are not conducive to making healthy food choices [see Table 4]. Only one finding in the category of social consequences was in the opposite direction: the belief that too much alcohol intake can lead to bad conduct [see Table 4].

Social norms. Social normative beliefs have been studied in relation to several reference groups but mostly peers and parents. Peer norms have been found to have an effect on all four behaviors. However, results in the alcohol domain are inconsistent, with one longitudinal and two review studies reporting the absence of an association and, in the tobacco domain, much of the evidence stems from reviews. The findings for parental norms are more consistent, at least in the domains of smoking and drinking. Social norms in the sex domain were only examined in one study (Beal, Ausiello, & Perrin, 2001). It has been found that use of tobacco and alcohol is stimu-

lated when these products are offered. However, adolescents do not feel overtly pressurized by others to engage in substance use. Rather, peer pressure is reported to be more internalized: adolescents want to do what (they see or think) others do (Bauman & Ennet, 1996; Kobus, 2003).

Self-efficacy. Self-efficacy has been studied less frequently than other proximal factors. General or unspecified measures, mainly used in the nutrition domain, have consistently shown positive correlations with healthy behavior. Refusal self-efficacy has been examined in only a few studies, but there are positive results for all four domains. Other self-efficacy beliefs have been studied, predominantly in the safe sex domain, with the main focus on skills for using and discussing condoms.

3.2.3 *Distal factors*

Distal domain-specific determinants generally pertain to knowledge and modeling behavior. Knowledge of behavior risks has mostly been studied in the safe sex domain, where results of cross-sectional studies and reviews are conflicting. Positive associations between knowledge and healthy behavior have been reported mainly in reviews, whereas cross-sectional studies have shown null findings or negative associations. Reviews in the domains of nutrition and tobacco indicate that knowledge of behavior risks does not seem to relate directly to behavior; in these reviews correct information is suggested to be a prerequisite for healthy behavior.

Modeling behavior has received much attention in determinant research, especially in the domain of smoking. Perceived health behavior of peers or friends seems to relate positively to adolescents' own health behavior in all four domains, although the absence of such a relation was also found for all behaviors. The influence of friends may be overrated in studies, especially cross-sectional ones, as selection and projection processes appear to account for at least a part of the correlation (Bauman & Ennet, 1996). Nevertheless, in the domain of substance use, not only perceived but also actual peer use relates to adolescents' own use of tobacco or alcohol, although correlations with actual use are generally lower than those with perceived use (Bauman & Ennet, 1996).

Perceived health behavior of parents has been related to adolescents' own behavior in all four domains, with the most and firmest evidence coming from the tobacco and alcohol domains and least evidence from the sex domain.

3.2.4 *Ultimate factors*

At the ultimate level, only two behavior-specific factors were identified: media influence and genetic factors. Two reviews on nutrition reported that the media had a negative influence on healthy nutrition. In the tobacco domain, evidence for negative media influence is very weak, although one longitudinal study found a negative influence of susceptibility to advertising for cigarettes. As for genetic factors, four reviews in the alcohol domain consistently reported that a genetic component to at least one type of problem drinking has been identified. In the tobacco domain, the evidence for genetic factors is less consistent. One review concluded that there is

only weak evidence for a genetic influence on smoking. Another review discussed studies that reported substantial heritability but was unclear about the strength of the evidence.

4. DISCUSSION

4.1 *Similarities between behavior-specific determinants*

This review has focused on similarities between behavior-specific determinants of four health-related behaviors: smoking, (binge) drinking, safe sex and healthy nutrition. To allow comparison across different behaviors, the determinants were carefully categorized, where possible, to a higher, non-behavior-specific level. Thirty-five determinants were identified that have been studied for more than one behavior.

Several determinants were found to be relevant for all four behaviors: beliefs that the unhealthy behavior will lead to immediate gratification and to social advantages, peer norms, peer and parental modeling behavior and refusal self-efficacy. Moreover, the direction of each determinant's relationship with behavior (i.e. as a risk or protective factor) was consistent across the four domains. These determinants appear to be the most relevant ones to include in a transfer-oriented program.

For the remaining determinants that have been examined for multiple behaviors, the direction of their influence is in most cases the same across behaviors. A negative influence on multiple behaviors was found for previous experience with the unhealthy behavior (tobacco and alcohol), early onset of unhealthy behavior (tobacco, alcohol and sex), availability or accessibility of unhealthy products (nutrition and tobacco), school acceptance of substances (tobacco and alcohol) and offers of unhealthy products (tobacco and alcohol). A protective influence on multiple behaviors was found for perceived personal health risk (sex, nutrition and tobacco), strict parental norms and rules (nutrition, tobacco and alcohol) and strict sibling norms (nutrition and tobacco). The influence of several factors was inconsistent across behaviors or was unclear for weight management beliefs (risk factor for smoking, inconsistent findings for nutrition), performance beliefs (protective factor for nutrition and smoking, risk factor for alcohol), knowledge of behavior risks (inconsistent findings for safe sex, unimportant for tobacco and nutrition) and media portrayals and commercials (risk factor for nutrition, very weak evidence for tobacco).

Out of a total of 86 determinants, 51 could not be classified meaningfully to a higher level or have only been studied for one behavior. This may be partly due to our conservative categorization process. For some determinants, their uniqueness may be due to their behavior-specific relevance. For instance, the perceived risk of pregnancy is only directly relevant for sexual behavior; we could not think of a meaningful category that would include similar beliefs for other behaviors. Other determinants, however, may be relevant for all domains but may not have been examined for them all. For instance, in the alcohol domain only one study had examined health-related beliefs.

In addition to this paper's main focus on overlap across domains, it presents a broad overview of research results in four domains. Researchers in a particular do-

main can use the results of this review to look beyond the boundaries of their own domain to generate ideas from results in other domains.

4.2 *Implications for interventions*

A prerequisite for developing interventions that are tailored to multiple behaviors is that these behaviors have some predictors in common. After all, if a factor is predictive of several behaviors, an intervention that can impact that factor may contribute to changes in all related behaviors. In a recent review we found evidence that several general, non-domain-specific factors (e.g., self-esteem, warm and strict parenting style) are predictive of all four behaviors that were also examined in the present review (Wiefferink et al., 2006). Interventions that affect such factors have thus the potential to lead to changes in all four behaviors. The Child Development Project and the Seattle Social Development Project are examples of such an approach in the primary school setting (Battistich, Schaps, Watson, Solomon, & Lewis, 2000; Hawkins, Catalano, Kosterman, Abbott, & Hill, 1999).

The present review concentrated on domain-specific predictors or correlates. These predictors are mostly proximal factors, comprising attitudinal, social normative and self-efficacy beliefs, and are the typical focus of educational interventions. Research in social psychology and health promotion has shown that such beliefs are most predictive of a specific behavior when they are formulated specifically in terms of that behavior (Ajzen, 1991). It is not likely that, without extra effort, changes in such factors in one domain will lead to changes in similar factors in other behavioral domains. Research in education has shown that transfer of learning – e.g., from the school context to the private or work setting, or from one situation or problem to another - does not happen by itself but must be actively promoted (Perkins & Solomon, 1996). The issue of transfer has been raised from different theoretical points of view, mainly from cognitive psychology and situated perspectives, which have different implications for promoting transfer (Tuomi-Gröhn & Engeström, 2003). Situated perspectives emphasize that abstract schooling does not make sense to young people (Säljö, 2003). Knowledge and skills should be meaningful in the context of the students' personal objectives in order for it to be carried over to a similar problem or behavior domain (Säljö, 2003). The perspective of cognitive educational psychology is relevant to the finding of this review that various behaviors have similar determinants. To achieve transfer, the teaching content should focus not only on domain-specific issues but should also invite students to decontextualize these issues into general principles and to examine and practise their application in various other behavioral domains (e.g., Elshout-Mohr et al., 1999). For instance, learning how to refuse a cigarette by understanding general refusal skills can help students to refuse alcohol use or unsafe sex. Application to other domains should be specific and should include relevant domain-specific knowledge, beliefs and circumstances as well as an assessment of the similarities and dissimilarities between domains. In the case of recontextualizing refusal skills from the tobacco to the alcohol domain, students could be invited to act out a situation involving alcohol. They would then assess what the situation entails, look at the ways it is comparable to or different from a tobacco situation, examine whether the response options are comparable and dis-

cuss which specific response could be used. By practising this in several domains, students may learn to use their knowledge and skills flexibly, thus increasing the chance that they will use them in domains they have not rehearsed.

Examples of other general principles that seem relevant in the light of the findings of this review are: understanding the mechanisms of social influences; exploring and questioning expected consequences of the target behavior; exploring alternative behaviors that have similar immediate gratification or social advantages but are less health-compromizing; and considering and weighing various behavioral options and their consequences (decision-making and problem-solving). However, since we do not know of any examples of explicit transfer-oriented learning in health promotion, it is not altogether clear what level of generalization would work best. Moreover, whatever level of generalization is chosen, domain-specific components will always be necessary. After all, young people will have to learn basic domain-specific knowledge and skills.

4.3 *Limitations*

This review fulfils generally acknowledged criteria for systematic reviews (Jackson, 2005): identification of the review question in advance, comprehensive literature search, use of explicit inclusion/exclusion criteria, application of established standards for appraising study quality, and explicit methods of extracting and synthesizing study findings. The following limitations should be discussed.

Because of our broad focus on four health-related behaviors we had to limit our search and may thus have missed relevant studies. Optimal use of restricted resources was made by searching a medical and a social science database (Peersman et al., 1999), by searching empirical as well as review studies and by backward search. Reviews were included to account for results of older studies but, as was mentioned above, this may have some disadvantages, such as the danger of overrepresentation of certain results.

There was considerable variation across the four behavioral domains in the design of the empirical studies. Whereas nearly all studies of safe sex and healthy nutrition had a cross-sectional design, all empirical studies of tobacco and alcohol use were longitudinal. In terms of causality, the findings on smoking and alcohol abuse are thus more robust than the findings on safe sex and nutrition. Although this may hamper comparison of results across different domains, the results in each behavioral domain can be considered to reflect available evidence and current study quality standards *within that domain*.

Within behavioral domains, and especially in the nutrition domain, there was great variation in outcome measures. We included all measures and thus looked at broad behavioral domains, since there is no consensus as to which specific outcome measures in these domains are most relevant.

Definition of determinants was in some cases unclear, as most reviews and some empirical studies did not give specifications of measures. Therefore, as stated earlier, we categorized the determinants conservatively. If we were not sure that determinants addressed the same content or concept, they were treated as separate determinants. Placement under the same heading indicates that there is at least some simi-

larity between determinants. In addition, studies that examined multiple behaviors measured the determinants for each of the behaviors in the same way. In these studies, the results did not differ from studies that examined only one behavior.

This review could even have been stronger if, in addition to type of study, we had included other methodological aspects for weighing study results. Such aspects may include validity and reliability of measures, level of respondent representation and appropriateness of statistical analyses.

Although use of stricter or alternative review methodology might have led to other specific results for some factors or behaviors, it is not likely that the main finding of this review would be different i.e. that there are similarities between domain-specific determinants across behavioral domains. Despite the inclusion of studies with a variety of designs, measures and analyses, the results for most of the determinants examined for multiple behaviors in this review point in the same direction: most determinants are either a risk factor or a protective factor across different behavioral domains. This main finding implies that an important precondition for a transfer-oriented approach to adolescent health promotion can be met. Such an approach is new to this field but seems promising. The determinants that were found to be relevant to all four behaviors are the primary candidates for consideration in a transfer-oriented program.

Table 2. Characteristics of studies included in the review

	Author (year)	Design	Dependent variable	Age	Gender	Ethnicity	N ²	Country
	Studies of multiple behaviors							
19	Adalbjarnardottir (2001)	Longitudinal 3 y	Daily smoking, heavy alcohol use	14	M&F	White	347	Iceland
20	Goldberg (2002)	Longitudinal 6m	Alcohol use (smoking)	Grade 5, 7, 9	M&F	Various, 80% White	395	USA
21	Maxwell (2002)	Longitudinal 1y	Smoking, alcohol, sexual experience	12-18	M&F	Various, 49% White	1969	USA
22	Wills (2002)	Longitudinal 4y	Smoking frequency, alcohol use	Grade 7-10	M&F	Various, 37% White	1364	USA
23	Beal (2001)	Cross-sectional	Smoking, alcohol, sexual experience	12-13	M&F	Mostly Black + Hispanic	208	USA
24	La Greca (2001)	Cross-sectional	Smoking, alcohol, risky sexual behavior	Mean = 16,8	M&F	Mostly middle class	250	USA
25	Maes (2003)	Cross-sectional	Smoking, alcohol, healthy diet	High School	M&F	Not specified	3225	Belgium
26	Topolski (2001)	Cross-sectional	Smoking, alcohol, risky sexual behavior	High school	M&F	Various, 71% White	2801	USA
27	Amaro (2001)	Review	Smoking, drinking (substance abuse)	Mostly 12-18	M&F	Various	219 ref	Mostly USA
28	Bauman (1996)	Review	Smoking, drinking (marijuana)	Adolescents	M&F	Not specified	116 ref	Mostly USA
29	Belcher (1998)	Review	Smoking, drinking (substance use)	Adolescents	M&F	Various	113 ref	Mostly USA
30	Fahs (1999)	Review	Smoking, drinking	Adolescents	M&F	Various	31	Mostly USA
31	Scaramella (2001)	Review	Smoking, drinking	Adolescents	M&F	Various	91 ref	USA
32	Swadi (1999)	Review	Smoking, drinking	Adolescents	M&F	Not specified	151 ref	USA and Western
	Studies of tobacco use							
33	Carvajal (2000)	Longitudinal 9m	Smoking	Grade 6-7	M&F	Various, 60%	736	USA

	Author (year)	Design	Dependent variable	Age	Gender	Ethnicity	N ²	Country
34	Chassin (2000)	Longitudinal 13y	Smoking trajectories	Grade 6-12	M&F	White	736	USA
35	Choi (2001)	Longitudinal, Sample 1: 4 yrs, Sample 2: 3 yrs	Established smoking (> 100 sig/life)	12-18	M&F	96% White Sample 1: nationally representative Sample 2: not specified	7960 3376	USA
36	Choi (2002)	Longitudinal 3y	Established smoking (> 100 sig/life)	12-17	M&F	Various, 64% White	2965	USA
37	Ellickson (2001)	Longitudinal 5y	Smoking	13 and 18	M&F	Various, 72% White	3056	USA
38	Epstein (2000)	Longitudinal 1+2y	Smoking	Grade 7 and 10	M&F	Various, 54% Hispanic	1094	USA
39	Hine (2002)	Longitudinal 3m	Smoking	12-19,	M&F	Not specified	361	Canada
40	Orlando (2001)	Longitudinal 2+5=7y	Smoking	Grade 10 + 12	M&F	Various, 67% White	2961	USA
41	Soldz (2002)	Longitudinal 7 x 1y	Smoking trajectories	Grade 6-12	M&F	Various, 87% White	852	USA
42	Tucker (2002)	Longitudinal 5y	Daily smoking	Grade 7	M&F	Various, 68% White	4165	USA
43	Wang (2001)	Longitudinal 3y	Smoking (experimental and regular)	12-19	M&F	Nationally representative	4431	USA
44	White (2002)	Longitudinal 18y	Smoking trajectories	12	M&F	92% White	374	USA
45	Woodruff (2003)	Longitudinal 1y	Ever smoking	12-15	M&F	Various, 63% Hispanic	478	USA
46	Avenevoli (2003)	Review	Smoking	Mostly 11-17	M&F	Various, mostly White	116 ref	USA and Western
47	Darling (2003)	Review	Smoking	Adolescents	M&F	Not specified	96 ref	Not specified
48	Derzon (1999)	Meta-analysis	Smoking	Up to 18	M&F	Various, mostly	64	USA and

	Author (year)	Design	Dependent variable	Age	Gender	Ethnicity	N ²	Country
						White		Western
49	DuRant (1999)	Review	Smoking	Adolescents	M&F	Not specified	5	Not specified
50	Eissenberg (2000)	Review	Initial smoking	Adolescents	M&F	Not specified	105 ref	Not specified
51	Flay (1998)	Review	Smoking	Adolescents	M&F	Not specified	34	Not specified
52	Kobus (2003)	Review	Smoking	11-20	M&F	Not specified	125 ref	Not specified
53	Mayhew (2000)	Review	Stages in smoking	Adolescents	M&F	Not specified	86 ref	Not specified
54	Pletcher (2000)	Review	Smoking	Adolescents	M&F	Various	22 ref	Mostly USA
55	Sasco (1999)	Review	Smoking	Young people	M&F	Not specified	86 ref	Western
56	Tyas (1998)	Review	Smoking	Adolescents	M&F	Various	226 ref	Mostly western
57	Wagner (2000)	Review	Smoking	Teenagers	F	Not specified		Mostly USA
58	Wilcox (2003)	Review	Smoking	Adolescents	M&F	Not specified	146 ref	Mostly USA
Studies of alcohol use								
59	D'Amico (2001)	Longitudinal 6m	Binge drinking (> 5 drinks)	13-18	M&F	Various, 70% White	621	USA
60	Ellickson (2001)	Longitudinal 2+5=7y	Alcohol misuse	Grade 7 and 10	M&F	Various, 67% White	4200	USA
61	Griffin (2000)	Longitudinal 2y	Alcohol use	Grade 7	M&F	Various, 40% Black	1950	USA
62	Lonczak (2001)	Longitudinal 1, 2 y	Alcohol misuse	14-15	M&F	Various, 46% White	808	USA
63	Poikolainen (2001)	Longitudinal 5y	Alcohol use, heavy drinking (> 13 drinks)	15-19	M&F	Not specified	611	Finland
64	Scheier (2000)	Longitudinal 4y	Alcohol use	Grade 7-10	M&F	90% White	740	USA
65	Johnson (1999)	Review	Drinking	Adolescents	M&F	Black, Hispanic	46 ref	Mostly USA
66	Kodjo (2002)	Review	Drinking (substance use)	Adolescents	M&F	Various	39 ref	Mostly USA
67	Patton (1995)	Review	Drinking	Adolescents	M&F	Not specified	63 ref	Mostly USA
68	Schor (1996)	Review	Drinking	Adolescents	M&F	Not specified	86 ref	Mostly USA
Studies of safe sex								
69	Bachanas (2002)	Cross-sectional	% intercourse with condom	12-19	F	Black	164	USA

	Author (year)	Design	Dependent variable	Age	Gender	Ethnicity	N ²	Country
70	Ben-Zur (2000)	Cross-sectional	Frequency condom use	14-18	M&F	60 % immigrants	1082	Israel
71	Boyer (2000)	Cross-sectional	Susceptibility STD's	13-21	M&F	Black	303	USA
72	Colon (2000)	Cross-sectional	Intention condom use	14-19	M	Black	229	USA
73	Crosby (2000)	Cross-sectional	Frequency unsafe sex	14-18	F	Black	522	USA
74	Dilorio (2001)	Cross-sectional	Condom use	13-15	M&F	Black	405	USA
75	Gutierrez (2000)	Cross-sectional	Condom use	14-19	M&F	Black, White	333	USA
76	Henderson (2002)	Cross-sectional	Condom use 1st intercourse	13-14	M&F	Not specified	1220	Scotland
77	Hendrickx (2002)	Cross-sectional	Condom use	15-21	M&F	Moroccan	55	Belgium
78	Rosengard (2001)	Cross-sectional	Intention condom use	14-19	M&F	Not specified	236	USA
79	Beckman (1996)	Review	Condom use	Adolescents	M&F	Not specified	16	USA
80	Gage (1998)	Review	Condom use	10-19	M&F	Not specified	10	Various
81	Jemmott (2000)	Review	Condom use	11-21	M&F	Not specified	10	USA
82	Kirby (2002)	Review	Use of contraception	< 19	M&F	Not specified	250	USA
83	Kotchick (2001)	Review	Condom use	Adolescents	M&F	Not specified	121 ref	USA
84	Rotheram-Borus (1995)	Review	Condom use	Adolescents	M&F	Not specified	112 ref	USA
85	Whaley (1999)	Review	Risky sexual behavior	Older than 13	M&F	Not specified	49 ref	USA
Studies of nutrition behavior								
86	Backman (2002)	Longitudinal	Intention healthy diet, calory + F&V intake	14-19	M&F	Various, 36% Hispanic	780	USA
87	Berg (2000)	Cross-sectional	Milk and bread choice	11-15	M&F	Not specified	1096	Sweden
88	Berg (2002)	Cross-sectional	Breakfast food choice fat fiber	11-15	M&F	Not specified	181	Sweden
89	Contento (1995)	Cross-sectional	Quality of food intake	11-18	M&F	Various, 47% White	411	USA
90	Croll (2001)	Cross-sectional	Healthy food choice	Grade 7-12	M&F	Various, 50% White	203	USA
91	De Bourdeaudhuij (1998)	Cross-sectional	Family members influence on decision making about food	Families with 2 adol. 12-18	M&F	Not specified	92 fam.	Belgium

	Author (year)	Design	Dependent variable	Age	Gender	Ethnicity	N ²	Country
92	Gillman (2000)	Cross-sectional	Frequency of fruit and vegetables	9-14	M&F	Various, 93% White	16202	USA
93	Masu (2002)	Cross-sectional	Food intake	11-12	M&F	Not specified	238	USA
94	Neumark-Sztainer (1996)	Cross-sectional	Vegetable and fruit(juice) consumption	12-20	M&F	Various, 86% White	36284	USA
95	Neumark-Sztainer (1999)	Cross-sectional	Food-choice	Grade 7 and 10	M&F	Various, 40% White	141	USA
96	Neumark-Sztainer (2003)	Cross-sectional	Nutrient intake	11-18	M&F	Various, 49% White	4746	USA
97	O'dea (2003)	Cross-sectional	Benefits and barriers of healthy eating	7-17	M&F	Representative mix	213	Australia
98	Pirouznia (2001)	Cross-sectional	Eating behavior	10-13	M&F	Not specified	532	USA
99	Roos (2001)	Cross-sectional	Consumption of raw vegetables	Mean = 15,3	M&F	Not specified	65059	Finland
100	Weber Cullen (1998)	Cross-sectional	Stages of change for F&V intake	9-12	F	Various, 77% White	259	USA
101	Woodward (1996)	Cross-sectional	Intake of 22 selected food items	12-15	M&F	Not specified	2082	Australia
102	Birch (1998)	Review	Eating behavior	Adolescents	M&F	Not specified	106 ref	Not specified
103	Eertmans (2001)	Review	Eating behavior	Not specified	M&F	Not specified	124 ref	Not specified
104	Koivisto Hursti (1999)	Review	Food choice	Not specified	M&F	Not specified	75 ref	Sweden
105	Story (2002)	Review	Eating behavior	Adolescents	M&F	Not specified	100 ref	Not specified

¹ Reference numbers are copied from published paper Peters et al. (2009)

² In empirical studies N=number of respondents; in reviews N=number of included studies. Some reviews were not clear about the number of studies included: in these cases the total number of references is given.

Table 3. Domain-specific determinants studied for two or more behaviors

Determinants	Safe sex			Healthy nutrition			Non-smoking			Low alcohol consumption		
	+	-	0/ unclear	+	-	0/ unclear	+	-	0/ unclear	+	-	0/ unclear
Behavioral factors												
Previous experience with the behavior												
Previous experience with the unhealthy behavior							19L, 35L, 37L, 38L, 51R, 21L, 53R, 40L, 42L, 50R		64L	19L, 59L, 60L, 20L, 62L, 21L	22L	
Positive experiences with trial behavior										20L		
Early onset of unhealthy behavior							30R, 53R, 56R			59L, 63L	59L	
Lower age at first intercourse		75C, 76C, 81R, 82R, 83R	75C			25C						
Barriers/availability factors												
Availability / accessibility of unhealthy products					90C, 103R, 104R,		45L, 49R, 58R	45L, 56R				

Determinants	Safe sex			Healthy nutrition			Non-smoking			Low alcohol consumption		
	+	-	0/ unclear	+	-	0/ unclear	+	-	0/ unclear	+	-	0/ unclear
						105R						
Proximal factors												
Attitude												
General, unspecified or mixed beliefs	70C, 78C		74C	86L, 87C, 88C			33L, 48R, 53R, 41L, 56R, 43L		39L, 42L	27R, 20L, 61L		20L
Health beliefs												
Perceived personal health risk	79R, 71C, 73C, 80R, 75C, 77C, 82R, 83R, 84R	85R	69C, 79R, 73C, 75C, 83R		105R		53R, 56R	49R				
Perceived general health risk							46R, 34L		39L, 44L			60L
Denial of health problems in young people		70C			90C							
Physiological and psychological gratification												
Unhealthy behavior gives immediate gratification (e.g.		79R, 71C, 73C,		86L, 87C, 102R,		93C		20L				20L

SIMILARITIES BETWEEN DETERMINANTS OF HEALTH BEHAVIORS

Determinants	Safe sex			Healthy nutrition			Non-smoking			Low alcohol consumption		
	+	-	0/ unclear	+	-	0/ unclear	+	-	0/ unclear	+	-	0/ unclear
condom reduces pleasure, unhealthy food tastes better)		80R, 77C, 81R, 84R			90C, 103R, 104R, 95C, 97C, 105R, 100C, 101C							
Unhealthy behavior helps relax, reduce stress and negative affect								27R, 34L, 51R, 39L, 54R, 55R			67R	
Anticipated regret (e.g. hangover)									20L	20L		20L
Appearance Behavior helps lose or maintain weight				86L		87C		30R, 51R, 39L, 54R, 55R, 57R				
Performance Mental / cognitive performance					97C						67R	
Athletic / physical / motor performance					97C	86L	55R				67R	
Social consequences Unhealthy behavior		74C						38L,	39L, 34L		67R, 61L	

Determinants	Safe sex			Healthy nutrition			Non-smoking			Low alcohol consumption		
	+	-	0/ unclear	+	-	0/ unclear	+	-	0/ unclear	+	-	0/ unclear
has social advantages									39L, 52R			
Social normative beliefs												
General social norm	78C		78C	86L, 87C, 102R, 103R, 100C		93C						
Healthy behavior acceptable to peers / peer norms	23C, 79R, 71C, 80R			86L, 97C			23C, 33L, 48R, 49R, 51R, 53R, 56R, 57R		37L, 42L	61L, 23C		29R, 60L, 68R
Healthy behavior acceptable to parents / parental norms			23C	86L, 97C			27R, 46R, 33L, 47R, 48R, 49R, 52R, 53R, 55R, 31R, 42L, 56R, 57R		23C, 37L, 51R	23C, 29R, 61L, 65R, 68R		60L
Rules set by parents about behavior				91C, 103R			55R					

SIMILARITIES BETWEEN DETERMINANTS OF HEALTH BEHAVIORS

63

Determinants	Safe sex			Healthy nutrition			Non-smoking			Low alcohol consumption		
	+	-	0/ unclear	+	-	0/ unclear	+	-	0/ unclear	+	-	0/ unclear
Healthy behavior acceptable to partner	82R, 83R				87C							
Healthy behavior acceptable to siblings				86L			57R					
School acceptance of cigarettes and drugs								58R			31R	
Offers of unhealthy products								53R, 42L, 45L	45L		60L	
Direct social pressure to engage in unhealthy behavior									28R, 52R			28R
Self-efficacy												
General self-efficacy to perform healthy behavior				86L, 87C, 93C, 105R, 100C			33L					
Perception of skills to perform healthy behavior (e.g. use condoms, prepare healthy food)	79R, 74C, 75C, 81R, 82R, 83R, 84R		71C, 75C	86L								
Refusal self-efficacy	72C, 74C			105R			49R		60L	60L		
Distal factors												
Knowledge/values												
Knowledge of behavior risks	82R, 83R,	70C, 75C,	69C, 71C,				104R, 105R		56R			

Determinants	Safe sex			Healthy nutrition			Non-smoking			Low alcohol consumption		
	+	-	0/ unclear	+	-	0/ unclear	+	-	0/ unclear	+	-	0/ unclear
	85R, 71C	83R, 85R	72C, 75C, 84R									
Social bonding/Others' behavior												
Perceived healthy behavior general				87C, 102R, 104R		93C	36L, 51R, 32R					
Perceived healthy behavior peers/friends	69C, 71C, 73C, 83R, 24C, 21L		69C, 23C, 73C, 74C	105R, 101C		105R, 101C	27R, 46R, 28R, 23C, 33L, 34L, 36L, 48R, 49R, 30R, 52R, 24C, 21L, 53R, 54R, 55R, 56R, 57R, 43L, 44L	37L		19L, 37L, 42L, 44L	19L, 27R, 28R, 23C, 59L, 60L, 61L, 24C, 21L, 68R, 32R	59L
Actual healthy behavior peers/friends							28R, 52R, 21L		28R		28R, 21L	28R

SIMILARITIES BETWEEN DETERMINANTS OF HEALTH BEHAVIORS

Determinants	Safe sex			Healthy nutrition			Non-smoking			Low alcohol consumption		
	+	-	0/ unclear	+	-	0/ unclear	+	-	0/ unclear	+	-	0/ unclear
Perceived healthy behavior parents	83R		23C	87C, 105R, 101C			19L, 27R, 46R, 23C, 34L, 36L, 47R, 48R, 30R, 52R, 25C, 53R, 54R, 55R, 32R, 42L, 56R, 57R, 43L, 44L		36L, 44L	23C, 29R, 60L, 65R, 67R, 68R, 32R		19L, 25C
Ultimate factors												
Cultural environment												
Media/commercials					102R, 105R			36L	51R			
Biology												
Genetic influences								46R	51R		29R, 66R, 67R, 32R	
	+	-	0	+	-	0	+	-	0	+	-	0

Studies can be in two columns of one behavior. For empirical studies this means that different relations were found for different groups of respondents or for different outcome measures. For reviews, it means that different relations were found in different studies and no overall conclusion was formulated. Study design is indicated by a letter: L=longitudinal, C=cross-sectional, R=review. + = determinant enhances healthy behavior; - = determinant impedes healthy behavior; 0 = no relationship with behavior.

Table 4. Domain-specific determinants studied for only one behavior

Determinant	Behavior	+	-	0
Behavioral factors				
Previous experience with the behavior				
Previous behavior to relieve tension	Low alcohol consumption		63L	
Behavior-related health consequences in the past (STD, pregnancy)	Safe sex		73C, 82R, 78C, 85R	78C
Nicotine dependence	Non-smoking		30R	
Behavior specifics				
Eating dinner with family members	Healthy nutrition	92C, 96C, 99C, 105R		
Eating outside the house (e.g. school, restaurants, fast-food)	Healthy nutrition		105R	
Member of school lunch program	Healthy nutrition	99C		
Eating snacks during school hours	Healthy nutrition		99C	
Binge eating	Healthy nutrition		94C	
Dieting	Healthy nutrition	89C	94C	94C
Number of sex partners	Safe sex		84R	
Barriers/availability factors				
Availability and accessibility of healthy products	Healthy nutrition	86L, 103R, 95C, 97C	105R	
Proximal factors				
Attitude				
Health beliefs				
Perceived protection against health risks	Healthy nutrition	87C, 90C, 101C		101C
Define healthy breakfast as low in fat	Healthy nutrition			88C
Define healthy breakfast as high in fiber	Healthy nutrition	88C		
Feel healthy when acting healthy	Healthy nutrition	97C		86L
Perceived risk of pregnancy	Safe sex	79R, 73C, 80R, 77C, 82R		73C
Other contraception than condoms protects against HIV/STD	Safe sex		73C	
Physiological and psychological gratification				
Unhealthy behavior (UB) enhances mood	Healthy nutrition		97C	
UB Helps feel confident	Non-smoking		27R	
UB Helps feel rebellious	Non-smoking		27R, 55R	

Determinant	Behavior	+	-	0
UB Helps feel independent, autonomous	Non-smoking		51R, 52R	
UB Helps feel unique	Non-smoking		55R	
UB Helps feel sexually active	Non-smoking		27R	
Image/stereotype of smokers more positive than self-image	Non-smoking		52R, 55R, 57R	
Feeling good when acting healthy	Healthy nutrition	86L, 97C		
Energy level increases when acting healthy	Healthy nutrition	90C, 97C		86L
Feeling comfortable with own sexuality	Safe sex	79R		
<u>Appearance</u>				
Look good when acting healthy	Healthy nutrition	90C		86L
<u>Social consequences</u>				
UB helps cope with social insecurity	Non-smoking		27R	
Behavior does not fit social situation	Healthy nutrition		90C	
Belief alcohol influences conduct negatively	Low alcohol consumption	30R		
<u>Other</u>				
Costs of behavior	Healthy nutrition		86L, 95C	
Efforts / time needed to perform the behaviour	Healthy nutrition		90C, 95C, 97C	86L
<u>Social normative beliefs</u>				
Congruence between parental norms and behavior (parents do not drink)	Low alcohol consumption	65R		
Healthy behavior acceptable to teacher, coach	Healthy nutrition			86L
<u>Self-efficacy</u>				
Self-efficacy in risky situations (e.g. drunk, holiday, party, etc.)	Safe sex	78C		75C
Self-efficacy to quit unhealthy behavior	Non-smoking		36L	
<u>Distal factors</u>				
<u>Knowledge/values</u>				
Knowledge about the food content	Healthy nutrition	88C, 93C, 98C		88C, 98C
Knowledge of symbol for healthy food	Healthy nutrition			88C
Received education about health behavior	Safe sex	82R		
Traditional attitude toward sex roles	Safe sex		80R, 82R, 84R	
Permissive attitude toward (premarital) sex	Safe sex		82R, 83R	83R

Determinant	Behavior	+	-	0
Social bonding/Others' behavior				
Parents have alcohol problem	Low alcohol consumption		67R, 32R	63L
Perceived healthy behavior siblings	Non-smoking	46R, 47R, 52R, 53R, 55R, 42L, 56R, 43L		44L
Perceived healthy behavior partner	Non-smoking	52R		
Perceived healthy behavior in family/ household	Non-smoking	49R, 50R, 57R		36L, 37L
Perceived healthy behavior adults	Low alcohol consumption	61L		
Perceived healthy behavior teachers	Non-smoking			43L
Perceived healthy behavior of others	Non-smoking	36L, 51R, 32R		
Communication with parents about health behavior	Safe sex	82R, 83R		82R
Ultimate factors				
Cultural environment				
Culture/traditions food	Healthy nutrition	103R, 104R	103R, 104R	

Studies can be in two columns of one behavior. For empirical studies this means that different relations were found for different groups of respondents or for different outcome measures. For reviews, it means that different relations were found in different studies and no overall conclusion was formulated. Study design is indicated by a letter: L=longitudinal, C=cross-sectional, R=review. + = determinant enhances healthy behavior; - = determinant impedes healthy behavior; 0 = no relationship with behavior; STD=sexually transmitted disease; UB=unhealthy behavior.