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Clustering of Health-Related Behaviors and Their Determinants: Possible Consequences for School Health Interventions

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Characterizing school health promotion is its category-by-category approach, in which each separate health-related behavior is addressed independently. Such an approach creates a risk that extra-curricular activities become overloaded, and that teaching staff are distracted by continuous innovations. Within the health promotion sector there are thus increasing calls for an integrative approach to health-related behaviors. However, a meaningful integrative approach to different lifestyles will be possible only if there is some clustering of individual health-related behaviors and if health-related behaviors have a minimum number of determinants in common. This systematic review aims to identify to what extent the four health-related behaviors smoking, alcohol abuse, safe sex and healthy nutrition cluster; and how their determinants are associated. Potentially modifiable determinants that offer clues for an integrative approach of school health-promotion programs are identified. Besides, the direction in which health educators should look for a more efficient instructional design is indicated.

KEY WORDS: health-related behaviors; clustering; determinants; school health interventions; smoking; alcohol abuse; safe sex; nutrition.

INTRODUCTION

Characterizing school health-promotion is its category-by-category approach, in which each separate health-related behavior is addressed independently. Such an approach creates a risk that extra-curricular activities (including health-promotion programs) become overloaded, and that teaching staff are distracted by continuous innovations (Ten Dam, 2002).

In the Netherlands, health promotion is not the only social theme requiring attention in schools: emancipation, cultural education and environmental education have all been around for a considerable time, joined more recently by peace education. Within the health promotion sector there are thus increasing calls for an integrative approach to health-related behaviors. These envisage a single intervention program that addresses several health-related behaviors simultaneously, simultaneously saving costs and making fewer demands on the limited innovative capacity of schools.

However, Paulussen has assumed that a meaningful integrative approach to different lifestyles will be possible only if, at the very minimum, the following criteria are met: (1) that there is some clustering of individual health-related behaviors and (2) that these health-related behaviors have a minimum number of predictors in common (Paulussen *et al.*, 1998). While there is some evidence of clustering among health-compromising behaviors, such as smoking, alcohol abuse, and high fat intake, there is little evidence of it among health-enhancing behaviors, such as safe sex, exercise, and fruit and vegetable

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consumption (Aarø *et al.*, 1995; Burke *et al.*, 1997; Flay, 2002; Little *et al.*, 1995; Schaalma *et al.*, 1997). Neither is it clear how health-enhancing behaviors relate to health-compromising behaviors (Flay, 2002). Although there have been extensive studies and reviews on psychosocial constructs as predictors of individual health-related behaviors, it is still not clear which predictors are broadly common to all behaviors, and which are behavior specific.

Because there has been no systematic review indicating the predictors that can be included in an integrative approach, this study aims to fill the gap by presenting the results of a systematic review of (1) the clustering of four health-related behaviors: smoking, alcohol abuse, safe sex and healthy nutrition; and (2) the relationships between predictors of these four behaviors.

Theoretical Approaches to Predicting Health-Related Behaviors

There are very many theories on predicting health-related behaviors. Probably the most common ones are the psychological theories of decision making, which describe the cognitive variables that are thought to predict behavior. Some of these theories, such as the Health Belief Model, Protection Motivation Theory, and Theory of Planned Behavior, focus on the individual (Ajzen, 1991; Becker, 1974; Rogers, 1983). Other theories, such as the Social Learning Theory, are interpersonal theories which include the social context (Bandura, 1986). These theories assume that each specific behavior has its own set of specific beliefs that directly predict behavior. Such beliefs, known as proximal determinants because they are believed to have the most direct link to behavior, are in turn influenced by other factors, so-called distal determinants, which are more distant from behavior than proximal determinants.

There are also some theories on distal determinants, such as The Five-Factor Model and Problem Behavior Theory (Gullone & Moore, 2000; Jessor, 1991). Including determinants such as self-esteem, extraversion, sensation seeking, and relations with adults, such theories are assumed to be predictive for multiple health-related behaviors.

Finally, there are integrative theories that combine proximal, distal, intrapersonal and interpersonal determinants; these include the Biopsychosocial Model, the Ecologic Perspective, and the Theory of Triadic Influence (TTI) (Irwin & Millstein, 1986; Irwin *et al.*, 1997; Bronfenbrenner, 1986; Flay & Petraitis, 1994).

A more comprehensive overview of predictive theories of health-related behavior is given by (Petraitis *et al.*, 1995). Of all attempts to formulate an integrative theory that predicts health-related behaviors, the (TTI) appears to be the most comprehensive one (Flay & Petraitis, 1994). It includes not only determinants at different levels (i.e., proximal, distal, and ultimate), but also determinants of different types (i.e., intrapersonal determinants in the biology/personality stream, interpersonal determinants in the social situation stream, and cultural determinants in the cultural environment stream). For the purpose of this study we decided to use the TTI as a basis for modeling the determinants of health behaviors.

Framework for Organizing Psychosocial Variables

Figure 1 shows the framework we used for modeling these determinants. It is a simplified version of the TTI (Flay & Petraitis, 1994). The top line represents the ultimate determinants of behavior, i.e., determinants that are predictive for multiple behaviors but are believed to be almost unchangeable. They include the culture and society one lives in, the more immediate social environment, and one's inherited traits. The second line represents the distal determinants of behavior, including knowledge and values, social relationships, and sense of self and social competence. These determinants are more immediate causes of behavior than ultimate causes, and are also supposed to be predictive for multiple behaviors. The third line represents proximal determinants, such as attitudes, social normative beliefs, and self-efficacy. Although proximal determinants are highly predictive for one behavior, the specific content of these belief structures are supposed to differ between specific behaviors.

Ultimate determinants are more deeply rooted and less predictive of behavior than distal and proximal determinants, but are (almost) impossible to change. While people cannot change their inherited traits or personality dispositions, it is possible to change distal determinants (such as social competence), and proximal determinants (such as self-efficacy).

Like Flay, we assume that there are "interstream pathways" between ultimate and distal determinants (Flay & Petraitis, 1994). For instance, personality can not only influence distal determinants in the same stream, such as social competence, but also, to a lesser extent, distal determinants in the other streams, such as social bonding.

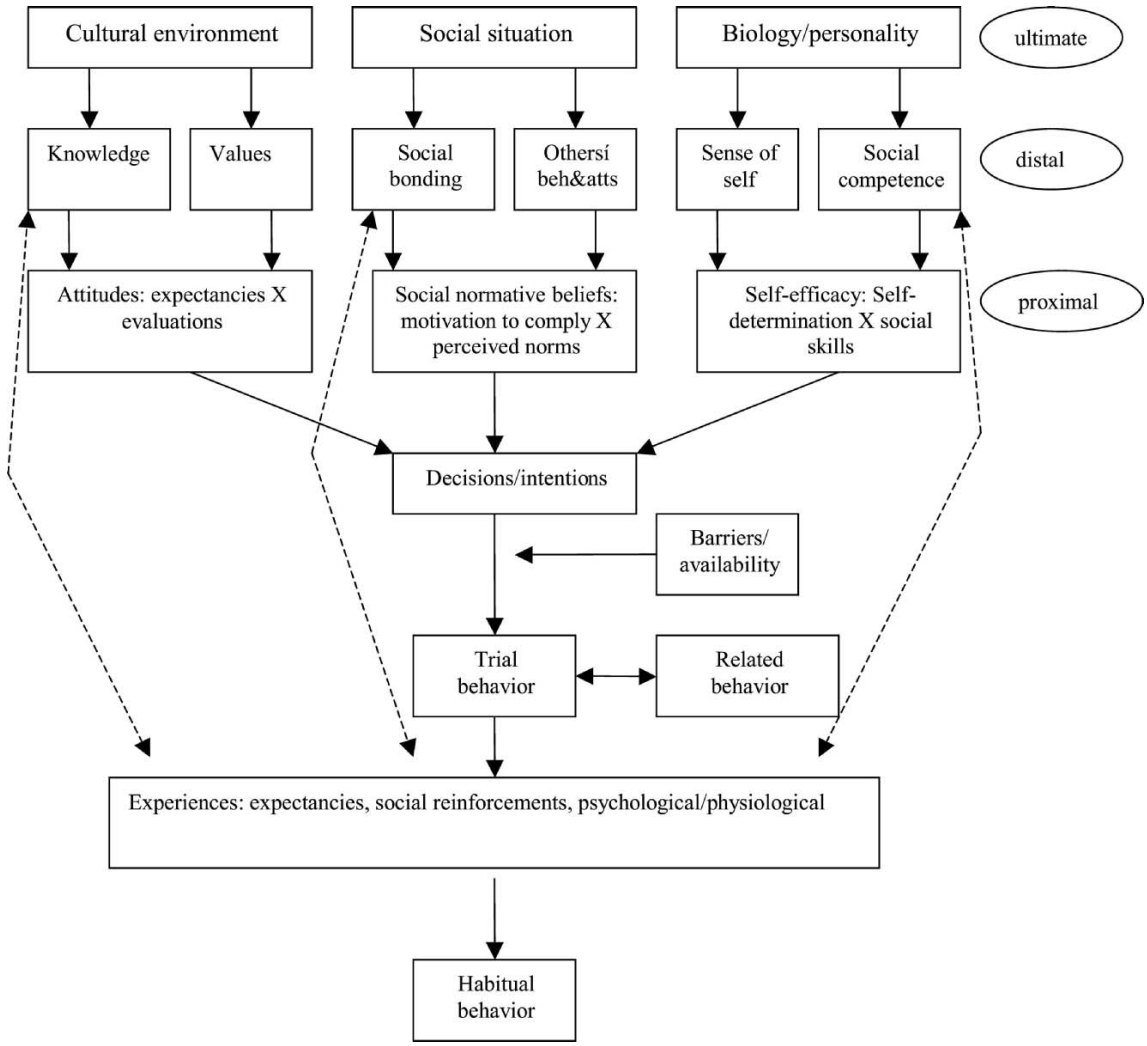

Fig. 1. Framework of determinants predicting health-related behaviors.

Aims of this Study

Using the TTI, we organized the determinants of health-related behaviors in order to answer the following questions:

1. To what extent are the four health-related behaviors (smoking, alcohol abuse, safe sex, and healthy nutrition) associated?
2. Which determinants are correlated with two or more of these four behaviors?

We expected that health-compromising behaviors, such as smoking and alcohol abuse would be related more to each other than to health-enhancing behaviors such as safe sex and healthy nutrition. We also expected that determinants of behaviors would be more similar on a distal and ultimate level than on a proximal level.

It should be noted that this study was limited to determinants on the ultimate, distal and proximal levels that influence intentions to carry out the behavior. And although we are aware that there is a gap between intention and actual behavior, it was beyond the scope of this study to study and to explain this gap.

METHOD

Sample of Studies

To generate the sample of studies, we searched the Medline and PsycINFO databases using the

following keywords: risk-taking, risk factors, risk perception, psychosocial factors, psychology, intention, motivation, personality (characteristics), personality correlates, predisposition, knowledge, attitudes, and practice. Five searches were performed, one each for the four individual behaviors, and one for multiple behaviors. Each search featured keywords specific to the behavior or behaviors in question. For instance, for safe sex we used the following keywords: safe sex, contraception behavior, condoms, Acquired Immunodeficiency Syndrome/prevention and control, AIDS prevention, sexual risk-taking, psychosexual behavior, and attitudes to AIDS.

Inclusion Criteria

Studies were included if they met the following criteria:

1. Studies had to have been published in journals included the Social Science Citation Index list.
2. Reviews had to have been published between 1995 and 2003.
3. Empirical studies had to have been published between 2000 and 2003.
4. Data collection had to have been carried out in Western countries (Western-Europe and United States).
5. Respondents had to be between 10 and 18 years.
6. Studies had to report on the relationship between the behavior and its determinants.

Because of the huge number of empirical studies on smoking and alcohol abuse, we included only longitudinal studies for these behaviors. The time window for reviews from 1995 to 2003 was chosen to make sure that reviews of all four behaviors could be included. The time window for empirical studies was limited between 2000 and 2003 because we assumed that empirical studies published before 2000 were included in one of the included reviews. Because there are fewer studies on nutrition, we included empirical studies on nutrition published between 1995 and 2003.

On the basis of these inclusion criteria, 116 studies were included in the review: 23 on safe sex, 27 on smoking, 13 on alcohol abuse, 23 on nutrition, 10 on smoking and alcohol abuse, and 20 on multiple behaviors.

Of the 20 studies that examined multiple behaviors, 5 did not present results on the links between determinants and separate behaviors, but instead constructed a single index that included a number of health-related behaviors. In three of these studies, this index consisted of smoking, alcohol abuse, and sexual experience; in one study, it consisted of smoking, alcohol abuse, and healthy nutrition; and in one it consisted of smoking and alcohol abuse. In all studies, the indexes also included other behaviors, for instance marijuana use or suicidal behavior. Table 1 shows the characteristics of the studies we included. Thirty-six reviews were included (including one meta-analysis) and 80 empirical studies. Most of the reviews are on smoking (53%) and only four reviews are on nutrition (11%). Empirical studies on smoking and alcohol abuse were longitudinal studies, whereas most empirical studies on safe sex and nutrition were cross-sectional studies (88 and 95%). Studies that addressed more than one behavior were mostly cross-sectional. Most studies (70%) were conducted in the United State, the remaining studies in Western Europe, Australia, New Zealand or Canada.

Coding

Three reviewers coded the studies, with one reviewer coding smoking and alcohol abuse studies, one coding safe sex and multiple-behavior studies, and one coding nutrition studies. To ensure that coding of the studies was carried out according to the protocol, coding was discussed in several meetings. For each study we coded the following: study design; the age; gender and ethnic group of respondents; the number of respondents; the country where data were collected, the method whereby behavior was measured; and relationships between behavior and determinants. Studies that measured multiple behaviors, but presented relationships between each separate behavior and determinants, were coded as separate behaviors, whereas studies that presented relationships between determinants and an index of multiple behaviors were analyzed separately.

Determinants were categorized to meaningful categories, according to the model presented in Fig. 1. For example, we categorized “perceived personal risk of HIV” and “perceived personal risk of cancer” in the category “perceived personal health risk.” The only determinants included for further analysis were those measured for two or more behaviors. Behavior-specific proximal determinants that could not be categorized on a more conceptual level were not included in our study.

Table 1. Characteristics of Studies Included in the Review[a]

		Design	Dependent variable	Age	Gender	Ethnicity	N[b]	Country
1	Adalbjarnardottir and Hafsteinsson (2001)	Longitudinal 3 y	Daily smoking, heavy alcohol use	14	M&F	White	347	Iceland
2	Amaro *et al.* (2001)	Review	Smoking, drinking (substance abuse)	Mostly 12–18	M&F	Various ethnicities	219 ref	Mostly USA
3	Avenevoli and Merikangas (2003)	Review	Smoking	Mostly 11–17	M&F	Various ethnicities, mostly white	116 ref	USA and Western
4	Bachanas *et al.* (2002)	Cross-sectional	% intercourse with condom	12–19	F	Afro-American	164	USA
5	Backman *et al.* (2002)	Longitudinal	Intention healthy diet, calorie + F&V intake	14–19	M&F	Various ethnicities, 36% Hisp	780	USA
6	Bauman and Ennet (1996)	Review	Smoking, drinking (marijuana)	Adolescents	M&F	Not specified	116 ref	Mostly USA
7	Beal *et al.* (2001)	Cross-sectional	Smoking, alcohol, sexual experience	12–13	M&F	Mostly black + Hispanic	208	USA
8	Beckman and Harvey (1996)	Review	Condom use	Adolescents	M&F	Not specified	16	USA
9	Belcher and Shinitzky (1998)	Review	Smoking, drinking (substance use)	Adolescents	M&F	Various ethnicities	113 ref	Mostly USA
10	Ben-Zur *et al.* (2000)	Cross-sectional	Frequency condom use	14–18	M&F	60 % immigrants	1082	Israel
11a	Berg *et al.* (2000)	Cross-sectional	Milk and bread choice	11–15	M&F	Not specified	1096	Sweden
11b	Berg *et al.* (2002)	Cross-sectional	Breakfast food choice	11–15	M&F	Not specified	181	Sweden
12	Birch and Fisher (1998)	Review	Eating behavior	Adolescents	M&F	Not specified	106 ref	Not specified
13	Blum *et al.* (2000)	Cross-sectional	Smoking, alcohol, sexual experience	Grade 7–12	M&F	Various ethnicities, 70% white	10803	USA
14	Boyer *et al.* (2000)	Cross-sectional	Susceptibility STD's	13–21	M&F	Afro-American	303	USA
15	Brooks *et al.* (2002)	Cross-sectional	Smoking, alcohol, healthy diet, risky sexual behavior	Mean = 16	M&F	Not specified	2224	USA
16	Carvajal *et al.* (2000)	Longitudinal 9m	Smoking	Grade 6–7	M&F	Various ethnicities, 60% white	736	USA
17	Chassin *et al.* (2000)	Longitudinal 13y	Smoking trajectories	Grade 6–12	M&F	96% white	736	USA
18	Choi *et al.* (2001)	Longitudinal, sample 1: 4 yrs, sample 2: 3 yrs	Established smoking (> 100 sig/life)	12–18	M&F	Sample 1: nationally representative Sample 2: not specified	1: 7960 2: 3376	USA
19	Choi *et al.* (2002)	Longitudinal 3y	Established smoking (> 100 sig/life)	12–17	M&F	Various ethnicities, 64% white	2965	USA
20	Coker and Borders (2001)	Longitudinal 2 y	Binge drinking (> 5 drinks)	Grade 8	M&F	Nationally representative	17424	USA
21	Colon *et al.* (2000)	Cross-sectional	Intention condom use	14–19	M	Afro-American	229	USA
22	Contento *et al.* (1995)	Cross-sectional	Quality of food intake	11–18	M&F	Various ethnicities, 47% white	411	USA

Table 1. Continued

		Design	Dependent variable	Age	Gender	Ethnicity	N^b	Country
23	Cooper (2002)	Review	Condom use	12–24	M&F	Not specified	43	USA
24	Cooper *et al.* (2003)[a]	Longitudinal 4 y	Smoking, alcohol, risky sexual behavior	13–19	M&F	Black & white	1978	USA
25	Croll *et al.* (2001)	Focusgroup	Healthy food choice	Grade 7–12	M&F	Various ethnicities, 50% white	203	USA
26	Crosby (2000)	Cross-sectional	Frequency unsafe sex	14–18	F	Afro-American	522	USA
27	Crosby and Yarber (2001)	Cross-sectional	Condom use	14–18	F	Afro-American	469	USA
28	Crosby *et al.* (2002a, 2002b)	Cross-sectional	Condom use	14–18	F	Afro-American	522	USA
29	Cullen *et al.* (1999)	Cross-sectional	Fruit, vegetable and fat intake (i.o.)	14–21	M&F	Not specified	5881	USA
30	D'Amico *et al.* (2001)	Longitudinal 6 m	Binge drinking (>5 drinks)	13–18	M&F	Various ethnicities, 70% white	621	USA
31	Darling and Cumsille (2003)	Review	Smoking	Adolescents	M&F	Not specified	96 ref	Not specified
32	De Bourdeaudhuij and Van Oost (1998)	Descriptive	Family members influence on decision making about food	Families with 2 adol. 12–18	M&F	Not specified	92 fam	Belgium
33	Derzon and Lipsey (1999)	Meta-analysis	Smoking	Up to 18	M&F	Various ethnicities, mostly white	64	USA and Western
34	DiClemente *et al.* (2001)	Cross-sectional	Alcohol, risky sexual behavior	14–18	F	Afro-American		USA
35	Dilorio *et al.* (2001)	Cross-sectional	Condom use	13–15	M&F	Afro-American	405	USA
36	DuRant and Smith (1999)	Review	Smoking	Adolescents	M&F	Not specified	5	Not specified
37	Eertmans *et al.* (2001)	Review	Eating behavior	Not specified	M&F	Not specified	124 ref	Not specified
38	Eissenberg and Balster (2000)	Review	Initial smoking	Adolescents	M&F	Not specified	105 ref	Not specified
39	Ellickson *et al.* (2001a)	Longitudinal 5 y	Smoking	13 and 18	M&F	Various ethnicities, 72% white	3056	USA
40	Ellickson *et al.* (2001b)	Longitudinal 2+5 = 7y	Alcohol misuse	Grade 7 and 10	M&F	Various ethnicities, 67% white	4200	USA
41	Epstein *et al.* (2000)	Longitudinal 1+2y	Smoking	Grade 7 and 10	M&F	Various ethnicities, 54% Hispanic	1094	USA
42	Fahs *et al.* (1999)	Review	Smoking, drinking	Adolescents	M&F	Various ethnicities	31	Mostly USA
43	Ferdinand *et al.* (2001)	Longitudinal 4,6,8y	Heavy smoking	10–18	M&F	Not specified	487	The Netherlands
44	Flay *et al.* (1998)	Review	Smoking	Adolescents	M&F	Not specified	34	Not specified

Table 1. Continued

		Design	Dependent variable	Age	Gender	Ethnicity	N^b	Country
45	Flisher *et al.* (2000)[a]	Cross-sectional	Score of 6 risk behaviors	9–17	M&F	Not specified	1285	USA
46	Gage (1998)	Review	Condom use	10–19	M&F	Not specified	10	Various
47	Gillman *et al.* (2000)	Cross-sectional	Frequency of fruit and vegetables	9–14	M&F	Various ethnicities, 93% white	16202	USA
48	Goldberg *et al.* (2002)	Longitudinal 6 m	Alcohol use (smoking)	Grade 5, 7, 9	M&F	Various ethnicities, 80% white	395	USA
49	Greene *et al.* (2000)	Cross-sectional	Smoking, alcohol, risky sexual behavior	11–18	M&F	Various ethnicities, 82% white	381	USA
50	Griffin *et al.* (2000)	Longitudinal 2 y	Alcohol use	Grade 7	M&F	Various ethnicities, 40% Afro-Am	1950	USA
51	Gutierrez *et al.* (2000)	Cross-sectional	Condom use	14–19	M&F	Afro- + European-American	333	USA
52	Halpern-Felsher *et al.* (1996)	Review	Risky sexual behavior	13–20	M&F	Not specified	15	USA
53	Hanna *et al.* (2001)	Cross-sectional	Smoking, alcohol	12–16	M&F	National representative	2001	USA
54	Henderson *et al.* (2002)	Cross-sectional	Condom use 1e intercourse	13–14	M&F	Not specified	1220	Scotland
55	Hendrickx *et al.* (2002)	Focusgroup	Condom use	15–21	M&F	Moroccan	55	Belgium
56	Hine *et al.* (2002)	Longitudinal 3 m	Smoking	12–19,	M&F	Not specified	361	Canada
57	Hoglund *et al.* (1998)	Cross-sectional	Food-frequency of various products	14–15	M&F	Not specified	7605	Sweden
58	Jemmott and Jemmott (2000)	Review	Condom use	11–21	M&F	Not specified	10	USA
59	Johnson and Johnson (1999)	Review	Drinking	Adolescents	M&F	Afro-American, Hispanic	46 ref	Mostly USA
60	Kirby (2002)	Review	Use of contraception	<19	M&F	Not specified	250	USA
61	Kobus (2003)	Review	Smoking	11–20	M&F	Not specified	125 ref	Not specified
62	Kodjo and Klein (2002)	Review	Drinking (substance use)	Adolescents	M&F	Various ethnicities	39 ref	Mostly USA
63	Koivisto Hursti (1999)	Review	Food choice	Not specified	M&F	Not specified	75 ref	Sweden
64	Kotchick *et al.* (2001)	Review	Condom use	Adolescents	M&F	Not specified	121 ref	USA
65	Kremers *et al.* (2003)	Cross-sectional	Fruit consumption and intention	16–17	M&F	Not specified	1771	The Netherlands
66	Kumpulainen (2000)	Longitudinal 3 y	Heavy alcohol use	12	M&F	Not specified	1111	Finland
67	La Greca *et al.* (2001)[a]	Cross-sectional	Smoking, alcohol, risky sexual behavior	Mean = 16,8	M&F	Mostly middle class	250	USA
68	Laukkanen *et al.* (2002)	Cross-sectional	Smoking, alcohol	15	M&F	Not specified	171	Finland

Table 1. Continued

		Design	Dependent variable	Age	Gender	Ethnicity	N^b	Country
69	Li *et al.* (2000)	Cross-sectional	Alcohol, condom use	9–17	M&F	Afro-American	1000	USA
70	Lonczak *et al.* (2001)	Longitudinal 1, 2 y	Alcohol misuse	14–15	M&F	Various ethnicities, 46% white	808	USA
71	Maes and Lievens (2003)	Cross-sectional	Smoking, alcohol, healthy diet	High School	M&F	Not specified	3225	Belgium
72	Masui *et al.* (2002)	Cross-sectional	Food intake	11–12	M&F	Not specified	238	USA
74	Maxwell (2002)	Longitudinal 1y	Smoking, alcohol, sexual experience	12–18	M&F	Various ethnicities, 49% white	1969	USA
75	Mayhew *et al.* (2000)	Review	Stages in smoking	Adolescents	M&F	Not specified	86 ref	Not specified
76	McGee and Williams (2000)[a]	Longitudinal	Smoking, alcohol, sexual experience	9–15	M&F	Various ethnicities	1037	New-Zealand
77	Neumark-Sztainer *et al.* (1996)	Cross-sectional	Vegetable and fruit(juice) consumption	12–20	M&F	Various ethnicities, 86% white	36284	USA
78	Neumark-Sztainer *et al.* (1999)	Focusgroup	Food-choice	7th + 10th grade	M&F	Various ethnicities, 40% white	141	USA
79	Neumark-Sztainer *et al.* (2003)	Cross-sectional	Nutrient intake	11–18	M&F	Various ethnicities, 48,5% white	4746	USA
80	O'dea (2003)	Focusgroup	Benefits and barriers of healthy eating	7–17	M&F	Representative mix	213	Australia
81	Oman *et al.* (2002)	Cross-sectional	Smoking, alcohol, sexual experience	13–19	M&F	Various ethnicities, 47% white	1350	USA
82	Orlando *et al.* (2001)	Longitudinal 2+5 = 7y	Smoking	Grade 10 + 12	M&F	Various ethnicities, 67% white	2961	USA
83	Patton (1995)	Review	Drinking	Adolescents	M&F	Not specified	63 ref	Mostly USA
84	Pirouznia (2001)	Cross-sectional	Eating behavior	10–13	M&F	Not specified	532	USA
85	Pletcher and Schwarz (2000)	Review	Smoking	Adolescents	M&F	Various ethnicities	22 ref	Mostly USA
86	Poikolainen *et al.* (2001)	Longitudinal 5y	Alcohol use, heavy drinking (> 13 drinks)	15–19	M&F	Not specified	611	Finland
87	Roos *et al.* (2001)	Cross-sectional	Consumption of raw vegetables	Mean = 15,3	M&F	Not specified	65059	Finland
88	Rosengard *et al.* (2001)	Cross-sectional	Intention condom use	14–19	M&F	Not specified	236	USA
89	Rotheram-Borus *et al.* (1995)	Review	Condom use	Adolescents	M&F	Not specified	112 ref	USA
90	Sasco and Kleihues (1999)	Review	Smoking	Young people	M&F	Not specified	86 ref	Western
91	Scaramella and Keyes (2001)	Review	Smoking, drinking	Adolescents	M&F	Various ethnicities	91 ref	USA

Table 1. Continued

		Design	Dependent variable	Age	Gender	Ethnicity	N^b	Country
92	Scheier *et al.* (2000)	Longitudinal 4y	Alcohol use	Grade 7–10	M&F	90% white	740	USA
93	Schor (1996)	Review	Drinking	Adolescents	M&F	Not specified	86 ref	Mostly USA
94	Simantov *et al.* (2000)	Cross-sectional	Smoking, alcohol	Grade 7–12	M&F	Various ethnicities, 54% white	5513	USA
95	Soldz and Cui (2002)	Longitudinal 7x1y	Smoking trajectories	Grade 6–12	M&F	Various ethnicities, 87% white	852	USA
96	Story *et al.* (2002)	Review	Eating behavior	Adolescents	M&F	Not specified	100 ref	Not specified
97	Swadi (1999)	Review	Smoking, drinking	Adolescents	M&F	Not specified	151 ref	USA and Western
98	Topolski *et al.* (2001)	Cross-sectional	Smoking, alcohol, risky sexual behavior	High school	M&F	Various ethnicities, 71% white	2801	USA
99	Tschann *et al.* (2002b)	Cross-sectional	Condom use	14–19	M&F	Not specified	228	USA
100	Tschann *et al.* (2002a)[a]	Cross-sectional	Substance use	12–15	M&F	Mexican-Americans	151	USA
101	Tucker *et al.* (2002)	Longitudinal 5 y	Daily smoking	Grade 7	M&F	Various ethnicities, 68% white	4165	USA
102	Tyas and Pederson (1998)	Review	Smoking	Adolescents	M&F	Various ethnicities	226 ref	Mostly western
103	Wagner and Atkins (2000)	Review	Smoking	Teenagers	F	Not specified		Mostly USA
104	Wang (2001)	Longitudinal 3 y	Smoking (experimental and regular)	12–19	M&F	Nationally representative	4431	USA
105	Weber Cullen *et al.* (1998)	Cross-sectional	Stages of change for F&V intake	9–12	F	Various ethnicities, 77% white	259	USA
106	Whaley (1999)	Review	Risky sexual behavior	Older than 13	M&F	Not specified	49 ref	USA
107	White *et al.* (2002)	Longitudinal 18 y	Smoking trajectories	12	M&F	92% White	374	USA
108	Wilcox (2003)	Review	Smoking	Adolescents	M&F	Not specified	146 ref	Mostly USA
109	Williams *et al.* (2000)[a]	Cross-sectional	Score of 5 risk behaviors	Grade 9–12	M&F	Various ethnicities	271	USA
110	Wills *et al.* (2002)	Longitudinal 4 y	Smoking frequency, alcohol use	Grade 7–10	M&F	Various ethnicities, 37% white	1364	USA
111	Wingood *et al.* (2002)	Cross-sectional	Condom use	14–18	F	Afro-American	522	USA
112	Woodruff *et al.* (2003)	Longitudinal 1 y	Ever smoking	12–15	M&F	Various ethnicities, 63% Hispanic	478	USA
113	Woodward *et al.* (1996)	Cross-sectional	Intake of 22 selected food items	12–15	M&F	Not specified	2082	Australia
114	Yarcheski *et al.* (2000)	Cross-sectional	Score of 6 risk behaviors	12–14	M&F	Various ethnicities, 77% white	148	USA
115	Young and Fors (2001)	Cross-sectional	Healthy breakfast + lunch and F&V intake	Grade 9–12	M&F	Various ethnicities, 80% white	3155	USA
116	Zweig *et al.* (2002)	Cross-sectional	Four risk profiles	Grade 9–12	M&F	Various ethnicities	12955	USA

[a] Studies included for clustering of health-related behaviors.
[b] In empirical studies *N*: number of respondents; in reviews *N*: number of included studies. Some reviews are not clear about the number of studies included: in these cases the total number of references is given.

The terms 'negative association' and 'positive association' are used in this study. A negative associations means that a determinant predicts unhealthy behavior, while a positive associations means that a determinant predicts healthy behavior.

RESULTS

Clustering of the Four Health-Related Behaviors

Most studies that investigated the links between health-related behaviors found significant relationships between the health-compromising behaviors alcohol abuse and smoking. There was clear evidence that smoking and alcohol abuse cluster, with correlations varying from 0.43 to 0.60.

The relationship between safe sex and other behaviors is more complicated. Most studies did not measure the health enhancing behavior safe sex, but sexual experience, which some authors considered to be health-compromising behavior. There is evidence that sexual experience clusters with smoking and alcohol abuse; correlations vary from 0.29 to 0.54.

We found only one study that investigated the relationship between nutrition and health-compromising behaviors (Karvonen *et al.*, 2000). This study identified three clusters: (1) adolescents who eat healthily, i.e., fruit and vegetables, and who do not smoke or drink alcohol (this cluster accounted for approximately half of the study population); (2) adolescents who eat unhealthily, i.e., who eat little fruit and vegetables, and who smoke and drink alcohol (20% of the study population); and (3) adolescents who eat unhealthily, but who do not smoke or drink alcohol (about 30% of the study population).

Correlation Between Determinants and Health Behaviors

Many determinants were studied for the four health-related behaviors. Most of these were studied for two or more behaviors, but, owing to their behavior-specific nature, some were studied for one behavior. For instance, "perceived healthfulness of the product" was studied only for nutrition, whereas "traditional attitude towards sex roles" was studied only for safe sex.

Several determinants were also measured for smoking and alcohol abuse, but not for safe sex and nutrition. These included the "belief that smoking and alcohol use reduce stress," and "number of offers of unhealthy products."

Table 2 presents the relationships between determinants and the four health-related behaviors (i.e., smoking, alcohol abuse, safe sex, and healthy nutrition). The figures in Table 2 refer to the studies with the same figure in Table 1. We will elaborate on the results presented in Table 2 in the following sections.

Studies Examining Determinants of One Behavior

Ultimate Determinants

Ultimate determinants in the cultural environment stream were measured in only a few studies. While non-smoking and low alcohol consumption were positively associated with religiousness or frequent church attendance, there seemed to be no such correlation with safe sex. Exposure to commercials was negatively associated with a healthy diet, but findings concerning smoking were not uniform: while one study found a negative relationship of commercials with non-smoking, another found no relationship.

In the social situation stream, four determinants were studied for more than one behavior. Life in a two-parent family was more positively associated with all four health-related behaviors than life in a one-parent family. However, family problems (e.g., illness, unemployment or remarrying) seemed to have no influence, with an exception for males, who had a higher risk of smoking. The influence of Social Economic Status (SES) was not clear: some studies found that a higher SES was protective, but other studies did not find a relationship.

Determinants in the biology/personality stream had frequently been studied for smoking and alcohol abuse. Positive traits such as reliability, sociability, and intelligence generally had a positive association with health-related behavior, while negative traits, such as rebelliousness were negatively associated with it. Emotional distress was studied for all four behaviors: there is evidence that this had a negative association with all four health-related behaviors. Sensation seeking was negatively associated with non-smoking, low alcohol consumption and safe sex. In general, risk taking was negatively associated with non-smoking and safe sex.

Distal Determinants

In the cultural environment stream, knowledge of behavior risks was the only determinant measured

Table 2. Relations Between Determinants and Behaviors[a]

Determinants	Safe sex			Healthy nutrition			Non-smoking			Alcohol abuse		
	+[b]	−	0/unclear	+	−	0/unclear	+	−	0/unclear	+	−	0/unclear
Ultimate determinants												
Cultural environment												
Religion/church visit	54	60	4, 10, 54, 64				19, 36, 44, 85, 95			91		
Media/commercials					12, 96			19	44			
Social situation												
Two parents	**13**[c], 60, 64, **81**			87, 96, 115			3, **13**, 31, 39, 61, **81, 94**, 95, 101, 102, **110**		**110**	**13**, 40, **81, 94**	59	
Family problems (e.g., divorce, remarried, lost job, hospitalized)								82	82			66
Socio-economic status	**81**		60, 64	77, 87, 96			31, 44, **94**, 102, 107, 110	39	**1**, 33, 36, **81**, 101, 107, 110	**94**		**1**, 40, 66, **81**
Life events			51					**94, 110**			86, **94, 110**	86
Biology/personality												
General risk-taking		60						42, 102	44			
Sensation-seeking		**24, 49**, 60, 64						**49**, 107	**24**, 44		**24, 49**, 83, 97	
Feeling invulnerable			**49**					**49**			**49**	
Emotional distress (anxiety, depression)		**15**, 60, **98**	4, 10, **24**		**15**	**15**		2, **15, 24**, **43**, 44, **68**, 82, 85, **94, 98**, 100, 102, 103, **110**	**43, 53**, 107	30	2, **24**, 50, **53**, 66, **94, 98**, 100, **110**	**15**, 30, **43**, 66, **68**, 86
Impulsiveness, lack of behavioral control		**24**						**24**, 97	44		2, **24**, 50, 97	30
Sociability (not shy)							2, 97	2	44, **53**	97		**53**
Rebellious								82, 97			97	40
Reliable							97			97		
Intelligence							44			83		
Early onset of puberty								2			2	
Genetic influences								3	44		9, 62, 83, 97	
Age	8, 60	26, 58, 64, **74, 81**	**7**, 106		29, 77, 115	11a, 22, 47, 77, 115		**7**, 19, **43, 48, 53, 71, 74**, 75, **81, 94**, 95, 102, 112	**74**		**7**, 9, 30, **48, 53, 71, 74, 81**, 92, **94**	30, **74**
Female	**7**	64, 88	**74**	5, 29, 77, 96	29, 96, 115	11a, 22, 47, 115	9, 33, **74**, 102	39, 101, 102, 107, 110	**1, 7**, 17, **43, 53, 74**, 75, 95	**1**, 9, 30, 40, 42, **43**, 50, 62, 86, 92, 97		2, **7**, 30, **53, 74**

Table 2. Continued

Determinants	Safe sex			Healthy nutrition			Non-smoking			Alcohol abuse		
	+[b]	−	0/unclear	+	−	0/unclear	+	−	0/unclear	+	−	0/unclear
Ethnicity white	**13**							**13**, 17, 33, 39, 44, **74**, 75, 85, 95, 101, 102, 108, 110	**7**		**13**, 40, 42, 50, 59, **74**, 83	**7**
Distal determinants												
Knowledge/values												
Knowledge of behavior risks	60, 64, 106, 14	10, 51, 64, 106	4, 14, 21, 51, 89			63, 96			102			
Tolerance for deviance								17, 75			70	
Social bonding/Others' behavior/attitudes												
General modeling/perceived behavior others				11a, 12, 63		72	19, 44, 97					
Perceived healthy-behavior peers	4, 14, 26, 64, **67, 74**		4, **7**, 26, 35	96, 113		96, 113	2, 3, 6, **7**, 16, 17, 19, 33, 36, 42, 61, **67, 74**, 75, 85, 90, 102, 103, 104, 107	39	**1**, 39, 101, 107	**1**, 2, 6, **7**, 30, 40, 50, **67, 74**, 93, 97		30
Actual healthy-behavior peers							6, 61, **74**		6	6, **74**		6
Perceived healthy-behavior parents	64		**7**	11a, 96, 113			**1**, 2, 3, **7**, 17, 19, 31, 33, 42, 61, **71**, 75, 85, 90, 97, 101, 102, 103, 104, 107	19	107	**7**, 9, 40, 59, 83, 93, 97		**1, 71**
Parental monitoring, control, strictness	**34**, 54, 60, 64, **69**		**7**	115			31, 61, 102		**7**, 17	**34**, 59, **69**, 83, 97		**7**, 20
Parental connectedness/ support	60, 64, **98, 116**		64	77			17, 19, 31, 36, 61, **71, 94, 98**, 102, **116**	75		20, 59, **71**, 83, 91, **94**, **98, 116**		59
Authoritative parenting style (control, strictness & warmth, acceptance, involvement)				65			31, 44, 61, 91, 102		**1**	**1**, 59, 91		59
Hours home alone					115			9, 36			9	
Family communication				115			31, 101			93		

Table 2. Continued

Determinants	Safe sex			Healthy nutrition			Non-smoking			Alcohol abuse		
	+[b]	−	0/unclear	+	−	0/unclear	+	−	0/unclear	+	−	0/unclear
Socialize with deviant peers								91			91	
School acceptance of cigarettes and drugs								108			91	
Sense of self/social competence												
Self-esteem	21, 60, 64, **98, 116**		**76**				16, 44, 90, 95, **98**, 102, **116**		16, **76**, 107	2, 30, 62, 50, 83, 92, 97, **98, 116**	92	40, **76**, 86, 92
Defensive coping		**24**	4					**24**			**24**	
Coping (immature, mature, neurotic)									102		86	86
General social skills, social self-efficacy (interacting in social situations)			21				44	16	16	70, 83, 92		92
Decision making skills (41, I can get info; acknowledge consequences of decisions, etc)							41			50		
Problem-solving skills	60									92		
Personal effectiveness (I can accomplish something by working hard)							41			92		
Internal locus of control							17, 102		44	2, 62, 83		
Proximal determinants												
Attitude												
Positive attitude to healthy behavior (general, unspecified or mixed beliefs)	10, 88		35	5, 11a			16, 33, 75, 95, 102, 104		56, 101	2, 48, 50		48
Health beliefs												
Perceived personal health risk	8, 14, 26, 46, 51, 55, 60, 64, 89	106	4, 8, 26, 51, 64;		96		75, 102					
Perceived general health risk							3, 17		56, 107			40
Importance of good health			88	11a								
Denial of health problems / still young		10			25							
Well-being (psychological)												

Table 2. Continued

Determinants	Safe sex			Healthy nutrition			Non-smoking			Alcohol abuse		
	+[b]	−	0/unclear	+	−	0/unclear	+	−	0/unclear	+	−	0/unclear
Immediate gratification (e.g., reduction of pleasure, taste-preference unhealthy food, enjoy the moment)		8, 14, 26, 46, 55, 58, 89			5, 11a, 12, 25, 37, 63, 78, 80, 96, 105, 113	72		**48**			**48**	
Relaxation, reduction stress or negative affect (emotional control)								2, 17, 44, 56, 85, 90			83	
Anticipated regret (e.g., hangover, regret of drunken behavior)									42**, 48**	**48**		**48**
Appearance												
Lose or maintain weight				5		11a		42, 44, 56, 85, 90, 103				
Performance												
Mental/cognitive performance				80							83	
Athletic/physical/motor performance				80		5	90				83	
Social consequences												
Unhealthy behavior facilitates social interaction								61			83, 50	
Social advantages of unhealthy behavior		35						41, 56	56, 17			
Social normative beliefs												
General Social/subjective norm	88	88		5, 11a, 12, 37, 105		72						
Healthy behavior acceptable to peers/peer norms	**7**, 8, 14, 46,			5, 80			**7**, 16, 33, 36, 44, 75, 102, 103		39, 101	**7**, 50		9, 40, 93
Healthy behavior acceptable to parents/parental norms			**7**	5, 80			2, 3, 16, 31, 33, 36, 61, 75, 90, 91, 101, 102, 103		**7**, 39, 44	**7**, 9, 50, 59, 93		40

Table 2. Continued

Determinants	Safe sex			Healthy nutrition			Non-smoking			Alcohol abuse		
	+[b]	−	0/unclear	+	−	0/unclear	+	−	0/unclear	+	−	0/unclear
Healthy behavior acceptable to partner	60, 64,				11a							
Healthy behavior acceptable to siblings				5			103					
Direct social pressure to engage in unhealthy behavior									6, 61			6
Rules set by parents about behavior				32, 37			90					
Self-efficacy												
General self-efficacy/perceived behavioral control				5, 11a, 72, 96, 105			16					
Perception of skills to perform healthy behavior (e.g., using condoms, discuss condom use, prepare healthy food)	8, 35, 51, 58, 60, 64, 89		14, 51	5								
Perception of (refusal) skills to make healthy choices (e.g., refuse (unsafe) sex, cigarettes, etc.)	21, 35			96			36		40	40		

[a] Studies can be scored in two columns for one behavior. For empirical studies this means that different relations were found for different groups of respondents. Reviews found different relationships in different studies, but did not draw clear conclusions. Besides, it can be that one study has several outcome measures, and that different results were found for different outcome measures.

[b] + = determinant enhances healthy behavior; − = determinant impedes healthy behavior; 0 = no relationship with behavior.

[c] Studies that examined more than one behavior are marked bold.

for more than one behavior. The findings were not uniform: while most studies did not find any relationship between knowledge and behavior, some studies found a positive relationship and others a negative one.

On the distal level, determinants in the social situation stream were studied the most, principally (1) the perceived behavior of significant others and (2) the parent-child relationship. In general, the perceived healthy behavior of significant others (e.g., peers, friends, parents) was positively associated with the health-related behavior of adolescents. Only a small number of studies found no relationship. With regard to the parental-child relationship, in all four behaviors we found clear evidence that it was an important factor in adolescents' health-related behavior. Although different studies were carried out in different ways, one picture became clear: adolescents were more likely to behave healthily if they lived in a close family with supportive, involved parents who monitored them and communicated with them in a positive way.

In the biology/personality stream, self-esteem was the most—studied determinant. There was evidence that safe sex, non-smoking and low alcohol consumption were positively associated with high self-esteem, although some studies found no relationship. Similarly, non-smoking and low alcohol consumption seemed to be positively associated with an internal locus of control.

Proximal Determinants

On the proximal level, determinants in the cultural environment stream were studied the most. A feature of proximal determinants is that they are specific to one behavior. The studies in our review showed a great variety of beliefs concerning specific health behaviors, some of which were relevant to more than one behavior. The findings for perceived personal health risks of the specific behaviors all tended in the same direction, as most studies found that such perception was positively associated with safe sex and non-smoking, although some studies on safe sex reported a positive association for some groups in the study population but no association for other groups. In addition, a study on nutrition found a negative association for perceived personal health risk with healthy nutrition.

There was convincing evidence that for all four behaviors adolescents believe that immediate gratification will result from performing the unhealthy behavior.

While perceived subjective norms of peers seemed to have a positive association with safe sex, healthy nutrition and non-smoking, this was not the case with low alcohol consumption. Similarly, perceived subjective norms of parents were positively associated with healthy nutrition, non-smoking and low alcohol consumption. This had not been studied with regard to safe sex, however.

Finally, there is some evidence that all four behaviors are positively associated with perception of skill in refusing to engage in unhealthy behavior.

Studies Examining Determinants of More Than one Behavior

Studies that examined determinants of more than one behavior focused mainly on the social situation stream and the biology/personality stream, each at the ultimate and distal level; these studies hardly examined determinants at the proximal level. The results of these studies were consistent with the results of studies that examined one behavior. Studies that examined more than one behavior are marked bold in Table 2.

Studies Examining Determinants of an Index of Multiple Behaviors

Five studies used one measure for several health-related behaviors. Determinants on a distal or ultimate level were examined the most.

The results of these studies confirmed the results described earlier regarding self-esteem, emotional distress, and parental monitoring/support. Besides, in one study, a positive association with social, verbal, and intellectual competence, and academic achievement was found and in an other study, a negative association between healthy behavior and an extrinsic aspiration for wealth, fame, and image was found.

DISCUSSION

Clustering of the Four Health-Related Behaviors

The review of clustering of the behaviors smoking, alcohol abuse, safe sex, and healthy

nutrition confirms our hypothesis that the health-compromising behaviors smoking and alcohol abuse indeed cluster. However, we could not clarify the clustering of health-enhancing behaviors such as safe sex and healthy nutrition, as this was not examined in the studies included in this review.

The confirmation of our hypothesis is consistent with Flay, who claims that although clustering certainly takes place between different adolescent problem-behaviors (including smoking and alcohol abuse), there is no evidence to support the idea of clustering of health-enhancing behaviors (Flay & Petraitis, 1994).

Although we found evidence that the health-compromising aspects of sexual behavior are moderately associated with other health-compromising behaviors, such as smoking and alcohol abuse, it should be stated that most studies in this review were carried out in the USA, where adolescent sex, especially sex with multiple partners, is considered as risky, health-compromising behavior. In the Netherlands, sexual experience is not generally considered as risky sexual behavior, whereas having sex without using a condom is.

No evidence was found for clustering of health-enhancing behaviors, such as safe sex and healthy nutrition; neither, however, was there any evidence that these behaviors do *not* cluster. Nor did we find evidence whether health-enhancing and health-compromising behaviors are negatively or positively associated, although one study reported a negative association for a large group of the study population and a positive association for a smaller group (Karvonen *et al.*, 2000). This suggests that many adolescents do not have a lifestyle that can simply be labeled "healthy" or "unhealthy," but rather that some may have a lifestyle that is partly healthy and partly unhealthy.

As there are still many gaps in our knowledge of how health-related behaviors are associated, more studies are needed on the clustering of these behaviors.

Correlations Between Determinants and Health-Related Behaviors

To date, correlational studies between determinants and health-related behavior have focused predominantly on (1) ultimate determinants in the personality/biology stream, (2) distal determinants in the social situation stream, and (3) proximal determinants in the cultural environment stream. The majority of these studies identified the relationships between determinants and health-related behavior which we expected to find, with the four health-related behaviors generally being predicted at a distal and ultimate level by the same determinants.

Because we categorized proximal determinants at a conceptual level, some of these determinants appear to be related to more than one health-related behavior. For example, perception of personal health risk, the belief that performing the behavior will bring immediate gratification, and normative beliefs of significant others were related to all four behaviors. While it is true that normative beliefs (to take just one example) are specific to one behavior, all behavior-specific normative beliefs refer to the same idea: for adolescents, it is important that a behavior be acceptable to their peers and/or parents, whether this behavior is safe sex, smoking, healthy nutrition or alcohol abuse. However, as we expected, all other proximal determinants were behavior specific and could not be categorized on a more conceptual level and therefore were not included in our study.

Most Relevant Determinants of Health-Related Behaviors

Although the results of the various studies differed with regard to the relationship between some determinants and the four behaviors, other determinants were studied for all four behaviors, with which they showed relatively consistent relationships. Several determinants seem to have a protective influence on adolescents: living with supportive parents, high self-esteem, high perceived personal health risk, perceived healthy behavior of peers and parents, and perceived acceptability of the healthy behavior by peers and parents. However, adolescents can be seduced into unhealthy behavior by the immediate gratification they anticipate.

Limitations

Before we focus on the implications of the present findings for research and intervention, we will first discuss some limitations of our study.

First, there was considerable variation in the design of the studies we selected: most of those on nutrition and safe sex were cross-sectional studies, and all of those on smoking and alcohol abuse were

longitudinal studies. This implicates that the findings on smoking and alcohol abuse are more robust than the findings on safe sex and nutrition as far as causality is concerned. Cross-sectional studies only show that there is an association between determinants and behavior, whereas longitudinal studies also show that a determinant indeed is a predictor of a certain behavior.

Similarly, various statistical procedures had been used. Some studies conducted qualitative analyses, others carried out only univariate statistical analysis, and yet others multivariate analyses. Most of the reviews we included were narrative reviews and thus did not use any statistical procedures at all.

Across all studies, there was a great variation in the selection of outcome measures. For example, some studies measured condom use at first intercourse, while other studies assessed sexual experience. Most studies about alcohol assessed alcohol abuse, while some studies measured if the respondent had ever drank alcohol. In some cases, the reporting did not make it clear what exactly had been assessed. Some studies failed to report how outcome measures were coded or recoded.

Definition of determinants was often unclear: terms such as antisocial behavior, sociable and social problems were used without a clear description of the measurements. However, studies that examined more than one behavior measured the determinants in the same way for each of the behaviors examined. In these studies, the results did not differ from studies that examined only one behavior. This indicates that in each of the studies we included the definitions of determinants were more or less the same. Despite differences in study design, statistical analysis and variability in outcome measures, the results for most determinants pointed in the same direction.

Because of the huge number of studies, we had to limit our search, and may thus have missed some relevant empirical studies. However, we assume that the reviews we included incorporated these empirical studies, and that we therefore included the relevant information they contained.

Implications for Research and Interventions

This review shows that while health-compromising behaviors have been studied extensively, far less attention has been devoted to health-enhancing behaviors. The emphasis on health-compromising behavior is understandable: after all, health promoters want to prevent adolescents from smoking, drinking alcohol, and from other health-compromising behaviors.

Nonetheless, greater understanding of the determinants of health-enhancing behavior may help identify options for developing interventions that simultaneously promote health-enhancing behavior and prevent health-compromising behavior. More studies about the determinants of health-enhancing behavior are thus highly relevant to health-promotion programs.

The determinants presented here do not cover the full possible range of determinants. Most of the studies we included concentrated on proximal determinants in the cultural environment stream, distal determinants in the social situation stream, and/or ultimate determinants in the personality/biology stream; other determinants were hardly examined. For instance, social competence, a distal determinant in the personality/biology stream, was examined in only one study, which found a relationship with an index of health-related behavior.

According to our theoretical framework, these kinds of distal determinants in the personality/biology stream might be important, as, unlike ultimate determinants in the personality/biology stream, they are potentially modifiable. Distal determinants, such as self-esteem, also underlie multiple behaviors and thus predict not only smoking but also other behaviors such as safe sex and alcohol abuse. More research should therefore be conducted on the impact of the distal determinants of health-related behaviors.

To conclude this review, we will briefly address its educational consequences. In recent years, various people have warned of the pressures imposed on schools and teachers by constantly changing learning-objectives and adding new ones. The introduction of social themes such as health education on top of those of multicultural education, environmental education, and so on means that the curriculum is in danger of becoming overfull (Ten Dam *et al.*, 2000).

Implementing such innovations makes constant demands on teachers' flexibility and ability; the problem is made worse by the accumulation of different intervention programs, each addressing a single behavioral domain. Bearing in mind the danger of an overloaded curriculum, it is thus important to question whether schools can work effectively on developing the knowledge, skills and attitudes that health education demands of students.

Our analysis of the clustering of health-related behaviors in terms of their predictors indicates the direction in which health educators should look for a more efficient instructional design. This review of the literature identifies potentially modifiable distal determinants (such as coping strategies), which are assumed to have more flexible properties than ultimate determinants (such as personality traits) and, therefore, to offer more clues for intervention aimed at various health-related behaviors simultaneously. In contrast, potential modifiable proximal determinants are more specifically linked to a single-behavior domain.

Determinants that are shared by several behaviors, distal as well as proximal determinants, should be taught in schools. However, the fact that health-related behaviors share some determinants does not necessarily mean that knowledge, attitudes, and skills can be learned independent of a specific behavioral context (e.g., smoking, alcohol abuse, safe sex, nutrition). This is borne out by research on learning and instruction (Brown *et al.*, 1989). New knowledge, attitudes or skills can be learned only within the context of a specific behavior: coping strategies, self-efficacy, values, refusal skills, cannot be learnt in a vacuum. But, when several behaviors share the same determinant(s), a transfer-oriented learning process can provide students with skills to apply what they learned in other contexts. Transfer-oriented learning involves the alternate decontextualization and contextualization of the subject matter, in which, on the basis of a specific context, students are given insight into a general principle or concept, and are then asked to provide new specific examples of that principle. For example, if students learn how to resist the pressure of their peers when offered a cigarette, they can also use these skills when they are pressed to drink a lot of alcohol or to have sex without a condom, provided that a transfer-oriented learning process is used.

To summarize, in view of the risk of overloaded curriculums, the key is not to try to teach the competences that are important for general health-related behavior. Instead, the main challenge is to teach the domain-specific knowledge, skills and attitudes—regarding smoking, for example—in a transfer oriented way that, both in and out of school, students are also able and willing to apply the learned skills in other domains (e.g., alcohol abuse or safe sex) (Ten Dam, 2002). To study the possibilities of such an approach, we therefore recommend that a curriculum for the transfer-oriented learning of health-related behavior is developed and tested.

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