PROMOTING MENTAL HEALTH AND HEALTHY BEHAVIORS IN ADOLESCENTS

Studies on determinants and interventions

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Promoting Mental Health and Healthy Behaviors in Adolescents

Studies on determinants and interventions

Het bevorderen van de geestelijke gezondheid en gezond gedrag bij adolescenten

Studies naar determinanten en interventies

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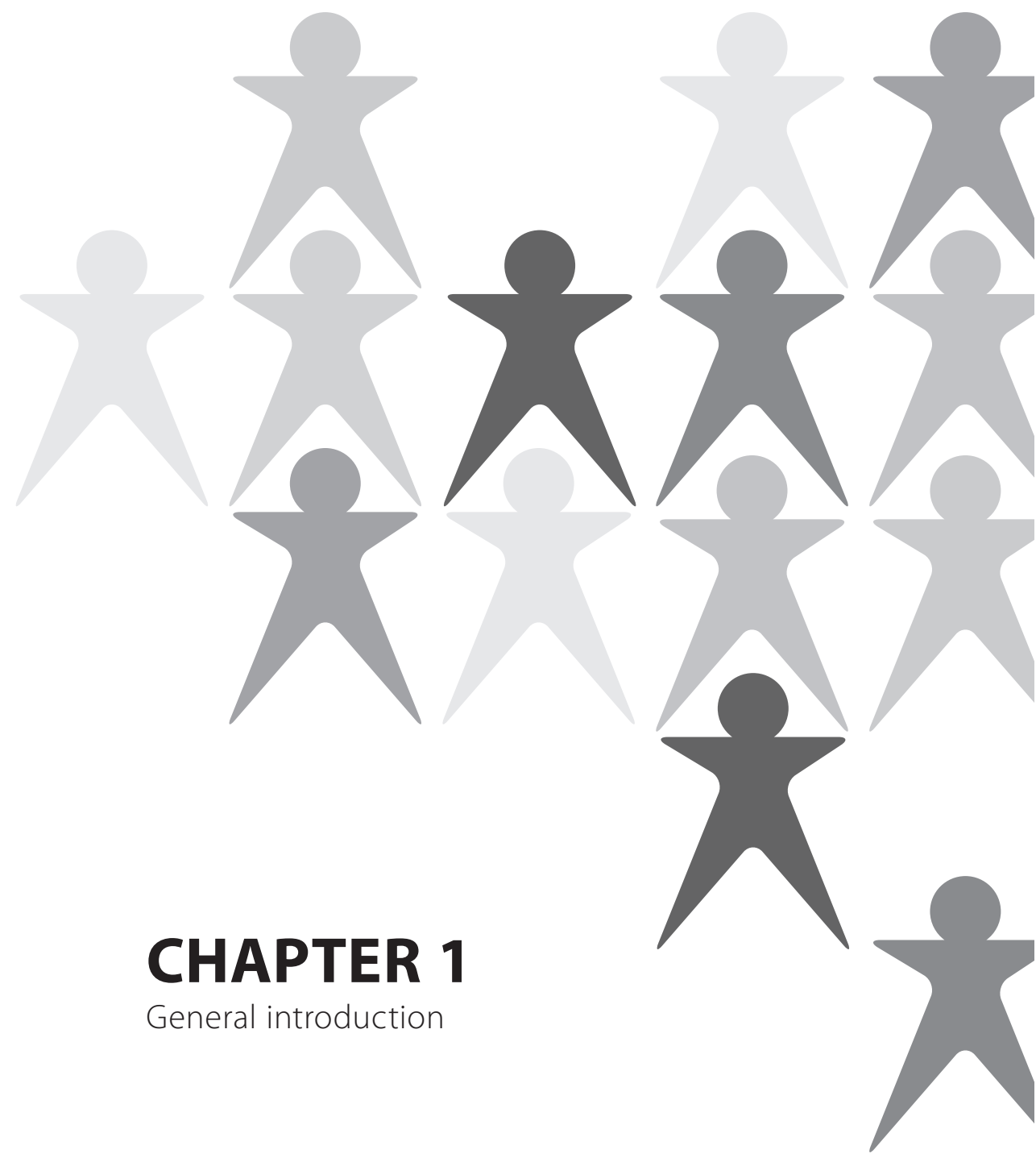
CONTENT



CHAPTER 1

General introduction

ADOLESCENTS' MENTAL HEALTH PROBLEMS AND HEALTH-RISK BEHAVIORS

Mental health problems often have their first manifestation during adolescence. During this period, a high percentage of adolescents suffers from mental health problems[1] with prevalence estimates ranging between 10% and 20%.[2] In the Netherlands, an estimated 15% of adolescents have mental health problems.[3] Mental health problems are associated with severe adverse health outcomes, including impairments in age-appropriate social skills, delinquency, and an elevated risk of suicide.[4,5] Furthermore, mental health problems have a poor prognosis – they are often persistent[2] and pose a risk for the development of psychiatric disorders in adulthood.[6-9]

Adolescence is also a period in which adolescents are likely to start experimenting and engaging in health-risk behaviors, such as excessive alcohol consumption, cigarette smoking, and drug use.[3] Other risk behaviors, such as truancy, delinquency, and making purchases that one can not afford are also often acquired during adolescence. For example, a survey among Dutch 16-year-old adolescents attending secondary school (i.e. *'voortgezet onderwijs'* in Dutch) showed that nearly half of these 16-year-olds reported to have been drunk at least once in their life, 19% reported to smoke daily, 12% to have used cannabis during the 30 days preceding the survey, and more than 25% reported to have been truanting in the past 4 weeks.[3] A similar pattern of risk behaviors can be observed among adolescents (aged 15 years and older) attending senior vocational education (i.e. *'middelbaar beroepsonderwijs'* in Dutch). Research has shown that 27% of these adolescents reported to have been drunk at least once in the past 4 weeks, 24% reported to smoke daily, and 14% to have used cannabis in the past 4 weeks.[10] Furthermore, 30% of these adolescents reported to have been truanting in the past 4 week,[10] 7% to frequently exhibit small criminal behaviors (e.g. stealing a CD),[10] and a third of these adolescents reported to have debts.[11] These risk behaviors may have adverse health consequences on the short and longer term.[12] For instance, starting to use alcohol at early age can have adverse psychological and neurological consequences,[13,14] whereas alcohol and drugs use are often associated with aggressive and delinquent behavior.[15,16] Moreover, these health-risk behaviors, just as mental health problems, often persist into adulthood, thereby affecting not only current health, but also health later in life.[12,13,17]

Furthermore, all behaviors mentioned above, as well as mental health problems, are likely to influence the course of the educational careers of adolescents and are associated with school dropout.[18-22] Subsequently, school dropout results in substantially lower earnings over the life course, poorer health, considerably more dependence on public assistance, and a marked increase in the likelihood of involvement in crime and incarceration.[23-27] Given the adverse individual and societal impact of adolescents' mental health problems and risk behaviors, these problems and behaviors are major public health concerns in most Western countries.[28]

DETERMINANTS OF MENTAL HEALTH PROBLEMS AND HEALTH-RISK BEHAVIORS

As mentioned above, adolescents´ mental health problems and health-risk behaviors could have adverse consequences on the short and longer term, and therefore, it is of special interest to investigate the factors that are associated with the occurrence of these problems and behaviors.[2] Insight in the determinants of mental health problems and health-risk behaviors is important in order to develop strategies to identify adolescents at risk of these problems and behaviors, and to develop effective interventions to improve adolescents´ health and behaviors.

Previous research has already identified a variety of factors associated with the development of mental health problems and risk behaviors among adolescents. In fact, there even seems to be a reciprocal relationship between mental health problems and risk behaviors. That is, mental health problems have been identified as predictors of risk behaviors, but on the other hand, research has also shown that risk behaviors can be predictors of mental health problems.[29-31] Furthermore, a wide range of factors influences the development of either mental health problems or risk behaviors, or both. For example, previous research has shown that stress is a factor that has been proposed to play both a role in the development of mental health problems and risk behaviors. More specifically, research findings have identified bullying as an environmental stress factor that is associated with mental health problems and risk behaviors.[32-41] A further important stress factor that has been shown to increase the risk of developing psychopathology is the impact of negative life events.[42,43] Examples of negative life events that may imply risk factors for the development of mental health problems are physical illness of a parent,[44] parental psychiatric illness,[45,46] early parenthood,[47] parental substance use,[48,49] and family conflicts.[50,51] Parental substance use and family conflicts have also been identified as factors increasing the risk for substance use initiation during adolescence.[52,53]

Although there is already a considerable amount of literature examining factors influencing the development of mental health problems and risk behaviors, still significant gaps in the literature exist. For instance, most studies examine risk factors in isolation and fail to examine the clustering of a range of risk behaviors among adolescents. However, in order to improve intervention programs for reducing multiple risk behaviors simultaneously, it is important to examine the clustering of a wide range of risk behaviors, including, for example, delinquency, truancy, and making purchases that one can't afford. This could help to determine which risk behaviors cluster and will potentially be prone to an integrated approach. Previous research has, for example, already shown that substance use-related risk behaviors (i.e. alcohol use, drug use and cigarette smoking) often cluster in an adolescent and are prone to an integrated approach.[54-56]

Furthermore, to date, most promising program approaches for reducing multiple risk behaviors seem to simultaneously address domains of risk *and* protective factors.[54] Therefore, increasing research attention should be devoted to protective factors (i.e. factors that promote health) and their interaction with risk factors, instead of only focusing on risk factors. This could help to distinguish adolescents with good adaptation under difficult circumstances from those with poorer adaption under difficult circumstances, which in its turn could help to identify adolescents who are most in need of an intervention.

Another issue that needs more research attention is the use of Internet and mobile phones. With the explosive growth of the Internet and the current generation of adolescents spending a lot of time on the Internet and their mobile phones, much is still unknown about the potential advantages and disadvantages of the use of Internet and mobile phones on the development or prevention of mental health problems and risk behaviors among adolescents. Although the Internet has generated an increase in the availability of health information and health education practice, it has also contributed to a heightened appreciation of the potential negative impact of the Internet and mobile phones. For example, the impact that bullying via the Internet or via mobile telephones can have on the mental health of adolescents.

INTERVENTIONS PROMOTING ADOLESCENTS' MENTAL HEALTH AND HEALTHY BEHAVIORS

Insight in the determinants of mental health problems and risk behaviors is needed in order to develop strategies to identify adolescents at risk of these problems and behaviors, and to develop effective interventions to improve adolescents' health and behaviors. The early identification of problems and risk behaviors, and interventions improving adolescents' health and behaviors are important; not only do problems and behaviors often have their first manifest during this period, but if undetected and not treated these problems and behaviors often persist into adulthood.[12,13,17,57]

Because adolescents often do not seek help for their problems themselves,[58-60] schools are viewed as an ideal environment to identify problems early and to promote the health of adolescents. This is especially true as schools represent a place where the majority of adolescents are present and studies indicate that prevention programs delivered at schools are well utilized.[57,61]

Prevention programs at schools can be well conducted by the preventive youth health care. The aim of preventive youth health care is to improve and protect the health, growth, and development of young people.[62] In the Netherlands, all children and adolescents are invited for periodic preventive health consultations at set ages until the age

of 13 years.[62] These consultations with a nurse or physician, which focus on growth, development, health functioning, and behavior, often take place at school. Given the rapid maturation in adolescence and the mental health problems and health-risk behaviors associated with this developmental period, the government in the Netherlands encourages preventive youth health care organizations to implement an additional preventive health consultation at the age of 15 years and older.[63,64] From 2013, the government in the Netherlands has made funds available to conduct such an additional preventive health consultation. In advance, various pilot studies were conducted with different approaches (e.g. consultations offered to everyone or only to risk groups), and offered to different groups of adolescents, (e.g. adolescents attending secondary schools or senior vocational education). Two of these pilots, which are described below, will be discussed in this thesis.

E-health4Uth study

The E-health4Uth study was conducted among adolescents in the third and fourth year of secondary school (average age of these adolescents: 15–16 years). To identify mental health problems and health-risk behaviors early and to promote mental health and healthy behaviors among adolescents, two interventions (E-health4Uth and E-health4Uth with consultation) were developed and implemented by the preventive youth health care. Both interventions used Web-based tailored messages. Web-based tailoring is a health education technique that enables the adaptation of information to individual characteristics.[65] Web-based tailored messages eliminate (as far as possible) information that is not personally relevant[65,66] and may be, therefore, more likely to be effective in changing behavior compared to non-tailored messages.[66] Previous research has shown that the use of Web-based applications for delivering tailored preventive messages in current preventive youth health care practice is a promising development.[67-69] Furthermore, interventions delivered via the Internet may be particularly suitable to reach the current generation of adolescents spending a lot of time on the Internet.

In this study, both interventions (E-health4Uth and E-health4Uth with consultation) used the same Web-based tailored messages, which were developed for adolescents in an earlier study.[70] The Web-based tailored messages focused on topics related to health-risk behaviors (e.g. alcohol consumption, smoking) and well-being (e.g. mental health status, suicidal thoughts). In the E-health4Uth with consultation group, adolescents who were at risk of mental health problems were subsequently referred to a nurse for a consultation. Nurses who provided these consultations were trained to apply motivational interviewing with these 15/16-year-old adolescents. To facilitate communication during the consultations,[67] the nurses received information regarding the adolescents' health and behaviors from the E-health4Uth tool prior to the consultation. During the consultation, nurses focused on the risk behaviors relevant to the adolescent in consultation, and

on mental health in particular. Furthermore, they either initiated a further consultation with themselves or referred adolescents to another professional if they deemed this necessary.

Your Health study

In contrast to the E-health4Uth study, the Your Health study was conducted among adolescents from the lowest two levels of senior vocational education (aged 15 years and older). In the Your Health study, a proactive, integrated preventive health consultation was developed, implemented, and evaluated in the first year of senior vocational education. Adolescents who had recently started their education were invited for a consultation with the nurse of the preventive youth health care. During the confidential consultation, nurses used the Dutch version of the Self-Sufficiency Matrix (SSM-D), a structured assessment tool, to determine the strengths and areas for improvements in functioning of the adolescents. Prior to the consultations, nurses were trained to work with the SSM-D. The role of the nurse during the consultations included support, health promotion, and referral to appropriate professionals if considered necessary.

STUDY AIMS ADDRESSED IN THIS THESIS

The aim of this thesis is threefold. The first aim is to examine factors (i.e. bullying victimization, negative life events, and parent-adolescent attachment relationship quality) that are hypothesized to play a role in the development of mental health. Furthermore, the clustering of risk behaviors and association with mental health problems is examined. The second aim is to evaluate the appreciation and effectiveness of three interventions (i.e. E-health4Uth, E-health4Uth with consultation, and Your Health) aiming to identify adolescents' at risk of mental health problems and health-risk behaviors, and to promote adolescents' mental health and healthy behaviors. Third, the psychometric properties of two measures of adolescent self-sufficiency are examined among adolescents attending senior vocational education, namely a self-report questionnaire and the Dutch version of the Self-Sufficiency Matrix (SSM-D) for professionals. The SSM-D is increasingly used by health care professionals to assess the self-sufficiency of adolescents attending senior vocational education, but has not yet been validated among this population. The self-report questionnaire has not been validated either. Therefore, more insight in the psychometric properties of these self-sufficiency assessment tools in this population is needed.

OUTLINE OF THE STUDIES PRESENTED IN THIS THESIS

Table 1 provides an overview of the studies presented in this thesis. The current thesis presents a series of nine studies (Chapter 2 to 10) which can roughly be divided into three parts in accordance to the three aims above described. In ***Part I,*** studies investigating factors associated with mental health problems and health-risk behaviors are described. That is, in **Chapter 2**, the clustering of a range of health-risk behaviors (alcohol consumption, smoking, drug use, truancy, debts, and delinquency), and associations with depressive symptoms are examined in a cross-sectional study. In **Chapter 3**, associations of truancy, perceived school performance, and mental health with alcohol consumption are examined cross-sectionally, whereas, in **Chapter 4**, associations between parent-adolescent attachment relationship quality, negative life events, and mental health are examined prospectively. **Chapter 5** describes a prospective cohort study investigating whether cyber and traditional bullying are associated with mental health problems and suicidal ideation.

In ***Part II***, studies investigating the evaluation of three interventions (i.e. E-health 4Uth, E-health4Uth with consultation, and Your Health) aiming to identify adolescents' at risk of mental health problems and health-risk behaviors, and to promote adolescents' mental health and healthy behaviors are described. The design of the E-health4Uth study is presented in **Chapter 6.** The use and appreciation of the Web-based tailored messages (E-health4Uth) and subsequent consultation are evaluated in **Chapter 7. Chapter 8** describes the evaluation of the effects of the Web-based tailored messages as a standalone intervention (E-health4Uth) and in combination with a consultation for adolescents at risk of mental health problems (E-health4Uth with consultation). In **Chapter 9,** the appreciation, application, and effects of the Your Health intervention, in which adolescents attending senior vocational education received a consultation with the nurse, are evaluated.

In ***Part III***, the psychometric properties of a self-report questionnaire assessing self-sufficiency and the SSM-D are examined (**Chapter 10**). This is important as psychometric sound instruments that can be used by the preventive youth health care to identify vulnerable adolescents are needed.

Finally, **Chapter 11** provides an overall discussion, including recommendations for future research and implications for policy and practice.

Table 1. Overview of the studies presented in this thesis

	Design	Sample	Population for analyses	Research focus
Part I – Determinants of mental health problems and health-risk behaviors				
Chapter 2[a]	Cross-sectional	Students attending senior vocational education (mean age 18.3 years)	584	Examining the clustering of risk behaviors, and the association with depressive symptoms
Chapter 3[b]	Cross-sectional	Students attending secondary education (mean age 15.9 years)	1167	Examining the association of truancy, perceived school performance, and mental health with alcohol consumption
Chapter 4[c]	Prospective cohort	Students attending secondary education (mean age 12.5 years)	3181	Exploring whether there is an interaction effect between parent-adolescent attachment relationship quality and negative life events on mental health
Chapter 5[c]	Prospective cohort	Students attending secondary education (mean age 12.5 years)	3181	Examining whether traditional and cyber bullying victimization are associated with mental health problems and suicidal ideation at two-year follow-up
Part II –Interventions promoting adolescents' mental health and health behaviors				
Chapter 6[b]	Cluster – RCT	Students attending secondary education (third and fourth grade)	NA	Describing the design of a study which evaluates the effects of Web-based tailored messages (E-health4Uth) and a subsequent consultation on adolescents' mental health and health behaviors
Chapter 7[b]	Cluster – RCT	Students attending secondary education (mean age 15.9 years)	1034	Evaluating the use and appreciation of Web-based tailored messages (E-health4Uth) and a subsequent consultation
Chapter 8[b]	Cluster – RCT	Students attending secondary education (mean age 15.9 years)	1256	Evaluating the effect of Web-based tailored messages (E-health4Uth), and a subsequent consultation on adolescents' mental health and health behaviors
Chapter 9[a]	Cluster – RCT	Students attending senior vocational education (mean age 18.3 years)	418	Evaluating the appreciation, application, and effects of an intervention (Your Health), in which adolescents received a consultation with the nurse
Part III –Psychometric properties of self-sufficiency assessment tools				
Chapter 10[a]	Cross-sectional	Students attending senior vocational education (mean age 18.3 years)	581	Examining he psychometric properties of a self-report questionnaire assessing self-sufficiency and the Dutch version of the Self-Sufficiency Matrix

[a] Chapters 2, 9, and 10 report on data from the Your Health study.

[b] Chapters 3, 6, 7, and 8 report on data from the E-health4Uth study.

[c] Chapters 4 and 5 report on data from the Rotterdam Youth Monitor, which was provided by the Municipal Public Health Service Rotterdam area.

NA Not Applicable.

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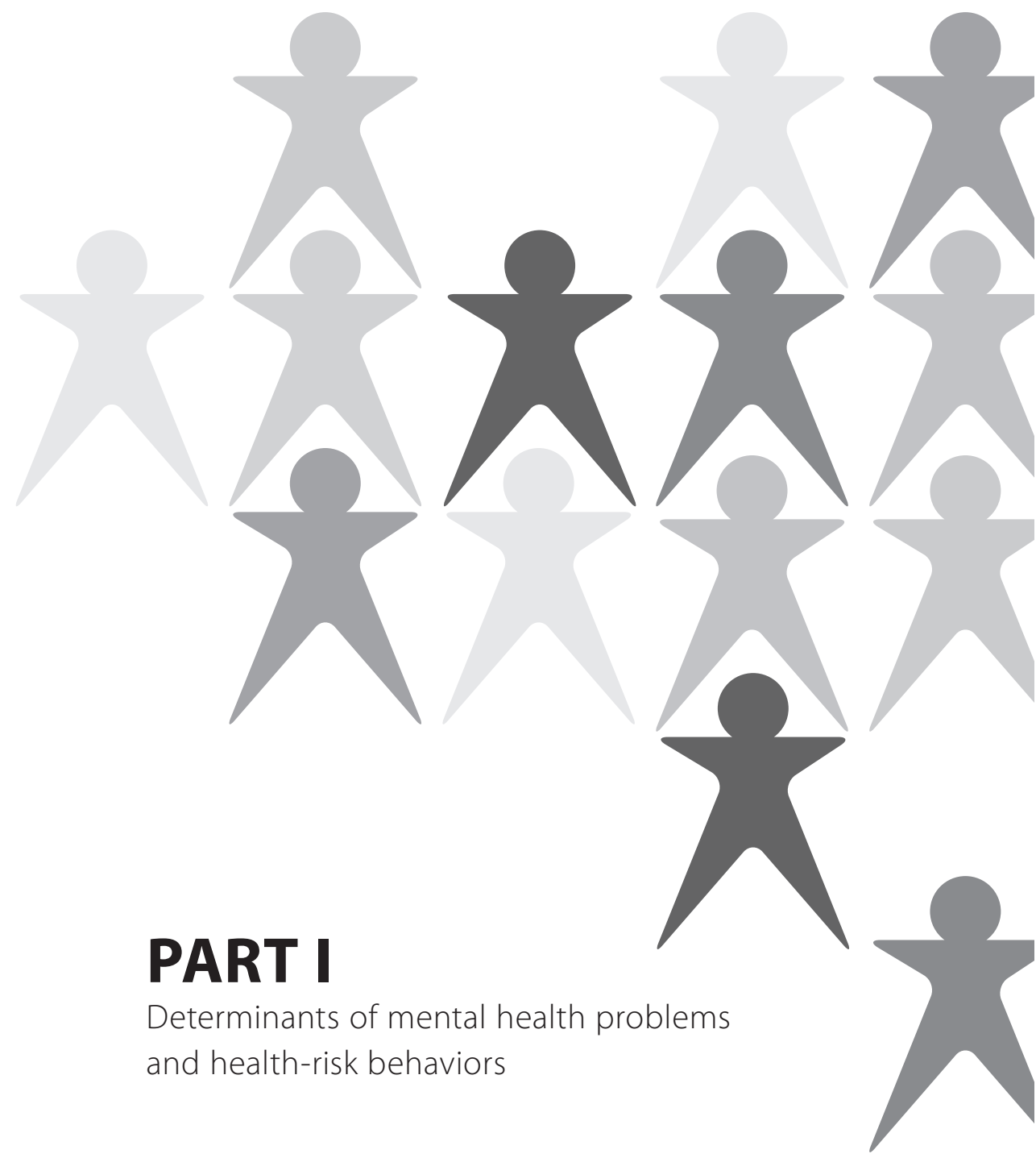
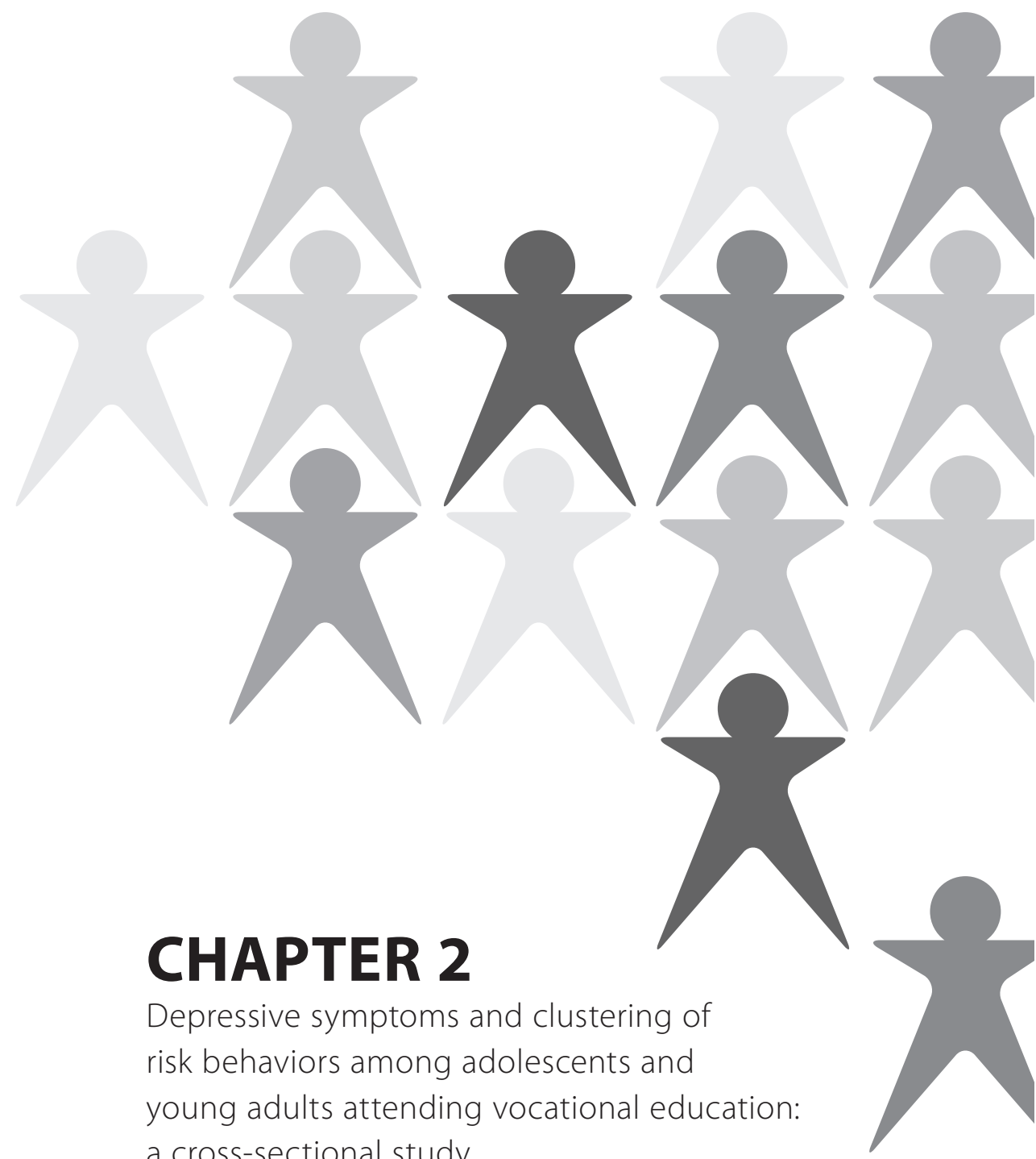


PART I

Determinants of mental health problems and health-risk behaviors



CHAPTER 2

Depressive symptoms and clustering of risk behaviors among adolescents and young adults attending vocational education: a cross-sectional study

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ABSTRACT

Background

Depressive symptoms and risk behaviors often do not occur in isolation among adolescents and young adults. In order to improve intervention programs, more research is needed to elucidate the clustering of risk behaviors, the association with depressive symptoms, and demographic variables. Therefore, this study examined the clustering of risk behaviors, the association with depressive symptoms, and demographic variables among adolescents and young adults in vocational education. Furthermore, the prevalence of depressive symptoms and risk behaviors was examined.

Methods

This study included 584 students (mean age 18.3 years) attending vocational education in the Netherlands. Depressive symptoms and risk behaviors (binge drinking, cannabis use, smoking, delinquency and incurring debts) were assessed with self-report questionnaires. Truancy was monitored via the school registration system. Principal Components Analysis (PCA) was conducted to assess the factor structure of the risk behaviors (i.e. clustering). Linear regression analyses with a bootstrapping method were performed to assess the associations.

Results

Binge drinking was reported by 50.5% and cannabis use by 14.2% of the students (both in the past 4 weeks), whereas 37.7% reported currently being a smoker. More than 10% reported having been questioned at a police station in the past year. Furthermore, 82.2% had been truanting in the first two months of education, 21.0% reported having debts and 29.2% reported clinically-relevant depressive symptoms. The PCA indicated two clusters. The 'substance use' cluster consisted of the risk behaviors: binge drinking, cannabis use and smoking. The 'problem behaviors' cluster consisted of the risk behaviors: delinquency, truancy and incurring debts. Both clusters were associated with depressive symptoms. Various demographic variables were associated with both clusters.

Conclusions

Risk behaviors formed two clusters, both of which were associated with depressive symptoms. These findings underscore the importance of screening adolescents and young adults at lower educational levels for multiple risk behaviors and depressive symptoms and of focusing on multiple risk behaviors in interventions simultaneously.

BACKGROUND

A high percentage of adolescents and young adults suffer from depressive symptoms and display many risk behaviors such as substance use, delinquency, truancy and making purchases they can not afford, which are acquired during adolescence.[1] By increasing the risk of developing major diseases such as cancer, cardiovascular disease, and psychiatric and psychosocial disorders, depressive symptoms and risk behaviors contribute to the public health burden.[2,3] Furthermore, depressive symptoms and risk behaviors often persist into adulthood, thereby affecting not only current health but also health later in life.[2,4] Furthermore, adolescents and young adults experiencing depressive symptoms or displaying risk behaviors are at increased risk of school dropout.[5-9] This phenomenon seems especially true for students attending vocational education. For example, in the Netherlands, 75% of school dropouts occur in vocational education.[10] As the senior level of the vocational track in Dutch secondary education, vocational education provides specialized vocational training to students aged 15 years and older.

According to studies, dropping out of school results in substantially lower earnings over the course of life,[11] considerably more dependence on public assistance,[12] and a substantially higher likelihood of involvement in crime and incarceration.[13] Since dropout often experience problems and exhibit risk behaviors earlier on, it is essential to gain a greater understanding of these problems and behaviors in order to prevent dropout and the associated problems later in life. However, little is known about the prevalence of risk behaviors among students in vocational education, especially delinquency, truancy and incurring debts.

According to Jessor's problem behavior theory, risk behaviors (e.g. drinking alcohol, delinquent behavior) tend to co-occur in youth.[14] In previous research it was also shown, for example, that risk behaviors related to substance use (i.e. alcohol use, drug use and cigarette smoking) often cluster in adolescents.[15,16] However, most studies on health behavioral clustering have focused on a relatively small range of health behaviors and fail to examine the clustering of a wide range of risk behaviors such as delinquency, truancy and incurring debts.[15,17] Investigating the clustering of health risk behaviors is important because individuals with multiple health risk behaviors are at the greatest risk of developing chronic diseases and disabilities.[15,18-20] Understanding the prevalence of these behavioral clusters may inform health improvement planning efforts.[20] In addition, if risk behaviors cluster, prevention programs aimed at changing clusters of risk behaviors, rather than separate risk behaviors, could lessen the burden on public health services. Therefore, the development of a prevention strategy to target multiple health risk behaviors simultaneously could be useful when behaviors cluster and have an underlying basis and similar predictors.[17] Although many public health intervention strategies still focus on behaviors in isolation, research has shown that risk behaviors

related to substance use are responsive to such an integrated approach.[21] Furthermore, the World Health Organization (WHO) has adopted a holistic approach to health that emphasizes prevention by tackling combinations of risk factors.[19]

Additionally, previous research has suggested an association between depressive symptoms and substance use.[22-25] However, knowledge about relationships between depressive symptoms and other clusters of behaviors including delinquency, truancy and incurring debts is scarce. It is important to examine the association between different clusters of behaviors and depressive symptoms to further improve intervention programs, and especially to improve the early identification of those at risk of multiple risk behaviors and/or depressive symptoms. Furthermore, to further improve intervention programs, it is also important to examine if demographic characteristics can be used to identify adolescents and young adults at risk. Although research suggests that demographics can be used to identify adolescents displaying single risk behaviors or experiencing depressive symptoms, research on whether demographics can be used to identify adolescents and young adults at risk of multiple, clustered risk behaviors, especially clusters including delinquency, truancy and debts, is rare.[26,27]

Overall, the purpose of this study was to examine the prevalence of depressive symptoms and risk behaviors (binge drinking, cannabis use, smoking, truancy, delinquency and incurring debts) among adolescents and young adults in vocational education. It also examined the clustering of risk behaviors and the association between the clusters and depressive symptoms and between the clusters and demographic variables (i.e. gender, ethnicity, age, and being a parent).

METHODS

Participants and recruitment

This study used data obtained upon enrolment (pre-test measure) in the Your Health study, a cluster randomized controlled trial. The pre-test measure that was used in this study was conducted in 2012 and before randomization had taken place. The intervention study is described in detail elsewhere.[28] A total of 44 first-year classes of students in vocational education in the Rotterdam region of the Netherlands participated. There are four levels of vocational education in the Netherlands. In this study, students from the two lowest levels of vocational education (the easiest levels) participated. The two lowest levels of vocational education last one to three years and focus on basic practical tasks. Only students from the two lowest levels were included, since studies have shown that the prevalence of risk behaviors among these students is high and school dropout rates are the highest of any group.[6,7,29,30]

A few weeks prior to the start of the study, all students and parents received information about the study. If parents did not want their child to participate, they could object to the participation of their child (until adolescent age 18 years). During a classroom session, students who were present in class, were asked written consent before they completed a questionnaire. Written consent was provided by 70.4% (N = 584) of students. The main reason for non-participation was absence at time of the assessment.

The Medical Ethical Committee of Erasmus MC has declared that the Medical Research Involving Human Subjects Act (also known by its Dutch abbreviation WMO) does not apply to this research proposal. The Medical Ethical Committee had no objection against the execution of this research proposal (MEC-2012-367).

Measurements

At school, during one classroom session (+/- 45 min), students completed a self-report questionnaire. Risk behaviors were assessed by items based on existing instruments previously developed by Municipal Public Health Services and health institutes in the Netherlands.[31] Truancy was monitored via the school registration system.

Demographics

Demographic characteristics included age, gender, country of birth of the students and both parents, and whether or not the student already was a parent him/herself. Ethnicity was classified as Dutch or non-Dutch, in accordance with the definitions of Statistics Netherlands.[32]

Depressive symptoms

Symptoms of depression were assessed by the Center for Epidemiologic Studies Depression Scale (CES-D).[33] The CES-D consists of 20 items. The frequency of symptoms is rated on a 4-point scale. Items scores are summed (range from 0–60), with higher scores indicating higher levels of depressive symptoms (current study $\alpha = 0.89$). A cut-off point of 16 is used to indicate clinically significant depressive symptoms. This cut-off score corresponds with the 80th percentile in community samples.[34] This cut-off point was used to determine the percentage of students with clinically significant depressive symptoms. For the remaining analyses, the (continuous) total CES-D score was used.

Risk behaviors

Binge drinking was defined as 5 or more alcoholic drinks consumed on one occasion, a commonly used definition.[35] Students in this study were asked to report the number of times they consumed 5 or more drinks on one occasion in the past 4 weeks (never–9 or more times). Cannabis use was assessed by the number of times the student had used cannabis over the past 4 weeks (never–20 or more times). Cigarette smoking was

assessed by how often the student smoked at time of assessment (not–every day). Delinquency was assessed by the item: "In the past 12 months, have you been questioned at a police station, because you were accused of doing something that was not permitted?" (never–6 or more times). Debts were assessed by the items: 1) do you have any debts (yes/no/don't know), and 2) approximately how high is the sum of all your debts (less than 50 euro–more than 2500 euro). School administrators registered every hour of impermissible absence (i.e. absence without notification or valid reason) in the school's registration system. Truancy was defined as the number of hours students were absent impermissible over the two months at the start of the study. Truancy data is not available for part of the students (12.5%; n = 73) due to school dropout, other reasons for leaving the school (e.g. switching schools), and failure to match the data.

Chi-square tests and t-tests were conducted to compare students from whom truancy information was or was not available. Group differences were found, with the students from whom no truancy information was available, more often being of non-Dutch ethnicity ($\chi^2 = 5.48$; $p = .02$), binge drinkers ($\chi^2 = 7.37$; $p = .007$), cannabis users ($\chi^2 = 9.52$; $p = .002$) , cigarette smokers ($\chi^2 = 4.64$; $p = .03$), reporting delinquency ($\chi^2 = 16.76$; $p < .001$), incurring debts ($\chi^2 = 4.60$; $p = .03$), and having depressive symptoms ($t = 3.23$; $p = .002$).

For describing the prevalence of single risk behaviors ordinal scales were used. For other analyses purposes, risk behaviors were categorized as follows: binge drinking in the past 4 weeks (yes/no); cannabis use in the past 4 weeks (yes/no); current cigarette smoker (yes/no); delinquency in the past 12 months (yes/no); incurring debts (yes/no); truancy more than 2 hours in two months (yes/no).

Statistical analyses

Statistical analyses were performed using SPSS version 21. Principal Components Analysis (PCA) with direct oblimin rotation was conducted to assess the factor structure of the risk behaviors (i.e. clustering of risk behaviors). The following criteria were used to determine the number of clusters: factors must have an eigenvalue of > 1.00 and factor loadings must have an absolute value of > 0.40. Furthermore, it was checked whether no substantial secondary factor loadings (i.e. > 0.40) emerged.[36] Subsequently, factor scores according to cluster were computed for each student by adding up all of the risk behavior score weights by their factor loading.[37] The factor scores were then used as separate variables in linear regression analyses. Linear regression analyses were performed to explore associations between: clustering of risk behaviors and depressive symptoms, demographics and depressive symptoms, and demographics and clustering of risk behaviors. For the linear regression analyses, a bootstrapping method was used.[38] This method deals with data that are skewed, as is often the case with data on depressive symptoms, and in this study. Additional logistic regression analyses treating depressive symptoms as binary outcome, instead of as continuous outcome, were also conducted (see Appendix 1 and 2). Any P values of < .05 were considered statistically significant.

RESULTS

Students' characteristics

The average age of the students in this study was 18.3 years (SD = 2.59).The majority (52.6%) of the students was under the age of 18, 43.0% was between 18 and 24 years old and 4.5% was 25 years or older. Of the students in this study, 38.9% was male and 10.6% was a parent (Table 1). The majority (62.1%) was of non-Dutch ethnicity.

Risk behaviors and depressive symptoms

Binge drinking was reported by 50.5% and cannabis use by 14.2% of the students (both in the past 4 weeks), whereas 37.7% reported currently being a smoker (Table 1). More than 10% reported having been questioned at a police station in the past year because they were accused of doing something that was not permitted. Furthermore, 82.2% had been truanting one or more hours in the past two months, 21.0% reported having debts and 29.2% reported clinically-relevant depressive symptoms.

Clustering of risk behaviors

The PCA yielded two factors with eigenvalues > 1.00 with all factor loadings being > 0.40 on one of the two factors, and low secondary factor loading (i.e. < 0.40) (Table 2). The first factor consisted of three risk behaviors: binge drinking (r = 0.74), cannabis use (r = 0.74) and smoking (r = 0.73). This cluster was therefore named 'substance use'. The second factor also consisted of three risk behaviors: delinquency (r = 0.50), truancy (r = 0.69) and incurring debts (r = 0.72). This cluster was named 'problem behaviors'. There was a small correlation between the two clusters (r = 0.16, p = .001). Of the students, 33.2% reported the use of one substance, 18.1% the use of two substances, and 11.0% the use of three substances. Furthermore, 48.8% reported one problem behavior, 19.3% two problem behaviors, and 2.3% three problem behaviors.

Associations between clustering of risk behaviors and depressive symptoms

The substance use and problem behaviors clusters were significantly associated with depressive symptoms (Table 3). A higher score on the substance use cluster was associated with more depressive symptoms (B = 1.61, 95% CI = 0.49 – 2.55). A higher score on the problem behaviors cluster was also associated with more depressive symptoms (B = 1.30, 95% CI = 0.23 – 2.47). After adjusting for the other cluster, the beta coefficients remained significant (substance use: B = 1.45, 95% CI = 0.48 –2.46; problem behavior: B = 1.04, 95% CI = 0.04 – 2.16).

Table 1. Demographics, risk behaviors and depressive symptoms of the study population (N = 584)

	Total N = 584
Age in years	
Mean [2]	18.3 (SD=2.59, range 15–30)
	%
Gender [1]	38.9
Boys	
Ethnicity [4]	
Dutch	27.9
Surinamese	10.3
Antillean	15.7
Moroccan	6.4
Turkish	9.0
Cape Verdean	5.0
Other	25.7
Being a parent [28]	
Yes	10.6
Binge drinking (past 4 weeks) [16]	
Never	49.5
1 time	18.7
2 times	13.4
3 - 4 times	8.6
5 or more times	9.9
Cannabis use (past 4 weeks) [8]	
Never	85.8
1 – 4 times	4.5
5 or more times	9.7
Cigarette smoking (currently) [11]	
No	62.3
Yes, but not daily	8.0
Yes, daily	29.7
Delinquency [6]	
Questioned at a police station (last year)	11.1
Truancy (past two months) [73]	
Never	17.8
1 – 2 hours	15.9
3 – 10 hours	30.5
> 10 hours	35.8
Debts [46]	
None	79.0
< 500 euro	7.1
> 500 euro	13.9
Depressive symptoms [16]	
CES-D score in the clinical range (score ≥ 16)[a]	29.2
CES-D score[b], mean (SD)	12.5 (9.49)

Note: [missing data].

[a] A cut-off point of 16 is used to indicate clinically significant depressive symptoms and corresponds to the 80th percentile in community samples.[34]

[b] A higher score on the CES-D indicates higher levels of depression symptoms (range 0–60).

Table 2. Factor structure and loadings of the risk behaviors[a]

	Loadings	
	Factor 1	Factor 2
Risk behaviors	Substance use	Problem behaviors
Binge drinking	0.74	-0.17
Cannabis use	0.74	0.06
Cigarette smoking	0.73	0.16
Delinquency	0.05	0.50
Truancy	-0.002	0.69
Debts	0.05	0.72
Eigenvalue	1.77	1.17
% Explained variance	29.55	19.53

[a] Principal Components Analysis.

Table 3. Associations between clusters of risk behaviors and depressive symptoms (N = 424)[a]

	Depressive symptoms		
	Model 1a	Model1b	Model 2
	Beta coefficient (95% CI)	Beta coefficient (95% CI)	Beta coefficient (95% CI)
Substance use	**1.61 (0.49 – 2.55)**		**1.45 (0.48 – 2.46)**
Problem behaviors		**1.30 (0.23– 2.47)**	**1.04 (0.04 – 2.16)**

Note: Bold numbers indicate significant results at $p < .05$.
[a] Linear regression analyses using a bootstrapping method.
Model 1a is adjusted for age, gender, ethnicity, being a parent and substance use.
Model 1b is adjusted for age, gender, ethnicity, being a parent and problem behaviors.
Model 2 is adjusted for age, gender, ethnicity, being a parent, substance use and problem behaviors.

Associations between demographics, clusters of risk behaviors and depressive symptoms

Age was associated with the problem behaviors cluster (Table 4). Older students reported more often problem behaviors (B = 0.11, 95% = CI 0.05 – 0.16). Girls reported more depressive symptoms than boys (B = 3.56, 95% CI = 2.18 – 5.15). Ethnicity was significantly associated with the cluster substance use and problem behaviors. Students of non-Dutch ethnicity less often reported using substances (B = -0.51, 95% CI = -0.72 to -0.29), but more often reported problem behaviors (B = 0.31, 95% CI 0.11 – 0.53) compared to students of Dutch ethnicity. Separate exploratory analyses, in which each non-Dutch ethnicity was compared to Dutch ethnicity, yielded a similar pattern of results for each non-Dutch ethnicity. Finally, being a parent was associated with reporting more often problem behaviors (B = 0.56, 95% CI = 0.19 – 0.95).

Table 4. Associations between demographics, clusters of risk behaviors and depressive symptoms[a]

	Substance use[b]	**Problem behaviors[b]**	**Depressive symptoms[b]**
	Beta coefficient (95% CI)	Beta coefficient (95% CI)	Beta coefficient (95% CI)
	N = 432	N = 432	N = 534
Age	0.04 (-0.02 – 0.09)	**0.11 (0.05 – 0.16)**	0.20 (-0.19 – 0.60)
Gender (ref. = boys)	-0.10 (-0.33 – 0.10)	-0.16 (-0.34 – 0.01)	**3.56 (2.18 – 5.15)**
Ethnicity (ref. = Dutch)	**-0.51 (-0.72 – 0.29)**	**0.31 (0.11 – 0.53)**	1.34 (-0.55 – 3.25)
Being a parent (ref. = No)	0.14 (-0.26 – 0.61)	**0.56 (0.19 – 0.95)**	-1.10 (-3.84 – 2.51)

Note: Bold numbers indicate significant results at $p < .05$.

[a] Linear regression analyses using a bootstrapping method.

[b] Age, gender, ethnicity and being a parent are included at the same time.

DISCUSSION

This study shows that risk behaviors and depressive symptoms are prevalent among adolescents and young adults attending vocational education. The results suggest that clustering of risk behaviors occurs. More specifically, the risk behaviors examined occurred in two clusters: substance use (i.e. alcohol use, cannabis use and cigarette smoking) and problem behaviors (i.e. incurring debts, truancy and delinquency). Furthermore, both clusters of risk behaviors were associated with depressive symptoms. In addition, various demographic characteristics were associated with the clusters of risk behaviors and depressive symptoms.

Each of the individual risk behaviors was prevalent among the study population, with truancy having an especially high prevalence. That is, more than 4 out of 5 students had been truanting in the first two months of education. This is very worrying since truancy is a risk factor for school dropout, as are the other risk behaviors included in this study.[5-9] To the best of our knowledge, there have been no previous studies examining the prevalence of truancy (in hours) among students attending vocational education, as registered by a school registration system. Most often truancy is measured by self-report measures, which is a less objective measure than a school registration system.

The prevalence of cannabis use, cigarette smoking, depressive symptoms and incurring debts was high, though comparable with other studies among students attending vocational education.[29,30,39] However, binge drinking was more prevalent in our study (50.5%) compared to the study of Vogel et al. in which 33.2% of students attending vocational education reported having been binge drinking in the past 4 weeks.[29] This discrepancy may be due to differences in the level of education; the study by Vogel et al. included students from all four levels of vocational education, whereas our study only included students from the two lowest levels. Students at a lower education levels have a greater tendency to drink large amounts of alcohol compared to students at higher

levels of education.[40] This difference is probably attributable to the fact that students at lower levels spend more time with their peers and are not supervised by their parents as much, both of which are associated with more drinking.[27] Studies examining the prevalence of delinquency among adolescents and young adults attending vocational education seem to be lacking and therefore more research is needed. This is especially true given that more than 10% of students in our study reported that they were questioned at a police station in the past year after being accused of breaking the law.

Two clusters of risk behaviors were identified (i.e. substance use and problem behaviors). The clustering of substance use-related risk behaviors (i.e. alcohol use, cannabis use, and cigarette smoking) was also found in other studies among adolescents in general,[15,16,21] whereas prior research among students attending vocational education showed an association between binge drinking, cannabis use and cigarette smoking.[29] The clustering of the use of different substances has been explained by so-called gateway theories and by a shared determinant that increases the risk of using substances in general. Gateway theories state that the use of one substance leads to experimentation and use of other substances.[41] Alternatively, a shared determinant, such as a personality trait (e.g. novelty seeking) that makes it more likely a student will experiment with substances, or an environment in which students are exposed to substance use and/or abuse by the example of parents or friends, could increase students' risk of multiple substance use.[42]

The other cluster, problem behaviors, comprised the risk behaviors incurring debts, truancy and delinquency. Although previous research showed an association between incurring debts and delinquency,[43] between delinquency and truancy,[8,44] and between incurring debts and active participation at school among students,[45] it appears that the clustering of these three has never before been investigated. The clustering of these risk behaviors may be explained by the Strain Theory, which posits that financial problems are a source of strain in young people.[46] If these youngsters are not capable of dealing with strain in a legal manner, the risk of committing a minor violation, e.g. truancy or substance use, and delinquency may increase. Although the use of substances by adolescents is considered illegal behavior in some countries, in the Netherlands the use of substances by adolescents is legal. That is, until 2013 the purchase of alcohol and cigarettes was allowed for those 16 and over (starting in 2014 the age was raised to 18), and the use of cannabis is allowed for those 18 and over.

The clustering of risk behaviors suggests that interventions should preferably focus on multiple risk behaviors simultaneously rather than on separate risk behaviors in order to lessen the burden on public health services.[17,18] Because multiple risk behaviors were relatively common in the study population, preventive interventions targeting students attending vocational education and focusing on multiple behaviors simultaneously could be especially beneficial. However, to date, most intervention programs still take

a single risk behavior approach, instead of an integrated one.[21] The finding of separate clusters indicates that some combinations of risk behaviors, i.e. those which form clusters could potentially be responsive to an integrated prevention approach. Moreover, it is of interest to examine whether the risk behaviors included in certain clusters have a shared determinant, such as a personality trait (e.g. novelty seeking) or a specific family environment (e.g. an environment with a lot of violence). Although the present research only focused on risk behaviors, some of the most promising intervention program approaches for reducing multiple risk behaviors simultaneously address multiple domains of risk and protective factors predictive of risk behavior.[21]

Furthermore, our study shows that both clusters of risk behaviors were associated with depressive symptoms. This observation supports findings by Clark et al. and Boys et al., which demonstrate that adolescents who engaged in more health risk behaviors (i.e. smoking, alcohol, and/or drug use) were at increased risk of depressive symptoms.[23,24] Therefore, if multiple risk behaviors are evident in adolescents and young adults, it could be useful to screen for and address depressive symptoms, whereas if depressive symptoms are evident it could be useful to screen for and address multiple risk behaviors. This approach may help to improve the early identification of those at risk of multiple risk behaviors and/or depressive symptoms.

Moreover, to determine which students are at risk of multiple risk behaviors or depressive symptoms, it was also examined if demographic characteristics could help identify at risk students. Results showed that students with a non-Dutch ethnic background reported less substance use than students of Dutch descent. This may) be due (at least partly) to their cultural and/or religious beliefs and practices related to smoking, drinking alcohol and using drugs.[40] However, students of non-Dutch descent more often reported problem behaviors compared to students with a Dutch background. Older students and students who were a parent also more often reported problem behaviors compared to their younger counterparts and to adolescents who were not a parent yet. This observation is in line with previous research showing that ethnic minority students, older students, and students who are a parent, are at increased risk of dropout.[7] Finally, girls more often reported depressive symptoms compared to boys, which is also supported by previous research.[47]

The present study has some limitations. As this is a cross-sectional study, we cannot determine the direction of association between risk behaviors and depressive symptoms. While earlier research has identified depression as a predictor of risk behaviors, research has also shown that risk behaviors can be predictors of depression. Furthermore, a third factor may make youth susceptible to both depression and a wide range of behaviors.[48-50] Although our population reflects the average population in vocational schools in the Netherlands as regards age, gender, and ethnicity,[29,30,39] this study was only conducted among students in the Netherlands in the two lowest levels of vocational

education. Therefore, generalization to other education levels and countries should be done with caution. Moreover, almost 30% of students did not provide written consent, mainly because they were absent during the assessment and participating students for whom truancy information was not available were more likely to display risk behaviors and depressive symptoms than students for whom truancy information was available. This could have affected the generalizability of the results since non-participating students were not included in the analyses and students for whom truancy information was missing were not included when calculating prevalence of risk behavior clusters. This limitation probably means that the prevalence of risk behavior clusters has been underestimated. Furthermore, potential underestimation of risk behaviors clusters may have also led to underestimation of the association between risk behaviors clusters and depressive symptoms. Another limitation is the use of self-reporting for most variables included in this study, which may have resulted in less reliable outcomes. Nevertheless, research suggests that, for example, self-reported alcohol consumption among adolescents is generally valid.[51]

Conclusions

In conclusion, risk behaviors formed two separate clusters, which suggests that interventions should preferably address multiple risk behaviors simultaneously. However, more research is needed to further examine how risk behaviors cluster among adolescents and young adults and further investigations are warranted to determine if shared determinants can be identified. Furthermore, this study highlights the importance of screening for multiple risk behaviors when depressive symptoms are evident in adolescents and young adults, whereas if depressive symptoms are evident it could be useful to screen for multiple risk behaviors. Finally, the findings of this study suggest that interventions to prevent risk behaviors and depressive symptoms should target older students, girls, and students who are a parent, in particular, because these groups reported risk behaviors clusters or depressive symptoms more frequently.

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Appendix 1. Associations between clusters of risk behaviors and depressive symptoms (as binary outcome) (N = 424)[a]

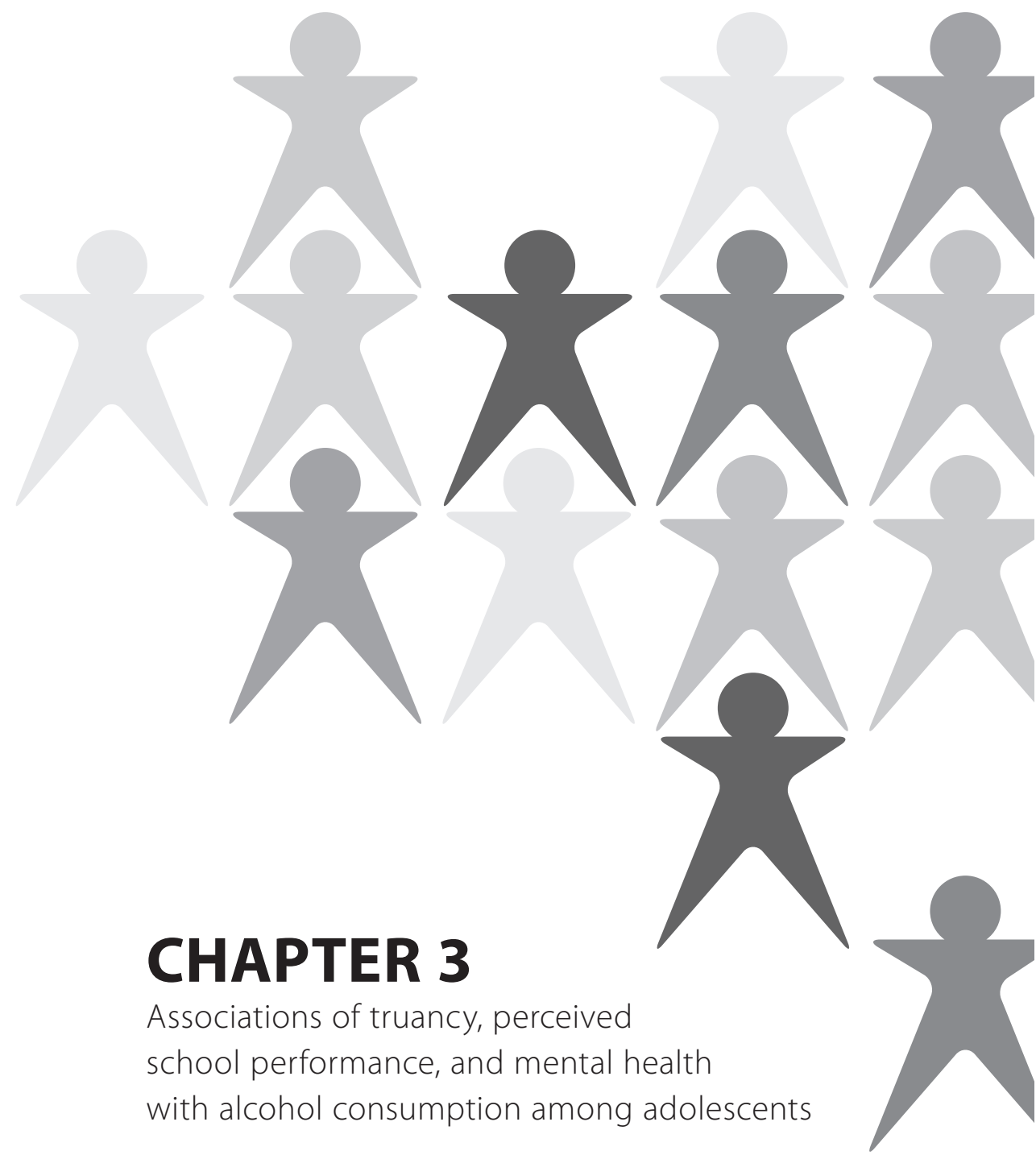
	Depressive symptoms		
	Model 1a	Model1b	Model 2
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Substance use	**1.37 (1.10 – 1.70)**		**1.31 (1.05 – 1.63)**
Problem behaviors		**1.45 (1.13 – 1.85)**	**1.38 (1.08 – 1.77)**

Note: Bold numbers indicate significant results at $p < .05$.
[a] Logistic regression analyses.
Model 1a is adjusted for age, gender, ethnicity, being a parent and substance use.
Model 1b is adjusted for age, gender, ethnicity, being a parent and problem behaviors.
Model 2 is adjusted for age, gender, ethnicity, being a parent, substance use and problem behaviors.

Appendix 2. Associations between demographics and depressive symptoms (as binary outcome) (N = 534)[a]

	Depressive symptoms[b]
	OR (95% CI)
Age	**1.14 (1.05 – 1.24)**
Gender (ref. = boys)	**2.39 (1.56 – 3.67)**
Ethnicity (ref. = Dutch)	1.15 (0.75 – 1.78)
Being a parent (ref. = No)	0.56 (0.27 – 1.18)

Note: Bold numbers indicate significant results at $p < .05$.
[a] Logistic regression analyses.
[b] Age, gender, ethnicity and being a parent are included at the same time.



CHAPTER 3

Associations of truancy, perceived school performance, and mental health with alcohol consumption among adolescents

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Submitted

ABSTRACT

Background

This study examined associations of truancy, perceived school performance, and mental health with adolescents' week, weekend and binge drinking.

Methods

A cross-sectional study was conducted among 1167 secondary school students of Dutch ethnicity (mean age = 15.9, SD = 0.69). Alcohol consumption, truancy, perceived school performance and mental health status were assessed with self-report questionnaires. Ordinal regression analyses were performed to assess the associations.

Results

Truancy (OR = 2.53, 95% CI = 1.70 – 3.77) and a poorer mental health (OR = 1.04, 95% CI = 1.02 – 1.07) were associated with binge drinking more often. Truancy (OR = 1.89, 95% CI = 1.14 – 3.16) and a poorer mental health (OR = 1.06, 95% CI = 1.02 – 1.09) were also associated with drinking (more) alcohol on week days. Furthermore, truancy (OR = 2.60, 95% CI = 1.76 – 3.83) and having an average (OR = 1.81, 95% CI = 1.19 – 2.77) or less than average (OR = 3.65, 95% CI = 1.93 – 6.90) perceived school performance were associated with drinking (more) alcohol on the weekend.

Conclusions

Findings of this study suggest that adolescents who are truanting and/or have a poor mental health status are at increased risk of binge and week drinking. Furthermore, adolescents' who are truanting and/or have an average or less than average perceived school performance are at increased risk of weekend drinking.

INTRODUCTION

Alcohol use among adolescents is a worldwide public health concern.[1] Adolescents often start drinking at an early age and consume large amounts of alcohol on one occasion.[2] In the USA and most European countries, the average age of onset of alcohol use is 13 years and at the age of 15 years about 21% of adolescents drinks alcohol on a weekly basis.[2,3] As the brain undergoes major changes during adolescence, it may be especially vulnerable to the adverse effects of alcohol during this period.[4,5] More specifically, adolescents who drink alcohol put themselves at risk of brain damage and cognitive dysfunction, e.g. poorer memory, smaller cerebellar volume and poorer decision making.[4,5] Especially binge drinking, that is drinking five or more glasses of alcohol on one occasion, may be a harmful way of consuming alcohol in this regard.[6] Furthermore, the consumption of alcohol increases adolescents' risk of other adverse health outcomes such as (traffic) injuries, violence, suicide, sexually transmitted disease, and alcohol dependence in adulthood.[5,7-11]

Although the consumption of alcohol on its own already has several adverse health consequences, this behavior often does not occur in isolation. Various other factors, including school, social, and behavioral problems, have found to be associated with alcohol consumption. Earlier research has, for example, shown that truancy is associated with alcohol consumption,[12-16] with adolescents who have been truanting reporting an earlier alcohol debut,[12] more frequent use of alcohol[13,14] and binge drinking[15,16] than non-truanting adolescents. Studies have also shown that (perceived) school performance is associated with alcohol consumption. That is, adolescents who perceive their school performance as less favorable than others are at increased risk of alcohol intoxication[17] and alcohol misuse in early adulthood.[18] Furthermore, adolescents with lower school grades are at greater risk of binge drinking.[15] In addition to truancy and perceived school performance, a poor mental health is associated with increased alcohol consumption in adolescents as well. Several studies indicate that mental health problems such as depression, anxiety, and externalizing problems are associated with engagement in binge drinking and self-reported alcohol intoxication.[19-22]

Although previous studies have examined the association of truancy, perceived school performance, and mental health with alcohol consumption, these studies have primarily focused on binge drinking.[15-17,19,20,22] Still little is known about other patterns of alcohol consumption, such as drinking on week days or the weekends, and their association with truancy, perceived school performance, and mental health. The associations with alcohol consumption on week days may be different than the association with drinking on the weekends. Weekend drinking seems to be more of a social activity occurring in the presence of peers where adolescents seek enhancement,[23] whereas week drinking might be more of an individual act representing other drinking motives, for example

drinking to cope with social and/or environmental problems. Therefore, it seems important to distinguish between drinking on week and weekend days and binge drinking when examining the associations of truancy, perceived school performance, and mental health with alcohol consumption. Taken together, the current study aimed to examine the association of truancy, perceived school performance, and mental health with different patterns of alcohol consumption (i.e. week, weekend, and binge drinking) in adolescents. Thereby, this study will provide knowledge on whether and how these variables are associated with pattern(s) of alcohol consumption. If truancy, perceived school performance, and/or mental health are associated with pattern(s) of alcohol consumption, it can be important, for example, for school staff and health professionals to be aware of different patterns of alcohol consumption when confronted with truancy, perceived school performance, and/or mental health problems among adolescents. Likewise, if school staff and health professionals are confronted with alcohol consumption among adolescents, school staff and health professionals possibly need to be aware of truancy, perceived school performance, and/or mental health problems.

METHODS

Subjects and recruitment

This study used data obtained at the enrolment in the E-health4Uth study (Trail Registration: Current Controlled Trails NTR3596), as described in detail elsewhere.[24] From September 2012 to May 2013 data were collected on secondary schools in the Dutch cities of Dordrecht and Zwijndrecht (South-Holland). Of the 14 secondary schools invited by the preventive youth health organizations to participate in the study, 12 schools agreed and provided a total of 11 classes of third-year students (2 schools) and 75 classes of fourth-year students (10 schools). In the Netherlands, adolescents in the third and fourth year of secondary school are on average 15–16 years of age. At the time of data collection the purchase of alcohol was allowed by law from the age of 16 (from 2014 this was increased to 18 years). Adolescents of both the lower (i.e. vocational training) and higher educational level (i.e. pre-university education) participated in this study.

A few weeks prior to the start of the study, all adolescents and their parents received information about the study. If parents did not want their child to participate, they could object to participation of their child. Adolescents were asked to provide written consent before they completed the baseline questionnaire. Of the 1989 eligible adolescents, a total of 1702 participated (85.6%). The main reason for non-participation was absence, mainly because of illness. Furthermore, 29 parents refused their child's participation and 24 adolescents refused participation themselves.

Instrumentation

At school, an online self-administration questionnaire was completed by the adolescents during one classroom session (+/- 45 min). Alcohol consumption, truancy, and perceived school performance were assessed by items based on existing instruments previously developed by health institutes and Municipal Public Health Services in the Netherlands.[25] Mental health status was assessed by the Strengths and Difficulties Questionnaire (SDQ).[26]

Alcohol consumption

Alcohol consumption was assessed by several questions which were divided into three categories; week drinking, weekend drinking, and binge drinking. Week drinking was defined as drinking on Monday, Tuesday, Wednesday, and/or Thursday. This was measured by two items using an ordinal scale: (1) on average, on how many of the four week days do you drink alcohol? (never-4 days), and (2) how many glasses, bottles, or cans of alcohol do you drink on such a weekday? (1 glass-11 or more). Weekend drinking was defined as drinking alcohol on Friday, Saturday, and/or Sunday. This was measured by two items using an ordinal scale: (1) on average, on how many of the three weekend days do you drink alcohol? (never-3 days), and (2) how many glasses, bottles, or cans of alcohol do you drink on such a weekend day? (1-20 or more). When adolescents selected "*less than one day*" as an answer to the first question about week and weekend drinking, this was counted as one day. The second question about week and weekend drinking was only assessed if adolescents reported to drink alcohol during the week or weekend. For analyses purposes, week drinking was categorized as follows: no, 1 glass, or 2 or more glasses. Weekend drinking was categorized as: no, 1-2 glasses, 3-4 glasses, 5-6 glasses, or 7 or more glasses.

Binge drinking was defined as the consumption of 5 or more alcoholic drinks on one occasion, a commonly used definition.[27] Binge drinking was assessed with one question "how often did you drink 5 or more alcohol drinks on one occasion on the past 4 weeks?" (never-9 or more times). For analyses purposes, binge drinking was categorized as follows: never, 1 time, 2 times, 3-4 times, or 5 or more times.

Truancy

Truancy was assessed by the question. "Have you ever been truanting in the past four weeks?" (no-more than 20 hours). For analyses purposes, truancy was dichotomized into: never and one or more hours.

Perceived school performance

Perceived school performance was measured with the question: "How do you think your teacher estimates your school performance compared to other classmates?". Answer

categories were: *very good, good, average,* and *less than average*. The perceived school performance item seems to be a valid question that can distinguish groups of respondents that obtain good grades at school from those that do not.[28]

Mental health

Mental health status was assessed with the SDQ. The SDQ consist of 25 items describing positive and negative attributes of adolescents that can be allocated to 5 subscales of 5 items each: the emotional problems , the conduct problems , the hyperactivity-inattention , the peer problems , and the prosocial behavior subscale.[29] Each item is scored on a 3-point Likert scale (0 = *not true,* 1 = *somewhat true,* 2 = *certainly true)*. A total difficulties score is calculated by summing the scores for the emotional problems, conduct problems, hyperactivity-inattention, and peer problems subscales (range 0–40). The validity and reliability of the scale were evaluated as satisfactory (current study $\alpha = 0.77$).[26,29,30]

Confounders

Based on literature age, sex, ethnicity, and educational level were incorporated as potential confounders in this study. Education was categorized into two groups: lower educational level (i.e. vocational training) and higher educational level (i.e. pre-university education). Ethnicity was classified as Dutch or non-Dutch, in accordance with the definitions of Statistics Netherlands;[31] adolescents with at least one parent born outside the Netherlands were classified as non-Dutch.

Data analysis

Descriptive statistics were used to describe the characteristics of adolescents and the prevalence of alcohol consumption on week and weekend days and binge drinking. Multilevel ordinal regression analyses were conducted to investigate the association between truancy, perceived school performance, mental health, and alcohol consumption patterns. Multilevel analysis adjusts for clusters (i.e. classes) by taking into account the dependency between observations of adolescents from the same class.

At first, we tested whether there were ethnic differences in the association between alcohol consumption and truancy, perceived school performance, and mental health. A significant Ethnicity × Perceived school performance and Ethnicity × Mental health interaction on alcohol consumption was found ($p < .05$). Since separate analyses for each non-Dutch ethnicity were not possible because of the small size of these subgroups, adolescents with a non-Dutch ethnicity (n = 495) were excluded. Subsequently, it was explored whether sex, age, or level of education moderated the association between truancy, perceived school performance, mental health and the different patterns of alco-

hol consumption among adolescents of Dutch ethnicity. Since no significant interaction effects ($p < .05$) were found, no separate analyses were performed.

Furthermore, multilevel ordinal regression analyses were conducted to assess the association between alcohol consumption and truancy, perceived school performance, and mental health among adolescents of Dutch ethnicity. In the first (bivariate) model, the independent variables were tested separately, adjusting for demographic factors. In the second (multivariate) model, all independent variables and demographic factors were included. Corresponding odds ratio's (ORs) and 95% confidence intervals (95% CIs) were calculated. Results were considered significant at $p < .05$.

The multilevel regression analyses were performed in Stata 13.1. Other analyses were performed in SPSS 21.0. Cases with missing values on either the dependent or independent variables (n = 40) were excluded. The final data analyses were based on 1167 adolescents.

RESULTS

Descriptive characteristics

As can be seen in Table 1, 53.7% of the sample consisted of boys and 46.3% of girls. Of the adolescents, 48.2 % attended vocational training, whereas 51.8% attended pre-university education. The average age of the adolescents was 15.9 years (SD = 0.69). The prevalence of adolescents who reported to have been truanting for 1 or more hours in the past 4 weeks was 9.0%. The mean SDQ score of the adolescents in this study was 10.02 (SD = 5.21, range 0–36). The majority (56.0%) of adolescents reported that their teacher would perceive their school performance, in comparison to their classmates, as '*good*' or '*very good*'.

Alcohol consumption

Of the adolescents, 60.6% reported to have consumed alcohol in the past 4 weeks (Table 2). Most alcohol was consumed on the weekends; 65.6% of the adolescents reported to drink on the weekend, whereas a minority (14.1%) of the adolescents drunk on week days. An average alcohol consumption of 7 or more glasses on the weekend was reported by 17.3% of the adolescents. For week days, 9.4% of the adolescents reported drinking 1 glass on average and 4.7% reported drinking two or more glasses Binge drinking was reported by 37.6% of the adolescents and 3.8% of adolescents reported to have been binge drinking 5 or more times in the past 4 weeks.

Table 1. General characteristics of the study population (N = 1167)

	Total
Age in years, mean (SD)	15.9 (0.69)
Sex (%)	
Boys	53.7
Girls	46.3
Educational level (%)	
Vocational	48.2
Pre-university	51.8
Truancy in past 4 weeks (%)	
Never	91.0
One or more hours	9.0
Perceived school performance (%)	
Very good	9.4
Good	46.5
Average	38.9
Less than average	5.1
Mental health	
SDQ score[a], mean (SD)	10.0 (5.21)

[a] A higher score indicates more mental health problems (range 0–40).

Table 2. Alcohol consumption of the study population (N = 1167)

	%
Alcohol use in the past 4 weeks	
No	39.4
One or more times	60.6
Total drinking on week days[a]	
No	85.9
1 glas	9.4
2 or more glasses	4.7
Total drinking on the weekend[b]	
No	34.4
1-2 glasses	23.2
3-4 glasses	15.2
5-6 glasses	9.9
7 or more glasses	17.3
Binge drinking in the past 4 weeks[c]	
Never	62.4
1 time	16.8
2 times	8.9
3 - 4 times	8.1
5 or more times	3.8

[a] Monday, Tuesday, Wednesday and Thursday were considered week days.

[b] Friday, Saturday and Sunday were considered weekend days.

[c] Binge drinking was defined as drinking 5 or more glasses of alcohol on one occasion.

Binge drinking

Multivariate analyses (Table 3) showed that truanting for one or more hours was significantly associated with more frequent binge drinking (Model 2: OR = 2.53, 95% CI = 1.70 – 3.77). Additionally, a poorer mental health was associated with more frequent binge drinking (Model 2: OR = 1.04, 95% CI = 1.02 – 1.07). In the bivariate analyses, '*less than average*' perceived school performance was significantly associated with more frequent binge drinking (Model 1: OR = 2.94, 95% CI = 1.55 – 5.56). However, in the multivariate analysis this association did not remain significant.

Table 3. Bivariate and multivariate associations of truancy, perceived school performance, and mental health with binge drinking[a] (N = 1167)

	Model 1a[b]	**Model 1b[b]**	**Model 1c[b]**	**Model 2[c]**
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Truancy (past 4 weeks)[d]				
1 or more hours	**2.97 (2.01 – 4.40)**			**2.53 (1.70 – 3.77)**
Mental health[e]		**1.06 (1.03 – 1.08)**		**1.04 (1.02 – 1.07)**
Perceived school performance[f]				
Good			1.19 (0.75 – 1.90)	1.16 (0.73 – 1.85)
Average			1.60 (1.00 – 2.57)	1.41 (0.88 – 2.28)
Less than average			**2.94 (1.55 – 5.56)**	1.84 (0.95 – 3.59)

Note: bold numbers indicate significant *P* values ($p < .05$).

[a] Drinking 5 or more glasses on one occasion was considered binge drinking.

[b] Model 1 was adjusted for age, sex and educational level.

[c] Model 2 was adjusted for age, sex, educational level, truancy, mental health and perceived school performance.

[d] Reference is never.

[e] SDQ score, a higher score indicates more mental health problems (range 0–40).

[f] Reference is 'very good' perceived school performance.

Week drinking

Multivariate analyses showed that truanting for one or more hours was significantly associated with drinking more alcohol on week days (Model 2: OR = 1.89, 95% CI = 1.14 – 3.16) (Table 4). Moreover, a poorer mental health was significantly associated with increased alcohol consumption on week days (Model 2: OR = 1.06, 95% CI = 1.02 – 1.09). No significant relationship was found between perceived school performance and drinking on week days.

Weekend drinking

Bivariate and multivariate analyses yielded similar results on the association between truancy and alcohol consumption on the weekends (Table 5). Truanting for one or more

Table 4. Bivariate and multivariate associations of truancy, perceived school performance, and mental health with alcohol consumption on week days[a] (N = 1167)

	Model 1a[b]	**Model 1b[b]**	**Model 1c[b]**	**Model 2[c]**
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Truancy (past 4 weeks)[d]				
1 or more hours	**2.23 (1.35 –3.67)**			**1.89 (1.14 – 3.16)**
Mental health[e]		**1.07 (1.03 –1.10)**		**1.06 (1.02 – 1.09)**
Perceived school performance[f]				
Good			0.79 (0.44 –1.44)	0.78 (0.43 –1.42)
Average			1.02 (0.56 – 1.86)	0.91 (0.49 – 1.67)
Less than average			1.73 (0.76 – 3.92)	1.09 (0.47 – 2.56)

Note: bold numbers indicate significant *p* values ($p < .05$).
[a] Monday, Tuesday, Wednesday and Thursday were considered week days.
[b] Model 1 was adjusted for age, sex and educational level.
[c] Model 2 was adjusted for age, sex, educational level, truancy, mental health and perceived school performance.
[d] Reference is never.
[e] SDQ score, a higher score indicates more mental health problems (range 0–40).
[f] Reference is 'very good' perceived school performance.

hours was associated with increased alcohol consumption on the weekend (Model 2: OR = 2.60, 95% CI = 1.76 – 3.83). Furthermore, a significant relationship between 'average' and 'less than average' school performance and weekend drinking was found. Compared to adolescents with a 'very good' perceived school performance, having an 'average' (Model 2: OR = 1.81, 95% CI = 1.19 – 2.77) or 'less than average' (Model 2: OR = 3.65, 95%

Table 5. Bivariate and multivariate associations of truancy, perceived school performance, and mental health with alcohol consumption on the weekend[a] (N = 1167)

	Model 1a[b]	**Model 1b[b]**	**Model 1c[b]**	**Model 2[c]**
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Truancy (past 4 weeks)[d]				
1 or more hours	**2.96 (2.02 –4.34)**			**2.60 (1.76 –3.83)**
Mental health[e]		**1.04 (1.02–- 1.06)**		1.02 (0.99 –1.04)
Perceived school performance[f]				
Good			1.37 (0.91 –2.06)	1.36 (0.90 –2.06)
Average			**1.91 (1.26 –2.90)**	**1.81 (1.19 –2.77)**
Less than average			**4.69 (2.53 –8.70)**	**3.65 (1.93 –6.90)**

Note: bold numbers indicate significant *p* values ($p < .05$).
[a] Friday, Saturday and Sunday were considered weekend days.
[b] Model 1 was adjusted for age, sex and educational level.
[c] Model 2 was adjusted for age, sex, educational level, truancy, mental health and perceived school performance.
[d] Reference is never.
[e] SDQ score, a higher score indicates more mental health problems (range 0–40).
[f] Reference is 'very good' perceived school performance.

CI = 1.93 – 6.90) perceived school performance was associated with an increased alcohol consumption on the weekends. At last, bivariate analyses showed that mental health status was significantly associated with alcohol consumption on the weekends (Model 1: OR = 1.04, 95% CI = 1.02 – 1.06). However, in the multivariate analyses this relationship did not remain significant.

DISCUSSION

The purpose of this study was to examine the association of truancy, perceived school performance, and mental health with week, weekend and binge drinking. The multivariate results showed that truancy and a poorer mental health were associated with more frequent binge drinking. Truancy and a poorer mental health were also associated with drinking (more) alcohol on week days. Furthermore, truancy and having an average or less than average perceived school performance were associated with drinking (more) alcohol on the weekend.

Interpretation of Results

In line with other studies among secondary school students,[2,32] this study showed that the prevalence of alcohol consumption in the past 4 weeks was high among adolescents (60.7%). Binge drinking was reported by 37.6% of the adolescents, which is comparable to prevalences found in other Dutch, European, and Northern American studies.[2,27,32] Besides binge drinking and weekend drinking, this study showed that a minority of adolescents also already consumed alcohol on week days (14.1%).

Regarding binge drinking, this study confirmed the results of earlier studies indicating an association between truancy and binge drinking.[12-16] Compared to adolescents who had not been truanting, adolescents who were truanting for one or more hours in the past 4 weeks, reported more frequent binge drinking over these past 4 weeks. Furthermore, adolescents with a poorer self-reported mental health reported more frequent binge drinking. In line with earlier studies among adolescents, perceived school performance was also associated with binge drinking more often.[15,17] However, no significant association was found between perceived school performance and binge drinking after correction for truancy and mental health status. This suggests that the association between school performance and binge drinking maybe (partly) explained by truancy and/or mental health status. Poor perceived school performance may lead to truancy and/or a poorer mental health status, which may influence adolescents binge drinking behavior.[15] However, future longitudinal research is required to gain more insight into these associations.

The particular interest of this study was focused on the associations of truancy, perceived school performance, and mental health with drinking on week- and weekend days, because most studies fail to make the distinction between week and weekend drinking. First, this study showed that truancy was associated with drinking (more) alcohol on week- and weekend days. These associations may be explained by the "peer cluster theory".[33] This theory was originally used to explain the relationship between drug use and truancy, but has been used to explain the relationship between truancy and alcohol use as well.[34,35] The theory assumes that substance use could increase as adolescents who truant form peer groups in which substance use is normalized.[33] The association of truancy with weekend drinking could indicate that the influence of the peer groups on alcohol consumption, as mentioned above, goes beyond the actual moment of truanting from school that takes place on week days. The influence of peer groups on alcohol consumption of adolescents is supported by previous studies which showed that adolescents with more frequent peer contact and belonging to a bigger peer group are at risk of drinking more alcohol.[21,36] In accordance with the motivational model, which states that people drink in order to attain certain valued outcomes, such as having fun, forgetting problems or being sociable, adolescents who are truanting may drink alcohol to achieve peer acceptance or avoid social rejection.[23,37] Another possible explanation of the association between truancy and different patterns of alcohol consumption is that risk behaviors including truancy and (binge) drinking may have a shared determinant,[27,38-40] such as personality trait (e.g. novelty seeking) or a specific family environment (e.g. living in a single-parent family) which increases the risk of all risk behaviors.

Second, this study showed that reporting an average or less than average perceived school performance was associated with drinking (more) alcohol on the weekend. Adolescents with poor perceived school performance may be drinking alcohol on the weekend as they want to 'forget' school and may be motivated to drink alcohol by internal rewards such as enhancement (i.e. drinking to have fun and to get high). Drinking on the weekend in order to have fun and "cut loose" might be a compensation for everyday (study) responsibilities, demands and duties and the switch off from everyday realities.[23,37] Earlier research has shown that adolescents who are motivated by such enhancement consume significantly more alcohol on both Friday and Saturday nights.[23]

Third, in this study an association between mental health and drinking on week days was found. Adolescents with a poorer mental health reported drinking (more) alcohol on week days. These adolescents may be motivated to drink alcohol in order to cope with their mental health problems. This is supported by the self-medication hypothesis that states that substances are consumed as a remedy to cope with mental health problems.[41] However, no association between mental health and drinking on weekends was found. A possible explanation for this discrepancy between the association between mental

health and drinking on week and weekend days, could be that most adolescents drink on weekend days, regardless of their mental health status, while week drinking is a less common behavior among adolescents, and potentially associated with problems and problem behaviors, such as mental health problems. In line with this hypothesis, earlier research on weekend drinking has shown that adolescents who are more motivated to drink alcohol by coping motives, for example, to forget problems because of mental health problems, do not drink more alcohol on weekends than their peers.[23] Thus far, no other research seems to have explore the association between mental health problems and week drinking. Therefore, more research is needed on week (and weekend) drinking among adolescents and the reasons why and the conditions under which adolescents drink alcohol on different times during the week. Furthermore, longitudinal studies are needed to examine the causal link between mental health, truancy and perceived school performance, and different patterns of alcohol consumption.

Limitations

The present study has some limitations that need to be addressed. This study only focused on adolescents of Dutch ethnicity, since ethnic differences in the association between alcohol consumption and perceived school performance, and mental health were found. Unfortunately, separate analyses for each non-Dutch ethnicity were not possible because of the small size of these subgroups. Therefore, generalization to other ethnicities and countries should be done with caution. Generalization of results to other countries should also be done with caution as the meaning of perceived school performance may have different connotations across student populations from different countries with different school systems.[28] Furthermore, as this was a cross-sectional study, this study is not able to determine causal relations. Moreover, the study relied on self-reported data, which may have resulted in under- or over-reporting of behaviors. Nevertheless, research has, for example, shown that adolescents are better reporters of their own drinking behavior than their families or friends, and that self-report on alcohol consumption is generally valid among adolescents.[42]

Conclusions

Findings of this study suggest that adolescents who are truanting and/or have a poor mental health status are at increased risk of binge and week drinking. Furthermore, adolescents' who are truanting and/or have an average or less than average perceived school performance are at increased risk of weekend drinking. Results of this study contribute to a better understanding of different pattern(s) of alcohol consumption and their associations with truancy, perceived school performance, and mental health status among adolescents.

IMPLICATIONS FOR SCHOOL HEALTH

This study showed that alcohol consumption is common among adolescents. Over the last 4 weeks, the majority of adolescents consumed alcohol on weekends, while a minority also used alcohol on week days. Given the vulnerability of adolescents and the consequences of alcohol consumption on adolescents' developing brain, early identification of adolescents at risk of alcohol consumption and further development of effective intervention programs is necessary. This study illustrates that alcohol consumption does not always occur in isolation; truancy, perceived school performance, and mental health problems were found to be associated with different patterns of alcohol consumption among adolescents. Therefore, school staff and health professionals need to be aware that if they are confronted with truancy, low perceived school performance, and/or mental health problems among adolescents, these adolescents may be at risk of different patterns of alcohol consumption as well. Likewise, if school staff and health professionals are confronted with alcohol consumption among adolescents, school staff and health professionals need to be aware of truancy, perceived school performance, and/or mental health problems among these adolescents. Furthermore, in the further development of effective intervention programs, professionals should be aware that problems do not always occur in isolation.

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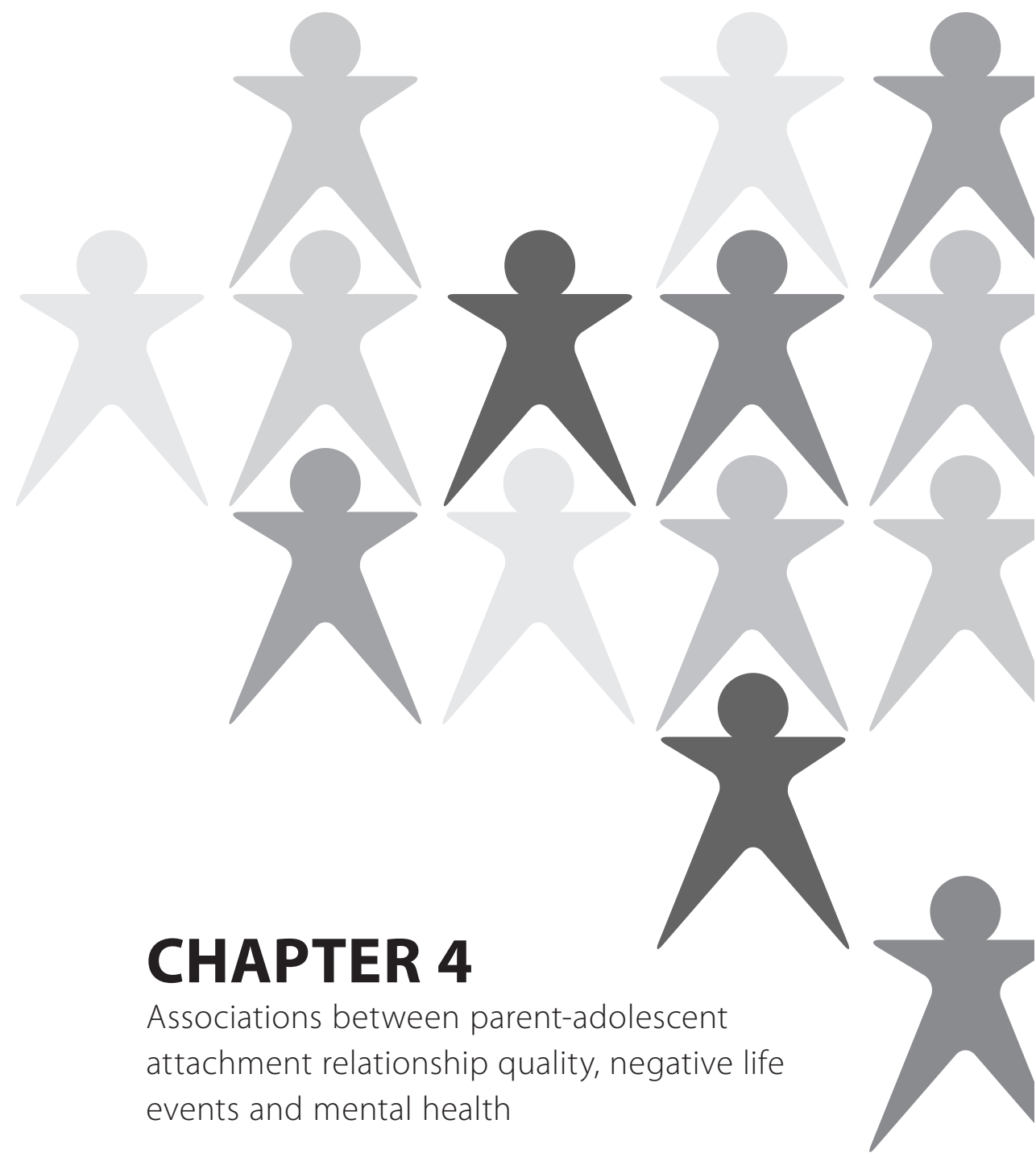

CHAPTER 4

Associations between parent-adolescent attachment relationship quality, negative life events and mental health

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ABSTRACT

Purpose

The aim of this study was to examine the association of negative life events and parent-adolescent attachment relationship quality with mental health problems and to explore an interaction between the parent-adolescent attachment relationship and one or multiple negative life events on the mental health of adolescents.

Methods

A two-year longitudinal study was conducted among first-year secondary school students (N = 3181). The occurrence of life events and the quality of parent-adolescent attachment were assessed at baseline and mental health status at two-year follow-up by means of self-report questionnaires. Binary logistic regression analyses were conducted to assess associations between life events, parent-adolescent attachment and mental health problems. Relative Excess Risk due to Interaction techniques were used to determine the interaction effects on the additive scale.

Results

Life events were related to mental health status, as was parent-adolescent attachment. The combined effect of an unfavorable parent-adolescent attachment with life events on mental health was larger than the sum of the two individual effects. Among adolescents with one life event or multiple life events, an unfavorable parent-adolescent attachment increased the risk of mental health problems at follow-up compared to the group without life events.

Conclusion

Results supported an interaction effect between parent-adolescent attachment and negative life events on mental health. Especially adolescents with one or multiple life events and an unfavorable parent-adolescent attachment seems to be a vulnerable group for mental health problems. Implications for further research are discussed.

INTRODUCTION

An estimated 15% of adolescents in the Netherlands have mental health problems.[1] Mental health problems often have their first manifestation during adolescence[2] and are associated with serious co-morbidity including underachievement in age-appropriate social skills, delinquency and an elevated risk of suicide.[3,4] Mental health problems in adolescence pose a risk for the development of psychiatric disorders in adulthood.[5-8] Understanding determinants of mental health problems, such as risk and protective factors, is important for the prevention of these problems.

One important risk factor for psychopathology that has been under investigation for many years is the impact of negative life events.[9,10] Results from several studies indicate an association in adolescents between negative life events and mental health problems. Examples of such life events that have been posited as risk factors for developing mental health problems in previous studies are physical illness of a parent,[11] parental psychiatric illness,[12,13] parental substance use,[14,15] family breakdown,[16] parental conflicts[17,18] and early parenthood.[19]

Longitudinal studies have also identified factors positively influencing the mental health of adolescents.[20-23] One of these factors is parent-adolescent attachment relationship quality. Previous research has shown that a favorable parent-adolescent attachment relationship may serve as a protective factor for mental health problems,[21,22,24,25] with the quality of adolescents' attachment with parents having an impact on their current mental health status, as well as on their prospect of developing mental health problems, such as major depression, later in life.[23]

Although there is a considerable amount of literature examining the simple association of life events and parent-adolescent attachment with mental health problems in isolation, most studies fail to examine the interaction between protective and risk factors such as parent-adolescent attachment and life events on mental health. Instead of concentrating on risks factors in isolation, increasing research attention is devoted to factors that promote health and their interaction with risk factors. This corresponds to research on resilience within the field of developmental psychology. Research on resilience focuses on adolescents who show positive developmental outcomes despite experiencing significant adversity.[26,27]

Social support, for example, is seen as one of these resilience factors and is theorized to protect adolescents from the impacts of stress. Support from parents is thought to operate by lessening the threat children experience when encountering stress, thereby leading to more adaptive coping efforts.[28] Finally, families who provide adequate support meet adolescent's needs for safety and security and may empower adolescents by bolstering their sense of self-esteem or control.[29]

The parent-adolescent attachment relationship is another potential resilience factor that warrants further research attention. It is essential to understand the role that parent-adolescent attachment plays in the relationship between life events and mental health, because while life events often cannot be avoided, parent-adolescent attachment is amendable.[30] If a favorable parent-adolescent attachment could buffer the association between life events and mental health problems, this could help to distinguish vulnerable adolescents from those with good adaptation under extenuating circumstances, and could have implications for preventing and treating mental health problems in adolescents.

One initial study has examined the buffering role of multiple protective factors, including parental support, on mental health among adolescents with or without life events.[31] Wille et al.[31] compared the percentages of mental health problems in adolescents with different numbers of life events while taking into account the availability of protective factors. Protective factors were found to significantly buffer the association between adolescents exposed to one or two life events and mental health. Adolescents without a life event did not benefit from the availability of protective factors. The current study capitalizes on a large study and differs from Wille et al. by specifically quantifying the additional effect that the interaction between parent-child attachment and life events may have on mental health. In line with previous findings, we hypothesize that a favorable parent-adolescent attachment (i.e. the protective factor) will buffer the association between life events and mental health. The goals of this study were 1) to examine the association of negative life events and parent-adolescent attachment relationship quality with mental health problems and 2) to investigate if there is an interaction between the parent-adolescent attachment relationship and one or multiple negative life events on the mental health of adolescents.

METHODS

Design and participants

A prospective study with a two-year follow-up was conducted as part of the Rotterdam Youth Monitor (RYM), a longitudinal youth health surveillance system. The RYM monitors the general health, well-being, behavior and related factors of youth aged 0 to 19 years living in Rotterdam and the surrounding region in the Netherlands. The RYM is incorporated into the preventive care (regular health examinations) of the preventive youth healthcare system; the RYM is used to detect potential individual health risks and problems in order to take necessary preventive measures (including referrals for treatment).

The current study used RYM data from students at secondary schools. At baseline, the students were in the first year of secondary education (M_{age} = 12.5 years, SD = 0.62), and at follow-up (Year 2) in the third year (M_{age} = 14.3 years, SD = 0.58). Data were collected throughout the school year, except in the months of July and August (Dutch summer holidays). The students completed a baseline questionnaire between September 2008 and July 2009 and a follow-up questionnaire between September 2010 and July 2011. Administration of the questionnaire at schools was conducted by specially trained researchers and school nurses from the Municipal Public Health Service and/or by a teacher. In 2008–2009, 8272 adolescents participated (95% participation rate), of whom 3181 participated again in 2010–2011 (38%). The main reason for non-response at baseline was students' illness at the time of administering the questionnaire. The main reason for non-response at follow-up was that schools were not willing to participate at follow-up. Other reasons were: students had transferred to a school that did not participate at follow-up, students had repeated a school year or students were absent at the time of administering the follow-up questionnaire.

Ethics statement

All data were gathered within and as part of the government approved routine health examinations of preventive youth health care; the RYM was completed on a voluntary basis; anonymous data were used in this study; separate informed consent was therefore not requested. Adolescents received verbal information on the RYM, each time it was applied; their parents received written information on the RYM, each time it was applied; both adolescents and their parents were free to object to participation.

Measures

Mental health problems

Mental health was assessed at follow-up by the Dutch self-report version of the Strengths and Difficulties Questionnaire (SDQ).[32-36] The SDQ consists of 25 items for describing positive and negative attributes of adolescents that can be allocated to five subscales of five items each. The subscales are: emotional problems, conduct problems, hyperactivity-inattention, peer problems, and prosocial behavior. Each item has to be scored on a three-point scale, with 0 = *not true*, 1 = *somewhat true*, and 2 = *certainly true*. A total difficulties score can be calculated by adding up the scores on the emotional problems, conduct problems, hyperactivity-inattention and peer problems subscales (range 0–40; current study α = 0.74).

Two groups were created based on the total SDQ score: normal (cut-off point SDQ at follow-up ≤ 80th percentile; score ≤ 13) and borderline/abnormal mental health problems (cut-off point SDQ at follow-up > 80th percentile; score ≥ 14).[37] Cut-off points were based on a previous large cross-national survey among 14–15 year old adolescents.[1]

Life events

Adolescents were asked about 11 negative life events, which were measured using three different types of response categories. Each life event was assessed at baseline with one item. For six of the life events (i.e. chronic or severe illness of parent, chronic or severe illness of sibling, mental illness of parent, mental illness of sibling, addiction to alcohol, drugs and/or gambling of parent, addiction to alcohol, drugs and/or gambling of sibling), the possible responses were: *not true*, *not currently true* and *true*. For analysis, these items were dichotomized into: not (currently) true, and true. For two life events (i.e. regular conflicts between parents, parental divorce), possible responses were: *not experienced*, *experienced > 2 years ago* and *experienced ≤ 2 years ago*. For analysis, regular conflicts between parents was dichotomized into: not experienced or > 2 years ago, and experienced ≤ 2 years ago. Parental divorce, as well as three other life events (i.e. unwanted pregnancy, victim of sexual abuse and victim of violence), were categorized as: no and yes.

A total life event score was calculated by adding up the dichotomized item scores. Subsequently, three groups were created based on the total life event scores: no life event, one life event or multiple life events.

Parent-adolescent attachment relationship

Parent-adolescent attachment relationship quality was measured at baseline using the 'Family attachment scale' of The Communities That Care Youth Survey.[38,39] This scale consists of six items: three items about the adolescent's relationship with the mother and three items about the relationship with the father. The items were scored on the four-point scale using: *NO!*, *no*, *yes*, *YES!*. A total score could be calculated by taking the average of the six items (range 0–3; current study $\alpha = 0.82$). This scale was dichotomized based on the sample distribution in this study: unfavorable parent-adolescent attachment (cut-off point < 20th percentile; score < 2.00) and favorable parent-adolescent attachment (cut-off point ≥ 20th percentile; score ≥ 2.00).

Confounders

Age, gender, ethnicity, and education level of the adolescent were measured at baseline and are incorporated in this study as potential confounders. For analysis purposes, confounders were dichotomized. Age was dichotomized into the categories below 13 years and 13 years or older. Education was categorized into two groups: basic or theoretical pre-vocational education, and general secondary/pre-university education.[40] Ethnicity was classified as Dutch or non-Dutch. In accordance with the definitions of Statistics Netherlands,[41] adolescents with at least one parent born outside the Netherlands were classified as non-Dutch.

Statistical analysis

Descriptive statistics were calculated for general characteristics of the study population (Table 1). Differences in gender, age, ethnicity, education, life events and parent-adolescent attachment among adolescents with and without mental health problems were evaluated by chi-square test (Table 1).

Binary logistic regression analyses were conducted to assess the association between life events, parent-adolescent attachment and mental health status at follow-up (Table 2).

Odds ratios (OR) and their corresponding 95% confidence intervals (95% CI) were calculated. First, bivariate analyses were used to assess the association between life events and mental health status at follow-up and to assess the association between parent-adolescent attachment and mental health status at follow-up, adjusting for confounders (i.e. age, gender ethnicity and education). Second, a multivariate analysis using an enter method was performed incorporating all life events, parent-adolescent attachment and all confounders. Life events were checked for multicollinearity (all Phi correlation coefficients ≤ 0.17). Because multicollinearity was not present among the life events, all life events were entered in the same model.

To study if and to what extent parent-adolescent attachment modified the effect of one life event or multiple life events on mental health status, interaction effects were analyzed on the additive scale (Table 3). Interaction on an additive scale means that the combined effect of two risk factors is different from (larger or smaller than) the *sum* of the individual effects of the factors.[42] Because we included a protective factor in our study, i.e. parent-adolescent attachment, this factor was recoded to a risk factor before calculating the interaction effect.[42] As a measure of interaction on the additive scale we present the Relative Excess Risk due to Interaction (RERI) and their 95% confidence intervals, using the delta method in Excel.[43,44] RERI considers absolute risk and is positive (> 0) when the joint effect of risk factors is greater than the product of the effects of the individual factors. RERIs were calculated with mental health status as outcome measure at follow-up. RERIs are calculated using the following formula[42]:

$$RERI = OR_{A+B+} - OR_{A+B-} - OR_{A-B+} + 1$$

RERI = 0 means no interaction or exact additivity; RERI > 0 means positive interaction or more than additivity; RERI < 0 means negative interaction or less than additivity; RERI can range from – infinity to + infinity.

As part of this analysis we also calculated the proportion attributable to interaction (proportion of the combined effect that is due to interaction) using the following formula[42]:

$$AP = RERI/OR_{A+B+}$$

AP = 0 means no interaction or exact additivity; AP > 0 means positive interaction or more than additivity; AP < 0 means negative interaction or less than additivity; AP can range from -1 to +1.

Analyses were conducted using SPPS version 20 and Excel. Results were considered significant at $p < .05$.

Non-response analysis

A comparison of adolescents included in this study (N = 3181) with adolescents who were excluded due to non-participation at follow-up (N = 5091) did not indicate significant differences in terms of gender ($\chi^2 = 0.70$; $p = .40$) and parent-adolescent attachment ($\chi^2 = 1.20$; $p = .27$). However, differences were found with regards to education, age, ethnicity and life events, with the excluded group being lower educated ($\chi^2 = 151.53$; $p < .001$), older ($\chi^2 = 5.94$; $p < .05$), more often of Dutch ethnicity ($\chi^2 = 47.68$; $p < .001$), and with more life events ($\chi^2 = 55.22$; $p < .001$) than the adolescents who were included.

RESULTS

Descriptive information

As can be seen in Table 1, the average age of adolescents in the current sample was 12.5 years (SD = 0.62); 51.0% of the sample consisted of boys and 48.4% was of Dutch ethnicity. Regular conflicts between parents during the past two years was the most frequently reported life event that adolescents had experienced (26.9%). At baseline, 32.0% of the adolescents reported one life event and 15.7% reported multiple life events. Girls and lower educated adolescents had significantly more mental health problems at follow-up than boys ($\chi^2 = 10.04$; $p = .002$) and higher educated adolescents ($\chi^2 = 25.03$; $p < .001$).

Life events and mental health status

Table 1 shows the distribution of specific life events and the number of life events for the total sample, and for adolescents with normal and borderline/abnormal mental health at follow-up. The three groups with different numbers of life events differed significantly from each other ($\chi^2 = 118.82$; $p < .001$), with the no life event group displaying the least mental health problems (10.4%) and the multiple life events group showing the highest rate of mental health problems (30.3%).

The presence of each specific life event, with the exception of Chronic or severe illness of sibling and Addiction of sibling, was related to a significantly increased risk of mental health problems in bivariate analyses (Table 2). After adjusting for other life events and parent-adolescent attachment, all ORs decreased and only Addiction of a parent,

Table 1. General characteristics for the total study population at baseline and by mental health at follow-up (N = 3181)

	Total	Mental health at follow-up		
		Normal	Borderline/ Abnormal	
	(N = 3181)	(n = 2705)	(n = 476)	*p* value (χ^2)
Gender				
Boys	51.0	52.2	44.3	.002
Age (mean = 12.5, SD = 0.62)				
< 13 years	56.2	56.3	55.4	.692
Ethnicity				
Dutch	48.4	49.0	44.6	.076
Level of education				
Basic or theoretical pre-vocational education	50.1	48.3	60.7	<.001
Life events				
Chronic or severe illness of parent	7.5	6.9	10.8	.003
Chronic or severe illness of sibling	3.6	3.4	4.9	.118
Mental illness of parent	2.4	1.7	5.9	<.001
Mental illness of sibling	1.5	1.2	3.6	<.001
Addiction to alcohol, drugs and/or gambling of parent	2.9	2.1	7.6	<.001
Addiction to alcohol, drugs and/or gambling of sibling	1.6	1.4	2.5	.082
Conflicts between parents	26.9	25.0	37.6	<.001
Parental divorce	17.4	16.1	25.1	<.001
Unwanted pregnancy	0.4	0.3	1.3	.003
Victim of sexual abuse	1.3	0.9	3.2	<.001
Victim of violence	4.9	3.6	12.0	<.001
Number of life events				<.001[a]
No life event	52.3	55.0	36.6	
One life event	32.0	32.2	31.2	
Multiple life events	15.7	12.9	32.1	
Parent-adolescent attachment				
Unfavourable	12.2	10.2	23.5	<.001

[a] The three groups with different number of life events differed significantly from each other, with the no life event group displaying the least mental health problems (10.4%) and the multiple life events group showing the highest rate of mental health problems (30.3%).

Mental illness of a parent, Conflicts between parents and Victim of violence were still significantly associated with mental health problems.

Parent-adolescent attachment relationship and mental health status

An unfavorable parent-adolescent attachment at baseline was related to an increased risk of mental health problems at follow-up (see Table 2). After adjusting for the life events, the OR remained significant (OR = 2.03, 95% CI = 1.55 – 2.65).

Table 2. Bivariate and multivariate associations of life events and parent-adolescent attachment with mental health problems (N = 3181)

	Bivariate[a]		Multivariate[a]	
	OR	95% CI	OR	95% CI
Life events				
Chronic or severe illness of parent	**1.57**	**1.13 – 2.19****	1.34	0.94 – 1.90
Chronic or severe illness of sibling	1.43	0.89 – 2.29	1.23	0.75 – 2.04
Mental illness of parent	**3.37**	**2.08 – 5.47*****	**1.86**	**1.08 – 3.21***
Mental illness of sibling	**2.97**	**1.63 – 5.44*****	1.91	0.98 – 3.73
Addiction of parent	**3.64**	**2.36 – 5.63*****	**2.34**	**1.45 – 3.79****
Addiction of sibling	1.58	0.82 – 3.06	0.82	0.39 – 1.71
Conflicts between parents	**1.85**	**1.50 – 2.27*****	**1.51**	**1.21 – 1.88*****
Parental divorce	**1.64**	**1.30 – 2.08*****	1.25	0.97 – 1.62
Unwanted pregnancy	**4.22**	**1.44 – 12.33****	2.17	0.63 – 7.45
Victim of sexual abuse	**3.02**	**1.56 – 5.83****	1.11	0.50 – 2.50
Victim of violence	**3.66**	**2.59 – 5.19*****	**2.51**	**1.69 – 3.70*****
Unfavourable parent- adolescent attachment	**2.65**	**2.07 – 3.40*****	**2.03**	**1.55 – 2.65*****
Nagelkerke R^2			0.10	

[a] Bivariate and multivariate analyses included confounders: age, sex, ethnicity, and education level.
* $p < .05$ ** $p < .01$ *** $p < .001$.
Note: Bold numbers indicate significant *P*-values.

Interaction effect of parent-adolescent attachment relationship and life events on mental health

As shown in Table 3, parent-adolescent attachment interacts with life events on mental health outcome. The combined effect of an unfavorable parent-adolescent attachment and life events on mental health was larger than the sum of the two individual effects. An unfavorable parent-adolescent attachment was associated with a higher risk of mental health problems among adolescents with one life event (RERI = 1.56, 95% CI = 0.15 – 2.96) and multiple life events (RERI = 3.32, 95% CI = 0.80 – 5.84) compared to those without a life event. Figure 1 displays the parent-adolescent attachment – multiple life events interaction effect on mental health outcome. The proportion of the combined effect that is due to interaction (AP) was 0.51 in the group with an unfavorable parent-adolescent attachment and one life event, and 0.51 in the group with an unfavorable parent-adolescent attachment and multiple life events. This indicates that 51% of the combined effect can be attributed to the interaction between parent-adolescent attachment and life events. Interaction analyses were repeated for the subgroups of age, gender, ethnicity and education; these analyses yielded similar results (data not shown, results available upon request).

Table 3. Interaction effect of parent-adolescent attachment and life events on mental health (N = 3181)

Life events		Parent-adolescent attachment	Total	Mental health				
				Borderline/ Abnormal				
			n	n	OR	95% CI	RERI	95%CI
One life event	Not present[a]	Favourable	1532	157	1.00		1.56	0.15 – 2.96
	Not present[a]	Unfavourable	101	13	1.29	0.70 – 2.36		
	Present	Favourable	850	105	1.23	0.95 – 1.60		
	Present	Unfavourable	143	38	3.07	2.04 – 4.63		
Multiple life events	Not present[a]	Favourable	1532	157	1.00		3.32	0.80 – 5.84
	Not present[a]	Unfavourable	101	13	1.29	0.70 – 2.37		
	Present	Favourable	360	92	2.86	2.14 – 3.84		
	Present	Unfavourable	131	57	6.47	4.39 – 9.55		

Analyses included confounders: age, sex, ethnicity, and education level.
[a] The reference group is no life event.

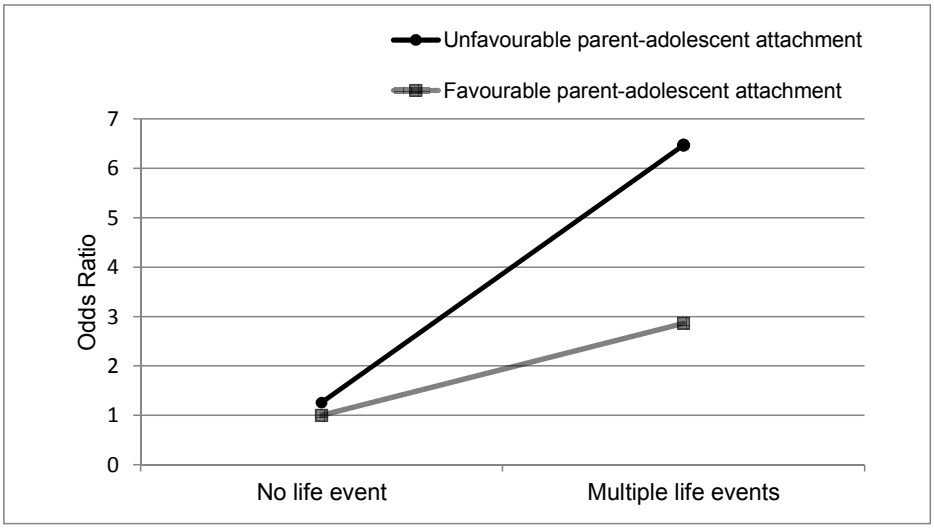

Figure 1. Interaction effect of parent-adolescent attachment and multiple life events on mental health

DISCUSSION

This study shows that negative life events and parent-adolescent attachment relationship quality were associated with mental health problems in adolescents. More importantly, an interaction between the parent-adolescent attachment relationship and one and multiple life events on adolescents' mental health was found.

This study confirms the results of earlier studies indicating a clear relationship between life events and mental health problems among adolescents.[11-19] A particularly high impact on mental health was observed among victims of violence. Consistent with other studies, some life events were found to no longer be significantly linked to mental health after controlling for the other life events,[31] thus reflecting that some life events often co-occur. Higher rates of mental health problems were shown when multiple life events occurred together. This is also in line with previous studies, suggesting a higher probability of mental health problems when several life events accumulate.[31,45] Furthermore, the results fit with indications by other studies that a favorable parent-adolescent attachment may be a protective factor for mental health problems in adolescents.[20-25]

We were particularly interested in the interaction effects of parent-adolescent attachment and life events on mental health because most studies fail to examine this effect. An interaction effect of parent-adolescent attachment and life events on mental health was observed in this study. The combined effect of an unfavorable parent-adolescent attachment and life events on mental health was larger than the sum of the two individual effects, with more than half of the combined effect being due to the interaction. Thus, it seems important to not only look at direct associations, but also to assess the presence of an interaction between these factors in future research. In line with our hypothesis, these results seems to suggest that a favorable parent-adolescent attachment may serve as a buffer on the association between one or multiple life events and the mental health of adolescents. A potential explanation of the interaction found in this study could be that a favorable parent-adolescent attachment enhances adolescent's coping abilities. Coping theory suggests that when individuals encounter potentially stressful situations one of the things they do is to evaluate their resources (e.g. parent-adolescent relationship) to handle the situation.[46] In this appraisal process, if individuals decide their internal or external resources are adequate to handle the situation, then they are not likely to feel threatened and thereby leading to more adaptive coping efforts. So, when adolescents are experiencing life events they possible could better cope with these life events if they have a favorable parent-adolescents attachment instead of an unfavorable parent-adolescent attachment.

Among adolescents who reported no life events, there was no association between the quality of the parent-adolescent attachment and their mental health status. This is in line with the findings from Wille et al.[31] An explanation could be that individuals only benefit from protective factors, such as a favorable parent-adolescent attachment, in the presence of a risk factor.[26]

There are strengths and limitations to this study that have to be mentioned. One strength of this study is that it was embedded in a longitudinal study. Also, the data set provided a unique opportunity to explore relations between particular variables of

interest within a large sample. An innovative aspect of this study is that it looked not only at direct associations among the variables of interest but also at interaction effects.

However, this study also has some limitations. First, adolescents were excluded due to non-participation at follow-up. In a non-response analysis we showed that the excluded group was lower educated, older and more often of Dutch ethnicity. Although we included these variables as confounders in our analyses, the current findings should be generalized with caution, and we propose replication in large and varied populations. Second, as with any self-report survey, adolescents' self-report could be biased. Although it would have been preferably to use multiple informants, research suggests that adolescents are better reporters of their own mental health status than parents and teacher. For example, adolescents' self-reported mental health status corresponded better with independent psychiatric assessment than parent or teacher.[47] Nevertheless, results of this study have to be interpreted with caution and we recommend future studies to use multiple informants. Third, a total life event score was calculated, which makes it not possible to distinguish, for example, the interaction between parent-adolescent attachment and life events that are (at least partly) related to the adolescents' own behavior (behavior-dependent events), such as conflicts with parents or peers, and those that are independent of their behavior (behavior-independent), such as natural disasters. Therefore we cannot distinguish if a favorable parent-adolescent attachment may be particularly beneficial for adolescents exposed to particular life events, and/or not beneficial for adolescents exposed to other life events.

Furthermore, as our main aim was to predict the *occurrence* of mental health problems at follow-up. Therefore, we choose not to adjust for baseline mental health in the analyses because this would have only allow us to draw conclusions about the influences of an unfavorable parent-adolescent attachment and life events on *changes* in mental health between follow-up and baseline. In that case, we would not have taken into account the impact that an unfavorable parent-adolescent attachment and life events already had on the mental health of adolescents at baseline. The unfavorable parent-adolescent attachment and life events could have been present earlier than at baseline. So, due to the nature of our research question (i.e. about the occurrence of mental health), and not changes in mental health (i.e. incidence), we did not adjust for baseline mental health in this study. Thereby, we studied whether there is a long term relationship and interaction effect between parent-adolescent attachment, life events and mental health. However, it must be noted that causality cannot be inferred from these analyses, because it is unknown for example whether mental health problems were already present when life events occurred or whether life events, parent-adolescent attachment and mental health problems have mutually influenced each other.

To disentangle the questions posed above, future research with a prospective design that enables researchers to examine the temporal ordering of the variables is needed.

However, this is difficult, because life events and mental health issues are often already present at very young age. Long-term longitudinal cohort studies that follow children from fetal life onwards are therefore desirable. Furthermore, better understanding of why the parent-adolescent attachment could serve as a buffer on the relation between life events and mental health problems is necessary. As we mentioned before, it is possible, for example, that a favorable parent-adolescent attachment enhance adolescent's coping abilities, which mediates the relation between life events and mental health problems. Therefore, future studies should integrate moderator and mediator research by testing for specific mediators (e.g. threat or coping abilities) in relation to parent-adolescent attachment as a moderator, so that we can further test our hypotheses and better understand the complex way in which life events affect the mental health of adolescents. Further, experimental studies in which the parental-adolescent attachment will be enhanced by an intervention can give more information about the causal influence the parent-adolescent attachment relationship may have on mental health problems.

In conclusion, results from the current study support earlier studies indicating an association of negative life events and parent-adolescent attachment with mental health problems. Results also support an interaction effect between parent-adolescent attachment and negative life events on mental health. This seems to support the hypothesis that a favorable parent-adolescent attachment relationship may serve as a buffer for adolescents with one or multiple life events. However, conclusions about causality cannot be drawn from this study and examining the effects of life events and an unfavorable parent-adolescent attachment on adolescents' mental health simplifies the complex processes in the development of mental health problems in which a large number of factors play a role. Nonetheless, it enables the identification of adolescents with a high probability of displaying disturbed development. Adolescents with one or multiple life events and an unfavorable parent-adolescent attachment seems to be a vulnerable group for mental health problems. Future research needs to continue to probe the reasons why some adolescents with life events are functioning better than others. This knowledge would be helpful in designing effective prevention and intervention programs for adolescents exposed to life events.

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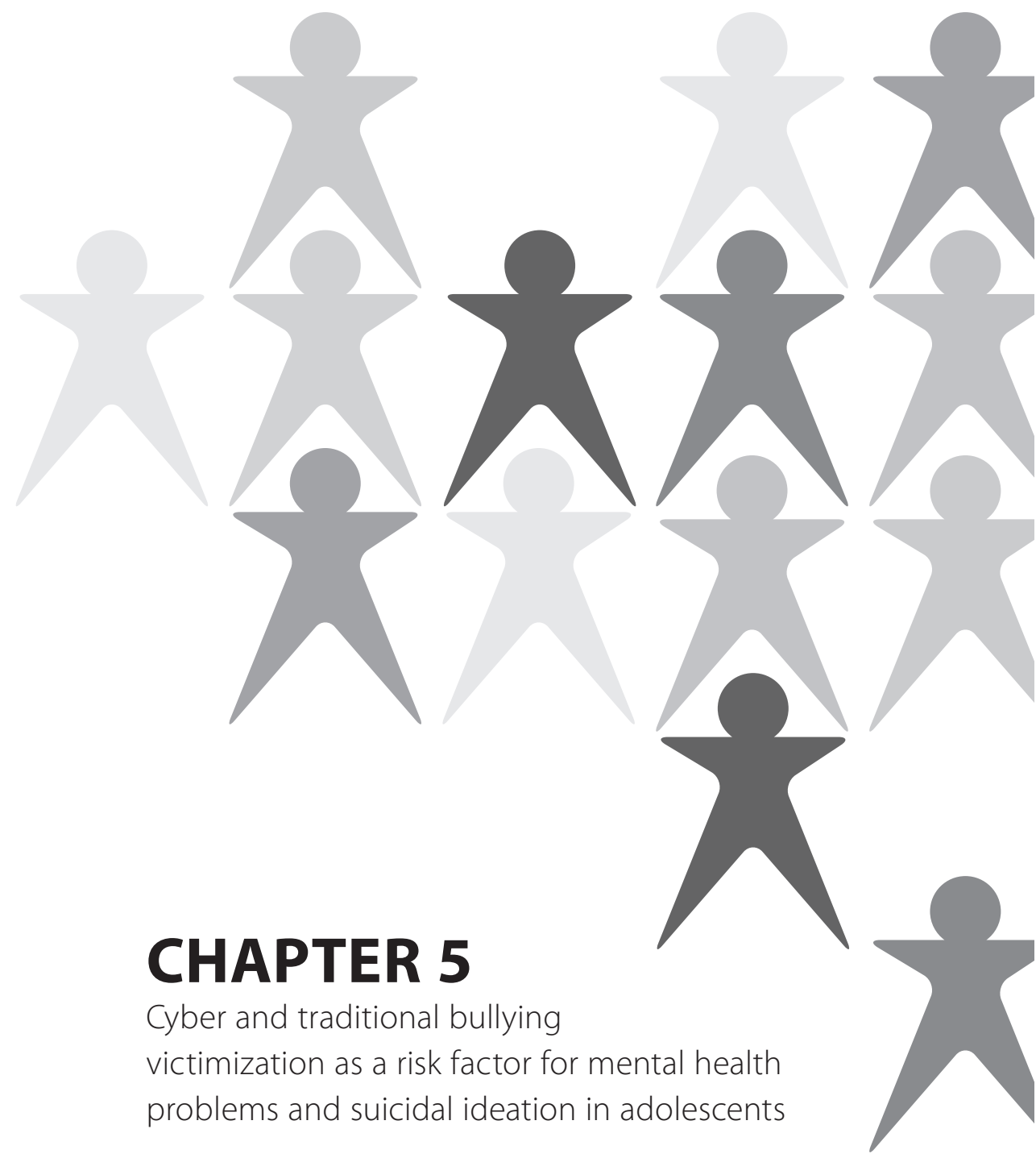

CHAPTER 5

Cyber and traditional bullying victimization as a risk factor for mental health problems and suicidal ideation in adolescents

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ABSTRACT

Purpose

To examine whether traditional and cyber bullying victimization were associated with adolescent's mental health problems and suicidal ideation at two-year follow-up. Gender differences were explored to determine whether bullying affects boys and girls differently.

Methods

A two-year longitudinal study was conducted among first-year secondary school students (N = 3181). Traditional and cyber bullying victimization were assessed at baseline, whereas mental health status and suicidal ideation were assessed at baseline and follow-up by means of self-report questionnaires. Logistic regression analyses were conducted to assess associations between these variables while controlling for baseline problems. Additionally, we tested whether gender differences in mental health and suicidal ideation were present for the two types of bullying.

Results

There was a significant interaction between gender and traditional bullying victimization and between gender and cyber bullying victimization on mental health problems. Among boys, traditional and cyber bullying victimization were not related to mental health problems after controlling for baseline mental health. Among girls, both traditional and cyber bullying victimization were associated with mental health problems after controlling for baseline mental health. No significant interaction between gender and traditional or cyber bullying victimization on suicidal ideation was found. Traditional bullying victimization was associated with suicidal ideation, whereas cyber bullying victimization was not associated with suicidal ideation after controlling for baseline suicidal ideation.

Conclusions

Traditional bullying victimization is associated with an increased risk of suicidal ideation, whereas traditional, as well as cyber bullying victimization is associated with an increased risk of mental health problems among girls. These findings stress the importance of programs aimed at reducing bullying behavior, especially because early-onset mental health problems may pose a risk for the development of psychiatric disorders in adulthood.

INTRODUCTION

Recent studies indicate that approximately 20–35% of adolescents report involvement in traditional, offline bullying either as a bully, a victim or both.[1] Bullying can be defined as an aggressive act that is carried out by a group or an individual repeatedly and over time against a victim who cannot easily defend himself or herself.[2] Traditionally, four main types of bullying are distinguished: physical (e.g. assault), verbal (e.g. threats), relational (e.g. social exclusion) and indirect (e.g. spreading rumors).[3] With the increased use of Internet and mobile phones, a new form of bullying has emerged, often labeled 'cyber bullying'.[3-5] In cyber bullying, aggression occurs via electronic forms of contact.[6]

Increased exposure to the online environment has contributed to a heightened appreciation of the potential negative impact of cyber bullying.[7] Recent cross-sectional studies have shown an association between cyber bullying victimization and mental health problems, and even between cyber bullying victimization and suicide.[4,6,8,9] Despite evidence from these cross-sectional studies, little is known with regard to the longitudinal impact of cyber bullying. To the best of our knowledge, only Schultze-Krumbholz et al. studied the longitudinal association between cyber bullying victimization and mental health problems in a relatively small sample (N = 233). They only showed a significant association between cyber bullying victimization and mental health problems in girls, not in boys.[10]

The few available longitudinal studies examining the relationship between *traditional* bullying and mental health problems or suicide (ideation) show that being a victim of traditional bullying increases the risk of developing mental health problems and committing suicide later in life.[6,11-16] However, longitudinal studies examining the associations between traditional bullying victimization and mental health problems or suicide (ideation) within large samples are still rare and further research is recommended.[6]

Therefore, it is of interest to examine the longitudinal associations between traditional bullying and mental health and suicide (ideation), as well as the longitudinal associations between cyber bullying and mental health and suicide (ideation) in a large sample. The impact of traditional bullying victimization on mental health and suicide may be different than the impact of cyber bullying victimization on mental health. It is possible that for example blocking online bullying messages, an option not available for face-to-face bullying, lessens the impact of cyber bullying on mental health while, in contrast, the possible breadth of audience on for instance websites may heighten the impact.[3]

Furthermore, the impact of bullying victimization on boys may differ from the impact on girls. Few longitudinal studies have examined gender differences in victimization and mental health. These longitudinal studies indicate that both genders may have differ-

ent risk profiles,[6,17-21] with girls who are victimized at baseline developing symptoms of depression or suicidal ideation at follow-up[10,17,20,21] and boys not.[10,18-23]

The purpose of the current study was to examine whether traditional and cyber bullying victimization were associated with mental health problems and suicidal ideation at two-year follow-up (when controlling for mental health problems or suicidal ideation at baseline) in a large sample of adolescents. In line with previous findings,[6,17-23] we hypothesize that being a victim of *traditional* bullying is associated with mental health problems and suicidal ideation at two-year follow-up. In line with cross-sectional studies on cyber bullying victimization,[4,6,8,9] we hypothesize that *cyber* bullying victimization is associated with mental health problems and suicidal ideation at two year follow-up. Additionally, we explored whether bullying affects boys and girls in a different way, as previously suggested.[6,17-21]

METHODS

Design and participants

A prospective study with two-year follow-up was conducted as part of the Rotterdam Youth Monitor (RYM), a longitudinal youth health surveillance system. The RYM monitors the general health, well-being, behavior and related factors of youth aged 0 to 19 years living in Rotterdam and the surrounding region in the Netherlands. The RYM is incorporated in the care (regular health examinations) of the preventive youth healthcare system; the RYM is used to detect (potential) individual health risks and problems in order to take the necessary preventive measures (including referrals for treatment).

The current study used RYM data from students at secondary schools. At baseline, the students were in their first year of secondary education (M_{age} = 12.50 years, SD = 0.62), and at follow-up in their third year (M_{age} = 14.31 years, SD = 0.58). Data were collected throughout the school year, except for July and August (Dutch summer holidays). The students completed a baseline questionnaire between September 2008 and July 2009 and a follow-up questionnaire between September 2010 and July 2011. Administration of the questionnaire took place at schools and was conducted by specially trained researchers and school nurses from the Municipal Public Health Service and/or by a teacher. In 2008–2009, 8272 adolescents participated (95% participation rate), of whom 3181 participated again in 2010–2011 (38%). The main reason for non-response (62%) at follow-up was schools being unwilling to participate again, which led to 49% of adolescents not being invited to participate at follow-up. Other reasons were: students were absent at the time of administering the follow-up questionnaire (about 5%), students had transferred to a school that did not participate at follow-up or students had repeated a school year (about 8%).

Ethics statement

The data became available in the context of the government approved routine health examinations of the preventive youth health care. Separate informed consent was therefore not requested. Only anonymous data were used and the questionnaires were completed on a voluntary basis. Adolescents received verbal information about these questionnaires each time they were applied, whereas their parents received written information at every assessment point. Adolescents and their parents were free to refuse participation. Observational research with data does not fall within the ambit of the Dutch Act on research involving human subjects and does not require the approval of an ethics review board. As the data was provided anonymously to the researchers, the study is not covered by the WMA Declaration of Helsinki.

Measures

Bullying victimization

At baseline, two questions assessed whether the adolescent had been bullied in the past four week: 1) at school, and/or 2) via the Internet or via their telephone via Short Message Service (SMS). The response categories were: *never, once or twice, once a week, several times a week*, and *daily*. For analysis purposes, being a victim of bullying at school (traditional victim), and being a victim on the Internet or via SMS (cyber victim) were dichotomized into the following categories: Never being victimized and Being victimized at least once or twice.

Mental health problems

At baseline and follow-up, mental health was assessed by the Dutch self-report version of the Strengths and Difficulties Questionnaire (SDQ).[24,25] The SDQ consists of 25 items describing positive and negative attributes of adolescents that can be divided into five subscales (five items each), i.e. emotional problems, conduct problems, hyperactivity-inattention, peer problems, and prosocial behavior. Each item is scored on a 3-point scale, with 0 = *not true*, 1 = *somewhat true*, and 2 = *certainly true*. A total difficulties score is calculated by summing the scores on the emotional problems, conduct problems, hyperactivity-inattention and peer problems subscales (range 0–40; current study α = 0.74).

In line with other authors who divided their sample into subgroups (normal versus borderline/abnormal) based on questionnaire scores,[13,17,19-23] we created two 'mental health' groups: normal (cut-off point SDQ total score at follow-up ≤ 80th percentile; score ≤ 13) and borderline/abnormal mental health problems (cut-off point SDQ total score at follow-up > 80th percentile; score ≥ 14).[26] These cut-off points were based on a large national survey in the Netherlands among 14–15 year-old adolescents.[27]

Suicidal ideation

Suicidal ideation during the past 12 months was examined with one question at baseline and follow-up: 'In the past 12 months, have you ever seriously considered ending your life?'. This item was scored on a 5-point scale: *never, once in a while, sometimes, often* and *very often*. For analysis purposes, suicidal ideation was dichotomized in: Never had suicidal ideation over the last year; versus Had suicidal ideation at least once in a while over the last year.

Confounders

Age, gender, ethnicity, and level of education of the adolescent were measured at baseline and were incorporated as potential confounders in this study. Age was dichotomized into Below 13 years versus 13 years or older. Education was dichotomized into Basic or theoretical pre-vocational education versus, General secondary/pre-university education.[28] Ethnicity was classified as Dutch or non-Dutch in accordance with the definition of Statistics Netherlands[29]; i.e. adolescents with at least one parent born outside the Netherlands were classified as non-Dutch.

Statistical analyses

All analyses were conducted using the total sample. Descriptive statistics were used to describe general characteristics of the study population. Differences in age, ethnicity, educational level, bullying victimization, mental health problems, and suicidal ideation between boys and girls were evaluated using chi-square tests. A chi-square test was also conducted to assess the association between traditional and cyber bullying victimization.

Furthermore, binary logistic regression analyses were used to assess the association between bullying victimization and mental health status or suicidal ideation at follow-up. Model 1 tested the association between traditional or cyber bullying victimization and mental health status or suicidal ideation at follow-up, adjusting for confounders (i.e. gender, age, ethnicity, and education) and the other type of bullying victimization. Model 2 also adjusted for baseline mental health status or suicidal ideation. Model 2 corresponds with the purpose of the study to examine the two-year longitudinal association between bullying victimization and mental health status or suicidal ideation, while controlling for mental health problems or suicidal ideation at baseline. In addition, we tested whether there were gender differences on mental health and suicidal ideation for the two types of bullying by respectively adding a Gender × Traditional bullying victimization (Model 3a) or a Gender × Cyber bullying victimization (Model 3b) interaction term to Model 2. If there was a significant Gender × Bullying victimization interaction, the results were described separately for boys and girls. Finally, we explored whether there were significant interactions between traditional and cyber bullying victimization

on mental health and suicidal ideation. Odds ratios (OR) and their corresponding 95% confidence intervals (95% CI) were calculated.

Analyses were conducted using SPSS version 20. Results were considered significant at $p < .05$, with the exception of interactions which were considered significant at $p < .10$, in line with recommendations of Twisk.[30]

RESULTS

Non-response analysis

Differences between the boys/girls included in this study (N = 3181) and the boys/girls who did not participate in the follow-up assessment (N = 5091) were examined using chi-square tests (Table 1). Chi-square tests did not yield significant age differences between adolescents who participated at follow-up and who were lost-to-follow-up. However, group differences were found for education, ethnicity, mental health problems, suicidal ideation, and bullying victimization, with the lost–to-follow-up group having a lower education level, more often being of Dutch ethnicity, having more mental health problems, more suicidal ideation, and more often being a traditional and cyber bullying victim (only for girls) than the adolescents who participated at follow-up.

Table 1. Differences between boys/girls who did and did not participate at follow-up (N = 8271)

	Boys			**Girls**		
	Participated	Lost-to-follow-up		Participated	Lost-to-follow-up	
	n = 1623	n = 2645	*p* value	n = 1558	n = 2445	*p* value
	%	%	(χ^2)	%	%	(χ^2)
Age (mean = 12.50 , SD = 0.62)						
< 13 years	53.9	51.2	.09	58.6	56.0	.09
Ethnicity						
Dutch	50.4	56.9	<.001	46.3	55.4	<.001
Level of education						
Basic or theoretical pre-vocational education	49.3	63.6	<.001	51.0	64.2	<.001
Victim of bullying						
Traditional alone	22.4	25.8	.01	20.3	24.4	.002
Cyber alone	4.7	5.3	.45	5.5	9.0	<.001
Mental health problems	20.5	24.9	.001	20.5	25.5	<.001
Suicidal ideation	13.8	17.5	.002	23.9	26.8	.04

Descriptives

Mean age of adolescents in the current sample was 12.47 years (SD = 0.62); 51.0% of the sample consisted of boys and 48.4% was of Dutch ethnicity (Table 2). In total, 21.4% of the adolescents was a victim of traditional bullying and 5.1% was a victim of cyber bullying. No significant gender differences were found on bullying victimization (p = .10). Compared with boys, girls had significantly more mental health problems at follow-up (χ^2 = 10.04; p < .002) and suicidal ideation at baseline (χ^2 = 52.42; p < .001) and at follow-up (χ^2 = 58.69; p < .001). Furthermore, cyber bullying victims were more likely to also be traditional bullying victims compared to non-cyber bullying victims (boys: χ^2 = 60.38; p < .001; girls: χ^2 = 29.21; p < .001).

Table 2. General characteristics of the total study population, and by gender (N = 3181)

	Total	**Boys**	**Girls**	
	N = 3181 %	n = 1623 %	n = 1558 %	p value (χ^2)
Age (mean = 12.47, SD = 0.62)				
< 13 years	56.2	53.9	58.6	.01
Ethnicity				
Dutch	48.4	50.4	46.3	.02
Level of education				
Basic or theoretical pre-vocational education	50.1	49.3	51.0	.33
Victim of bullying				.10
Traditional alone	18.8	19.6	17.9	
Cyber alone	2.6	2.0	3.2	
Traditional and cyber	2.6	2.8	2.4	
Mental health problems				
At baseline	20.5	20.5	20.5	.98
At follow-up	15.0	13.0	17.0	.002
Suicidal ideation				
At baseline	18.8	13.8	23.9	<.001
At follow-up	11.8	7.5	16.3	<.001

Bullying victimization and mental health problems

There was a significant interaction between gender and traditional bullying victimization (p = .08) (Model 3a) in the total sample (Table 3). Among boys, traditional bullying victimization was not significantly related to mental health problems in the fully-adjusted model (OR = 1.03, 95% CI = 0.72 – 1.47). Among girls, traditional bullying victimization was significantly related to mental health problems in the fully-adjusted model (OR = 1.41, 95% CI = 1.02 – 1.96).

There was a significant interaction between gender and cyber bullying victimization (p = .04) (Model 3b). Being a victim of cyber bullying was not related to mental health problems among boys (OR = 1.18, 95% CI = 0.64 – 2.17), whereas among girls, cyber bullying victimization was significantly related to mental health problems after controlling for baseline mental health (OR = 2.38, 95% CI = 1.45 – 3.91).

No significant interaction was found between traditional and cyber bullying victimization on mental health.

Table 3. Associations of bullying victimization and mental health problems (N = 3181)

	Model 1		**Model 2**		**Model 3a**		**Model 3b**	
	OR (95%CI)	*p* value	OR (95%CI)	*p* value	OR (95%CI)	*p* value	OR (95%CI)	*p* value
Sociodemographic characteristics								
Gender, boy	0.73 (0.60 – 0.89)	.002	0.71 (0.58 – 0.88)	.001	0.80 (0.63 – 1.02)	.07	0.76 (0.61 – 0.95)	.01
Age, < 13 years[a]	1.13 (0.92 – 1.39)	.25	1.10 (0.89 – 1.38)	.34	1.11 (0.90 – 1.38)	.34	1.11 (0.90 – 1.39)	.33
Ethnicity, Dutch	0.95 (0.77 – 1.17)	.62	0.89 (0.72 – 1.10)	.29	0.89 (0.72 – 1.11)	.30	0.88 (0.71 – 1,09)	.24
Education, basic or theoretical pre-vocational education	1.58 (1.27 – 1.96)	<.001	1.23 (0.98 – 1.54)	.08	1.23 (0.98 – 1.54)	.08	1.23 (0.98 – 1.54)	.08
Bullying victimization								
Traditional victim	1.64 (1.31 – 2.05)	<.001	1.20 (0.95 – 1.53)	.13	1.45 (1.06 – 2.00)	.02	1.22 (0.96 – 1.54)	.11
Cyber victim	2.35 (1.64 – 3.36)	<.001	1.79 (1.23 – 2.61)	.003	1.81 (1.24 – 2.65)	.002	2.53 (1.55 – 4.12)	<.001
Mental health problems at baseline			4.59 (3.68 – 5.73)	<.001	4.59 (3.68 – 5.73)	<.001		
Gender × Traditional bullying victimization					0.66 (0.42 – 1.54)	.08		
Gender × Cyber bullying victimization							0.44 (0.20 – 0.95)	.04

Note: OR = odds ratio; CI = confidence interval.

[a] Similar results were obtained when age was included as a continuous variable in the analysis.

Model 1 is adjusted for sociodemographic characteristics and bulling victimization. Mental health problems is the dependent variable.

Model 2 is the same as Model 1, but also adjusted for mental health problems at baseline.

Model 3a is the same as Model 2, but also includes a Gender × Traditional bullying victimization interaction term.

Model 3b is the same as Model 2, but also includes a Gender × Cyber bullying victimization interaction term.

Bullying victimization and suicidal ideation

No significant interaction was found between gender and traditional bullying victimization (p = .20) (Model 3a) and between gender and cyber bullying victimization (p = .48) (Model 3b) (Table 4). In the total sample, traditional bullying victimization was significantly related to suicidal ideation in the fully-adjusted model (Model 2: OR = 1.56, 95% CI = 1.21 – 2.02). Cyber bullying victimization was not associated with suicidal ideation after controlling for baseline suicidal ideation (Model 2: OR = 1.22, 95% CI = 0.80 – 1.87).

A significant interaction was found between traditional and cyber bullying victimization on suicidal ideation (p = .01). Follow-up logistic regression analysis revealed that there was no further increased risk of developing suicidal ideation for adolescents being a victim of both types of bullying compared to adolescents being solely a victim of cyber (OR = 1.35, 95% = CI 0.86 – 2.12) or traditional bullying (OR = 1.13, 95% CI = 0.91 – 1.41).

Table 4. Associations of bullying victimization and suicidal ideation (N = 3181)

	Model 1		**Model 2**		**Model 3a**		**Model 3b**	
	OR (95%CI)	*p* value	OR (95%CI)	*p* value	OR (95%CI)	*p* value	OR (95%CI)	*p* value
Sociodemographic characteristics								
Gender, boy	0.40 (0.32 – 0.51)	<.001	0.48 (0.37 – 0.60)	<.001	0.53 (0.40 – 0.70)	<.001	0.49 (0.38 – 0.63)	<.001
Age, < 13 years[a]	0.89 (0.71 – 1.12)	.31	0.90 (0.71 – 1.15)	.39	0.90 (0.71 – 1.15)	.39	0.90 (0.71 – 1.14)	.39
Ethnicity, Dutch	1.06 (0.84 – 1.34)	.63	1.10 (0.87 – 1.41)	.42	1.11 (0.87 – 1.41)	.41	1.10 (0.86 – 1.40)	.44
Education, basic or theoretical pre-vocational education	1.32 (1.04 – 1.68)	.02	1.17 (0.91 – 1.50)	.22	1.17 (0.91 – 1.50)	.22	1.17 (0.91 – 1.50)	.22
Bullying victimization								
Traditional victim	1.95 (1.53 – 2.48)	<.001	1.56 (1.21 – 2.02)	<.001	1.77 (1.29 – 2.44)	<.001	1.57 (1.21 – 2.03)	.001
Cyber victim	1.74 (1.17 – 2.61)	.007	1.22 (0.80 – 1.87)	.36	1.23 (0.80 – 1.89)	.34	1.36 (0.81 – 2.28)	.24
Suicidal ideation at baseline			4.82 (3.79 – 6.12)	<.001	4.84 (3.81 – 6.15)	<.001	4.81 (3.79 – 6.10)	<.001
Gender × Traditional bullying victimization					0.71 (0.43 – 1.20)	.20		
Gender × Cyber bullying victimization							0.72 (0.29 – 1.79)	.48

Note: OR = odds ratio; CI = confidence interval.

[a] Similar results were obtained when age was included as a continuous variable in the analysis.

Model 1 is adjusted for sociodemographic characteristics and bulling victimization. Suicidal ideation is the dependent variable.

Model 2 is the same as Model 1, but also adjusted for suicidal ideation at baseline.

Model 3a is the same as Model 2, but also includes a Gender × Traditional bullying victimization interaction term.

Model 3b is the same as Model 2, but also includes a Gender × Cyber bullying victimization.

DISCUSSION

This study shows that both *traditional* and *cyber* bullying victimization were associated with mental health problems in girls but not in boys, after controlling for baseline problems. Only *traditional* bullying victimization was associated with suicidal ideation after controlling for baseline suicidal ideation.

As hypothesized, but only among girls, traditional bullying victimization was associated with mental health problems after controlling for baseline mental health. This difference between boys and girls in the long-term effects of traditional bullying victimization on mental health is supported by various previous studies.[6,17-21] The current study extends these findings to cyber bullying victimization, as we too found that the association between cyber bullying victimization and mental health problems was particularly driven by girls.

The gender differences in the impact of bullying on mental health found in our study may be partly explained by differences in the types of bullying (e.g. physical, relational) to which girls and boys are exposed. Regarding to traditional bullying, previous studies have found that girls more often experience relational victimization and that relational victimization has a greater impact on mental health problems than overt victimization, which is more often experienced by boys.[31-33] However, as the present study did not distinguish between different types of traditional or cyber bullying, it remains unclear whether the gender differences found in our study can be explained by the type of bullying. Therefore, future research should focus on different types of traditional bullying, as well as cyber bullying (e.g. via photos or video clips, emails), as different types of cyber bullying may also have different associations with mental health problems and suicidal ideation, and girls and boys may be exposed to different types of cyber bullying as well.

Furthermore, this study confirms the results of earlier studies indicating an association between traditional bullying victimization and suicidal ideation.[6,12,15] In contrast with our hypothesis, being a cyber bullying victim was not related to suicidal ideation after controlling for baseline suicidal ideation. A possible explanation for this discrepancy is the small size of the group of adolescents who were either a cyber bullying victim *and* had suicidal ideation. This may have resulted in limited power to detect a significant relationship between cyber bullying and suicidal ideation. Another possible explanation could be the difference in duration of exposure to the two types of bullying. Adolescents in our sample may have been exposed to cyber bullying for a shorter period of time compared to the time that they have been exposed to traditional bullying. This is in line with previous research showing that traditional bullying victimization remains relatively stable over time (between the ages of 8 and 16 years),[34] whereas cyber bullying victimization may occur at a later age, around the age of 14 years,[4] when children spend more time on their mobile phones and are more likely to participate on social network sites (e.g.

Facebook, MySpace) which are likely places for cyber bullying to occur.[35] It is possible that on the long-term, suicidal ideation only develops as a result of more pronounced and further developed mental health problems[36] and/or after persistent long-term exposure to bullying, as may have been the case with traditional bullying, but perhaps not yet with cyber bullying in our sample. Future research is required to gain more insight into these associations.

The purpose of the current study was to examine if bullying victimization was associated with mental health problems and suicidal ideation at follow-up. Nevertheless, analyzing the cross-sectional associations and the change in the percentage of adolescents with problems between baseline and follow-up among the different bullying victimization subgroups could provide additional information. Exploratory analyses on the baseline data (cross-sectional analyses) showed similar results as the longitudinal analyses described in the results section of this manuscript. As is often the case, our cross-sectional analyses yielded somewhat stronger associations between both types of bullying victimization and mental health and suicidal ideation than our longitudinal analyses. No significant interactions were found between gender and bullying victimization on mental health or suicidal ideation. This could indicate that the short term impact of bullying victimization on adolescents' mental health is similar for boys and girls, but that the long term impact of bullying on the mental health is different for boys and girls. Furthermore, additional analyses showed that the proportion of adolescents with mental health problems in the bullying victimization group significantly decreased more over the two year follow-up period compared to adolescents in the non-bullying victimization group (data not shown). However, it must be noted that percentage of mental health problems at two year follow-up was still higher in the bullying victimization group than in the non-bullying group. The same results were found for suicidal ideation. The only exception was that no significantly different change in the proportion of mental health problems in girls in the cyber bullying victimization group over the two-year follow-up period was found compared to girls who were not a cyber bullying victim at baseline.

The present study has both strengths and limitations that need to be addressed. A strength of the study is its longitudinal nature. The dataset provided the opportunity to explore relationships between the particular variables of interest within a large sample. Furthermore, many studies on cyber bullying are conducted online, and, therefore, may have a bias toward the experiences of adolescents who use the Internet more frequently. However, this study also has some limitations. First, not all adolescents in the study were available for analyses due to non-participation at follow-up. A non-response analysis showed that the adolescents who did not participate at follow-up had a lower educational level, were older, more often of Dutch ethnicity, more often a traditional or cyber bullying victim, and more often had mental health problems and suicidal ideation

at baseline. Although we included these variables as confounders and adjusted for baseline problems in our analyses, it is possible that this selective drop out led to underestimation of the size of the association between bullying victimization and mental health problems or suicidal ideation, since a vulnerable group (i.e. a group with a high risk of mental health problems and suicidal ideation) dropped out. However, additional analyses showed that the relationship between both types of bullying victimization and mental health or suicidal ideation at baseline did not significantly differ between adolescents who dropped out and adolescents who did not drop out at follow-up. Nevertheless, the current findings should be generalized with caution, and we propose replication in large and varied populations. Second, traditional and cyber bullying victimization were assessed using single, self-reported items. Moreover, there is currently no consensus among researchers how to measure cyber bullying, and the changing nature of communication technology makes it difficult to establish a fixed definition. Third, mental health and suicidal ideation were also assessed using self-reported items, which may have resulted in less reliable outcomes. Nevertheless, research suggests that adolescents are better reporters of their own mental health status than parents and teachers.[37]

In conclusion, our findings suggest that traditional bullying victimization is associated with an increased risk of suicidal ideation, and traditional and cyber bullying victimization are associated with an increased risk of mental health problems among girls. Future research should examine the mechanisms responsible for this differential response of girls and boys to the stress caused by bullying victimization. Furthermore, based on our results and results of other studies, studies on the current topic may want to consider differentiating between boys and girls. Our findings stress the importance of programs aimed at reducing bullying behavior in schools and online. These programs are particularly important because early-onset mental health problems may pose a risk for the development of psychiatric disorders in adulthood.[38-40] Moreover, although several intervention programs are available that reduce bullying behavior and victimization in schools[41,42] such programs should not solely focus on school bullying. Prevention of cyber bullying should also be included in school anti-bullying policies[3,4] since this is currently often lacking.[43] While some traditional methods for reducing bullying may be useful for cyber bullying too (e.g. peer support), more specific interventions will also be needed to reduce cyber bullying, such as how to contact mobile phone companies and internet service providers.[3]

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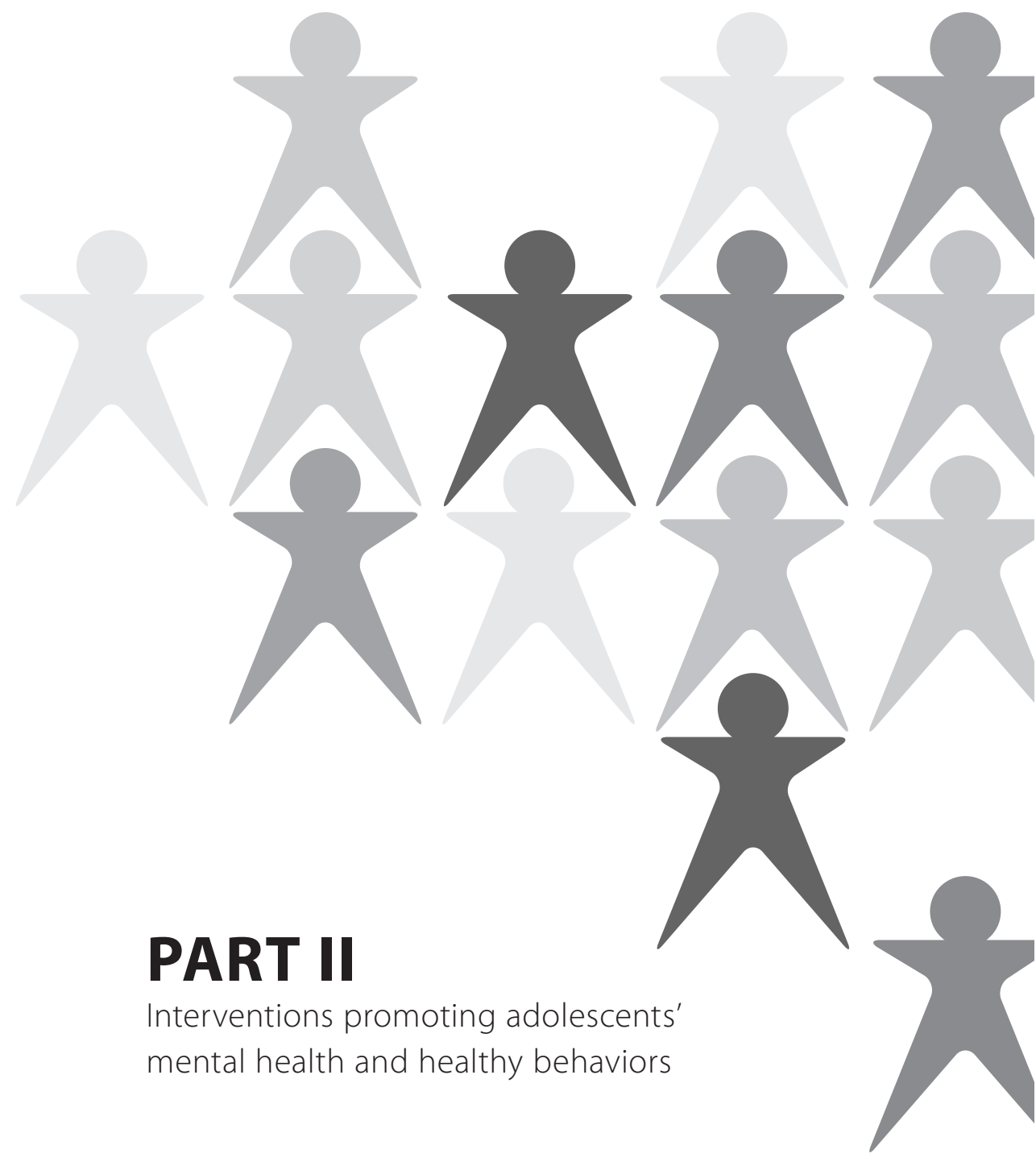
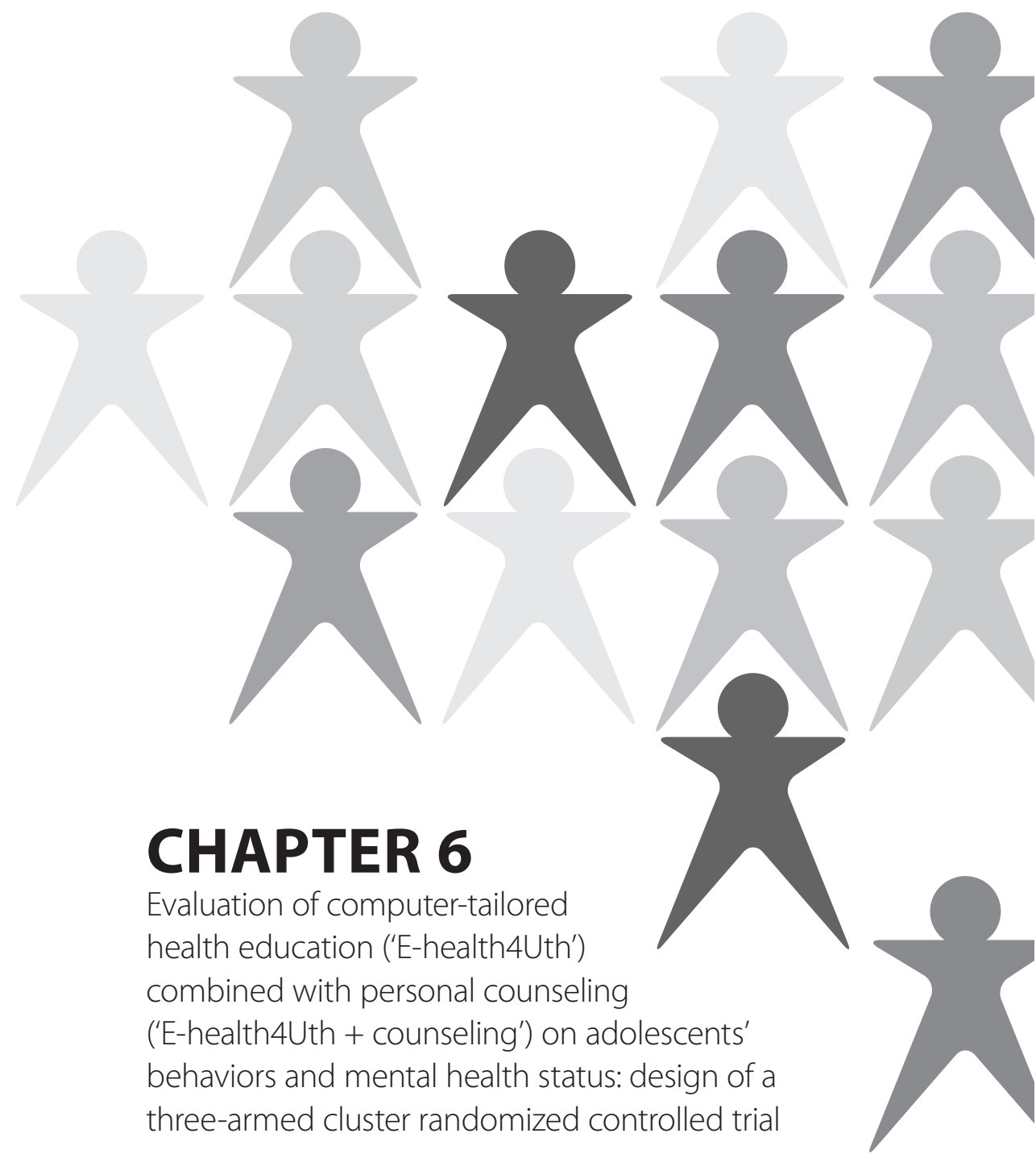


PART II

Interventions promoting adolescents' mental health and healthy behaviors



CHAPTER 6

Evaluation of computer-tailored health education ('E-health4Uth') combined with personal counseling ('E-health4Uth + counseling') on adolescents' behaviors and mental health status: design of a three-armed cluster randomized controlled trial

Rienke Bannink, Evelien Joosten - van Zwanenburg, Petra van de Looij - Jansen, Els van As, Hein Raat

BioMed Central Public Health 2012; 12:1083

ABSTRACT

Background

About 15% of adolescents in the Netherlands have mental health problems and many also have health risk behaviors such as excessive alcohol consumption, cigarette smoking, use of drugs, and having unsafe sex. Mental health problems and health risk behaviors may have adverse effects on the short and longer term. Therefore, in the Netherlands there is a considerable support for an additional public health examination at age 15–16 years. The study evaluates the effect of two options for such an additional examination. Adolescents in the 'E-health4Uth' group receive internet-based tailored health messages on their health behavior and well-being. Adolescents in the 'E-health4Uth + counseling' group receive the computer-tailored messages combined with personal counseling for adolescents at risk of mental health problems.

Methods and design

A three-arm cluster randomized controlled trial will be conducted in the Netherlands among fourth-grade secondary school students. School classes are the unit of randomization. Both intervention groups complete the computer-tailored program during one class session; the program focuses on nine topics related on health behavior and well-being. For each topic a score is computed that can be compared with the Dutch health norms for adolescents. Based on the score, a message is presented that reflects the person's current behavior or well-being, the Dutch health norm, and offers advise to change unhealthy behavior or to talk to a person they trust. Adolescents in the 'E-health4Uth + counseling' group are also invited for an appointment to see the nurse when they are at risk of mental health problems. The control group receives 'care as usual'. The primary outcome measures are health behavior (alcohol, drugs, smoking, safe sex) and mental health status. The secondary outcome measure is health-related quality of life. Data will be collected with a questionnaire at baseline and at 4-months follow-up. A process evaluation will also be conducted.

Discussion

It is hypothesized that at follow-up adolescents in the 'E-health4Uth' group and adolescents in the 'E-health4Uth + counseling' group will show fewer mental health problems and less risky behavior compared to the control group.

Trial registration

Current Controlled Trials NTR3596

BACKGROUND

Problems among adolescents

About 15% of adolescents in the Netherlands have mental health problems.[1] During adolescence, mental health problems among girls tend to increase, and young people from lower educational levels or from families with a lower socioeconomic status report more difficulties than young people from better-off families.[1,2] Young persons with mental health problems are at risk of adverse mental health outcomes later on.[3-5] In general, high levels of behavioral and emotional problems at a young age are related to the DSM-IV diagnoses in adulthood.[6]

Health risk behaviors such as excessive alcohol consumption, cigarette smoking, use of drugs, and having unsafe sex are also prevalent among adolescents.[1] The Health Behavior in School-Aged Children: WHO Collaborative Cross-National Study (HBSC) shows that of the 16-year-old adolescents in the Netherlands about 71% drank alcohol during the 30 days preceding the survey, 19% smoked daily, 12% used cannabis during the 30 days preceding the survey, and 20% of the sexually active adolescents did not use a condom at last sexual intercourse.[1] These health risk behaviors may have adverse effects on the short and longer term.[7] For example, through unsafe sex adolescents can get sexually transmitted diseases or become pregnant.[1] Beginning at an early age with alcohol use may have adverse psychological consequences[8] and smoking may negatively affect school performance.[9] Moreover, alcohol and drugs use are often associated with aggressive and delinquent behavior.[10-12]

Early detection and prevention of problems in adolescence

The Netherlands has a well-organized system for maintenance of the health of children, i.e. the Youth Health Care system.[13] All children and adolescents are invited for 'preventive periodic health examinations' at set ages until the age of 13 years. These examinations focus on growth, development, health functioning, and behavior of infants, children, and adolescents. At age 13 years, the physician or nurse interviews the adolescents and provides health counseling. If physical of psychosocial problems are encountered, the physician or nurse may invite the adolescent (and parents) for a follow-up visit or may refer them to a general practitioner. Participation is voluntary and the care is offered free of charge by the government.

Given the rapid maturation of adolescents, and the associated mental health problems and health risk behaviors, there is a considerable support in the Netherlands for an additional examination at age 15–16 years. Several options for this examination have been proposed by the National Institute for Public Health and Environment.[14] One option is that adolescents complete an online questionnaire about their health behavior and well-being, and then receive tailored messages about their health behavior and

well-being ('E-health4Uth'). Computer-tailored health education is a good opportunity to provide health messages regarding individual health behavior and behavioral determinants, because tailored messages eliminate (as far as possible) information that is not personally relevant.[15-18] Computer-tailored messages are more likely to be effective in changing behavior compared to non-tailored messages.[16] A second option, advised by the National Institute for Public Health and Environment, is to combine the computer tailoring with personal counseling for adolescents at risk of mental health problems ('E-health4Uth + counseling').[14] The online questionnaire used for generating the tailored messages can also be used for early detection of adolescents at risk of mental health problems. Early detection of mental health problems, and if necessary tailored counseling or referral for treatment, may improve the prognosis of adolescents with mental health problems.[19] Therefore, it may be beneficial to combine computer tailoring with personal counseling for adolescents at risk of mental health problems.

For both these options ('E-health4Uth' and 'E-health4Uth + counseling'), it is possible to use E-health modules with internet-based tailored messages, which were developed for adolescents (aged 12–18 years) and applied in an earlier study.[20] In a process-evaluation it was found that the individually-tailored messages were appreciated by adolescents. However, the effects of the internet-based messages on adolescents' behavior and well-being has not yet been studied.[21]

Objectives

The aim of this study is to evaluate the effect of two interventions on mental health and health behavior (alcohol and drug use, smoking, safe sex). Adolescents in the intervention group 'E-health4Uth' receive the computer-tailored health education. Adolescents in the intervention group 'E-health4Uth + counseling' receive computer-tailored health education combined with counseling for adolescents at risk of mental health problems. Additionally, a process evaluation will be conducted to provide insight in the feasibility of the two interventions. This article describes the design of the study.

Study hypothesis

The hypotheses of the study are twofold. First, adolescents in the 'E-health4Uth' group will show fewer mental health problems and less risky behavior (alcohol and drug use, smoking, safe sex) at follow-up compared to the control group ('care as usual'). Second, adolescents in the 'E-health4Uth + counseling' group will show fewer mental health problems and less risky behavior (alcohol and drug use, smoking, safe sex) at follow-up compared to the control group ('care as usual').

METHODS AND DESIGN

Study design

The study design is a three-armed cluster randomized controlled trial (RCT), with a baseline measure point before the interventions and a follow-up measure four months after start of the interventions. This study is conducted in the Netherlands among fourth-grade secondary school students (aged 15–16 years). School classes are the unit of randomization, because randomization at the individual level (i.e. the level of the adolescents) may lead to contamination of the control group.[22] Block randomization is used as this allows to start the study whilst still including schools and classes. The randomization code was developed using a computer random number generator in SPSS to select random permuted blocks (specified allocation ratio 1:1:1). School classes are stratified according to educational level, with pre-vocational education in one stratum and higher than pre-vocational education in the other stratum.

The effects of 'E-health4Uth' and 'E-health4Uth + counseling' will be evaluated at 4-months follow-up by comparing the outcomes on mental health status and health behavior between the adolescents in the two intervention groups and in the control group.

Data collection started in the autumn of 2012 and will continue until June 2013. The Medical Ethical Committee of Erasmus MC declares that the Medical Research Involving Human Subjects Act (also known by its Dutch abbreviation WMO) does not apply to this research proposal. The Medical Ethical Committee has no objection against the execution of this research proposal (MEC-2012-337).

Procedure

A few weeks prior to the start of the study, all adolescents and parents receive information about the study. Information letters providing details about the study for the students and the parents are handed out at school. If parents do not want their child to participate, they can object to participation of their child. Adolescents are asked for their permission to participate before they complete the baseline questionnaire.

All adolescents receive a singular, personal code to log in at one of the three websites of the study. The link of the websites depends on the group ('E-health4Uth', 'E-health4Uth + counseling', or the control group) to which the adolescent is assigned. At the websites the adolescents can complete the questionnaires. A trained research assistant explains the procedure for the completion of the questionnaire at the beginning of the lesson and is available to answer questions. During one class session (+/– 45 min) adolescents complete the online questionnaire. In the two intervention groups the adolescents also receive the tailored messages during this class session. Prior to the start of the study,

specialised Youth Health Care nurses were informed about the study and trained in interviewing adolescents in this age group.

The participant flow is shown in Figure 1.

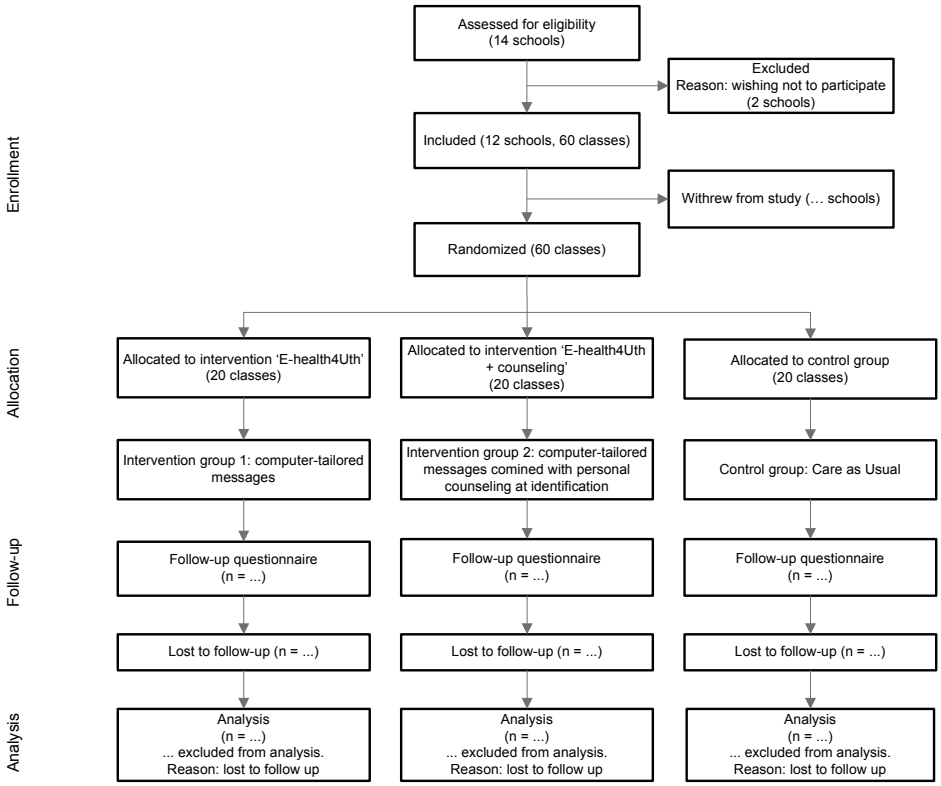


Figure 1. Flow chart of the clusters and participants through the trial

Participants

Youth Health Care organizations and schools

This study is carried out in the Dutch cities of Dordrecht and Zwijndrecht. Recruitment of schools is organized in collaboration with two Youth Health Care organizations. The directors of 14 secondary schools in Dordrecht and Zwijndrecht have been informed about the study by letter, invited to participate, and have been contacted by the researchers. From the 14 schools, 12 agreed to participate in the study with a total of 60 classes of fourth-grade students.

Adolescents

Per school, all the students in the fourth grade are invited to participate. A trained researcher assistant briefly explains the purpose and procedure of the study in the classroom.

Intervention 'E-health4Uth'

Adolescents complete the computer-tailoring program during one class session (+/– 45 min). This program focuses on nine topics related to health risk behavior and well-being: alcohol consumption, drugs use, smoking, sexual behavior, bullying, mental health status, suicidal thoughts, suicidal attempts and unpleasant sexual experience (Table 1). We use internet-based tailored messages which were developed for adolescents (aged 12–18 years) and applied in an earlier study.[21] The questionnaire used for the tailored messages is constructed on the basis of several existing instruments which are used by Municipal Public Health Services and health institutes (Table 1).[23] Consensus on the use of these instruments was established by the National Institute for Public Health and Environment (RIVM), the Dutch association for residential and home care organizations and infant and child health clinics (Actiz), and the Association of Muncipal Public Health Services in the Netherlands (GGD Nederland).

Table 1. Topics of the E-health modules

Behavior and well-being	Items
Alcohol consumption	How often and how much the adolescent drinks (9 items)
Drugs use	How often the adolescents has used different types of drugs (17 items)
Smoking	How often the adolescent smokes (2 items)
Sexual behavior	How often the adolescent uses condoms during sexual intercourse (2 items)
Bullying	How often the adolescent is bullied at school, somewhere else or on the internet (3 items)
Mental health status	Strength and Difficulties Questionnaire (SDQ) (25 items) with a total score range 0–40
Suicidal thoughts	If the adolescent has had suicidal thoughts last year (1 item)
Suicidal attempts	If the adolescent made a suicidal attempt last year (1 item)
Unpleasant sexual experience	If the adolescent has ever had an unpleasant sexual experience (1 item)

For each topic, a score is computed that can be compared with the Dutch health norms for adolescents.[21] Based on the score, a message is presented that reflects the person's current behavior or well-being, the Dutch health norm, and offers advise to change unhealthy behavior or to talk to a person they trust. By providing links to relevant websites, adolescents are encouraged to search for more information on the topics. The tailored messages are presented on the computer screen immediately after the questionnaire

has been completed (Figure 2). The messages are displayed in red, orange or green, indicating unhealthy behavior, behavior just below the norm, or behavior according to the Dutch health norm, respectively. The topics on well-being are always displayed in blue. At the end of the program, adolescents are invited to follow the Facebook page of 'E-health4Uth' to find additional information about all the topics. Also, adolescents can check a box for a self-referral with the nurse, or can send an e-mail to the nurse. After one month the adolescents receive a reminder of the tailored messages.

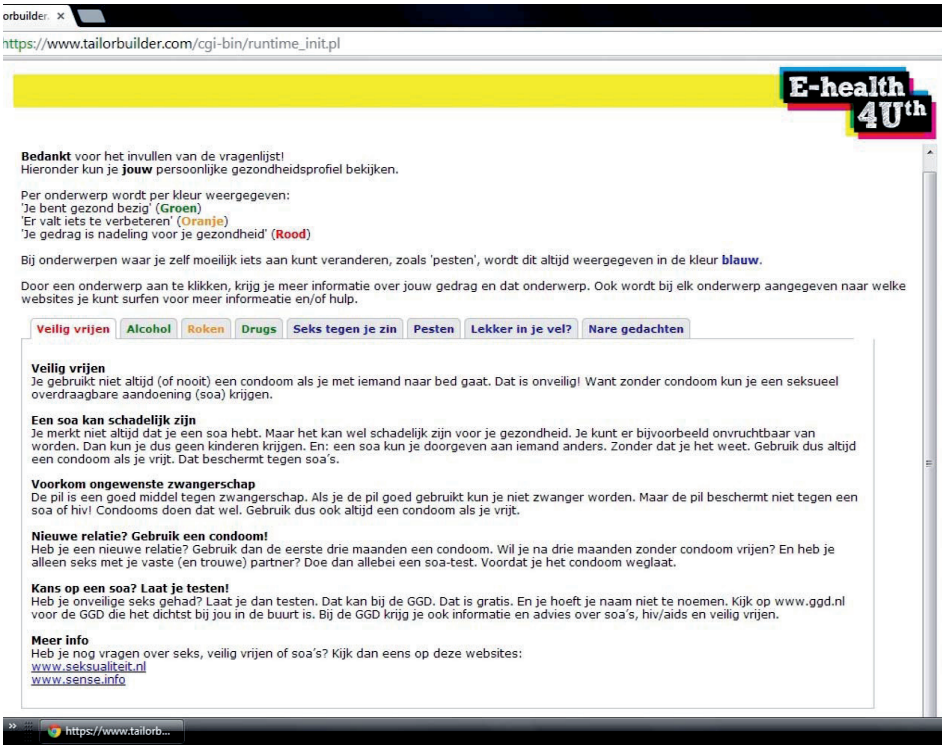


Figure 2. Screenshot of the 'E-health4Uth' intervention

Intervention 'E-health4Uth + counseling'

Adolescents in this group also receive the tailored messages, are invited to follow the Facebook page (see Intervention 'E-health4Uth'), and can check a box for a self-referral with the nurse or send an e-mail to the nurse. In this group, adolescents at risk of mental health problems are also invited for an appointment to see the nurse (Table 2). The criteria for an appointment are: those who report mental health problems as measured with the Strengths and Difficulties Questionnaire (SDQ) (cut-off point > 90th percentile), those who report emotional problems as measured with the SDQ subcale 'emotional problems' (cut-off point > 90th percentile), those who report having suicidal thoughts

'occasionally' or more often, and those who report a suicide attempt last year. The cut-off points of > 90th percentile are based on a cross-national survey among 15–16 year old adolescents. This study was carried out by the Health Behavior in School-Aged Children: WHO Collaborative Cross-National Study (HBSC).[1]

The appointment with the nurse takes place at the adolescent's school. We expect that about 20% of the adolescents will meet the inclusion criteria for an appointment with the nurse.[24] The nurses receive the results of the assessment for each referred adolescent prior to the consultation. During the consultation the nurses focus on specific risk areas, and refer adolescents to other professionals when considered necessary.

Table 2. Cutt-off points used to select adolescents at risk for mental health problems (in intervention group 'E-health4Uth + counseling')

Well-being	Cutt-off point applied
Mental health status (25 items)	Score on the Strength and Difficulties Questionnaire (SDQ) ≥ 17, or a score of ≥ 6 on the subscale emotionality of the SDQ[1]
Suicidal thoughts (1 item)	Having suicidal thoughts 'occasionally' or more often
Suicidal attempts (1 item)	Made an attempt at suicide last year

Control group

The control group receives care as usual, i.e. adolescents can check a box for a self-referral with the nurse or can send an e-mail to the nurse.

Measurements

Primary outcome measures

The primary outcomes of the study are adolescents' health behaviors (alcohol, drug, smoking, safe sex) and mental health status. The electronic, self-administered questionnaire, which is used for the tailored messages in the two intervention groups, serves also as the baseline questionnaire. The questionnaires used for the health behaviors are constructed on the basis of several existing instruments used by Municipal Public Health Services and health institutes[23] (Table 1). Mental health status is measured by the Strengths and Difficulties Questionnaire (SDQ)[25-29] and the Youth Self Report (YSR).[30] The SDQ consists of 25 items describing positive and negative attributes of adolescents that can be allocated to 5 subscales of 5 items each: the emotional problems subscale, the conduct problems subscale, the hyperactivity-inattention subscale, the peer problems subscale, and the prosocial behavior subscale. Each item is scored on a 3-point scale with 0 = *not true*, 1 = *somewhat true*, and 2 = *certainly true*. A total difficulties score is calculated by summing the scores on the emotional problems, conduct problems, hyperactivity-inattention, and peer problems subscales (range 0–40).[26] The YSR comprise 119 items addressing emotional and behavioral problems of adolescents. Respon-

dents have to indicate on 3-point scales the extent to which each item applies: 0 = *not*, 1 = *sometimes*, or 2 = *often*. The YSR assess two broad domains of psychopathology: one is the externalizing which reflects behavioral problems and the other is internalizing which refers to emotional problems. In addition, problems can be grouped into eight narrow-band scales: anxious-depressed, withdrawn-depressed, somatic complaints, social problems, thought problems, attention problems rule-breaking behavior, and aggressive behavior.[30]

The health behaviors and SDQ will be measured at baseline and at 4-months follow-up. The YSR will be measured at 4-months follow-up.

Secondary outcome measure

The secondary outcome is health-related quality of life measured with the general health perceptions scale of the Child Health Questionnaire Child Form (CHQ-CF87)[31] at baseline and at 4-months follow-up.

Socio-demographic characteristics

Socio-demographic questions include gender, age, educational level, country of birth, parents' country of birth, family structure, employment situation of the parents, and family affluence. Family affluence is measured with the Family Affluence Scale (FAS). The HBSC Family Affluence Scale has been developed by the Health Behavior in School-Aged Children: WHO Collaborative Cross-National Study (HBSC) to measure the socioeconomic status of adolescents in cross-national surveys.[32,33] The Health Behavior in School-Aged Children: WHO Collaborative Cross-National Study (HBSC) is an international study carried out by the HBSC International Research Network in collaboration with the WHO Regional Office for Europe. Further information on the study is available from http://www.hbsc.org.

Process-evaluation

After the baseline and follow-up questionnaires, the adolescents in the two intervention groups are invited to complete an additional questionnaire. This latter questionnaire provides data on the evaluation of the tailored messages. Topics covered are: appreciation, personal relevance, and perceived usefulness of the information. Questions are asked about: reading the information, reading the reminders, discussing the advice with parents and peers, intention to change their behavior, the length of the module, using the advice in practice, finding the information interesting, learning new things, and usability. In addition, adolescents are asked to rate the program from 1 (most-negative evaluation) to 10 (most-positive evaluation). Adolescents' satisfaction with consultation is assessed by 11-items, with answers given on a five-point Likert scale. An extra item is measured to rate the consultation from 1 (most-negative evaluation) to 10 (most-positive

evaluation). The nurses complete an evaluation that provides data on: the helpfulness of the information received from the assessment of the referred adolescent, estimation of the problems of the adolescent, action that is taken, and to which professional the adolescent is referred if considered necessary.

Power of the study

Sample size was calculated taking into account the design that includes cluster randomization. We assume an intra-cluster correlation coefficient (ρ) of 0.1. The number of clusters is 60, the power of the study 0.80 and alpha .05. With a participation of 85%, and a loss-to-follow-up of 30%, at least 1500 adolescents need to be invited to participate in the study to have a final sample of about 900 adolescents (300 in each group). Assuming a SD of the SDQ total score to be 5.0,[27-29] a difference in mean of 1.6 between the adolescents in the intervention groups and the adolescents in the control group can be established under the assumptions mentioned above. Assuming a SD of the YSR total score (range 0–210) to be 20.6,[30] a difference in mean of 6.6 can be established.

Statistical analyses

The study assesses the effect of internet-based, tailored messages, and assesses the effect of these messages combined with personal counseling for adolescents at risk of mental health problems. An intention-to-treat analysis will be applied.[34]

Multilevel regression analysis will be used to test group differences on the outcome measures.[35] This technique adjusts for the dependency between observations of students from the same class. Linear multilevel analysis is applied for continuous outcome variables and logistic multilevel analysis for dichotomous outcome variables.

Descriptive statistics are used to carry out the process evaluation.

DISCUSSION

This paper describes the design of a randomized controlled trial on the promotion of health behaviors and the prevention of mental health problems in adolescents.

The study evaluates the effect of internet-based, tailored messages ('E-health4Uth'), and evaluates the effect of these messages combined with personal counseling for adolescents at risk of mental health problems ('E-health4Uth + counseling').

It is hypothesized that at 4-months follow-up adolescents in the 'E-health4Uth' group and adolescents in the 'E-health4Uth + counseling' group will show fewer mental health problems and less risky behavior (alcohol and drug use, smoking, safe sex) compared to the control group ('care as usual').

Strengths of the study are the randomized controlled design, and providing the intervention within the daily practice of the Dutch Youth Health Care system. This will facilitate implementation of the interventions if found to be effective. Data will be collected in both rural and urban areas of the Netherlands, resulting in a higher level of generalizability. However, because the outcome measures are based on self-report, misclassification might occur. In addition, because of including multiple-risk behaviors are included it is not possible to assess each type of behavior in depth.

In conclusion, this study evaluates the effect of two interventions on the promotion of health behavior and prevention of mental health problems in adolescents. The results of this study will provide insight into the effectiveness of computer-tailored messages on health behaviors and mental health status, and the effectiveness of these messages combined with personal counseling for adolescents at risk of mental health problems.

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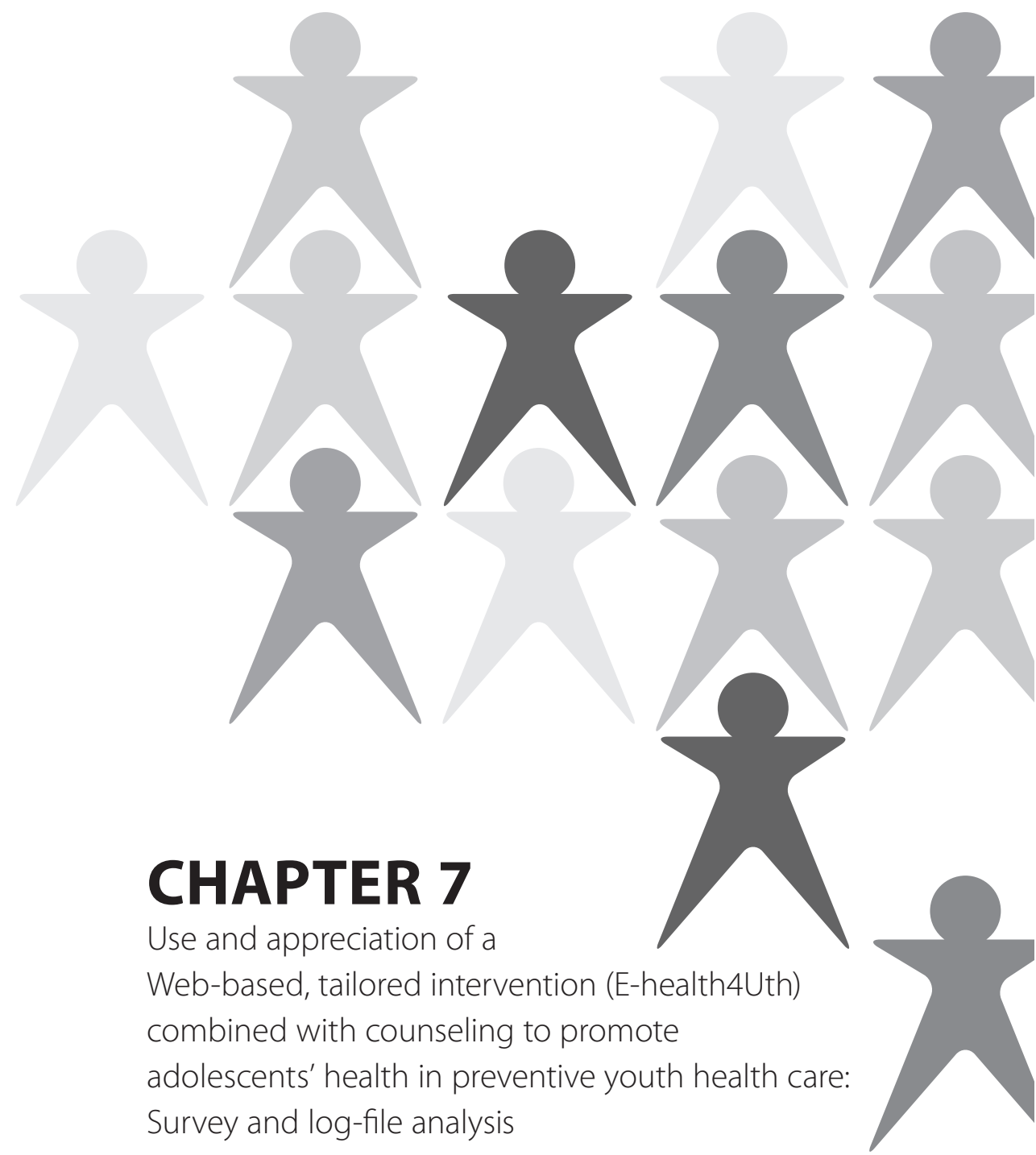

CHAPTER 7

Use and appreciation of a Web-based, tailored intervention (E-health4Uth) combined with counseling to promote adolescents' health in preventive youth health care: Survey and log-file analysis

Rienke Bannink, Suzanne Broeren, Evelien Joosten - van Zwanenburg, Els van As, Petra van de Looij - Jansen, Hein Raat

JMIR Research Protocols 2014; 3(1):e3

ABSTRACT

Background

Health promotion for adolescents is important in the prevention of mental health problems and health-risk behaviors. We implemented two interventions in a preventive youth health care setting. Adolescents in the E-health4Uth group received Web-based, tailored messages on their health behavior and well-being. Adolescents in the E-health4Uth and counseling group received the same tailored messages, but were subsequently referred to a school nurse for a consultation if they were at risk of mental health problems.

Objective

This study evaluated the use and appreciation of these Web-based, tailored messages and additional consultation with a school nurse. Differences in use and appreciation according to demographics (i.e. gender, level of education, and ethnicity) of the adolescents were also assessed.

Methods

Two youth health care organizations participated in this study and conducted the interventions in 12 secondary schools. In total, 1702 adolescents participated; 533 in the E-health4Uth group, 554 in the E-health4Uth and counseling group, and 615 in the control group (i.e. care as usual). Adolescents completed an evaluation questionnaire assessing the use and appreciation of the tailored messages immediately after receiving these messages and at a 4-month follow-up. After the consultation, adolescents and nurses completed an evaluation questionnaire on the use and appreciation of the consultation.

Results

The majority of the adolescents (845/1034, 81.72%) indicated they had read the tailored messages. Most items on the use and appreciation of the tailored messages and the program were scored positive (overall satisfaction on a scale from 1, most-negative, to 10, most-positive: mean = 6.70, SD = 1.60). In general, adolescents in vocational training, girls, and adolescents of non-Dutch ethnicity, indicated they used the tailored messages more often and appreciated the content of the messages better than adolescents receiving pre-university education, boys, and adolescents of Dutch ethnicity, respectively (all $p <$. 05). In the E-health4Uth and counseling group, 18.6% (103/553) of the adolescents were referred to a nurse. Adolescents in vocational training and girls were more often referred to a nurse than adolescents receiving pre-university education (p = .007) and boys (p = .03), respectively. Adolescents and nurses positively evaluated the consultation (overall satisfaction of adolescents: mean = 8.07, SD = 1.21). Adolescents in vocational training attended the consultation more often (p = .047) and considered the consul-

tation a more valuable addition to the tailored messages than adolescents receiving pre-university education ($p = .034$).

Conclusions

The Web-based, tailored messages and additional consultation were used and appreciated positively by adolescents and nurses. The consultation seems a valuable addition to the tailored messages. However, the tailored messages might need further improvement since adolescents did not rate all evaluation items about these messages explicitly positive. As these interventions were already interwoven with the existing practice of the preventive youth health care, they are especially promising for future implementation.

Trial registration

Netherlands Trial Register Number (NTR): NTR3596;
http://www.trialregister.nl/trialreg/admin/rctview.asp?TC=3596
(Archived by WebCite at http://www.webcitation.org/6LryL42zH).

INTRODUCTION

Mental health problems often have their first manifestation during adolescence,[1] and many health-risk behaviors, such as excessive alcohol consumption, cigarette smoking, drug use, and unsafe sex, are acquired during adolescence.[2] These mental health problems and health-risk behaviors often persist into adulthood, thereby affecting not only current health but also health later in life.[3-8] Therefore, adolescents are an important target group for health promotion.

Promoting good health and a healthy lifestyle is a task of the preventive youth health care.[9] The aim of preventive youth health care is to improve and protect the health, growth, and development of young people. In the Netherlands, all children and adolescents are invited for preventive periodic health examinations at set ages until the age of 13 years.[10] From the age of 5 years, these examinations often take place at school. The examinations focus on growth, development, health functioning, and behavior of infants, children, and adolescents. Given the rapid maturation in adolescence and the mental health problems and health-risk behaviors associated with this developmental period, it is desirable to implement an additional preventive health examination between ages 15 and 16 years.[11,12]

Furthermore, with an increasing demand for adolescent health promotion by the government and preventive youth health care in the Netherlands,[11,12] and the current financial strain on preventive health care, greater efficiency is required. Providing health information through the Internet (eHealth) can be beneficial for achieving this. For example, the Internet is very efficient for data sampling and offers the opportunity to give immediate computerized, tailored messages on health and health behavior.[13,14] Web-based, tailored messages eliminate (as far as possible) information that is not personally relevant[13,15-17] and are therefore more likely to be effective in changing behavior compared with non-tailored messages.[15] Various studies have shown that Web-based tailoring is a promising technique to promote health behaviors of adolescents.[18-23] Additionally, it provides the opportunity to enhance the efficiency of face-to-face counseling by collecting information on adolescents' health prior to the consultation, which could support the nurse during the consultation.[24-28]

However, currently eHealth is not broadly applied in preventive youth health care, even though earlier research indicates that Web-based, tailored interventions can be combined with current daily practice of the preventive youth health care.[28-30] Therefore, we implemented two interventions in preventive youth health care using Web-based, tailored messages (E-health4Uth and E-health4Uth and counseling).[31] These Web-based, tailored messages focused on topics related to health risk behaviors (e.g. alcohol consumption, smoking) and well-being (e.g. mental health status, suicidal thoughts). Both interventions used the same messages, which were developed for adolescents (aged

12–18 years) in an earlier study.[32,33] In the E-health4Uth and counseling group, adolescents who were at risk of mental health problems were also referred to a school nurse for a consultation. With adolescents' knowledge, the nurses received information regarding adolescents' health and health behaviors from the E-health4Uth tool, to facilitate communication during the consultation.[28]

Evaluating use and appreciation of Web-based, tailored interventions and the consultation is important to guide improvement of interventions to increase intervention's effectiveness.[34] Successful use and appreciation of an intervention are prerequisites for active information processing, which is necessary for achieving behavioral change.[35,36] Because demographic variables (gender, level of education, and ethnicity) have shown to influence the use of eHealth tools in general,[37,38] research on the use and appreciation among specific demographic subgroups can provide insight into the usability of Web-based tailoring among such specific groups.

Taken together, the aim of this study was to evaluate the use and appreciation of the Web-based, tailored messages, and the use and appreciation of the subsequent consultation applied by the preventive youth health care in schools. Differences in use and appreciation according to demographics of the adolescents (by gender, level of education, and ethnicity) are explored.

METHODS

Study design

The study design is a three-armed cluster randomized controlled trial (RCT), with two intervention groups (E-health4Uth and E-health4Uth and counseling) and a control group (i.e. care as usual). The interventions were applied by preventive youth health care in secondary schools. School classes were the unit of randomization, because randomization at the individual level (i.e. the level of the adolescents) may lead to contamination of the control group.[39] For allocation of the school classes (clusters) to one of the study arms, a computer-generated list of random numbers was used. Randomization sequence was stratified with a 1:1:1 allocation using random block sizes of three. The computer-generated random number list was prepared by an investigator with no involvement in the trial. The random number list was applied by the researchers in the order schools committed to participate. This paper reports on the use and appreciation of the Web-based, tailored messages and counseling conducted in 2012 and 2013. Further details about the study design and the interventions are described in a design paper published elsewhere.[31] The Medical Ethical Committee of Erasmus Medical Center has declared that the Medical Research Involving Human Subjects Act (also known by its Dutch abbreviation WMO) does not apply to this research proposal. The Medical Ethical

Committee had no objection against the execution of this research proposal (MEC-2012-337).

Sample and setting

Two youth health care organizations in the Dutch cities of Dordrecht and Zwijndrecht participated in this study and conducted the interventions in secondary schools. The youth health care organizations invited all 14 secondary schools in these cities to participate, of which 12 agreed with a total of 11 classes with third-grade students (2 schools) and 75 classes with fourth-grade students (10 schools). In the Netherlands, adolescents in the third- and fourth-grades of secondary school are on average 15–16 years of age. In secondary schools, distinction is made in the level of education adolescents are following. Lower levels of education are called "vocational training" and higher levels of education are called "pre-university education". Adolescents following vocational training and adolescents following pre-university education both participated in this study.

A few weeks prior to the start of the study, all adolescents and parents received information about the study. If parents did not want their child to participate, they could object to participation of their child. Adolescents were asked to provide written consent before they completed the baseline questionnaire. Of the 1989 eligible adolescents, 1702 (85.57%) adolescents participated; 533 in the E-health4Uth group, 554 in the E-health4Uth and counseling group, and 615 in the control group (Figure 1). The main registered reason for not participating was absence, mainly due to illness. Furthermore, 29 parents objected to their child's participation, whereas 24 adolescents refused to participate. Of the 1087 adolescents who received the tailored messages (533 in the E-health4Uth group and 554 in the E-health4Uth and counseling group), 1034 (95.12%) completed the evaluation questionnaire at baseline.

At the 4-month follow-up, 3 schools did not succeed in scheduling the follow-up classroom assessments for all or several classes (missing data from 14 classes). At the remaining schools, 135 adolescents were absent at the follow-up. In total, 1256 adolescents participated at the 4-month follow-up (73.80%); 392 in the E-health4Uth group, 430 in the E-health4Uth and counseling group, and 434 in the control group. Of the 822 adolescents who participated at follow-up and received the tailored messages at baseline, 821 (99.9%) completed the evaluation questionnaire at follow-up.

All adolescents who attended the consultation with the nurse (n = 126) completed the consultation evaluation questionnaire. Nurses also completed an evaluation questionnaire for every consultation (100%), but did not complete all questions.

The E-health4Uth intervention

During one classroom session (+/- 45 minutes), adolescents completed a self-report questionnaire via the Internet to assess health-risk behavior and well-being on the fol-

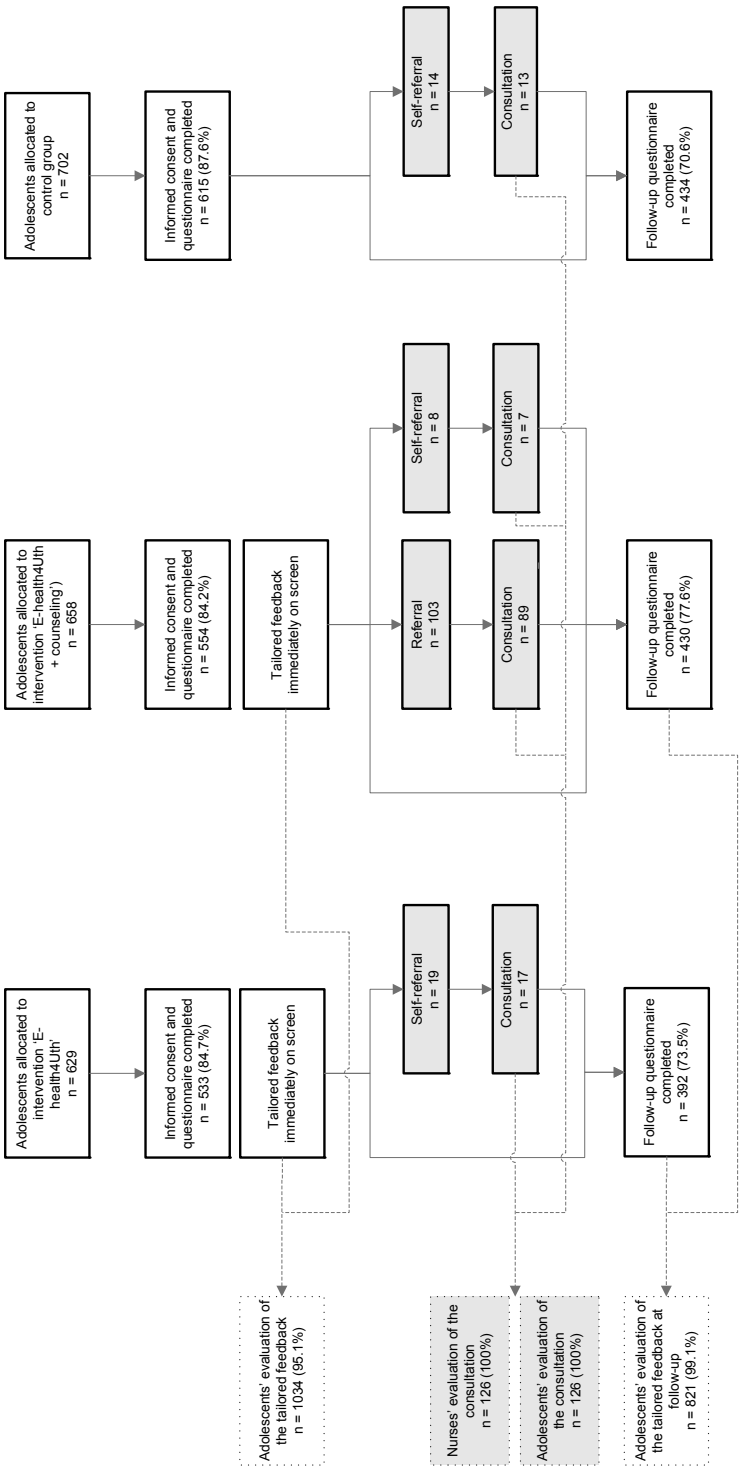

Figure 1. Flow chart of the adolescents' participation

lowing topics: alcohol consumption, drug use, smoking, sexual behavior, bullying, mental health status, suicidal thoughts, suicide attempts, and unpleasant sexual experiences (Multimedia Appendix 1). This questionnaire served as the basis to tailor the messages, but also as a baseline measure for the effect evaluation. For each topic, a score was computed that was compared with the Dutch health norms for adolescents.[32,40] Based on this score, a message was immediately presented on the screen, which reflected the person's current behavior or well-being in relation to the Dutch health norm, and offered advice to change unhealthy behavior and/or to talk to a person the adolescent trusts (Figure 2). The messages were displayed in red, orange, or green, indicating unhealthy behavior, behavior just below the norm, or behavior according to the Dutch health norm, respectively. The topics on well-being were always displayed in blue. By providing links to relevant websites, adolescents were encouraged to read more information on the topics. These Web-based, tailored messages were specifically developed for adolescents (aged 12–18 years) in a previous study.[32]

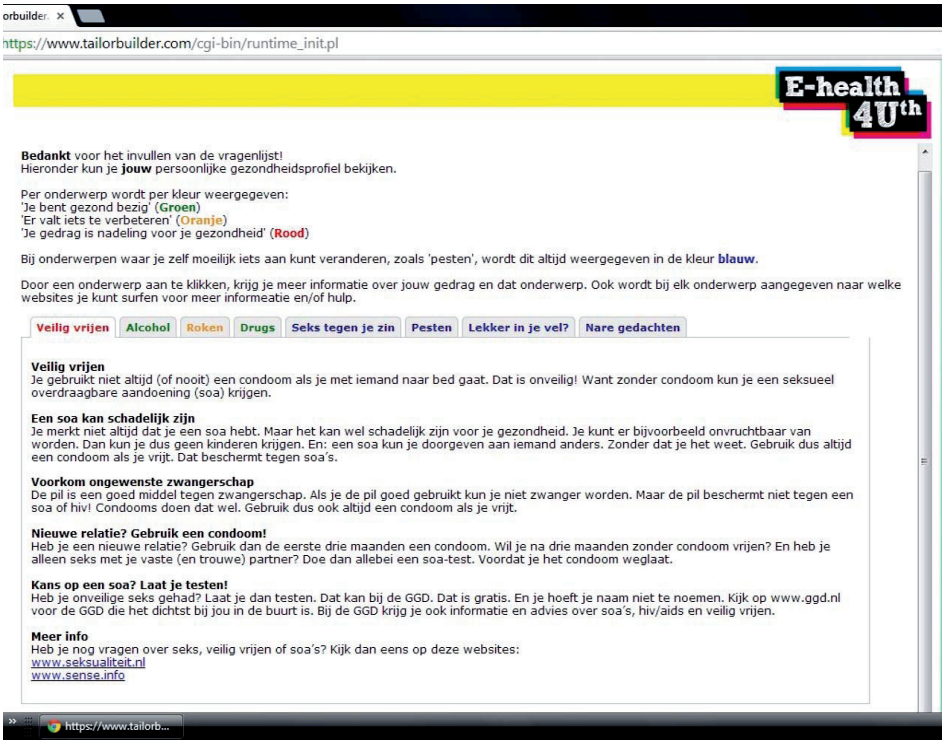

Figure 2. Screenshot of the computer-tailored messages. This is an example of a message (most left tab) that is presented to adolescents who have answered that they have had unsafe sex. The message is therefore displayed in red, indicating unhealthy behavior. By providing links to relevant websites, adolescents are encouraged to search for more information on the topic. The messages on the other topics are presented when clicking on the other (colored) tabs.

At the end of the program, adolescents were invited to follow the Facebook page of "E-health4Uth" to find additional information on the topics. Additionally, adolescents could check a box for a self-referral to the nurse or could send an email to the nurse. After 1 month, adolescents received a reminder of the tailored messages by email.

The E-health4Uth and counseling intervention

During a classroom session, adolescents in the E-health4Uth and counseling group completed the questionnaire assessing health-risk behaviors and well-being. This was the same questionnaire as the one that was applied in the E-health4Uth-only group. They also received the tailored messages, and were invited to follow the Facebook page (see "The E-health4Uth intervention"). Adolescents could also check a box for a self-referral to the nurse or could send an email to the nurse.

Additionally, in this group adolescents at risk of mental health problems were invited for a consultation with the nurse. Adolescents were classified as at risk of mental health problems when: their score on the total problem scale of the Strengths and Difficulties Questionnaire (SDQ) was higher than 16, and/or their score on the SDQ emotional problems was higher than 5, and/or they reported having suicidal thoughts occasionally, more frequently, or did not want to answer this question, and/or they reported a suicide attempt last year or did not want to answer this question.[31] The consultation took place at school. The nurses received the results of the assessment for each referred adolescent prior to the consultation. During the consultation the nurses focused on specific risk areas and referred adolescents to other professionals if considered necessary.

Control group

Adolescents in the control group completed the same questionnaire assessing health-risk behaviors and well-being as adolescents in the intervention groups. The control group received care as usual (i.e. adolescents could check a box for a self-referral with the nurse or could send an email to the nurse with any question or request for information or care). Due to the aim of this paper, this paper only uses this control group to assess the use and appreciation of the self-referred consultations (n = 14).

Measures

Evaluation of the Web-based, tailored messages

Immediately after receiving the tailored messages and after 4 months, the adolescents were invited to complete an online evaluation questionnaire on the appreciation and use of the tailored messages. Effect outcome measures were also included, but these measures are described elsewhere,[31] as they were not included in this study.

The use of the tailored messages was assessed with seven items. Immediately after adolescents received the tailored messages two items assessed the use of the messages:

(1) reading the tailored messages (having read the messages completely/partly, or not at all), and (2) viewing websites to which reference was made (yes or no/not yet). Five items assessed the use of the tailored messages at the 4-month follow-up: (1) viewing the Facebook page of E-health4Uth (yes or no), (2) discussing messages with parents (yes or no), (3) discussing messages with peers (yes or no), (4) adhering to the advice, and (5) changing own behavior in a positive way. The last two items were scored on 5-point Likert scales ranging from 1 (totally disagree, most negative evaluation) to 5 (totally agree, most positive evaluation).

Appreciation of the tailored messages was assessed with 11 items immediately after the adolescents received the tailored messages. Six items assessed if the content of the tailored messages was credible, easy to understand, personally relevant, gave the adolescents insight into their own behavior, contained new information, and was attractive to read. A further two items assessed whether the adolescent learned a lot and appreciated to get information in this manner. Finally, three items measured overall satisfaction with the program, the ease of use of the program, and if the program was interesting. These items on the appreciation of the tailored messages and the program were all scored on a 5-point Likert scale ranging from 1 (totally disagree, most negative evaluation) to 5 (totally agree, most positive evaluation) with exception of the overall satisfaction with the program, which was scored on a scale from 1 (most negative evaluation) to 10 (most positive evaluation).

Evaluation of the consultation

The use and appreciation of the consultation with the nurse was evaluated by computer log data and a paper-and-pencil questionnaire. That is, the number of adolescents that was referred or referred themselves to a nurse was measured objectively, based on computer log data. When adolescents attended the consultation, they were invited to complete a paper-and-pencil questionnaire about their appreciation of the consultation. The nurses noted whether or not the adolescents attended the consultation, and if the adolescent attended the consultation, they were invited to complete a written evaluation form regarding the consultation as well.

Various dimension of appreciation of the consultation were assessed among adolescents and nurses. One item measured the overall satisfaction with the consultation among adolescents on a scale from 1 (most-negative evaluation) to 10 (most-positive evaluation). Another two items evaluated the appreciation of being invited for consultation and whether the consultation was a valuable addition to the tailored messages among adolescents. These items were measured on 5-point Likert scales ranging from 1 (totally disagree, most negative evaluation) to 5 (totally agree, most positive evaluation). Two items addressed the nurse's evaluations of whether the referral was legitimate and whether the information on the referred adolescents was helpful. These two items were

also measured on a 5-point Likert scale ranging from 1 (not legitimate at all/very unhelpful) to 5 (completely legitimate/very helpful).

Demographics

Age (assessed by date of birth), gender, country of birth of the adolescent and both parents, and the level of education that the adolescents attended (i.e. vocational or pre-university education) were assessed in the evaluation questionnaire. Ethnicity was classified as Dutch or non-Dutch, in accordance with the definitions of Statistics Netherlands.[40] Adolescents with at least one parent born outside the Netherlands were classified as non-Dutch.

Statistical analysis

Overview

Descriptive statistics were used to describe both the study sample that received the tailored messages and the sample referred for consultation. Chi-square tests and independent samples *t* tests were conducted to test differences in demographic characteristics between both intervention groups. Descriptive statistics were also used to describe the use and appreciation of the tailored messages and the consultation. Chi-square tests (for dichotomous outcomes) and independent samples *t* tests or Mann-Whitney *U* tests (for ordinal outcomes) were conducted to test differences in use and appreciation according to: gender (boys versus girls), educational level (vocational versus pre-university), and ethnicity (Dutch versus non-Dutch). Independent samples *t* tests were used for analyzing data evaluating the tailored messages on 5- and 10-point scales. Because of the relative small sample size of the subsample receiving the consultation (n = 126), data evaluating the consultation on 5- and 10-point scales were checked for normality. For ordinal variables that were non-normally distributed, Mann-Whitney *U* tests were used.

Statistical analyses were performed using SPSS 20.0. Results were considered significant at $p < .05$.

Non-response analysis

A comparison of adolescents participating at follow-up (n = 822) with adolescents who were not participating at follow-up (n = 265) did not indicate significant differences in terms of educational level ($\chi^2_1 = 1.92$; $p = .17$) or gender ($\chi^2_1 = 0.64$; $p = .42$). However, the group participating at follow-up was more often of Dutch ethnicity ($\chi^2_1 = 32.12$; $p < .001$).

RESULTS

Adolescents' characteristics

The average age of adolescents who received the tailored messages was 15.9 years (SD = 0.72); 57.13% (621/1087) of the sample consisted of boys, 72.40% (787/1087) was of Dutch ethnicity, 52.53% (571/1087) attended vocational training, and 47.47% (516/1087) pre-university education (Table 1). Although adolescents in the E-health4Uth group were significantly younger than adolescents in the E-health4Uth and counseling group, the actual mean age difference was very small (mean = 15.9, SD = 0.73 vs. mean = 16.0, SD = 0.70, $p = .02$, respectively).

Table 1. General characteristics of the study population, and by intervention group (N = 1087)

	Total	**E-health4Uth**	**E-health4Uth + counseling**	
	N = 1087	n = 533	n = 554	*p* value
Age in years				
Mean age (SD)	15.9 (0.72)	15.9 (0.73)	16.0 (0.70)	**.02**[a]
Gender (%)				
Boys	57.1	55.2	59.0	.20[b]
Ethnicity (%)				
Dutch	72.4	74.1	70.8	.22[b]
Educational level (%)				
Vocational training	52.5	49.7	55.2	.07[b]

[a] Independent samples *t*-tests.
[b] Chi-square tests.

Adolescents' use of the Web-based, tailored messages

The results regarding the use of the tailored messages (E-health4Uth) are shown in Tables 2 and 3. During the school session, 81.72% (845/1034) of the adolescents read the messages, whereas 4.5% (38/841) of these adolescents also viewed the websites to which reference was made in these messages. After 4 months, 3.6% (29/814) of the adolescents had viewed the Facebook page of E-health4Uth. Of the adolescents who reported at follow-up that they read the messages, 18.4% (105/572) had discussed these messages with their parents and 24.0% (137/572) with their peers, 41.1% (235/572) reported that they could adhere to advice, and 21.5% (123/572) indicated that the messages changed their behavior in a positive way.

Adolescents receiving pre-university education read the tailored messages more often than adolescents in vocational training ($p < .001$), whereas adolescents in vocational training more often viewed the websites to which they were referred ($p < .001$), more often indicated that they could adhere to advice ($p < .001$), and had changed their

behavior accordingly in a positive way ($p < .001$). Adolescents of Dutch ethnicity and girls discussed the messages more often with their peers than adolescents of non-Dutch ethnicity ($p < .02$) and boys ($p < .04$), whereas adolescents of non-Dutch ethnicity more often indicated that they could adhere to advice ($p < .005$).

Table 2. Adolescents' use and appreciation of the tailored messages and the E-health4Uth program for the study sample and by educational level

	Total sample		**Educational level**		
			Vocational	Pre-university	*p* value
Use tailored messages	**% (n)**		**% (n)**	**% (n)**	
Read during school session	81.7 (845/1034)		76.4 (407/533)	87 4 (438/501)	<**.001**
Viewed websites to which reference was made (when read messages)	4.5 (38/841)		7.7 (31/403)	1.6 (7/438)	<**.001**
Viewed Facebook page of E-health4Uth [a]	3.6 (29/814)		4.3 (18/415)	2.8 (11/399)	.22
Discussed with parents[a]	18.4 (105/572)		21.1 (57/270)	15.9 (48/302)	.11
Discussed with peers[a]	24.0 (137/572)		21.9 (59/270)	25.8 (78/302)	.27
	% positive score[d] (n)	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	
Could adhere to advice[a,b]	41.1 (235/572)	3.24 (1.14)	3.47 (1.13)	3.04 (1.11)	<**.001**
Changed own behavior in a positive way[a,b]	21.5 (123/572)	2.69 (1.19)	2.89 (1.23)	2.52 (1.12)	<**.001**
Appreciation content tailored messages[b]	**% positive score[d] (n)**	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	
Credible	60.5 (510/843)	3.59 (0.96)	3.60 (0.98)	3.58 (0.94)	.70
Easy to understand	83.4 (703/843)	4.02 (0.83)	3.93 (0.92)	4.10 (0.74)	**.003**
Personal relevant	42.2 (356/843)	3.21 (1.06)	3.27 (1.03)	3.17 (1.08)	.17
Gave insight into own behavior	27.8 (234/843)	2.83 (1.11)	3.00 (1.12)	2.67 (1.08)	**<.001**
Contained new information	19.2 (162/843)	2.44 (1.14)	2.71 (1.18)	2.20 (1.05)	**<.001**
Attractive to read	28.8 (243/843)	2.89 (1.05)	2.94 (1.09)	2.85 (1.01)	.26
Learned a lot	25.1 (212/843)	2.80 (1.07)	2.95 (1.11)	2.66 (1.01)	**<.001**
Appreciated to get information in this manner	38.2 (332/843)	3.15 (1.02)	3.19 (1.05)	3.12 (0.99)	.36
Appreciation E-health4Uth program					
Overall satisfaction[c]		6.70 (1.60)	6.77 (1.81)	6.64 (1.39)	.26
Easy to use[b]	66.1 (557/843)	3.68 (0.93)	3.60 (0.95)	3.76 (0.91)	**.01**
Interesting [b]	31.0 (261/843)	2.96 (1.06)	3.03 (1.09)	2.89 (1.03)	.06

Note: SD, standard deviation; bold numbers indicate significant *p* values.

[a] Measured at follow-up.

[b] Scores on a 5-point Likert scale ranging from 1 (totally disagree) to 5 (totally agree).

[c] Scores on a 10-point Likert scale ranging from 1 (most-negative evaluation) to 10 (most-positive evaluation).

[d] Percentages of adolescents who scored a 4 *agree* or 5 *totally agree* on the 5-point Likert scale .

Adolescents' appreciation of the Web-based, tailored messages

Of the adolescents who had read the messages, a large majority (703/843, 83.4%; mean = 4.02, SD = 0.83) was positive about the ease to understand the messages (Table 2). More than half of the adolescents found the messages credible (510/843, 60.5%; mean = 3.59, SD = 0.96) and the program easy to use (557/843, 66.1%; mean = 3.68, SD = 0.93). On six other items, the adolescents evaluated the messages and the program about neutral (score 3 reflects not negative/not positive): personal relevance (mean = 3.21, SD = 1.06), appreciated getting information in this manner (mean = 3.15, SD = 1.02), gave insight into own behavior (mean = 2.83, SD = 1.11), attractive to read (mean = 2.89, SD = 1.05), learned a lot (mean = 2.80, SD = 1.07), and program was interesting (mean = 2.96, SD = 1.06). In general, adolescents evaluated the messages on containing new information as slightly negative (mean = 2.44, SD = 1.14), indicating that at least a part of the information in the messages was not new to the adolescents. Furthermore, adolescent's mean rating of the E-health4Uth program was positive, namely a 6.70 (SD = 1.60) on a scale from 1 (most-negative evaluation) to 10 (most-positive evaluation).

When considering subgroups, adolescents receiving pre-university education considered the messages easier to understand ($p = .03$) and the program easier to use ($p = .01$) than adolescents in vocational training (Table 3). Adolescents in vocational training appreciated the messages better than adolescents receiving pre-university education on three items; they rated the messages as containing more novel information ($p < .001$), providing them more insight into their own behavior ($p < .001$), and more instructive ($p < .001$). Adolescents of non-Dutch ethnicity also appreciated these three items better (i.e. contained new information, $p = .002$; gained insight into own behavior, $p = .02$; and learned a lot, $p = .002$), and they rated the program as more interesting than adolescents of Dutch ethnicity ($p = .004$). Furthermore, girls appreciated the messages and the program better than boys; girls found the messages more credible ($p = .03$) and easier to understand ($p = .002$). Furthermore, they were more satisfied with the program ($p = .005$), found the program easier to use ($p = .004$), and more interesting ($p = .006$) than boys.

Adolescents' use of the consultation

The results regarding the use of the consultation with the nurse are shown in Tables 4 and 5. Of the 554 adolescents in the E-health4Uth and counseling group, 103 (18.6%) adolescents were referred to a nurse. Adolescents were most often referred based on a high score (> 16) on the total problem scale of the SDQ (12.1% of the 18.6%, i.e. 65.0%; Table 4). Adolescents in the two intervention groups and the control group could also check a box for a self-referral; 44 of the 1702 adolescents checked the box for a self-

referral (2.6%). Three of these 44 adolescents were in the E-health4Uth and counseling group and at risk of mental health problems, and therefore already referred to a nurse.

Table 3. Adolescents' use and appreciation of the tailored messages and the E-health4Uth program by gender and ethnicity

	Gender			Ethnicity		
	Boys	Girls	*p* value	Dutch	Non-Dutch	*p* value
Use tailored messages	**% (n)**	**% (n)**		**% (n)**	**% (n)**	
Read during school session	80.2 (473/590)	83.8 (372/444)	.14	82.6 (624/755)	79.2 (221/279)	.20
Viewed websites to which reference was made (when read messages)	5.4 (25/467)	3.5 (13/374)	.19	3.7 (23/621)	6.8 (15/220)	.06
Viewed Facebook page of E-health4Uth [a]	3.5 (16/458)	3.7 (13/356)	.90	3.5 (22/625)	3.7 (7/189)	.90
Discussed with parents[a]	15.5 (45/290)	21.3 (60/282)	.08	18.5 (83/449)	17.9 (22/123)	.88
Discussed with peers[a]	20.3 (59/290)	27.7 (78/282)	**.04**	26.1 (117/449)	16.3 (20/123)	**.02**
	Mean (SD)	**Mean (SD)**		**Mean (SD)**	**Mean (SD)**	
Could adhere to advice[a,b]	3.21 (1.19)	3.28 (1.09)	.46	3.17 (1.12)	3.50 (1.16)	**.005**
Changed own behavior in a positive way[a,b]	2.69 (1.22)	2.70 (1.15)	.98	2.71 (1.16)	2.65 (1.28)	.65
Appreciation content tailored messages[b]	**Mean (SD)**	**Mean (SD)**		**Mean (SD)**	**Mean (SD)**	
Credible	3.53 (1.00)	3.67 (0.89)	**.03**	3.57 (0.92)	3.65 (1.05)	.30
Easy to understand	3.94 (0.91)	4.11 (0.71)	**.002**	4.01 (0.80)	4.02 (0.93)	.91
Personal relevant	3.21 (1.08)	3.22 (1.03)	.96	3.19 (1.03)	3.28 (1.23)	.27
Gave insight into own behavior	2.79 (1.15)	2.88 (1.06)	.21	2.78 (1.09)	2.98 (1.16)	**.02**
Contained new information	2.41 (1.16)	2.48 (1.11)	.42	2.37 (1.11)	2.64 (1.21)	**.002**
Attractive to read	2.84 (1.08)	2.96 (1.02)	.10	2.87 (1.02)	2.96 (1.14)	.25
Learned a lot	2.76 (1.12)	2.85 (1.00)	.22	2.73 (1.02)	3.00 (1.18)	**.002**
Appreciated to get information in this manner	3.12 (1.05)	3.20 (0.98)	.27	3.13 (1.01)	3.20 (1.05)	.42
Appreciation E-health4Uth program						
Overall satisfaction[c]	6.57 (1.75)	6.87 (1.39)	**.005**	6.72 (1.54)	6.65 (1.78)	.56
Easy to use[b]	3.60 (0.98)	3.79 (0.86)	**.004**	3.72 (0.90)	3.58 (1.02)	.08
Interesting	2.87 (1.07)	3.07 (1.04)	**.006**	2.90 (1.04)	3.13 (1.11)	**.004**

Note: SD, standard deviation; bold numbers indicate significant *p* values.

[a] Measured at follow-up.

[b] Scores on a 5-point Likert scale ranging from 1 (totally disagree) to 5 (totally agree).

[c] Scores on a 10-point Likert scale ranging from 1 (most-negative evaluation) to 10 (most-positive evaluation).

One hundred twenty-six of 144 adolescents who were referred or self-referred attended the consultation (87.5%). The average age of adolescents who presented for the consultations was 16 years (SD 0.73); 50.7% of this sample consisted of boys, 61.4% was of Dutch ethnicity, and 66.4% attended vocational training.

Table 4. Description of adolescents' use and appreciation of the consultation for the study sample and by educational level

	Total sample		**Educational level**		
			Vocational	Pre-university	*p* value
Use of consultation	**% (n)**		**% (n)**	**% (n)**	
Referred to a nurse	18.6 (103/553)		22.6 (69/305)	13.7 (34/248)	**.007**
Total SDQ score > 16	12.1 (67/553)		14.8 (45/305)	8.9 (22/248)	**.035**
SDQ subscale emotional problems > 5	7.2 (40/553)		7.9 (24/305)	6.5 (16/248)	.52
Suicidal thoughts 'occasionally' or more often	4.0 (22/553)		3.9 (12/305)	4.0 (10/248)	.95
Did not want to answer question about suicidal thoughts	4.7 (26/553)		6.2 (19/305)	2.8 (7/248)	.06
Suicide attempt last year	0.7 (4/553)		1.0 (3/305)	0.4 (1/248)	.42
Did not want to answer question about suicidal attempt last year	3.6 (20/553)		4.6 (14/305)	2.4 (6/248)	.17
Asked for a referral	2.6 (44/1702)[a]		3.0 (27/914)	2.2 (17/788)	
Attending consultation	87.5 (126/144)		91.5 (86/94)	80.0 (40/50)	**.047**
ADOLESCENT					
Appreciation of consultation	**% positive score[c] (n)**	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	
Overall satisfaction[b]		8.07 (1.21)	8.07 (1.00)	8.08 (1.58)	.42[e]
Appreciated to be invited[c]	65.9 (83/126)	3.70 (1.10)	3.81 (1.05)	3.45 (1.18)	.09[e]
Valuable addition to the tailored messages[c]	64.3 (81/126)	3.85 (1.04)	3.99 (0.98)	3.55 (1.11)	**.03**[e]
NURSE					
Appreciation of consultation					
Referral was legitimate[c]	70.8 (63/89)	3.53 (1.00)	3.60 (0.99)	3.35 (1.02)	.21[e]
Self-referral was legitimate[c]	56.8 (21/37)	3.30 (1.15)	3.17 (1.19)	3.50 (1.09)	.45[e]
Information of the adolescent was helpful[c]	80.0 (88/110)	3.83 (0.86)	3.75 (0.92)	3.97 (0.71)	.21[e]

Note: SD, standard deviation; bold numbers indicate significant *p* values.

[a] Three of the 44 adolescents who asked for a referral were in the E-health4Uth + counselling group and at risk of mental health problems, and therefore also referred to a nurse.

[b] Scores on a 10-point Likert scale ranging from 1 (most-negative evaluation) to 10 (most-positive evaluation).

[c] Scores on a 5-point Likert scale ranging from 1 (most-negative evaluation) to 5 (most-positive evaluation).

[d] Percentages of adolescents or nurses who scored a 4 *agree/legitimate/helpful* or 5 *totally agree/completely legitimate/very helpful* on the 5-point Likert scale.

[e] Mann-Whitney *U*-test.

Table 5. Description of adolescents' use and appreciation of the consultation by gender and ethnicity

	Gender			Ethnicity		
	Boys	Girls	*p* value	Dutch	Non-Dutch	*p* value
Use of consultation	**% (n)**	**% (n)**		**% (n)**	**% (n)**	
Referred to a nurse	15.6 (51/326)	22.9 (52/227)	**.03**	17.6 (69/391)	21.0 (34/162)	.36
Total SDQ score > 16	11.3 (37/326)	13.2 (227)	.51	11.5 (45/391)	13.6 (22/162)	.50
SDQ subscale emotional problems > 5	3.4 (11/326)	12.8 (29/227)	**<.001**	8.7 (34/391)	3.7 (6/162)	**.039**
Suicidal thoughts 'occasionally' or more often	4.0 (13/326)	4.0 (9/227)	.99	4.3 (17/391)	3.1 (5/162)	.49
Did not want to answer question about suicidal thoughts	4.3 (14/326)	5.3 (12/227)	.59	2.8 (11/391)	9.3 (15/162)	**.001**
Suicide attempt last year	0.6 (2/326)	0.9 (2/227)	.72	1.0 (4/391)	0.0 (0/162)	.20
Did not want to answer question about suicidal attempt last year	3.4 (11/326)	4.0 (9/227)	.71	2.0 (8/391)	7.4 (12/162)	**.002**
Asked for a referral	2.6 (24/906)	2.5 (20/796)	.86	1.7 (20/1207)	4.8 (24/495)	**<.001**
Attending consultation	84.9 (62/73)	90.1 (64/71)	.35	84.1 (74/88)	92.9 (52/56)	.12
ADOLESCENT						
Appreciation of consultation	**Mean (SD)**	**Mean (SD)**		**Mean (SD)**	**Mean (SD)**	
Overall satisfaction[a]	8.20 (0.98)	7.95 (1.39)	.47[c]	8.10 (0.97)	8.04 (1.50)	.85[c]
Appreciated to be invited[b]	3.69 (0.97)	3.70 (1.22)	.55[c]	3.59 (1.03)	3.85 (1.18)	.11[c]
Valuable addition to the tailored messages[b]	3.92 (1.00)	3.78 (1.08)	.50[c]	3.70 (1.14)	4.06 (0.83)	.13[c]
NURSE						
Appreciation of consultation						
Referral was legitimate[b]	3.53 (0.98)	3.52 (1.03)	.90[c]	3.66 (0.88)	3.27 (1.17)	.16[c]
Self-referral was legitimate[b]	3.00 (1.20)	3.61 (1.04)	.13[c]	3.07 (1.16)	3.45 (1.14)	.33[c]
Information of the adolescent was helpful[b]	3.73 (1.01)	3.90 (0.72)	.47[c]	3.98 (0.62)	3.59 (1.09)	.06[c]

Note: SD, standard deviation; bold numbers indicate significant *p* values.
[a] Scores on a 10-point Likert scale ranging from 1 (most-negative evaluation) to 10 (most-positive evaluation).
[b] Scores on a 5-point Likert scale ranging from 1 (most-negative evaluation) to 5 (most-positive evaluation).
[c] Mann-Whitney *U*-test.

Adolescents in vocational training were more often referred to a nurse because of a high total problem score on the SDQ than adolescents receiving pre-university education ($p = .035$), whereas girls and adolescents of Dutch ethnicity were more often referred to a nurse because of a high score on the SDQ emotional problems subscale than boys ($p < .001$) and adolescents of non-Dutch ethnicity ($p = .039$). Adolescents of non-Dutch ethnicity were more often referred to a nurse because they did not want to answer the question about suicidal thoughts ($p = .002$) and/or suicide attempts ($p = .001$) than ado-

lescents of Dutch ethnicity. Adolescents of non-Dutch ethnicity more often asked for a referral than adolescents of Dutch ethnicity ($p < .001$), whereas adolescents in vocational training attended the consultation more often than adolescents receiving pre-university education ($p = .047$).

Adolescents' and nurses' appreciation of the consultation

Adolescents appreciated being invited for the consultation (mean = 3.70, SD = 1.10), found the consultation a valuable addition to the tailored messages (mean = 3.86, SD = 1.03), and they gave the consultation a positive mean rating of 8.07 on a 10-point scale (SD = 1.21). Adolescents in vocational training considered the consultation a more valuable addition to the Web-based, tailored messages than adolescents receiving pre-university education ($p = .034$).

After the consultation, nurses evaluated most referrals for the adolescents at risk of mental health problems (63/89, 70.8%; mean = 3.53, SD = 1.00) and for adolescents that self-referred (21/37, 56.8%; mean = 3.30, SD = 1.15) as legitimate. In most cases (88/110, 80.0; mean = 3.83, SD = 0.86), the nurses also rated the information they received about the adolescents prior to the consultation as helpful.

DISCUSSION

Principal results

In the present study, we evaluated the use and appreciation of two interventions (E-health4Uth and E-health4Uth and counseling) applied by preventive youth health care in secondary schools. Results showed that most adolescents had read the tailored messages and evaluated the use and appreciation of the tailored messages and the E-health4Uth program overall as positive. In general, adolescents in vocational training, girls, and adolescents of non-Dutch ethnicity used the Web-based, tailored messages more and appreciated them better than adolescents receiving pre-university education, boys, and adolescents of Dutch ethnicity, respectively. Adolescents in vocational training and girls were more often referred to a nurse than adolescents receiving pre-university education and boys, respectively. Adolescents of Dutch and non-Dutch ethnicity were as often referred to a nurse, but for different reasons. Adolescents of Dutch ethnicity were more often referred because of a high score on the SDQ emotional problems subscale, whereas adolescents of non-Dutch ethnicity were more often referred because they did not want to answer questions about suicidal thoughts and suicide attempts. Adolescents of non-Dutch ethnicity asked for a referral more often than adolescents of Dutch ethnicity, whereas adolescents in vocational training attended the consultation more often than adolescents receiving pre-university education. The adolescents who

attended the consultation evaluated the consultation positively, just as the nurses did. Adolescents, especially those in vocational training, considered the consultation a valuable addition to the Web-based, tailored messages.

Interpretation

This study indicates that Web-based tailoring is useful in a preventive-care setting to provide adolescents with information about their lifestyle behaviors and well-being. Other studies in which tailored messages were used among adolescents have shown comparable ratings of use and appreciation of tailored messages about health and healthy behavior.[22,41,42] Adolescents in the E-MOVO (Electronic Monitor and Health Education) study, in which similar tailored messages were used, appreciated the messages slightly more than adolescents in our study with regard to credibility, personal relevance, giving insight into own behavior, and ease of understanding.[43] However, in the E-MOVO study the response rate of the evaluation questionnaire was very low (i.e. only 3%). Therefore, perhaps only the highly-motivated adolescents completed the evaluation questionnaire, which could have resulted in a more positive rating.

Results of earlier studies[28,41] and this study show that a vast majority of the adolescents had read the messages. This indicates that adolescents are interested in receiving feedback on lifestyle behaviors and well-being when communicated through the Internet. Furthermore, Web-based tailoring seems an appropriate way to adjust messages to adolescents' needs of information on their lifestyle behaviors and well-being in a preventive-care setting. It must be noted though that the percentage of adolescents that clicked on a link or viewed the Facebook page to obtain additional information on the various topics in the intervention was relatively low. This could be due to the messages already containing enough information, the adolescents not wanting to obtain more information, or adolescents not wanting to be continually sent "off-site" from the intervention page to view information.[44] Beside these explanations, visiting Facebook is often not allowed at schools, and therefore maybe not preferable to use in this context.

Furthermore, approximately 20% of the adolescents indicated they had discussed the messages with their parents or peers. In a study of Ezendam et al.,[41] which used Web-based, tailored messages on dietary and physical activity, 40% of the adolescents indicated that they discussed the messages with their parents or peers. Although in our study, fewer adolescents discussed the messages with their parents or peers, this still may be an indication that adolescents, to some extent, actively process the information, a prerequisite for behavior change.[35,36] Moreover, the rationale behind using tailored messages is that the information is personally relevant, new, giving insight into own behavior, and is interesting, which results in greater attention and more thoughtful consideration of the information.[13,45] In our study, these items regarding personal relevance, giving insight into own behavior, and finding it interesting were evaluated as neutral

and at least part of the information in the messages was not new to the adolescents. Therefore, the tailored messages in this study possibly need further improvement, which may result in the messages becoming even more effective. The current messages could be further tailored using, for example, demographics, personal cognitive factors (e.g. manner in which health risks are perceived by the individual), social factors (e.g. susceptibility to social pressure from peers), or self-efficacy of the individual (e.g. judgment of capability to change unhealthy behavior).[46,47]

The differences in use and appreciation of the tailored messages according to demographics of the adolescents found in our study also support the need to further tailor the messages to the individual adolescents' needs. That is, in line with the research of Ezendam et al.,[41] in our study, adolescents receiving pre-university education perceived the messages as easier to understand than adolescents in vocational training. An explanation for this finding, which is supported by research of Ezendam et al.[41] and our results on the novelty of the information, may be that the information was already familiar to adolescents receiving pre-university education. Therefore, we suggest that messages should be tailored to educational level. This is important as lesser-educated adolescents tend to have a less healthy lifestyle and they rate their well-being as lower compared with higher-educated people.[2,41,48] However, effects for other demographics were also found. Additional analyses (data not shown) showed that the various demographics (i.e. level of education, gender, and ethnicity) had an effect on the use and appreciation of the tailored messages independent of each other, indicating it is important to use multiple characteristics to best tailor these messages.

Although the tailored messages have the potential to reach large groups of adolescents in a very cost-effective manner,[13] the consultation with the nurse was rated more positively. This was supported by additional analyses with the subsample of adolescents who evaluated the tailored messages and received and evaluated the consultation. These analyses showed similar results on the use and appreciation of the tailored messages for the subsample of adolescents compared with the whole group

of adolescents (data not shown). The more positive evaluation of the consultation in comparison with the tailored messages could have been due to the interaction between the nurse and adolescent during the consultation, as previous research has shown that interaction in health communication could improve patient satisfaction.[49,50] Furthermore, the collected information on adolescents' health prior to the consultation could have supported the nurse during the consultation to better tailor the provided information to the adolescent's needs. Sciamanna et al.[27] have shown that discussing previously collected information with a patient during a consultation could improve patient satisfaction as well. Therefore, the consultation seems a valuable addition to the Web-based, tailored messages for adolescents at risk of mental health problems and for adolescents wanting a referral to the nurse.

Finally, as expected, approximately one-fifth of the adolescents met the inclusion criteria for an appointment with the nurse.[31] In line with previous studies,[2,51] adolescents in vocational training were more often at risk of mental health problems than adolescents receiving pre-university education, whereas girls and adolescents of Dutch ethnicity were more often at risk of emotional problems than boys and adolescents of non-Dutch ethnicity. Adolescents of non-Dutch ethnicity more often did not want to answer the questions about suicidal thoughts and suicide attempt. It is possible that the stigma associated with suicidal thoughts and suicide attempts among some cultural groups may have contributed to not wanting to answer the questions regarding these issues.[52,53] Adolescents of non-Dutch ethnicity more often asked for a referral than adolescents of Dutch ethnicity, which is in line with, for example, the more frequent use of the general practitioner by ethnic minorities in the Netherlands.[54]

In this study, as well as in another study in a similar setting,[28] most adolescents attended the consultation, and in most cases nurses evaluated the referral as legitimate and the information they received on the adolescent prior to the consultation as helpful. This may indicate that the criteria we used to select adolescents at risk of mental health problems were suitable and selected adolescents were willing to attend the consultation with the nurse. Furthermore, the information regarding adolescents' health and health behavior from the E-health4Uth tool to facilitate communication during consultation seemed appropriate.

Strengths and limitations

The response rate on the evaluation questionnaires was relatively high and our study population resembles the average Dutch adolescent population in secondary schools in gender, ethnicity, and educational level.[55] However, this study was only conducted among Dutch adolescents of ages 15–16 years in a preventive-care setting and therefore generalization to other countries, age groups, and settings should be done with caution. Because adolescents' response was not anonymous, but confidential due to the necessity to match the follow-up data and to provide the nurse with information about the adolescents who were invited for the consultation, this could have had an effect on the social desirability of the adolescent's responses. However, a previous study showed that anonymous and confidential collection of data revealed similar results on adolescents' self-report measures of various (psychological) health indicators.[56]

A strength of this study is the focus on multiple behaviors, which is also becoming an increasingly popular strategy in research on the effectiveness of Web-based, tailored messages.[57-60] However, due to this focus on multiple behaviors, adolescents received a lot of information and it is conceivable that adolescents became overwhelmed due to the amount of information and may have read the information less carefully. Future studies might therefore consider reducing the number of topics or offering the multiple

tailored messages consecutively at different points in time.[60] Moreover, the current messages could be further tailored by using demographics, personal cognitive factors, social factors, or self-efficacy of the individual to show healthy behavior.

A strength of the interventions is the adaptability to other settings. For example, the tailored messages could be embedded in the school's health promotion curriculum, and offered at relevant moments in the curriculum. But it is also possible that the assessment takes place at home and the subsequent consultation at the preventive health care organization. However, future research is required to investigate the application of the interventions in other settings. Finally, it is possible that some adolescents have mainly read the messages because they had to attend their class anyway. Nevertheless, our study showed that the adolescents rated the messages overall as positive, indicating that regardless of their motivation to participate they appreciated the content of the messages.

Conclusions

The Web-based, tailored messages and additional consultation were used and appreciated positively by adolescents and nurses. The consultation seems a valuable addition to the tailored messages for adolescents at risk of mental health problems and for adolescents wanting a referral to the nurse. However, the tailored messages may need further improvement, since adolescents did not rate all the evaluation items on the messages as positive. As these interventions were already interweaved with the existing practice of the preventive youth health care, they are especially promising for future implementation. Furthermore, algorithms generating tailored information can be easily extended using more characteristics of the adolescent to tailor the messages, and wide-scale distribution can be arranged at relatively low cost. Future research is necessary to investigate the possible effects of the Web-based, tailored messages and the consultation with the nurse on the well-being and health behaviors of adolescents.

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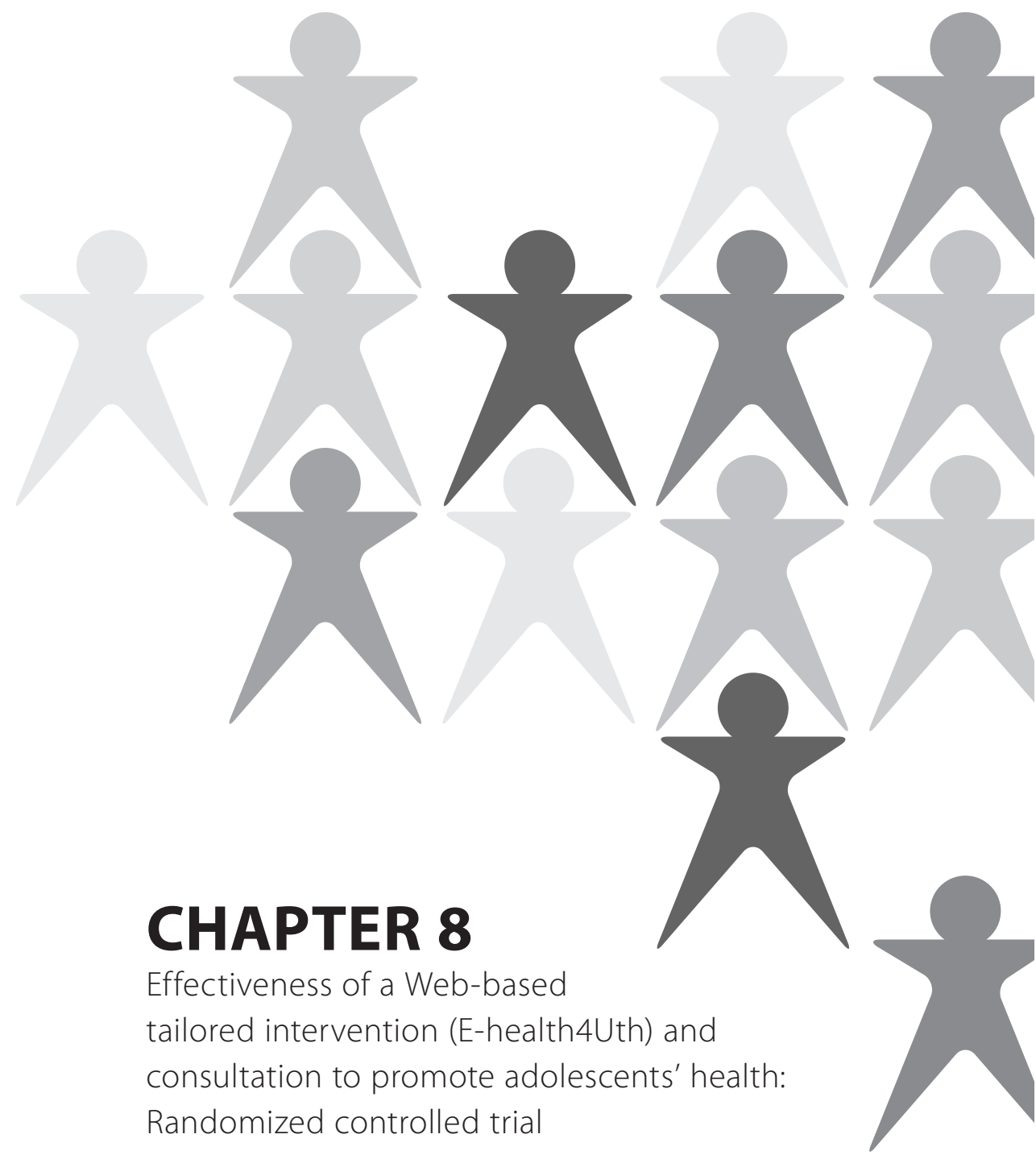
Appendix 1. Topics of the E-health modules

Behavior and well-being	Items
Alcohol consumption	How often and how much the adolescent drinks alcohol (9 items)
Drugs use	How often the adolescents has used different types of drugs (17 items)
Smoking	How often the adolescent smokes (2 items)
Sexual behavior	How often the adolescent uses condoms during sexual intercourse (2 items)
Bullying	How often the adolescent is bullied at school, somewhere else or on the internet (3 items)
Mental health status	Strength and Difficulties Questionnaire (SDQ) (25 items) with a total score range 0–40
Suicidal thoughts	If the adolescent has had suicidal thoughts last year (1 item)
Suicidal attempts	If the adolescent made a suicidal attempt last year (1 item)
Unpleasant sexual experience	If the adolescent has ever had an unpleasant sexual experience (1 item)



CHAPTER 8

Effectiveness of a Web-based tailored intervention (E-health4Uth) and consultation to promote adolescents' health: Randomized controlled trial

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ABSTRACT

Background

To promote well-being and health behaviors among adolescents, 2 interventions were implemented at 12 secondary schools. Adolescents in the E-health4Uth group received Web-based tailored messages focused on their health behaviors and well-being. Adolescents in the E-health4Uth and consultation group received the same tailored messages, but were subsequently referred to a school nurse for a consultation if they were at risk of mental health problems.

Objective

This study evaluated the effect of E-health4Uth and E-health4Uth and consultation on well-being (i.e. mental health status and health-related quality of life) and health behaviors (i.e. alcohol and drug use, smoking, safe sex).

Methods

A cluster randomized controlled trial was conducted among third- and fourth-year secondary school students (mean age = 15.9, SD = 0.69). School classes (clusters) were randomly assigned to (1) E-health4Uth group, (2) E-health4Uth and consultation group, or (3) control group (i.e. care as usual). Adolescents completed a questionnaire at baseline and at 4-month follow-up assessing alcohol consumption, smoking, drug use, condom use, mental health via the Strengths and Difficulties Questionnaire (SDQ) and the Youth Self Report (YSR; only measured at follow-up), and health-related quality of life. Multilevel logistic, ordinal, and linear regression analyses were used to reveal differences in health behavior and well-being between the intervention groups and the control group at follow-up. Subsequently, it was explored whether demographics moderated the effects.

Results

Data from 1256 adolescents were analyzed. Compared to the control intervention, the E-health4Uth intervention, as a standalone intervention, showed minor positive results in health-related quality of life (B = 2.79, 95% CI = 0.72 – 4.87) and condom use during intercourse among adolescents of Dutch ethnicity (OR = 3.59, 95% CI = 1.71 – 7.55) not replicated in the E-health4Uth and consultation group. The E-health4Uth and consultation intervention showed minor positive results in the mental health status of adolescents (SDQ: B = −0.60, 95% CI = −1.17 to −0.04), but a negative effect on drug use among boys (OR = 0.36, 95% CI = 0.13 – 0.96). In the subgroup of adolescents who were at risk of mental health problems at baseline (and referred for a consultation with the nurse), the E-health4Uth and consultation group showed minor to moderate positive results

in mental health status (SDQ: B = −1.79, 95% CI = −3.35 to −0.22; YSR: B =−9.11, 95% CI = −17.52 to −0.71) and health-related quality of life (B = 7.81, 95% CI = 2.41 – 13.21) at follow-up compared to adolescents in the control group who were at risk of mental health problems at baseline.

Conclusions

Findings from this study support the use of the E-health4Uth and consultation intervention in promoting the well-being of adolescents at risk of mental health problems. Future research is needed to further evaluate the effects of the consultation as a stand-alone intervention, and the dual approach of further tailored eHealth messages and a consultation.

Trial registration

Nederlands Trial Register: NTR 3596;
http://www.trialregister.nl/trialreg/admin/rctview.asp?TC=3596
(Archived by WebCite at http://www.webcitation.org/6PmgrPOuv).

INTRODUCTION

Background

A high percentage of adolescents suffer from mental health problems, and many health-risk behaviors, such as excessive alcohol consumption, cigarette smoking, use of drugs, and having unsafe sex, are acquired during adolescence.[1] These mental health problems and health-risk behaviors often persist into adulthood, thereby affecting not only current health but also health later in life.[2-4] Given this, reducing the burden of adolescent mental health problems and health-risk behaviors is a major public health priority, one in which preventive youth health care can play an important role.

Many countries have established preventive youth health care, which refers to a variety of activities aimed at improving and protecting the health, growth, and development of young people. These activities include a system of child health care, which serves children from birth through to 18 years. In the Netherlands, all children and adolescents are invited by youth health care organizations to attend regularly scheduled preventive health consultations until the age of 13 years.[5] These consultations with a nurse or physician focus on growth, development, health functioning, and behaviors of infants, children, and adolescents. Furthermore, the consultations are funded by the government, are free of charge, and take place at the preventive youth health care center or at school. Given the rapid rate of maturation in adolescence and the mental health problems and health-risk behaviors associated with this developmental period, the government in the Netherlands encourages an additional preventive health consultation at age 15–16 years.[6]

Previous research shows the use of Web-based applications for delivering tailored preventive messages in current preventive youth health care practice to be a promising development.[7-9] Web-based tailoring is a health education technique that enables the adaptation of information to individual characteristics. Web-based tailored messages eliminate (as far as possible) information that is not personally relevant[10,11] and are, therefore, more likely to be effective in changing behavior compared to non-tailored messages.[11] Additionally, they facilitate the enhanced efficiency of face-to-face consultations by collecting information on adolescents' health before the consultation, which a professional can use during the consultation.[7,12,13]

To promote well-being and health behaviors among adolescents, 2 interventions using Web-based tailored messages (E-health4Uth and E-health4Uth and consultation) were implemented in a preventive youth health care setting. The Web-based tailored messages focused on topics related to health-risk behaviors (e.g. alcohol consumption, smoking) and well-being (e.g. mental health status, suicidal thoughts). Both interventions used the same Web-based tailored messages, which were developed for adolescents (aged 12–18 years) in an earlier study.[14] In the E-health4Uth and consulta-

tion group, adolescents who were at risk of mental health problems were also referred to a school nurse for a consultation. Consequently, the intervention in this subgroup was more extensive. To facilitate communication during the consultations,[7] the nurses received information regarding the adolescents' well-being and health behaviors from the E-health4Uth tool, with the adolescents' knowledge. A first investigation showed that the Web-based tailored messages and additional consultation were positively experienced by the adolescents and nurses alike.[15] However, the effectiveness of these interventions are currently unknown.

Objective of the study

This study evaluates the effect of E-health4Uth and E-health4Uth and consultation on well-being (i.e. mental health status and health-related quality of life) and health behaviors (i.e. alcohol and drug use, smoking, safe sex) as applied by preventive youth health care in secondary schools. The hypotheses of the study are twofold. First, it is expected that adolescents in the E-health4Uth group will show a higher level of well-being and less risky behavior at 4-month follow-up compared to the control group (i.e. care as usual). Second, it is expected that adolescents in the E-health4Uth and consultation group will show a higher level of well-being and less risky behavior (alcohol and drug use, smoking, safe sex) at 4-month follow-up compared to the control group (i.e. care as usual). In addition, to gain more insight into the combined effect of E-health4Uth with a consultation, we assessed effects on well-being in the subgroup of adolescents' at risk of mental health problems at baseline, because only these adolescents were invited for a consultation with the nurse.

METHODS

Study design

A 3-armed cluster randomized controlled trial (RCT) was conducted from September 2012 to May 2013 with measurements at baseline and 4 months after the baseline measurement (trial registration: Current Controlled Trials NTR3596). The interventions were applied by preventive youth health care in secondary schools. School classes (clusters) were randomly assigned to one of the study arms (i.e. E-health4Uth, E-health4Uth and consultation, control group). School classes were the unit of randomization because randomization at the individual level (i.e. the level of the adolescents) can lead to contamination of the control group.[16] A computer-generated list of random numbers was used to allocate the school classes (clusters) to one of the study arms. The randomization sequence was stratified with a 1:1:1 allocation using random block sizes of 3. This list was prepared by an investigator with no involvement in the trial and was applied by

the researchers. The research proposal was reviewed by the Daily Board of the Medical Ethical Committee of Erasmus MC. As a result of this review, the Committee declared that the Medical Research Involving Human Subjects Act (also known by its Dutch abbreviation WMO) did not apply to this research proposal. The Medical Ethical Committee had no objection to the execution of this research proposal (MEC-2012-337). Further details about the study design and the interventions are provided in a design paper published elsewhere.[17]

Participants and procedures

Two youth health care organizations in the Dutch cities of Dordrecht and Zwijndrecht participated in this study and conducted the interventions in secondary schools. Of the 14 secondary schools invited by the youth health care organizations to participate in the study, 12 agreed and provided a total of 11 classes of third-year students (2 schools) and 75 classes of fourth-year students (10 schools). In the Netherlands, adolescents in the third and fourth years of secondary school are on average 15–16 years of age.

A few weeks before the start of the study, all adolescents and parents received information about the study. If parents did not want their child to participate, they could object to their child's participation. Adolescents were asked to provide written consent before they completed the baseline questionnaire. Of the 1989 eligible adolescents, 1702 (85.57%) participated: 533 (84.7%) in the E-health4Uth group, 554 (84.2%) in the E-health4Uth and consultation group, and 615 (87.6%) in the control group (Figure 1). The main reason for nonparticipation was absence, primarily because of illness. Furthermore, 29 parents refused their child's participation and 24 adolescents refused participation themselves.

At 4-month follow-up, 3 schools did not schedule the follow-up classroom assessments for all or several classes (missing data from 14 classes). At the remaining schools, 135 adolescents were absent at follow-up. In total, 1256 adolescents participated at 4-month follow-up (73.79%): 392 of 533 in the E-health4Uth group (73.5%), 430 of 554 in the E-health4Uth and consultation group (77.6%), and 434 of 615 in the control group (70.6%).

The E-health4Uth intervention

During one classroom session (approximately 45 min), adolescents completed a self-report questionnaire via the Internet to assess health-risk behavior and well-being with respect to the following topics: alcohol consumption, drug use, smoking, sexual behavior, bullying, mental health status, suicidal thoughts, suicide attempts, and unpleasant sexual experiences (Multimedia Appendix 1). This questionnaire served as a basis to tailor the messages, but also as a baseline measurement for the effect evaluation. The questionnaire was constructed based on several existing instruments used by

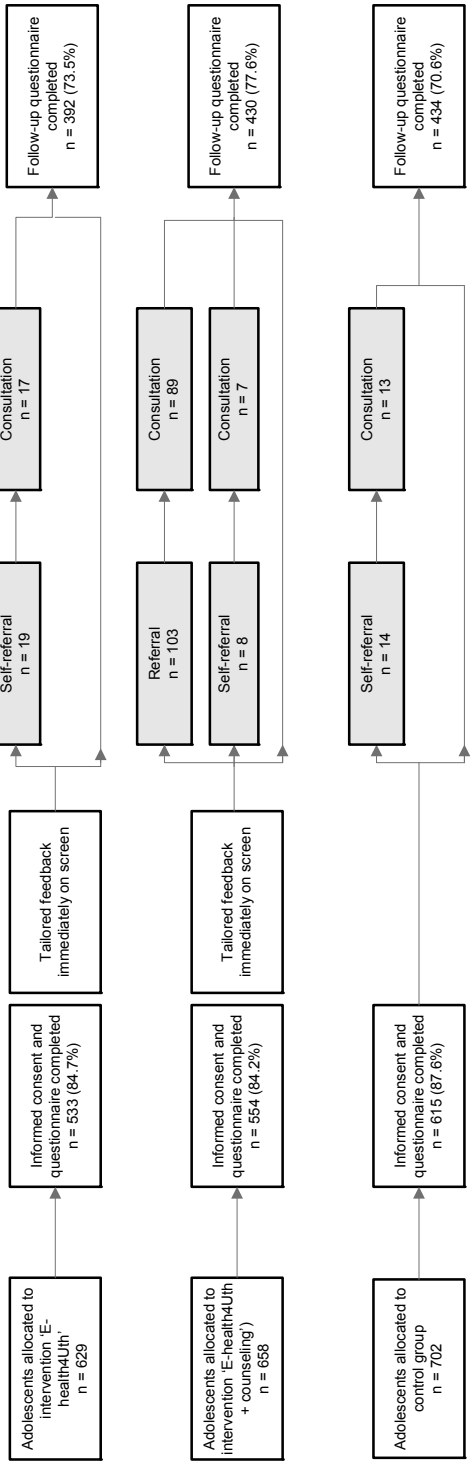

Figure 1. Flow chart of the adolescents' participation

municipal public health services and health institutes.[18] Consensus on the use of these instruments was established by the National Institute for Public Health and Environment (RIVM), the Dutch association for residential and homecare organizations and infant and child health clinics (Actiz), and the Association of Municipal Public Health Services in the Netherlands (GGD Nederland).

After completing the questionnaire, the participants were presented with a message of approximately the same length for each topic (see Figure 2 for an example of a message on one topic). We used Web-based tailored messages that were developed for adolescents (aged 12–18 years) and applied in an earlier study.[14] The messages were developed by the Department of Health Promotion and Health Education of the University of Maastricht. The messages were tailored to the answers given in the questionnaire. Tailored feedback is more useful in motivating people to perform the desired behaviors than non-tailored feedback.[11] It also provides the opportunity to give normative feedback (i.e. a comparison between individual responses and the health norms) and positive feedback to reinforce desired states, both of which were used in this study.

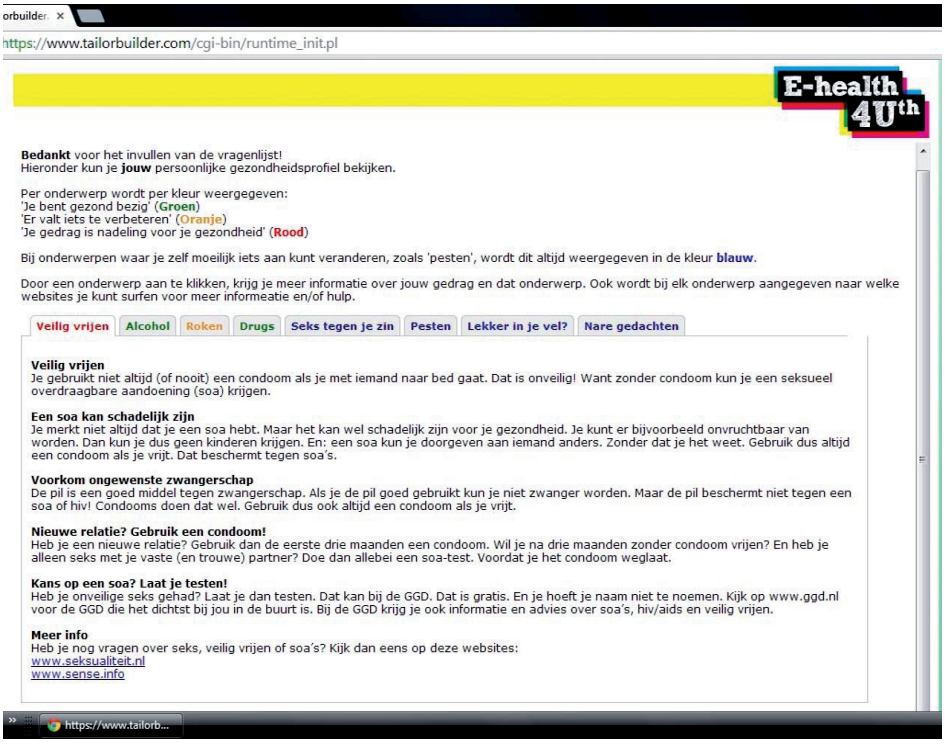

Figure 2. Screenshot of the Web-based tailored messages. This message was presented to adolescents who answered that they have had unsafe sex (left-most tab). The message is displayed in red, indicating unhealthy behavior. The messages on the other topics are presented when clicking on the other (colored) tabs.

For each topic, a score was computed which was compared with the Dutch health norms for adolescents.[14,18,19] Based on this score, a message was immediately presented on the screen that reflected the person's current behavior or well-being in relation to the Dutch health norm, and the adolescent was offered advice to change unhealthy behavior and/or to talk to a person of trust (Figure 2). The messages were displayed in red, orange, or green, indicating unhealthy behavior, behavior just below the norm, or behavior meeting the Dutch health norm, respectively. The topics on well-being were always displayed in blue.

With links to relevant websites, adolescents were encouraged to read more information on the topics. At the end of the program, adolescents were invited to follow the Facebook page of E-health4Uth to find more information on the topics. Additionally, adolescents could check a box for a self-referral to the nurse or could send an email to the nurse. After 1 month, adolescents received a reminder of the tailored messages by email.

The E-health4Uth and consultation intervention

During a classroom session, adolescents in the E-health4Uth and consultation group completed the same questionnaire and received the same intervention as that applied in the E-health4Uth-only group. Additionally, adolescents at risk of mental health problems were invited for a consultation with the nurse. Adolescents were classified as at risk of mental health problems when their score on the total problem scale of the Strengths and Difficulties Questionnaire (SDQ) was higher than 16, and/or their score on the SDQ for emotional problems was higher than 5, and/or they reported having suicidal thoughts occasionally or more frequently (or did not want to answer this question), and/or they reported a suicide attempt within the past year (or did not want to answer this question).[17]

The consultation took place at school and was provided by school nurses who were already working at the schools and who had already provided consultations to adolescents at approximately 13 years of age. These nurses were trained to apply motivational interviewing with adolescents at age 15–16 years. They received the results of the assessment for each referred adolescent before the consultation. During the consultation, the nurses focused on specific risk areas and on mental health in particular. Furthermore, they either initiated a further consultation with themselves or referred adolescents to another professional if they deemed this necessary.

Control group

Adolescents in the control group completed the same questionnaire assessing health-risk behaviors and well-being as adolescents in the intervention groups, with the exception of the questions on unpleasant sexual experience, suicidal thoughts, and

suicidal attempts, because these questions were used only to tailor the messages in the intervention group, not as measurements to assess the effectiveness of the interventions.[17] Adolescents in the control group received no messages afterwards based on their scores.

Measures

Overview

The primary outcomes of the study were adolescents' health behaviors (i.e. alcohol and drug use, smoking, safe sex) and mental health status. The secondary outcome of the study was health-related quality of life. The self-report questionnaire, used to tailor the eHealth messages in the 2 intervention groups, also served as the baseline questionnaire.

Health behaviors

The questionnaire used to assess health behaviors was based on existing instruments previously developed by municipal public health services and health institutes in the Netherlands.[18] This questionnaire was administered at baseline and at 4-month follow-up. In this questionnaire, the frequency of alcohol consumption, smoking, drug use, and condom use were assessed on ordinal scales. Alcohol consumption was covered by 2 items: (1) how often did you drink 5 or more drinks on 1 occasion in the past 4 weeks (never to 9 or more times), and (2) how often have you been drunk or tipsy in the past 4 weeks (never to 20 or more times).

Drugs use was assessed by how often the adolescent had used drugs in the past 4 weeks (never to 20 or more times), smoking by how often the adolescent currently smokes (not at all to every day), and condom use by how often the adolescent had used condoms during intercourse (never to always). This last question was only presented if it was applicable (i.e. when an adolescent had answered he/she was sexually active).

Well-being

Mental health status was assessed by the Strengths and Difficulties Questionnaire (SDQ)[20,21] and the Youth Self Report (YSR).[22] The SDQ consists of 25 items describing positive and negative attributes of adolescents that can be allocated to 5 subscales of 5 items each: the emotional problems, the conduct problems, the hyperactivity-inattention, the peer problems, and the prosocial behavior subscales. Each item is scored on a 3-point scale (0 = *not true*, 1 = *somewhat true*, and 2 = *certainly true*). A total difficulties score is calculated by summing the scores for the emotional problems, conduct problems, hyperactivity-inattention, and peer problems subscales (range 0–40). The YSR comprises 119 items addressing emotional and behavioral problems of adolescents. Respondents have to indicate on 3-point scales to which extent each item applies to him/her (0 = *not*,

1 = *sometimes*, or 2 = *often*). A total score is calculated by summing the scores on all items (range 0–210).

Health-related quality of life was measured at baseline and at 4-month follow-up by 4 items of the general health perceptions scale of the Child Health Questionnaire-Child Form (CHQ-CF-GH4).[23] One item is scored on a 5-point scale of 1 = *excellent*, 2 = *very good*, 3 = *good*, 4 = *moderate*, 5 = *bad* and 3 items are scored on a 5-point scale of 1 = *true*, 2 = *usually true*, 3 = *do not know*, 4 = *usually not true*, 5 = *not true*. A total score is calculated by weighing the scores and summing the weighed scores for all items (range 0–100).

The SDQ and CHQ-CF-GH4 were administered at baseline and at 4-month follow-up. The YSR was administered only at 4-month follow-up to reduce respondent burden at baseline. At baseline, adolescents also received the E-health4Uth messages after the questionnaires.

Demographics

Age (assessed by date of birth), gender, country of birth of the adolescent and both parents, and the level of education that the adolescents attended were assessed in the baseline questionnaire. In the Netherlands, a distinction is made in the levels of education adolescents attend at secondary schools. Lower levels of education are referred to as vocational training and higher levels of education are referred to as pre-university education. Ethnicity was classified as Dutch or non-Dutch, in accordance with the definitions of Statistics Netherlands[24]; adolescents with at least 1 parent born outside the Netherlands were classified as non-Dutch.

Statistical analysis

Descriptive statistics were used to describe the characteristics of adolescents in the 3 study conditions. Differences between each of the intervention conditions and the control condition, as measured at baseline, were tested with independent sample *t* tests (continuous variables), Mann-Whitney *U* tests (ordinal variables), and chi-square tests (categorical variables). The effectiveness of E-health4Uth and E-health4Uth and consultation was investigated by means of multilevel logistic (categorical variables), ordinal (ordinal variable), and linear (continuous variables) regression analyses. Multilevel analysis adjusts for clusters (i.e. classes) by taking the dependency between observations of adolescents from the same class into account. For the multilevel linear regression analyses, a bootstrapping method was used.[25] This method deals with data that are skewed, as is often the case with data on well-being and in this study. All regression analyses were adjusted for demographic factors that significantly differed between each of the intervention conditions and the control condition. All regression analyses were also adjusted for the baseline value of each outcome, with the exception of the

YSR because this questionnaire was only assessed at follow-up. Therefore, the results of the YSR analyses were only adjusted for demographic factors that significantly differed between each of the intervention conditions and the control condition. However, exploratory analyses showed that when adjusting for the baseline value of the SDQ, which assesses a similar concept (mental health) as the YSR,[21] similar results were obtained in the YSR analyses as when not adjusting for the SDQ baseline value.

To gain more insight into the combined effect of E-health4Uth with a consultation, we tested the effects on well-being in the subgroup of adolescents at risk of mental health problems at baseline because only these adolescents were referred for a consultation with the nurse. The effectiveness was tested by means of multilevel linear regression analyses (with a bootstrap procedure). The subgroup consisted of those with a score on the SDQ of > 16 or a score of > 5 on the emotional problems subscale of the SDQ.[17] Suicidal thoughts and suicide attempts could not be used to classify adolescents at risk of mental health problems at baseline because suicidal thoughts and suicide attempts were not assessed in the control group. These questions were not administered in this group because this group did not receive an intervention in which these concerns were addressed.

Subsequently, it was explored whether gender, ethnicity, or level of education moderated the effects of E-health4Uth and E-health4Uth and consultation on health behaviors and well-being. This was done by adding an intervention dummy × demographic factor interaction term to the regression analyses. If the interaction term was significant at $p < .05$, a stratified analysis was conducted.

Participants were analyzed in the groups to which they had been randomized, regardless of whether they received the allocated intervention or not (e.g. not attending consultation after an invitation). Each analysis of the effectiveness of the intervention was performed on the follow-up data that was available on the outcome concerned. The multilevel regression analyses were performed in Stata 13.0 (StataCorp LP, College Station, TX, USA). Other analyses were performed in SPSS 21.0 (IBM Corp, Armonk, NY, USA). The significance level was set at .05 and tests were 2-sided. To indicate the clinical significance of any benefits of the interventions, we also report odds ratios (OR) for categorical and ordinal outcomes and Cohen's *d* (*d*) for continuous outcomes.

RESULTS

Non-response analysis

Chi-square tests and *t* tests were conducted to compare adolescents participating at follow-up with adolescents not participating at follow-up. Participating at follow-up (yes/no) was used as the dependent variable and gender, age, education, ethnicity, and

study condition as independent variables. Group differences were found for gender, age, education, ethnicity, and study condition, with the adolescents not participating at follow-up more often being female ($\chi^2_1 = 4.1$, $p = .04$), older ($t_{680} = 6.69$, $p < .001$), lower educated ($\chi^2_1 = 20.0$, $p < .001$), of non-Dutch ethnicity ($\chi^2_1 = 64.7$, $p < .001$), and allocated to the control group instead of the E-health4Uth and consultation group ($\chi^2_1 = 7.5$, $p = .006$).

Adolescents' characteristics

The average age of the adolescents in this study was 15.9 years (SD = 0.69); 54.70% (687/1256) of the sample consisted of boys, 76.19% (957/1256 were of Dutch ethnicity, 50.48% (634/1256) attended vocational training, and 49.52% (622/1256) pre-university education. Table 1 shows general characteristics and baseline health behaviors and well-being of adolescents in the 3 study conditions. At baseline, a lower percentage of adolescents in the E-health4Uth group had used drugs in the past 4 weeks compared to adolescents in the control group (4.6% vs. 8.1%; $p < .04$). Further, adolescents in the E-health4Uth and consultation group were significantly younger than adolescents in the control group (mean = 15.95, SD = 0.70 vs. mean = 15.79, SD = 0.66; $p < .001$). Therefore, all analyses evaluating the effectiveness of E-health4Uth and consultation were adjusted for age.

Effects of E-health4Uth

Adolescents in the E-health4Uth group used condoms significantly more often at follow-up compared to adolescents in the control group (52.1% vs. 40.6%; OR = 2.09, 95% CI = 1.04 – 4.22) (Table 2). Furthermore, the health-related quality of life of adolescents in the E-health4Uth group was significantly better at follow-up compared to adolescents in the control group (mean = 75.34, SD = 16.56 vs. mean = 73.73, SD = 18.17; B = 2.79, 95% CI = 0.72 – 4.87; $d = 0.09$). No other effects of the E-health4Uth intervention on health behaviors or well-being were found.

Effects of E-health4Uth and consultation

At follow-up, adolescents in the E-health4Uth and consultation group reported a significantly better mental health status compared to adolescents in the control group (SDQ: mean = 8.42, SD = 5.05 vs. mean = 9.07, SD = 5.38; B =–0.60, 95% CI = –1.17 to –0.04; $d = 0.12$) (Table 2). No effects of the E-health4Uth and consultation intervention on health behaviors were found.

Adolescents in the E-health4Uth and consultation group, who were at risk of mental health problems at baseline and were therefore referred for a consultation with the nurse, reported a significantly better mental health status (SDQ: mean = 12.79, SD = 5.63 vs. mean = 14.57, SD = 5.03; B = –1.79, 95% CI = –3.35 to –0.22; $d = 0.33$; YSR: mean = 48.13,

Table 1. General characteristics and baseline health behaviors and well-being of adolescents for the intervention groups and control group (N = 1256)

	E-health4Uth	**E-health4Uth + consult**	**Control group**	**E-health4Uth vs. control group**	**E-health4Uth + consult vs. control group**
	n = 392	n = 430	n = 434	*p* value	*p* value
Number of school classes	27	26	25		
Age in years					
Mean (SD) [39]	15.84 (0.70)	15.95 (0.70)	15.79 (0.66)	.28	**<.001**[a]
Gender	**% (n)**	**% (n)**	**% (n)**		
Boys	56.9 (223)	56.0 (241)	51.4 (223)	.11	.17[b]
Ethnicity					
Dutch	79.3 (311)	74.4 (320)	75.1 (326)	.15	.81[b]
Educational level					
Vocational training	48.7 (191)	53.7 (231)	48.8 (212)	.97	.15[b]
Alcohol consumption [3]					
5 or more drinks on one occasion in the past 4 weeks					
0 times	65.1 (255)	63.4 (272)	67.6 (292)	.48[c]	.20[c]
1 times	15.8 962)	16.1 (69)	14.4 (62)		
2 times	9.2 (36)	8.4 (36)	7.9 (34)		
3 – 4 times	5.6 (22)	8.2 (35)	6.7 (29)		
5 or more times	4.3 (17)	4.0 (17)	3.5 (15)		
Have been drunk or tipsy in the past 4 weeks					
0 times	74.0 (290)	74.1 (318)	77.1 (333)	.28[c]	.30[c]
1 times	13.8 (54)	14.0 (60)	12.3 (53)		
2 times	5.4 (21)	5.1 (22)	5.6 (24)		
3 or more times	6.9 (27)	6.8 (29)	5.1 (22)		
Smoking [3]					
No	83.9 (329)	82.1 (352)	81.5 (352)	.39[c]	.92[c]
Less than once a week	3.3 (13)	3.7 (16)	4.4 (19)		
At least once a week, but not every day	3.8 (15)	3.3 (14)	4.6 (20)		
Every day	8.9 (35)	11.0 (47)	9.5 (41)		
Drug use (past 4 weeks) [3]					
0 times	95.4 (274)	93.7 (402)	91.9 (397)	**.04**[b]	.31[b]
1 or more times	4.6 (18)	6.3 (27)	8.1 (35)		
Condom use during intercourse (n = 324)					
Always	53.1 (52)	52.3 (68)	51.0 (49)	.50[c]	.55[c]
Usually	21.4 (21)	19.2 (25)	15.6 (15)		
Sometimes / almost never	14.3 (14)	19.2 (25)	18.8 (18)		
Never	11.2 (11)	9.2 (12)	14.6 (14)		
Well-being	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**		
SDQ score[d] [3]	10.06 (5.57)	9.75 (5.14)	9.91 (5.32)	.69[a]	.67[a]
CHQ-CF-GH4 score[e]	71.39 (17.87)	71.62 (18.49)	73.67 (17.78)	.07[a]	.10[a]

Note: [missing data]; bold numbers indicate significant *p* values.
[a] Independent-Samples T-Test.
[b] Chi-Square test.
[c] Mann-Whitney u-test.
[d] A higher score indicates more mental health problems (range 0–40).
[e] A higher score indicates a better health-related quality of life (range 0–100).

Table 2. Follow-up health behaviors and well-being of adolescents and effects of the interventions with the control group as reference (N = 1252)

	E-health4Uth n = 392	E-health4Uth + consult n = 430	Control group n = 434	Intervention effects: E-health4Uth vs. control group[a]	Intervention effects: E-health4Uth + consult vs. control group[b]
Alcohol consumption [8]	**% (n)**	**% (n)**	**% (n)**	**OR (95% CI)**	**OR (95% CI)**
5 or more drinks on one occasion in the past 4 weeks					
0 times	59.0 (230)	65.9 (280)	63.7 (276)	0.90 (0.61 – 1.34)[c]	1.21 (0.77 – 1.26)[c]
1 times	15.9 (62)	10.4 (44)	13.4 (58)		
2 times	11.0 (43)	7.5 (32)	8.5 (37)		
3 – 4 times	7.2 (28)	10.8 (46)	7.9 (34)		
5 or more times	6.9 (27)	5.4 (23)	6.5 (28)		
Have been drunk or tipsy in the past 4 weeks					
0 times	70.5 (275)	74.6 (317)	74.1 (321)	0.90 (0.61 – 1.35)[c]	1.22 (0.85 – 1.74)[c]
1 times	14.6 (57)	12.2 (52)	13.2 (57)		
2 times	4.6 (18)	4.7 (20)	4.6 (20)		
3 or more times	10.3 (40)	8.5 (36)	8.1 (35)		
Smoking [9]					
No	82.8 (323)	82.6 (351)	80.8 (349)	0.97 (0.61 – 1.56)[c]	0.95 (0.58 – 1.57)[c]
Less than once a week	5.4 (21)	3.3 (14)	5.3 (23)		
At least once a week, but not every day	3.6 (14)	2.6 (11)	4.4 (19)		
Every day	8.2 (32)	11.5 (49)	9.5 (41)		
Drug use (past 4 weeks) [9]					
0 times	94.1 (367)	89.6 (381)	91.7 (396)	1.06 (0.43 – 2.61)[d]	0.65 (0.26 – 1.59)[d]
1 or more times	5.9 (23)	10.4 (44)	8.3 (36)		
Condom use during intercourse (n = 376)					
Always	52.1 (62)	43.7 (66)	40.6 (43)	**2.09* (1.04 – 4.22)[c]**	1.36 (0.76 – 2.44)[c]
Usually	20.2 (24)	21.2 (32)	14.2 (15)		
Sometimes / almost never	15.1 (18)	25.2 (38)	25.5 (27)		
Never	12.6 (15)	9.9 (15)	19.8 (21)		
Well-being	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**Beta coefficient (95% CI)**	**Beta coefficient (95% CI)**
SDQ score[f] [8]	8.92 (5.26)	8.42 (5.05)	9.07 (5.38)	-0.24 (-0.78; 0.29)[e]	**-0.60* (-1.17; -0.04)**[e]
YSR score[f] [4]	33.89 (23.02)	31.58 (22.58)	34.75 (25.26)	-0.89 (-4.18; 2.40)[e]	-2.74 (-5.92; 0.44)[e]
CHQ-CF-GH4 score[g]	75.34 (16.56)	74.00 (18.49)	73.73 (18.17)	**2.79*** (0.72 – 4.87)**[e]	1.03 (-1.12; 3.19)[e]

Note: [missing data]; bold numbers indicate significant *p* values.
[a] E-health4Uth vs. control group: analyses were adjusted for the baseline value of each outcome.
[b] E-health4Uth + consultation vs. control group: analyses were adjusted for age and the baseline value of each outcome.
[c] Multilevel ordinal regression.
[d] Multilevel logistic regression.
[e] Multilevel linear regression.
[f] A higher score indicates more mental health problems (SDQ range 0–40, YSR range 0–210).
[g] A higher score indicates a better health-related quality of life (range 0–100).
* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 3. Follow-up well-being of adolescents who were at risk of mental health problems at baseline and the effects of the interventions on well-being, with the control group as reference (n = 194)

	Adolescents at risk of mental health problems			Intervention effects	
	E-health4Uth[a] n = 63	E-health4Uth + consult n = 63	Control group[a] n = 68	E-health4Uth vs. control group[b]	E-health4Uth + consult vs. control group[c]
Well-being	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	**Beta coefficient (95% CI)**	**Beta coefficient (95% CI)**
SDQ score[e][1]	14.44 (5.67)	12.79 (5.63)	14.57 (5.03)	0.04 (-1.60; 1.68)[d]	**-1.79* (-3.35; -0.22)**[d]
YSR score[e][1]	56.49 (27.86)	48.13 (25.45)	57.12 (27.66)	-0.63 (-9.72; 8.47)[d]	**-9.11* (-17.52; -0.71)**[d]
CHQ-CF-GH4[f]	67.59 (17.14)	69.56 (18.37)	62.53 (20.08)	4.78 (-0.70; 10.25)[d]	**7.81** (2.41; 13.21)**[d]

Note: [missing data]; bold numbers indicate significant *p* value.

[a] In the E-health4Uth (5 of the 63) and control group (4 of the 68), some adolescents at risk of mental health problems also attended the consultation after they referred themselves to the nurse. In the E-health4Uth + consultation group, 57 of the 63 referred adolescents attended the consultation.

[b] E-health4Uth vs. control group: analyses were adjusted for the baseline value of each outcome.

[c] E-health4Uth + consultation vs. control group: analyses were adjusted for age and the baseline value of each outcome.

[d] Multilevel linear regression.

[e] A higher score indicates more mental health problems (SDQ range 0–40, YSR range 0–210).

[f] A higher score indicates a better health-related quality of life (range 0–100).

* $p < .05$, ** $p < .01$, *** $p < .001$.

SD = 25.45 vs. mean = 57.12, SD = 27.66; B = −9.11, 95% CI = −17.52 to −0.71; $d = 0.34$) and a better health-related quality of life (mean = 69.56, SD = 18.37 vs. mean = 62.53, SD = 20.08; B = 7.81, 95% CI = 2.41 – 13.21; $d = 0.37$) at follow-up compared to adolescents in the control group who were at risk of mental health problems at baseline (Table 3). These results were not replicated among adolescents who were at risk of mental health problems in the E-health4Uth standalone intervention group (Table 3), indicating that the dual approach of advice and a consultation (i.e. E-health4Uth and consultation) may have been responsible for the positive effects on well-being.

Interaction effects

Exploratory interaction analyses showed 3 statistically significant interactions between the dummy variables for intervention groups and the demographic factors. Ethnicity moderated the intervention effect of E-health4Uth on condom use and gender moderated the intervention effect of E-health4Uth on alcohol consumption and the intervention effect of E-health4Uth and consultation on drug use (Table 4). More specifically, adolescents of Dutch ethnicity in the E-health4Uth group were more likely to use condoms during intercourse at follow-up compared to adolescents of Dutch ethnicity in the control group (OR = 3.59, 95% CI = 1.71 – 7.55), whereas there was no significant effect of the intervention among adolescents of non-Dutch ethnicity (OR = 0.25, 95%

CI = 0.02 – 2.49). Furthermore, boys in the E-health4Uth and consultation group were more likely to use drugs at follow-up compared to boys in the control group (OR = 0.36, 95% CI = 0.13 – 0.96), whereas there was no significant intervention effect among girls (OR = 4.47, 95% CI = 0.72 – 27.74). Among boys and girls in the E-health4Uth and consultation group, no significant intervention effect was found on alcohol consumption (boys: OR = 0.68, 95% CI = 0.40 – 1.15, girls: OR = 1.35, 95% CI = 0.76 – 2.38).

Table 4. Stratified analyses of intervention effects on health behavior for the various levels of the significant moderator variables

	E-health4Uth vs. control group	**E-health4Uth + consult vs. control group**
	OR (95% CI)	OR (95% CI)
Alcohol consumption		
Have been drunk or tipsy in the past 4 weeks		
Gender		
Boys	0.68 (0.40; 1.15)[a]	
Girls	1.35 (0.76; 2.38)[a]	
Drugs use (past 4 weeks)		
Gender		
Boys		**0.36* (0.13; 0.96)[b]**
Girls		4.47 (0.72; 27.74)[b]
Condom use during intercourse		
Ethnicity		
Dutch	**3.59** (1.71; 7.55)[a]**	
Non-Dutch	0.25 (0.03; 2.49)[a]	

Note: only the results of the stratified analyses according to the significant moderators of the intervention effects are presented.
[a] Multilevel ordinal regression.
[b] Multilevel logistic regression.
* p <.05, ** p <.01, *** p <.001.

DISCUSSION

Principal results

Using a cluster RCT, we evaluated the effect of E-health4Uth as a standalone intervention and in combination with an additional consultation for adolescents who were at risk of mental health problems. The E-health4Uth intervention as a standalone intervention showed minor positive results in a small number of outcomes, namely in the health-related quality of life and in condom use during intercourse among adolescents of Dutch ethnicity. The 2 positive results found in the E-health4Uth intervention were not replicated in the E-health4Uth and consultation group. The E-health4Uth and

consultation intervention showed minor positive results in the mental health status of adolescents, but a negative effect on drug use among boys was found. In the subgroup of adolescents who were at risk of mental health problems at baseline and were, therefore, referred for a consultation with the nurse, the E-health4Uth and consultation group showed small to moderate positive results on mental health status and health-related quality of life at follow-up compared to adolescents in the control group who were at risk of mental health problems at baseline.

Interpretation

Although it is promising that positive effects were found in the E-health4Uth group, only a small number of outcome measures were statistically significant (i.e. health-related quality of life and condom use during intercourse), the effects were small, and the effects on condom use were only found among adolescents of Dutch ethnicity. Furthermore, because the E-health4Uth and consultation group received the same messages as the E-health4Uth group plus an additional consultation for the adolescents at risk of mental health problems, one would expect that the effects on condom use and health-related quality of life would have also been present in the E-health4Uth and consultation group. Although these effects pointed in the same direction, they were not significant in the E-health4Uth and consultation group. Therefore, the effects found in the E-health4Uth group have to be interpreted with caution.

In contrast to our hypothesis, we could not demonstrate that the E-health4Uth intervention was effective in promoting other health behaviors or the mental health status of adolescents. Although various studies show that Web-based tailoring is a promising technique to promote health behaviors and mental health status of adolescents,[26-34] most studies are focused on older adolescents. Furthermore, the results of the evaluation of the appreciation of the tailored messages used in this trial showed that adolescents did not evaluate the tailored messages as explicitly positive in terms of their personally relevance.[15] If messages are not deemed personally relevant, the positive effect of these messages may be reduced.[35] Therefore, the tailored messages used in this study could potentially be improved further, possible resulting in messages that are more personally relevant and effective. The current messages could be further tailored by using, for example, demographics, personal cognitive factors (e.g. manner in which health risks are perceived by the individual), social factors (e.g. susceptibility to peer pressure), or the self-efficacy of the individual (e.g. judgment of capability to change unhealthy behavior).[36,37] Furthermore, algorithms generating tailored information can be easily extended to use more characteristics of the adolescent to tailor the messages, whereas wide-scale distribution can be arranged at relatively low cost.

Moreover, knowledge on how adolescents process and respond to personalized feedback is currently scarce.[38] More insight into how adolescents process the feedback

messages, single messages, and when receiving multiple feedback messages on various behaviors at one point in time is needed to be able to improve interventions. Although the focus on multiple behaviors is becoming an increasingly popular strategy in interventions using Web-based tailored messages,[39-41] adolescents receive a lot of information at the same time and it is conceivable that adolescents become overwhelmed by the amount of information. Furthermore, tailored messages were used and appreciated positively by adolescents in this trial[15] and they seemed interested in receiving feedback on health behaviors. In contrast to older people who are confronted with chronic diseases more often, adolescents are probably less likely to see the benefits of health behavior changes and consequently less likely to be internally motivated to invest time in health behavior changes.[42]

As hypothesized, the E-health4Uth and consultation intervention was effective in enhancing the mental health status of adolescents. Furthermore, it is promising that expanding the Web-based tailored intervention with a consultation in the subgroup of adolescents at risk of mental health problems, improved the effectiveness of the intervention on mental health and health-related quality of life among these adolescents. The effect of the E-health4Uth and consultation intervention on the well-being of adolescents at risk of mental health problems was minor to moderate, in-line with the results of previous studies in which adolescents at risk of depression and anxiety, 2 components of the broader construct of mental health, benefited from an Internet program combined with a consultation.[43-46] A potential explanation for the effects on the well-being of adolescents is the dual approach of advice and a consultation. This approach guaranteed a repetition of the main mental health message and combined digital and oral feedback. However, it is also feasible that the consultation was responsible for the positive effects that were found and that the E-health4Uth questionnaire was primarily a useful way to select adolescents who needed further face-to-face support.

Because the nurses rated the information they received about the adolescents before the consultation as helpful in most cases (80.0%),[15] this information on adolescents' health may have supported the nurse during the consultation to better tailor the information provided to the adolescent's needs, thereby enhancing the effectiveness.

In contrast to our hypothesis, positive effects in the E-health4Uth and consultation group were not found in promoting health behaviors. Therefore, it might also be beneficial to apply the dual approach of advice and a consultation to the health behavior messages (i.e. expand the Web-based tailored messages on the health behaviors with a consultation focused on these health behaviors), instead of primarily focusing on mental health in the consultation. A previous study, integrating Web-based tailored messages on fruit and vegetable intake with a consultation focused on this intake among schoolchildren showed promising results in the area of preventive youth health care.[35] However, future research is needed to investigate the degree to which the impact of Web-based

tailored messages on health behaviors may be enhanced through expanding these messages with a consultation. Especially since an unexpected negative effect on drug use among boys was found in the E-health4Uth and consultation group. Although this result could be a random effect, another possible explanation is that giving information about drug use to adolescents raises adolescents' curiosity about trying drugs. In earlier studies, a similar negative effect on drug use among Dutch adolescents was found.[47,48] In one of these studies, it was found that this increase in frequency was only a temporary effect.[48] However, it is an indication that one has to be careful with health promotion on drug use among adolescents and it highlights the importance of careful evaluation and in-depth study of how health promotion on drug use works for adolescents.

Because the Web-based tailored messages and the additional consultation were already interwoven with the existing practice of preventive youth health care, they are especially promising for future implementation. Implementing the Web-based tailored messages as a universal program (i.e. offering it to all adolescents in a school class regardless of current symptom level or risk status) has multiple benefits. Universal programs, instead of programs that only focus on adolescents who are at risk (e.g. for mental health problems), are often preferred by school administrators.[49] Additionally, by collecting information on the health of all adolescents in a school class, this approach presents an opportunity to select vulnerable adolescents and to enhance the efficiency of face-to-face consultations[7,12,13] Efficiency is essential given the current financial strain on preventive health care.

Strengths and limitations

Important strengths of this study are the randomized controlled design and large sample size. The response rate was relatively high and our study population resembles the average Dutch adolescent population in secondary schools for gender, ethnicity, and education level.[50] However, this study was conducted only among Dutch adolescents aged 15–16 years in a preventive care setting; therefore, generalization to other countries, age groups, and settings should be done with caution. Furthermore, dropout was higher among girls, older adolescents, adolescents with a low education level, adolescents of non-Dutch ethnicity, and adolescents allocated to the control group instead of the E-health4Uth and consultation group, which could also affect the generalizability of the results. Nevertheless, we expect that the effects of our study would have been stronger without this selective dropout. A vulnerable group research has shown to be at a particularly heightened risk of mental health problems[15] and of exhibiting unhealthy behavior,[1,51] dropped out while interventions are especially effective in high risk groups.[52]

Additionally, the use of self-report measures may have resulted in less reliable outcomes. Therefore, the collection of more objective data on health behavior and additional parent and teacher ratings on the well-being of the adolescents may have

been useful. Nevertheless, research suggests, for example, that self-reported alcohol consumption among adolescents is generally considered valid[53] and that adolescents are better reporters of their own mental health status than parents and teachers.[54] The percentages of adolescents with unhealthy behaviors and mental health problems in this study are largely comparable with the percentages of adolescents aged 15–16 years with unhealthy behaviors and mental health problems in the Netherlands.[1] Another limitation is that some adolescents in the control group may have received information from friends in the intervention groups despite the randomization of school classes. This may have contaminated the results. Furthermore, the overlap between the 2 intervention groups and control group is a limitation. In the E-health4Uth and consultation group, only adolescents at risk of mental health problems were invited for a consultation; thus, the other adolescents in this group received actually only the E-health4Uth intervention. Moreover, adolescents in all the groups could ask for a self-referral with the school nurse. Although only a few adolescents in the E-health4Uth group (17 of 533) and the control group (13 of 615) attended a consultation with the nurse (Figure 1), this may have underestimated the results. Therefore, in addition to the intention-to-treat analyses in which we analyzed adolescents in the groups to which they were randomized, regardless of whether they received the allocated intervention or not (e.g. whether they attended the consultation or not after an invitation), we conducted exploratory per-protocol analyses. For these exploratory analyses, adolescents were allocated to the intervention they actually received (e.g. the adolescents who self-referred to the nurse for a consultation were included in the E-health4Uth and consultation group for analysis purposes). The results from these per-protocol analyses were stronger than the results from the intention-to-treat analyses. That is, these analyses showed larger effects on mental health and health-related quality of life for the subgroup of adolescents at risk of mental health problems at baseline than the intention-to-treat analyses, suggesting that the results presented in this study may be underestimations of the actual effects. Unfortunately, information about the percentages of adolescents invited for a further consultation with the nurse or who were referred to another professional was not available because this information was not consistently administered by the nurse. However, the available data suggest that a low percentage of adolescents were invited for a further consultation with the nurse or referred to another professional. Further research is necessary to assess whether the consultation is an effective way in selecting adolescents who need help and providing them with the help they need.

Conclusions

Findings from this study support the use of the E-health4Uth and consultation intervention in promoting the well-being of adolescents at risk of mental health problems. Compared to care as usual, E-health4Uth combined with a consultation was effective in

promoting the mental health status and health-related quality of life in the subgroup of adolescents at risk of mental health problems. It is feasible that the consultation (and not the dual approach) was primarily responsible for these positive effects. However, E-health4Uth may have been a valuable tool to select vulnerable adolescents and to provide the nurse with information about the health of these adolescents. This could have contributed to the efficiency of the face-to-face consultation. Because the E-health4Uth and consultation intervention can be embedded in the existing practice of preventive youth health care, this increases the chance of future implementation. However, more research is needed to further evaluate the effects of the consultation as a standalone intervention and of the dual approach of further tailored eHealth messages and a consultation. Adding a consultation for adolescents at risk of mental health problems seems promising; therefore, future research is recommended to evaluate the potential effect of a consultation for adolescents who exhibit unhealthy behavior.

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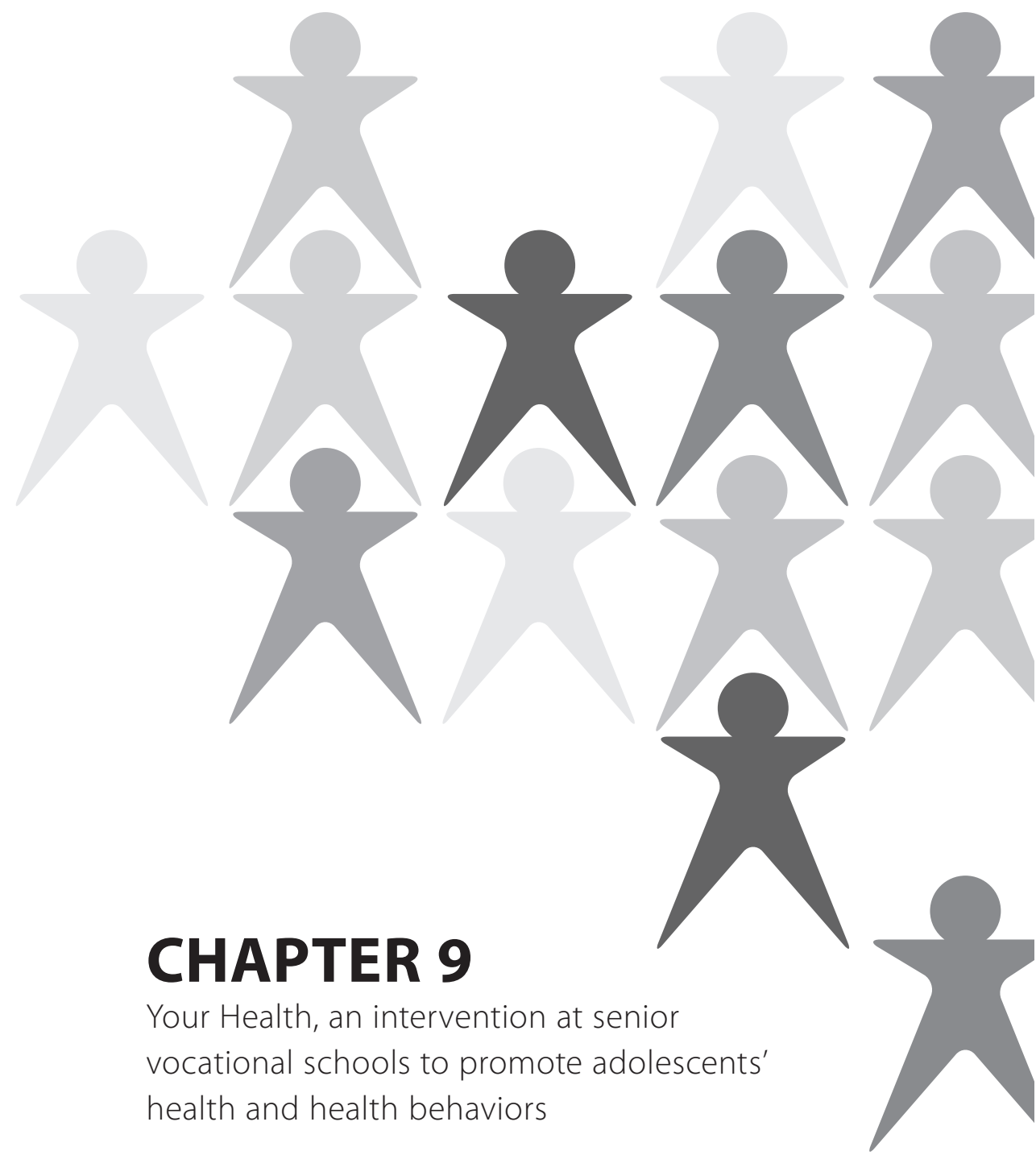
Appendix 1. Topics of the E-health modules

Behavior and well-being	Items
Alcohol consumption	How often and how much the adolescent drinks alcohol (9 items)
Drugs use	How often the adolescents has used different types of drugs (17 items)
Smoking	How often the adolescent smokes (2 items)
Sexual behavior	How often the adolescent uses condoms during sexual intercourse (2 items)
Bullying	How often the adolescent is bullied at school, somewhere else or on the internet (3 items)
Mental health status	Strength and Difficulties Questionnaire (SDQ) (25 items) with a total score range 0–40
Suicidal thoughts	If the adolescent has had suicidal thoughts last year (1 item)
Suicidal attempts	If the adolescent made a suicidal attempt last year (1 item)
Unpleasant sexual experience	If the adolescent has ever had an unpleasant sexual experience (1 item)



CHAPTER 9

Your Health, an intervention at senior vocational schools to promote adolescents' health and health behaviors

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ABSTRACT

This study evaluates the appreciation, application and effects of an intervention (Your Health), in which adolescents received a consultation with the school nurse. A cluster randomized controlled trial with an intervention and control group (care-as-usual) was conducted among first-grade senior vocational students. Adolescents (N = 418) completed a questionnaire at baseline and 6-month follow-up assessing health and health behaviors. School absenteeism was monitored via the school registration system. After the consultation, adolescents and nurses evaluated the consultation by questionnaire. Adolescents appreciated being invited for the consultation and gave the consultation a positive mean rating of 8.78 on a 10-point scale. Adolescents rated the other nine items on the appreciation of the consultation also high. In 36.8% of the adolescents, nurses suspected problems. Most often these adolescents were given tailored advice (59.3%) or they were referred to another professional (40.7%). No statistically significant effects of the intervention were found on the health and health behaviors of adolescents. This study supports the use of Your Health as a promising intervention to reach senior vocational students. Future research is needed to evaluate long-term effects and the effects and appreciation of the subsequent help that is offered.

Trial registration

www.trialregister.nl, NTR3545.

INTRODUCTION

A high percentage of adolescents suffer from mental health problems and adolescents often engage in behaviors that negatively impact their health, such as substance abuse.[1] Moreover, among adolescents, school absenteeism[2,3] and debts[4] are also common. School absenteeism[4,5] and debts[4] as well as mental health problems[6] and substance abuse[6,7] are likely to influence the course of the educational careers of adolescents, and are associated with school dropout. Studies indicate that school dropout results in substantially lower earnings over the life course,[8] poorer health,[9,10] considerably more dependence on public assistance[11] and a marked increase in the likelihood of involvement in crime and incarceration.[12]

Because dropping out of school is often preceded by problems that started earlier and adolescents often do not seek help when suffering from these problems,[13-15] a proactive approach from health care professionals may be needed to prevent school dropout. In this approach, a wide variety of risk factors should be targeted, given that school dropout has a wide variety of causes.[5] The preventive youth health care can play an important role in this proactive approach.

Many Western countries have installed some form of preventive youth health care, which refers to various activities to improve and protect the health of young people. In The Netherlands, all children and adolescents are invited by the preventive Youth Health care organization in their region to attend 'preventive periodic health consultations' with a physician or nurse at set ages until the age of 13 years.[16] From the age of 5 years, these consultations often take place at school. In other countries similar consultations with school nurses are provided at school. However, sometimes these consultations are provided by schools or the municipality, instead of the Youth Health care. These consultations focus on growth, development, health functioning, behavior and health promotion. Given the rapid maturation in adolescence and the health (behavior) problems associated with this developmental period, it is desirable to implement an additional consultation for adolescents aged 15 years and older.[17]

School dropout is very high among adolescents attending senior vocational education (i.e. ~40%), especially in the first grade.[4] As the senior continuation of the vocational track in Dutch secondary education, senior vocational education provides specialized vocational training to students aged 15 years and older. Because of the high dropout among adolescents attending senior vocational education, we developed, implemented and evaluated a proactive, integrated preventive health consultation (Your Health) at the start of senior vocational education. Adolescents who recently started with their education were invited for a consultation with the school nurse. During the consultation, the nurses used a structured assessment tool to determine the strengths and areas for improvements in functioning of the adolescents. The role of the nurse included sup-

port, health promotion and referral to appropriate professionals if considered necessary through confidential consultations. The nurse was part of the School Health Services (SHS), which also includes other professionals such as social workers and social psychiatric nurses.

The aim of the preventive health consultation was to reach vulnerable adolescents with a well-evaluated consult and to start help if needed. Therefore, this study evaluates the reach of Your Health, the appreciation among adolescents and application among school nurses. In addition, we also explored the 6-month follow-up effect of Your Health on health (behavior) outcomes.

METHODS

Study design

A cluster randomized controlled trial was conducted in 2012–2013 with assessments at baseline and at 6-month follow-up. School classes (clusters) were randomly assigned to the Your Health or control condition after the baseline questionnaire was administered. School classes were the unit of randomization, because randomization at the individual level (i.e. the level of the adolescents) may lead to contamination of the control group.[18] For allocation of the school classes to one of the study arms, a computer-generated list of random numbers was used. The list was prepared by an investigator with no involvement in the trial.

The Medical Ethical Committee of Erasmus MC has declared that the Medical Research Involving

Human Subjects Act (also known by its Dutch abbreviation WMO) does not apply to this research proposal. The Medical Ethical Committee had no objection against the execution of this research proposal (MEC-2012-367).

Participants and procedures

The Youth Health Care organization in the Dutch city of Rotterdam and two large organizations that provide senior vocational education in the region of Rotterdam participated with a total of 44 first-grade classes. In The Netherlands, distinction is made in four levels of senior vocational education. In this study, students from the lowest two levels were participating, because these students are considered the most vulnerable and have the highest percentage of school dropout.[4]

A few weeks before the start of the study, all adolescents and parents received information about the study. If parents did not want their child (until 18 years) to participate, they could object to the participation of their child. During a classroom session, adolescents who were present were asked written consent before they completed the baseline

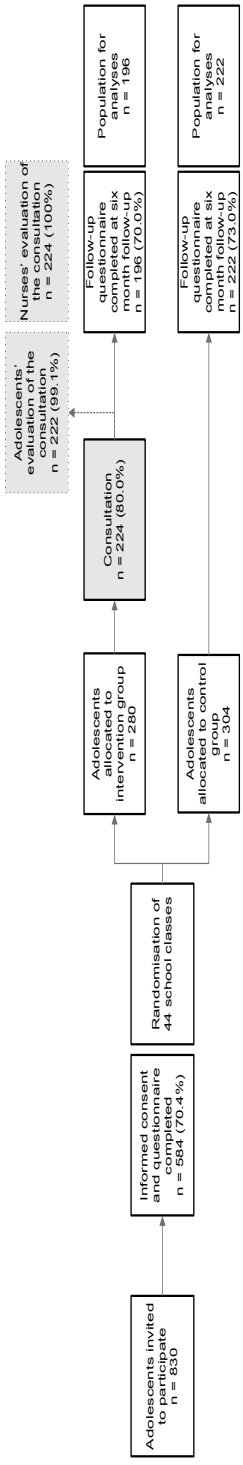

Figure 1. Flow chart of the adolescent's participation

questionnaire. Of the 830 adolescents who received information about the study, 584 (70.4%) adolescents were present, provided informed consent and participated; 280 in the Your Health group; 304 in the control group (Figure 1). The main reason for nonparticipation was absence at time of the assessment. In total, 418 adolescents participated at 6-month follow-up (71.6%); 196 in the Your Health group (70.0%), and 222 in the control group (73.0%).

Of the adolescents who attended the consultation with the nurse (n = 224, 80.0%), 99.1% completed the consultation evaluation questionnaire. Nurses completed an evaluation questionnaire for every consultation (100%).

Your Health intervention

Adolescents were invited for a one-to-one consultation with the school nurse in the first month after they started their education. The consultation took place at school. During the consultation, the nurses used the Dutch version of the Self Sufficiency Matrix (SSM-D) as a structured assessment tool.[19] The SSM-D was already in use by other professionals at the participating schools. The SSM-D was used to determine the strengths and areas for improvements in functioning of the adolescents and includes a wide variety of domains. The SSM-D assesses a persons' level of self-sufficiency on 11 domains: income, daytime activities, housing, domestic relations, mental health, physical health, addiction, daily life skills, social network, community participation and judiciary. Nurses reviewed these areas together with the adolescents and provided a rating on the matrix scales for each domain. Ratings ranged from 1, representing lowest functioning, to 5, representing highest functioning. The role of the nurse included support and health promotion. Furthermore, they either initiated a further consultation with themselves or referred adolescents to another professional if considered necessary. Prior to the consultations, nurses were trained to work with the SSM-D.

Control group

The control group received care-as-usual, i.e. adolescents could indicate on the baseline questionnaire that they wanted a consultation with their class mentor. Usually, this is a teacher without specific knowledge of health care, but who serves as a person of trust for the adolescents in his/her class and can refer adolescents to appropriate professionals if necessary. This option was provided to all participating adolescents, since school classes were randomly assigned after the baseline questionnaire was administered.

Measures

The primary outcomes are indicators of adolescents' mental health (i.e. mental health status and depressive symptoms), school absenteeism and debts. The secondary outcomes are health-related quality of life, alcohol consumption and soft drug use.

A self-administration questionnaire was administered at baseline and at 6-month follow-up assessing demographics, primary and secondary outcomes. Debts, alcohol consumption and soft drug use were assessed by items based on existing instruments previously developed by Municipal Public Health Services and health institutes in The Netherlands.[20] Information about school absenteeism was monitored via the school registration system.

Demographics

Age, gender, country of birth of the adolescent and both parents, and whether the adolescent already was a parent him/herself were assessed in the baseline questionnaire. Ethnicity was classified as Dutch or non-Dutch, in accordance with the definitions of Statistics Netherlands[21]; adolescents with at least one parent born outside The Netherlands were classified as non-Dutch.

Mental health status

Mental health status was assessed by the Mental Health Inventory (MHI-5).[22] TheMHI-5 includes five questions referring to both positive and negative aspects of mental health. All questions contain six possible response categories, scored between 1 and 6. The total score is transformed into a variable ranging from 0 to 100 using a standard linear transformation, with a score of 100 representing optimal mental health (current study $\alpha = 0.71$). Because no formal clinical cut-off point has been determined for the Dutch version of the MHI-5, we used a cut-off score of 60 to define poor mental health status. This cut-off is internationally used and provides the best sensitivity and specificity for detecting depressive symptoms.[23] This cut-off point was used to determine the percentage of adolescents with a poor mental health status. For the remaining analyses, the total (continuous) MHI-5 score was used.

Depressive symptoms

Symptoms of depression were assessed by the Center for Epidemiologic Studies Depression Scale (CES-D).[24] The CES-D consists of 20 items. The frequency of symptoms is rated on a 4-point scale ranging from 0 to 3. Items scores are summed (range from 0 to 60), with higher scores indicating higher levels of depressive symptoms (current study α total score = 0.90). A cutoff point of 16 is used to indicate clinically significant depressive symptoms. This cutoff score corresponds with the 80th percentile in community samples.[25] This cutoff point was used to determine the percentage of adolescents with clinically significant depressive symptoms. For the remaining analyses, the (continuous) total CES-D score was used.

School absenteeism

In the school registration system every hour absence was registered and school administrators indicated whether the absence was permitted (i.e. because of illness or another valid reason) or not (i.e. without notification or valid reason). At baseline, absenteeism was defined as the number of hours adolescents were absent (permitted or not permitted) over the past 2 months (September–October 2012). At follow-up, absenteeism was defined as the number of hours adolescents were absent in the months of February and March 2013. Absenteeism data were not available for part of the adolescents (13.9%; n = 81) due to school dropout, other reasons for leaving the school (e.g. switching schools) and failure to match the data.

Debts

Debts were assessed on an ordinal scale by the items: (i) do you have debts (yes/no/don't know) and (ii) approximately how high is the sum of all your debts (< 50 euro-more than 2500 euro).

Health-related quality of life

Health-related quality of life was assessed with the Short Form-12 Health Survey (SF-12). The SF-12 consists of 12 items, with variable response categories across the items. The scores are summarized into two components, corresponding to mental and physical health-related quality of life, with scores ranging from 0 (worst possible health state) to 100 (best possible health state) (current study α total score = 0.73). Scale scores were standardized using norm-based methods (a mean of 50 and SD of 10 in the general US population).[26] Research has shown that the mean score on physical health-related quality of life is 54.4 and 52.0 on mental health-related quality of life among adolescents aged 16–20 years.[27]

Alcohol consumption and soft drug use

The frequency of alcohol consumption and soft drug use were assessed on ordinal scales. Alcohol consumption was covered by two items: (i) how often did you drink 5 or more drinks on one occasion over the past 4 weeks (never–9 or more times) and (ii) how often have you been drunk or tipsy over the last 4 weeks (never–20 or more times). Soft drug use was assessed by how often the adolescent had used soft drugs over the past 4 weeks (never–20 or more times). Appreciation and application of the Your Health intervention Adolescents who attended the consultation were invited to complete an 11-item questionnaire about their appreciation of the consultation.[28] The items were measured on a 5-point Likert scale ranging from 1 (most-negative evaluation) to 5 (most-positive evaluation). One item measured the overall satisfaction with the consultation on a scale from 1 (most-negative evaluation) to 10 (most-positive evaluation).

The nurses noted whether or not the adolescents attended the consultation, and if the adolescent attended the consultation, they were invited to complete a written evaluation form regarding the consultation. Nurses reported on the following items: the time they needed for the consultation (minutes), judgment about problems (yes/no), severity of the problems (light/moderate/severe) and action that has been taken (e.g. referral to another professional).

Statistical analysis

Descriptive statistics were used to describe the characteristics of adolescents and to evaluate the appreciation and application of the Your Health intervention. Differences between the intervention and the control condition, as measured at baseline, were tested with independent samples t-tests, Mann-Whitney U-tests and Chi-square tests. The effectiveness the intervention was investigated by means of multilevel logistic, ordinal and linear regression analyses, taking the dependency between observations of adolescents from the same class into account. For the multilevel linear regression analyses, a bootstrapping method was used.[29] This method deals with data that are skewed, as is often the case with data on mental health, school absenteeism and health-related quality of life, and in this study. All regression analyses were adjusted for demographic factors that significantly differed between the two study conditions and for the baseline value of each outcome.

Participants were analyzed in the group to which they were randomized, regardless of whether they received the allocated intervention or not. Each analysis on the effectiveness of the intervention was done on the follow-up data that was available on the concerning outcome. The multilevel regression analyses were performed in STATA 13.0. Other analyses were performed in SPSS 21.0. The significance level was set at .05 and tests were two sided.

Non-response analysis

Chi-square tests and t-tests were conducted to compare adolescents who were participating at follow-up with adolescent who were not participating at follow-up. No significant differences in terms of gender and study condition were found. Group differences were found on age, ethnicity and being a parent, with the adolescents not participating at follow-up being older (t = -3.76; $p < .001$; mean = 18.93, SD = 2.73 versus mean = 18.01, SD = 2.49), more often of non-Dutch ethnicity (χ^2 = 8.35; p = .004; n = 133, 80.6% versus n = 285, 68.7%) and more often being a parent (χ^2 = 6.13; p = .01; n = 25, 15.7% versus n = 34, 8.6%).

RESULTS

Adolescents' characteristics

The average age of the adolescents was 18.0 years (SD = 2.49); 36.9% of the sample consisted of boys, 31.3% was of Dutch ethnicity and 8.6% was a parent (Table 1). Clinically significant depressive symptoms were reported by 28.0% of the adolescents and a poor mental health status by 22.8% of the adolescents. In the first 2 months of education, the mean number of hours of permitted absenteeism was 11.3 (SD = 20.02), and the mean numbers of non-permitted absenteeism was 10.1 (SD = 13.37). The mean score on physical health-related quality of life was 51.9 (SD = 6.51) and on the mental health-related quality of life 50.5 (SD = 8.44). These scores are in line with scores from a previous Dutch study among adolescents in the entire population. Of the adolescents, 15.6% reported having debts and 9.3% reported having debts of more than 500 euro. More than half of the adolescents (50.6%) reported they had been drinking five or more drinks on one occasion the past 4 weeks, and 11.9% reported that they had used soft drugs in the past 4 weeks.

Boys were overrepresented in the intervention group when compared with the control group ($p = .03$). At baseline, a higher percentage of adolescents in the intervention group had debts ($p < .03$), and adolescents in this group were more often absent from school without permission ($p = .001$) compared with adolescents in the control group.

Table 1. General characteristics and health and health behaviors of the intervention and control group (N = 418)

	Total	**Your Health**	**Control group**	
	N = 418	n = 196	n = 222	*p* value[a]
Age in years				
Mean (SD) [2]	18.0 (2.49)	18.2 (2.55)	17.9 (2.43)	.25
Gender [1]	**% (n)**	**% (n)**	**% (n)**	
Boys	36.9 (154)	42.6 (83)	32.0 (71)	**.03**
Ethnicity [3]				
Dutch	31.3 (130)	29.4 (57)	33.0 (73)	.42
Being a parent [21]				
Yes	8.6 (34)	11.2 (21)	6.2 (13)	.08
Mental health status [5]	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	
MHI-5 score[b]	73.8 (16.21)	74.0 (16.03)	73.5 (16.40)	.78
	% (n)	**% (n)**	**% (n)**	
Poor mental health (MHI-5 score ≥ 60)	22.8	22.2	23.3	.79

Table 1. Continued

	Total	Your Health	Control group	
	N = 418	n = 196	n = 222	*p* value[a]
Depression symptoms [11]	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	
CES-D score[c]	12.4 (9.73)	12.5 (9.15)	12.3 (10.23)	.86
	% (n)	**% (n)**	**% (n)**	
CES-D score in the clinical range (score ≥ 16)	28.0 (114)	27.7 (53)	28.2 (61)	.91
School absenteeism *first two months of education (n = 503)*	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	
Permitted absenteeism (hours)	11.3 (20.02)	12.0 (22.47)	10.7 (17.41)	.47
Not-permitted absenteeism (hours)	10.1 (13.37)	12.32 (14.91)	8.2 (11.39)	**.001**
Debts [28]	**% (n)**	**% (n)**	**% (n)**	
None	84.4 (346)	80.2 (154)	88.1 (192)	**.03**
< 500 euro	6.3 (26)	8.3 (16)	4.6 (10)	
> 500 euro	9.3 (38)	11.5 (22)	7.3 (16)	
Quality of life[e] [45]	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	
Physical health	51.9 (6.51)	52.5 (6.06)	51.4 (6.83)	.11
Mental health	50.5 (8.44)	50.2 (8.91)	50.7 (8.05)	.55
Alcohol consumption				
5 or more drinks on one occasion the past 4 weeks [7]	**% (n)**	**% (n)**	**% (n)**	
0 times	50.6 (208)	51.0 (99)	50.2 (109)	.75
1 times	20.0 (82)	20.1 (39)	19.8 (43)	
2 times	14.6 (60)	15.5 (30)	13.8 (30)	
3 – 4 times	7.5 (31)	6.7 (13)	8.3 (18)	
5 or more times	7.3 (30)	6.7 (13)	7.8 (17)	
Have been drunk or tipsy the last 4 weeks [37]				
0 times	69.0 (263)	71.0 (125)	67.3 (138)	.55
1 – 2 times	19.7 (75)	17.0 (16)	22.0 (45)	
3 or more times	11.3 (43)	11.9 (22)	10.7 (22)	
Drug use (past 4 weeks) [6]				
0 times	88.1 (363)	87.0 (168)	89.0 (195)	.39
1 or more times	11.9 (49)	13.0 (25)	11.0 (24)	

Note: [missing data]; bold numbers indicate significant *P*-values.

[a] Differences between intervention group and control group, as measured at baseline, tested with Independent-Samples T-Test (continuous variables), Mann-Whitney u-test (ordinal variables), and Chi-Square test (categorical variables).

[b] A higher score on the MHI-5 indicates less mental health problems (range 0–100).

[c] A higher score on the CES-D indicates higher levels of depression symptoms (range 0–60).

[d] School absenteeism was monitored in the school registration system and therefore available for a larger sample of adolescents than the self-administration data (n = 503).

[e] A higher score indicates a better quality of life (range 0–100).

Adolescents' evaluation of the Your Health intervention

In total 80.0% of the invited adolescents attended the consultation with the nurse. A large majority of adolescents appreciated being invited for the consultation (93.2%; mean = 4.51, SD = 0.72, on a 5-point scale), had confidence in the nurses (96.4%; mean = 4.57, SD = 0.60) and were satisfied with the topics discussed with the nurse (96.4%; mean = 4.57, SD = 0.64). Moreover, adolescents felt that the nurses took them seriously (97.7%; mean = 4.75, SD = 0.48), listened to them very well (100%; mean = 4.84, SD = 0.37) and put them at ease (97.7%; mean = 4.65, SD = 0.54). Furthermore, adolescents found that the nurses responded to all the questions they asked them (93.6%; mean = 4.51, SD = 0.70), gave explanation and provided information in understandable language

(97.3%; mean = 4.69, SD = 0.54) and took their personal situation into account when providing information (96.8%; mean = 4.62, SD = 0.55). Adolescents rated the item 'I dared to ask the nurse questions' (90.0%; mean = 4.35, SD = 0.48) the lowest. The overall rating of the consultation was positive with a mean rating of 8.78 on a 10-point scale (SD = 1.13) (Table 2).

Table 2. Adolescents' evaluation of the consultation with the nurse (N = 222)

	Your Health group	
	Mean (SD)	**% positive score (n)[a]**
1. The nurse listened very well to me	4.84 (0.37)	100 (222)
2. I have confidence in the nurse [1]	4.57 (0.60)	96.4 (213)
3. The nurse gave me explanation and information in understandable language [1]	4.69 (0.54)	97.3 (215)
4. I dared to ask the nurse questions [2]	4.35 (0.48)	90.0 (197)
5. I felt that the nurse took me seriously [1]	4.75 (0.48)	97.7 (216)
6. The nurse responded to all the questions that I asked [4]	4.51 (0.70)	93.6 (204)
7. The nurse put me at ease [2]	4.65 (0.54)	97.7 (215)
8. When providing information, the nurse took into account my personal situation [2]	4.62 (0.55)	96.8 (213)
9. I am satisfied with the topics discussed with the nurse [1]	4.57 (0.64)	96.4 (213)
10. I liked to be invited for a consultation with the nurse	4.51 (0.72)	93.2 (207)
	Mean (SD)	
11. Overall satisfaction with the consultation [1]	8.78 (1.13)	

Note: [missing data]; item 1 – 10 are scored on a 5-point Likert scale ranging from 1 (totally disagree [most-negative evaluation]) to 5 (totally agree [most-positive evaluation]); item 11 is scored on a 10-point Likert scale ranging from 1 (most-negative evaluation) to 10 (most-positive evaluation).

[a] Percentages of adolescents who scored a 4 *agree* or 5 *totally agree* on the 5-point Likert scale.

Nurses' evaluation of the Your Health intervention

The mean duration of the consultation with the nurse was 23.8min (SD = 9.55, range 10–60). Nurses suspected problems in 36.8% of the adolescents. In 52.4% of these cases, the nurses estimated the severity of the problems to be moderate, and in 13.4% of the cases severe (Table 3). Some adolescents for whom the nurses suspected problems, already received help from professionals (7.8%). Furthermore, when the nurses suspected problems, various actions were taken by the nurses during and after the consultation. Specifically, tailored advice was given to 59.3% of the adolescents and 24.7% of the adolescents was reassured. Nurses contacted school for 23.5% of the adolescents, parents for 4.9% of the adolescents and other professionals for 4.9% of the adolescents. A further consultation with the nurse was initiated in 12.3% of the adolescents, whereas 35.8%

Table 3. Nurses' evaluation of the consultations (N = 224)

	Mean (SD)	**Range**	
Consultation time in minutes [16]	23.8 (9.55)	10–60	
	Yes	**No**	
Nurse suspects problems [1]	36.8% (n = 82)	63.2% (n = 141)	
	Light	**Moderate**	**Severe**
	% (n)	**% (n)**	**% (n)**
Severity of the problems (n = 82)[a]	34.1 (28)	52.4 (43)	13.4 (11)
Action that is taken (n = 81) [1][a,b]			
None, because…	11.1 (9)		
Adolescent already had help from professional(s)	77.8 (7)		
Adolescent did not want help	11.1 (1)		
Adolescent did not need help	11.1 (1)		
Reassurance of the adolescent	24.7 (20)		
Tailored advice	59.3 (48)		
Advice to seek help	35.8 (29)		
Initiate a further consultation with nurse	12.3 (10)		
Contact school	23.5 (19)		
Contact parents	4.9 (4)		
Contact other professionals	4.9 (4)		
Referral to other professional	40.7 (33)		
Social worker	45.7 (16)		
Multi-problem family counseling team	11.4 (4)		
General practitioner	11.4 (4)		
Psychologist	5.7 (2)		
Pedagogue	2.9 (1)		
Physiotherapist	2.9 (1)		
Other	20.0 (7)		

Note: [missing data].

[a] These questions were only asked when the nurse indicated that she suspected problems .

[b] Multiple answers were possible.

Table 4. Follow-up health and health behaviors and effects of the intervention with the control group as reference (N = 418)

	Your Health	Control group	Intervention effects[a]
	n = 196	n = 222	
Mental health status	**Mean (SD)**	**Mean (SD)**	**Beta coefficient (95% CI)**
MHI-5 score[b] [1]	70.4 (17.5)	71.1 (18.88)	-1.17 (-4.00 – 1.66)
Depression symptoms			
CES-D score[c] [3]	12.9 (10.22)	12.6 (10.36)	0.54 (-1.14 – 2.23)
School absenteeism *fifth and sixth month of education (n = 503)*[d]			
Permitted absenteeism (hours)	14.8 (30.67)	12.1 (31.28)	1.51 (-3.74 – 6.76)
Not-permitted absenteeism (hours)	27.5 (45.26)	16.5 (31.52)	4.67 (-0.93 – 10.26)
Debts	**% (n)**	**% (n)**	**OR (95% CI)**
None	78.6 (151)	85.1 (188)	0.73 (0.37 – 1.44)
< 500 euro	5.7 (11)	4.5 (10)	
> 500 euro	15.6 (30)	10.4 (23)	
Quality of life[e] [18]	**Mean (SD)**	**Mean (SD)**	**Beta coefficient (95% CI)**
Physical health	52.5 (6.54)	51.8 (6.74)	0.13 (-1.10 – 1.35)
Mental health	47.9 (8.98)	48.4 (9.52)	-0.42 (-2.10 – 1.26)
Alcohol consumption			
5 or more drinks on one occasion the past 4 weeks [4]	**% (n)**	**% (n)**	**OR (95% CI)**
0 times	57.0 (110)	53.4 (118)	1.05 (0.66 – 1.67)
1 times	16.6 (32)	18.6 (41)	
2 times	8.8 (17)	9.0 (20)	
3 – 4 times	10.9 (21)	8.6 (19)	
5 or more times	6.7 (13)	10.4 (23)	
Have been drunk or tipsy the last 4 weeks [5]			
0 times	74.6 (144)	66.8 (147)	1.51 (0.83 – 2.76)
1 – 2 times	15.0 (29)	20.5 (45)	
3 or more times	10.4 (20)	12.7 (28)	
Drug use (past 4 weeks) [3]			
0 times	87.1 (169)	89.1 (197)	0.95 (0.36 – 2.48)
1 or more times	12.9 (25)	10.9 (24)	

Note: [missing data].

[a] Group differences were tested with multilevel linear, ordinal and logistic regression. Analyses were adjusted for gender, and the baseline value of each outcome.

[b] A higher score on the MHI-5 indicates less mental health problems (range 0–100).

[c] A higher score on the CES-D indicates higher levels of depression symptoms (range 0–60).

[d] School absenteeism was monitored in the school registration system and therefore available for a larger sample of adolescents than the self-administration data (n = 503).

[e] A higher score indicates a better quality of life (range 0–100).

was advised to seek help and 40.7% was referred to another professional. Most adolescents were referred to a social worker (45.7%), a social counselor (14.3%), a general practitioner (11.4%) or a multi-problem family counseling team (11.4%).

Effects of Your Health

Table 4 shows that there were no statistically significant effects of the Your Health intervention on mental health status, depressive symptoms, school absenteeism, and debts at the 6-month post- intervention assessment compared with the control group (all $p > .05$). There were no statistically significant group differences found on health-related quality of life, alcohol consumption or soft drug use either (all $p > .05$).

DISCUSSION

This study shows that the proactive, integrated preventive health consultation offered to adolescents at the start of senior vocational education was highly appreciated by adolescents. In about a third of the adolescents, nurses suspected problems and several actions were taken. The majority of these adolescents were given tailored advice or they were referred to another professional. No effects of the Your Health intervention on mental health, school absenteeism, debts, health-related quality of life, alcohol consumption or soft drug use were found.

This study included adolescents from the lowest two levels of senior vocational education. This group is a vulnerable group; school dropout is high among this group, and many of these adolescents experience problems such as debts and substance abuse.[4] Results of our study support this notion; risk behaviors and depressive symptoms were, comparable with other studies among adolescents attending senior vocation education,[30-32] highly prevalent, nurses suspected problems in a third of these adolescents and in two-thirds of these adolescents nurses rated the severity of the problems as moderate to severe. Importantly, a vast majority of the adolescents attended the consultation offered in this study. Therefore, Your Health seems to be a promising intervention to reach vulnerable adolescents at the start of their senior vocational education.

Furthermore, because adolescents often do not seek help for their problems themselves, and their problems may go undetected and untreated,[13-15] an advantage of Your Health was that it provided an entry point for adolescents into the health care system. Results showed that during the consultations tailored advice was offered to the majority of adolescents with suspected problems, and a large minority of adolescents was referred to other professionals, thereby providing adolescents an opportunity to access help, which they may otherwise not have been offered.

In this study, adolescents reported they had confidence in the nurse. Previous research indicates that adolescents' confidence in professionals on whom they rely for help is very important.[33-34] For example, confidence in professionals is needed to feel comfortable to also share the most sensitive information. Furthermore, adolescents reported that the nurse took into account their personal situation when providing information. The importance of taking into account the adolescent's personal situation was supported by a study of Golsäter et al.,[35] indicating that adolescents preferred consultations based on their own situation over general recommendations for healthy lifestyles. Although adolescents in our study were already satisfied with the topics discussed with the nurse, satisfaction could potentially be further improved by having adolescents complete a questionnaire on topics that are relevant for the consultation. Previous research has shown that completing such a questionnaire on health and health behaviors before consultation familiarizes adolescents with the topics the nurse will bring up and better enables adolescent to take an active part during the consultation.[35] From the nurses' point of view, collecting information on adolescents' health and health behaviors prior to the consultation assists in determining the crucial aspect(s) to focus the discussion on.[36,37] This could be especially helpful, since the vulnerable group of adolescents included in this study is probably dealing with multiple problems.[4] Therefore, collecting information prior to the consultation could help to prioritizing problems to discuss. Finally, adolescents also evaluated other aspects of the consultation with the nurse positively. This is of great importance, because if adolescents obtain positive experiences with accessing help from professionals, they are more likely to comply with advice and more likely to continue seeking help when they need it throughout their lives.[34,38]

Positive effects of the intervention on the health and health behaviors of adolescents were not found. This is in line with earlier research, showing little evidence for the effectiveness of short-term counseling by school nurses.[39-41] In this study, only one consultation was offered to adolescents. Such a consultation may be a valid mean to assess adolescent problems and to refer adolescents to other professionals if necessary, but may often not be sufficient in its own right to ameliorate the problems that adolescents have.[42] A longer follow-up period is probably needed before effects emerge from the subsequent help that is offered by professionals. This is supported by previous research on school-based prevention programs that indicates that significant effects were not found until the longer-term follow-up periods (i.e. 1–3 years).[43] Because this study only had a 6-month follow-up period, potential long-term effects could have been missed. Moreover, the nurses focused on a wide variety of domains and the areas for improvement were different for each individual adolescent, making it harder to find effects on any one specific outcome.

Your Health could potentially be further improved by strengthening the collaboration between the school nurses and the other professionals within the SHS. An effective

collaboration between professionals is essential in order to enable successful health promotion work at schools.[44,45]

Because the nurses were only recently added to the SHS, this collaboration was possibly not optimal yet. This is supported by the relatively low number of instances in which the nurse contacted the school after a consultation, and referred adolescents within the SHS. Specifically, nurses mainly referred to professionals outside SHS, such as multi-problem family counseling teams and General practitioners. Within SHS, nurses only referred to social workers, despite other professionals being available within the SHS, such as social psychiatric nurses or guidance counselors. Seen the nature of adolescents' problems, these professionals could also have made a valuable contribution to adolescents' health promotion. Nevertheless, in some cases, especially if complex care is needed, it is preferable to refer adolescents to professionals outside the SHS for adolescents to receive the best care possible.

Strengths and limitations

The present study has both strengths and limitations that need to be addressed. An important strength is the evaluation of the feasibility of the intervention from the perspective of both adolescents and nurses. However, the research design also has its limitations, especially concerning the evaluation of the effect of the intervention on health and health behaviors. The post-intervention and longer-term effects of the consultation were not evaluated. Furthermore, the dose and intensity of the intervention itself were most probably too small to sort direct effects on the outcome measures, whereas the subsequent help that adolescents received after the consultation and its effect were not evaluated. Therefore, future studies need to evaluate the appropriateness and effects of the referrals and subsequent help that adolescents received as a result of the consultation.

It is feasible that this subsequent help will sort effects on health (behavior) outcomes. Moreover, although school classes (instead of individual students) were the unit of randomization to reduce contamination of the control group, adolescents from the control and intervention group were both present at the same school. Therefore, there was still a small risk of contamination of the control group. However, since the participating schools were rather different from each other in terms of demographics (e.g. in terms of the type of vocational training they provided education in the fields of care or technic, which respectively attract more girls and boys), we decided to randomize at the level of school classes in order to obtain a control and intervention group that were as comparable as possible. Additionally, 5.9% of adolescents in the control group asked for a consultation with their class mentor, which may also have resulted in contamination of the control group. However, exploratory analyses of the effectiveness of the intervention showed the same (non-significant) results when the analyses were conducted with and without

the adolescents from the control group who asked for a consultation with the class mentor. Furthermore, this study was only conducted among Dutch adolescents following the lowest levels of senior vocational education, and therefore, generalization to other countries and settings should be done with caution. Furthermore, dropout was higher among older adolescents, adolescents of non-Dutch ethnicity and adolescents having a child, which could also affect the generalizability of the results. Another limitation is the use of self-report measures, which may have resulted in less reliable outcomes. Therefore, the collection of more objective data on health behavior and additional parent- and/or teacher-ratings on health and health behaviors of the adolescents might have been useful. Nevertheless, research suggests that, e.g. self-reported alcohol consumption among adolescents is generally considered valid[45] and that adolescents are better reporters of their own mental health status than parents and teachers.[47]

Conclusion

In conclusion, this study supports the use of Your Health as a promising intervention to reach vulnerable adolescents at the start of senior vocational education. Furthermore, the consultation was evaluated positively by adolescents. As the intervention can be easily embedded in the existing practice of the SHS, the chances of future implementation are increased. However, no effects on health and health behaviors were found at 6-month follow-up. The intervention could probably be improved by strengthening the collaboration between school nurses and other professionals in the SHS and by having adolescents complete a questionnaire on topics that are relevant for the consultation. Furthermore, future research is needed to evaluate potential long-term effects and to evaluate the effects and appreciation of the subsequent help that is offered by the SHS.

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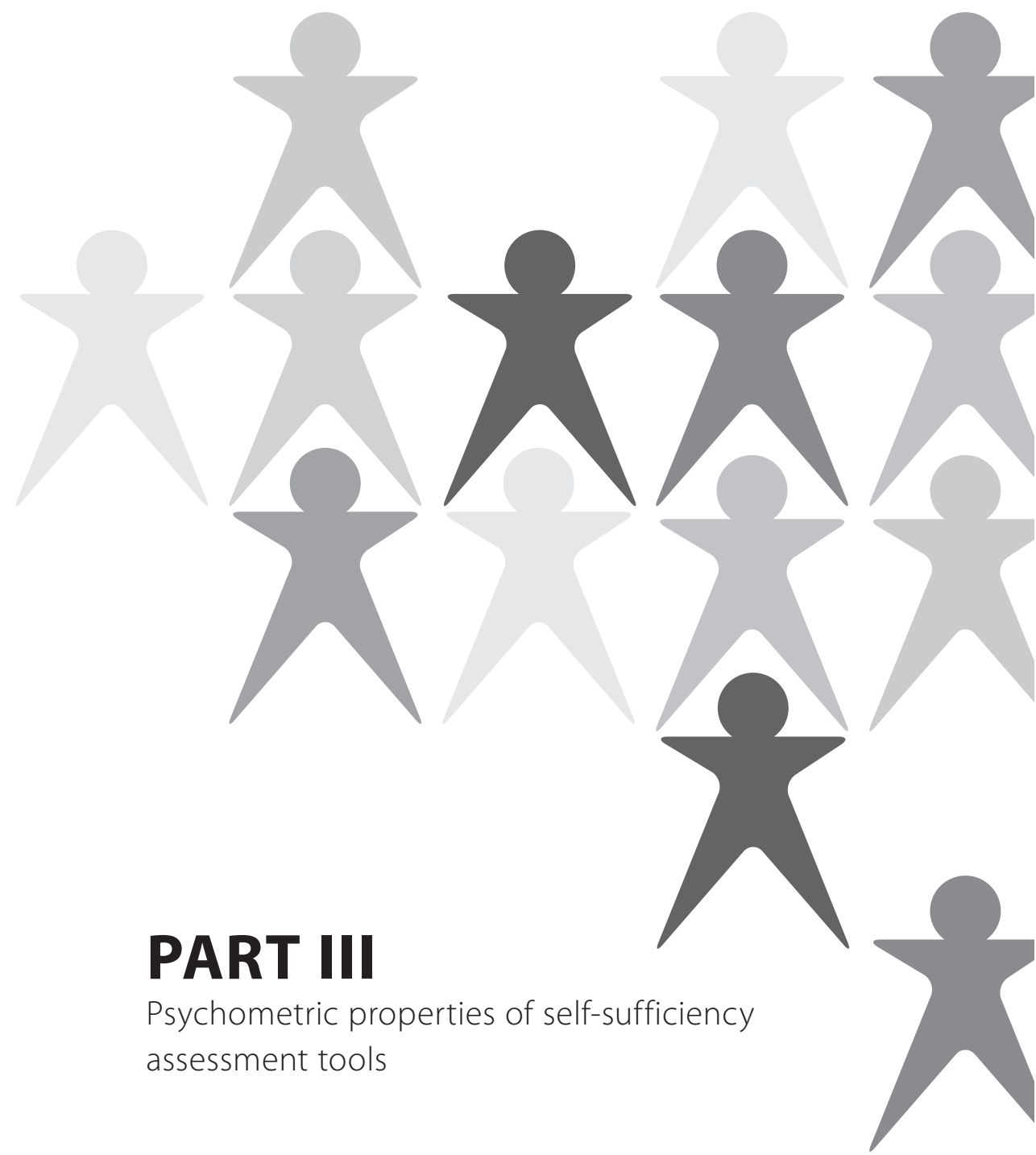
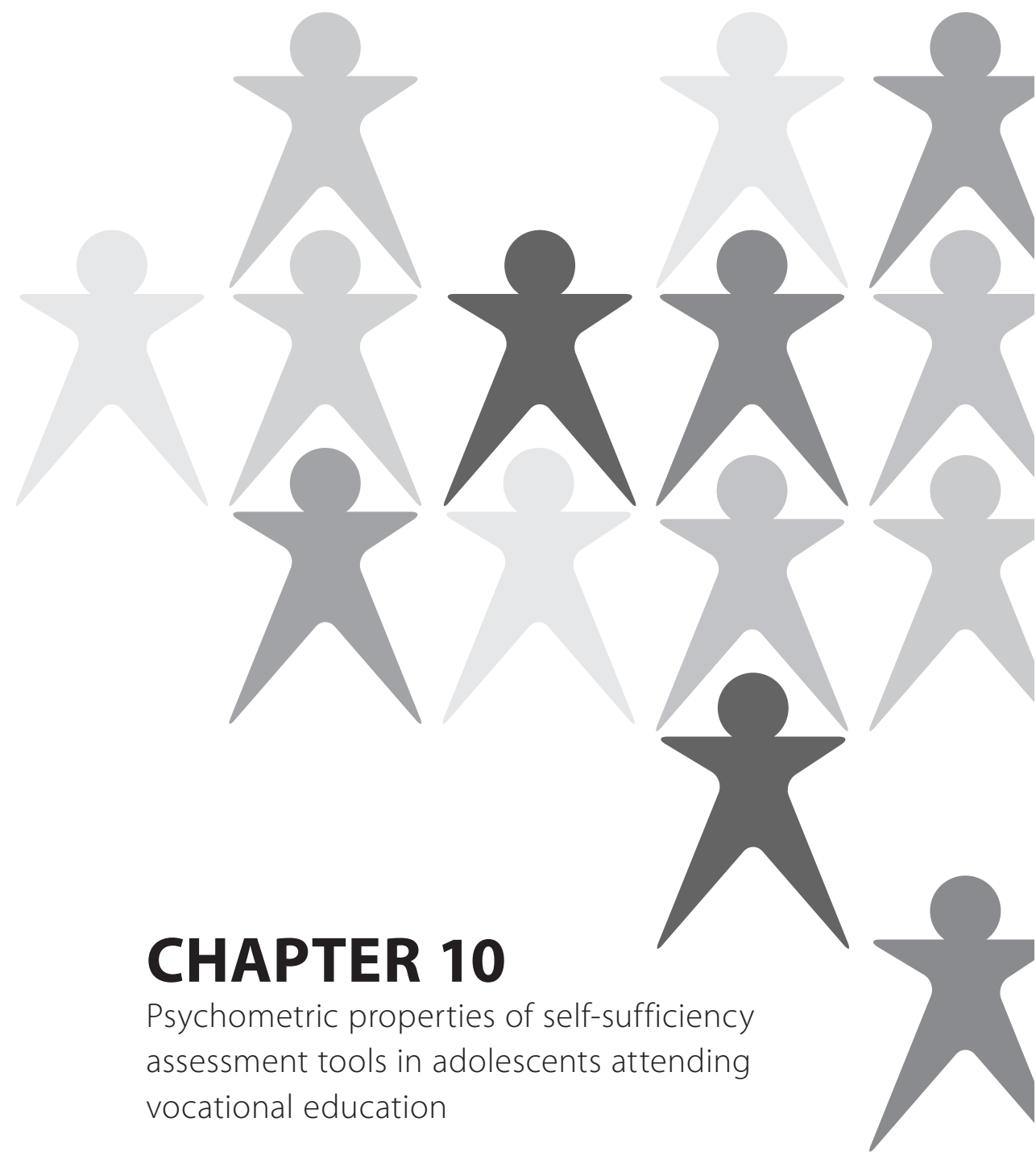


PART III

Psychometric properties of self-sufficiency assessment tools



CHAPTER 10

Psychometric properties of self-sufficiency assessment tools in adolescents attending vocational education

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Submitted

ABSTRACT

Purpose

Self-sufficiency is the realization of an acceptable level of functioning either by the person him/herself or by adequately organizing the help of informal or formal care providers. Assessment of self-sufficiency to determine the strengths and areas for improvements in functioning of an individual is increasingly applied among adolescents attending senior vocational education, which is considered a vulnerable group with high school drop-out, and in which problems often accumulate. This study examined the psychometric properties of two instruments, i.e. a self-report questionnaire assessing self-sufficiency and the Self-Sufficiency Matrix for professionals (SSM-D) among adolescents attending senior vocational education.

Methods

The self-report questionnaire used to assess self-sufficiency was completed by 581 adolescents; 219 of these adolescents completed the questionnaire again after six months. Professionals completed the SSM-D for 224 of the 581 adolescents. Furthermore, constructs related to the domains of self-sufficiency were assessed with self-report questionnaires and information about school absenteeism was monitored via the school registration system.

Results

For both self-report and professional-report ratings, the internal consistency was satisfactory (Cronbach's $\alpha > 0.70$) and various small to strong correlations were found between domains of self-sufficiency and related constructs. For most of the domains, there was no or poor agreement between professionals and adolescents. The (six-month) temporal stability among the adolescents for most of the domains was fair.

Conclusions

Both the self-report questionnaire assessing self-sufficiency and the SSM-D applied in this study seem to possess adequate psychometric properties. The results indicated that adolescents and professionals provide different views of adolescents' self-sufficiency, which merits further study. In the meantime, we recommend assessment of adolescents' self-sufficiency by using both self-report questionnaire and the SSM-D to get a comprehensive measure of adolescent's self-sufficiency.

INTRODUCTION

Mental health problems are highly prevalent in adolescents and risk behaviors, such as substance use, and truancy are often acquired during adolescence.[1] These problems and behaviors can negatively affect the functioning of adolescents on different life domains.[2] Furthermore, mental health problems and risk behaviors often do not occur in isolation among adolescents, but are associated with each other and accumulate.[3-9] The co-occurrence of mental health problems and risk behaviors, and the influence that these problems and behaviors have on the functioning of adolescents on various life domains, suggests that professionals should preferably address problems and risk behaviors on several life domains simultaneously. However, to date most intervention programs and assessment tools take a single problem/risk behavior/life domain approach instead of an integrated approach.[10]

Self-sufficiency matrices (SSM) are instruments that have adopted such an integrated approach.[11,12] In the United States, the basis for the SSM was developed. The SSM can be used by professionals during consultations to determine the strengths and areas for improvements in functioning of, for example, vulnerable adolescents. It expresses functioning in levels of self-sufficiency on several domains (e.g. mental health and social network). Self-sufficiency is thereby defined as the realization of an acceptable level of functioning either by the person him/herself or by adequately organizing the help of informal or formal care providers.[2]

Although the SSM is applied in the United States[11,12] and is quickly gaining popularity in other countries as well,[13] to the best of our knowledge, there is only one study available examining the psychometric properties of the SSM. Fassaert et al.[2] showed that an adapted 11 domain version of the SSM (SSM-D) is a reliable instrument to assess self-sufficiency of adolescents with severe and complex psychiatric problems by professionals. However, more insight in the psychometric properties of the SSM among other populations, such as adolescents attending senior vocational education (SVE) is needed. The SSM is increasingly used among this population, which is considered a vulnerable group with high school dropout (i.e. approximately 40%), in which problems often accumulate.[3,4]

So far, the SSM is only available for professionals to complete during consultations. However, previous research has shown low correlations between different informants (e.g. adolescents and professionals) when assessing problems, and a valuable unique contribution can be made by different informants.[14-18] Hence, assessment of self-sufficiency by a questionnaire for adolescents alongside a proxy rating by professionals could give a more comprehensive measure of adolescents' self-sufficiency. Therefore, additional to assessing self-sufficiency by a proxy rating provided by professionals, assessment of self-sufficiency by a questionnaire for adolescents was applied in this study.

The purpose of this study was to assess the psychometric properties of a self-report questionnaire assessing self-sufficiency and the SSM-D in a group of vulnerable adolescents (i.e. attending SVE). This study investigated: 1) internal consistency of both instruments assessing self-sufficiency (i.e. self-report questionnaire and SSM-D), 2) correlations between adolescents' and professionals' ratings on domains of self-sufficiency and related constructs (concurrent validity), and 3) (six-month) temporal stability of adolescents' ratings on domains of self-sufficiency. Additionally, we examined degree of agreement between adolescents and professional ratings on the domains of self-sufficiency.

Since there are some conceptual differences between domains of self-sufficiency and the related constructs that were used to assess concurrent validity (e.g. Finances and Debts), small to strong correlations are expected depending on the level of overlap between the constructs under study. Furthermore, we hypothesize that the temporal stability of adolescents' rating on the domains of self-sufficiency is fair since there was a relatively long period (six-months) between both measurements. In line with previous studies on adolescent's psychopathology agreement between informants,[14,15,17,18] we hypothesize that the degree of agreement between adolescents and professionals on the domains of self-sufficiency will be fair at most. Low levels of agreement between adolescents and professionals could indicate that these informants cannot be substituted for one another, because they provide unique information.[14]

METHODS

Data collection

This study used data obtained at enrolment in the Your Health study, a cluster randomized controlled trial, as described in detail elsewhere.[19] A total of 44 first-grade classes with students attending SVE in the region of the Dutch city of Rotterdam participated. A few weeks prior to the start of the study, all adolescents and parents received information about the study. Parents were asked passive written informed consent. If parents did not want their child to participate, they could object to the participation of their child (until adolescent age 18 years). During a classroom session, adolescents who were present in class, were asked active written informed consent before they completed a questionnaire. The self-report questionnaire assessing self-sufficiency was included in this questionnaire. After the self-report questionnaire was administered, school classes were randomly assigned to the Your Health or control condition. Adolescents in the intervention group were invited for a preventive health consultation with the school nurse. During this consultation, the nurse used the SSM-D and rated the self-sufficiency

of the adolescent. Adolescents in the control group completed the self-report questionnaire assessing self-sufficiency again at six-month follow-up.

Of the 830 adolescents who received information about the study, 584 (70.4%) adolescents were present at time of assessment, provided informed consent, and participated; 280 in the Your Health group; 304 in the control group. The main reason for non-participation was absence at time of the assessment. The questionnaire used to assess self-sufficiency was completed by 581 of the 584 (99.5%) participating adolescents. Of the 280 adolescents who were invited for a consultation, 224 (80.0%) attended the consultation. Of the 304 adolescents in the control group, 219 (72.0%) completed the self-report questionnaire assessing self-sufficiency again at follow-up (See Figure 1).

Ethics statement

The Medical Ethical Committee of Erasmus MC has reviewed the research proposal for this study and declared that this study does not fall under the ambits of the Medical Research Involving Human Subjects Act (also known by its Dutch abbreviation WMO) and therefore, does not require further approval of an ethics review board. The Medical Ethical Committee had no objection against the execution of this research proposal (MEC-2012-367).

Measurements

Assessment of self-sufficiency by professionals

The Dutch version of the SSM (SSM-D) was used and assesses an individual's level of self-sufficiency on 11 life domains: finances, day-time activities, housing, domestic relations, mental health, physical health, addiction, activities daily living, social network, community participation, and judicial. Each of the domains is measured by a single item and the level of self-sufficiency is rated on a 5-point scale: 1 = '*acute problem*', 2 = '*not self-sufficient*', 3 = '*barely self-sufficient*', 4 = '*adequately self-sufficient,*' and 5 = '*completely self-sufficient*'. For every domain, indicators that specify each level of self-sufficiency are defined. Together these indicators form a matrix of domains and levels of self-sufficiency.[2,20] For an example of the indicators for a SSM-D domain (i.e. Finances), see Table 1. Prior to the consultations, nurses were trained to work with the SSM-D.

Assessment of self-sufficiency by adolescents

A self-report questionnaire assessing self-sufficiency was developed based on the 11-domain version of the SSM-D. Each domain name was translated into plain language, and a short description was made describing the content of each domain in plain language. Plain language was used because some adolescents may have relatively poor reading skills. Subsequently, based on group discussions and consensus between professionals, language adjustments were made and the response scale of the professional

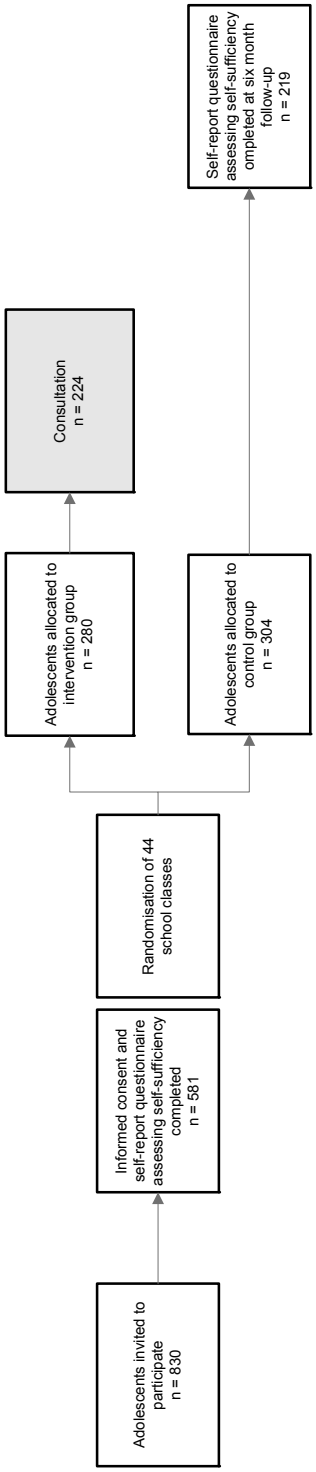

Figure 1. Flow chart of the adolescent's participation

version was simplified. Professionals indicated that the word 'self-sufficiency', used in the response scale of the SSM-D, would be too difficult for adolescents to understand. Therefore, the response scale was replaced in a simple 5-point Likert scale: 1 = '*no problems*', 2 = '*few problems*', 3 = '*not few/not many problems*', 4 = '*many problems*', and 5 = '*very many problems*'. Furthermore, a smiley was displayed with each response option to support adolescents with poor reading skills. Finally, a pilot was conducted among the target group (i.e. adolescents attending SVE) to examine whether the language and the response scale used were clear; and the instrument was usable in this group. No further adjustments were needed based on this pilot.

Our self-report questionnaire differs in some respects from the SSM-D. First, in the self-report questionnaire, a short description is provided for each domain, but there are no indicators defined that specify each level of self-sufficiency as there is in the SSM-D. Second, the self-report questionnaire has a different 5-point response scale (with smileys) than the SSM-D.

Table 1. Example of an indicator in the Dutch Self-Sufficiency Matrix: Finances

Rating	Label	SSM-D description
1	Acute problem	No income. High, increasing debts.
2	Not self-sufficient	Insufficient income and / or spontaneous or inappropriate spending. Increasing debts.
3	Barely self-sufficient	Can meet basic needs with income and/or appropriate spending. If there are debts, they are at least stable and/or controlled by a third party.
4	Adequately self-sufficient	Meets basic needs without receiving social security benefits. Manages possible debts without assistance and they are decreasing.
5	Completely self-sufficient	Income is ample, well managed. Has the ability to save with income.

Demographics

Demographic characteristics included age, gender, country of birth of the adolescent and both parents, and whether or not the adolescent already was a parent him/herself. Ethnicity was classified as Dutch or non-Dutch, in accordance with the definitions of Statistics Netherlands.[21]

Related constructs

Debts, homelessness, alcohol consumption, soft drug use, and delinquency were assessed by items based on existing instruments previously developed by Municipal Public Health Services and health institutes in the Netherlands.[22]

Debts

Debts were assessed on an ordinal scale by the items: (1) do you have debts (yes/no/don't know), and (2) approximately how high is the sum of all your debts (less than 50 euro – more than 2500 euro).

Homelessness

Homelessness was assessed by the item: "In the past 3 months, have you been homeless? This means that you had no perspective on a permanent place to sleep for at least one night per month" (yes/no).

Alcohol and soft drug

Alcohol consumption was covered by two items: (1) how often did you drink 5 or more alcoholic drinks on one occasion over the past 4 weeks (never – 9 or more times), and (2) how often have you been drunk or tipsy over the last 4 weeks (never – 20 or more times). Soft drug use was assessed by how often the adolescent had used soft drugs over the past 4 weeks (never – 20 or more times).

Delinquency

Delinquency was assessed by the item: "In the past 12 months, were you questioned at a police station, because you were accused of doing something that was not permitted?" (never – 6 or more times).

Mental health status

Mental health status was assessed by the Mental Health Inventory (MHI-5).[23] The MHI-5 includes five questions referring to both positive and negative aspects of mental health. All questions contain six possible response categories, scored between 1 and 6. The total score is transformed into a variable ranging from 0-100, with a score of 100 representing optimal mental health (current study $\alpha = 0.69$).

Depressive symptoms

Symptoms of depression were assessed by the Center for Epidemiologic Studies Depression Scale (CES-D).[24] The CES-D consists of 20 items. The frequency of symptoms is rated on a 4-point scale ranging from 0 to 3. Items scores are summed (range from 0-60), with higher scores indicating higher levels of depressive symptoms (current study $\alpha = 0.89$).

Health-related quality of life

Health-related quality of life was assessed by the Short Form-12 Health Survey (SF-12). The SF-12 consists of 12 items, with variable response categories across the items. The scores are summarized into two components, corresponding to mental and physical

health-related quality of life, with scores ranging from 0 (worst possible health state) to 100 (best possible health state) (current study $\alpha = 0.72$).

School absenteeism

In the school registration system every hour of absence was registered as permitted (i.e. because of illness or another valid reason) or not (i.e. without notification or valid reason). Absenteeism was defined as the number of hours adolescents were absent (permitted or not permitted) in a two-month period around the administration of the questionnaire.

Statistical analyses

Internal consistency was assessed by Cronbach's alpha, for which a value of ≥ 0.70 was considered adequate.[25] To determine concurrent validity, ratings on eight domains of both instruments (i.e. self-report questionnaire and SSM-D) assessing self-sufficiency were compared to ratings on related constructs. Concurrent validity was assessed by calculating the rank biserial, polychoric, or polyserial correlation between each domain and related constructs. Rank biserial correlation (r_{rb}) is used to determine the correlation between an ordinal and dichotomous variable. Polychoric correlation (r_{pc}) is used to determine the correlation between two ordinal variables, and polyserial correlation (r_{ps}) to determine the correlation between a continuous and an ordinal variable.[26] The criteria for judging the size of the correlation coefficient suggested by Cohen were applied: correlations < 0.30 are considered small; correlations ≥ 0.3 and ? 0.5 are considered medium, and ≥ 0.5 are considered strong.[27]

The degree of agreement between professionals and adolescents on each of the domains was determined with weighted kappa with linear weighting. Weighted kappa is a measurement of agreement for categorical data with an ordinal level.[28] Linear weighting is used when the difference between each category has the same importance. According to Altman's guidelines,[29] *K* is poor when it has a value of ≤ 0.20, fair when it is between 0.21–0.40, moderate when it is between 0.41–0.60, and good when it is ≥ 0.60. Weighted kappa with linear weighting was also used to determine the (six-month) temporal stability of adolescents' ratings on the self-report questionnaire assessing self-sufficiency.

Statistical analyses were performed using SPSS version 21. Polyserial, polychoric, and rank biserial correlations were calculated in SAS version 9.3.

RESULTS

Adolescents' characteristics

The self-report questionnaire assessing self-sufficiency was completed by 581 adolescents. The average age of these adolescents was 18.3 years (SD = 2.60), 39.0% were male, 28.1% was of Dutch ethnicity, and 10.6% was a parent (Table 2). Professionals completed the SSM-Dfor 224 of these adolescents. The average age of this subsample of adolescents was 18.3 years (SD = 3.59), 41.7% were male, 25.3% was of Dutch ethnicity, and 12.2% was a parent.

Table 2. Demographic characteristics of the study population

	Self-sufficiency			
	Completed questionnaires - Adolescents			Completed SSM-D - Professionals
	Total group	Control group	Intervention group	
Number (n)	581	301	280	224
Mean age; years (SD)	18.27 (2.60)	18.09 (2.54)	18.46 (2.65)[a]	18.26 (2.59)[a]
Gender of adolescent (male, %)	39.0	35.2	43.0	41.7
Ethnicity (Dutch, %)	28.1	31.0	24.9	25.3
Being a parent (yes, %)	10.6	8.1[b]	13.4[b]	12.2

[a] Adolescents in the intervention group who attended the consultation (n=224) were significantly younger than adolescents in the intervention group who did not attend the consultation (n=56).

[b] Adolescents in the intervention group (n=280) were significantly more often a parent than adolescents in the control group (n=301).

Self-sufficiency

The domains on which the professionals deemed the highest percentages of adolescents "not to barely self-sufficient" were: Community participation (36.7%), Domestic relations (15.8%), and Social network (14.5%) (Table 3). The domains on which the highest percentage of adolescents deemed themselves "not to barely self-sufficient" were a bit different, namely: Finances (23.3%), Domestic relations (17.4%), and Mental health (16.7%).

Internal consistency

Internal consistency was adequate. The Cronbach's alpha of the self-report questionnaire was 0.84 and of the SSM-D 0.71.

Concurrent validity

Various small to strong correlations were found between domains and related constructs (Table 4). All significant correlations were in the hypothesized direction. Correlations

Table 3. Professionals' and adolescents' ratings of self-sufficiency (n=224)

	Not to barely self-sufficient[a]	Acute problem	Not self-sufficient	Barely self-sufficient	Adequately self-sufficient	Completely self-sufficient
	%	%	%	%	%	%
Professionals' ratings (n=224)	1 - 3	1	2	3	4	5
Finances	12.9	0.9	4.9	7.1	42.4	44.6
Day-time activities [1]	1.3	0.0	0.0	1.3	85.2	13.5
Housing [3]	9.0	0.0	1.4	7.7	26.7	64.3
Domestic relations [2]	15.8	0.5	3.2	12.2	25.7	58.6
Mental health [1]	8.5	0.0	0.4	8.1	22.4	69.1
Physical health	4.5	0.0	0.4	4.0	29.0	66.5
Addiction	3.6	0.0	0.0	3.6	34.8	61.6
Activities daily life [2]	4.5	0.0	0.0	4.5	29.3	66.2
Social network [3]	14.5	0.9	1.8	11.8	43.4	42.1
Community participation [3]	36.7	0.5	12.7	23.5	47.1	16.3
Judicial [1]	12.6	0.0	5.4	7.2	18.4	69.1
	Not to barely self-sufficient[a]	**Very many problems**	**Many problems**	**Not few/ not many problems**	**Few problems**	**No problems**
	%	%	%	%	%	%
Adolescents' rating (n=224[b])	1 – 3	1	2	3	4	5
Finances [1]	23.3	4.9	5.4	13.0	23.3	53.4
Day-time activities [2]	8.1	0.5	1.4	6.3	19.8	72.1
Housing [1]	12.1	2.2	2.2	7.6	6.3	81.6
Domestic relations	17.4	2.7	4.0	10.7	17.9	64.7
Mental health [3]	16.7	3.2	4.1	9.5	17.2	66.1
Physical health [2]	11.3	1.8	2.3	7.2	18.9	69.8
Addiction [5]	7.8	0.9	1.4	5.5	9.1	83.1
Activities daily life	6.3	0.4	0.9	4.9	10.3	83.5
Social network [1]	8.1	0.9	0.9	6.3	12.6	79.4
Community participation [3]	8.1	0.9	2.3	5.0	14.9	76.9
Judicial	5.4	0.4	0.9	4.0	7.1	87.5

Note: [missing data].

[a] A rating of ≤ 3 is considered as not to barely self-sufficient.

[b] For comparability, only ratings were displayed for adolescents for whom a professional rating was available as well in this table (n=224).

between professionals' ratings of self-sufficiency on the different domains and related constructs varied from no correlation to strong correlations. The strongest correlations were found between the domain Finances and Debts (r_{pc} = -0.66), the domain Addiction

and Soft drug use (r_{pc} = -0.53), the domain Addiction and Alcohol consumption (drunk or tipsy) (r_{pc} = -0.41), and the domain Judicial and Delinquency (r_{pc} = -0.41).

Correlations between adolescents' ratings of self-sufficiency on the different domains and related constructs also varied from no to strong correlations. Comparable with correlations between professionals' ratings and related constructs, the strongest correlations between adolescents' ratings and related constructs were found between the domain Finances and Debts (r_{pc} = -0.74), the domain Addiction and Soft drug use (r_{pc} = -0.53), the domain Addiction and Alcohol consumption (drunk or tipsy) (r_{p} = -0.53), and the domain Judicial and Delinquency (r_{pc} = -0.53). In addition, strong correlations were found between the domain Mental health and Mental health status (r_{ps} = 0.60), Depressive symptoms (r_{ps} = -0.59 and Mental health-related quality of life (r_{ps} = -0.54).

Table 4. Concurrent validity: correlations between professionals' and adolescents' ratings of self-sufficiency and related constructs

Self-sufficiency	Related constructs	Correlation	
		With professionals' self-sufficiency rating (n=224)	With adolescents' self-sufficiency rating (n=581)
Finances	Debts	-0.66[a]	-0.74[a]
Day-time activities	Not-permitted school absenteeism	-0.26[b]	-0.17[b]
	Permitted school absenteeism	0.01[b,d]	-0.11[b]
Housing	Homelessness	-0.41[c,d]	-0.39[c]
Mental health	Mental health status (MHI-5)[e]	0.30[b]	0.60[b]
	Depressive symptoms (CES-D)	-0.33[b]	-0.59[b]
	Mental health-related quality of life (SF-12)[f]	0.29[b]	0.54[b]
Physical health	Physical health-related quality of life (SF-12)[f]	0.10[b,d]	0.33[b]
	Permitted school absenteeism	-0.08[b,d]	-0.13[b]
Addiction	Alcoholic drinks: 5 or more on 1 occasion	-0.30[a]	-0.39[a]
	Alcohol: drunk or tipsy	-0.41[a]	-0.53[a]
	Soft drug use	-0.53[a]	-0.53[a]
Community participation	Not-permitted school absenteeism	-0.20[b]	0.03[b,d]
	Permitted school absenteeism	-0.11[b,d]	-0.04[b,d]
Judicial	Delinquency	-0.41[a]	-0.58[a]

[a] Polychoric correlation.
[b] Polyserial correlation.
[c] Rank biseral correlation.
[d] Non-significant correlations; all other correlations were significant at $P < 0.05$.
[e] A higher score indicates less mental health problems.
[f] A higher score indicates a better quality of life.

Temporal stability of adolescents' ratings

The six-month temporal stability of adolescents' ratings varied between poor and moderate (Table 5). For the domains Finances (k = 0.41), and Mental health (k = 0.42) the temporal stability was moderate. The temporal stability was fair for the following seven domains: Housing (k = 0.30), Domestic relations (k = 0.33), Physical health (k = 0.21), Social network (k = 0.24), Activities daily life (k = 0.22), Community participation (k = 0.24), and Judicial (k = 0.26). The temporal stability was poor for the domains: Day-time activities (k = 0.16), and Addiction (k = 0.19).

Degree of agreement between professionals and adolescents

The degree of agreement between professionals and adolescents varied from no agreement to fair agreement (Table 6). The degree of agreement, in accordance with Altman's guidelines,[29] was fair on four domains: Finances (k = 0.22), Housing (k = 0.28), Domestic relations (k = 0.21), and Judicial (k = 0.21). The degree of agreements was poor for the domains: Day-time activities (k = 0.07), Mental health (k = 0.15), Physical health (k = 0.17), and Addiction (k = 0.18). For the remaining three domains (Activities daily life, Social network, and Community participation) no agreement (all ps > .05) was found.

Table 5. (Six-month) temporal stability of adolescents' ratings of self-sufficiency (n=219)[a]

Self-sufficiency	Weighted kappa
Finances	0.41
Day-time activities	0.16
Housing	0.30
Domestic relations	0.33
Mental health	0.42
Physical health	0.21
Addiction	0.19
Activities daily life	0.22
Social network	0.24
Community participation	0.24
Judicial	0.26

Note: all correlations were significant at P <0.001.

[a] Analyses were conducted on data of adolescents from the control group.

Table 6. Degree of agreement between professionals' and adolescents' ratings of self-sufficiency (n=224)

Self-sufficiency	Weighted kappa
Finances	0.22
Day-time activities	0.07
Housing	0.28
Domestic relations	0.21
Mental health	0.15
Physical health	0.17
Addiction	0.18
Activities daily life	0.004[a]
Social network	0.01[a]
Community participation	-0.003[a]
Judicial	0.21

[a] Non-significant correlations; all other correlations were significant at $P < 0.01$.

DISCUSSION

Both the self-report questionnaire assessing self-sufficiency and the SSM-D applied in this study seem to possess adequate psychometric properties in a group of vulnerable adolescents. The internal consistency was satisfactory. As hypothesized, concurrent validity was adequate and the (six-month) temporal stability was fair for most of the self-sufficiency domains. For most of the domains, there was also poor or fair agreement between professionals and adolescents.

More specifically, various small to strong correlations between the domains of both self-report questionnaire assessing self-sufficiency and SSM-D and the related constructs were found. This is in line with our hypothesis, as conceptual differences existed between domains and the related constructs that were measured. Furthermore, different raters were used and this is reflected by the higher correlations that were found between the domains of the self-report questionnaire assessing self-sufficiency and the adolescent-reported related constructs than between the domains of the SSM-D and the adolescent-reported related constructs.

In line with our hypothesis, the temporal stability of the self-report questionnaire was fair for most of the domains. The stability would probably have been higher if the test-retest interval would have been shorter,[30] for example one month instead of six months. Also using a shorter test-retest interval would have been desirable, because a test-retest interval should preferably be short enough to avoid genuine changes.[31]

For most of the domains, the degree of agreement between adolescents and professionals was poor to fair. A low agreement between informants is in line with previous research. For example, a small mean correlation ($r = 0.22$) between subjects and other

informants was found when using questionnaires to measure adolescents psychopathology.[14] Furthermore, 'needs' as measured with an assessment instrument using areas of life related to the domains of self-sufficiency (i.e. Camberwell Assessment of Need), are often assessed differently by professionals and clients.[16]

There are several factors that could have decreased the degree of agreement between adolescents and professionals. First, the self-report questionnaire has, instead of the SSM-D, no indicators that specify each level of self-sufficiency, which may have contributed to a lower degree of agreement. A second potential explanation is that the subjective norms of professionals and adolescents differ from each other.[15] For example, professionals may have judged that an adolescent is not self-sufficient on the domain 'day-time activities' when the adolescent had been truanting during the past week, while the adolescent might not see this as a problem when the truanting only happens occasionally. Third, it could be that adolescents are only partially aware of their problems,[17] such as having 'bad' friends or being addicted, whereas professionals may be able to estimate these problems better. Fourth, professionals cannot observe all aspects of the life of an adolescent and they depend on what the adolescent tells them.[15]

The low agreement between adolescents and professionals indicates that both informants can provide different information on the self-sufficiency of adolescents.[14] Since there is no golden standard against which to validate measures of adolescents functioning on domains, it is essential to use the contributions of different informants to get a more complete picture of the problems adolescents are dealing with.[14] Having the adolescent complete the self-report questionnaire assessing self-sufficiency prior to the consultation with the professional could encourage professionals to also pay attention to adolescents' view on their self-sufficiency and in determining the crucial aspect(s) to focus their discussion on.[32,33] Furthermore, previous research has shown that completing a questionnaire on topics that are relevant for the consultation familiarizes adolescents with the topics the professional will bring up and better enables the adolescent to take an active part during the consultation.[34]

Nevertheless, we recommend further improvement of the self-report questionnaire assessing self-sufficiency with respect to user friendliness. In contrast to the SSM-D, which was completed by professionals, the self-report questionnaire has no indicators that specify each level of self-sufficiency (from 1 to 5) per domain yet, only a short description of the contents of the domain. In order to make the self-report questionnaire more user-friendly and each level of self-sufficiency easier to interpret, it is desirable to add indicators that specify each level of self-sufficiency per domain. Preferably, these indicators correspond with the indicators available for professionals.

A strength of the study is the high response rate in a vulnerable population. However, the present study also has its limitations. The study relied on adolescents attending SVE. Therefore, the psychometric properties of both a self-report questionnaire assessing self-

sufficiency and the SSM-D remain to be established in other settings and populations. Furthermore, the temporal stability of professionals' ratings could not be examined and the temporal stability of adolescents' ratings are probably lower than if the follow-up period would have been shorter.[30] Moreover, concurrent validity could not be examined for three domains (i.e. Domestic relations, Activities daily life, and Social network), because no related constructs were measured. Furthermore, conceptual differences existed between the other self-sufficiency domains and related constructs. Comparison of ratings on the self-sufficiency domains with ratings on an instrument that is as closely related to the domains as possible (e.g. Camberwell Assessment of Need)[16] would have strengthened this study.

In conclusion, results of this study showed that both the self-report questionnaire assessing self-sufficiency and the SSM-D seem to possess adequate psychometric properties. Future research is necessary to investigate whether the results presented here can be replicated in different settings and populations, and to investigate additional psychometric properties as well. We recommend using the adolescent-report questionnaire assessing self-sufficiency and the SSM-D concurrently to get a more complete picture of adolescent's self-sufficiency. A great advantage of the self-report questionnaire assessing self-sufficiency and the SSM-D is that both versions can be completed in a short time, are freely available, and can be used in a group of vulnerable adolescents.

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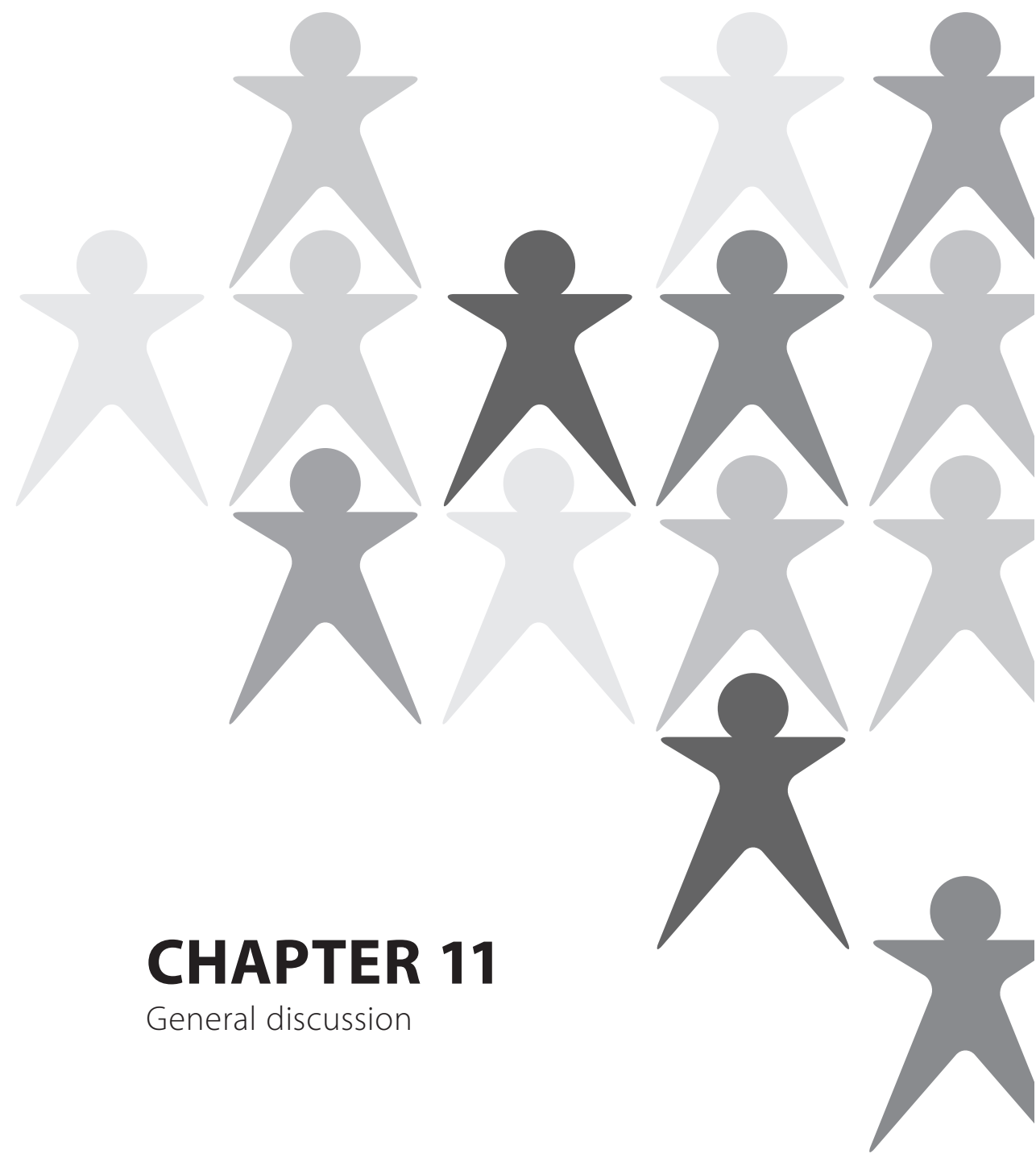

CHAPTER 11

General discussion

The main aims of the present thesis were to examine factors associated with mental health problems and health-risk behaviors, and second, to evaluate interventions aiming to identify adolescents' at risk of mental health problems and health-risk behaviors, and to promote adolescents' mental health and healthy behaviors. Furthermore, the psychometric properties of two measures of adolescent self-sufficiency are examined among adolescents attending senior vocational education, namely a self-report questionnaire and the Dutch version of the Self-Sufficiency Matrix (SSM-D) for professionals.

In the current chapter, the main results of the studies presented in this thesis are summarized and interpreted alongside the existing literature. The methodological issues that (could) have affected the findings will also be addressed. To conclude, recommendations for future research, policy, and practice will be outlined.

MAIN FINDINGS AND INTERPRETATION

Part I – Determinants of mental health problems and health-risk behaviors

In **Chapter 2 to 5**, studies investigating factors associated with mental health problems and health-risk behaviors were described. It is important to examine factors associated with the occurrence of these problems and behaviors as mental health problems and health-risk behaviors are highly prevalent among adolescents and can have adverse consequences on the short and longer term. Insight in the determinants of mental health problems and risk behaviors is necessary to enable the development of strategies to identify adolescents at risk of these problems and behaviors, and to develop effective interventions to improve adolescents' health and behaviors.

In **Chapter 2**, the clustering of a wide range of health-risk behaviors, and the association with depressive symptoms was examined among adolescents attending senior vocational education. Results showed that the included risk behaviors clustered. More specifically, two clusters of risk behaviors were identified: substance use (i.e. alcohol use, cannabis use, and cigarette smoking), and problem behaviors (i.e. truancy, delinquency, and having debts). The clustering of substance-use related risk behaviors (i.e. alcohol use, cannabis use, and cigarette smoking) was also found in other studies among adolescents.[1-3] The other cluster, problems behaviors, comprised the risk behaviors truancy, delinquency, and having debts. Although previous research showed an association between debts and delinquency,[4] between delinquency and truancy,[5,6] and between debts and active participation at schools among adolescents,[7] the clustering of these three risk behaviors seems to not have been previously investigated. The clustering of risk behaviors suggests that interventions should preferably address multiple risk behaviors simultaneously. However, to date, most intervention programs still take a single risk behavior approach, instead of such an integrated approach.[1] The finding of separate

clusters indicates that some combinations of risk behaviors, i.e. those which are clustering, will potentially be prone to an integrated prevention approach.

Furthermore, results showed that both clusters of risk behaviors were associated with depressive symptoms. This supports findings from earlier research, which show that adolescents engaged in more health-risk behaviors were at increased risk of depressive symptoms.[8,9] Therefore, if multiple risk behaviors are evident in adolescents, it could be useful to screen for and address depressive symptoms, whereas if depressive symptoms are evident it could be useful to screen for and address multiple risk behaviors.

In **Chapter 3**, associations of truancy, perceived school performance, and mental health with adolescents' week, weekend, and binge drinking were examined. The results confirmed the findings of earlier studies concerning binge drinking indicating an association between truancy and binge drinking, and between a poorer mental health and binge drinking.[10-16] Furthermore, results showed that truancy and a poorer mental health were associated with drinking (more) alcohol on weekdays. Truancy and having an average or less than average perceived school performance were associated with drinking (more) alcohol on the weekend.

These results illustrate that alcohol consumption does not always occur in isolation; truancy, perceived school performance, and mental health were found to be associated with different patterns of alcohol consumption in adolescents. Therefore, school staff and health professionals need to be aware that if they are confronted with truancy, low perceived school performance, and/or mental health problems among adolescents, these adolescents may be at risk of different patterns of alcohol consumption as well. Likewise, if school staff and health professionals are confronted with alcohol consumption among adolescents, school staff and health professionals need to be aware of truancy, perceived school performance, and mental health problems among these adolescents.

While the studies described in Chapter 2 and 3 were cross-sectional of nature, the studies reported in Chapter 4 and 5 were prospective. **Chapter 4** described a two-year longitudinal study examining the association between negative life events and mental health problems on the one hand, and between parent-adolescent attachment relationship quality and mental health problems on the other hand, among first-year secondary school students. Furthermore, the interaction between parent-adolescent attachment relationship and one or multiple negative life events on the mental health of adolescents was explored. In line with previous research,[17-31] the results of this study showed that negative life events were associated with an increased risk of mental health problems, as was an unfavorable parent-adolescent attachment. This fits with indications from these previous studies that negative life events posit a risk factor for mental health problems,[23-31] whereas a favorable parent-adolescents attachment may be a protective factor for these problems in adolescents.[17-22]

Furthermore, the results showed the hypothesized interaction between parent-adolescent attachment and negative life events on mental health. That is, the combined effect of an unfavorable parent-adolescents attachment relationship and negative life events on mental health was larger than the sum of the two individual effects. This result seems to suggest that a favorable parent-adolescent attachment may serve as a buffer against the potential adverse impact of negative life events on adolescents' mental health. A potential explanation of this interaction could be that a favorable parent-adolescent attachment leads to more adaptive or constructive coping efforts when an adolescent encounters negative life events. Coping theory suggests that when individuals encounter a potentially stressful situation one of the things they do is to evaluate their resources (internal and external) to handle the situation.[32] The parent-adolescent attachment relationship (e.g. the support adolescents think they will get from their parents) is one of those resources. In the appraisal process, if individuals decide their internal and/or external resources are adequate to handle the situation, they are less likely to feel threatened by the situation and more likely to cope with the situation. So, when adolescents are experiencing negative life events they might be better able to cope with these life events if they have a favorable parent-adolescents attachment instead of an unfavorable parent-adolescent attachment.

Chapter 5 described a study investigating whether traditional and cyber bullying victimization in the first-year of secondary school were associated with mental health problems and suicidal ideation in the third-year of secondary school. Additionally, it was explored whether bullying affects boys and girls in a different way, as previously suggested. Findings showed that both traditional and cyber bullying victimization were associated with an increased risk of mental health problems in girls, but not in boys. The difference between boys and girls in the long-term effects of traditional bullying victimization on mental health is also observed in other studies.[33-38] Our study extended these findings to cyber bullying victimization, as our results showed that the association between cyber bullying victimization and mental health problems was particularly driven by girls as well. The gender differences in the impact of bullying on mental health found in our study may be partly explained by differences in the subtypes of bullying to which girls and boys are exposed. Regarding to traditional bullying, previous studies have found that girls more often experience relational victimization and that relational victimization has a greater impact on mental health problems than overt victimization, which is more often experienced by boys.[39-41] Although much less is known about the impact of different subtypes of cyber bullying (e.g. via photos, video clips, or e-mails) on mental health, in line with the traditional bullying literature, it is viable that boys and girls also experience different types of cyber bullying, which could partly explain the gender differences found on cyber bullying as well.

Furthermore, in line with previous research,[33,42,43] results showed that *traditional* bullying victimization was associated with suicidal ideation at two year follow-up. However, being a *cyber* bullying victim was not related to suicidal ideation after controlling for baseline suicidal ideation. A possible explanation for this discrepancy is the small size of the group of adolescents who were either a cyber bullying victim *and* had suicidal ideation. This may have resulted in limited power to detect a significant relationship between cyber bullying and suicidal ideation. Another potential explanation may be the duration of exposure to bullying. Adolescents in our sample may have been exposed to cyber bullying for a shorter period of time compared to the time that they have been exposed to traditional bullying. Previous research showed that traditional bullying victimization remains relatively stable over time (between the ages of 8 and 16 years),[44] whereas cyber bullying victimization may occur at a later age, around the age of 14 years[45] Around this time children start to spend more time on their mobile phones and are more likely to participate on social network sites (e.g. Facebook, MySpace) which are likely places for cyber bullying to occur.[46] Therefore, adolescents may not have been exposed to cyber bullying long enough to develop suicidal ideation. It is possible that on the long-term, suicidal ideation will develop as a result of more pronounced and further developed mental health problems[47] and/or after persistent long-term exposure to bullying. This may have been the case with traditional bullying, but perhaps not yet with cyber bullying in our sample.

Part II – Interventions promoting adolescents' mental health and healthy behaviors

The findings on factors associated with mental health problems and health-risk behaviors, as described above, can help to improve the identification of those at risk of mental health problems and/or (multiple) health-risk behaviors, and to develop effective interventions to improve adolescents' health and behaviors. The identification of mental health problems and risk behaviors, and interventions improving adolescents' health and behaviors are important, because mental health problems and risk behaviors often have their first manifestation during adolescence, and, if undetected and not treated, often persist into adulthood. Therefore, three interventions (i.e. E-health4Uth, E-health4Uth with consultation, and Your Health) aiming to identify adolescents at risk of mental health problems and health-risk behaviors, and to promote adolescents' mental health and healthy behaviors, were developed, implemented, and evaluated. The design of the E-health4Uth study (including the E-health4Uth and E-health4Uth with consultation interventions) is described in **Chapter 6**. In **Chapter 7 to 9**, studies investigating the evaluation of the three interventions are described.

Chapter 7 and 8 evaluated the appreciation and effectiveness of Web-based tailored messages (E-health4Uth) as a standalone intervention, and in combination with a consul-

tation with a preventive youth health care nurse for adolescents at risk of mental health problems (E-health4Uth with consultation). These two interventions were applied by preventive youth health care organizations in secondary schools. A cluster-Randomized Controlled Trial (cluster-RCT) with a 4-month follow-up period was conducted.

Results showed that the Web-based, tailored messages (E-health4Uth) and the consultation with the nurse were used and appreciated positively by adolescents and nurses (**Chapter 7**). Other studies in which tailored messages were used among adolescents have shown comparable ratings of the use and appreciation of tailored messages on health and behaviors.[48-50] Although the ratings of the use and appreciation of the tailored messages were comparable with previous research, the tailored messages potentially can be further improved. The rationale behind using tailored messages is that the information is personally relevant, new, giving insight into own behavior, and is interesting, which results in greater attention and more thoughtful consideration of the information.[51,52] However, in the E-health4Uth study, the items regarding personal relevance of the messages, the messages giving insight into own behavior, and finding the messages interesting were evaluated as neutral by the adolescents and at least a part of the information in the messages was not new to the adolescents. This implies that the tailored messages could be further improved at least on these points.

The consultation with the nurse was considered a valuable addition to the Web-based tailored messages by adolescents, and the consultation with the nurse was rated more positively than the tailored messages (**Chapter 7**). The more positive evaluation of the consultation in comparison with the tailored messages could have been due to the interaction between the nurse and adolescent during the consultation, as previous research has shown that interaction in health communication could improve patient satisfaction.[53,54] Furthermore, the collected information on adolescents' health prior to the consultation could have supported the nurse during the consultation to better tailor the provided information to the adolescents' needs. Additionally, most adolescents attended the consultation, and in most cases nurses evaluated the referral as legitimate and the information they received on the adolescent prior to the consultation as helpful. This may indicate that the E-health4Uth questionnaire and criteria that were used to select adolescents at risk of mental health problems were suitable and selected adolescents were willing to attend the consultation with the nurse.

Moreover, the effects of the E-health4Uth and E-health4Uth with consultation interventions on well-being (i.e. mental health status and health-related quality of life) and health behaviors (i.e. alcohol and drug use, smoking, safe sex) of adolescents were evaluated (**Chapter 8**). The E-health4Uth intervention as a standalone intervention only showed small positive effects on a limited number of outcome measures, namely on health-related quality of life and condom use during intercourse among adolescents of Dutch ethnicity. Although it is promising that two positive effects were found in the

E-health4Uth group, these positive results were not found in the E-health4Uth with consultation intervention. Because the E-health4Uth with consultation group received the same messages as the E-health4Uth group plus an additional consultation for the adolescent at risk of mental health problems, one would expect that the effects on condom use and health-related quality of life would have also been present in the E-health4Uth with consultation group. Therefore, the effects found in the E-health4Uth group have to be interpreted with caution.

The E-health4Uth with consultation intervention showed minor positive results on the mental health status of adolescents. In the subgroup of adolescents who were at risk of mental health problems at baseline and were, therefore, referred to the nurse for a consultation, the E-health4Uth with consultation intervention showed small to moderate positive results on mental health status and health-related quality of life at follow-up compared to adolescents in the control group who were at risk of mental health problems at baseline. This is in line with the results of previous studies in which adolescents at risk of depression and anxiety, two components of the broader construct of mental health, benefited from an Internet program combined with a consultation.[55,58] A potential explanation for the effects on the mental health of adolescents is the dual approach of advice and a consultation. This approach guaranteed a repetition of the main mental health messages and combined digital and oral feedback. However, it is also feasible that the consultation on its own was responsible for the positive effects that were found and that the E-health4Uth questionnaire was primarily a useful way to select adolescents who needed further face-to-face support, and to support the nurse during the consultation.

Note that an unexpected negative effect on drug use among boys was found in the E-health4Uth with consultation group. Although this result could be a random effect, another possible explanation is that providing information about drug use to adolescents raises adolescents' curiosity about trying drugs. In earlier studies, a similar negative effect on drug use among Dutch adolescents was found.[59,60] In one of these studies, it was found that this increase in frequency of drug use was only a temporary effect.[60] However, this indicates that one has to be careful with health promotion on drug use among adolescents and it highlights the importance of a careful evaluation and in-depth study on how health promotion on drug use works for adolescents.

In **Chapter 9**, the appreciation, application, and effects of the Your Health intervention, in which adolescents attending the lowest two levels of senior vocational education received a consultation with a preventive youth health care nurse, were evaluated in a cluster-RCT with a 6-month follow-up period. Results showed that a vast majority of adolescents attended the proactive, integrated preventive health consultation, and that the consultation was highly appreciated by these adolescents. Adolescents reported they had confidence in the nurse. Previous research indicates that adolescents' confidence in

professionals on whom they rely for help is very important.[61,62] For example, confidence in professionals is needed to feel comfortable to also share the most sensitive information. Other aspects of the consultation with the nurse were also evaluated positively. This is of great importance, because if adolescents obtain positive experiences with (accessing) help from professionals, they are more likely to comply with professionals' advice and more likely to continue seeking help when they need it throughout their lives.[62,63]

In about a third of the adolescents, nurses suspected problems and several actions were taken. For example, the majority of these adolescents were given tailored advice or they were referred to another professional. This provided adolescents with an opportunity to access help, which they may otherwise not have been offered. However, no direct effects of the Your Health intervention on mental health or health-risk behaviors were found. This could be due to the fact that in every consultation the nurse focused on a number of domains and the areas for improvement (from all possible domains and areas of improvement). These domains and areas for improvement were different for each individual, depending on the individual needs of the adolescent. This makes it harder to find effects on any specific outcome. Also only a single consultation was offered to adolescents. Although a single consultation may be a valid mean to assess adolescents' problems and to refer adolescents to other professionals if necessary, it may often not be sufficient in its own right to ameliorate the problems that adolescents have.[64] This is in line with earlier research, showing little evidence for the effectiveness of short-term counseling other than some small effects on mild internalizing problems.[64-67] A longer follow-up period is probably needed before effects may emerge from the subsequent help that is offered by professionals. This hypothesis is supported by previous research on school-based prevention programs which indicates that significant effects on depression were not found until the longer-term follow-up periods (i.e. 1–3 years).[68]

Part III – Psychometric properties of self-sufficiency assessment tools

Next to effective interventions, psychometric sound instruments that can be used by the preventive youth health care to identify vulnerable adolescents are needed. In **Chapter 10**, the psychometric properties of a self-report questionnaire assessing self-sufficiency and the Dutch version of the Self-Sufficiency Matrix (SSM-D) were examined among adolescents attending senior vocational education. The SSM-D is a structured assessment tool used to determine the strengths and areas of improvements in functioning of an individual. It expresses functioning in levels of self-sufficiency on several life domains (e.g. domestic relations, mental health, and social network).[69] Both the self-report questionnaire assessing self-sufficiency and the SSM-D applied in this study seem to possess adequate psychometric properties. The internal consistency was satisfactory. The (six-month) temporal stability of the self-report questionnaire was

fair for most domains. The stability would probably have been higher if the test-retest interval would have been shorter, for example one month instead of six months. Various small to strong correlations between the domains of both self-report questionnaire assessing self-sufficiency and the SSM-D and related constructs were found, indicating reasonable concurrent validity. It must be noted that higher correlations were found between the domains of the self-report questionnaire assessing self-sufficiency and adolescent-reported related constructs than between the SSM-D, which was completed by professionals, and adolescent-reported related constructs. Furthermore, for most of the domains, the degree of agreement between adolescents and professionals was poor to fair. A low agreement between informants is in line with previous research.[70,71] The low agreement between adolescents and professionals indicates that both informants can provide unique information on the self-sufficiency of adolescents.[70] Since there is no golden standard against which to validate measures of adolescents' functioning on life domains, it is essential to use the contributions of different informants to get a more complete picture of the problems adolescents are dealing with.[70]

METHODOLOGICAL CONSIDERATIONS

The results of this thesis should be interpreted in light of some methodological considerations. First, the methodological considerations related to the different study designs used in the studies described in this thesis are outlined. Second, more general methodological considerations related to the studies included in this thesis are described in the paragraphs Setting and population, Missing data, Measurements, and Confounding.

Study design

Cross-sectional studies

In Chapter 2 and 3, a cross-sectional design was used to explore associations between mental health problems and health-risk behaviors. Cross-sectional studies are often used to determine prevalences and are useful to identify associations.[72] However, because cross-sectional studies are carried out at one time point and give no direction of the sequence of events, it is impossible to infer causality.

Prospective cohort studies

The studies described in Chapter 4 and 5 examined whether bullying victimization, negative life events, and parent-adolescent attachment were associated with mental health problems. These prospective evaluations were based on baseline and follow-up measurements. A longitudinal design with more than two measurements may provide additional information about patterns of change.[72] Especially because there are possible

bi-directional influences in the associations under study and it is unknown whether, for example, the parent-adolescent attachment and mental health problems have mutually influenced each other (Chapter 4).

Randomized controlled trials

The studies described in Chapter 6 to 9 were part of two cluster-RCT´s. RCT´s are experimental studies in which data is collected before and after an intervention takes place.[72] In the E-health4Uth and Your Health study, school classes were the unit of randomization, which were assigned to either the intervention or control condition. This randomization procedure limited contamination of the control condition[73] as adolescents in the same class received the same intervention (i.e. either intervention or usual care). However, there was still small risk of contamination of the control group since adolescents from the control and intervention groups were present at the same school. Furthermore, adolescents in the same school class may share more characteristics than adolescents in different school classes, influencing the outcome of the studies. Therefore, multilevel analyses were conducted to take the dependency between observations of adolescents from the same school class into account.[74,75]

Furthermore, the design of the E-health4Uth and Your Health study should also be interpreted in light of some other methodological considerations which could have influenced the effectiveness of the interventions. First, the results on the effectiveness of the interventions may have been affected by adolescents in the control group who have also received (a part of) the intervention by requesting a consultation with their class mentor (Your Health study) or with the preventive youth health care nurse (E-health4Uth study) through the Web-based module. Nevertheless, exploratory analyses of the effectiveness of the Your Health intervention showed the similar results when the analyses were conducted with and without the adolescents from the control group who asked for a consultation with the class mentor. In the E-health4Uth study, exploratory per-protocol analyses yielded stronger effects of E-health4Uth with consultation on mental health and health-related quality of life for adolescents at risk of mental health problems at baseline than the intention-to-treat analyses. This suggests that the results presented in Chapter 8 may in fact be underestimations of the actual effects of the E-health4Uth with consultation intervention.

Second, the relatively low dose and intensity of the interventions (i.e. only one consultation) may be another explanation for the absence of larger effects. The dose and intensity of the interventions itself may have been too small to sort direct effects on the outcome measures.[64-67] Although a single consultation may be a valid mean to assess adolescent's problems and to refer adolescents to other professionals if necessary, it may often not be sufficient in its own right to ameliorate the problems that adolescents have.[64] A long follow-up period is probably needed before effects may emerge from the

subsequent help that is offered to the adolescents by professionals.[68] However, in the presented studies the subsequent help that adolescents received after the consultation and its effect was not evaluated.

Setting and population

The studies in this thesis used large opportunity samples of adolescents from schools in both rural and urban areas of the Netherlands. Conducting the studies in the preventive youth health care system, which usually has a high attendance rate, is a strength of the studies. The samples used in the different studies resembled the average Dutch adolescent population in secondary schools and senior vocational education for gender, ethnicity, and educational level.[76] However, the use of opportunity samples may have caused limited generalizability of the study results and generalization to other countries and settings should be done with caution.

Missing data

The initial participation rate in all studies was relatively high (70.4% to 95%). Nevertheless, there may still have been a selection bias present, since participating adolescents may differ from non-participating adolescents. However, it is not possible to estimate the influence of non-participation on the results described in this thesis, since data on the characteristics of the non-participating participants could not be collected. Therefore, generalization of the study results should be done with caution. Especially since loss-to-follow up has also occurred in the described cohort studies. Retention and loss-to-follow up is a common issue in cohort studies, as was the case in the studies (Chapters 4, 5, 7, 8, 9) described in this thesis; After 4-months, 73.8% of the E-health4Uth baseline participants completed the follow-up questionnaire, whereas after 6-months, 71.6% of the Your Health baseline participants completed the follow-up questionnaire, and after 2-years, 38% of the Rotterdam Youth Monitor baseline participants completed the follow-up questionnaire. To compare adolescents who were participating at follow-up with adolescents who were not participating at follow-up non-response analyses were conducted for the studies included in this thesis. Since various group differences were found on age, gender, ethnicity, educational level, and being a parent or not, these analyses indicated that selective dropout had occurred. Although the variables, on which groups differences were found, were included as confounders in the analyses, the findings of the studies embedded in this thesis should be interpreted cautiously.

Measurements

All data were collected through self-reported questionnaires, with the exception of data about school absenteeism in the Your Health study, which was monitored via the school registration system. The reliance on self-report measures instead of multiple informants

may have led to response bias. Nevertheless, research suggest that, for example, self-reported alcohol consumption among adolescents is generally considered valid[77] and that adolescents are better reporters of their own mental health status than parents and teachers.[78] However, the collection of more objective data on health behavior and additional parent- and/or teacher-ratings on mental health and health behaviors of the adolescents is recommended for future research.

Confounding

Confounding variables could have affected the results of the studies presented in this thesis. Confounding variables are variables that are associated with both the determinants and the outcome under study, but should not be on the causal pathway.[79] Ignoring confounding variables can lead to over- or underestimation of the true association between the determinant(s) and outcome and can even change the direction of the observed effect.[79] In the studies presented in this thesis, analysis were adjusted for potential confounders. The confounders included in the analyses described in this thesis were chosen based on previous literature, exploratory analyses, and conceptual grounds. However, the possibility of residual confounding cannot be ruled out.

RECOMMENDATIONS FOR FUTURE RESEARCH

The results presented in this thesis have led to several recommendations for future research. Specific recommendations have been described in the Chapters on the studies of this thesis. In the following paragraphs general recommendations for future research, related to Study design and measurements, and Intervention development and evaluation, are described.

Study design and measurements

There are several recommendations for future research in the areas of study design and measurements that can be made based on the studies described in this thesis. First of all, most previous studies examine risk factors in isolation and fail to examine the clustering of a range of risk behaviors among adolescents. However, this thesis provides evidence for the clustering of risk behaviors (Chapter 2). Clustering of risk behaviors indicates that interventions should preferably address multiple risk behaviors simultaneously, instead of risk behaviors in isolation. To enable the design of interventions with such an integrated approach, more research is needed on the clustering of a broad range of health-risk behaviors among adolescents. Moreover, it is of interest to examine whether clusters of risk behaviors have a shared determinant, such as a personality trait (e.g. novelty seeking) or a specific family environment (e.g. an environment with a lot of violence

or substances abuse). More research into underlying mechanisms that play a role in the occurrence of mental health problems is also important. For example, research on the impact that bullying victimization could have on mental health of adolescents should examine the mechanisms responsible for the differential response of girls and boys to the stress caused by bullying victimization (Chapter 5). In addition, future research on mechanisms that play a role in the occurrence of mental health problems and risk behaviors should also include protective factors, and their interaction with risk factors, instead of only focusing on risk factors. This is supported by the results of the study described in Chapter 4, where an interaction between a protective factor (i.e. parent-adolescent attachment) and a risk factor (i.e. negative life events) on mental health was found.

Furthermore, longitudinal study designs, with inclusion of more than two points of measurement, could provide further understanding of associations between determinants of mental health problems and health-risk behaviors. Moreover, it would be preferable to collect objective data on health behaviors complementary to adolescents' self-report, and to use the ratings on mental health and health behaviors of multiple informants, such as adolescents, parents, and teachers.

Intervention development and evaluation

Recommendations for future research on intervention development and evaluation will be described in this paragraph. First, the Web-based tailored messages of the E-health4Uth study could probably be improved, since adolescents did not rate all the evaluation items on the messages as explicitly positive (Chapter 7). Further research may identify opportunities to improve the Web-based tailored messages. For example, a qualitative study with focus groups could be conducted with adolescents and preventive youth health care professionals to obtain more in-dept information regarding their evaluation of the tailored messages, and to gain suggestions for improvements. Furthermore, theoretical models on behavior (change), such as the attitudes – social influences – efficacy (ASE) model, the Theory of Planned behavior (TPB),[80] and the I-Change model (an integrated model of various behavior-oriented theories),[81,82] could also be helpful to further tailor the messages. These theories define important changeable determinants that can be addressed in (Web-based) interventions, such as attitudes (e.g. manner in which health risks are perceived by the individual), social factors (e.g. susceptibility to social pressure from peers), or self-efficacy of the individual (e.g. judgment of capability to change unhealthy behaviors).[80-84] Moreover, other theoretical insights, which follow from the self-determination theory (SDT) and motivational interviewing (MI), could be used to tailor and improve the messages as well.[85,86] In face-to-face counseling, theoretical insights from SDT and MI are already frequently used and have proven to be effective.[87-89] Recently, these insights have been applied to Web-based interven-

tions too. Interventions combining the technology of Web-based computer tailoring and the theoretical insights from SDT and MI use a more participant-centered approach and are more focused on promoting behaviors based on autonomous motivation (i.e. motivation that originates from the self instead of pressured or coerced by intrapsychic or interpersonal forces) than traditional Web-based tailored interventions.[86] This could apply to Web-based messages as well; integrating theoretical insights from STD and MI in Web-based messages may enhance their efficacy.[86]

Furthermore, delivering the tailored messages via the computer could probably be complemented with delivering the messages via mobile devices (m-Health); especially as smartphones became ubiquitous.[90] However, further research needs to be conducted to ensure that mobile health technologies are appropriately designed and targeted to the end-users' needs before they are used as health interventions.[90]

Moreover, expanding the Web-based tailored messages with a consultation for adolescents at risk of mental health problems seemed promising in the E-Health4Uth study. It might also be beneficial to apply the dual approach of advice and a consultation to the health behavior messages. Thus, instead of only inviting adolescents at risk of mental health problems for a consultation and primarily focusing on mental health in the consultation, also inviting adolescents displaying risk behaviors for a consultation and focusing on health-risk behaviors. A previous study, integrating Web-based tailored messages on fruit and vegetable intake with a consultation focused on this topic among school children already showed promising results in the preventive youth health care.[91] However, future research is needed to investigate the degree to which the impact of Web-based tailored messages on healthy behaviors may be enhanced through expanding these messages with a consultation.

Besides measuring the direct effects of the tailored messages and the consultation with the preventive youth health care professional on adolescents' mental health and healthy behaviors, future studies need to evaluate the appropriateness and effects of referrals and subsequent help that adolescents receive as a result of the tailored messages and consultation. It is feasible that this subsequent help will sort (further) effects on health (behavior) outcomes.

Furthermore, before implementing the different interventions in the daily practice of the preventive youth health care, it is recommended to assess possible barriers and facilitators that could be encountered when implementing the interventions. This could be done through qualitative research, including interviews and focus groups with professionals, adolescents, and school staff. Results of such studies could be helpful to increase the likelihood of properly implementing the interventions.[92,93]

IMPLICATIONS FOR PRACTICE AND POLICY

The results of the studies described in this thesis have implications for the identification of adolescents at risk of mental health problems and health-risk behaviors, and for interventions promoting adolescents' mental health and behaviors. In the following paragraphs these implications for practice and policy will be described.

Adolescents at risk of mental health problems and health-risk behaviors

Several determinants of mental health problems have been identified in this thesis, i.e. bullying victimization, negative life events, and parent-adolescent attachment. These results could be used to improve the early identification of adolescents at risk of mental health problems, and thereby, possibly reducing adverse health consequences on the short and longer term. This thesis also showed that risk behaviors and mental health problems often do not occur in isolation among adolescent, but are associated and accumulate. This suggests that interventions aiming to identify adolescents with mental health problems and health-risk behaviors, and to promote mental health and healthy behaviors should preferable address mental health problems and (multiple) risk behaviors simultaneously. Such an integrated approach can be supported and coordinated in the health policy of the municipalities and preventive youth health care organizations.

Use of E-health4Uth and Your Health in the preventive youth health care

From 2013, the government in the Netherlands encourages preventive youth health care organizations to implement an additional preventive health consultation for adolescents aged 15 years and older.[94,95] From 2015, this additional consultation is included in the new Basic task package of the preventive youth health care (i.e. in Dutch: *'Basistakenpakket van de jeugdgezondheidszorg'*).[96] In this basic task package, the importance of a number of elements is emphasized: monitoring all adolescents, early identification of problems and providing help, responding to needs of clients (e.g. adolescents), and collecting information to support policy advice. Based on the results described in this thesis, recommendations are made to assist preventive youth health care organizations with the implementation of an additional consultation at the age of 15 years and older in which the above-mentioned elements are integrated.

The E-health4Uth study showed that the Web-based tailored messages were evaluated positively by adolescents attending secondary education. Therefore, the tailored messages are promising to reach adolescents (with tailored messages they evaluate positively), and to monitor adolescents via the tailored program at the same time. The tailored messages are freely available to use by the different preventive youth health care organizations in the Netherlands, and the wide-scale distribution of the algorithms that are used to generate the Web-based tailored messages can be arranged at relatively

low cost. Furthermore, these algorithms can easily be extended depending on the local needs. Extending the algorithms by using more characteristics of the adolescent can lead to messages that are even more tailored to the individual situation of the adolescent. Moreover, as suggested previously, by combining the technology of Web-based tailoring with theoretical insights and practical applications from, for example, the SDT and MI,[86] the self-sufficiency of adolescents could be further emphasized in the messages. This is important as emphasizing the self-sufficiency of adolescents (and parents) is a new element of the Basic task package of the preventive youth health care, which will be implemented in 2015.[96]

Furthermore, results showed that the consultation with the preventive youth health care nurse was evaluated positively by adolescents and nurses, and that expanding the Web-based tailored messages with a consultation in the subgroup of adolescents at risk of mental health problems, improved the effectiveness of the intervention on mental health and health-related quality of life among this subgroup of adolescents. This indicates that the dual approach has added value. This dual approach of Web-based tailored messages and a consultation for adolescents at risk of mental health problems presents an opportunity for the preventive youth health care to: 1) monitor all adolescents and provide them with tailored messages they evaluate positively, 2) select vulnerable adolescents for a well evaluated and effective consultation, 3) give adolescents the opportunity to refer themselves for a consultation, and 4) collect information on the health of adolescents prior to the consultation, and thereby, enhancing the efficiency of face-to-face consultations which is essential given the current financial strain on preventive youth health care.[97-99] Therefore, it is recommended to offer the Web-based tailored messages to adolescents aged 15 years and older attending secondary education, and to extend these messages with a consultation for adolescents at risk of mental health problems. This dual approach fits well with the new Basic task package of the preventive youth health care.

The Your Health study showed that Your Health is a promising intervention to reach vulnerable adolescents at the start of senior vocational education, and provide them with a well evaluated consultation. Furthermore, an advantage of Your Health is that it provides the preventive youth health care organizations, in collaboration with the schools and other health professionals, the opportunity to early identify vulnerable adolescents, and to get these adolescents in care. This is of great importance, because adolescents often do not seek help for their problems themselves, and their problems may go undetected and untreated.[100-102]

Furthermore, to support the consultations with adolescents attending senior vocational education, it is recommended to also use the self-report questionnaire assessing self-sufficiency and the SSM-D, which is completed by professionals, to get a more complete picture of the self-sufficiency of the adolescents. Having the adolescent complete

the self-report questionnaire assessing self-sufficiency prior to the consultation with the professional could help professionals determining the crucial topic(s) to focus their consultation on.[103] This could be especially helpful, since adolescents attending senior vocational education are often dealing with multiple problems.[104] A great advantage of the self-report questionnaire assessing self-sufficiency and the SSM-D is that both versions can be completed in a short time, and are freely available.

Finally, the interventions E-health4Uth, E-health4Uth with consultation, and Your Health are especially promising for future implementation, as they were already interwoven with the existing practice of the preventive youth health care. Nevertheless, in order to enable successful health promotion at schools, an effective collaboration between professionals of the preventive youth health care and (health care) professionals of other organizations is essential.

GENERAL CONCLUSION

The aim of this thesis was threefold. First, this thesis aimed to extend the current knowledge on factors associated with mental health problems and health-risk behaviors, and second, to evaluate three interventions aiming to identify adolescents' at risk of mental health problems and health-risk behaviors, and to promote adolescents' mental health and healthy behaviors. Third, it aimed to examine the psychometric properties of two measures of adolescent self-sufficiency among adolescents attending senior vocational education, namely a self-report questionnaire and the Dutch version of the Self-Sufficiency Matrix (SSM-D) for professionals.

In accordance with the first aim, determinants of mental health problems are identified, i.e. bullying victimization, negative life events, and parent-adolescent attachment. Furthermore, this thesis shows that determinants may interact with each other and that risk behaviors and mental health problems do not always occur in isolation among adolescents, but are often associated and can accumulate. These findings can help to improve the early identification of adolescents at risk of mental health problems and (multiple) health-risk behaviors, and to develop effective, integrated interventions to improve adolescents' health and behaviors. Thereby, possible reducing adverse health consequences on the short and longer term.

Second, the results of the studies with regard to the three interventions (E-health4Uth, E-health4Uth with consultation, Your Health) evaluated in this thesis support the appreciation of these three interventions by adolescents and preventive youth health care nurses. It also supported the effectiveness of the E-health4Uth with consultation intervention in promoting adolescents' well-being. More specifically, this thesis shows that Web-based tailored messages (E-health4Uth) combined with a consultation (E-

health4Uth with consultation) may be effective in promoting the mental health status and health-related quality of life of adolescents attending secondary school and adolescents at risk of mental health problems. Furthermore, the tailored messages and consultation are appreciated positively by adolescents and nurses. Another intervention, Your Health, is a promising intervention to reach vulnerable adolescents at the start of senior vocational education with a well-evaluated consultation. Furthermore, the Your Health intervention provides an entry point for adolescents into the health care system.

Third, the self-report questionnaire assessing self-sufficiency and the SSM-D, which was completed by professionals, seem to possess adequate psychometric properties among adolescents attending senior vocational education, and may support nurses during a consultation to determine the strengths and areas for improvements in functioning of an adolescent.

Taken together, the studies presented in this thesis could be helpful in improving the identification of adolescents at risk of mental health problems and/or (multiple) health-risk behaviors, and in promoting adolescents' health and behaviors.

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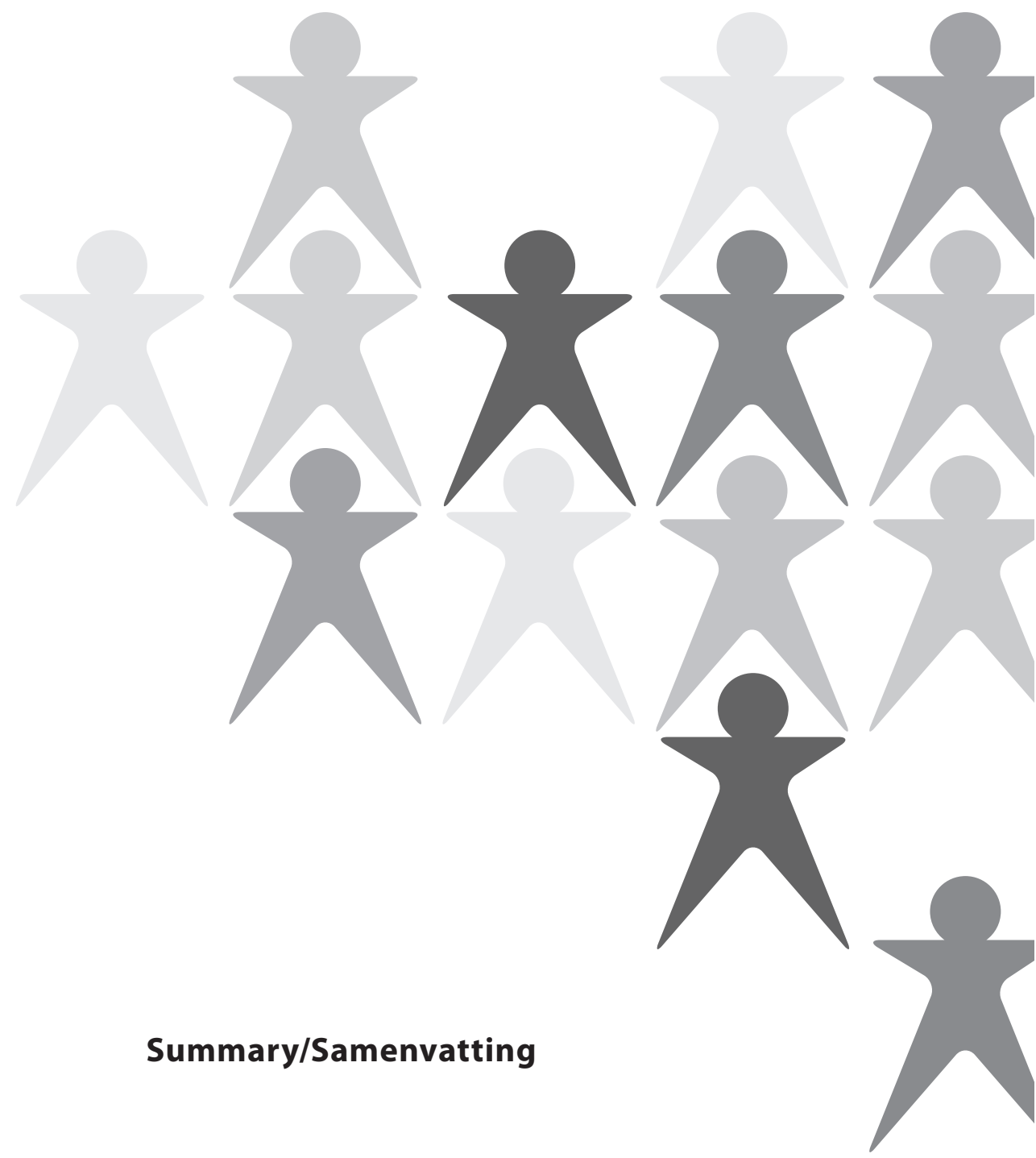


Summary/Samenvatting

SUMMARY

A high percentage of adolescents suffer from mental health problems and many health-risk behaviors, such as excessive alcohol consumption, cigarette smoking, and drug (mis)use, are acquired during adolescence. These mental health problems and health-risk behaviors often persist into adulthood, thereby affecting not only current health but also health later in life. Given the adverse short and long term effects of adolescents' mental health problems and health-risk behaviors, these problems and behaviors are major public health concerns.

Insight in factors associated with mental health problems and risk behaviors is needed in order to develop strategies to identify adolescents at risk of these problems and behaviors, and to develop effective interventions to improve adolescents' health and behaviors. Therefore, the first aim of this thesis was to examine factors associated with mental health problems and health-risk behaviors. The second aim was to evaluate three interventions aiming to identify adolescents' at risk of mental health problems and health-risk behaviors, and to promote adolescents' mental health and healthy behaviors. Third, the psychometric properties of the self-report questionnaire assessing self-sufficiency and the Dutch version of the Self-Sufficiency Matrix (SSM-D), both instruments to evaluate adolescent's levels of self-sufficiency on various domains, were examined among adolescents attending senior vocational education.

Main findings

The first part of this thesis focused on factors associated with mental health problems and health-risk behaviors. In **Chapter 2**, the clustering of a wide range of health-risk behaviors, and the association with depressive symptoms was examined among adolescents attending senior vocational education. Results showed that the included risk behaviors clustered. More specifically, two clusters of risk behaviors were identified: substance use (i.e. alcohol use, cannabis use, and cigarette smoking), and problem behaviors (i.e. truancy, delinquency, and having debts). Furthermore, results showed that both clusters of risk behaviors were associated with depressive symptoms.

In **Chapter 3**, associations of truancy, perceived school performance, and mental health with adolescents' week, weekend, and binge drinking were examined. Results showed that truancy and a poorer mental health were associated with binge drinking more often, and drinking (more) alcohol on weekdays. Furthermore, truancy and having an average or less than average perceived school performance were associated with drinking (more) alcohol on the weekend.

Chapter 4 described a two-year longitudinal study examining the association between negative life events and mental health problems on the one hand, and between parent-adolescent attachment relationship quality and mental health problems on the

other hand among first-year secondary school students. Furthermore, the interaction between parent-adolescent attachment relationship and one or multiple negative life events on the mental health of adolescents was explored. The results of this study showed that negative life events were associated with an increased risk of mental health problems, as was an unfavorable parent-adolescent attachment. Furthermore, an interaction between parent-adolescent attachment and negative life events on mental health was found. That is, the combined effect of an unfavorable parent-adolescents attachment and negative life events on mental health was larger than the sum of the two individual effects.

Chapter 5 described a study investigating whether traditional and cyber bullying victimization in the first-year of secondary school were associated with mental health problems and suicidal ideation in the third-year of secondary school. Additionally, it was explored whether bullying affected boys and girls in a different way. Findings showed that both *traditional* and *cyber* bullying victimization were associated with an increased risk of mental health problems in girls, but not in boys. Only *traditional* bullying victimization was associated with suicidal ideation at two year follow-up.

The second part of this thesis described the evaluation of three interventions aiming to identify adolescents' at risk of mental health problems and health-risk behaviors, and to promote adolescents' mental health and healthy behaviors. **Chapter 6** covered the design of the E-health4Uth study (including the E-health4Uth and E-health4Uth with consultation interventions). **Chapter 7** reported on the use and appreciation of the Web-based tailored messages (E-health4Uth) as a standalone intervention, and in combination with a consultation with a preventive youth health care nurse for adolescents at risk of mental health problems (E-health4Uth with consultation). These two interventions were applied by preventive youth health care organizations at secondary schools. Results showed that the Web-based, tailored messages and the consultation with the nurse were used and appreciated positively by adolescents and nurses. The consultation with the nurse was considered a valuable addition to the Web-based tailored messages by adolescents. Furthermore, the consultation with the nurse was rated more positively than the tailored messages.

Chapter 8 presented the effects of the E-health4Uth and E-health4Uth with consultation interventions on well-being (i.e. mental health status and health-related quality of life) and health behaviors (i.e. alcohol and drug use, smoking, safe sex) of adolescents at 4-month follow-up. The E-health4Uth intervention as a standalone intervention only showed small positive effects on a limited number of outcome measures, namely on health-related quality of life and condom use during intercourse among adolescents of Dutch ethnicity. These two positive results were not replicated in the E-health4Uth with consultation group. The E-health4Uth with consultation intervention showed minor

positive results on the mental health status of adolescents, but a negative effect on drug use among boys was found. In the subgroup of adolescents who were at risk of mental health problems at baseline and whom were, therefore, referred for a consultation with the nurse, the E-health4Uth with consultation intervention showed small to moderate positive results on mental health status and health-related quality of life at follow-up compared to adolescents in the control group who were at risk of mental health problems at baseline.

Chapter 9 described the appreciation, application, and effects of the Your Health intervention, in which adolescents attending senior vocation education received a consultation with a preventive youth health care nurse. Results showed that a vast majority of adolescents attended the proactive, integrated preventive health consultation, and that the consultation was highly appreciated by these adolescents. In about a third of the adolescents, nurses suspected problems and several actions were taken. However, no direct effects of the Your Health intervention on mental health or health-risk behaviors were found at 6-month follow-up.

The third part of this thesis, **Chapter 10**, focused on the psychometric properties of the self-report questionnaire assessing self-sufficiency and the SSM-D, which was completed by professionals. Both the self-report questionnaire assessing self-sufficiency and the SSM-D applied in this study seem to possess adequate psychometric properties. The internal consistency was satisfactory. Various small to strong correlations between the domains of both self-report questionnaire assessing self-sufficiency and the SSM-D and related constructs were found. The (six month) temporal stability of the self-report questionnaire was fair for most domains. Finally, for most of the domains, the degree of agreement between adolescents and professionals was poor to fair.

Conclusion

First, in this thesis, determinants of mental health problems are identified, i.e. bullying victimization, negative life events, and parent-adolescent attachment. Furthermore, this thesis shows that determinants may interact with each other and that risk behaviors and mental health problems do not always occur in isolation among adolescents, but are often associated and can accumulate. These findings can help to improve the early identification of adolescents at risk of mental health problems and (multiple) health-risk behaviors, and to develop effective, integrated interventions to improve adolescents' health and behaviors. Thereby, possibly reducing adverse health consequences on the short and longer term.

Second, the results of the studies with regard to the three interventions (E-health4Uth, E-health4Uth with consultation, Your Health) evaluated in this thesis support the appreciation of these three interventions by adolescents and preventive youth health

care nurses. It also supported the effectiveness of the E-health4Uth with consultation intervention in promoting adolescents' well-being. More specifically, this thesis shows that Web-based tailored messages (E-health4Uth) combined with a consultation (E-health4Uth with consultation) may be effective in promoting the mental health status and health-related quality of life of adolescents attending secondary school and adolescents at risk of mental health problems. Furthermore, the tailored messages and consultation are appreciated positively by adolescents and nurses. Another intervention, Your Health, is a promising intervention to reach vulnerable adolescents at the start of senior vocational education with a well-evaluated consultation. Furthermore, the Your Health intervention provides an entry point for adolescents into the health care system.

Third, the self-report questionnaire assessing self-sufficiency and the SSM-D, which was completed by professionals, seem to possess adequate psychometric properties among adolescents attending senior vocational education, and may support nurses during a consultation to determine the strengths and areas for improvements in functioning of an adolescent.

SAMENVATTING

Psychosociale problemen komen veel voor onder jongeren en veel risicovolle gezondheidsgedragingen, zoals overmatig alcoholgebruik, roken en drugsgebruik, worden tijdens de adolescentie verworven. Deze problemen en gedragingen blijven vaak tot in de volwassenheid bestaan en hebben daarmee niet alleen invloed op de huidige gezondheid, maar ook op de gezondheid op latere leeftijd. Gezien de negatieve effecten van psychosociale problemen en risicovolle gezondheidsgedragingen bij jongeren op de korte en lange termijn staan deze problemen en gedragingen hoog op de agenda van de publieke gezondheidszorg.

Inzicht in de factoren die samenhangen met het ontstaan van psychosociale problemen en risicovolle gedragingen is nodig om strategieën te kunnen ontwikkelen om jongeren met een verhoogd risico op deze problemen en gedragingen te kunnen identificeren. Daarnaast is dit inzicht nodig om effectieve interventies te kunnen ontwikkelen die de gezondheid en het gedrag van jongeren verbeteren. Daarom was het eerste doel van dit proefschrift factoren te onderzoeken die samenhangen met psychosociale problemen en risicovolle gezondheidsgedragingen. Het tweede doel was om drie interventies te evalueren die gericht zijn op het identificeren van jongeren met een verhoogd risico op psychosociale problemen en risicovolle gezondheidsgedragingen en die gericht zijn op het verbeteren van de psychosociale gezondheid en gedragingen van jongeren. Ten derde zijn de psychometrische eigenschappen van een zelfrapportage vragenlijst ter beoordeling van zelfredzaamheid en de Zelfredzaamheid Matrix (ZRM), beide instrumenten om het niveau van zelfredzaamheid van een adolescent op verschillende domeinen te evalueren, onderzocht onder jongeren in het middelbaar beroepsonderwijs.

Belangrijkste bevindingen

Het eerste deel van dit proefschrift richt zich op factoren die samenhangen met psychosociale problemen en risicovolle gezondheidsgedragingen. In **Hoofdstuk 2** is de clustering van een breed scala van risicovolle gezondheidsgedragingen en hun samenhang met depressieve symptomen onderzocht onder jongeren in het middelbaar beroepsonderwijs. De resultaten lieten zien dat de risicovolle gedragingen clusterden. Meer in het bijzonder, twee clusters van risicovolle gedragingen werden geïdentificeerd: middelengebruik (d.w.z. het gebruik van alcohol, cannabis en het roken van sigaretten), en probleemgedrag (d.w.z. spijbelen, criminaliteit en het hebben van schulden). Bovendien lieten de resultaten zien dat beide clusters van gedragingen samenhingen met depressieve symptomen.

In **Hoofdstuk 3** zijn de associaties tussen spijbelen, waargenomen schoolprestaties, psychosociale problemen en het week, weekend en binge drinken van jongeren onderzocht. De resultaten van deze studie lieten zien dat spijbelen en een slechtere

psychosociale gezondheid geassocieerd waren met vaker binge drinken en drinken van (meer) alcohol op doordeweekse dagen. Verder waren spijbelen en een gemiddelde of minder dan gemiddelde waargenomen schoolprestatie geassocieerd met drinken van (meer) alcohol in het weekend.

Hoofdstuk 4 beschrijft een twee jaar durende longitudinale studie naar de associatie tussen negatieve levensgebeurtenissen en psychosociale problemen onder eerstejaars scholieren in het voortgezet onderwijs. Daarnaast beschrijft deze studie de associatie tussen de hechtingsrelatie tussen ouder en jongere en psychosociale problemen. Bovendien is de interactie tussen de hechtingsrelatie tussen ouder en jongere en één of meerdere negatieve levensgebeurtenissen op de psychosociale gezondheid van jongeren onderzocht. De resultaten van deze studie lieten zien dat zowel negatieve levensgebeurtenissen als een ongunstige hechtingsrelatie tussen ouder en jongere geassocieerd waren met een verhoogd risico op psychosociale problemen. Bovendien lieten de resultaten de interactie tussen de hechtingsrelatie tussen ouder en jongere én negatieve levensgebeurtenissen op de psychosociale gezondheid zien; het cumulatieve effect van een ongunstige hechtingsrelatie tussen ouder en jongere én negatieve levensgebeurtenissen op de psychosociale gezondheid was groter dan de som van de twee afzonderlijke effecten.

Hoofdstuk 5 beschrijft een studie waarin onderzocht is of slachtoffer zijn van traditioneel en/of cyberpesten in het eerste jaar van het voortgezet onderwijs geassocieerd is met psychosociale problemen en suïcidale gedachten in het derde jaar van het voortgezet onderwijs. Bovendien is onderzocht of het effect van het slachtoffer zijn van pesten verschillend is voor jongens en meisjes. Bevindingen lieten zien dat slachtoffer zijn van traditioneel en/of cyberpesten geassocieerd was met een verhoogd risico op psychosociale problemen bij meisjes, maar niet bij jongens. Alleen slachtoffer zijn van *traditioneel* pesten was geassocieerd met suïcidale gedachten.

Het tweede deel van dit proefschrift presenteert de evaluatie van drie interventies die gericht zijn op het identificeren van jongeren met een verhoogd risico op psychosociale problemen en risicovolle gedragingen en op het bevorderen van de psychosociale gezondheid en gezondheidsgedragingen van jongeren. **Hoofdstuk 6** beschrijft de opzet van het E-health4Uth onderzoek (inclusief de E-health4Uth en E-health4Uth met consult interventies). **Hoofdstuk 7** beschrijft het gebruik en de waardering van online advies-op-maat (E-health4Uth) als losstaande interventie en in combinatie met een consult met een jeugdverpleegkundige voor jongeren met een verhoogd risico op psychosociale problemen (E-health4Uth met consult). Deze twee interventies werden door jeugdgezondheidszorg organisaties toegepast in het voortgezet onderwijs. De resultaten lieten zien dat het online advies-op-maat en het consult met de verpleegkundige positief gewaardeerd werden door jongeren en verpleegkundigen. Het consult met de

verpleegkundige werd door jongeren beschouwd als een waardevolle aanvulling op het online advies-op-maat. Daarnaast werd het consult met de verpleegkundige positiever beoordeeld dan het advies-op-maat.

Hoofdstuk 8 presenteert de effecten van de E-health4Uth en E-health4Uth in combinatie met een consult interventies op het welzijn (d.w.z. de psychosociale gezondheid en algemene gezondheidsperceptie) en de gezondheidsgedragingen (d.w.z. alcohol- en drugsgebruik, roken, veilig vrijen) van jongeren bij 4 maanden follow-up. E-health4Uth als losstaande interventie liet kleine positieve effecten zien op een beperkt aantal uitkomstmaten, namelijk op de algemene gezondheidsperceptie en het gebruik van condooms tijdens het vrijen onder jongeren van Nederlandse afkomst. Deze twee positieve resultaten werden niet gerepliceerd in de E-health4Uth met consultgroep. De E-health4Uth met consultinterventie liet kleine positieve resultaten zien op de psychosociale gezondheid van jongeren, maar een negatief effect op het drugsgebruik onder jongens. In de subgroep van jongeren die bij aanvang van de studie een verhoogd risico hadden op psychosociale problemen, en daarom uitgenodigd waren voor een consult met de verpleegkundige, liet de E-health4Uth met consultinterventie kleine tot matige positieve resultaten zien op psychosociale gezondheid en algemene gezondheidsperceptie in vergelijking met jongeren in de controlegroep die bij aanvang een verhoogd risico hadden op psychosociale problemen.

Hoofdstuk 9 beschrijft de waardering, toepassing en effecten van de Your Health interventie, waarin jongeren in het middelbaar beroepsonderwijs een consult met de jeugdverpleegkundige aangeboden kregen. De resultaten geven aan dat de overgrote meerderheid van de jongeren het proactieve, geïntegreerde preventieve consult heeft bijgewoond en dat het consult zeer gewaardeerd werd door de jongeren. Bij ongeveer een derde van de jongeren werd problemen vermoed door de verpleegkundige en diverse acties werden ondernomen. Bij 6 maanden follow-up zijn er geen directe effecten van de Your Health interventie gevonden op de psychosociale gezondheid of de gezondheidsgedragingen van jongeren.

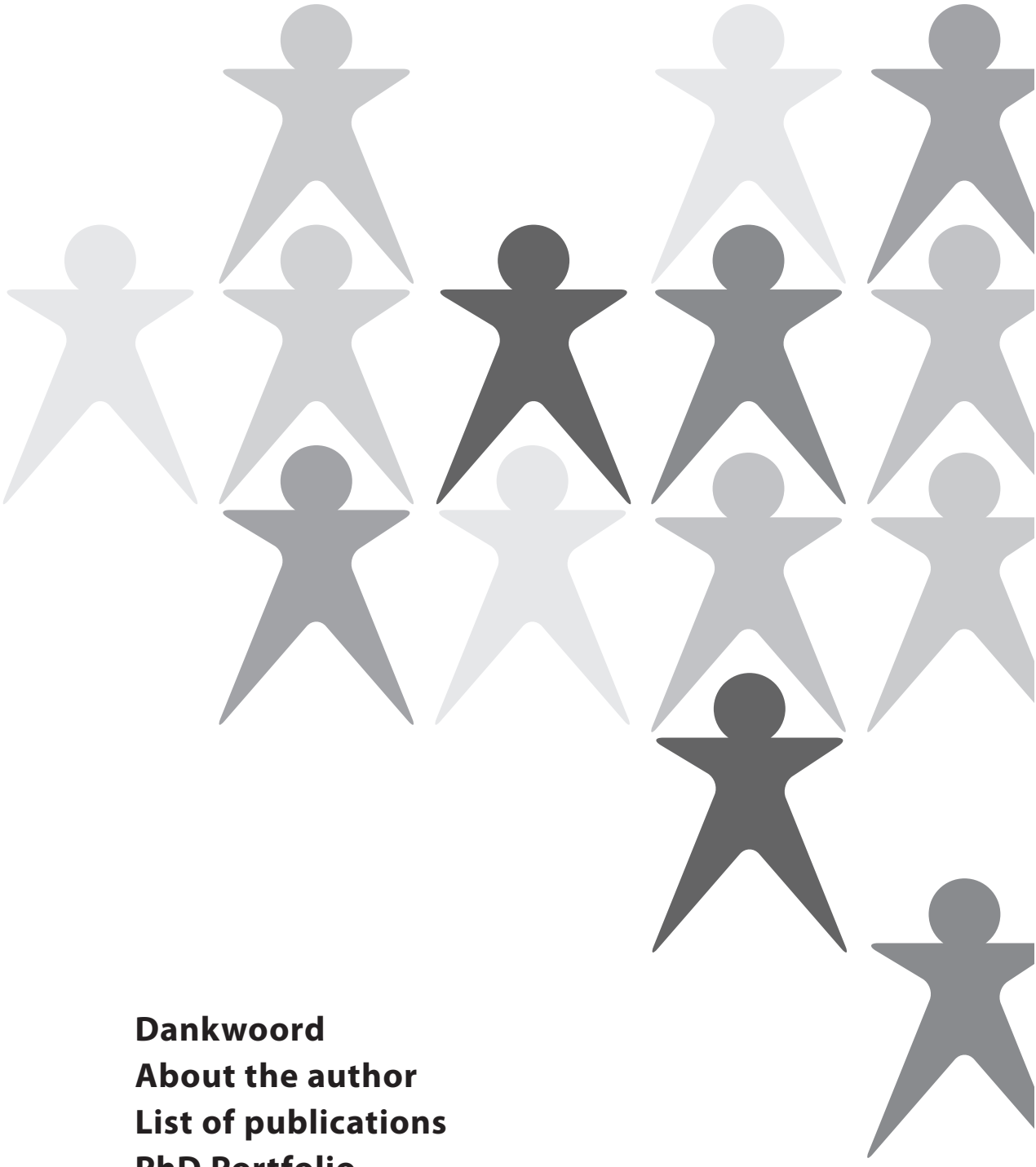
Het derde deel van dit proefschrift, **Hoofdstuk 10,** richt zich op de psychometrische eigenschappen van de zelfrapportage vragenlijst ter beoordeling van zelfredzaamheid en de ZRM. De resultaten lieten zien dat zowel de zelfrapportage vragenlijst als de ZRM adequate psychometrische eigenschappen bezit. De interne consistentie was voldoende. Diverse kleine tot sterke correlaties tussen de domeinen van de zelfrapportage vragenlijst en de ZRM en gerelateerde constructen werden gevonden. De (zesmaands) temporele stabiliteit van de zelfrapportage vragenlijst was redelijk voor de meeste domeinen. Voor de meeste van de domeinen was de mate van overeenstemming tussen jongeren en professionals slecht tot redelijk.

Conclusie

Ten eerste zijn in dit proefschrift determinanten van psychosociale problemen geïdentificeerd, namelijk slachtoffer zijn van pesten, negatieve levensgebeurtenissen en een ongunstige hechtingsrelatie tussen ouder en jongere. Bovendien heeft dit proefschrift laten zien dat determinanten kunnen interacteren en dat risicovolle gedragingen en psychosociale problemen niet altijd op zichzelf staan bij jongeren, maar vaak samenhangen en zich kunnen opstapelen. Deze bevindingen kunnen helpen bij het vroegtijdig identificeren van jongeren met een verhoogd risico op psychosociale problemen en (meerdere) risicovolle gezondheidsgedragingen. Daarnaast kunnen deze bevindingen helpen om effectieve, geïntegreerde interventies te ontwikkelen die de gezondheid en het gedrag van jongeren kunnen verbeteren. Hierdoor kunnen de negatieve effecten van psychosociale problemen en risicovolle gedragingen op de korte en lange termijn mogelijk verminderd worden.

Ten tweede, de resultaten met betrekking tot de drie interventies (E-health4Uth, E-health4Uth met consult, Your Health) die geëvalueerd zijn in dit proefschrift ondersteunen de waardering van deze drie interventies door jongeren en jeugdverpleegkundigen. Daarnaast ondersteunen zij de effectiviteit van E-health4Uth met consult in het bevorderen van het welzijn van jongeren; online advies-op-maat (E-health4Uth) gecombineerd met een consult (E-health4Uth met consult) kan effectief zijn in het bevorderen van de psychosociale gezondheid en algemene gezondheidsperceptie van jongeren in het voortgezet onderwijs met een verhoogd risico op psychosociale problemen. Bovendien worden het online advies-op-maat en het consult positief gewaardeerd door jongeren en verpleegkundigen. Een andere interventie, Your Health, is een veelbelovende interventie om kwetsbare jongeren bij de start van het middelbaar beroepsonderwijs met een goed geëvalueerd consult te bereiken. Bovendien biedt de Your Health interventie een toegang tot de gezondheidszorg voor jongeren.

Ten derde, de zelfrapportage vragenlijst ter beoordeling van zelfredzaamheid en de ZRM beschikken over adequate psychometrische eigenschappen binnen de groep jongeren in het middelbaar beroepsonderwijs. Daarnaast kunnen beide instrumenten verpleegkundigen ondersteunen tijdens een consult om de sterke kanten van en gebieden voor verbeteringen in het functioneren van een jongere te bepalen.



Dankwoord
About the author
List of publications
PhD Portfolio

DANKWOORD

Met erg veel plezier heb ik gewerkt aan dit proefschrift! Graag bedank ik iedereen die direct of indirect heeft geholpen bij het tot stand komen van dit proefschrift. Een aantal mensen wil ik in het bijzonder bedanken.

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ABOUT THE AUTHOR

Rienke Bannink was born on the 22th of December 1983 in Ruurlo, the Netherlands. In 2002, she finished secondary school (Staring College, Lochem). Subsequently, she completed her bachelor degree in Nursing in 2006. In this year, she also started to study Nursing Science at Utrecht University, while she worked as a preventive youth health care nurse at the Municipal Public Health service (The Hague and Utrecht). After she completed her master degree in Nursing Science in 2009, she worked as a teacher at the Institute of Nursing (University of professional education Utrecht) and Institute of Nursing Science (Utrecht University) until the end of 2011.

Subsequently (2012), Rienke started as a researcher at the Department of Public Health of the Erasmus Medical Center in Rotterdam. She performed the E-health4Uth and the Your Health study as described in this thesis. Both studies were conducted in collaboration with the preventive youth health care. The project 'Your Health' received the 'Jeugdgezondheidszorg innovatieprijs' [Preventive Youth Health Care innovation award] from the Dutch Center for Youth Health (NCJ). For the article 'Effectiveness of E-health4Uth and consultation', Rienke received the Publication award 'Maatschappelijke Gezondheidszorg Stimuleringsprijs' for 'Best Debut Publication'.

In 2013, in collaboration with other colleagues, Rienke received a grant from ZonMw for a research project on the use of questionnaires to identify psychosocial problems in the preventive youth health care. Currently, she is working on this project as project leader and supervisor of the junior researcher working on this project. Furthermore, she is a member of the 'Wetenschappelijke commissie jeugdverpleegkundigen, V&VN fractie Jeugd' [Scientific committee of preventive youth health care nurses], and of the 'Opleidingscommissie sociaal verpleegkundigen' [Education committee social nurses], Netherlands School of Public & Occupational Health (NSPOH).

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Bannink R, Broeren S, Heydelberg J, van 't Klooster E, Raat H. Depressive symptoms and clustering of risk behaviors among adolescents and emerging adults attending vocational education. BMC Public Health, accepted for publication (March 2015).

Bannink R, Broeren S, Heydelberg J, van 't Klooster E, van Baar C, Raat H. Proces- en effectevaluatie van een extra contactmoment in het mbo (Your Health) om de gezondheid en het gedrag van adolescenten te bevorderen. Tijdschr Jeugdgezondheidsz, published online: 27 March 2015.

Bannink R, Broeren S, Joosten-van Zwanenburg E, van As E, van de Looij-Jansen P, Raat H. Effectiviteit van een extra contactmoment in het Voortgezet Onderwijs: Digitaal advies-op-maat (E-health4Uth) en een consult. Tijdschr Jeugdgezondheidsz, accepted for publication (February 2015).

Submitted

Bannink R, Broeren S, Heydelberg J, van 't Klooster E, Raat H. Psychometric properties of self-sufficiency assessment tools in adolescents attending vocational education. Submitted for publication.

Holtes M, Bannink R, Joosten-van Zwanenburg E, van As E, Raat H, Broeren S. Associations of truancy, perceived school performance, and mental health with alcohol consumption among adolescents. Submitted for publication.

PHD PORTFOLIO

Summary of PhD training and teaching

Name PhD student:	Rienke Bannink
Erasmus MC Department:	Public Health
PhD period:	January 2012 – March 2015
Promotor:	Prof.dr. H. Raat
Supervisor:	Dr. S.M.L. Broeren

1. PhD training	Year	Workload (ECTS)
General courses		
- Integrity in research	2014	0.3
- Starten met leidinggeven in de wetenschap	2014	0.6
Specific courses (Nihes, Erasmus University)		
- Principles of Research in Medicine and epidemiology	2012	0.7
- Introduction to Global Public Health	2012	0.7
- Methods of Public Health Research	2012	0.7
- The practice of epidemiologic analysis	2012	0.7
- Social epidemiology	2012	0.7
- Biostatistics for Clinicians'	2012	1.0
- Regression Analysis for Clinicians'	2013	1.9
- Maternal and child health	2013	0.9
- Logistic regression	2013	1.4
- Causal Inference	2013	0.7
- Methods of Health Services Research	2013	0.7
- Primary and Secondary Prevention Research	2013	0.7
- Advanced Topics in Clinical Trials	2014	1.4
- Missing Values in Clinical Research	2014	0.7
- Topics in Meta-analysis	2014	0.7
Presentations		
- E-health4Uth: nieuw contactmoment Jeugdgezondheidszorg voor 15/16 jarigen. Oral presentation at: NWO Retraite Jeugd en Gezondheid, Soesterberg	2012	0.5
- Your Health: integraal preventief zorgaanbod aan de voorkant van het MBO voor studenten met een hoog risico. Oral presentation at: Jaarcongres Jeugdgezondheidszorg, Ede	2012	0.5
- Your Health: support of adolescents by public health nurses at the start of secondary vocational education. Oral presentation at: Nihes course, Maternal and child health, Erasmus MC, Rotterdam	2013	0.5
- A web-based, tailored intervention (E-health4Uth) combined with counseling to promote adolescents' health in preventive youth health care. Oral presentation at: Research seminar Department of Public Health, Erasmus MC, Rotterdam	2013	0.5

- Your Health: integraal preventief zorgaanbod aan de voorkant van het MBO voor studenten met een hoog risico. Oral presentation at: Focusdag Gemeente Rotterdam, Rotterdam	2013	0.5
- E-health4Uth: nieuw contactmoment Jeugdgezondheidszorg voor 15/16 jarigen. Oral presentation at: Vakgroep verpleegkundigen, Rivas, Zwijndrecht	2013	0.3
- Your Health: Support of deprived adolescents by public health nurses at the start of secondary vocational education. Poster presentation at: INRICH 4th: annual workshop, Rotterdam	2013	0.2
- Support of adolescents by public health nurses at the start of secondary vocational education: Design and first results. Poster presentation at: EUSUHM congress, London	2013	0.2
- Evaluation of computer-tailored health education (E-health4Uth) combined with personal counselling on adolescents' behaviors and mental health status: Design and first results. Poster presentation at: EUSUHM congress, London	2013	0.2
- Online advies op maat (E-health4Uth) en een consult om de gezondheid van jongeren te bevorderen. Oral presentation at: NWO Retraite Jeugd en Gezondheid, Soesterberg	2014	0.3
- Your Health: integraal preventief zorgaanbod aan de voorkant van het MBO voor studenten met een hoog risico. Oral presentation at: Meeting of MBO youth health nurses, CJG Rijnmond, Rotterdam	2014	0.3
- Your Health: extra contactmoment JGZ voor studenten aan de start van het MBO. Oral presentation at: Artsen Jeugdgezondheidszorg Nederland (AJN) dag, Utrecht	2014	0.5
- E-health4Uth: extra contactmoment vanuit de Jeugdgezondheidszorg voor 15/16 jarigen. Oral presentation at: Nederlands Congres Volksgezondheidszorg (NCVGZ), Rotterdam	2014	0.5
- Your Health: extra contactmoment JGZ voor studenten aan de start van het MBO. Oral presentation at: Symposium Wenselijke innovatie JGZ en zorg voor jeugd, Utrecht	2014	0.5
- E-health4Uth: nieuw contactmoment JGZ voor 15/16 jarigen. Oral presentation at: Meeting for researchers and health promoters, GGD Amsterdam, Amsterdam	2014	0.3
- E-health4Uth: nieuw contactmoment JGZ voor 15/16 jarigen. Oral presentation at: Meeting 'Wetenschappelijke commissie jeugdverpleegkundigen', V&VN fractie Jeugd, Utrecht	2014	0.3
- Your Health: contactmoment JGZ voor jongeren op niveau 1 en 2 van het mbo. Oral presentation at: Meeting 'Jong, gezond en talentvol op het mbo' van GGD Gelderland-Midden en Centrum voor jeugd en gezin Rijnmond, Arnhem en Rotterdam	2014	0.5
- E-health voor ouders en kinderen in de Jeugdgezondheidszorg. Oral presentation at: Symposium E-health, Erasmus MC, Rotterdam	2014	0.1
Seminars, workshops and symposia		
- Seminars at the department of Public Health, Erasmus MC, Rotterdam	2012 – 2015	2
- DWARS and CEPHIR seminars, Rotterdam	2012 – 2015	0.5
- NWO Retraite Jeugd en Gezondheid, Soesterberg	2012	0.3
- Symposium Study Design: Beyond Simple Randomization, Erasmus MC, Rotterdam	2012	0.2
- Symposium Wenselijke innovatie JGZ en zorg voor jeugd, Universiteit Utrecht, Utrecht	2014	0.3
- NWO Retraite Jeugd en Gezondheid, Soesterberg	2014	0.3

- Meeting 'Jong, gezond en talentvol op het mbo' van GGD Gelderland-Midden en Centrum voor jeugd en gezin Rijnmond, Arnhem en Rotterdam	2014	0.3
- Symposium E-health, Erasmus MC, Rotterdam	2014	0.1
(Inter)national conferences		
- Nederlands Congres Volksgezondheid (NCVGZ), Amsterdam	2012	0.6
- INRICH 4th: annual workshop, Rotterdam	2012	0.6
- Jaarcongres Jeugdgezondheidszorg, Ede	2012	0.3
- Jaarcongres Jeugdgezondheidszorg, Ede	2013	0.3
- EUSHUM Congress, London	2013	0.7
- Nederlands Congres Volksgezondheidszorg (NCVGZ), Rotterdam	2014	0.6
- Jaarcongres Jeugdgezondheidszorg, Maarssen	2014	0.3
2. Teaching	Year	ECTS
Lecturing		
- Lecturing Erasmus MC medical students 'Medication Safety'	2012	0.4
Supervising practicals, Tutoring		
- Supervising Erasmus MC medical students 'Community projecten'	2013 - 2014	0.6
Supervising Master's thesis		
- Supervising master student 'Health Sciences' VU University of Amsterdam. Thesis title: 'Associations between well-being, truancy and alcohol consumption in adolescents'	2014	2.0
Supervising PhD student		
- Supervising PhD student at the Department of Public Health, section Youth, Erasmus MC. Project title: 'Mag het ietsje minder zijn? Het terugdringen van de vragenlijstendruk bij het signaleren van psychosociale problemen in de JGZ'	2014 – 2015	1.5
3. Other activities	Year	ECTS
- Member of the junior respresentatives consultation, Department of Public Health, Erasmus MC	2012 – 2014	0.3
- Member of the 'Wetenschappelijke commissie jeugdverpleegkundigen, V&VN fractie Jeugd'	2012 – 2015	0.4
- Contribution to NCJ workgroup: 'De JGZ in beeld bij adolescenten'	2012 – 2013	0.5
- Contribution to ZonMw Verspreidings- en Implementatie Impuls (VIMP) grant application (honored): 'Implementatie en professionalisering Your Health'	2013	0.2
- Contribution to ZonMw grant application (honored): 'Mag het ietsje minder zijn? Het terugdringen van de vragenlijstendruk bij het signaleren van psychosociale problemen in de JGZ'	2013	2
- Review for scientific journals (Tijdschrift voor Gezondheidswetenschappen, Social Psychiatry and Psychiatric Epidemiology, PLoSOne)	2013 – 2014	0.6
- Contribution to ZonMw grant application (honored): 'Evaluatie van de rol van de jeugdarts bij "M@ZL op het MBO", een interventie voor een integrale aanpak van ziekteverzuim op het MBO'	2014	0.3
- Contribution to CJG Rotterdam workgroup: 'MBO en de JGZ'	2014	0.2
- Contribution to ZonMw VIMP proposal for grant application: 'Ervaringen met (screenings) instrumenten ontwikkelen'	2014	0.1
- Contribution to ZonMw VIMP proposal for grant application: 'Data bundeling'	2014	0.1

- Contribution to ZonMw grant application: 'Academische Werkplaats Transformatie Jeugd'	2014	0.3
- Member of the 'Opleidingscommissie sociaal verpleegkundigen', Netherlands School of Public & Occupational Health (NSPOH)	2014 – 2015	0.2
- Project leader of the ZonMw-funded project: 'Mag het ietsje minder zijn? Het terugdringen van de vragenlijstendruk bij het signaleren van psychosociale problemen in de JGZ'	2014 – 2015	2
- International research project at University College London, Institute of Child Health, London, England	2015	

Grants and awards	Year	Euro
- Preventive youth health care innovation award for the project 'Your Health	2012	5.000
- ZonMw VIMP grant: 'Implementatie en professionalisering Your Health' (co-applicant)	2013	25.000
- ZonMw grant: 'Mag het ietsje minder zijn? Het terugdringen van de vragenlijstendruk bij het signaleren van psychosociale problemen in de JGZ' (projectleader and secretary)	2013	200.000
- ZonMw grant: 'Evaluatie van de rol van de jeugdarts bij "M@ZL op het MBO", een interventie voor een integrale aanpak van ziekteverzuim op het MBO' (co-applicant)	2014	150.000
- Publication award: 'Maatschappelijke Gezondheidszorg Stimuleringsprijs' for 'Best Debut Publication' for the article 'Effectiveness of E-health4Uth and consultation'	2015