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Longitudinal patterns and predictors of multiple health risk behaviors among adolescents: The TRAILS study

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ABSTRACT

Background. Most studies on multiple health risk behaviors among adolescents have cross-sectionally studied a limited number of health behaviors or determinants.

Purpose. To examine the prevalence, longitudinal patterns and predictors of individual and multiple health risk behaviors among adolescents.

Methods. Eight health risk behaviors (no regular consumption of fruit, vegetables or breakfast, overweight or obesity, physical inactivity, smoking, alcohol use and cannabis use) were assessed in a prospective population study (second and third wave). Participants were assessed in three waves between ages 10 and 17 (2001–2008; n = 2230). Multiple linear regression was used to assess the influence of gender, self-control, parental health risk behaviors, parental monitoring and socioeconomic factors on the number of health risk behaviors adjusted for preceding multiple health risk behaviors (analysis: 2013–2014).

Results. Rates of >5 health risk behaviors were high: 3.6% at age 13.5 and 10.2% at age 16. Smoking at age 13.5 was frequently associated with health risk behaviors at age 16. No regular consumption of fruit, vegetables and breakfast, overweight or obesity, physical inactivity and smoking predicted the co-occurrence of health risk behaviors at follow-up. Significant predictors of the development of multiple health risk behaviors were adolescents' levels of self-control, socioeconomic status and maternal smoking.

Conclusions. Multiple health risk behaviors are common among adolescents. Individual and social factors predict changes in multiple health risk behaviors, showing that prevention targeting multiple risk behaviors is needed. Special attention should be paid to adolescents with low self-control and families with low socioeconomic status or a mother who smokes.

Introduction

Many health risk behaviors, such as poor dietary habits, physical inactivity or substance use, develop or increase during adolescence (Alamian and Paradis, 2009b; Monshouwer et al., 2012; Nader et al., 2008; Trang et al., 2012; Mitchell et al., 2012; Ortega et al., 2013). This can have enduring effects on health behaviors during adulthood (Ortega et al., 2013; Trudeau et al., 2004; Post et al., 2001) and may increase the occurrence of disease and mortality in older age (Djoussé et al., 2009). Unfortunately, many adolescents do not meet the guidelines for specific health behaviors; prevalence rates for unhealthy behaviors among adolescents vary from 5.0% to 88.5% (Pearson et al., 2009; Pronk et al., 2004; Plotnikoff et al., 2009; Sanchez et al., 2007). Especially, fruit and vegetable guidelines are less frequently met in adolescents (Sanchez et al., 2007). Furthermore, health risk behaviors often occur simultaneously (Pronk, 2012; Plotnikoff et al., 2009; Alamian and Paradis, 2009a; Lawlor et al., 2005; Mistry et al., 2009; Trang et al., 2012; Sanchez et al., 2007; Van Nieuwenhuijzen et al., 2009). Studies on multiple health risk behavior in the US (Pronk, 2012: Sanchez et al., 2007; Mistry et al., 2009), Canada (Plotnikoff et al., 2009; Alamian and Paradis, 2009a; Li et al., 2009), Australia (Lawlor et al., 2005) and Europe (Pearson et al., 2009; Van Nieuwenhuijzen et al., 2009) frequently studied a combination of smoking, alcohol use, diet and physical activity. Epidemiological studies in adults show that multiple health risk behaviors may substantially increase health risks (Åkesson et al., 2007; Myint et al., 2009; Chiuve et al., 2006; Martin-Diener et al., 2014; Khaw et al., 2008). Insight into the patterns and predictors of multiple health risk behaviors in adolescents may contribute to more successful and targeted prevention.

Multiple theories have been used to explain the behavior of individuals by addressing both individual and environmental factors (Jessor,

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1984). Theories suggest that individual factors such as gender, (Plotnikoff et al., 2009; Ottevaere et al., 2011; Mistry et al., 2009; Mahalik et al., 2013) previous health behavior (Paavola et al., 2004; Gillander Gådin and Hammarström, 2002) and self-control (Moffitt et al., 2011; Griffin et al., 2012; Williams and Ricciardelli, 2003; Pokhrel et al., 2013; Wills et al., 2007, 2008) may affect health risk behaviors. In addition, the social environment may also play an important role in the development of health risk behaviors (Bandura, 2004; Pampel et al., 2010). Previous studies have found associations between individual or multiple health risk behaviors among adolescents and parental health behaviors, (Frech, 2012; Feunekes et al., 1998; Cameron et al., 2011; Sanchez et al., 2007) parental monitoring, (Mistry et al., 2009) support from parents, (Frech, 2012), peer influences (Hair et al., 2009; Frech, 2012) and low socioeconomic status (SES) (Alamian and Paradis, 2009a,b; Lawlor et al., 2005; Mistry et al., 2009). Trajectories of health risk behaviors in youth have been linked to health risk behaviors and health in adulthood (Hamil-Luker and Angela, 2007; Mahalik et al., 2013; Frech, 2012; Angela and Hamil-Luker, 2005).

Although current knowledge of multiple health risk behaviors among adolescents is mostly based on cross-sectional studies, longitudinal studies can provide valuable insights into the development of health risk behaviors and, furthermore, give stronger evidence for the impact of individual and social factors. More insight into the role that potentially modifiable factors such as self-control or parental behaviors play on changes in multiple health risk behaviors will aid prevention programs that target multiple health risk behaviors. Therefore, this prospective study aimed to: 1) assess the prevalence and longitudinal patterns of individual or multiple health risk behaviors during adolescence and 2) identify predictors of changes in adolescents' multiple health risk behaviors.

Methods

Sample and procedures

This study used data from the first, second and third waves of the Tracking Adolescents' Individual Lives Survey (TRAILS), a prospective cohort study of Dutch adolescents. Sample selection involved five municipalities in the north of the Netherlands and started in 2001. During the first measurement wave (T1), 2230 children (mean age = 11.09 years, SD = 0.56; response rate 76%) were enrolled in the study (for more details about the sample selection, see De Winter et al., 2005), of whom 2149 (96.4%; mean age = 13.56 years, SD = 0.53) and 1816 (81.4%; mean age = 16.26 years, SD = 0.73) participated in the second (T2) and third (T3) measurement waves, respectively. The first assessment wave of TRAILS ran from March 2001 to July 2002. The first follow-up assessment (T2) was held two to three years after T1 (mean number of months 29.47, SD = 5.43; range 16.69–48.06). The second follow up was held 0.9 to 4 years after T2 (mean number of months 32; SD = 7.07; range 11–53).

During T1, parents or guardians (preferably the mother, 95.6%) were interviewed in their homes. They were also asked to fill out questionnaires during the three measurement waves. The adolescents filled out questionnaires at school or other testing locations, under the supervision of one or more TRAILS assistants. The design of each wave of the TRAILS study was approved by the Dutch National Medical Ethics Committee.

Measures

Health risk behavior among adolescents at T2 and T3

Adolescents documented their health behaviors at T2 and T3 by completing a self-report questionnaire using questions of which the validity was confirmed in previous studies (Van Nieuwenhuijzen et al., 2009). The weight and height of the adolescents were also measured at T2 and T3. All health behaviors were classified as in agreement with (national) guidelines at the moment of measurement (yes/no), using the same criteria for T2 and T3. Each health risk factor is described in more detail below.

No regular fruit consumption: fruit was consumed on fewer than five days a week. No regular vegetable consumption: vegetables were consumed on fewer than five days a week. No regular breakfast: breakfast was consumed on fewer than five days a week.

Overweight or obesity: body mass index (BMI; in kg/m^2) was calculated by measuring weight and height using regularly calibrated equipment (models 770 and 214, respectively; Seca, Hamburg, Germany). The definition of overweight or obesity was in accordance with international age- and gender-adjusted BMI criteria (Cole et al., 2000).

Physical inactivity: the Short Questionnaire to ASsess Health-enhancing physical activity (SQUASH) (Wendel-Vos et al., 2003) was used; it included questions about activities such as walking or sport. Since physical activity varies participants were instructed to think about a regular week in the past months. The amount of physical activity was quantified in the Metabolic Equivalent of the Tasks (METs). Moderate and vigorous physical activity (METS ≥3) was defined as meeting the recommended level of physical activity (7 days a week, 60 min a day); physical inactivity was defined as METS <3 using a subdivision of light physical activity versus moderate and vigorous physical activity (Pate et al., 1995; Haskell et al., 2007).

Alcohol use: at T2 and T3, this was defined as alcohol use during the past 12 months. Alcohol use was assessed by asking how often participants drunk alcoholic beverages in the last 12 months with fourteen categories ranging from 0 to more than 40 times. At the time of the study, adolescents aged 16 and older could legally drink alcohol in the Netherlands. An additional variable for alcohol use at T3 was constructed based on the guidelines for adults. The guideline for adults was as follows: not more than one drink per day for women and two drinks per day for men (U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2010).

Smoking: *at T2 and at T3 smoking was defined as* smoking one or more cigarettes. Smoking was measured by asking participants whether they have ever smoked, even though it was only one cigarette or a few puffs *with five categories ranging from I never smoked to I smoke each day. The categories "I smoked never" and "I have smoked in the past but I stopped completely" were classified as non-smoking.*

Cannabis use: any use during the past 12 months. Cannabis use was assessed by asking how often participants used cannabis in the last 12 months ranging from 0 to more than 40 times.

Individual characteristics

Self-control (T1) was assessed by the Dutch parent version of the Early Adolescent Temperament Questionnaire-Revised (EATQ-R) using the Effortful control scale (11 items, $\alpha = 0.86$), which denotes the capacity to voluntarily regulate behavior and attention (Putnam et al., 2001; Rothbart et al., 2000). Examples of items are: "Has a difficult time tuning out background noise and concentrating when trying to study" (Reversed) or "Is usually able to stick with his/her plans and goals." Items were rated on a five-point scale; higher scores reflect greater self-control.

The adolescents' levels of education were measured at T2 and consisted of eight categories (ranging from primary school to pre-university education).

Social environment characteristics

Socioeconomic status at T1 was measured with a parental questionnaire by assessing family income, highest maternal and paternal educational level attained, and the occupational levels of both parents (using the International Standard Classification for Occupations) (Ganzeboom and Treiman, 1996). An index of socioeconomic status was created by averaging the standardized scores of the five indicators *giving all factors equal weights. Because of the interrelationships between different SES indicators, composite SES measures fully account for the effects that can be attributed to socioeconomic conditions, such as resources available to families, the ability to build up networks or influence of parental education on raising a child* (Galobardes et al., 2007; Lahelma et al., 2004). The scale captured 61.2% of the variance in the five items and had an internal consistency of 0.84. Missing values (e.g., only one parent in the family) did not affect the association of this scale with other variables (Veenstra et al., 2005). Three SES groups were created, in which the lowest 25% of the scores were categorized as "low SES," the highest 25% as "high SES" and the remaining groups as "intermediate SES."

The following parental behaviors were measured; responses could be given separately for the father and mother. If the mother was the person completing the survey she also provided information on the health behaviors of the father and vice versa.

Physical activity (PA): how many days in an average week the parent engaged in PA for at least 30 min during the summer (question 1) and winter (question 2). Responses ranged from 0 (never) to 7 (seven days per week). Responses to the two questions were averaged.

Parental smoking (T2): tobacco smoking during the last four weeks. Responses ranged from 1 (never smoked) to 7 (more than 20 cigarettes a day).

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