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The Antecedents and Consequences of Interpersonal Communication during a School-based Health Intervention

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ABSTRACT

School-based health interventions often have limited and inconsistent effects. Although interpersonal communication likely is important, hardly any studies have investigated interpersonal communication of students with their friends, classmates, and parents about the health programs and health behaviors in school-based health interventions. In a two-wave prospective study of 389 adolescents focusing on three health behaviors (i.e., alcohol use, snack intake, and exercise), we addressed two aims. Our first aim was to investigate how student evaluations of a school-based health intervention influenced interpersonal communication about health behaviors (i.e., valence and frequency of conversations). Findings showed that positively evaluating a school-based health intervention increased how often students talked about the intervention with friends, classmates, and parents, as well as how they discussed the three health behaviors. Our second aim was to investigate the influence of interpersonal communication with friends, classmates, and parents on predictors of health behaviors. We found for conversational frequency that frequently discussing health behaviors resulted in healthier (more positive) predictors of exercise, but also in unhealthier (more positive) predictors of snacking and drinking. Furthermore, findings showed that positively discussing exercising, and negatively discussing snacking and drinking, resulted in healthier predictors of these behaviors. Our findings show that it is important to understand the impact of post-intervention communication and that post-intervention communication with peers and parents about health behaviors are predictors of health behavior.

Many young people engage in unhealthy behaviors, such as alcohol use, eating unhealthy foods, and living a sedentary lifestyle (Akseer et al., 2017; Johnston et al., 2016; Salmon et al., 2011). These unhealthy behaviors usually worsen during adolescence, reaching their peak during late adolescence (Kwan et al., 2012; Mahalik et al., 2013). Alcohol use, a poor diet, and a sedentary lifestyle have all been associated with detrimental health outcomes. Consumption of excessive amounts of alcohol has been related to blackouts (Boekeloo et al., 2013), injuries (Hingson et al., 2009), alcohol dependence (Olsson et al., 2016), and impaired brain development (Jones et al., 2018). Both a poor diet and physical inactivity have been found to result in obesity (Akseer et al., 2017), and lack of physical activity has also been found as a major cause of chronic diseases (Booth et al., 2012). These consequences illustrate the importance of reducing these unhealthy behaviors.

Schools offer school-based health interventions to prevent adolescents from developing unhealthy lifestyles. Unfortunately, meta-analyses showed that most school-based health interventions have limited and inconsistent effects on various health behaviors (Onrust et al., 2016; Strøm et al., 2014). One reason may be interpersonal communication. Investigating interpersonal communication is important because health intervention effectiveness depends upon whether and what interpersonal communication is generated (Hornik & Yanovitzky, 2003; Southwell & Yzer, 2007). Therefore, our study investigated interpersonal

communication with friends, classmates, and parents in school-based health interventions.

Because research has shown that evaluations of interventions determine interpersonal communication about health topics (Hafstad & Aarø, 1997; Kim et al., 2013), we investigated the influence of student evaluations of a school-based health intervention on how often (i.e., conversational frequency) and how positive or negative (i.e., conversational valence) students talked about drinking alcohol, snacking, and exercising (aim 1). Investigating this relationship is relevant, because conversational valence and frequency can influence (predictors of) health behavior (Boers et al., 2020; Real & Rimal, 2007). Given that research on interpersonal communication in school-based health interventions is lacking, we also investigated how frequency and valence of conversations related to predictors of the three health behaviors (aim 2).

In sum, our first research objective was to investigate the influence of intervention evaluations on conversational frequency and valence about the health intervention and health behaviors. Our second research objective was to investigate the influence of interpersonal communication about health behaviors on predictors of health behavior during a school-based health intervention. For our study, we investigated interpersonal communication with friends, classmates, and parents. This information might benefit the design of school-based health interventions, if they, for example, are able to influence

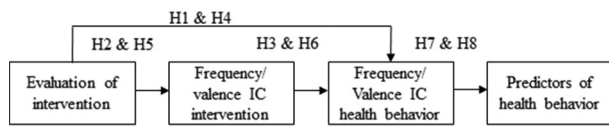


Figure 1. Conceptual model.

interpersonal communication in a desirable direction. Our conceptual model is shown in Figure 1.

Influence of intervention evaluations on conversational valence and frequency

Our first research objective was to investigate whether student evaluations of an intervention influenced conversational frequency and valence about the health intervention, and about health behaviors. To the best of our knowledge, effects of how students evaluate a school-based health intervention on conversational frequency and valence about health behaviors remain unclear to this day. However, it is likely that intervention evaluations of students influence the conversational frequency. That is, positive reactions toward antismoking health messages elicited more discussions about the health messages than neutral reactions (Hafstad & Aarø, 1997; Kim et al., 2013). Furthermore, exposure to an antismoking campaign directly triggered more conversations about quitting, as well as, triggered conversations about quitting indirectly by first stimulating conversations about the campaign (Van den Putte et al., 2011). Together, these studies show that student evaluations of the intervention could directly increase the number of conversations about alcohol use, snacking, and exercising, but also indirectly by first increasing the conversational frequency about the health intervention. Therefore, we pose the following hypotheses:

H1: Positively evaluating the health intervention results in more frequent discussions about alcohol use (H1a), snacks (H1b), and exercise (H1c).

H2: Positively evaluating the health intervention results in more frequent discussions about the health campaign.

H3: Positively evaluating the health intervention results in more frequent discussions about alcohol use (H3a), snacks, (H3b), and exercise (H3c), and this is mediated by more frequent discussions about the intervention.

Aside from an effect of students' intervention evaluations on conversational frequency, we consider it likely that student evaluations of interventions also influence conversational valence. That is, student evaluations of courses positively predicted how much students learned during these courses (Rodríguez et al., 1996; Zhang & Huang, 2008). For a school-based health intervention, this means that students may learn more about the unhealthy consequences of alcohol use, eating unhealthy snacks, and physical inactivity, and the importance of a healthy lifestyle, if they positively evaluate a school-based health intervention. This newly learned information may direct students' conversational valence about these behaviors into

a healthier direction. Furthermore, word-of-mouth research has shown that positive experiences with services or products usually lead to more positive discussions about these experiences (Brown et al., 2005; de Matos & Rossi, 2008). Therefore, it is likely that students talked more positively about the health intervention with their friends, classmates, and parents if they evaluated the health intervention positively. Additionally, a positive conversational valence about a health intervention has been related to anti-substance norms and refusal self-efficacy (Choi et al., 2017), indicating that positive discussions about health programs can result in healthier behavioral determinants. Potentially, positive conversations about the program progressed in healthier conversations about the behaviors, which subsequently resulted in healthier behavioral determinants. In our study, we test a similar notion. Based on previous studies, we posed the following hypotheses:

H4: Positively evaluating the health intervention results in more negative conversations about alcohol (H4a) and snacks (H4b) and more positive conversations about exercise (H4c).

H5: Positively evaluating the health intervention results in more positive discussions about the health intervention.

H6: Positively evaluating the health intervention results in healthier discussions about alcohol use (H6a), snacks, (H6b), and exercise (H6c), and this is mediated by more positive discussions about the interventions.

Influence of conversational frequency and valence on predictors of health behavior

Our second research objective was to investigate the influence of conversational frequency and valence on predictors of snack intake, alcohol use, and exercise. Interpersonal communication can be perceived as a source of information that influences behavioral determinants, similar to other sources of information such as a school-based health intervention. Potentially, interpersonal communication has a strong influence on behaviors because closely related discussion partners such as friends or family are likely seen as trustworthy and reliable (Larson et al., 2007). Interpersonal communication can enhance the extent to which people elaborate and reflect on information rather than just hearing the information (Eveland, 2004). According to the elaboration likelihood model, enhanced processing of information could then lead to longer lasting changes in predictors of behavior that are also more predictive of behavior (Petty & Cacioppo, 1986).

To understand interpersonal communication in relation to health programs, recipients of health messages should not be perceived as passive receivers. Instead, receivers of health messages actively engage with the program content, and also in various social settings such as with friends or family (Pettigrew et al., 2018). Illustrating this active role of health message receivers, school-based health interventions have been shown to trigger interpersonal communication, even though this was not an intended aspect of the intervention (Choi et al., 2017). Communicating about health messages can strengthen effects of health interventions by, for example, increased knowledge,

memory, and awareness of social norms (Southwell, 2013). In line with this research, a meta-analysis has shown that campaign-generated interpersonal communication resulted in higher program effectiveness (Jeong & Bae, 2017), indicating that interpersonal communication can indeed strengthen program effects. In fact, program effects can even be extended by participants in the intervention to non-participants (Campbell et al., 2008; Rulison et al., 2015), further illustrating the potential of interpersonal communication in the context of health interventions.

To study the effects of interpersonal communication on predictors of health behavior in a school-based health intervention, we based these predictors on the theory of planned behavior (TPB; Ajzen, 1991). This theory considers attitudes toward behavior, perceived social norms, and perceived behavioral control (PBC) as predictors of behavioral intention, which in turn, predicts actual behavior. Attitudes can be regarded as an evaluative summary of objects or behaviors. Subjective norms consist of injunctive and descriptive norms. Injunctive norms refer to perceptions of how others approve of a behavior (Ajzen, 1991), and descriptive norms are as evaluations of how people behave (Borsari & Carey, 2001). PBC refers to a person's perception of their ability to perform a certain behavior (Ajzen, 1991). In our study, we tested the effects of interpersonal communication about health behavior on these predictors because the health intervention that was tested in our study was partly based on the TPB. Additionally, the TPB has successfully been used to predict snack intake, alcohol use, and exercise (Cooke et al., 2016; Plotnikoff et al., 2013; Riebl et al., 2015).

In regards to the influences of interpersonal communication on these predictors of health behavior and actual health behavior, numerous studies have shown that how often people talked about health topics (i.e., conversational frequency) influenced attitudes, intentions, and behaviors. For example, studies found that frequently communicating about alcohol was related to an increased use of alcohol and unhealthier drinking intentions (Dorsey et al., 1999; Real & Rimal, 2007). These studies, however, investigated interpersonal communication without taking conversational valence into account, or without the presence of a health message that could have steered the conversational valence in a healthy direction. This may explain why some of these studies have found unhealthy influences of conversational frequency on health behavior. In line with this notion, H. Hendriks et al. (2014) showed that participants discussing alcohol without being exposed to an anti-alcohol message were less inclined to refrain from binge drinking compared to participants that discussed alcohol and were exposed to an anti-alcohol message, probably because these conversations without campaign exposure had a more positive valence about alcohol (see also Hendriks et al., 2012). Similarly, a meta-analysis investigating the influence of interpersonal communication on health behavior after health campaign exposure has indeed found that conversations elicited by health campaigns had a desirable effect on campaign outcomes (Jeong & Bae, 2017), indicating that the valence of conversations after exposure to a health message is likely more healthy. Together, these studies suggest that frequent discussions after exposure to a health message likely have a healthy influence on predictors of health behavior. Therefore, we pose the following hypothesis:

H7: Frequently discussing a health behavior leads to healthier attitudes (H7a), injunctive norms (H7b), descriptive norms (H7c), PBC (H7d), and intentions (H7e) toward health behavior.

As argued, the fact that some studies found healthy effects of communicating about health behaviors on health behaviors, whereas other studies found unhealthy effects on health behaviors, may be due to the valence of the conversations (e.g., Jeong & Bae, 2017; Real & Rimal, 2007). Therefore, in addition to the conversational frequency, our study also investigated how conversational valence influenced predictors of health behaviors. There are two reasons why conversational valence can influence predictors of health behavior. First, according to the self-perception theory, people can infer their position toward a health topic by perceiving how positively or negatively they talk about this topic (Bem, 1972). Second, people can be influenced by persuasive arguments of their conversation partner (Vinokur & Burnstein, 1974). Studies on conversational valence have shown that conversational valence was positively related to predictors of health behavior (Boers et al., 2020; Dunlop et al., 2010). This means that conversations that are positive about healthy behaviors (i.e., exercise) or negative about unhealthy behaviors (i.e., snack intake and alcohol use) result in healthier predictors of behavior. To test whether conversational valence has a similar function in a school-based health intervention, we hypothesized the following:

H8: Positively discussing a healthy behavior (i.e., exercise) and negatively discussing an unhealthy behavior (i.e., snack intake and alcohol use) after a school-based health intervention leads to healthier attitudes toward health behavior (H8a), injunctive norms (H8b), descriptive norms (H8c), PBC (H8d), and intention (H8e) toward health behavior.

Methods

The Trimbos Institute, the Netherlands Institute for Mental Health and Addiction, developed a new school-based health intervention that was used to study interpersonal communication. The goal of the intervention, called InCharge, stimulate healthier behaviors of older adolescents, by increasing their self-control abilities. The InCharge program consists of four lessons and each lesson lasts 45 minutes. In these lessons, students work on assignments such as discussions with classmates and watch a video about the negative consequences of binge drinking. These assignments are complemented with homework assignments such as the 7-days challenge in which students have to resist a self-chosen temptation for 1 week. This study is part of a larger research project in which intervention classes are compared with control classes. For this study, we focused on intervention classes only to investigate the antecedents and consequences of interpersonal communication during a school-based health intervention. The trial was approved by the Ethics Review Board of the Faculty of Social and Behavioral Sciences of the University of Amsterdam (Ref no. 2017-PC-8244).

Participants and design

Schools were recruited throughout the Netherlands after ethical approval was received. For this study, a two-wave design was used. T0 was administered 1 week before the start of the InCharge program, then the implementation of the four-week InCharge program followed, and T1 was administered 1 week after the InCharge program finished. All data were collected in the academic years 2017/2018 and 2018/2019. This study was part of a larger research project investigating the intervention condition versus the control condition. From our total sample, a total of 628 participants were randomly allocated to the experimental condition, and the unit of randomization were classes. For the present study, we only analyzed the experimental conditions. Our final sample consisted of 389 participants (222 females; $M_{age} = 16.64$, $SD_{age} = 1.97$) because five experimental classes forgot to fill out the first or second survey ($n = 128$), parents refused participation ($n = 5$), students were absent during the first or second survey ($n = 31$), and 71 students did not return the surveys for unknown reasons. Finally, five additional participants were removed because they reported inconsistent birthdates on the first and second survey. Of the final sample, 52.7% followed pre-university college, 37.3% followed intermediate vocational education, and 10% followed higher general secondary education.

Measures

Intervention evaluation

Measures assessing intervention evaluations were based on the affective learning scale (McCroskey, 1994) and the state motivation scale (Richmond, 1990). Intervention evaluations were measured at T1 with the statement “My experiences with the four lessons about temptations/self-control . . .” The statement was followed by eight semantic differential items from: (1) *I was motivated* to (5) *I was unmotivated*, (1) *I was excited* to (5) *I was bored*, (1) *I was uninterested* to (5) *I was interested*, (1) *I was involved* to (5) *I was uninvolved*, (1) *I was dreading it* to (5) *I was looking forward to it*, (1) *totally not enjoying* to (5) *totally enjoying*, (1) *totally not informative* to (5) *totally informative*, and (1) *totally not good* to (5) *totally good*. Items were coded so that higher values equaled positive evaluations of the intervention.

Interpersonal communication

Conversational frequency. Conversational frequency was assessed at T0 and T1 using the statement “How often have you talked to the following people about . . . in the past 4 weeks?” Included discussion partners were friends, classmates, and parents. Participants were asked about the health behaviors alcohol use, snack intake, and exercise at T0 and T1, and the health intervention was only asked about at T1. Response categories varied from (1) *not talked about* to (5) *Talked about very often*. For each conversation topic, we averaged the items to compute a scale score.

Conversational valence. Conversational valence was measured at T0 and T1 using the statement “How negative or

positive were these conversations about . . . ?” Again, included discussion partners were friends, classmates, and parents and health behaviors were asked about at T0 and T1, and the health intervention was only asked about at T1. Response categories varied from (1) *Very negative* to (5) *Very positive*, and participants could also indicate that they had not talked about the health behaviors and intervention with their friends, classmates, and parents. This resulted in a missing value. For each conversation topic, we averaged the items to compute a scale score.

Predictors of health behavior

Attitudes toward health behavior. Attitudes toward alcohol use were measured at T0 and T1 with the statement “I believe that drinking five or more glasses alcohol in one sitting would be . . .” attitudes toward exercising was measured with the statement “I believe that exercising less than once a week would be . . .” and attitudes toward snacking was measured with the statement “I believe that snacking or eating candy every day would be . . .” Four semantic differential items followed these statements varying from: (1) *unpleasant* to (7) *pleasant*, (1) *irresponsible* to (7) *responsible*, (1) *harmful* to (7) *harmless*, and (1) *bad* to (7) *good*. Attitudes toward exercise were recoded so that positive scores represented healthier attitudes toward exercise. For drinking alcohol, snacking, and exercising, we separately averaged the four items to compute a scale score.

Injunctive norms. Injunctive norms concerning alcohol use, exercising, and snacking were measured at T0 and T1 with the statements “How positive are the following people about drinking five or more glasses of alcohol in one sitting?,” “How positive are the following people about exercising less than once a week?,” “How positive are the following people about snacking every day?” Response options ranged from (1) *very negative* to (5) *very positive* for most of my friends, most of my classmates, and my parents. Injunctive norms concerning exercising were recoded so that positive scores represented healthier injunctive norms. For drinking alcohol, snacking, and exercising, we separately averaged the four items to compute a scale score.

Descriptive norms. Descriptive norms concerning alcohol use, exercising, and snacking were measured at T0 and T1 with the statements “How often do you think the following people drink five or more glasses in one sitting?,” “How often do you think the following people do sports or exercise?,” and “How often do you think the following people eat snacks or candy?” Response options ranged from (1) *Never* to (5) *Very often* for most of my friends, most of my classmates, and my parents. For drinking alcohol and snacking, higher values represent more unhealthy descriptive norms, and for exercising, higher values represent healthier descriptive norms. For drinking alcohol, snacking, and exercising, we separately averaged the four items to compute a scale score.

Perceived behavioral control. PBC was measured at T0 and T1 with the statement “If you were confronted with the following temptations, could you resist it if you wanted to?” followed by “drink alcohol”, “skip sports or exercise”, and “eat snacks or

candy”. Response options ranged from (1) *definitely not* to (5) *definitely*. More PBC is represented by higher values.

Intention. Intentions toward the health behaviors was assessed at T0 and T1 by the statements “Indicate how often you plan to do the following things in the upcoming 4 weeks,” followed by “exercise intensely”, “exercise mildly”, “eat snacks or candy”, “drink alcohol”, and “drink five or more glasses of alcohol on one occasion.” Response options were 1 = *never*, 2 = *less than once a week*, 3 = *once a week*, 4 = *several times a week*, and 5 = *every day*. For drinking alcohol and snacking, higher values represented unhealthier intentions, and for exercising, higher values represented healthier intentions.

Data-analysis

In our final sample of 389 participants, the proportion of missing data was less than 5%, which is considered inconsequential for the quality of statistical inferences (Schafer, 1999). To deal with missing values, we used expectation-maximization (EM) because maximum likelihood methods generally lead to optimal results (Cheema, 2014). For our model regarding conversational frequency, we used Amos version 24 (Arbuckle, 2014). For our model regarding conversational valence, participants were able to indicate that they had not talked about the intervention or health behaviors, resulting in missing values on conversational valence about the health intervention and health behaviors. Analyzing participants without missing values on conversational valence items only would drastically lower our sample size. Therefore, we were not able to add moderation effects to the model, and investigated conversational valence using (partial) correlations.

T0 measures of the predictors of drinking alcohol, snacking, and exercising were used as covariates for measures at T1. We allowed the error terms of the predictors of health behavior at T1 to covary because other unmeasured variables such as sensation seeking, for example, have been shown to influence alcohol use (Del Boca et al., 2004). T0 measures of conversational valence and frequency about health behaviors were used as covariates for measures at T1. Additionally, we used the conversational valence and frequency about health behaviors at T0 as covariates for conversational valence and frequency about the health intervention because how and how often students talk about a health behavior prior to the intervention may influence how and how often students talk about the health intervention (see Figure 2 for model with key variables). For the conversational frequency model, we reported chi-square, standardized root mean residual (SRMR), comparative fit index (CFI), and root mean square error of approximation (RMSEA). Fit indices were acceptable if SRMR < .08 (Hu & Bentler, 1999), CFI > .90 (Hair et al., 2010), and RMSEA < .08 (MacCallum et al., 1996). Variables were standardized to improve comparability.

Results

Univariate statistics

Means, standard deviations, and Cronbach’s alpha’s of all included variables are shown in Table 1. On average, students

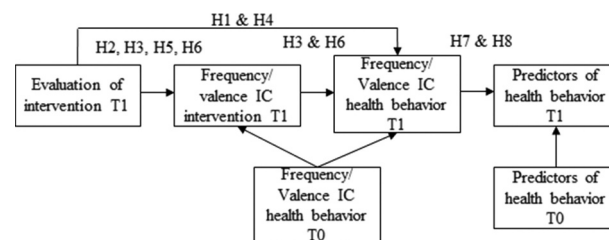


Figure 2. Model containing all key variables. Predictors of health behavior were attitudes, injunctive norms, descriptive norms, perceived behavioral control, and intention. Error terms were allowed to covary for the predictors of health behavior at T1. Additionally, covariances were allowed between all exogenous variables. Valence was analyzed using separate analyses due to a limited sample size.

Table 1. Descriptive statistics of background and variables included in the models.

| Background variables | M | | SD | | α | |
|---------------------------------------|------|------|------|------|----------|-----|
| | T0 | T1 | T0 | T1 | T0 | T1 |
| Alcohol use | 2.03 | | 1.26 | | | |
| Binge drink | 1.98 | | 1.50 | | | |
| Exercise | 5.16 | | 2.01 | | | |
| Snack intake | 4.98 | | 1.36 | | | |
| Intervention | | | | | | |
| Evaluation of intervention | | 2.96 | | .73 | | .85 |
| Interpersonal communication | | | | | | |
| Conversational frequency alcohol | 2.26 | 2.27 | 1.05 | 1.06 | .74 | .78 |
| Conversational frequency snack | 2.48 | 2.42 | 1.09 | 1.04 | .78 | .79 |
| Conversational frequency exercise | 2.92 | 2.78 | 1.04 | 1.00 | .77 | .77 |
| Conversational frequency intervention | | 1.80 | | .87 | | .80 |
| Conversational valence alcohol | 3.34 | 3.28 | .95 | .89 | .79 | .78 |
| Conversational valence snack | 3.21 | 3.18 | .81 | .79 | .75 | .67 |
| Conversational valence exercise | 3.85 | 3.78 | .83 | .85 | .80 | .87 |
| Conversational valence intervention | | 3.02 | | .80 | | .90 |
| Alcohol use | | | | | | |
| Attitudes toward alcohol | 2.69 | 2.90 | 1.59 | 1.64 | .90 | .86 |
| Injunctive norms | 2.67 | 2.66 | .99 | .97 | .76 | .75 |
| Descriptive norms | 2.82 | 2.76 | .97 | .87 | .67 | .62 |
| PBC | 4.26 | 4.09 | 1.06 | 1.08 | | |
| Intention to drink | 1.90 | 2.07 | .99 | 1.06 | | |
| Intention to binge drink | 1.63 | 1.79 | .90 | 1.01 | | |
| Snack intake | | | | | | |
| Attitudes toward snack | 3.29 | 3.43 | 1.35 | 1.30 | .84 | .73 |
| Injunctive norms | 2.90 | 2.95 | .72 | .72 | .76 | .76 |
| Descriptive norms | 3.61 | 3.60 | .52 | .55 | .61 | .66 |
| PBC | 3.72 | 3.53 | 1.04 | 1.09 | | |
| Intention to snack | 3.63 | 3.60 | .93 | 1.08 | | |
| Exercise | | | | | | |
| Attitudes toward exercise | 5.33 | 5.55 | 1.49 | 1.55 | .88 | .89 |
| Injunctive norms | 3.64 | 3.51 | .88 | .92 | .77 | .84 |
| Descriptive norms | 3.23 | 3.29 | .54 | .54 | .50 | .46 |
| PBC | 3.97 | 3.83 | 1.17 | 1.22 | | |
| Intention to exercise intensely | 3.71 | 3.72 | .89 | .92 | | |
| Intention to exercise mildly | 3.88 | 3.86 | 1.03 | .99 | | |

Attitude varied from 1 to 7 and all other variables were measured on a scale from 1 to 5. For snack intake and alcohol use, higher values represent more unhealthy predictors, whereas for exercise, higher values represent healthier predictors.

spoke least about alcohol, followed by snacking, and exercising on both T0 and T1. Of these conversations, students discussed exercising most positively followed by alcohol use and snacking. The intervention was not talked about as much as the health behaviors, and the valence of these conversations was around midscale. The predictors of health behavior remained relatively stable between T0 and T1. For alcohol use, attitudes, injunctive norms, PBC, and intention to drink and binge drink became unhealthier, and descriptive norms became more healthy. For exercise, attitudes, injunctive and descriptive norms and intention to exercise intensely became healthier, and PBC and intention to exercise mildly became more

unhealthy. Finally for snacking, attitudes, injunctive and descriptive norms, and PBC became more unhealthy, and intention to snack became more healthy.

Influence of intervention evaluation on conversational frequency and valence

Conversational frequency

For alcohol use and snacking, the model fit was acceptable, and the exercise model nearly fitted the data. Fit indices of the snack model were acceptable, $\chi^2(45) = 158.98, p < .001$, CFI was .91, SRMR was .07, and RMSEA was .08, of the alcohol model were acceptable, $\chi^2(60) = 219.56, p < .001$, CFI was .96, SRMR was .07 and RMSEA was .08, and of the exercise model were nearly acceptable, $\chi^2(60) = 199.88, p < .001$, CFI was .91, SRMR was .09, and RMSEA was .08. Results of all conversational frequency models are displayed in Table 2.

For our first hypothesis, we found that positively evaluating the health intervention increased conversational frequency about exercise ($\beta = .12, p = .005$), but did not increase conversational frequency about alcohol or snacks, thereby supporting H1c and rejecting H1a and H1b. For our second hypothesis, we found that positively evaluating the health intervention increased conversational frequency about the health intervention ($\beta = .20, p < .001$), thereby supporting H2. For our third hypothesis, we found that positively evaluating the health intervention indirectly led to more frequent discussions about alcohol ($\beta = .03, p = .005$), snacking ($\beta = .04, p = .005$), and exercise ($\beta = .03, p = .005$), and this effect was mediated by the conversational frequency about the health intervention, thereby supporting H3a, H3b, and H3c.

Conversational valence

Findings of all conversational valence models are shown in Table 3. For our fourth hypothesis, we found that positively evaluating the health intervention resulted in healthier conversations about snacks ($r = -.14, p = .032$) and exercise ($r = .12, p = .041$), but not about alcohol, thereby supporting H2b and H2c. For our fifth hypothesis, we found that positively evaluating the health intervention resulted in more positive conversations about the health intervention in the alcohol model, snack model (both $r = .51, p < .001$), and the exercise model ($r = .46, p < .001$), thereby supporting H5. In contrast to our sixth hypothesis, we found that the effect of evaluating the intervention on the conversational valence about the health behaviors was not mediated by the conversational valence about the intervention (all $p > .05$).

Influence of conversational frequency and valence on predictors of health behavior

Conversational frequency

For our seventh hypothesis, we found that frequently discussing alcohol use resulted in unhealthier attitudes toward alcohol ($\beta = .31, p < .001$), injunctive norms ($\beta = .26, p < .001$), descriptive norms ($\beta = .20, p < .001$), PBC ($\beta = -.31, p < .001$), intention to use alcohol ($\beta = .33, p < .001$) and to binge drink ($\beta = .38, p < .001$). For snacking, we found that frequently discussing snacks resulted in unhealthier attitudes toward snacks ($\beta = .13, p = .003$), injunctive norms ($\beta = .17, p < .001$), descriptive norms ($\beta = .14, p = .002$), intention to snack ($\beta = .11, p = .013$), but not PBC. Finally for exercise, findings showed that frequently discussing exercise increased

Table 2. Conversational frequency models of alcohol use, snack intake, and exercise.

| Dependent variables | Evaluation of intervention | Frequency IC Intervention | Frequency IC Alcohol |
|---|----------------------------|---------------------------|---------------------------|
| Conversational frequency model of alcohol use | | | |
| Frequency IC intervention | .20*** | | |
| Frequency IC alcohol | .04 | .16*** | |
| Attitudes toward alcohol | | | .31*** |
| Injunctive norms | | | .26*** |
| Descriptive norms | | | .20*** |
| PBC | | | -.31*** |
| Intention to drink | | | .33*** |
| Intention to binge drink | | | .38*** |
| Dependent variables | Evaluation of intervention | Frequency IC Intervention | Frequency IC Snack intake |
| Conversational frequency model of snack intake | | | |
| Frequency IC intervention | .20*** | | |
| Frequency IC snack | .004 | .21*** | |
| Attitudes toward snack intake | | | .13** |
| Injunctive norms | | | .17*** |
| Descriptive norms | | | .14** |
| PBC | | | -.06 |
| Intention to snack | | | .11* |
| Dependent variables | Evaluation of intervention | Frequency IC Intervention | Frequency IC Exercise |
| Conversational frequency model of exercise | | | |
| Frequency interpersonal communication intervention | .19*** | | |
| Frequency interpersonal communication exercise | .12** | .16*** | |
| Attitudes toward exercise | | | .09 [^] |
| Injunctive norms | | | .08 |
| Descriptive norms | | | .12** |
| PBC | | | -.03 |
| Intention to exercise extremely | | | .08* |
| Intention to exercise mildly | | | .09 [^] |

[^] $p < .10$, * $p < .05$, ** $p < .01$ *** $p < .001$. IC = interpersonal communication. Values represented standardized regression weights.

Table 3. Conversational valence model of alcohol use, snack intake, and exercise.

| Dependent variables | Evaluation of intervention | Valence IC Intervention | Valence IC Alcohol |
|--|----------------------------|-------------------------|-------------------------|
| Conversational valence model of alcohol use | | | |
| Valence IC intervention | .51***a (184) | | |
| Valence IC alcohol | .03b (244) | .04a (162) | |
| Attitudes toward alcohol | | | .24b*** (279) |
| Injunctive norms | | | .32b*** (282) |
| Descriptive norms | | | .22b*** (280) |
| PBC | | | -.13b* (281) |
| Intention to drink | | | .28b*** (278) |
| Intention to binge drink | | | .31b*** (279) |
| Dependent variables | Evaluation of intervention | Valence IC Intervention | Valence IC Snack intake |
| Conversation model of snack intake | | | |
| Valence IC intervention | .51***a (212) | | |
| Valence IC snack | -.14*b (250) | -.04a (186) | |
| Attitudes toward snack intake | | | .22b*** (284) |
| Injunctive norms | | | .17b** (282) |
| Descriptive norms | | | .21b*** (282) |
| PBC | | | .01b (285) |
| Intention to snack | | | .14b* (278) |
| Dependent variables | Evaluation of intervention | Valence IC Intervention | Valence IC Exercise |
| Conversation model of exercise | | | |
| Valence IC intervention | .46***a (228) | | |
| Valence IC exercise | .12* (304) | .08a (205) | |
| Attitudes toward exercise | | | .20b*** (324) |
| Injunctive norms | | | .21b*** (323) |
| Descriptive norms | | | .19b** (320) |
| PBC | | | .16b** (323) |
| Intention to exercise extremely | | | .31b*** (323) |
| Intention to exercise mildly | | | .32b*** (324) |

[^] $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. b = controlled for T0 valence of respective health behavior, a = controlled for T0 measure of variable in row. IC = interpersonal communication. Numbers between brackets represent *n*. Values represent correlations.

intention to exercise intensely ($\beta = .09$, $p = .023$) and descriptive norms ($\beta = .12$, $p < .001$), but not the attitudes, injunctive norms, PBC, and intention. Thus, for drinking alcohol and snacking, we found relations in the opposite direction than expected, and for exercising, we found support for H7c and H7e.

Conversational valence

For our eighth hypothesis, we found that negatively discussing alcohol use was related to healthier attitudes toward alcohol ($r = .24$, $p < .001$), injunctive norms ($r = .32$, $p < .001$), descriptive norms ($r = .22$, $p < .001$), PBC ($r = -.13$, $p = .030$), intention to use alcohol ($r = .28$, $p < .001$) and intention to binge drink ($r = .31$, $p < .001$). For snack intake, we found that negatively discussing snacks was related to healthier attitudes toward snack intake ($r = .22$, $p < .001$), injunctive norms ($r = .17$, $p = .003$), descriptive norms ($r = .21$, $p < .001$), and intention to snack ($r = .14$, $p = .020$), but not PBC. Finally for exercise, findings showed that positively discussing exercise was related to healthier attitudes toward exercise ($r = .21$, $p < .001$), injunctive norms ($r = .19$, $p = .001$), descriptive norms ($r = .24$, $p < .001$), PBC ($r = .16$, $p = .004$), intention to exercise intensely ($r = .31$, $p < .001$) and mildly ($r = .32$, $p < .001$). Thus, H8 was largely supported.

Discussion

Our first research objective was to investigate how student evaluations of a health intervention influenced frequency and valence of conversations with friends, classmates, and parents about health

behaviors. Our study shows that student evaluations of the intervention indirectly increases the conversational frequency about the three health behaviors, and this effect is mediated by the conversational frequency about the health intervention, thereby confirming H2 and H3, and (largely) rejecting H1. Additionally, positive student evaluations of the health intervention increases the conversational valence about the intervention, and directly leads to healthier conversations about snacking and exercising. This effect from evaluating the intervention on the valence of conversations about snacking and exercising is not mediated by the conversational valence about the health intervention, thereby largely confirming H4 and H5, and rejecting H6. Our second research objective was to investigate the influence of interpersonal communication with friends, classmates, and parents about health behaviors on predictors of health behavior during a school-based health intervention. Findings show that frequently discussing drinking and snacking resulted in more unhealthy predictors, whereas frequently discussing exercising resulted in healthier exercise predictors, partially supporting H7. Furthermore, our study shows that positively discussing exercising, and negatively discussing drinking, and snacking relate to healthier predictors, supporting H8.

Our findings demonstrate that student evaluations determine how often, and how students discuss health behaviors in the context of a school-based health intervention, confirming the importance of student evaluations for interpersonal communication as was found in other contexts (e.g., Hafstad & Aarø, 1997; de Matos & Rossi, 2008). Knowing that intervention evaluations determine health-related interpersonal communication is important, because these findings inform designers of health

interventions how to stimulate conversations and steer them into healthier directions. Health intervention designers that want to stimulate interpersonal communication may want to explore what elements of a school-based health intervention contribute to positive student evaluations in order to elicit desirable conversations about health-related topics. For example, designers of health interventions could look into how teachers communicate school-based health interventions because teacher communication behaviors such as clear teaching determine how students evaluate courses (Allen et al., 2006; Mesman et al., 2019; Titsworth et al., 2015). However, more research is needed to understand how student evaluations of interventions can be used to influence how often and how students communicate about health behaviors, and to test cascading longitudinal effects of interpersonal communication.

In line with studies showing that interpersonal communication can be important for health campaign effectiveness (e.g., Van den Putte et al., 2011), our findings also demonstrate that how often and how students talk about health behaviors influence predictors of health behavior in the context of a school-based health intervention. Interpersonal communication, however, may not always result in healthier behaviors. Similar to a study demonstrating unhealthy influences of interpersonal communication about marijuana (David et al., 2006), our study reveals frequent conversations about alcohol use and snack intake result in more unhealthy predictors for these health behaviors. Additionally, our findings suggest that designers of health interventions should focus on steering conversational valence about health behaviors into a desired direction. This might, for example, be achieved by asking a group of students to present the negative consequences of drinking alcohol, which might subsequently trigger healthy interpersonal communication about this topic. Future studies could investigate this and other strategies to understand how school-based health interventions can effectively steer conversational valence into a healthier direction. Thus, by directing the conversational valence about unhealthy behaviors such as snacking and drinking into a healthier direction, interpersonal communication can be used to increase the effectiveness of school-based health interventions.

In addition to our main findings described above, our study has some findings that warrant additional explanation. First, our findings show that positively evaluating the health intervention steers conversational valence about snacking and exercising into a more desired direction, but not for alcohol use. Arguably, alcohol may have been less of an interest to the students in our sample because their previous behavior shows that exercising and snacking are more prevalent, and therefore potentially more relevant to them compared to alcohol use. Second, conversational frequency about exercising resulted in healthier predictors, whereas for snacking and drinking, conversational frequency resulted in more unhealthy predictors. These contrasting effects may be explained by the fact that the overall conversational valence about snacking and alcohol use remained relatively unhealthy compared to the healthy conversational valence about exercise.

Third, findings show that student evaluations of the intervention are differently related to conversational frequency and valence about health behaviors. On the one hand, the influence of student evaluations of the intervention on the conversational frequency about the three health behaviors is mediated by the

conversational frequency about the health intervention. On the other hand, the influence of student evaluations of the intervention on conversational valence about snacking and exercising was not mediated by the conversational valence about the intervention. An explanation for this difference is that the conversational valence about the intervention was more related to evaluating particular assignments from the health intervention (e.g., watching a video about binge drinking) rather than its purpose (e.g., binge drinking is bad for your health). If this is the case, conversations about the intervention may still have increased the frequency of conversations about health behavior, but as the content of conversations about the intervention is not about the health behavior, the valence of these conversations may not have changed the conversational valence about the health behaviors. To validate these speculations, we believe that more research is needed to investigate the underlying mechanisms for conversational frequency and valence.

Limitations and future research

Our study has several limitations. First, our study measured an overall conversational valence. Interpersonal communication can influence behavior because of what people say themselves, as well as, what their discussion partners say during conversations (Bem, 1972; Vinokur & Burnstein, 1974). Although our study shows that conversational valence about health behaviors is consistently related to predictors of snacking, exercising, and drinking, we are unable to determine whether these effects are more based on the personal conversational valence or the conversational valence of the discussion partners. Future studies could examine whether changes in (predictors of) health behavior as a consequence of a school intervention are mostly caused by a personal conversational valence, conversational valence of the discussion partner, or by both.

Second, student evaluations of the intervention and conversational valence about the health intervention are measured simultaneously and only at T1. We cannot determine whether these student evaluations influence interpersonal communication about the intervention or the other way around. Therefore, the causal direction of the relation between intervention evaluations and interpersonal communication about the intervention is uncertain. Third, we used self-reports to measure the conversational frequency and valence. People may fail to remember certain conversations or the valence of these conversations over a longer period of time (Stafford et al., 1987). However, in a study in which independent researchers coded the conversational valence of student conversations about health, this coded conversational valence was significantly related to the self-reported conversational valence of participants (Hendriks et al., 2015). Given that participants were asked about interpersonal communication relatively shortly after the health intervention, we assume that perceptions of interpersonal communication are fairly accurate.

Fourth, our dataset was not sufficiently large to reliably test for interaction effects between the frequency and valence of the conversations on predictors of drinking, snacking, and exercising behavior. Therefore, our study cannot determine whether frequently engaging in positive discussions about healthy

behaviors or negative discussions about unhealthy behaviors has a healthier effect on (predictors of) health behavior compared less frequent discussions but positive discussions. Additionally, our dataset did not allow to test all three health behaviors in a single model. A rule of thumb recommends at least 5 to 10 cases per parameter for sample sizes (Kline, 2011); however, sample sizes may need to be even larger (Wolf et al., 2013). We created separate models for the health behaviors to stay within the recommended sample size range. Future research with datasets that are sufficiently large could investigate interaction effects between conversational frequency and valence, and combine different outcomes in a single model.

Conclusion

Our study extends previous research by showing that interpersonal communication with friends, classmates, and parents can be a significant factor during a school-based health intervention. First, findings reveal that positively evaluating a school-based health intervention increases the conversational frequency about all three health behaviors, and steers the conversational valence of exercising and snacking into a desired direction. Second, by frequently and positively discussing snacking, drinking, and exercising, these three health behaviors become more likely. Our findings inform designers of health interventions about the importance of interpersonal communication during a school-based health intervention. Designers of health interventions are advised to steer the conversational valence about the health behaviors into a desired direction to stimulate healthy behaviors and discourage unhealthy behaviors.

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