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The Intervening Role of Conversational Frequency and Valence in a School-Based Health Intervention

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ABSTRACT

School-based health interventions are potentially an effective method to communicate health messages to adolescents. Unfortunately, effectiveness of such interventions is limited. Research in other contexts has shown that interpersonal communication can influence the effectiveness of health programs, but this has not been thoroughly tested for school-based health interventions. Therefore, our study investigated interpersonal communication (i.e., conversational valence and frequency) in a school-based intervention context. We used a three-wave randomized-controlled trial with 1056 students to study three aims. The first aim was to investigate the influence of a health intervention on conversational frequency and valence about drinking, snacking, and exercising. Our second aim was to investigate the influence of conversational frequency and valence on (predictors of) drinking, snacking, and exercising. Our third aim was to investigate whether the health intervention indirectly influenced the program outcomes through conversational frequency and valence. Findings showed that conversational frequency and valence were related to (predictors of) the three behaviors. Additionally, findings showed that the intervention did not influence conversational frequency and valence. Accordingly, findings showed no indirect influence of the intervention on program outcomes through conversational frequency and valence. Our findings show the potential of interpersonal communication for health behaviors and predictors; however, they also stress the importance of a health intervention to properly influence interpersonal communication. If health interventions can successfully influence interpersonal communication, intervention effectiveness can be improved.

Many schools provide health interventions to discourage young individuals from engaging in unhealthy behaviors, such as drinking, snacking, and physical inactivity. However, school-based health interventions have often been shown to produce small and inconsistent effects (Onrust et al., 2016; Strøm et al., 2014). These underwhelming effects are unfortunate because young people spend much time at schools, and therefore school-based health interventions have a great potential for reaching young individuals with health messages. From research in other intervention settings such as mass-mediated health campaigns, we know that interpersonal communication can explain the effectiveness of health interventions (Jeong et al., 2015; Southwell & Yzer, 2007). For school-based health interventions, interpersonal communication has not been thoroughly studied yet (for exceptions see Choi et al., 2017; Pettigrew et al., 2018; Rulison et al., 2015), and studies examining interpersonal communication in health interventions for older adolescents are especially lacking. Our study aimed to address this gap.

To examine interpersonal communication in a school-based health intervention, we investigated the extent to which a health intervention elicited interpersonal communication compared to a control condition receiving no health intervention. From one of the few studies on interpersonal communication in the school-based health intervention context, we know that a school-based health intervention can elicit conversations about substances with

parents (Pettigrew et al., 2018). Extending these findings to other discussion partners, we investigated whether a school-based health intervention stimulated how often people talk (i.e., conversational frequency) about three health behaviors (i.e., alcohol, snacking, and exercising) with friends, classmates, and parents. Given that the valence (i.e., how negatively or positively people talk) of these conversations determines whether conversations might increase or decrease the effectiveness of interventions (Southwell, 2013), we also investigated whether a health intervention stimulated healthier or unhealthier conversations about health behaviors (i.e., conversation valence). To further investigate interpersonal communication in a school-based health intervention, we examined whether the intervention indirectly influenced program outcomes through conversational frequency and valence.

Previous research has suggested that studies are needed to understand the effect of interpersonal communication generated by health programs on health outcomes (e.g., Jeong & Bae, 2017), and this is especially true in the school-based health intervention context. Therefore, our study aimed to address this need by investigating the influence of a school-based health intervention on conversational frequency and valence about drinking, snacking, and exercising behavior (aim 1), the extent to which conversational frequency and valence predicted program outcomes (i.e., [predictors of] drinking,

snacking, and exercising behavior; aim 2), and whether the health intervention indirectly influenced program outcomes through conversational frequency and valence (aim 3).

Theoretical framework

Influence of a health intervention on conversational frequency and valence

Our first aim was to investigate the influence of a school-based health intervention on the frequency and valence of conversations about drinking, snacking, and exercising behavior compared to a control condition following no health education. Research has shown that even school-based health interventions that not explicitly aimed to elicit conversations, stimulated discussions which can subsequently influence program outcomes (Choi et al., 2017; Pettigrew et al., 2018). Furthermore, interpersonal communication triggered by school-based health interventions has also been shown to diffuse to other contexts such as conversations with family members or friends (Pettigrew et al., 2018; Rulison et al., 2015). An explanation for why health interventions trigger conversations about health topics is because recently encountered topics are more accessible, and subsequently these topics are more likely to be talked about (Berger & Iyengar, 2013; Iyengar & Kinder, 1987). Similarly, in the context of mass-mediated health messages, van den Putte et al. (2011) showed that an antismoking campaign elicited more frequent discussions about smoking cessation, indicating that health messages can increase the frequency of conversations about health behaviors. Based on these studies, we posed the following:

H1: A school-based health program leads to higher conversational frequency about drinking (H1a), snacking (H1b), and exercising (H1c).

In addition to the influence of a school-based health intervention on the frequency of conversations about drinking, snacking, and exercising, we also investigated the influence of the health intervention on the valence of conversations about the three health behaviors. School-based health interventions are potentially an effective method to change the conversational valence about health topics. A previous experimental study that investigated the influence of a health message on the valence of conversations about alcohol use found that viewing anti-alcohol messages before a conversation about alcohol resulted in more negative (i.e., healthy) conversations about alcohol compared to viewing no anti-alcohol message (Hendriks et al., 2012). One possible explanation for this healthy effect on conversational valence is that the anti-alcohol message is still in memory and its therefore more often discussed in related conversations (Fazio, 1995; Higgins, 1996). This research indicates that exposure to health promoting messages can indeed steer the valence of conversations about health behaviors in a healthier direction. However, this has not been tested in the context of a school-based health intervention. Therefore, we pose the following hypothesis:

H2: A school-based health intervention leads to a more healthy conversational valence about drinking (H2a), snacking (H2b), and exercising (H2c).

Prediction of conversational frequency and valence on program outcomes

Our second aim was to investigate the influence of conversational frequency and valence on (predictors of) drinking, snacking, and exercising behavior. In addition to the effect of health messages on conversational frequency and valence, health messages could have effects on (predictors of) drinking, snacking, and exercising because previous research has shown that conversational frequency and valence are related to (predictors of) health behavior. That is, outside the school-based health intervention context, a meta-analysis has shown that interpersonal communication generated by health campaigns related to program outcomes (Jeong & Bae, 2017). For the frequency of conversations, research has shown that frequently discussing alcohol was positively related to drinking intentions (Carey et al., 2016; Real & Rimal, 2007). Regarding conversational valence, it was shown that positive conversations about alcohol use resulted in unhealthier predictors of drinking (Boers et al., 2020; Hendriks et al., 2020). Together, these studies indicated that the frequency and valence of conversations about health behaviors related the outcomes of the studies.

The predictors of health behavior that were measured in our study were attitudes, social norms, perceived behavioral control and intention. These predictors were based on the theory of planned behavior (TPB; Ajzen, 1991) because the development of the health intervention used in our study was partly based on this theory. The TPB states that behavior is predicted by behavioral intention, which is subsequently predicted by attitudes, social norms, and perceived behavioral control (PBC). First, attitudes toward behavior are regarded as summary evaluations of behaviors (Ajzen, 1991). Second, social norms consist of injunctive and descriptive norms. Injunctive norms are defined as the perceived approval of engaging in a behavior, and descriptive norms are defined as perceptions of how often others engage in certain behaviors (Ajzen, 1991; Borsari & Carey, 2001). Third, PBC is defined as people's perceptions of their ability to perform behaviors (Ajzen, 1991). Finally, intentions follow from attitudes, social norms, and PBC and can be understood as people's inclinations to perform behaviors. The TPB has been found effective for predicting drinking, snacking, and exercising behavior (Cooke et al., 2016; Plotnikoff et al., 2013; Riebl et al., 2015). Based on previous studies, we posed the following hypotheses:

H3: The frequency of conversations about drinking (H3a), snacking (H3b), and exercising (H3c) is related to unhealthier predictors of drinking and snacking, and healthier predictors of exercising.

H4: The frequency of conversations about drinking (H4a), snacking (H4b), and exercising (H4c) is related to unhealthier drinking and snacking behavior, and healthier exercising behavior.

H5: The valence of conversations about drinking (H5a), snacking (H5b), and exercising (H5c) is related to unhealthier predictors of drinking and snacking, and healthier predictors of exercising.

H6: The valence of conversations about drinking (H6a), snacking (H6b), and exercising (H6c) is related to unhealthier drinking and snacking behavior, and healthier exercising behavior.

Indirect influence via conversational frequency and valence on program outcomes

Our third aim was to investigate whether the health intervention has an indirect effect on (predictors of) drinking, snacking, and exercising through the conversational frequency and valence in the school-based health intervention context. Outside the school-based health intervention context, previous research has shown that exposure to health interventions can indirectly influence program outcomes through interpersonal communication (Southwell & Yzer, 2007; Wakefield et al., 2010). For the frequency of conversations, research has shown that exposure to a mass-mediated health message on program outcomes was mediated by the frequency of conversations (van den Putte et al., 2011). For the valence of conversations, research has shown that exposure to a short anti-alcohol message had indirect effects on predictors of binge drinking through the valence of alcohol conversations (Hendriks et al., 2012). That is, participants who were exposed to an anti-alcohol message compared to a control message, talked more negatively about alcohol use, which in turn, increased the intention to refrain from binge drinking. As the intervening role of interpersonal communication has not been tested in the school-based health intervention context, we aimed to test whether a health intervention indirectly influenced (predictors of) health behavior through conversational frequency and valence.

For conversational valence, we expected that the health intervention elicited healthier conversations, which in turn, resulted in healthier (predictors of) behavior. For conversation frequency, the direction of the effects depended on the valence of the conversations. As previous research showed that health messages elicited healthier conversations and that conversations after health messages had healthy effects on program outcomes (e.g., Jeong & Bae, 2017), we expected that the indirect effect of the health intervention through conversational frequency had a healthy effect on program outcomes due to an overall healthier conversational valence in the experimental condition compared to the control condition. As such, we posed the following hypotheses:

H7: The school-based health intervention has an indirect and healthy effect on predictors of drinking (H7a), snacking (H7b), and exercising (H7c) through conversational frequency.

H8: The school-based health intervention has an indirect and healthy effect on drinking (H8a), snacking (H8b), and exercising (H8c) behavior through conversational frequency.

H9: The school-based health intervention has an indirect and healthy effect on predictors of drinking (H9a), snacking (H9b), and exercising (H9c) through conversational valence.

H10: The school-based health intervention has an indirect and healthy effect on drinking (H10a), snacking (H10b), and exercising (H10c) behavior through conversational valence.

Methods

The health intervention that was tested in our study was called "InCharge". InCharge was newly-developed by the Trimbos Institute, the Netherlands Institute for Mental Health and Addiction, and its goal was to promote healthier lifestyles among older adolescents, for example by influencing behavioral predictors based on the TPB. The intervention consisted of four weekly lessons, and each lesson consisted of three assignments of approximately 15 minutes each. Assignments that were included in the intervention were for example viewing a video about the negative consequences of alcohol abuse and teacher-led discussions about drinking, snacking, and exercising (for more information see Mesman et al., 2020). The research project received approval from the Ethics Review Board of the Faculty of Social and Behavioral Sciences of the University of Amsterdam (reference number 2017-PC-8244).

Participants and design

For this study, ten Dutch secondary schools were recruited. The initial sample consisted of 1216 students, but participants were removed from this sample because parents refused participation of the students ($n = 10$), inconsistent birthdates between questionnaires were reported ($n = 13$), and students refused participation or did not return questionnaires for other unknown reasons ($n = 137$). After removing these participants from the initial sample, the final sample consisted of 1056 students (578 females, 468 males, 10 did not report gender; $M_{age} = 17.03$, $SD_{age} = 1.99$). The randomization process was that classes within schools were randomly assigned to the experimental ($n = 597$) or control condition ($n = 459$). Students in the experimental condition were taught the InCharge intervention, and students in the control condition received no health intervention. Given that we were interested in short and longer term effects, questionnaires were planned one week before the start of the InCharge intervention (T0), one week (T1) and twelve weeks (T2) after the intervention finished. At T0, response rate was 83.62% (i.e., 495 participants in the intervention condition and 388 in the control condition). At T1, response rate was of 80.02% (i.e., 479 participants in the intervention condition and 366 in the control condition). Finally at T2, response percentage was 61.45% (i.e., 333 participants in the intervention condition and 316 in the control condition).

Procedure

In accordance with the ethical procedures of the University of Amsterdam, parents of the students received passive informed consent form two weeks before the start of the InCharge intervention. Students themselves received active informed consent forms, which were added as the front page to the first questionnaire. No data was collected for students if either form of consent was refused, however, these students did

participate in the health intervention. Questionnaire T0 was administered 1 week before the intervention started, and assessed demographic information, behavior (drinking, snacking, and exercising), behavioral predictors of the three health behaviors, and the frequency and valence of conversations about the three health behaviors. Questionnaire T1 was administered 1 week after InCharge was finished and again assessed the behavioral predictors, health behaviors, and the frequency and valence of conversations about these health behaviors. Questionnaire T2 was administered 12 weeks after InCharge finished and assessed the same variables as T1.

Measures

Interpersonal communication about the health behaviors
Frequency of conversations about the health behaviors.
Frequency of conversations about drinking, snacking, and exercising was assessed at all waves by using the statement "How often have you talked to the following people about . . . in the past four weeks?" The referent groups that were included were friends, classmates, and parents, and the included health behaviors were drinking, snacking, and exercising behavior. Response scale ranged from (1) *Not talked about* to (5) *Talked about very often*. Responses were averaged for each health behavior and separately analyzed for each discussion partner.

Valence of conversations about the health behaviors. Valence of conversations about drinking, snacking, and exercising was assessed at all waves by using the statement "How negative or positive were these conversations about . . . ?" and the referent groups that were included were again friends, classmates, and parents. Health behaviors were drinking, snacking, and exercising behavior. The response scale ranged from (1) *Very negative* to (5) *Very positive*. Additionally, participants were able to indicate that health behaviors were not discussed with each of the discussion partners, which resulted in a missing value. Responses were averaged for each health behavior and separately analyzed for each discussion partner. Valence measures have been validated in previous research (Hendriks et al., 2015).

Predictors of drinking, snacking, and exercising behavior
Attitudes toward drinking, snacking, and exercising behavior. Attitudes toward the three health behaviors were assessed at all waves by using the statement "I believe that drinking five or more glasses alcohol in one sitting would be . . . ," attitudes toward snacking using the statement "I belief that snacking or eating candy every day would be . . . " and attitudes toward exercising using the statement "I belief that exercising less than once a week would be . . . ." Response scales were (1) *bad* to (7) *good*, (1) *harmful* to (7) *harmless*, (1) *irresponsible* to (7) *responsible, and* (1) *unpleasant* to (7) *pleasant*. We recoded attitudes toward exercising such that higher scores represented healthier attitudes. For each health behavior, an average scale score was computed.

Injunctive norms regarding drinking, snacking, and exercising behavior. We assessed injunctive norms about the three health behaviors at all waves by using the statement "How positive are the following people about drinking five or more glasses of alcohol in one sitting?," injunctive norms regarding snacking behavior using the statement "How positive are the following people about snacking every day?," and injunctive norms regarding exercising using the statement "How positive are the following people about exercising less than once a week?" Included referent groups were most of my friends, most of my classmates, and my parents, and the response scale ranged from (1) *very negative* to (5) *very positive*. We recoded injunctive norms regarding exercising such that higher scores represented healthier norms. For each health behavior, an average scale score was computed including all referent groups.

Descriptive norms regarding drinking, snacking, and exercising behavior. We assessed descriptive norms about the three health behaviors at all waves by using the statement "How often do you think the following people drink five or more glasses in one sitting?," descriptive norms regarding snacking using the statement "How often do you think the following people eat snacks or candy?," and descriptive norms regarding exercise using the statement "How often do you think the following people do sports or exercise?" Included referent groups were most of my friends, most of my classmates, and my parents, and the response scale ranged from (1) *Never* to (5) *Very often*. Higher scores on drinking norms and snacking norms represented unhealthy norms, and higher scores on exercise norms represented healthy norms. For each health behavior, an average scale score was computed including all referent groups.

PBC regarding drinking, snacking, and exercising behavior. We assessed PBC regarding the three health behaviors at all waves by using the statement If you were confronted with the following temptations, could you resist it if you wanted to?" The statement was followed by "drink alcohol," "eat snacks or candy," and "skip sports or exercise." Response scale ranged from (1) *definitely not* to (5) *definitely*, and higher values represented more control over the health behaviors.

Intentions to drink, snack, and exercise. We assessed intentions regarding the three health behaviors at all waves by using the statement "Indicate how often you plan to do the following things in the upcoming four weeks." The statement was followed by" drink alcohol," "drink five or more glasses of alcohol on one occasion," "eat snacks or candy," "exercise intensely," and "exercise mildly." The response scale ranged from 1 = *never*, 2 = *less than once a week*, 3 = *once a week*, 4 = *several times a week*, and 5 = *every day*. Higher scores on drinking and snacking intentions represented unhealthier intentions, and healthier intentions for exercising.

Health behaviors
Drinking behavior. We assessed drinking behavior at all waves by using the statement "On how many days in the last four weeks did you drink alcohol?" The response scale included 1 = *never*, 2 = *one or two days*, 3 = *three to five days*, 4 = *six to nine days*, 5 = *ten to nineteen days*, 6 = *twenty to twenty-nine days*, and 7 = *thirty days or more*. We also assessed binge drink behavior using the statement "On how many days of the last four weeks did you drink five or more glasses of alcohol on one

occasion?" Response scale included 1 = *never*, 2 = *once*, 3 = *twice*, 4 = *three or four times*, 5 = *five or six times*, 6 = *seven or eight times*, 7 = *nine times or more*.

Snacking behavior. We assessed snacking behavior at all waves by using the statement "On how many of the last seven days did you eat snacks or candy?" Response scale included 1 = *never*, 2 = *less than once a week*, 3 = *once*, 4 = *two to four times a week*, 5 = *five or six times a week*, 6 = *seven times a week*, 7 = *multiple times a day*.

Exercising behavior. We assessed exercising behavior at all waves by using the statement "On how many of the last seven days did you exercise for at least 60 minutes?" Response scale included 1 = *zero days*, 2 = *one day*, 3 = *two days*, 4 = *three days*, 5 = *four days*, 6 = *five days*, 7 = *six days*, and 8 = *seven days*.

Data-analysis

Our analyses were conducted in RStudio (R Core Team, 2019). There was a clustered structure in our data, which means that responses on questionnaires were nested within students, students were nested in classes, and classes were nested in schools. Therefore, multilevel analyses were used to account for the clustered structure. We used the lme4 and lmerTest packages for RStudio, and analyses were conducted using maximum likelihood estimation. For each health behavior, we computed separate valence and frequency models. For all models testing effects at T1, we fitted models with dummies for T0, T2, and InCharge, and the interaction effects of InCharge and T0, and InCharge and T2. For all models testing effects at T2, we fitted models with dummies for T0, T1, and InCharge, and the interaction effects of InCharge and T0, and InCharge and T1.

We conducted the following steps. First, we tested whether the health intervention influenced the frequency and valence of conversations about the health behaviors (i.e., H1 and H2). Second, we tested the effect of conversational frequency (or valence) on (predictors of) the three health behavior (i.e., H3 and H4). Third, we investigated the possibility of indirect effects, such that the health intervention influenced (predictors of) drinking, snacking, and exercising indirectly through conversational frequency or valence. To test the significance of these indirect effects, Sobel tests were used (i.e., H5 and H6).

Results

Randomization check

Randomization checks showed that participants in the experimental condition were more inclined to engage in binge drinking at T0 compared to students in the control condition, $t(868.58) = -2.32$, $p = .020$. Participants in the experimental condition also drank on more days in the past four weeks at T0, $t(858.89) = -2.34$, $p = .019$, and engaged in binge drinking behaviors in the past four weeks at T0, $t(871.35) = -2.91$, $p = .004$, compared to participants in the control condition. No significant differences were found for the other health behaviors and

behavioral predictors indicating that the randomization was successful for snacking and exercising, and partly for drinking-related outcomes.

Descriptive statistics

Table 1 displays the means, standard deviations, and Cronbach's alphas of all key variables. The means and standard deviations of the (predictors of) health behavior were consistent on all waves. Participants used alcohol once in the past four weeks, consumed candy or snacks five to six times in the past week, and exercised four times in the past week on all waves. Participants reported PBC above midscale for all three health behaviors and on all waves. For predictors of alcohol use, other predictors of drinking were lower than midscale, other predictors of snacking were reported around the midscale, and other predictors of exercising were reported higher than midscale. Students talked most about exercise, and least about alcohol. Students talked most positive about exercise and were neutral about alcohol and snacking.

Influence of health intervention on frequency and valence of conversations about health

First, we tested the effect of the health intervention on the valence and frequency of conversations about health behaviors (see Table 2 for results). Findings showed that the health intervention did not affect the frequency and valence of conversations about alcohol, snacks, and exercise at T1 and T2, rejecting H1 and H2.[1]

Influence of conversational frequency and valence about health on program outcomes

Second, we tested the effect of conversational frequency (or valence) on (predictors of) health behavior (see Table 3 for results). Findings showed that frequency and valence of conversations about the three health behaviors were related to the program outcomes, thereby confirming H3, H4, H5, and H6. For conversational frequency, frequently communicating about the three health behaviors resulted in increased drinking, snacking, and exercising behavior as well as increases in most behavioral predictors. For conversational valence, positively communicating about the three health behavior resulted in increased drinking, snacking, and exercising behavior as well as increases in most behavioral predictors. Conversational frequency and valence consistently influenced most predictors and health behaviors at T1 and T2, except for PBC. For PBC, conversational frequency had no effect on exercise-related PBC. However, frequently discussing alcohol and snacking reduced alcohol-related and snacking-related PBC. Additionally, conversational valence influenced snacking-related and exercise-related PBC only at T2.

Influence of a school-based health intervention on program outcomes through conversational frequency and valence

Third, we tested whether the health intervention indirectly influenced program outcomes through conversational frequency (or valence) on (predictors of) health behavior. Sobel

Table 1. Means, standard deviations and Cronbach's alphas of all variables.

	Means and (SD's)			α		
Alcohol	T0	T1	T2	T0	T1	T2
Drinking behavior	2.07 (1.28)	2.08 (1.26)	2.14 (1.27)			
Binge drinking behavior	2.04 (1.55)	1.98 (1.44)	2.06 (1.53)			
Attitudes toward drinking	2.75 (1.59)	2.92 (1.65)	2.88 (1.59)	.90	.86	.90
Injunctive norms	2.53 (.84)	2.56 (.82)	2.61 (.85)	.72	.73	.75
Descriptive norms	2.74 (.79)	2.71 (.74)	2.71 (.79)	.67	.66	.73
PBC	4.19 (1.08)	4.07 (1.08)	4.09 (1.06)			
Intention to drink	1.93 (.99)	2.07 (1.06)	2.04 (1.02)			
Intention to binge drink	1.65 (.93)	1.79 (1.02)	1.74 (.99)			
Snack						
Snacking behavior	4.85 (1.42)	4.91 (1.50)	4.81 (1.46)			
Attitudes toward snacking	3.18 (1.31)	3.43 (1.35)	3.58 (1.33)	.83	.75	.83
Injunctive norms	2.70 (.74)	2.80 (.72)	2.91 (.78)	.76	.74	.78
Descriptive norms	3.40 (.52)	3.42 (.53)	3.40 (.61)	.63	.63	.73
PBC	3.75 (1.03)	3.61 (1.07)	3.62 (1.02)			
Intention to snack	3.58 (.95)	3.59 (1.02)	3.62 (.96)			
Exercise						
Exercising behavior	5.24 (2.07)	5.28 (1.98)	5.18 (2.09)			
Attitudes toward exercising	5.27 (1.43)	5.40 (1.59)	4.98 (1.51)	.86	.89	.89
Injunctive norms	3.62 (.78)	3.50 (.85)	3.47 (.89)	.78	.87	.87
Descriptive norms	3.16 (.57)	3.19 (.55)	3.12 (.64)	.48	.50	.66
PBC	3.95 (1.20)	3.86 (1.17)	3.88 (1.11)			
Intention to exercise mildly	3.90 (.97)	3.82 (1.01)	3.76 (1.02)			
Intention to exercise intensely	3.69 (.90)	3.66 (.92)	3.60 (1.00)			
Interpersonal Communication						
Frequency alcohol	2.30 (1.06)	2.35 (1.07)	2.27 (1.06)	.76	.79	.79
Valence alcohol	3.35 (.89)	3.30 (.85)	3.30 (.85)	.75	.72	.74
Frequency snack	2.44 (1.06)	2.42 (1.04)	2.38 (1.05)	.76	.80	.81
Valence snack	3.21 (.78)	3.18 (.78)	3.26 (.79)	.70	.72	.78
Frequency exercise	2.90 (1.03)	2.78 (1.01)	2.73 (1.04)	.75	.79	.77
Valence exercise	3.85 (.82)	3.72 (.85)	3.69 (.87)	.84	.86	.89

Table 2. Differences between intervention and control condition in conversational frequency and valence.

	InCharge	
Alcohol	T1	T2
Conversational valence	−.06	−.07
Conversational Frequency	.003	−.14
Snack		
Conversational valence	.008	−.02
Conversational Frequency	.01	−.13
Exercise		
Conversational valence	.02	−.11
Conversational Frequency	−.005	−.10

***p < .001, **p < .01, *p < .05, ^p < .10.
Intervention classes = 1, control classes = 0. T1 coefficients are differences between the intervention condition and control condition at T1, controlled for time and the difference at T0 and T2. T2 coefficients are the differences between the intervention and control condition at T2, controlled for time and the difference at T0 and T1.

Table 3. Influence of conversational frequency and valence on (predictors of) the three health behaviors.

	Conversational frequency		Conversational valence	
	T1	T2	T1	T2
Alcohol				
Drinking behavior	.40***	.40***	.33***	.26***
Binge drinking behavior	.34***	.42***	.33***	.41***
Attitudes toward drinking	.60***	.51***	.65***	.51***
Injunctive norms	.30***	.29***	.36***	.36***
Descriptive norms	.26***	.26***	.24***	.23***
PBC	−.26***	−.17***	−.07	.01
Intention to drink	.36***	.37***	.33***	.30***
Intention to binge drink	.37***	.37***	.34***	.27***
Snack				
Snacking behavior	.05	.12*	.21***	.30***
Attitudes toward snacking	.18***	.26***	.31***	.33***
Injunctive norms	.12***	.20***	.22***	.35***
Descriptive norms	.08***	.07***	.16***	.18***
PBC	−.07*	−.10**	.04	.17***
Intention to snack	.08**	.10***	.15***	.13***
Exercise				
Exercising behavior	.22***	.34***	.43***	.41***
Attitudes toward exercising	.22***	.12*	.44***	.28***
Injunctive norms	.10***	−.01	.15***	.10*
Descriptive norms	.09***	.12***	.09***	.17***
PBC	−.02	.02	.05	.18***
Intention to exercise mildly	.11***	.16***	.24***	.32***
Intention to exercise intensely	.14***	.22***	.25***	.31***

***p < .001, **p < .01, *p < .05, ^p < .10.

tests indicated that the indirect effect of the health intervention on all program outcomes via conversational frequency and valence was not statistically significant (see Table 4 for results), thereby rejecting H7, H8, H9 and H10.

Discussion

The overall goal of our study is to investigate interpersonal communication in a school-based health intervention. To do this, we have three aims in our study. Our first aim is to investigate the influence of a school-based health intervention on the frequency and valence of conversations about drinking, snacking, and exercising. Our findings show that the school-based health intervention does not influence the frequency and

valence of conversations about the three health behaviors, rejecting H1 and H2. The second aim of our study is to investigate the influence of conversational valence and frequency on (predictors of) the three health behaviors. Findings reveal that both conversational frequency and valence are related to (predictors of)

Table 4. Sobel test indicates whether indirect effect of the health program on program outcomes via conversational frequency and valence is statistically different from zero.

	IC Frequency at T1		IC Frequency at T2		IC Valence at T1		IC Valence at T2	
	Sobel test	p	Sobel test	p	Sobel test	p	Sobel test	p
Alcohol								
Drinking behavior	.03	.976	−1.22	.221	−.60	.548	−.66	.511
Binge drinking behavior	.03	.976	−1.22	.221	−.60	.548	−.66	.509
Attitudes toward drinking	.03	.976	−1.23	.221	−.60	.547	−.66	.508
Injunctive norms	.03	.976	−1.22	.221	−.60	.547	−.66	.507
Descriptive norms	.03	.976	−1.22	.221	−.60	.547	−.66	.509
PBC	−.03	.976	1.19	.234	.56	.574	−.01	.991
Intention to drink	.03	.976	−1.23	.220	−.60	.547	−.66	.509
Intention to binge drink	.03	.976	−1.23	.220	−.60	.547	−.66	.509
Snack								
Snacking behavior	.12	.907	−1.36	.256	.13	.900	−.29	.774
Attitudes toward snacking	.12	.907	−1.25	.212	.13	.900	−.29	.774
Injunctive norms	.12	.907	−1.25	.210	.13	.900	−.29	.774
Descriptive norms	.12	.907	−1.20	.228	.13	.900	−.29	.774
PBC	−.12	.907	1.16	.247	.13	.901	−.29	.774
Intention to snack	.12	.907	−1.19	.231	.13	.900	−.29	.774
Exercise								
Exercising behavior	−.06	.950	−1.27	.205	.24	.807	−.78	.438
Attitudes toward exercising	−.06	.950	−1.23	.261	.24	.807	−.1.42	.156
Injunctive norms	−.06	.950	.43	.670	.24	.807	−1.30	.193
Descriptive norms	−.06	.950	−1.27	−.201	.24	.807	−1.49	.137
PBC	.06	.950	−.38	.706	.24	.811	−1.39	.163
Intention to exercise mildly	−.06	.950	−1.26	.207	.24	.807	−1.49	.135
Intention to exercise intensely	−.06	.950	−1.29	.199	.24	.807	−1.50	.134

***p < .001, **p < .01, *p < .05, ^p < .10.

the three health behaviors, confirming H3, H4, H5 and H6. The third aim of this study is to examine whether a school-based intervention influences program outcomes indirectly through conversational frequency and valence. In concurrence with our results for H1 and H2, our study shows that this is not the case, rejecting H7, H8, H9, and H10.

Regarding our first and third aim, findings are in contrast with previous studies showing that school-based health interventions influence interpersonal communication (Choi et al., 2017; Pettigrew et al., 2018) and that mass-mediated health programs can influence program outcomes indirectly through interpersonal communication (e.g., van den Putte et al., 2011). However, there are important differences between our study and previous studies investigating interpersonal communication in the context of a school-based health intervention that may explain the unexpected findings. First, students were much younger (i.e., 11–14 years old) in previous school-based health interventions compared to the students that participated in our study (i.e., 17 years old). This age difference is relevant because younger adolescents are more focused on relations with their peers (Vartanian, 2000), and are more concerned with the social acceptance from others (Forehand & Wierson, 1994) compared to older adolescents. In contrast to that, older adolescents are less influenced by social pressures because individuality becomes increasingly important to older adolescents (Sumter et al., 2008; Westenberg & Gjerde, 1999). Therefore, younger adolescents may have more frequent discussions about health-related topics with their peers because younger adolescents are more concerned about the opinions of their peers. Additionally, younger adolescents are more dependent on their parents because parents still play a vital role in the development of younger adolescents (Forehand & Wierson, 1994). Consequently, younger adolescents may have more conversations about health-related topics with their parents. Thus,

a school-based health intervention may be more effective as a conversation trigger for younger adolescents compared to older adolescents as older adolescents are more individualistic.

Second, the health intervention that was used in our study had a broad focus because its goal was to stimulate healthier lifestyles including a variety of health behaviors such as drinking alcohol, snacking, and exercising. Additionally, students themselves were free to choose a health behavior to work on that was most relevant to them during the health intervention, which further demonstrates the broad focus of the health intervention. In contrast to this broadly focused health intervention, previous health interventions that were used to study interpersonal communication in a school-based context had a more specific focus, which was reducing substance use (Choi et al., 2017; Pettigrew et al., 2018). Given the broad focus of the health intervention in our study, time spend on each health behavior is much less in the health intervention that we used compared to previously used and health interventions that focused on one health behavior. Therefore, effect of the health intervention on interpersonal communication may be smaller in health interventions with a broad focus. More specialized health interventions may serve as a better environment to study interpersonal communication.

Regarding our second aim, findings are in line with previous studies showing that both conversational frequency and valence are related to (predictors of) health behavior (e.g., Boers et al., 2020; Real & Rimal, 2007). Understanding that interpersonal communication has a similar role in the school-based health intervention context is important as it shows the potential to improve the effectiveness of school-based health interventions with interpersonal communication. Our findings show that conversational valence and frequency are positively related to the three health behaviors. For conversational frequency, this means that frequently discussing health

behaviors increased (predictors of) drinking, snacking, and exercising on one and twelve weeks after the intervention was finished. Given that the valence of the conversations positively relates to the (predictors of) health behavior, our findings suggest that designers of school-based health interventions should focus on steering the valence of conversations in a healthier direction. For example, designers of health interventions should test how students evaluate certain parts of the intervention because previous research has shown that a positively evaluated school-based health intervention triggered healthier conversations (Mesman et al., 2020). This way, frequently discussing health behaviors can lead to healthier behaviors because the overall valence of the conversations is healthier.

One remarkable finding is that conversational valence and frequency have less effect on PBC. This could arguably be because of what is discussed in the conversations about the health behaviors. Possibly, students have more conversations about experiences with the health behaviors and behavior-related norms, and less about PBC-related content. Future research examining the specific content of conversations about health could shed light on this matter.

Limitations and future research

Our study has several limitations. The first limitation relates to the broad focus of the health intervention that was tested in our study. To investigate interpersonal communication in a broadly focused health intervention, researchers have to choose a limited number of health behaviors for the questionnaire. A challenging aspect is that the selected health behaviors may not be relevant to all students, which would require larger sample sizes for sufficient power to be able to detect significant effects. Rather than including a selection of health behaviors that are not relevant to all students, a possible solution for future researchers could be to ask students what health behaviors are most relevant to them, how often they talked about this health behavior, and whether this was mainly positive or negative. Although health behaviors may differ between students, asking students for their most relevant health behaviors allows researchers to study interpersonal communication in broadly focused school-based health interventions.

Second, participating classes were randomized within schools and assigned to the experimental and control conditions. Given that students from both conditions were at the same schools during the experiment, students from the experimental condition may have shared information about the health intervention with the students from the control condition, or teachers may have informed students from the control condition about the experiment. A problem with sharing information between conditions is that significant effects of the intervention may not be detected (Torgerson, 2001). To avoid this issue, an alternative approach would be to randomize schools to the experimental and control condition rather than classes within schools to prevent students from sharing information between classes. This alternative, however, has important drawbacks because classes from the same school are more similar in comparison with classes from different schools, therefore making the groups in the two conditions more comparable. Although our study randomized classes within

schools, our experimental and control groups were still not identical in terms of drinking-related outcomes. We accounted for this by adding T0 as covariates in our analyses. Randomizing schools rather than classes within schools would have reduced the likelihood for comparable conditions even more. Therefore, we argue that randomizing classes within schools was the more valid option.

Third, our instrument for assessing interpersonal communication may not be sufficiently refined to assess interpersonal communication related to the health intervention or specific elements of interpersonal communication. Our post-intervention measures assessed interpersonal communication one week and twelve weeks after the intervention finished. Given that there was quite some time between the health intervention and the measures, it is hard to determine whether the interpersonal communication was triggered by the health intervention or by other factors because students may not remember most conversations. Although these other factors are expected to be relatively similar in both conditions, a solution would be to add a short questionnaire the day after the intervention finishes about interpersonal communication to assess interpersonal communication. This way, researchers are more likely to assess interpersonal communication that is triggered by the health intervention.

Furthermore, our conversational valence measure was generally formulated to capture a general sense of the perceived conversational valence about the health behaviors. However, there is possibility that the conversational valence of the participants did not match the conversational valence of the discussion partners. Although students can make fairly good evaluations of overall conversational valence (Hendriks et al., 2015), our measures limit us in providing information on whether this valence is mostly due to the conversational valence of the participants, the conversational valence of the discussion partners, or by both. Additionally, our measures limit us in informing about the content of the conversations. For example, do students talk about the advantages and disadvantages of health behaviors, or about social norms? Given that our findings show that conversational valence is related to (predictors of) health behaviors, it is important to increase our understanding of conversational valence. Therefore, future studies could examine how students constitute conversational valence by for example evaluating actual conversations.

Conclusion

Our study shows the potential of interpersonal communication within the school-based health intervention context. Findings show that both conversational frequency and valence are related to the program outcomes. However, findings also show that the health intervention did neither influence conversational frequency and valence, nor the program outcomes through conversational frequency and valence. School-based health interventions should focus more on influencing the conversational frequency and valence about health behaviors. Future research should investigate how school-based health interventions could effectively influence the conversational frequency and valence. Research on this topic is much needed because the effectiveness of school-based health interventions can be improved if school-based health interventions can successfully influence the interpersonal communication of students about health related topics.

Note

1. In addition to averaging the discussion partners, we also analyzed discussion partners separately. No significant findings were found for these separate analyses and therefore, we only showed the averaged results.

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