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Son, you're smoking on Facebook! College students' disclosures on social networking sites as indicators of real-life risk behaviors

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ABSTRACT

Health risk behavior in student populations is an issue of major concern, and students' risk levels are difficult to determine. In this study, we explore the extent to which information disclosed publicly on Facebook provides reliable indications of five real-life health behaviors.

Questionnaire data and Facebook contents (2928 items) on alcohol use, smoking, illicit drug use, (un)healthy nutrition, and participation in sports of 71 respondents were collected and analyzed.

The study shows that one can analyze Facebook profiles to reliably associate profile owners' smoking and sport behavior. It also shows that regarding alcohol use, some Facebook profile elements are indicative of real-life drinking.

We discuss and suggest improved methods of coding disclosed public data, which may lead to reliable indications of peoples' real-life behavior.

1. Introduction

When students leave home to attend college, they are confronted with a range of challenges, opportunities, freedoms, and fears. Although some people might argue that experience without learning is better than learning without experience, behavior of students can interfere with a responsible, healthy lifestyle. Unfortunately, students are generally known for their unhealthy lifestyles, and for engaging in a variety of severe health-risk behaviors (American College Health Association, 2006; American College Health Association, 2009; Douglas et al., 1997). These risk behaviors may involve (excessive) alcohol, tobacco, and illicit drug use; poor dietary habits; and a lack of sports participation. Risk behaviors are associated with a range of serious social and physical consequences, including poor academic achievement and performance (Kristjánsson, Sigfusdottir, & Allegrante, 2010; Trockel, Barnes, & Egget, 2000; Wolaver, 2002; Yamada, Kendix, & Yamada, 1996); obesity (Suter et al., 1997; Van Kranen and Harbers, 2009; Wannamethee, Field, Colditz, & Rimm, 2004; Wannamethee and Shaper, 2003; Wendel-Vos, 2010); injury, accidents, crime, and violence (Corrao, Bagnardi, Zambon, & La Vecchia, 2004; Ellickson, Tucker, & Klein, 2003; Harrison, Kelly, Lindsay, Advocat, & Hickey, 2011; Hingson, Heeren, Zakocs, Kopstein, & Wechsler, 2002; Lowry et al., 1999; Van Laar and Schoemaker, 2010; Wechsler, Davenport, Dowdall, Moeykens, & Castillo, 1994); unemployment and lower wages post-college (Ellickson et al., 2003; Jennison, 2004); greater risk of several forms of cancer, lung, liver, and heart diseases, and STDs (Corrao, Bagnardi, Zambon, & Arico, 1999; Corrao et al., 2004; Jones and Haynes, 2006; Rehm et al., 2003; Spencer, 2002; Van Kranen and Harbers, 2009; Wendel-Vos, 2010; Zeegers and Harbers, 2011); and even mortality (Bloss, 2005; Single, Robson, Rehm, & Xie, 1999; Wendel-Vos, 2010; Zeegers and Harbers, 2011).

Of course, not all students engage in risk behaviors, but since this group does have higher chances of being at risk, students are in the eye of the healthcare industry. Healthcare professionals aim at attaining the earliest identification of risk behaviors, to conduct treatment activities when the damage is still low and change is still possible. A variety of screening tools is available to identify those individuals who are at risk of health problems due to patterns of alcohol or other substance use, dietary habits, or physical (in)activity. These screening tools are an effective way to minimize harm by identifying college students at risk, and by providing appropriate interventions. These tools also indicate both the extent of the problem and trends in the development of the problem, which can be useful for health service strategies and policy-making (Griffiths, Stone, Tran, Fernandez, & Ford, 2007). However, a complication arises for healthcare professionals working with student populations. Students simply do not always care about their lifestyles, and the long-term consequences of substance use and

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poor eating habits; thus, they do not always utilize the screening methods or preventive healthcare methods that are provided by health organizations.

However, students do care about something else: making information about their lifestyles publicly accessible on the internet (Valkenburg and Peter, 2009). An examination of Facebook raises legitimate questions about the extent to which pictures and other content relate to real-life health behaviors. Timely recognition of emerging risks enables early risk management interventions and better chances of preventing serious health problems (Wiedemann, Clauberg, Karger, & Henseler, 2005). Therefore, unobtrusive screening methods like finding cues on the internet of risky behavior may be a relevant tool for risk prevention (cf. Heyman, 2010). Our question thus became: Can we use popular social networking sites (SNSs) as screening and identification tools for health risk behaviors in student populations?

The use of social networking sites—mainly as tools for fast and easy information sharing with friends and acquaintances—has intensified in recent years (boyd and Ellison, 2007). However, information posted on SNSs for friends and acquaintances is sometimes also available to strangers, whose use of the content can have negative consequences for the owner of the SNS profile. For instance, students were suspended or criminally charged based on information disclosed on their SNS profiles (Brady, 2006; NRC (27 March, 2012). Research has also shown that SNS profiles are often used to assess their owners' employment candidacy (Clark and Roberts, 2010; Van Wingerden, 2009), and on the other hand for strategic self-representation (Rui and Stefanone, 2013).

Despite the possible negative consequences of information-sharing, only a small number of students appear to be reserved about disclosing personal information online or conscious about the impressions they are making via their SNS profiles. The majority of students do not seem to consider or care about the negative consequences, and they regret the disclosure of personal information only when it is too late, such as when their profiles are not suitable for current or future employers to see (Acquisti and Gross, 2006; Christofides, Muise, & Desmarais, 2009; Peluchette and Karl, 2008). On the other hand, there are positive consequences of engaging in SNS. Students use SNS to gain a sense of identity (Valkenburg and Peter, 2009). As social conformism is one of the primers of unhealthy behavior (Laghi, Liga, Baumgartner, & Baiocco, 2012), a socially sensitive context as Facebook could well be used to show one's conformism to what a group deems sturdy. As the saying goes, "A picture is worth a thousand words." This could be one of the reasons why many students' SNS profiles contain content that is applauded by a group, but problematic in terms of health behavior: substance (ab)use, violence, sexual activities, or other health risks. In their study of the profiles of 270 adolescents, Moreno, Parks, Zimmerman, Brito, and Christakis (2009) found that over half of the profiles (54%) contained such risk behavior information; 41% of all profiles contained alcohol references, 24% contained sexual behavior references, and 14% contained references to violence. These findings are consistent with previous research by Moreno, Parks, and Richardson (2007), in which almost half of the profiles (47%) contained indications of risk behavior, and these findings are even exceeded by results from later research by Moreno, Briner, Williams, Brockman, Walker, and Christakis (2010) which showed that over half of SNS profiles (56%) contained references to alcohol use.

Despite the fact that SNS profiles appear to provide valid structures for communicating personality (Back et al., 2010; Gosling, Gaddis, & Vazire, 2007; Hall & Pennington, 2013), it is still necessary to examine the extent to which self-disclosed health behaviors on these profiles are reliable indicators of *real-life* health risks. Recently, Moreno, Christakis, Egan, Brockman, and Becker (2012) took a first step in using self-disclosed SNS content as a predictor of an alcohol problem, by connecting alcohol and intoxication references on Facebook to AUDIT problem drinking questionnaire scores. The aim of our study was to broaden that scope and to further explore whether Facebook profiles provide reliable indications of a range of profile owners' health behaviors. We analyzed the content of students' Facebook profiles regarding the five health behaviors that are most relevant to an assessment of their health risks: alcohol use, tobacco use, illicit drug use, nutrition, and participation in sports (American College Health Association, 2006; American College Health Association, 2009; Douglas et al., 1997). We then compared our findings to the students' scores on a self-reported questionnaire regarding these five risk behaviors. This comparison enabled us to explore the power of public Facebook profile information to predict health risk behaviors.

2. Methods

We used a within-subject design utilizing an online questionnaire and a content analysis of each respondent's Facebook profile. First, respondents were invited to complete the online questionnaire, and they were also asked to provide the online address of their personal Facebook profiles. When the respondent provided a link to his or her profile (81% of respondents did this), the profile's contents were saved within two days of the respondents completing the questionnaire. Subsequently, the contents (maximum of twenty photos, maximum of ten status updates, and all profile details) were coded using a pre-tested coding scheme (average Cohen's kappa .77).

2.1. Questionnaire

The online questionnaire consisted of three sections with a total of 55 items. After the introduction, six questions were asked about demographics (sex, age, educational level, nationality, body length, and body weight). The link to the respondent's Facebook profile was also requested in this section. In the instructions, the purpose of the study was explained, and the respondent was asked to provide the ID code that is depicted in the URL when he or she is logged in at Facebook. The second section of the questionnaire involved the five dependent health behaviors; alcohol use (18 items, explained below), tobacco use (3 items), illicit drug use (2 items), nutrition (10 items), and participation in sports (1 item). The third section of the questionnaire consisted of 10 items measuring a broad range of possible consequences, including the respondent's frequency of oversleeping, frequency of sick days, grade point average, number of dental cavities at his or her last dental check-up, frequency of positive remarks on his or her appearance, average hourly wage at a part-time job, frequency of work-performance-related compliments given by his or her manager, frequency of work-performance-related criticism by his or her manager, whether the respondent had been given a raise in the past year, and the respondent's level of happiness according to the 5-item Satisfaction With Life Scale (Diener, Emmons, Larsen, & Griffin, 1985).

2.1.1. Alcohol use

Alcohol use was measured by three different validated scales: *Alcohol Quantity–Frequency* (average number of week and weekend days on which the respondent consumed alcohol * the average number of alcoholic drinks consumed on those days); *Alcohol Use Disorders Identification Test* (*AUDIT*) (ten items measuring frequency of engaging in, and suffering from, hazardous and harmful alcohol consumption, Cronbach's alpha = .78); and *alcohol risk behavior* (originally four items, based on previous research on alcohol risk behavior among adolescents and college students) (Adams and Nagoshi, 1999; Casey and Dollinger, 2007; Moreno

et al., 2012). In our analyses, we used three items (Cronbach's alpha = .71). These items are "In the last 30 days, how often have you: drunk alone/drunk alcohol with the purpose of becoming drunk/participated in an alcohol-drinking game (driving a car when drunk excluded)?". The answer categories were: never, 1–2 times, 3–5 times, 6–10 times, 11–20 times, and over 20 times.

2.1.2. Tobacco

Tobacco use was measured by the *Tobacco Quantity–Frequency*, based on Douglas et al. (1997), consisting of three questions. First, "Have you ever smoked an entire cigarette?" (if the answer to this question was "no," then the next two questions were skipped). The subsequent questions included the number of days in the previous month on which the respondent smoked, and the average number of cigarettes that the respondent smoked on those days.

2.1.3. Illicit drugs

The possible use of illicit drugs was explored with two items. First, "Have you ever used any type of illicit drugs?" The Dutch terms 'soft drugs' (marijuana) and 'hard drugs' (e.g., cocaine) were used here. If the answer was "no," the next question was skipped. The subsequent question was "In the last 30 days, how many times have you used illicit drugs?".

2.1.4. Nutrition

Regarding the issue of nutrition, we asked the respondent to disclose the number of weekdays (on average) that he or she consumes ten particular types of food. These foods were selected based on the Dutch healthy nutrition institutions The Netherlands Nutrition Centre Foundation (2011), The Health Council of the Netherlands (2006), and on Douglas et al. (1997). The five most important healthy nutrition behaviors per day included eating two pieces of fruit, 200 g (about 7 lb) of vegetables, whole-wheat products, 1.5 l (approximately a third of a gallon) of water, and a decent breakfast (bread and a healthy drink). The five most unhealthy behaviors were consuming candy or chocolate, sugared soda drinks, potato chips or salted snacks, fattening fast foods, and biscuits or pies.

2.1.5. Sports

Finally, participation in sports was measured by one question, also derived from Douglas et al. (1997), in which the respondents were asked for the total number of hours per week that they normally participate in intensive physical activities.

2.2. Facebook coding scheme

The coding scheme consisted of three sections: photos, status updates, and the information page ("About"). For each section, the prevalent content related to alcohol, tobacco, illicit drugs, nutrition (healthy and unhealthy), and sports was registered. In Section 2.4, the calculation for the "density scores" will be explained.

2.2.1. Alcohol

Alcohol references in photos involved alcohol consumption (e.g., a person holding a can of beer, or a glass of wine sitting on a table), visible alcohol (e.g., a liquor cabinet showing different types of alcohol), a setting in which people normally consume alcohol (e.g., a bar or festival), and alcohol advertisements (e.g., posters or clothing showing an alcohol brand). In the status updates, alcohol references involved direct cues (e.g., mentions of drinking or physical conditions as a result of drinking) and indirect cues (e.g., mentions of going to a bar or of looking forward to going out with friends). For alcohol references on the information page, we registered all items that made reference to alcohol (e.g., "Heineken" being listed as a favorite brand).

2.2.2. Tobacco

In the photos associated with a respondent's profile, tobacco was coded when being consumed (e.g., a person smoking a cigar), displayed or directly referred to (e.g., a box of cigarettes or an ashtray on a table), and when tobacco advertisements were present (e.g., posters or clothing items showing a tobacco brand). In the status updates, and on the information page, all items referring to tobacco were registered (e.g., listing "having a smoke" as an activity or listing "Marlboro" as a favorite brand).

2.2.3. Illicit drugs

To analyze illicit drug references, photos were coded when they showed the consumption of drugs (e.g., smoking a water pipe or a joint), the display of illicit drugs (e.g., the display of joints or ecstasy pills), the respondent's presence in a setting that could provoke to illicit drug use (e.g., a coffee shop that allows marijuana-smoking or a hard-core party), and the presence of illicit drug advertisements (e.g., posters or clothing showing or promoting drug use, such as images of marijuana leaves). Within the status updates and on the information page, all items referring to drugs were registered (e.g., participants mentioning taking drugs or going to a coffee shop that allows marijuana-smoking).

2.2.4. Nutrition

With regard to nutrition, both healthy and unhealthy intakes were coded. In the photos, we coded the consumption of particular foods (e.g., people drinking water or eating a hamburger), the display of foods (e.g., a fruit basket on the table or soda bottles in the corner), the setting (e.g., a vegetable store or a McDonalds), and advertisements for food products or eating habits (e.g., posters or clothing showing or promoting healthy or unhealthy nutrition). For the status updates and the information page, all references to healthy and/or unhealthy eating habits were registered (e.g., eating an apple or listing "Bubblicious" bubble gum as a favorite brand).

2.2.5. Participation in sports

With regard to sports, photos that showed the respondent's participation in sports (e.g., playing soccer or riding a bicycle), the display of sports equipment (e.g., a snowboard or tennis racket in the corner), sports settings (e.g., active in a game), and sports advertisements (e.g., posters or clothing showing sports or athletes) were coded. For the status updates and the information page, all items referring to sports were registered (e.g., having a training session, winning a game, or listing "Nike" as a favorite brand).

In addition, *adverse cues* were registered. These cues could involve alcohol warning labels, "no smoking" signs, cues of a position against using illicit drugs, or "I hate sports" sweaters. (For nutrition, both positive and negative cues had already been coded.)

2.3. Respondents

We began with the research team's Facebook connections and, using a snowball approach, ultimately asked 160 respondents to join the study. To encourage people to participate, a fully catered barbecue for four people was raffled off. In addition, the participants were ensured that the data would be kept confidential and only used for research purposes. A total of 88 respondents completed the questionnaire, of which 71 respondents met the requirements of being a student, and provided the link to their Facebook profile. These 71 respondents were between 17 and 27 years old (average age of 21.3), and sex was divided approximately equally (56% females). All of the respondents were currently studying in the Netherlands and were Dutch (although one respondent had a German background).

2.4. Analyses

In total, we coded: 71 profiles; 1275 photos (maximum of 20 per profile); 505 status updates (maximum of 10 per profile); and 1148 information page items (per profile, between 0 and 28 "activities and interests" items, between 0 and 50 "arts and amusements" items, and between 0 and 8 "education and work" items). We decided to use a maximum of 20 photos and 10 status updates, to enable comparison between respondents, also given the fact that previous research showed that 20 photos appear to reflect a reliable snapshot of one's identity (Casey and Dollinger, 2007). Within each profile, an equal amount of photos (both photos posted by the participant and photos the participant was tagged in by others) was randomly selected from each album, and included in the analyses. For each of the three sections of each profile—photos, status updates, and information page items—six "density scores" were calculated: alcohol, tobacco, illicit drug use, healthy nutrition, unhealthy nutrition, and participation in sports. For example, if only 12 photos were available on a profile, and 6 of them were coded, then these findings resulted in a density score of .50. Within this calculation, adverse codes were deducted from the total (not for healthy and unhealthy food since these themselves are opposite values). For example, if "Marlboro" and "Camel" were mentioned as favorite brands on a profile, but "Smoking kills" was depicted as a favorite quote in a total of 25 items, the density score would be (2–1)/25 = .04. Subsequent to deducting these codes, we calculated an overall average density score for all six health behaviors, by taking the average of all 71 scores for each of the three Facebook profile sections. Then, we calculated an overall density score for alcohol, tobacco, illicit drug use, healthy nutrition, unhealthy nutrition, and participation in sports by taking the average of those three scores. For each health behavior, Pearson's correlations (the majority of the variables showed normal distributions) were used to investigate the relation between Facebook content and questionnaire data.

3. Results

3.1. Questionnaire data

With respect to alcohol consumption, the students in the sample appear to have high alcohol intakes: 81% of students report to have participated in at least one alcohol-related risk behavior in the last 30 days. Furthermore, on the *alcohol problem drinking* scale (AUDIT), 75% of the students score 8 or higher, which indicates that they are at risk for problem drinking (8 and higher), and 13% even have high risk scores (16 and higher). In addition, 25% of the students report having exceeded the weekly limits of alcoholic drink consumption: 14 drinks for females and 21 drinks for males.

Overall, 20% of participants report having smoked at least one cigarette in the last 30 days, 20% of participants report having used illicit drugs in the last 30 days, and 26% of participants do not satisfy the healthy exercise guidelines (Table 1).

The results on the ten additional health behavior measures are shown in Table 2. Participants report oversleeping an average of 4 times a year, and questionnaire results suggest that students on average take more than 3 sick days a year. In the Netherlands, students are graded on 10-point scales, with 1 being the lowest. Participants report an average grade of 6.86, and an average hourly wage of 8.47 Euros (approximately 11 US Dollars).

Additionally, 90% of the participants report having a paid part-time job. They report a higher frequency of work-related compliments than work-related criticism, and 13% of the participants were given a raise within the last year as a result of their working achievements.

Table 1
Self-reported questionnaire health behavior.

	Mean	SD	Limit	At risk
Alcohol				
Quantity-frequency	13.23	11.14	>14/21	25.4% (n = 18)
Problem drinking AUDIT	10.68	5.03	>7	74.6% (n = 53)
			>15	12.7% (n = 9)
Risk behavior	2.10	2.41	>0	81.4% (n = 58)
Tobacco				
Quantity-frequency	17.31	67.07	>0	19.7% (n = 14)
Illicit drugs				
Frequency	1.23	0.513	>0	19.7% (n = 14)
Nutrition				
Healthy nutrition freq.	25.65	5.06		
Unhealthy nutrition freq.	13.11	4.49		
Sports				
Frequency	5.61	2.03	<5	25.4% (n = 18)

Table 2
Questionnaire everyday health behavior implications.

	Mean	SD
Oversleeping frequency (#/last year)	3.90	7.28
Sick days frequency (#days/last year)	3.41	3.89
Grade point average (1–10)	6.86	0.82
Dental cavities (#/at last check)	0.34	1.03
Appearance-related compliments (5-items scale*)	2.94	0.78
Having a part-time job? (Yes/No)	90% Yes	
Part-time job wage (Euro/hour)	8.47	2.83
Work-related compliments by manager (#/last year)	8.63	6.41
Work-related criticism by manager (#/last year)	2.30	3.91
Got a pay check raise? (Yes/No)	13% Yes	
Satisfaction with life (5-item scale, 5–35)	26.13	4.33

* Scale: 1 = (almost) never, 2 = fewer than once a month, 3 = about once a month, 4 = about once a week, 5 = (almost) every day.

3.2. Facebook profiles' content

Of the 71 Facebook profiles, 99% (n = 70) contained alcohol references, 39% (n = 29) contained tobacco references, 10% (n = 7) contained illicit drug references, 52% (n = 37) contained healthy nutrition references, 65% (n = 46) contained unhealthy nutrition references, and 89% (n = 63) contained references to sports.

On those 71 Facebook profiles, a total of 2928 contents were coded: 1275 photos, 1148 information page items, and 505 status updates. In total, of those 2928 items, 785 contained alcohol references, 41 contained tobacco references, 12 contained drug references, 61 contained healthy nutrition references, 91 contained unhealthy food references, and 402 contained sports references.

Following the process explained in the Methods section, density scores were calculated for the photos, status updates, and information page contents, and an overall density score was calculated. Table 3 depicts the density scores (and standard deviation) and the number of references.

3.3. Facebook contents and questionnaire data

First, for each health behavior, correlation analysis was conducted between the Facebook density scores and the questionnaire data (see Table 4).

3.3.1. Alcohol

A correlation analysis between the four Facebook alcohol density scores from the content analysis and the three alcohol measures from the questionnaire showed significant correlations between the questionnaire Alcohol Quantity–Frequency (Q–F) scores and both the information page items' alcohol density scores

Table 3
Characteristics of participants' Facebook health behavior references and health behavior density scores.

	Pictures density score			Status up density score			Info page density score			Overall density		
	Score	SD	N Ref	Score	SD	N Ref	Score	SD	N Ref	Score	SD	N Ref
Alcohol	0.467	0.190	602	0.190	0.210	93	0.084	0.127	90	0.281	0.141	785
Tobacco	0.032	0.053	40	0.002	0.016	1	0.000	0.000	0	0.015	0.025	41
Drugs	0.004	0.018	6	0.002	0.013	1	0.004	0.016	5	0.004	0.012	12
Healthy nutrition	0.039	0.050	54	0.007	0.026	4	0.003	0.021	3	0.023	0.032	61
Unhealthy nutrition	0.057	0.062	75	0.013	0.038	8	0.006	0.024	8	0.033	0.033	91
Sports	0.121	0.141	163	0.123	0.196	65	0.173	0.185	174	0.147	0.128	402

Table 4
Correlations questionnaire data and Facebook density scores.

	Picture density	Status up density	Info items density	Overall density
Alcohol				
Quantity-frequency	.112	.268*	.282*	.100
Problem drinking	.118	.216	.214	.145
Risk behavior	.129	.285*	.050	.133
Tobacco				
Quantity-frequency	.594**	−.006	N/A	564**
Drugs				
Quantity-frequency	.125	.178	.112	.190
Nutrition				
Healthy nutrition freq.	−.048	−.059	.000	−.070
Unhealthy nutrition freq.	.066	−.067	−.096	−.034
Sports				
Frequency	.438**	.413**	.379**	.566**

N between 63 and 71.
N/A: no references available for this health behavior in this Facebook section.
* Significance levels $p < 0.05$.
** Significance levels $p < 0.01$.

($r = .28$; $p = .02$) and the status updates' alcohol density scores ($r = .27$; $p = .03$). No significant correlations were found between the photos' alcohol density scores and the questionnaire Alcohol Q–F scores, and no significant correlations were found between the overall alcohol density scores and the alcohol Q–F scores.

None of the alcohol density scores derived from the Facebook profiles showed significant correlations with the alcohol problem drinking scores from the questionnaire, although correlations between status updates' density scores ($p = .09$) and information page items' density scores ($p = .07$) approached statistical significance.

Significant correlations were found between the status updates' alcohol density scores and the alcohol risk behavior scores from the questionnaire ($r = .29$; $p = .02$). No significant correlations were found between the photos' or information page items' alcohol density scores and the alcohol risk behavior scores.

3.3.2. Tobacco

The correlation analysis showed significant correlations between the photos' tobacco density scores and the tobacco Q–F scores from the questionnaire ($r = .59$; $p < .01$). Significant correlations were also found between the overall tobacco density scores and the tobacco Q–F scores ($r = .56$; $p < .01$). Significant correlations were not found between the status updates' tobacco density scores and the tobacco Q–F scores, and significant correlations were not found between the information page items' tobacco density scores and the tobacco Q–F scores. As shown in Table 4, no tobacco references were found among the information page items from the analyzed Facebook profiles, and only one reference to tobacco use was encountered in the analyzed status updates.

3.3.3. Illicit drugs

The Pearson correlation analysis showed no significant correlations between any of the illicit-drugs-related density scores derived from the Facebook content analysis and the illicit drug use frequency measures from the questionnaire.

3.3.4. Nutrition

A Pearson correlation analysis between the four healthy nutrition density scores from the Facebook content analysis and the healthy nutrition frequency measure from the questionnaire showed no significant correlations. None of the four unhealthy nutrition density scores showed significant correlations with the unhealthy nutrition frequency measures from the questionnaire.

These correlation analyses were repeated on a scale-item level for the ten individual healthy and unhealthy nutrition items. First, a Pearson correlation analysis between the four healthy nutrition density scores from the Facebook content analysis and the five individual healthy nutrition items showed a significant negative correlation between the *vegetable frequency* item and the overall healthy nutrition density ($r = -.24$; $p = .05$). No additional significant correlations were found between the healthy nutrition density scores from the Facebook profiles content analysis and the individual healthy nutrition items from the questionnaire.

Second, a correlation analysis was conducted between the four unhealthy nutrition density scores and the five individual unhealthy nutrition items. None of the unhealthy nutrition density scores from the Facebook profiles content analysis correlated significantly with the individual unhealthy nutrition items from the questionnaire.

3.3.5. Sports

The Pearson correlation analysis showed significant correlations between the photos' sports density scores derived from the Facebook content analysis and the questionnaire sports frequency scores ($r = .44$; $p < .01$), between the information page items' sports density scores and sports frequency scores ($r = .38$; $p < .01$),

between the status updates' sports density scores and sports frequency scores ($r = .41$; $p < .01$), and between the overall sports density scores and sports frequency scores ($r = .57$; $p < .01$).

3.4. Health implications

In addition to finding the correlation between the main questionnaire data and the Facebook profiles' density scores, we analyzed the overlap between the health implications of the participants' responses to the questionnaire and their Facebook profiles (see Table 5).

A significant negative correlation was found between the *overall alcohol density scores* and the *average hourly wage at a part-time job* item ($r = -.56$; $p < .01$). No significant correlations were found between the overall tobacco density scores and the ten health implication items. For the *overall drugs density scores*, a significant positive correlation was found with the *satisfaction with life scores* ($r = .27$; $p = .02$). A significant negative correlation was found between the *overall unhealthy nutrition density scores* and the *average hourly wage at a part-time job* item ($r = -.27$; $p = 0.4$). For the *overall sports density scores*, significant negative correlations were found with the *sickness frequency scores* ($r = -.28$; $p = .02$) and the *dental cavities scores* ($r = -.27$; $p = .03$), and a positive correlation was found with the *average hourly wage at a part-time job scores* ($r = .25$; $p = .05$).

4. Discussion

College students are known for reckless lifestyles that involve high alcohol intake, smoking, illicit drug use, poor eating habits, and low participation in sports. In our sample, nearly nine out of ten respondents were at (high) risk of developing an alcohol problem, according to the AUDIT scores, and more than eight out of ten respondents had been involved in one or more alcohol risk behaviors in the past month. One out of five respondents was at risk of developing an addiction to cigarettes, and one out of four respondents did not exercise enough. Finally, and also strikingly, one out of five student respondents had used illicit drugs in the past month.

When we examined the Facebook profiles of the students in our sample, we concluded that Facebook is very "wet." All but one profile (99%) contained references to alcohol use, which exceeded findings from previous studies by Moreno et al. (2007, 2009, 2010). For the other coded content, we found that 89% of the profiles contained sports references, but fewer references to tobacco and drug use were found. The high presence of alcohol and sports references on Facebook profiles could be linked to the proven social nature of sports and alcohol activities (Casey and Dollinger, 2007; Keresztes, Piko, Pluhar, & Page, 2008). Facebook seems to be the means by which to communicate and share "social" drinking and sports activities. Tobacco references were encountered only in photos, and a total of only twelve references to illicit drug use were found in the 2928 items analyzed in this study.

According to our developed methodology for the three density scores (leading to the overall density score), self-disclosed information on Facebook about participation in sports turns out to be a valid indicator for real-life behavior. For smoking, photos on Facebook and the overall density scores are associated with real-life smoking behavior. In the categories of illicit drug use and nutrition, no significant correlations were found between the respondents' Facebook profiles and risk behavior questionnaires. In the case of illicit drug use, this phenomenon is due to the fact that the variance is very low; only 12 references to illicit drug use were observed in the Facebook profiles that we analyzed. Apparently, there is a limit to what students are willing to share publicly, and illicit drug use is beyond that limit. No clear relations were found between the profiles' references to healthy and unhealthy foods and real-life food intake. The coding, especially for the photos, was sometimes difficult. For example, how should we code a photo when it depicts a king size hamburger *and* a salad? If a photo shows a glass of transparent liquid, is it soda, water, or liquor? In our questionnaire, we used references to the Top 5 healthy foods and the Top 5 unhealthy foods according to Dutch standards. Therefore, in addition to reconsidering the coding of Facebook elements that refer to food, it might also be worth using another scale to measure real-life healthy/unhealthy food intake.

Of the cues on Facebook that we analyzed, the majority (785 out of a total of 1392 cues within 2928 elements) was related to alcohol. Especially for the photos, the results were rather disappointing: No significant correlations between those photos and actual drinking behavior were found using our method. We chose to calculate an alcohol density score for the photos, status updates and information page items for each respondent, and to calculate an overall density score. From our perspective, for each respondent, the prevalence of alcohol on his or her Facebook profile has a better variance than the one used by Moreno et al. (2012). In their study, each profile was coded in one of three groups: alcohol non-displayers; alcohol use, but no I/PD (Intoxication/Problem Drinking); and alcohol I/PD. The latter group included the CRAFFT criteria: driving or riding in a car while intoxicated (C, car); drinking to relax (R, relax); drinking alone (A, alone); forgetting what one did while drinking or blacking out (F, forget); having friends or family ask you to cut down on alcohol (F, friends/family); or getting into trouble—e.g., being arrested—due to alcohol use (T, trouble) (Moreno et al., 2012). After our investigations, we believe that a combination of both methodologies may be most useful for determining the seriousness of the alcohol depicted in the profiles *and* for calculating a percentage of the content to which that applies. One problem with the Moreno et al. (2012) method was that only one I/PD signal on a profile should have had a different impact than more than one signal. One problem with our own study was that we did not distinguish between different levels of seriousness regarding alcohol consumption (e.g., one glass of wine during dinner might not be unhealthy at all) and alcohol depiction or the difference between the profile owner drinking and a friend drinking. The best possible way (and the hardest way) to code alcohol prevalence on SNSs is using a weighted code (e.g., 0 = non-displayed, 1 = moderate alcohol, 2 = alcohol, 3 = severe alcohol) for each alcohol code. In this code, the amount of alcohol, the contexts (CRAFFT), and the consumer are incorporated. In future research, we should determine the weights of the different SNSs profiles' elements. Is the depiction of having a beer in a photo equal to listing "Heineken" as a favorite brand? Another question to answer is whether adverse cues have more weight than regular cues.

In terms of risk management, the use of SNS profiles may have another possible positive consequence. As Couch and colleagues have shown (Couch, Liamputtong, & Pitts, 2012), people often withdraw from the risks of their own behavior through focusing on a "risky other". The participants in their study externalized the risks of online dating by moving the ownership of risks away from themselves and onto others. A confrontation with the problematic content of one's own uploaded photos on Facebook impedes moving away from the facts. A combination of early detection of risky behavior and this confrontation style may be a fruitful way to prevent adolescents from a dangerous lifestyle. Schools, prevention programs, NGO's, or health-enhancing organizations could use Facebook or other SNSs to track risk populations or individuals. Instead of information campaigns in schools in which healthy lifestyles are promoted, specific groups could be targeted via Facebook. In doing so, other aspects of Facebook could also be analyzed which are aimed at actually targeting those

Table 5
Questionnaire health implications and Facebook profiles' density scores.

	Oversleeping	Sick days	Grade point average	Dental cavities	Appearance compliments	Hourly wage	Work compliments	Work criticism	Pay check raise	Satisfaction with life
Alcohol	−.028	.067	−.207	−.127	054	−.564**	−.186	.107	157	−.015
Tobacco	010	190	−.005	−.119	091	−.221	150	006	176	024
Drugs	−.030	−.010	−.082	−.078	−.122	−.023	005	−.022	007	.271*
Healthy nutrition	230	113	009	−.110	141	078	034	048	074	122
Unhealthy nutrition	122	.014	−.068	−.016	094	−.268*	159	233	064	−.085
Sports	−.049	−.281*	−.111	−.267*	−.088	.251*	176	012	−.075	134

N between 63 and 71.
* Significance levels $p < 0.05$.
** Significance levels $p < 0.01$.

groups. If, for instance, people who drink a lot also prefer certain television shows, specific (entertainment) education could be designed within or shorty after such a program.

We also encourage scholars to further explore the correlations between SNSs' content and real-life health issues. We did find *some* correlations between the Facebook density scores and what we call "health implications." Surprisingly, the more alcohol references on Facebook, the higher the average hourly wage at the part-time job. Unsurprisingly, we found that sport references on Facebook (significantly correlated to sports participation in real-life) were negatively associated with sick days. Thus, more participation in sports corresponded with fewer sick days. Students who depicted and participated in sports had fewer dental cavities (possibly due to eating healthy foods), but lower hourly wages at their part-time jobs (possibly due to focusing on sports rather than work). This phenomenon should be further investigated, as should other potentially interesting characteristics, such as weight, height, body mass index, money-spending patterns, (cyber) bullying, and other psychological measures.

In sum, this study found that using Facebook as an indication for real-life health behaviors is not off the table, but that the methods of data collection and analysis should be further improved. For the health behavior measured by the questionnaire, we used a series of validated scales, but also other scales should be investigated, especially because some topics, such as drug and alcohol use, are rather confidential or may cause socially desirable answering patterns (e.g. Brener, Billy, & Grady, 2003; Reinert and Allen, 2002). So, the relatively high values in the self-reported data might even be higher in reality. In addition to the screening possibilities of SNSs, an innovative intervention option exists: the use of social networking media as intervention tools. Using innovative targeted messaging based on the displayed content on SNSs profiles, targeted intervention messages can be distributed among profiles containing certain content, such as words or photo characteristics, regardless of privacy settings. Such intervention techniques can be used to approach students and subpopulations which, based on their SNS profiles, may benefit from interventions in health-risk behaviors to reduce short-term and long-term health consequences.

4.1. Limitations

Our study had some limitations which we want to mention here. First, the sample size of this study was rather small. Although the sample size proved to be large enough to reflect relationships between Facebook references and health behaviors, replication of the study with a larger sample is, of course, recommended. A few of the variables showed skewed distributions, which caused difficulties in choosing between Pearson and Spearman correlation analyses. A large-scale replication will solve these difficulties.

Our study differed from previous research on SNSs and health-risk behavior, because not all of the profiles examined were publicly available. However, the examination of the profiles that were not publicly available was only possible because we conducted the research among our personal Facebook connections. By conducting the survey among our personal direct and indirect Facebook connections, problems regarding profile privacy settings were prevented. Because the survey was conducted in an environment closely related to ourselves, it can be questioned whether the results can be generalized to other student populations.

Finally, a maximum of 20 photos (from each participant) was used in content analysis. However, many Facebook profiles have more, some even reaching several thousand photos. Consequently, for many participants, we did not include all of the photos that they made available on their Facebook profiles. By selecting photos from different albums and selecting both photos that the respondent owned and photos in which they were tagged, we selected

photos for content analysis that would reflect the overall variety of photos on the profile. However, analyses of more photos would provide an even better impression of a profile's owner.

5. Conclusions

Self-disclosure on Facebook profiles is a common phenomenon. Students show the world what they do, who their friends are, what their favorite brands are, and what they did on the weekend. Facebook profiles also contain cues which tell us about real-life health behavior. This study was a first attempt to analyze these cues and to match them with real-life (self-reported) health behavior. We found that the analyses of the cues on Facebook are complex, especially due to a broad variety in severity (e.g., one glass in the hand versus a drinking event), the location on Facebook (e.g., photo versus favorite brand), and the relation to the respondent (e.g., a brand poster in the background). Furthermore, not all cues can undoubtedly be labeled as such; what does an ashtray mean? Is that a smoking cue or a marijuana cue? Or is it used to store paper clips? The healthy and unhealthy food cues especially leave much space for discussion.

However, this study demonstrates that one's smoking and sport behavior can be predicted reliably, based on Facebook content. Regarding alcohol use, some Facebook profile elements are indicative of real-life drinking. Illicit drug use could not be predicted by Facebook content (its prevalence was too low), and (un)healthy food intake was not found to be depicted by Facebook content.

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