

Actual versus perceived peer sexual risk behavior in online youth social networks

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ABSTRACT

Perception of peer behaviors is an important predictor of actual risk behaviors among youth. However, we lack understanding of peer influence through social media and of actual and perceived peer behavior concordance. The purpose of this research is to document the relationship between individual perception of and actual peer sexual risk behavior using online social networks. The data are a result of a secondary analysis of baseline self-reported and peer-reported sexual risk behavior from a cluster randomized trial including 1,029 persons from 162 virtual networks. Individuals (seeds) recruited up to three friends who then recruited additional friends, extending three waves from the seed. ANOVA models compared network means of actual participant behavior across categories of perceived behavior. Concordance varied between reported and perceived behavior, with higher concordance between perceived and reported condom use, multiple partners, concurrent partners, sexual pressure, and drug and alcohol use during sex. Individuals significantly over-reported risk and under-reported protective peer behaviors related to sex.

KEYWORDS

Online social networks, Normative influence, Behavioral norms, Adolescents, Sexual risk behavior

BACKGROUND

Sexually transmitted infections (STIs) in American youth and young adults remain a persistent public health concern. According to the Centers for Disease Control and Prevention, adolescents aged 15–19 years and young adults aged 20–24 years are a higher risk of acquiring STIs compared to older adults. Although youth between the ages of 15–24 years currently represent 25 % of the sexually active population, they acquire nearly half of all new STIs [1].

Youth risk behavior is influenced in part by their perceptions about what their peers do. If youth believe that their peers engage in risk behaviors, research shows they are likely to do so as well. On the positive side, if youth believe their peers are engaging in healthy behaviors, they will also be likely to engage in healthy behaviors [1]. The Theories of Reasoned

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Implications

Practice: Practitioners in these fields should seek information to share with youth that others like them frequently engage in safe and protective behaviors so they can reinforce positive social norms.

Policy: The widespread adoption of social media suggests that these results have important implications beyond HIV and STI prevention, and suggest that policies from funders to support inclusion of networks into research on behaviors could be a critical and impactful advance to behavioral and social science.

Research: This work has implications for refining our theoretical understanding of how peer influence operates within networks and how we can capitalize on social media to leverage positive peer influence. Methods described here can be applied to interventions for other critical health behaviors such as healthy eating and physical activity, mental health, and prevention of substance abuse, all areas of importance for adolescent health.

Action and Planned Behavior (TRA/TPB) explain the relationship between these perceptions (called subjective norms, i.e., perceptions of both what peers think about behaviors and how peers behave) and individual behavior [4, 5]. According to the TRA/TPB, if an individual believes that others like him or her would support or endorse a particular behavior or behave in a specific way, then he or she is more likely to also support, endorse, and enact this behavior, regardless of his or her internal knowledge.

There can be, however, discordance between what individuals perceive their peers are doing and what their peers are actually doing. This discordance between what individuals believe is true about peer behavior and actual peer behavior is described as “misperception”. A misperception occurs when there is an underestimation or overestimation of the prevalence of risky behavior [2]. Researchers have demonstrated that we can take advantage of this misperception to influence youth risk behavior [3].

The significant impact of reducing misperception of peer risk behavior upon future individual behavior has been extensively studied in preventive strategies for alcohol abuse in university students. A Cochrane review of 22 interventions to address misperception between perceived and actual peer behavior (called social normative interventions or normative feedback interventions) demonstrated significant reduction in peak blood alcohol levels, bingeing, and drinking frequency when participants were given web/computer feedback demonstrating their peers engaged in these behaviors less frequently than they had perceived [2]. Small scale studies have been completed showing that a raised awareness of peer protective sexual behavior positively influences individual behavior. College campus safe sex promotions based on this normative feedback have successfully improved the attitudes and norms regarding condom use, in particular, in college residence halls [4].

Prior research has also underscored the importance of considering constructs in addition to perceived norms for behavior change. This is only one of the several constructs central to the TRA/TPB; others include behavioral beliefs (i.e., belief that behavioral performance is associated with certain outcomes and the consideration of what “good” and “bad” things might happen if one enacts a behavior), perceived behavioral control, and behavioral intention [5]. Several researchers have documented the importance of attitudes and perceived behavioral control in addition to norms as antecedent to behavior change [6–8]. Researchers have also considered the role of social networks in adoption of unhealthy behaviors over time. Seminal work by Christakis brought wide attention in the public health community to the understanding of an individual’s network and its subsequent influence on healthy behavior. Christakis and Fowler have shown that having real world friends and family members who become obese over time increases the likelihood that an individual will become obese [9]. Later work, again from the Christakis and Fowler lab, demonstrated that smokers tended to quit in clusters, suggesting smoking cessation campaigns are more effective when targeting groups of individuals [10]. A burgeoning number of studies can be found which evaluate the role of social networks in substance abuse and HIV prevention in particular [11–13]. Analyses of real world social networks have more recently been used as models to explore relationships and influence of networks of people in online environments. Researchers have investigated data from samples recruited from online social networking sites, showing how youth using these sites exhibit and display evidence that they may be engaging in risk related to sexually transmitted infections [14]. Here, it is important to state that networks can be defined as “real world” or “online” networks or both, depending on whether people know each other and interact exclusively face-to-face (without technology), exclusively online (never meeting

face-to-face) or both. Social network analysis, then, comprises analyses of networks, and networks may be real world or online networks. This is distinct from social media, which uses Internet technology and online environments to facilitate online communication between people. While social media may involve communication within or across networks of individuals, it may also simply involve dyadic communication. All of the literature summarized here, however, were conducted either with real world social networks or with individuals using social media; we know of no research on the perception of sexual risk behavior and actual risk behavior among youth whose networks exist in the real world as well as in online environments.

With the advent of online social media and specifically social networking sites, youth are online in unprecedented numbers and regularly engage with their peers. Social media sites are used by an estimated 73 % of US teens [15]. This widespread use of social networking sites by adolescents and young adults suggests that social media may be an ideal venue to reach young people with tailored health education messages. Facebook, in particular, due to its popularity over other social media sites [8], offers promising research potential as an online networking platform for both health promotion and health evaluation, as well as for identifying higher risk populations. Meta-analyses have demonstrated that computer- and Internet-based interventions contribute to improved sexual health outcomes both for youth and other at-risk groups, and that technology-based initiatives can have effects equivalent to nontechnology-based programs for sexual health [16]. Some recent evidence even suggests that computer-mediated interventions can be superior to in-person interventions specifically in changing attitudes toward condoms [17].

In this paper, we focus on the relationship between individual perception of peer sexual risk behavior and the actual behavior of peers from online social networks. Our focus on sexual risk behavior among young adults aged 16–25 is driven by the disproportionate incidence and prevalence of sexually transmitted infections in this group. We seek to first understand what youth perceive about their peers’ risk and if there is a discrepancy between youth perceptions of peer risky and protective sexual behaviors. This will help us establish if there is an opportunity to influence individual risk by changing misperceptions about peer behaviors. This opportunity could be realized using social networking sites—recent research has shown that we can use social networking sites prospectively to influence sexual health. Bull et al. have demonstrated the efficacy of health education promotion through social media sites, specifically Facebook and the internet to help promote positive STI preventative behavior in adolescents. The Just/Us campaign used a web-based promotion in combination with Facebook and demonstrated an efficacious use of health education messages, specifically preventing decline in condom use or proportions of protected acts over time [18].

Table 1 | Measures of individual sexual risk and perceptions of peer risk

Measure	Individual behavior ^a	Perceptions of peer behavior ^b
Sexually active	Have you ever had sex before?	How many of your Facebook friends have had sexual intercourse?
Protective behaviors		
Discuss condom use	How important is it for you to talk about using a condom with your sex partner the next time you have had sex? (Not at all, Not very important='No'; Somewhat, very important='Yes')	How often do you feel that your friends on Facebook friends talk about using condoms with their sexual partners?
Condom use	Did you use a condom the last time you had sex?	How often do you feel that your friends on Facebook who are having sex use condoms?
Risky behaviors		
Sexually active prior to age 15	How old were you the first time you had sex?	How many of your friends on Facebook do you feel had sex the first time before they were 15 years old
Multiple partners in past 2 months	How many different sex partners have you had in the last 2 months? >1 = multiple partner	How many of your friends on Facebook do you feel have had more than one sex partner in the past 2 months?
Have concurrent sexual partners	Were any of these sex partners concurrent? (by this, we mean you had sex with one partner, had sex with a different partner, and then went back and had sex with the first partner)	Of these, how many had partners who were concurrent? (by this, we mean they had sex with one partner, had sex with a different partner, and then went back and had sex with the first partner)
Have one night stands	Have you had any one night stands in the past 2 months?	How many of your friends on Facebook do you feel have had one night stands in the past 2 months?
Felt pressure to have sex	Have you experienced pressure to have sex before?	How many of your friends on Facebook do you feel have experienced pressure to have sex before?
Drug/alcohol use during sex	How often are you drunk or high while having sex?	How often do you feel that your friends on Facebook are drunk or high while having sex?
STI status	Has a health care provider ever told you that you have a sexually transmitted disease or infection (STD/STI)?	How many of your friends on Facebook do you feel have had an STD/STI (sexually transmitted disease/infection such as HIV, gonorrhea, etc.)?

^a Questions were dichotomous (Y/N) for individual items

^b Likert scale for peers (none, <half, about half, >half, and all)

Challenging the misperceptions of peer behavior can be a useful intervention tool for adolescents. The majority of the work has been in the context of substance abuse, and we found limited but growing evidence illuminating how it works in the context of sexual behavior. However, we lack a clear understanding of how peers may influence each other online and whether there is concordance between actual and perceived peer behaviors online. Our objective in this paper was to understand more about the concordance between perceived and actual peer sexual risk and protective behavior in online social networks.

METHODS

We utilized cross-sectional data to conduct a secondary analysis of baseline individual (self-reported)

and peer (peer-reported) sexual risk and protective behavioral data acquired using respondent driven sampling collected initially for a cluster randomized controlled trial. The trial was established to determine the efficacy of using Facebook as a venue for the reduction of sexual risk behaviors.

A modified respondent-driven sampling (RDS) approach was used to recruit participants for the baseline risk assessment in this trial. Data collection occurred between June 2010 and March 2011. RDS is a systematic approach to identify and recruit hard-to-reach populations, relying on referrals, where the initial "seed" or index person recruited is invited to identify and recruit others to participate [19]. Recruitment occurred in community settings in the Denver, CO metropolitan area and in a college community in Louisiana through online personal

channels and postings on popular blogs and websites, and through advertisements in college and local newspapers in US cities with higher-than-average combined incidence rates of STI and HIV [1, 20]. Recruitment was focused on African American and Latino youth given the disparity in HIV and STI infection between these youth compared to other groups, although no racial or gender criteria were used in selection of participants. In community settings, research assistants either approached people directly if they thought they might be eligible, or set up a table and waited for people to approach them. When recruiting online, three websites were accessed to better identify and reach youth of color, including Mi Gente, Black Planet, and Urban Chat. Recruiters posted information about the study to these sites and responded to requests for more details about the study. Finally, 16 local and school (community college, college, and university) newspapers in geographic areas with the highest prevalence of chlamydia, gonorrhea, and HIV among 15–19 year olds were identified, and recruitment ads were subsequently placed in these papers. Persons responding to the ads sent an e-mail or voice mail to study staff, which then enrolled them and encouraged them to recruit friends as described below.

All participants, regardless of recruitment method, were screened using identical eligibility criteria, i.e., were between the ages of 16–25, a US resident, maintained a Facebook account, willing to complete study behavioral risk assessments, and able to read and write in English. Because the random controlled trial intervention was designed for delivery on Facebook, only those who agreed to sign up to receive news from (i.e., “like”) our Facebook study pages would be eligible. Those eligible were invited to participate. Participants recruited by study staff were incentivized to recruit up to three of their Facebook friends to participate (wave 1); this wave of recruits were incentivized to recruit up to three of their Facebook friends (wave 2) who were also incentivized to recruit up to three Facebook friends to participate (wave 3). All individuals recruited by study staff (i.e., seeds) and all the people they recruited who were in subsequent waves were considered part of the same discrete social network, and the data from individuals could be compared to the data from others within their network. The participants received a gift card valued at \$5 per person for up to three people recruited into the study for a possible total of \$15.

All eligible participants, including seeds and all those referred through their Facebook social networks, completed informed consent and a baseline behavioral assessment of sexual risk via an online tool generated and delivered through Zoomerang, a commercial online survey software program that allows users to create and publish surveys online. Zoomerang served as a third party host for our data, and its third party hosting agreements comply with all current institutional review board requirements related to privacy and data security [25]. All participants were sent a link via e-mail on their Facebook

page that would take them from Facebook to a secure site behind our firewall to the informed consent and online survey, which they could self-administer on their own computer—all personal data on risk behavior was therefore solicited and stored off of the social media site, and no participant could see any data on sexual risk of another participant. The survey took approximately 15 min to complete. The participants were given a gift card valued at \$15 for completion of the baseline assessment. Study procedures were conducted in accordance with ethical standards of the Helsinki declaration and approved by institutional review boards at University of Colorado and Columbia Mailman School of Public Health. The trial is registered with Clinical Trials.gov, NCT00725959.

MEASURES

Measures included demographic characteristics of the participants: age, gender, race, ethnicity, education, and zip code. Individual and peer items related to sexual behavior are shown in Table 1. We asked the participants to describe their own sexual risk using validated constructs for assessing adolescent sexual behavior [21], including both protective behaviors (discussing condom use with sexual partners and condom use) and risky behaviors (being sexually active before age 15, having multiple partners in the prior 2 months, having concurrent sexual partners, having one night stands, feeling pressure to have sexual intercourse, drug and alcohol use during sex, and STI status).

Perceptions of peer behavior were assessed with questions assessing “How many of your Facebook friends: (e.g., have had sexual intercourse, have had one night stands).” These peer perception items were assessed with five ordered categories (“none,” “less than half,” “about half,” “more than half,” and “all”).

Individual’s reports of his/her own behavior were assessed on a yes-or-no scale. *Actual peer behavior* was then calculated as a network-level average of these individual self-reported behaviors to represent a mean estimate of average risk/protective behavior within each network. Values of this behavioral measure potentially ranged from 0 to 100, where a score of 0 indicated that no participants within a given network reported the behavior and a score of 100 indicated that all participants within a given network reported engaging in the behavior. The scores on these measures spanned the full range of the 0–100 scale and were treated as continuously measured outcomes in the analyses.

ANALYSIS

We assessed the relationship of each individual’s perception of risky behavior among their Facebook friends to the actual behaviors reported within their

network for each measure. We utilized ANOVA to compare the means of the actual participant behavior within a network across the five categories of perceived behavior of Facebook friends (none, <half, about half, >half, and all) using Proc GLM in SAS 9.2. A separate ANOVA model was estimated for each of the risky and protective behaviors of interest. The measure of actual peer behavior was based on a varying number of individuals based on the size of the network. The ANOVA models thus controlled for network size, as well as age, race, gender, Hispanic ethnicity, and region of the USA when these covariates were significantly related to the outcome at the bivariate level (i.e., $p < 0.001$), assuming that such an association could imply the possibility of confounding in a multivariate model. If a significant *F* value of differences in network behavior by the five perception categories was observed, post hoc comparisons using Tukey’s adjustment were conducted to determine how the five means differed from one another. Note we did not conduct network analyses such as degree of separation or other density and closeness relational data to better understand the diffusion of perception among network members.

RESULTS

Participants numbered 1,578 were enrolled at baseline; 1,029 participants in 162 non-overlapping networks containing at least two members were included in the normative analyses. There were 549 people who did not recruit anyone, which meant we could not link them to anyone else in the study and therefore did not belong to a network; these participants were not included in this analysis. The sample was ethnically diverse with 35 % African American, 14 % Latino, and 41 % Caucasian participants. The highest proportion of participants were from southern USA (39 %) followed

by western USA (35 %). The states with the greatest representation were Louisiana, Georgia, and Colorado. In these states, the proportion of African Americans, Latinos, and Caucasians between the ages of 18–24 differs somewhat, but overall, our sample included proportions of African Americans and Latinos equal or higher than documented in all three settings, while the White participants had lower representation in our sample than in these settings. Further demographic traits of the study group were described in previous work [18, 22, 23].

An assessment of the correlation between individual sexual risk behavior and individuals’ perceptions of peer risk shows that there are significant but modest correlations between level of risk and perceptions about what others are doing. For example, those who reported experiences of pressure to have sex were significantly more likely to perceive that their Facebook friends have also had experiences with pressure (Spearman’s rho=0.37, $p < 0.0001$). The correlations for behaviors including having multiple partners, one night stands, drug use, and experience were significant and ranged from 0.15 to 0.29. This demonstrates that those who engage in these behaviors tend to think that their friends do as well.

Table 2 is intended for descriptive purposes and depicts the frequency distribution of the participants’ perceptions of the risk and protective behaviors of their peers. On average, the participants reported a perception that less than half of their peers were engaging in risk behaviors and at least half were engaging in protective behaviors. Nonetheless, perceptions covered the full range where a small percentage of participants perceived “all” of their friends to be engaging in risk or “none” of their friends to be engaging in protective behaviors.

The results of the ANOVA models are shown in Table 3. For each of the behaviors listed, the table shows the mean level of actual peer behavior within

Table 2 | Frequency distribution of perceptions of peer protective and risk behaviors related to sexual health

	Perceptions of peer behavior				
	% (n), N=1,029, networks >1 participant ^a				
	None	<Half	About half	>Half	All
How many of your friends on Facebook:					
Protective behaviors					
Discuss condoms	16.3 (143)	37.4 (332)	17.7 (156)	24.7 (214)	3.7 (34)
Used a Condom at last sex	2.8 (24)	19.9 (173)	25.6 (221)	47.8 (407)	3.9 (35)
Risky behaviors					
Had sexual debut <15 years	8.7 (82)	61.3 (550)	17.2 (155)	11.3 (105)	1.4 (13)
Have multiple partners	5.5 (49)	49.6 (440)	23.4 (207)	18.2 (167)	3.2 (30)
Have concurrent partners	9.9 (73)	56.9 (415)	21.0 (149)	10.1 (74)	2.0 (15)
Have one night stands	8.8 (78)	59.1 (519)	18.7 (163)	11.5 (102)	1.8 (17)
Experience sexual pressure	7.8 (74)	36.7 (331)	22.9 (203)	23.2 (211)	9.3 (82)
Use drug/alcohol during sex	5.7 (50)	48.5 (423)	27.1 (240)	15.1 (132)	3.4 (31)
Have had sexually transmitted infections	24.3 (199)	60.5 (500)	10.6 (85)	3.4 (28)	1.2 (12)

^a <1 % missing, <10 % not sure or do not want to answer

Table 3 | ANOVA results of means of actual sexual behaviors among Facebook peers within each category of perceptions of peer behavior

Protective Behaviors	Means for network-level behaviors				F statistic	p Value	Significant covariates ($p < 0.001$)	
	Peer perception categories							
	None	<Half	About half	>Half				All
Discuss condoms	82.25 a	82.62 a	85.62 a	83.30 a	82.27 a	1.30	0.26	Race, region, age
Condom use at last sex	54.12 a,b	54.60 a	54.76 a	60.26 a,b	71.86 b	4.30	0.00	Gender, region, ethnicity, age
Risky behaviors								
Sexual debut <15 years	7.65 a	6.95 a	9.50 a	9.78 a	14.82 a	2.21	0.06	Gender, race, ethnicity
Multiple partners	5.41 a	6.34 a	8.17 a,b	11.08 b	18.6 c	8.70	0.00	Race, age
Concurrent partners	19.95 a,b	17.96 a	24.25 b	25.27 a,b	30.46 a,b	3.20	0.01	Gender, race, age
One night stands	7.56 a	10.48 a	12.91 a	9.63 a	8.43 a	1.48	0.21	Race, region, ethnicity
Sexual pressure	24.28 a	27.97 a	31.41 a,b	34.48 b,c	39.34 c	8.75	0.00	Race, region, age
Drug/alcohol use	14.82 a,b	10.11 a	14.56 b	15.41 b	16.40 a,b	5.22	0.00	Gender, region, age
Sexually transmitted infections	6.74 a	8.02 a	10.74 a	12.22 a	3.80 a	2.19	0.07	Race, age

Similar letters (e.g., "a") following means within each row indicate no significant mean difference between categories; dissimilar letters following means within each row indicate a significant mean difference between cells. Peer behaviors range from 1 to 100

each of the five categories of participants' perceptions of peer behavior. Significant F values indicate that the average self-report of the specific behavior within the network differed across the five categories representing individuals' perception of whether Facebook friends engage in the same behavior. Tukey's post hoc comparisons of the mean values across the five categories demonstrate whether there is concordance or discordance between reported and perceived behavior. Participant perceptions of peer behavior were related to actual peer behavior within their networks on five of the outcomes: condom use, multiple partners, concurrent partners, sexual pressure, and drug and alcohol use during sex. As shown in Table 3, as perceptions of risk increased, reported risk behavior also increased. Participant's perceptions of behavior did not relate to self-reported behaviors of those in their Facebook network for discussions of condoms, age at sexual debut, one night stands, and STI diagnosis. In other words, there was no relationship between individuals' perceptions of their friends' behavior and the actual behavior reported by those in their network for these four variables.

Table 3 also demonstrates how participants overestimated or underestimated risk and protective behaviors of their peers. Participants tended to overestimate the risky behaviors of their peers. For example, among those who believed "all" of their peers had multiple sexual partners, the mean of actual behavior among network members was only 18.60 on the 0–100 scale. Among those reporting "about half" of their peers had multiple partners, the mean was only 8.17. This pattern was stable across all risk behaviors. It was also stable across all five categories of peer perceptions, with one exception: those who reported "none" of their peers engaged in risky behavior were underestimating actual risk within their network. In contrast, participants tended to underestimate the degree to which their peers were engaging in protective behaviors. For example, among those who reported "none" of their peers used condoms at last intercourse, the mean of actual condom use behavior was actually 54.12 on a 0–100 scale. The primary exception to this pattern was those who perceived that "all" of their peers engaged in the protective behaviors.

DISCUSSION

This work reveals a persistent perception among youth in this sample that their peers are engaging more often in risky sexual behavior than they are in actuality. Individuals in this study were over-reporting the risky sexual behavior of their peers and under-reporting the protective behaviors of peers. This suggests that young people in general assumed that their peers were not engaging in safer behaviors when they actually did. This is consistent with other literature on adolescent perceptions on other risk behaviors, where youth perceive their peers are being more risky than they

are in fact. We posit that regular exposure to messages on sexuality in the general media may contribute to a perception that peers have sex at an earlier age, have multiple and concurrent partners, have one night stands, and have been exposed to STI when the reality from this sample is that far fewer Facebook friends actually are engaging in these risks.

These data underscore an important opportunity to utilize peer influence—when peers are engaging in healthy sexual behaviors—to benefit others via social media. As noted in the introduction, the TRA/TPB theories posit that social norms are among the critical antecedents to behavior change. In this work, we did not test the relationship between norms and safer sex behaviors and thus did not validate the model *per se*. The results do suggest we can offer more nuance to the understanding of the relationship between subjective norms, other TPB constructs such as behavioral beliefs, perceived behavioral control, intentions, and behavioral outcomes. We suggest that the critical element of this relationship is not that of an association between norms and a behavior, but rather between the level of concordance between actual and perceived norms and a behavior. We do not have a clear understanding as to why there was concordance between perceived and actual behaviors for some variables, but not for others and cannot say if there is something unique about the four variables with non-significant concordance that makes it more difficult to accurately determine peer behavior. The Cochrane Review on drinking behaviors is perhaps the most comprehensive from the social normative literature, and in this review, there were no data showing variability in concordance or discordance between perceived and actual behaviors. Similarly, with the social normative interventions of O’Grady et al. [4] for sexual risk behaviors described in the introduction, there is no mention of variability in concordance between perceived and actual sexual risk behavior. The research from the Cochrane review focused more narrowly on only two behaviors, binge drinking and frequency of drinking, which could have reduced the likelihood of variability in concordance. Here, we examined multiple behaviors, so the opportunities to find concordance may have been greater. Furthermore, perceptions of which sexual behaviors are risky may vary—some may consider one night stands are more risky than engaging in frequent serial monogamy.

These data suggest, however, that we have an opportunity to change misperceptions of peer normative sexual behavior and that this could positively influence on individual adolescent safer sexual behaviors. To achieve this, one needs to have access to both the perception of norms (by individual self-report) and actual behaviors of a network of peers, which could then represent the “norms” of a peer group. Identifying not only individual behaviors but also perceptions of those within an individual’s social network (physical or online), therefore, holds

possibilities to influence a major factor in changing risky behaviors [6]. This is particularly salient for translational research inasmuch as it suggests that an intervention with an entire network focused on norms can be an effective approach for behavior change; if this is indeed the case, this may result in a more efficient way to affect behaviors—and to disseminate information about healthy behavioral choices among groups. To do this, using social media would require two specific tasks. The first is measurement, where one would ask, as we did, details of individual risk behavior and perceptions of the risk behavior of “friends” in their network. The second is a network identification task, where one would need to identify the relationship between individuals and others in a study—this requires a network approach, where one seeks to enroll participants at a network rather than an individual level (methods employed by Berkowitz [3] and Valente et al. [11]). Networks exist on social media, but they also exist in the real world—e.g., sports teams, clubs, and neighbors. In research and interventions related to sexual health, if we enroll and intervene with networks and consider that youth can exchange information about sex and condom use with their social networks, we suggest that they would be more likely to be influenced by and base their decisions on social norms [10]. Future research should use social media tools to share information learned here—that youth from the Just/Us study overestimate risk and underestimate protection, with the hypothesis that awareness of the fact that youth more often engage in protective sexual behaviors could facilitate positive individual change. One way this could be accomplished would be to create a Myth/Fact post indicating that XX % of youth report that their “friends” never use condoms and then follow up with a post to “debunk” the myth with rewards (e.g., points for a prize) to those who re-post to their networks.

This work is not without limitations. We did not explicitly ask youth to distinguish between older and younger social media “friends” when answering questions about friend sexual risk behaviors, and we therefore cannot assume that their perceptions were of same-aged peers, which could have influenced the under- and over-estimations of protective and risk behaviors.

No social network relational data were used in this first analysis. Further investigation could include degree of separation or other density and closeness relational data to better understand the diffusion of perception among network members. Due to the structure of the questions, no indication of degree of closeness was intended or implied in the questions regarding peer behavior. Additionally, using respondent-driven sampling can evoke biases—however, this occurs when the intention of RDS is to approximate a probability sample. As our intent with the method was to implement RDS to facilitate identification of networks and ultimately generate a convenience sample,

the limitation is primarily related to those found with any convenience sample, i.e., the inability to generalize beyond this specific group.

Though the trend in the data reported here was for participants to over-report risky behaviors of their peers, peer reports were statistically significantly predictive of the network's aggregated self-reported behavior profiles for over half of the reported behaviors. With the advent of social media, we are now poised to compare information about an individual's close connections and their ability to predict risk factors in ways that have not been possible before. Combining social media and social network analysis can help us improve the reach of our interventions and may also help us hone in more effectively on who can be the optimal messenger for health promotion within networks.

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