Examining the Relationship between Online Social Capital and eHealth Literacy: Implications for Instagram Use for Chronic Disease Prevention among College Students

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Abstract

Background—College students actively seek online health information and use Instagram, an image- and video-based social networking website, to build social networks grounded in trust and behavioral norms (social capital), which have the potential to prevent chronic disease.

Purpose—This study aimed to: (1) examine how intensity of Instagram use moderates the relationship between eHealth Literacy and online social capital in college students, and (2) discuss how Instagram can be used as a social awareness platform for chronic disease prevention among college students.

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Methods—Hierarchical regression analyses were conducted to analyze web-based survey data from a random sample of college students (*N*=327).

Results—Online bridging social capital was associated with greater eHealth Literacy (*P*<.05) and intensity of Instagram use (*P*<.001), when controlling for socio-demographic variables. The relationship between eHealth Literacy and online bridging social capital was strongest among respondents' with average (*P*<.01) and high (*P*<.01) intensity Instagram use, as compared to low Instagram intensity.

Discussion—High intensity of Instagram may strengthen college students' low eHealth Literacy, especially when interacting with heterogeneous connections with weaker ties.

Translation to Health Education Practice—Health education specialists should continue to explore how college students' intensity of Instagram use can be strengthened to build bridging online social capital, and ultimately prevent chronic disease.

BACKGROUND

Approximately 117 million adults in the United States (US) are living with one or more chronic diseases.[1] While chronic conditions are typically not diagnosed until middle age or older adulthood, college-aged adults experience undetectable physiological health risks that are often associated with habitual unhealthy behaviors that are carried into adulthood.[2] To address the importance of fostering healthy lifestyles in early adulthood, the American College Health Association has aimed to increase the proportion of college students who receive health education about chronic disease prevention by 10% by the year 2020.[3] Many colleges and universities offer comprehensive health promotion programs that address chronic disease risk reduction behaviors (e.g., promoting physical activity, moderating alcohol intake, smoking cessation). Many of these programs are delivered through in-person, one-on-one or group counseling sessions in campus wellness centers.[4,5] However, findings from previous research indicates that college students are most likely to access and engage health information regarding chronic disease risk reduction online through popular online social networking websites.[6,7] Online relationships developed through social networking can result in the reinforcement of behavioral norms, establishment of mutual interests and trust; as well as engender meaningful socio-psychological resources that support positive health behaviors.[8,9]

Social Capital and Chronic Disease Prevention

Social capital is defined as "resources embedded in a social structure which are accessed and/or mobilized in purposive actions."[10] Building social capital can increase one's commitment to their community and improve collective actions toward health.[11] According to Geys and Murdoch,[12] there are two different types of social capital, including bridging and bonding. Bridging social capital is defined as "weak ties" or loose connections between individuals who may provide useful information or new perspectives for one another, but

typically not emotional support.[13] Larsen and colleagues[14] suggest that bridging social capital is generated between individuals from diverse communities to access and gain new resources, including knowledge and support. Bonding social capital is developed among individuals in tightly-knit communities which are grounded in emotionally supportive relationships, such as family and even close friends who share similar races, ethnicities, and ages.[15,16]

In general, social capital is an important determinant of chronic disease prevention and management behaviors.[17,18] A recent meta-analysis exploring the role of social capital in the health of children and adolescents (including college-aged adults) reported that greater social capital was associated with better health outcomes related to physical activity, nutrition, and alcohol, tobacco and other drug use.[19] In the college-aged population, high social capital promotes protective health behaviors, including safer sex practices and less binge drinking and illicit drug use.[20–22] Each of these health risk behaviors are linked to the development of various chronic diseases.[23] Accordingly, these health risk behaviors may become more modifiable as social capital becomes more attainable during the college years. College students are active users of social networking websites, where connections with other users become established and maintained over time. However, there is currently little known about how college students perceive online social capital that is generated through popular online social networks.

Online Social Capital in College Students

Online social capital is defined as accessibility to ties on an online network that promote trust and group norms. Online social capital is a relatively new concept that has emerged with widespread adoption of the Internet.[24,25] Active participation on popular online social networking websites enhances the amount and type of opportunities an individual has to build social ties that cultivate online social capital.[26] People who lack offline social capital may also use social networking websites to access people who possess similar health characteristics to rapidly disseminate health information that promotes behavioral norms that lead to the health and well-being of communities.[11,27] Considering that college students are members of both online social networks and campus communities, it is important to explore how intensity of social networking use is related to online social capital in this population.

Existing studies of the general college student population do not provide clarity as to how online social networking website use influences the development of different forms of online social capital. Ellison and colleagues,[26] described the association between intensity of Facebook use and bridging online social capital among college students as strong, especially for users experiencing low life-satisfaction. Interestingly, the intensity of ties on Facebook had a greater effect on online bridging social capital than online bonding social capital. Valenzuela and colleagues[28] reported small associations between Facebook use and perceptions of social capital, which was measured using variables such as life satisfaction, general trust in others, and participation in civic activities. In this study, greater intensity of Facebook use was significantly associated with higher social capital. This finding suggests that, among college students, intensity, or reliance, on using social networking websites may

be more predictive of global perceptions of belonging or connectedness with society, as compared to simply establishing a registered social networking account.

Similarly, Steinfield and colleagues[29] suggest that higher intensity Facebook use may help students with low self-esteem to develop greater bridging social capital with heterogeneous social networking users, which could to ultimately lead to greater connectedness with society. Given that college students are active seekers of online health information and tend to build diverse social networks that establish behavioral norms, it is important to understand how students' online health information seeking skills and behaviors influence their own perceptions of online social capital.

Electronic Health (eHealth) Literacy among College Students

Health literacy, or the skills to effectively locate, understand, and evaluate health information to make informed health decisions, is associated with positive health outcomes, including improved health status and reduced rates and severity of chronic disease.[30–32] Currently, more research is needed to better understand the impact of technology on society's well-being and health-related outcomes.[33–34] eHealth Literacy, for example, is defined as an individual's ability to locate, understand, evaluate, and act upon health information obtained from electronic sources to address or solve health problems.[35] Higher frequency of online health information seeking behaviors is strongly associated with greater eHealth Literacy in the general population.[36] Moreover, adequate eHealth Literacy is important to benefit from the wealth of health information circulated on the Internet.[35]

College students are active Internet users and regularly access online health information, yet evidence suggests that this population has relatively low eHealth Literacy.[37] More recently, Robb & Shellenbargar[38] found that the general college student population may have adequate knowledge about where and how to find relevant online health information; however, this population has low self-efficacy to evaluate and use online health resources once they are located. Limited skills to evaluate and use online health information is problematic, because college students who are able to accurately evaluate the relevance of health information will be able to make the most informed decision about whether or not to act upon the recommended behavior to protect against chronic disease.[39]

A recent study conducted by Kim and colleagues,[40] aimed to explore how the relationship between offline social capital and health information seeking self-efficacy and intent is moderated by the health literacy of the general adult population. Results suggested a positive relationship between bridging social capital and an individual's self-efficacy to locate, evaluate, and use health information, regardless of their health literacy. This study also documented a positive relationship between offline bonding social capital and intent to seek health information, regardless of health literacy. Importantly, individuals with high health literacy but low bridging and bonding social capital reported greater health information seeking self-efficacy and intention, as compared to participants with low health literacy. This finding indicates not only a positive relationship between health literacy and offline social capital, but it also suggests that high health literacy may compensate for low offline bridging and bonding social capital, which may enhance self-efficacy to seek out health information online. Because health literacy is positively associated with eHealth literacy, we expect that

a similar relationship would hold for eHealth literacy and online social capital.[35] Currently, however, there is limited evidence exploring this relationship. Moreover, there is a need to further examine how specific online social networking behaviors influence the relationship between eHealth literacy and online social capital in college students.

Instagram as a Source of Health Information for College Students

One emerging social networking website that has received little attention in the literature is Instagram (https://www.instagram.com/), a unique image and video-based blogging platform where users can capture and share aspects of their life, environment, and community with others in their social network. A report from Pew Internet & American Life Project,[41] suggests that 59% of Internet users between 18 and 29 have an Instagram account. Also, 24.1% of current college students use Instagram, visiting the website an average of 2–3 hours each day.[42]

Many college students are highly engaged and attentive to Instagram images and videos posted by organizations, especially within their college or university network.[43] As described by Gauthier & Spence,[44] Instagram allows users to exchange images and brief videos up to one minute with other users who subscribe to, or "follow," their account. Similar to other social networking websites, Instagram allows users to build diverse and heterogeneous relationships through following/being followed by others, sharing comments on posts, liking posts, tagging others on posted material, and even sending private messages. Users can also personalize their images and videos, by choosing from a variety of filters to emphasize or de-emphasize colors on images and also adjust the audio on posted videos. Additionally, Instagram allows users to "geo-tag" an image so that others can identify what date and geographic location images and/or videos were captured and posted to the website.[45] Ultimately, the primary motivation for using Instagram is to build and maintain social interaction with other users through briefly examining user-generated images.[46]

Although Instagram has emerged as an immensely popular form of communication, to date, limited research has been conducted on Instagram and Instagram users. Hu and colleagues,[47] used computer vision techniques to assess Instagram photo content, based on the kinds of photos posted, user characteristics, and the number of user followers. Results of this particular study indicated various categories in relation to types of photos typically posted; categories include: user and friends, food, gadgets, captioned photos, pets, indoor and outdoor activities, selfies, and fashion. In addition, this research showed that the number of user followers was not necessarily linked to the types of photos posted. Furthermore, Manikonda and others[45] analyzed millions of Instagram users, along with specific Instagram social networking properties, to find that Instagram, when compared to similar photo-sharing social media applications (i.e. Twitter and Flickr), provides a unique, and very popular, social awareness platform for everyday life.

Evidence suggests that brief image-based health education can improve accessibility, comprehension, and recall of chronic disease prevention and health promotion information among the general population.[48–52] Users of image-based social networking websites, such as Pinterest, are most likely to engage with images that depict real people encountering health-related issues and challenges that require informed decision-making.[53] Instagram is

another popular social networking website that may be ideal for reaching college students through disseminating actionable health information related to chronic disease prevention.

Boulos and colleagues[54] provide an overview of a number of studies that have explored the potential of Instagram to serve as a photo- and video-sharing platform for "visually rich" health care fields, such as radiology, dermatology, and clinical infectious diseases. This review also indicated that Instagram has been used effectively for providing timely information in public health situations for health communication, as it is one of the communication tools used by the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC). Despite this potential, college students with low eHealth literacy may be overly reliant on online social networks for health information. Because of this, students may use popular social media websites, such as Instagram, to compensate for poor individual eHealth Literacy skills. Nevertheless, this dependence on a social networking website for health information may facilitate mutual trust and respect with those in their social networks, consisting of both weak and strong ties to facilitate bridging and bonding online social capital, respectfully.

Given the rising popularity and engagement with Instagram among college students, and the cited potential for the use of Instagram in the field of public health education,[44,54] it is important for health education specialists to understand how this image-based social media platform could be used to promote online social capital and chronic disease prevention among college students. Currently, there is a limited understanding regarding the relationship between eHealth Literacy and individual perceptions of online bridging and bonding social capital among college students. It is also unknown how the intensity of social networking use, specifically Instagram use, impacts college student perceptions of online social capital.

PURPOSE

This study examined the relationship between eHealth Literacy and the two different types of online social capital, bridging and bonding social capital. We also explored whether or not intensity of Instagram use moderated the relationship between eHealth Literacy and the two different types of online social capital. The following hypotheses were tested in this study:

> **Hypothesis 1**: There will be a positive relationship between intensity of Instagram use and eHealth Literacy among college students.
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> **Hypothesis 2**: There will be a positive relationship between eHealth Literacy and online bridging social capital among college students.
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> **Hypothesis 3**: The relationship between eHealth Literacy and online bridging social capital will be stronger among college students with high intensity Instagram use.
>
> **Hypothesis 4**: There will be a positive relationship between eHealth Literacy and online bonding social capital among college students.
>
> **Hypothesis 5**: The relationship between eHealth Literacy and online bonding social capital will be stronger among college students with high intensity Instagram use.

METHODS

This cross-sectional study involved college student recruitment from a single, large southeastern university in the US via email to participate in a anonymous online survey administered through Qualtrics© (Provo, UT). Both undergraduate and graduate students were invited to participate in the study, which measured socio-demographic factors, online bridging and bonding social capital, eHealth literacy, and intensity of Instagram use.

Procedures

After receiving Institutional Review Board (IRB) approval, email invitations were sent to 2,000 randomly selected students to complete the Qualtrics© administered, online survey in November 2015. The online survey was open for a total of 2 weeks. Students were sent an invitation via their university email account with the survey link . Two reminder emails were sent to students one week and two weeks after the initial invitation email. Electronic consent was obtained prior to completing the online survey, where participants were notified that they would receive a $5.00 Amazon e-gift card incentive if they completed the survey.

Measures

Socio-demographic factors—The following socio-demographic factors were measured by adapting items from the American College Health Association's National College Health Assessment (ACHA/NCHA),[55] including: (a) sex (male, female, other); (b) age (years); (c) grade point average (GPA) on a 4.0 scale; (d) race (Caucasian, Black/African American, Asian, Native Hawaiian/Pacific Islander, American Indian/Alaska Native, Other); and (e) ethnicity (Hispanic, non-Hispanic).

Online social capital—Online social capital was measured by adapting seven items that examined online bridging social capital[26] and five items that measure online bonding social capital.[25] Relevant items from each subscale were selected and minor changes were made to the rewording of items. Both scales ask participants to rate their level of agreement with declarative statements describing beliefs regarding online interaction with others. Each item was measured with a 5-point Likert-type scale (1 = strongly disagree; 5 = strongly agree), and total scores for the bridging (min = 7; max = 35) and bonding (min = 5; max = 25) subscales were computed by calculating the sum of response options.

Data collected using the bridging (Cronbach's α = .85) and bonding (Cronbach's α = .84) survey items demonstrated adequate internal consistency. An exploratory factor analysis (EFA) using principal axis factoring found that the data from items used to measure online bonding social capital reflected a single construct (eigenvalue = 3.07) that explained 61.53% of variance in the data. An additional EFA conducted with data from items measuring online bridging social capital found one factor had an eigenvalue of 3.71 and a second factor had an eigenvalue of 1.0. Both factors were highly correlated and the majority of the variance was accounted for by the first construct.

eHealth literacy—Norman and Skinner's[56] 8-item eHealth Literacy Scale (eHEALS) was used to measure eHealth literacy. Participants were asked to rate their level of agreement

with eight declarative statements that assessed confidence to locate, understand, evaluate, and act upon health information gained from the Internet. Each item was measured on a 5-point Likert-type scale (1 = *strongly disagree*; 5 = *strongly agree*), and a composite score was computed by summing together responses on each item (min = 8; max = 40). Existing psychometric analyses of data produced by the eHEALS indicates that scores are valid and reliable in college student populations.[57] Internal consistency of data using the eHEALS in this study was adequate (Cronbach's α = .91).

Intensity and use of Instagram—Instagram use was measured by asking respondents to describe their use of Instagram by selecting from one of three options: (1) Yes, I have an active Instagram account; (2) Yes, but I no longer have an active Instagram account; or (3) I have never had an Instagram account. For the analyses, response options were collapsed into dichotomous categories (0 = *never had an Instagram account*; 1 = *I have/had an Instagram account at one time*).

Intensity of Instagram use can be conceptualized as degree of its use and reliance. Ellison and colleagues'[26] Facebook Intensity Scale was adapted to measure intensity of Instagram use. Items were adapted in this study by replacing "Facebook" with "Instagram." The adapted scale was comprised of two items assessing daily Instagram use (i.e., less than 10 minutes, 10–30 minutes, 31–60 minutes, 1–2 hours, 2–3 hours, more than 3 hours) and number of Instagram account "followers" (i.e., 10 or less, 11–50, 51–100, 101–150, 151–200, 201–250, 251–300, 301–400, more than 400), and six items assessing attitudes towards emotional connectivity on Instagram rated on a 5-point Likert-type scale. Data collected using each item were centered at the mean value prior to creating a summated Instagram use score. Because some items had differential response option values, data were centered so that scores for each item were on the same metric.[58] Data collected using this scale demonstrated adequate internal consistency (Cronbach's α = .88), which was higher than the internal consistency of data collected when the original Facebook intensity scale was administered (Cronbach's α = .83).[26] To provide further internal validity evidence for the data collected using the Instagram use scale, EFA results supported that the items on the Instagram Use scale measured a single construct (eigenvalue = 4.41) and explained 62.98% of the variance in data.

Data Analysis

SPSS v23[59] was used to compute frequency and descriptive statistics to describe socio-demographics, online social capital, eHealth literacy, and Instagram use results. To examine the relationship between intensity of Instagram use and eHealth literacy (Hypothesis 1), a simple linear regression analysis was conducted with intensity of Instagram use as the dependent variable and eHealth Literacy as the independent variable, controlling for socio-demographic characteristics (i.e., age, gender, race, ethnicity) and academic performance (i.e., self-reported GPA). To evaluate relationships between eHealth literacy and different types of online social capital (i.e., online bridging – Hypothesis 2; online bonding – Hypothesis 4) and explore moderating effects of Instagram use intensity on the relationship between eHealth literacy and online social capital (i.e., online bridging – Hypothesis 3; online bonding – Hypothesis 5), two hierarchical linear regression models were tested.[58]

Model 1 designated online bridging social capital as the dependent variable, while Model 2 specified online bonding social capital as the dependent variable. Socio-demographics and academic performance variables were entered into each hierarchical model as covariates in step 1 of the analysis. In the second step, the independent variables of eHealth literacy (mean centered) and intensity of Instagram use (mean centered) were entered as predictor variables. In the third and final step of the hierarchical regression analysis, the interaction term of eHealth literacy and intensity of Instagram use was entered into the model. Statistically significant interactions were followed by simple slope regression analyses to examine the strength of interaction effects at three levels (1 SD above = high intensity, 1 SD below = low intensity, at the M = average intensity) of the intensity of Instagram use. Tolerance and variance inflation factor (VIF) estimates were examined in each hierarchical model to ensure that tolerance estimates did not exceed .10 and VIFs were less than 10.[58] To determine if a statistically significant amount of variance was accounted for when adding predictors into each step of the hierarchical model, unstandardized beta coefficients were examined for each control and predictor variable and each interaction effect were assessed by interpreting R^2-change statistics at each step. Statistical significance was considered to be $P < .05$.

RESULTS

Participant Characteristics

Socio-demographics—Table 1 provides information about the socio-demographic breakdown of study participants (N = 327). On average, participants were 24 years old (SD = 7 years). Slightly over half of participants (50.8%) identified as being female. Over half (64.8%) of participants were Caucasian, 20.5% were Asian American (20.5%), and approximately 16% identified as being of Hispanic or Latino. Over half (60.9%) of the sample reported earning a GPA of 3.50 to 4.0 and approximately 30% self-reported between a 3.0 and 3.49.

eHealth literacy—eHealth Literacy scores ranged from 9 to 40 (M = 29.49; SD = 5.71). Over half of the participants in this study reported agreeing or strongly agreeing that they know what health resources are available on the Internet (n = 206; 63%), and also reported feeling confident in knowing where (n = 216; 66.1%) and how (n = 247; 75.5%) to find the helpful health resources on the Internet. In addition, more than three-quarters of participants reporting knowing how to answer questions about their health (n = 260; 79.5%) and use health information from the Internet to help address their health-related issues and concerns (n = 249; 76.1%). More than half of all participants reported agreeing or strongly agreeing that they possessed the skills to evaluate health resources on the Internet (n = 206; 63%), including how to distinguish high quality from low quality online health resources (n = 203; 62.1%). Almost half of respondents reported knowing how to use online health information to make informed health decisions (n = 163; 49.9%).

Instagram use and intensity—Over half of participants reported currently (n = 179; 54.7%) or previously (n = 20; 6.2%) using Instagram. Approximately 75% (n = 151) of current/past users of Instagram had 100 or less followers, and only 6% (n = 12) reported

having more than 400 followers. Over two-thirds of participants who reported using Instagram ($n = 137$; 68.5%) spent 30 minutes or less on Instagram each day, and approximately 23.5% ($n = 47$) spent between 31 minutes to 2 hours on a daily basis. Slightly more than half of college students who reported using Instagram reported that Instagram was part of their everyday life ($n = 104$; 51.7%); however, less than half reported they are proud to tell people that they use Instagram ($n = 81$; 40.3%). More than one-third of students reported feeling that they are part of the Instagram community ($n = 75$; 37.4%) and feel out of touch when they haven't used Instagram in a while ($n = 77$; 38.3%). Almost half of the Instagram users in this study also reported that they would feel sad if Instagram were to cease operations ($n = 104$; 46.8%).

Online social capital—Online bridging social capital scores ranged from 7 to 35 ($M = 21.89$; $SD = 5.60$). Figure 1 shows that over two-thirds of respondents agreed or strongly agreed that interacting with people online reminds them that everyone in the world is connected ($n = 225$; 68.8%). More than half of the respondents reported that online interaction helps them to connect with others at their university ($n = 178$; 54.4%). Almost 40% of respondents agreed or strongly agreed that they were willing to spend time to support the general online community ($n = 128$; 39.1%), and felt that interacting with other people online made them feel like part of their university ($n = 134$; 41%). Many college student respondents also indicated that online interaction provided an outlet for finding new people to communicate with ($n = 126$; 38.5%), and also helped them come in contact with other students at their university ($n = 135$; 41.3%). Interestingly, over half of respondents disagreed or strongly disagreed that they frequently came in contact with new people online ($n = 172$; 52.6%).

Online bonding social capital scores ranged from 5 to 23 ($M = 12.41$; $SD = 4.52$). Figure 2 shows that more than half of participants 'agreed' or 'strongly agreed' that they knew someone online that they trusted to help them solve their problems ($n = 171$; 52.3%). However, over half of respondents 'disagreed' or 'strongly disagreed' that they knew someone online who they could turn to if they needed an emergency loan of $500 ($n = 240$; 73.4%) or needed advice about making important life decisions ($n = 207$; 63.3%). About half of respondents also 'disagreed' or 'strongly disagreed' that there were several people they can talk to online when they feel lonely ($n = 161$; 49.2%) or someone in particular who they felt comfortable talking to online about intimate personal problems ($n = 164$; 50.2%).

Relationship between eHealth Literacy and Intensity of Instagram Use

Hypothesis 1: There will be a positive relationship between eHealth literacy and intensity of Instagram use college students—Table 2 shows that the relationship between eHealth Literacy and intensity of Instagram use was statistically significant, $F_{(8, 194)} = 4.95$, $P < .001$, $R^2 = .18$ ($R^2_{adj} = .14$), after controlling for socio-demographic characteristics and self-reported GPA. Table 3 shows that eHealth Literacy ($b = .30$; $SE = .10$) was positively associated with intensity of Instagram use. Younger age ($b = -0.42$; $SE = .11$) and identification as a female ($b = 2.18$; $SE = 1.10$) were both associated with greater intensity of Instagram use.

eHealth Literacy and Online Bridging Social Capital Moderated by Instagram Intensity

Table 3 shows that hierarchical linear regression analyses indicated that intensity of Instagram use significantly moderated the relationship between eHealth Literacy and online bridging social capital in college students, $F(10, 194) = 4.23$, $P < .001$, $R^2 = .19$ ($R^2_{adj} = .14$).

Hypothesis 2: There will be a positive relationship between eHealth literacy and online bridging social capital among college students—After controlling for socio-demographic characteristics and self-reported GPA, eHealth Literacy ($b = .20$; $SE = .05$; $P < .05$) was positively associated with online bridging social capital (Table 3).

Hypothesis 3: The relationship between eHealth literacy and online bridging social capital will be stronger among college students with high intensity Instagram use—Table 3 also shows that the interaction effect of eHealth Literacy and intensity of Instagram use ($b = .02$; $SE = .01$; $P < .05$) on online bridging social capital was also statistically significant. Figure 3 shows results from a post hoc simple slope regression analysis that was conducted subsequent to the statistically significant interaction effect. Results suggested that the relationship between eHealth Literacy and online bridging social capital was buffered by intensity of Instagram use ($b = .20$), such that the relationship was stronger among respondents with high intensity Instagram use ($b = .33$; $SE = .10$; $P < .01$) as compared to respondents with average ($b = .17$; $SE = .07$; $P < .05$) or low intensity ($b = .02$; $SE = .02$; $P = .83$) Instagram use.

eHealth Literacy and Online Bonding Social Capital Moderated by Instagram Intensity

Hypothesis 4: There will be a positive relationship between eHealth literacy and online bonding social capital among college students—eHealth Literacy ($b = .09$; $SE = .06$; $P = .10$) was not significantly associated with online bonding social capital, after controlling for key socio-demographic variables and self-reported GPA.

Hypothesis 5: The relationship between eHealth literacy and online bonding social capital will be stronger among college students with high intensity Instagram use—Hierarchical linear regression results indicated that intensity of Instagram use did not significantly moderate the relationship between eHealth Literacy and online bonding social capital, $F(10, 194) = 2.72$, $P = .07$, $R^2 = .13$ ($R^2_{adj} = .08$). The interaction effect of eHealth Literacy and intensity of Instagram use ($b = .01$; $SE = .01$) on online bonding social capital was non-significant ($P = .07$); however, in this hierarchical model, identifying as being a member of a race other than Black/African American (Black/AA) was associated with greater perceptions of online bonding social capital ($b = -3.12$; $SE = 1.41$; $P < .05$).

DISCUSSION

This study examined the relationship between eHealth Literacy and online bridging and bonding social capital, and it aimed to explore how intensity of Instagram use moderates these relationships. eHealth Literacy was positively associated with greater online bridging

social capital, and the relationship was stronger among college students who reported higher levels of Instagram intensity. Although intensity of Instagram use significantly moderated the relationship between eHealth Literacy and online bridging social capital, it did not moderate the relationship between eHealth literacy and online bonding social capital. Given that the vast majority of college students use Instagram, and the potential of Instagram use for health promotion is strong, this image-based social networking platform may become a particularly valuable tool to reach and engage college students with actionable chronic disease prevention messages.

Similar to previous research exploring the relationship between college students' intensity of Facebook use and their online social capital,[26] results from this study noted a positive relationship between intensity of Instagram use and online bridging social capital. However, contrary to what was found regarding Facebook use in college students,[26] intensity of Instagram use was not associated with online bonding social capital. Similarly, Nabi and colleagues[60] reported that the number of connections that college students reported on their social media profiles was positively associated with college students' perceived social support and psychological well-being. In the context of the current study, college students who use Instagram with a high degree of intensity may feel that they have access to new health information and resources through online connections with whom they do not have meaningful or deep connections. Future research should explore whether Instagram can be used to effectively reach and engage college students for chronic disease prevention. In particular, Instagram could potentially be used to increase awareness of chronic disease prevention by leveraging college students' existing Instagram followers.

Greater eHealth Literacy was associated with greater perceptions of online bridging social capital, yet the association between eHealth Literacy and online bonding social capital was not statistically significant. This result suggests that college students with high eHealth Literacy are more likely to possess weak, heterogeneous online connections with other users, as compared to stronger online connections and established relationships with others they can relate to. Proficiency accessing and evaluating online health information is especially important for college students who are highly active on social networking websites where most content is generated by users, not trained health professionals who are trained in communicating health information to the public.

Another key finding in support of our initial hypothesis was that higher intensity of Instagram use significantly buffered the relationship between eHealth Literacy and online bridging social capital. Among students with high eHealth literacy, the relationship between eHealth Literacy and online bridging social capital was stronger when college students reported high intensity of Instagram use, as compared to average and low intensity use. Among students with low eHealth Literacy, intensity of Instagram use did not moderate the relationship between eHealth literacy and online bridging social capital. This result suggests that college students with greater Instagram intensity demonstrate greater confidence in their ability to access and evaluate health information from new, heterogeneous online social networks without strong ties. According to Lee and colleagues,[46] Instagram users are considered acquaintances, or having para-social relationships, and much of the content on Instagram is user-generated. That being said, Instagram is a social networking platform

where users briefly examine images from diverse users to determine their relevance, rather than critically considering its content. Therefore, improving college students' skills evaluating the credibility of health information, particularly its source, posted to Instagram will be important to preventing the dissemination of images that promote and encourage deleterious health behaviors (e.g., excessive physical activity, poor dietary habits) that put college students at greater risk for chronic disease.

Findings from this study also support socio-demographic differences in the intensity of Instagram use exist among the college-aged population. Adults 18–29 years old in the general population are more likely than any other age group to use Instagram.[61] In the current study, over 60% of college students reported using Instagram, which supports other market research suggesting that college students are very active users of Instagram.[42] However, results indicated that intensity of Instagram use was negatively related with age, suggesting that younger college students were more likely to use Instagram more often than older college students in this study. This provides an optimal opportunity to reach younger adults, especially those transitioning from high school to college, earlier in their academic career with engaging and targeted health messages to facilitate behavioral norms that can protect against chronic disease.

Gender differences in intensity of Instagram use was also observed in this sample of college students. In this study, female students reported greater intensity of Instagram use as compared to male students. This finding is consistent with previous studies in the general population, suggesting that women are more likely to be Instagram users.[61] While gender differences in intensity of Instagram use were apparent in this study, there were no statistically significant differences in intensity of Instagram use by race or ethnicity. Other studies have reported that Hispanic and Black/African Americans are more likely than any other race/ethnicity groups to use Instagram.[61,62] Therefore, it will be important for health education specialists to consider if Instagram is an appropriate platform that meets the health needs of diverse populations.

Results of this study showed that online bridging social capital did not vary according to key socio-demographic factors (i.e., gender, age, race, ethnicity) or self-reported academic performance. However, online bonding social capital did vary by race, as college students identifying with a race other than Black/AA reported stronger perceived online bonding social capital. Vader and colleagues[63] examined the believability and accessibility of health information according to its source among a nationally representative sample of college students. Results found that Black/AAs are more likely than Caucasian students to access health information from offline sources that are central to the college experience. These sources included university health center medical staff, health education specialists, and college faculty members. Despite these readily available offline and trustworthy sources of health information on college campuses, racial disparities in chronic disease indicators persist on college campuses. Among college-aged adults, studies have shown greater physical fitness and healthier diets among Caucasian students as compared to Black/AA students,[64] with a lower proportions of Black/AA males asserting confidence in their ability to change behaviors associated with sugar-sweetened beverage consumption.[65] Future research aiming to enhance protective health behaviors against chronic disease among

Black/AAs should explore how to capitalize on these credible sources of health information to promote positive health indicators.

Limitations

There are limitations of note in the current study. Although results of this study are from a single major research university in the southeastern region of the US, the demographic makeup of this sample is reflective of the general population of college students.[66,67] However, to provide further support for generalizing results, this study should be replicated among college students from more diverse institutions of higher learning. With regard to the survey methodology, this study adopted a cross-sectional design to disseminate an online survey to college students. Because the cross-sectional research design was selected, results of this study imply correlation. Cause and effect relationships between eHealth Literacy, intensity of Instagram use, and online social capital cannot be established. Also, despite sending reminder emails and offering incentives to potential study participants, there was a relatively low response rate (18%).[68,69] To increase response rates in future online surveys of college students, future research should leverage social networking websites, such as Instagram, to recruit subjects from this population.

TRANSLATION TO HEALTH EDUCATION PRACTICE

Findings from this study provide important implications for health education specialists to consider for future practice, research, and policies among college students for online chronic disease prevention and health promotion initiatives. Engaging in multiple health-risk behaviors is associated with poorer mental health status among the university population.[70] In addition, despite reporting relatively normal BMI ranges, low fruit and vegetable intake has been observed among college students as well.[71] As compared to the market research estimates of college students who use Instagram,[42] there is approximately double the number of college students in our sample who report using this social networking website. High rates of behavioral risk factors coupled with consistent use of Instagram among college students makes it an opportune platform for health education specialists to disseminate chronic disease prevention messages among this at-risk population.

eHealth Literacy is positively associated with online bridging social capital, and this relationship is strengthened by higher intensity of Instagram use among college students. Increasing college student intensity of Instagram use for chronic disease prevention and health promotion has the potential to facilitate greater connections with college students that may enhance their health information seeking and evaluation skills. Because college students who typically use Instagram with greater intensity have high perceptions of online bridging social capital, it will be important to incorporate college-specific social norms into the design of Instagram messages that encourage behaviors protective against chronic disease.

Instagram also has the potential to "blur the line between expert and peer health information."[72] Although greater intensity of Instagram use was associated with greater eHealth Literacy, the credibility of health information spread across this platform for chronic disease prevention and health promotion is largely unknown. As with any user-generated

social networking platform, health messages disseminated to connections may or may not be grounded in evidence or behavior change theory, leaving the potential for unintentionally promoting unhealthy behaviors that may lead to chronic disease. For example, Lapinski[73] reports that user-generated content on pro-eating disorder media may unintentionally leverage behavior change theory to promote binge eating and purging. Considering the power of social norms to influence health behavior,[74] some user-generated posts may promote unattainable body and weight standards that can be promoted through social norms from other users on Instagram. Although social networking websites have become tools to promote healthy eating and exercise behaviors in various populations,[75,76] health education specialists must not ignore the potentially negative images and messages that can be spread through the use of these platforms. Because images of real people on social media may be viewed as more engaging[53] and enhance attention, recall, and comprehension of a message,[49] health education specialists should explore which user-generated content and sources have the greatest potential to influence college students' health behaviors. Moreover, health education specialists should explore how college students evaluate the credibility of online health-related content via images within weak online social networks.

Before using Instagram as a tool to facilitate chronic disease prevention among college students, it will be important for health education specialists to understand how online bridging social capital is generated on Instagram. Moreover, it will also be important to understand why Instagram use may not improve online bonding social capital among college students in the same way that it does on Facebook.[26] Ultimately, health education specialists need to develop a better understanding of how image-based and non-verbal communication on social networking websites may better reach college students through targeted or tailored health messages to promote chronic disease prevention. Effective use of Instagram as a health promotion tool in college student populations may help prevent the early onset of health risk behaviors that can lead to some of our nation's most deadly chronic diseases later in life.

Acknowledgments

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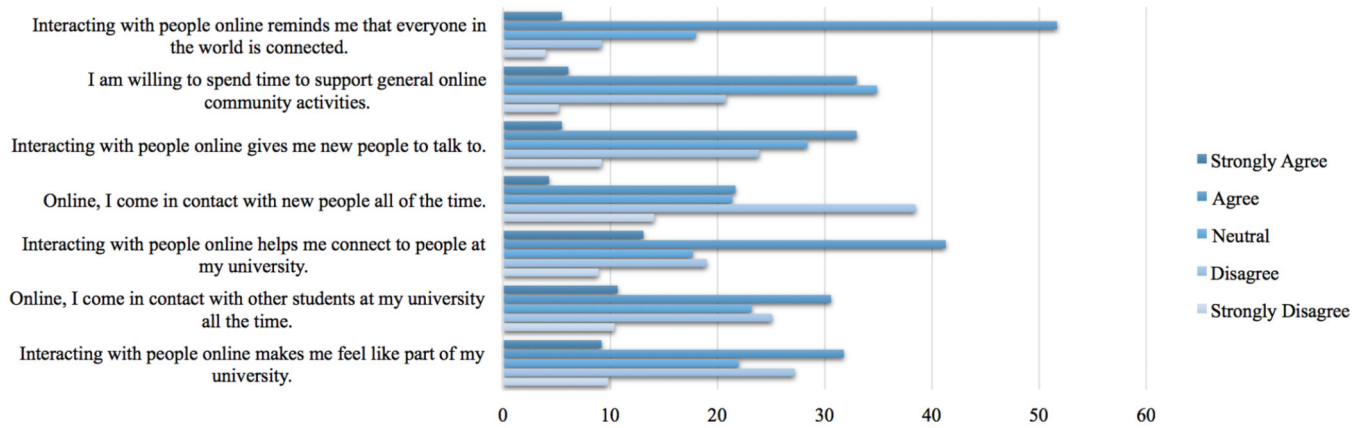
|	Interacting with people online makes me feel like part of my university.	Online, I come in contact with other students at my university all the time.	Interacting with people online helps me connect to people at my university.	Online, I come in contact with new people all of the time.	Interacting with people online gives me new people to talk to.	I am willing to spend time to support general online community activities.	Interacting with people online reminds me that everyone in the world is connected.
Strongly Agree	9.2	10.7	13.1	4.3	5.5	6.1	5.5
Agree	31.8	30.6	41.3	21.7	33	33	51.7
Neutral	22	23.2	17.7	21.4	28.4	34.9	18
Disagree	27.2	25.1	19	38.5	23.9	20.8	9.2
Strongly Disagree	9.8	10.4	8.9	14.1	9.2	5.2	4

Figure 1.
Online bridging social capital frequencies, % (*N* = 327)
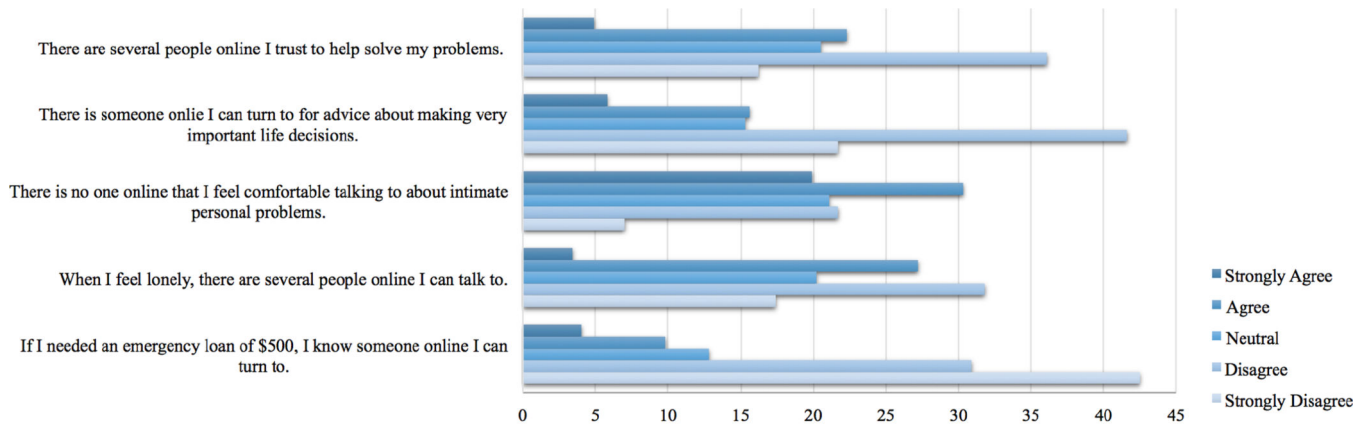
	If I needed an emergency loan of $500, I know someone online I can turn to.	When I feel lonely, there are several people online I can talk to.	There is no one online that I feel comfortable talking to about intimate personal problems.	There is someone onlie I can turn to for advice about making very important life decisions.	There are several people online I trust to help solve my problems.
Strongly Agree	4	3.4	19.9	5.8	4.9
Agree	9.8	27.2	30.3	15.6	22.3
Neutral	12.8	20.2	21.1	15.3	20.5
Disagree	30.9	31.8	21.7	41.6	36.1
Strongly Disagree	42.5	17.4	7	21.7	16.2

Figure 2.
Online bonding social capital frequencies, % (*N* = 327)
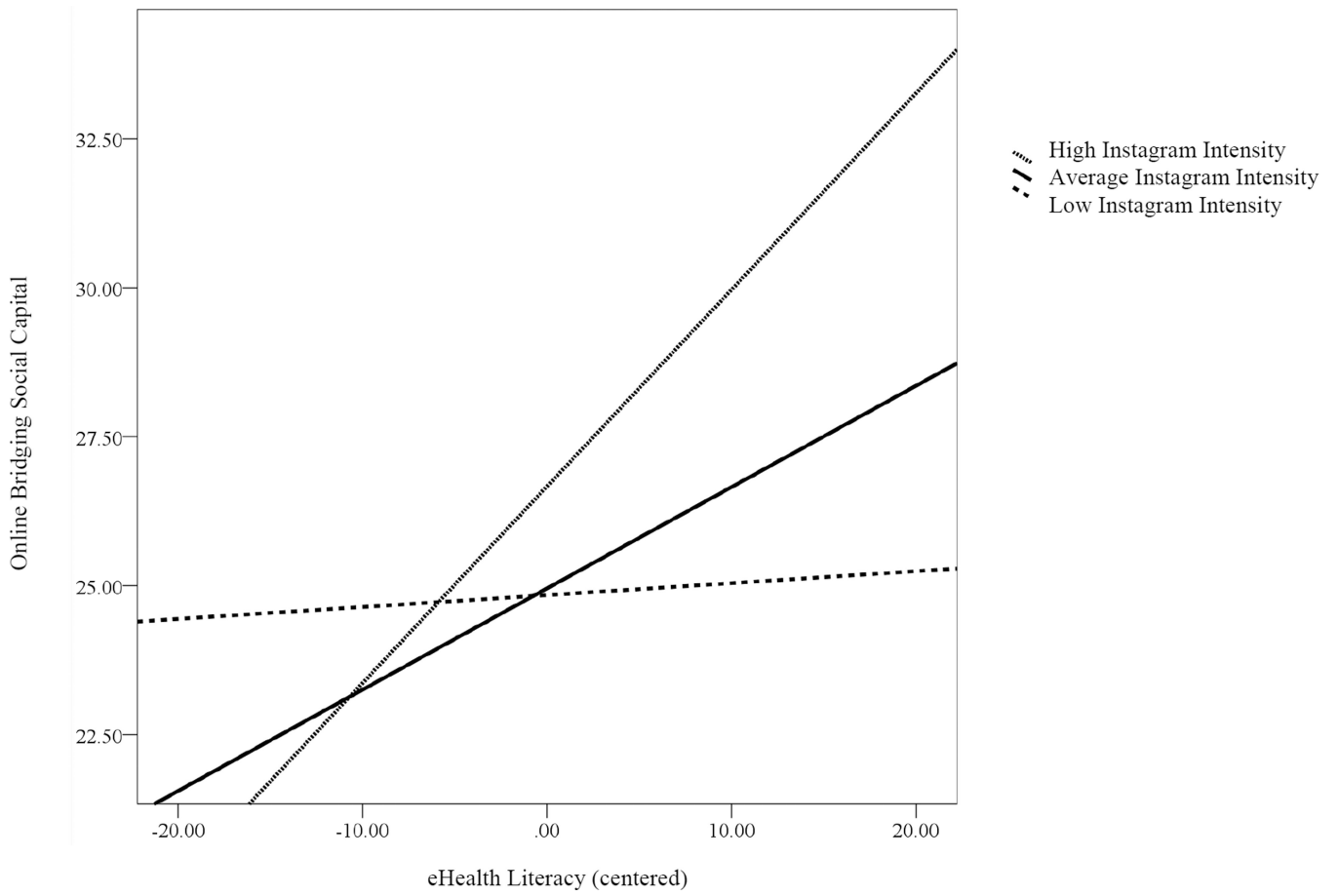
Figure 3.
Results of the interaction between eHealth literacy and intensity of Instagram use on online bridging social capital

Table 1

Socio-demographic characteristics of the sample ($N = 327$)

Characteristic	
Age *M* (*SD*)	24.34 (7.10)
Gender	*n* (%)
Female	166 (50.8)
Male	161 (49.2)
Race	*n* (%)
Caucasian	212 (64.8)
Asian American	67 (20.5)
Black/African American	19 (5.8)
American Indian	1 (0.3)
Native Hawaiian/Pacific Islander	1 (0.3)
Other	23 (7)
Missing	4 (1.2)
Ethnicity	*n* (%)
Non-Hispanic	273 (83.7)
Hispanic	53 (16.3)
Grade Point Average (GPA)	*n* (%)
4.00 – 3.50	199 (60.9)
3.49 – 3.00	97 (29.7)
2.99 – 2.50	24 (7.3)
2.49 – 2.00	2 (0.6)
Below 2.00	1 (0.3)
Missing	4 (1.2)

Table 2

Hierarchical linear regression model effects of eHealth Literacy on intensity of Instagram use ($n = 200$ Instagram users)

Predictor	R^2 Change	b	$SE\ b$	95% CI Lower Bound	95% CI Upper Bound
Step 1	.14***				
Age[a]		−0.42***	0.11	−0.63	−0.21
Gender[b]		2.18*	1.10	0.03	4.33
GPA		0.23	0.74	−1.23	1.68
Ethnicity		−2.20	1.38	−4.91	0.52
Caucasian		2.29	2.02	−1.70	6.28
Asian American		0.61	2.29	−3.91	5.13
Black/African American		1.19	2.69	−4.12	6.49
Step 2	.18**				
eHealth Literacy[d]		.30**	.10	0.09	0.50
Total R^2	.18**				
Adjusted R^2	.14**				

[a] Age (centered at the mean).

[b] Gender (0 = male, 1 = female).

[c] Intensity of Instagram use (centered at the mean).

[d] eHealth literacy (centered at the mean)

*
p < .05.

**
p < .01.

***
p < .001

Table 3

Hierarchical linear regression model effects of eHealth literacy and intensity of Instagram use on online bridging social capital in college students ($n = 200$ Instagram users)

Predictor	R^2 Change	b	$SE\ b$	95% CI Lower Bound	Upper Bound
Step 1	.05				
Age[a]		−0.06	0.08	−0.21	0.10
Gender[b]		0.89	0.78	−0.66	2.43
GPA		0.76	0.53	−0.29	1.80
Ethnicity		−0.83	0.99	−2.78	1.13
Caucasian		−2.13	1.45	−4.99	0.73
Asian American		−0.39	1.65	−3.64	2.85
Black/African American		−3.14	1.93	−6.95	0.67
Step 2	.16***				
Intensity of Instagram use[c]		0.20***	0.05	0.10	0.30
eHealth Literacy[d]		0.17*	0.72	0.27	0.31
Step 3	.19*				
eHealth literacy × Intensity of Instagram Use		0.02*	0.01	0.01	0.04
Total R^2	.19*				
Adjusted R^2	.14*				

[a] Age (centered at the mean).

[b] Gender (0 = male, 1 = female).

[c] Intensity of Instagram use (centered at the mean).

[d] eHealth literacy (centered at the mean)

*
$p < .05$.

**
$p < .01$.

***
$p < .001$