



Contents lists available at ScienceDirect

# Personality and Individual Differences

journal homepage: [www.elsevier.com/locate/paid](http://www.elsevier.com/locate/paid)

## Social media use, personality characteristics, and social isolation among young adults in the United States

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### ARTICLE INFO

#### Keywords:

Personality  
Social media  
Social isolation  
Conscientiousness  
Neuroticism  
Agreeableness  
Extraversion

### ABSTRACT

Although increased social media use (SMU) has been linearly associated with increased real-life social isolation (SI), it is unknown whether these associations differ by personality characteristics. With a nationally-representative sample of 1768 U.S. young adults aged 19–32, we assessed SI using a 4-item Patient-Reported Outcomes Measurement Information System scale, and personality using the 10-item Big Five Inventory. Using ordered logistic regression, we evaluated multivariable associations between SMU, personality characteristics, and SI. Extraversion and agreeableness were associated with lower odds of SI, while neuroticism was associated with higher odds. A significant interaction term demonstrated that the association between SMU and SI differed by conscientiousness. Among those with low conscientiousness, compared with the lowest quartile of SMU, those in the highest quartile had more than three times the odds (AOR = 3.20, 95% CI = 1.99, 5.15) for increased SI, but there was no significant association among the high conscientiousness group. Interaction terms between SMU and the other four personality characteristics were not significant. Conscientious individuals may approach social media in a way that helps maintain good face-to-face social interactions, reducing perceived SI.

### 1. Introduction

Social isolation (SI) is associated with negative health outcomes, including increased mortality (Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015). SI results in disturbances including increased sympathetic tone and glucocorticoid signaling, resulting in decreased immunity, poor sleep, and poor cognitive functioning (Cacioppo & Hawkey, 2009; Cacioppo, Hawkey, Norman, & Bertson, 2011). Other research suggests SI increases vascular disease risk, such as coronary heart disease and stroke, and can influence gene expression in such a way as to negatively impact mental health (Dang et al., 2015; Valtorta, Kanaan, Gilbody, Ronzi, & Hanratty, 2016).

SI can refer to objective or subjective SI (i.e., one could feel socially isolated but still have numerous social ties). Objective SI refers to physical isolation or a lack of social interaction (Holt-Lunstad et al., 2015). Subjective SI refers to the perception of isolation or disconnectedness (Holt-Lunstad et al., 2015). Our study focused on subjective, perceived SI, as it has been linked to poor mental health outcomes and increased mortality (Cacioppo & Hawkey, 2009).

Up to 90% of U.S. young adults use social media, from 12% in 2005 (Perrin, 2015). Because the goal of social media platforms is connecting

people, one might expect that increased social media use (SMU) would be associated with less SI and greater emotional support. However, the largest nationally-representative study to date counter-intuitively found that increased SMU—both in terms of time per day and frequency of site visits—was associated with low emotional support in a linear fashion (Shensa, Sidani, Lin, Bowman, & Primack, 2016). This result suggests that SMU might not be as effective as hoped in reducing SI and increasing emotional support. However, all individuals interact with social media differently. Personality differences explain some variance in the types of updates users post, leading to responses that may be socially rewarding or exclusionary (Marshall, Lefringhausen, & Ferenczi, 2015). Additionally, certain personality characteristics—extraversion, neuroticism, and openness—have been associated with increased SMU (Correa, Hinsley, & de Zúñiga, 2010; Mark & Ganzach, 2014).

It is not clear how the behaviors described by personality factors may influence the association between SMU and SI. For example, extraversion describes highly engaged, energetic, sociable behavior (McCrae & John, 1992). If these behaviors transfer online, extraverted individuals might form stronger ties due to increased volume and intensity of communication (Correa et al., 2010; Mark & Ganzach, 2014).

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Alternatively, increased online interaction could increase hazards encountered, including misinterpretation of comments, which may be associated with increased SI.

According to the Big Five theory of personality, there are four other personality traits: neuroticism, conscientiousness, openness to experience, and agreeableness (McCrae & John, 1992). Neuroticism describes anxious behaviors, negative affect, and self-consciousness, which may foster overreaction to negative online situations, leading to increased SI (McCrae & John, 1992). Alternatively, social media may allow neurotic individuals to form bonds that may be more difficult offline (Chan, 2014).

Conscientiousness describes diligence, impulse control, and organized behaviors, which may allow individuals to maintain greater control over emotions and impulses, thereby navigating social media more smoothly (McCrae & John, 1992). Openness to experience describes behaviors that tend toward intellectualism, creativity, and appreciation for the arts, which may be less relevant to associations between SMU and SI (McCrae & John, 1992). Finally, agreeableness describes altruistic behavior, consideration, and caring which may allow individuals to form strong ties online that decrease perceived SI (McCrae & John, 1992).

While evidence suggests that SMU is associated with emotional support and SI, and that personality characteristics are associated with SMU, interactions between personality characteristics and SMU in relation to SI have not been assessed (Correa et al., 2010; Shensa et al., 2016). This is an important gap in the literature, because understanding how personality-related behaviors may influence the association between SMU and SI may help develop targeted interventions and recommendations.

Therefore, in a nationally representative sample of U.S. young adults, we aimed to assess (1) associations between personality characteristics and SI and (2) interactions between personality characteristics and SMU as they relate to SI.

We focused on young adults because of the particular increase of social media use among this group, and because this group is at higher risk for SI, when individuals are leaving comfortable environments such as home or school, and experiencing rapid changes in romantic relationships and work (Arnett, Zukauskienė, & Sugimura, 2014). The Big Five personality theory complements and extends prior research (Hughes, Rowe, Batey, & Lee, 2012; Lee, Ahn, & Kim, 2014). Based on the literature, we hypothesized extraversion would be associated with decreased SI (H1a), and extraverted behavior would not affect the association between SMU and SI (H1b). Neuroticism, we hypothesized, would be associated with increased SI (H2a), and neurotic behavior would amplify the association between SMU and SI (H2b). We hypothesized conscientiousness would be associated with decreased SI (H3a), and conscientious behavior would dampen the association between SMU and SI (H3b). We hypothesized that openness (less of a social construct) would not have a direct association with SI (H4a), nor an indirect one through interaction with SMU (H4b). Similarly, we hypothesized that agreeableness would not be directly (H5a) or indirectly (H5b) associated with SI (McCrae & John, 1992).

## 2. Methods

### 2.1. Design, participants, and setting

We surveyed a nationally-representative sample of U.S. young adults aged 19–32, who answered questions about SMU, personality, and SI. This sample came from a panel maintained by Growth from Knowledge (GfK), a survey research organization (GfK KnowledgePanel®, 2013). GfK recruits participants by address-based sampling and random digit dialing, maintaining a sampling frame across 97% of the U.S. population (GfK KnowledgePanel®, 2013). GfK continuously recruits participants, a sampling strategy shown to be statistically valid for surveying health indicators (Baker et al., 2010;

GfK KnowledgePanel®, 2013). Researchers access GfK panels at negotiated costs based on sampling complexity, number of participants, and target demographics.

October–November 2014 our Web-based survey was sent to a random sample of 3048 non-institutionalized young adults. These individuals consented to an 18-month prior study wave for which the only criterion was that participants be ages 18–30 at baseline. We used the follow-up study data because SMU items were not asked at baseline. Thus, although age 32 is often not considered “young adult,” we will use that term here. Though the survey was part of a longitudinal study, the data for this study were collected at one time point. Responses were received from 1796 participants (59%), representing a very strong response rate because many baseline respondents were likely no longer in the panel, which turns over participants every two years to prevent survey fatigue.

GfK employs several data quality improvement strategies. They screen all data sets for patterns suggesting lack of participant effort. GfK minimizes survey length to reduce scrolling and avoids long grids. Participants were not forced to answer any items, but prompted once for unanswered questions.

Median survey completion time was 15 min, and participants received \$15. This study was approved by the [blinded for review] Institutional Review Board and was granted a Certificate of Confidentiality from the National Institutes of Health.

### 2.2. Participant demographics

Of 1796 individuals who responded, our final sample included 1768 individuals with complete responses. There were no differences between individuals included and those with missing responses on key study variables with respect to age ( $F[1.9, 3416.9] = 1.2, p = 0.30$ ), sex ( $F[1.0, 1795] = 0.01, p = 0.94$ ), or race ( $F[2.6, 4634.1] = 2.7, p = 0.06$ ). In addition, our survey weight accounted for non-response in addition to over- and under-coverage.

The weighted sample was 50.3% female, 57.5% White, 13.0% Black, 20.6% Hispanic, and 8.9% biracial/multiracial/other. In the sample 55.6% were married or in a committed relationship, and 35.6% lived with a significant other. For household income, 22.9% responded “Under \$30,000” and 38.7% responded “\$75,000 and above.” For education, 36.0% had high school or less, and 25.7% had a bachelor's degree or more (Table 1).

### 2.3. Measures

Participants completed online survey items including SI, SMU, personality, and covariates.

#### 2.3.1. Social isolation

We assessed SI using a 4-item Patient-Reported Outcomes Measurement Information System (PROMIS) scale. The scale has been correlated with and validated against other commonly used measures of SI and assesses perceptions of being avoided, excluded, disconnected from, or unknown by others (Johnston et al., 2016; Stacciarini, Smith, Garvan, Wiens, & Cottler, 2015). For example, one item asks how frequently in the past 7 days respondents felt left out. Items were scored using a 5-point Likert scale. Summing the numerical score for the 4 items gave a raw score for SI between 4 and 20.

We collapsed the raw scores into tertiles of “low,” “medium,” and “high” SI for analysis to differentiate between conceptually distinct categories of SI. The large number of individuals who responded without SI resulted in a skewed distribution, making analyses requiring a continuous dependent variable unfavorable. A transformation to correct this was not feasible, because even with any transformation, the result was non-normal. The PROMIS scale aims to grade severity rather than providing a cut-off, and no established clinical cut-off for SI exists, so we approximated tertiles using Stata 12.1 (Stata Corp., College

**Table 1**  
Social media use and sociodemographic characteristics of the whole sample and different levels of social isolation: U.S. Survey of Social Media Use and Emotional Health, 2014.

Independent variable	Whole sample	Social isolation			P value <sup>b</sup>
		Low	Medium	High	
	Column % <sup>a</sup>	Column % <sup>a</sup>			
<b>Social media use</b>					
Time, min per day					0.002
Quartile 1 (0–30)	29.8	35.4	28.2	22.3	
Quartile 2 (31–60)	20.8	21.8	23.2	16.3	
Quartile 3 (61–120)	24.0	22.8	21.0	29.6	
Quartile 4 (121 and above)	25.5	20.1	27.6	31.9	
<b>Personality</b>					
Extraversion					< 0.001
Low	41.0	23.5	46.9	62.9	
High	59.0	76.5	53.1	37.1	
Neuroticism					< 0.001
Low	51.7	66.6	48.3	30.9	
High	48.3	33.4	51.7	69.1	
Conscientiousness					< 0.001
Low	49.6	35.7	57.4	63.1	
High	50.4	64.3	42.6	36.9	
Agreeableness					< 0.001
Low	53.3	39.5	57.9	70.6	
High	46.7	60.5	42.1	29.4	
<b>Sociodemographic</b>					
Age, y					0.088
19–23	33.7	32.9	33.7	34.8	
24–26	24.8	21.6	30.5	23.1	
27–32	41.6	45.5	35.9	42.1	
Sex					0.074
Female	50.3	45.7	55.0	52.2	
Male	49.7	54.3	45.0	47.8	
Race					0.062
White, non-Hispanic	57.5	58.1	56.7	57.3	
Black, non-Hispanic	13.0	15.3	9.9	12.9	
Hispanic	20.6	21.4	20.4	19.6	
Other <sup>c</sup>	8.9	5.2	13.0	10.2	
Relationship status					0.0003*
Single/widowed/divorced	44.5	36.1	50.6	51.0	
Married/committed relationship	55.6	63.9	49.4	49.0	
Living situation					0.003
Parent/guardian	34.0	34.5	33.5	33.8	
Significant other	35.6	41.4	27.9	35.4	
Other <sup>d</sup>	30.4	24.1	38.5	30.9	
Yearly household income, \$					0.003
0–30,000	22.9	18.8	20.5	32.7	
30,000–74,999	38.4	40.8	41.2	31.2	
≥ 75,000	38.7	40.5	38.3	36.1	
Education level					0.95
High school or less	36.0	36.7	34.6	36.3	
Some college	38.3	37.0	39.8	38.8	
Bachelor's degree or higher	25.7	26.3	25.6	25.0	

<sup>a</sup> Values may not total 100 due to rounding. Column percentages are based upon survey weighted data, therefore may not be congruent with the cell frequency proportion of total N.

<sup>b</sup> P value derived using chi-square analyses comparing proportion of users in each category.

<sup>c</sup> Includes multiracial.

<sup>d</sup> Defined as not living with a parent/guardian or significant other.

Station, Texas). As a result, 39% of participants were considered low SI, 31% were medium SI, and 30% were high SI. The raw scores for low, medium, and high SI were 4–6, 7–10, and 11 and above, respectively. The scale displayed excellent internal consistency and reliability (Cronbach's  $\alpha = 0.92$ ).

### 2.3.2. Social media use

We assessed SMU by asking participants to estimate the amount of

time they spend on social media, not including time spent for professional use. Commonly used platforms were included: Facebook, Twitter, Google +, YouTube, LinkedIn, Instagram, Pinterest, Tumblr, Vine, Snapchat, and Reddit. Participants entered hours and minutes on an average day into numerical fields. To improve interpretability, we collapsed SMU into quartiles for the primary analysis. We also assessed SMU by frequency of visits to social media sites. Our analyses using frequency produced similar results to those discussed here, so we chose to focus on time, as it is easier to conceptualize. To ensure robustness of results, we also conducted all analyses with independent variables as continuous.

### 2.3.3. Personality

We assessed personality using the 10-item Big Five Inventory (BFI-10). A trait-based approach to personality lends itself best to assessment by survey, as compared with social-cognitive theory, for example. Additionally, the BFI-10 lent itself well to use within the context of a larger survey. Developed to abbreviate the original 44-item Big Five Inventory (BFI-44), BFI-10 is reliable and valid compared with other measures of personality (Rammstedt & John, 2007; Thalmayer, Saucier, & Eigenhuis, 2011). The format of all items is a descriptive phrase following “I see myself as someone who...” Participants responded on a 0–10 scale, with 0 being “Strongly Disagree” and 10 being “Strongly Agree.” Each characteristic was assessed by two items, one scored directly and one reverse-scored, which aims to reduce method bias from common scale formats among items (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). The scores from the two items were averaged to produce a final 0–10 score, and each characteristic was divided using the median into “high” and “low” levels. With a nationally-representative sample, median-splits are not dataset-specific, but represent the population of U.S. 19–32 year-olds. These splits are also useful for conceptualization and future clinical use, as they provide a cut-off value for categorizing individuals. For each characteristic, we used the Spearman-Brown prediction formula to calculate reliability. This is the preferred method for two-item scales because it is less sensitive than coefficient alpha to violations of measurement model assumptions (Eisinga, Grotenhuis, & Pelzer, 2013). Reliability coefficients for extraversion, neuroticism, conscientiousness, openness, and agreeableness in their continuous scales were 0.47, 0.44, 0.36, 0.02, and 0.31, respectively. Due to the low reliability coefficient for openness, this personality trait was removed from analyses. To ensure robustness of results, we also conducted all analyses with these variables as continuous.

### 2.3.4. Covariates

Based on the data distribution, protocols established by GfK, and interpretability of the results, we divided the sample into three age groups (19–23; 24–26; 27–32) and race/ethnicity into five mutually exclusive groups (White, non-Hispanic; Black, non-Hispanic; Hispanic; biracial, multiracial; or Other, non-Hispanic). Other covariates assessed included personal and environmental factors, including relationship status (single, in a committed relationship), living situation (with a parent or guardian; with a significant other; other situation), household income (under \$30,000; \$30,000–74,999; or \$75,000 and above) and level of education (high school or less; some college; bachelor's degree or higher).

(Kessler, Chiu, Demler, Merikangas, & Walters, 2005; Pew Research Center, 2015).

### 2.4. Data analysis

For analysis, we included participants who had complete data for SI, personality, and SMU. Less than 2% had missing data for these, so this did not affect our results. We calculated percentages of SI, time spent on social media, personality characteristics, and covariates. We used chi-square tests to assess bivariable associations between each independent

variable and covariate and SI.

Using ordered logistic regression, we conducted one analysis for each personality characteristic to evaluate multivariable associations between SMU, personality characteristics, and SI. To evaluate interactions between personality characteristics and SMU, we added interaction terms to each model. The significance of interaction effects was assessed using the adjusted Wald test.

To improve interpretability of results, we performed stratified ad hoc analyses when there was a significant interaction term. In these cases, we performed separate analyses that computed multivariable odds ratios for SMU on SI for those above and below the median for that characteristic.

All covariates were included in each multivariable model. All primary analyses were conducted using survey weights to take into account sex, age, race/ethnicity, education, household income, census region, metropolitan area, and internet access. We used regression analyses to determine if there was a linear trend between the ordered categorical variables (time, age, household income, education level) and SI.

To examine the robustness of our results, we performed four sets of sensitivity analyses. First, we performed all analyses selecting only the covariates with a bivariable association of  $P < 0.15$  with the outcome to ensure that our models did not over-control. Second, we performed all analyses without survey weights. Third, we conducted all analyses with independent variables in their original continuous scales. Finally, we conducted all analyses with personality subscales in their original continuous scales. Each sensitivity analysis demonstrated similar results to the primary analyses.

All statistical analyses used Stata 12.1 (Stata Corp., College Station, Texas), and two-tailed  $p$ -values  $< 0.05$  were considered significant.

### 3. Results

#### 3.1. Social isolation

Of the weighted sample, 42% had “low SI” with a raw score of 4–6, 31% had “medium SI” with a raw score of 7–10, and 27% had “high SI” with a raw score of 11 or above.

#### 3.2. Social media use and personality characteristics

Median time spent on social media was 61 min per day (interquartile range [IQR] = 30–135). Of the weighted sample, 41.0% were categorized as low extraversion and 59.0% as high. For neuroticism, 51.7% were categorized as low and 48.3% as high. For conscientiousness, 49.6% and 50.4% were categorized as low and high, respectively. Finally, 53.3% of the sample was categorized as low in agreeableness, and 46.7% as high. (Table 1).

#### 3.3. Bivariable analyses

We found significant bivariable associations between time spent on social media and SI ( $p = 0.002$ ). Significant associations existed for four personality characteristics and SI. Low extraversion, high neuroticism, low conscientiousness, and low agreeableness were all significantly associated with increased SI (all  $p < 0.001$ ) (Table 1). Three covariates had significant bivariable associations with SI (Table 1). For example, being single (vs. married) and having lower household income were significantly associated with SI ( $p = 0.0003$  and  $0.003$ , respectively) (Table 1).

#### 3.4. Multivariable analyses

In each multivariable model, regardless of personality, participants in the highest quartile of time spent on social media compared with those in the lowest had significantly greater odds of SI (Table 2). These

associations showed a significant linear trend (Table 2).

Three personality characteristics were significantly associated with SI (Table 2). Extraversion and agreeableness were significantly associated with lower odds of SI (OR = 0.31, 95% CI = 0.20–0.49; OR = 0.45, 95% CI = 0.29–0.71; respectively). Neuroticism was significantly associated with higher odds of SI (OR = 3.08, 95% CI = 1.97–4.83).

While conscientiousness was not significantly associated with SI, the interaction between time spent on social media and conscientiousness was significantly associated with SI ( $p = 0.003$ ; Table 2). We conducted post-hoc analyses stratifying for level of conscientiousness. For participants in the low conscientiousness group, a strong linear association between SMU and SI exists (Fig. 1). Among those in the low conscientiousness group, compared with those in the lowest quartile of SMU, those in the highest quartile had more than three times the odds (AOR = 3.20, 95% CI = 1.99, 5.15) for SI. However, among those in the high conscientiousness group, there was no significant association between SMU and SI.

The only covariates significantly associated with SI in the multivariable models were relationship status and yearly household income (Table 2). This remained true in each model, regardless of personality characteristics.

## 4. Discussion

Among a nationally-representative sample of young adults, SMU was linearly associated with SI across personality characteristics. Extraversion and agreeableness were significantly associated with lower odds of SI, whereas neuroticism was significantly associated with higher odds of SI. Findings support hypotheses (H1a), (H2a), and contradict (H3a) and (H5a). Conscientiousness is the only characteristic that interacts with SMU and its effect on SI. Specifically, SMU and SI are significantly and linearly associated for those in the low conscientiousness group. For those in the high conscientiousness group, no significant association between SMU and SI exists. Results support hypotheses (H1b), (H3b), and (H5b), and contradict (H2b).

Notably, SMU was independently associated with SI regardless of personality. Prior research suggests that SMU is associated with emotional support, and our findings emphasize the robustness of this association (Shensa et al., 2016). Studies on the mechanisms of this association would benefit our understanding, with the goal of intervening in SI. For now, these results can guide how healthcare providers counsel individuals to minimize SI.

High extraversion and agreeableness are associated with decreased SI. The association between extraversion and lower SI is consistent with the behaviors that extraversion describes. If you are more likely to be engaged, energetic, and sociable, you might also be more active in seeking out interactions that prevent SI (McCrae & John, 1992). Similarly, an agreeable person who behaves with altruism, consideration, and caring is well-equipped to begin and maintain relationships, potentially preventing SI (McCrae & John, 1992). Interestingly, one study found extraversion was the only Big Five trait not associated with concern about responses to one's selfies, and extraversion and agreeableness were associated with a tendency to like or comment on others' selfies (Choi, Sung, Lee, & Choi, 2017). This seems congruent; more extroverted or agreeable individuals might focus on positive interactions online and feel less isolated as a result.

Those in the high neuroticism group have higher odds of SI, consistent with the behaviors described by neuroticism. Individuals who are more anxious with negative affect might have difficulty initiating or maintaining relationships, predisposing them to SI (McCrae & John, 1992). Interestingly, a study by Seidman observed an association between neuroticism and sharing hidden or ideal aspects of oneself (Seidman, 2013). Perhaps individuals employ comparison of these aspects, which could contribute to perceived isolation when it produces envy or shame. Further exploration of whether comparison plays a role

**Table 2**  
Adjusted odds for social isolation based on social media use, personality traits, and sociodemographic characteristics: U.S. Survey of Social Media Use and Emotional Health, 2014.

Independent variables	Social isolation AOR			
	Model 1	Model 2	Model 3	Model 4
	Extraversion	Neuroticism	Conscientiousness	Agreeableness
Time, min per day				
Quartile 1 (0–30) [Ref]	1	1	1	1
Quartile 2 (31–60)	1.65 (1.03–2.67)	1.39 (0.85–2.28)	1.69 (0.99–2.89)	1.31 (0.80–2.15)
Quartile 3 (61–120)	2.33 (1.22–4.44)	1.48 (0.84–2.62)	2.90 (1.74–4.86)	1.95 (1.14–3.35)
Quartile 4 (121 and above)	2.56 (1.50–4.38)	1.87 (1.13–3.10)	3.20 (1.99–5.15)	1.93 (1.20–3.10)
Personality trait				
Low [Ref]	1	1	1	1
High	0.31 (0.20–0.49)	3.08 (1.97–4.83)	0.87 (0.55–1.38)	0.45 (0.29–0.71)
Interaction effect <sup>a</sup>	0.72	0.77	0.003	0.27
Age, y				
19–23 [Ref]	1	1	1	1
24–26	1.10 (0.77–1.57)	1.13 (0.79–1.60)	1.09 (0.78–1.53)	1.13 (0.80–1.61)
27–32	0.99 (0.68–1.44)	0.92 (0.63–1.32)	0.97 (0.68–1.37)	0.92 (0.64–1.33)
Sex				
Female [Ref]	1	1	1	1
Male	0.82 (0.62–1.10)	1.00 (0.76–1.32)	0.82 (0.62–1.08)	0.80 (0.61–1.06)
Race				
White, non-Hispanic [Ref]	1	1	1	1
Black, non-Hispanic	0.62 (0.37–1.05)	0.69 (0.40–1.17)	0.73 (0.44–1.21)	0.72 (0.44–1.21)
Hispanic	0.84 (0.57–1.23)	0.73 (0.50–1.07)	0.73 (0.51–1.06)	0.75 (0.51–1.09)
Other <sup>a</sup>	1.26 (0.81–1.94)	1.35 (0.85–2.12)	1.29 (0.81–2.04)	1.32 (0.86–2.00)
Relationship status				
Single/widowed/divorced [Ref]	1	1	1	1
Married/committed relationship	0.64 (0.45–0.92)	0.61 (0.43–0.87)	0.52 (0.36–0.74)	0.58 (0.41–0.81)
Living situation				
Parent/guardian [Ref]	1	1	1	1
Significant other	1.30 (0.84–2.01)	1.40 (0.91–2.14)	1.37 (0.90–2.10)	1.33 (0.88–2.00)
Other <sup>b</sup>	1.36 (0.95–1.96)	1.33 (0.93–1.88)	1.16 (0.83–1.64)	1.14 (0.81–1.62)
Yearly household income, \$				
0–30,000 [Ref]	1	1	1	1
30,000–74,999	0.55 (0.38–0.79)	0.57 (0.40–0.81)	0.56 (0.39–0.79)	0.58 (0.41–0.84)
≥ 75,000	0.63 (0.42–0.93)	0.61 (0.41–0.90)	0.59 (0.40–0.88)	0.60 (0.41–0.88)
Education level				
High school or less [Ref]	1	1	1	1
Some college	1.04 (0.73–1.50)	1.19 (0.82–1.70)	1.18 (0.83–1.68)	1.20 (0.84–1.72)
Bachelor's degree or higher	1.02 (0.69–1.50)	1.21 (0.82–1.79)	1.23 (0.83–1.82)	1.17 (0.79–1.72)

<sup>a</sup> Associated P value was determined by the adjusted Wald test for overall significance of the interaction effect in the model.

<sup>a</sup> Includes multiracial.

<sup>b</sup> Defined as not living with a parent/guardian or significant other.

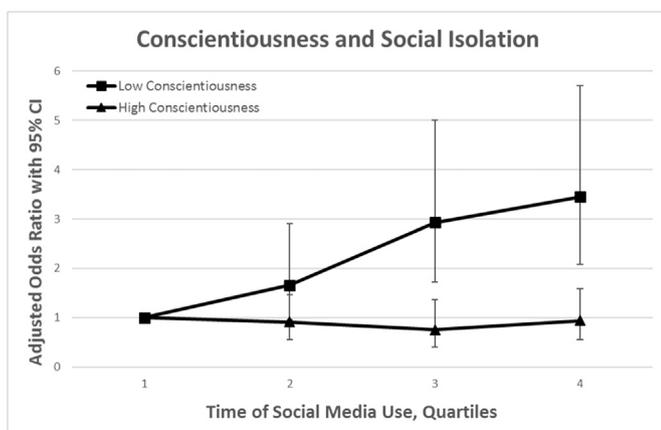


Fig. 1. Conscientiousness and social isolation.

in these associations is worthwhile. Our results contradict our hypothesis that conscientiousness would be associated with lower odds of SI. Perhaps this is because the behaviors described by conscientiousness are less socially-oriented (McCrae & John, 1992).

While personality is considered to be unchanging after development, these results can still shape interventions in SI. Providers can

educate patients about personality-related risks. Also, “social skills training,” based upon harmful personality-related behaviors may prevent negative outcomes. Additionally, other individual characteristics that might moderate the association between SMU and SI, such as self-esteem, narcissism, or attachment style are worth future investigation.

Though no direct association between conscientiousness and SI exists, an interaction exists between conscientiousness, SMU, and SI. SMU poses more significant risk for SI in those who act less conscientiously, as opposed to those who act more conscientiously. This makes sense, as individuals who are organized and diligent with good impulse control may approach SMU such that they maintain good face-to-face interactions, preventing SI. A study examining associations between self-presentation on Facebook and personality observed that conscientiousness was negatively associated with posting comments (Lee et al., 2014). Perhaps individuals with higher conscientiousness interact more carefully on social media, protecting themselves from negative interactions that contribute to perceived SI. Providers can caution patients who act less conscientiously about the greater risk associated with SMU. Also, “conscientiousness skills training” may help to decrease SI in larger groups.

While extraversion, agreeableness, and neuroticism all have associations with SI, these characteristics do not demonstrate significant interaction with SMU with regard to SI. That neuroticism does not amplify the association between SMU and SI suggests that while those

higher in neuroticism may be more prone to SI, their online interactions may not relate to this. Agreeableness was directly associated with lower odds of SI, contrary to our hypothesis. It did not interact with the association between SMU and SI, as hypothesized. This suggests that agreeable behaviors may be protective from SI in general, but do not impact individuals' SMU such that they are protected from SI. Our findings were similar for extraversion, and suggest that while a characteristic may describe behaviors that are generally protective, those behaviors will not necessarily translate to their SMU.

#### 4.1. Limitations

To accommodate the sample size, we could not use ecological momentary assessment or data directly from social media sites; in the future, use of these more fine-grained measures may be beneficial. Use of self-report presents the possibility of response bias. However, responses were anonymous and we informed participants that the study received a Certificate of Confidentiality from the National Institutes of Health, making response biases such as social desirability and acquiescence unlikely. While we could not formally assess the extent to which bias affected our results, we reduced common method bias by using clear, concise, and specific items, varied response scales and anchors, and assurance of anonymity. It would be valuable upon replication to separate predictor and outcome measures either temporarily or contextually to control for potential method bias (Podsakoff et al., 2003). Another limitation was the low within-trait correlations among personality items, especially openness. Using a 10-point response scale may have contributed to this, however, diminished psychometric properties associated with very brief measures are common and therefore our findings should be interpreted cautiously (Gosling, Rentfrow, & Swann, 2003). Our data were cross-sectional, limiting our ability to deduce directionality. Longitudinal studies may be useful in the future. The Big Five personality characteristics are descriptors, rather than drivers, of individual behaviors, so we cannot deduce a functional relationship between the characteristics themselves and SI and SMU. We studied young adults, so our results cannot be generalized to the whole U.S. population. Finally, though GfK turns over panel participants every two years, survey fatigue remains a possible limitation to using this survey method.

#### 4.2. Conclusion

This study found SMU and SI are strongly and linearly associated, regardless of personality characteristics. Also, extraversion and agreeableness are associated with decreased SI, whereas neuroticism is associated with increased SI. Finally, in those who act less conscientiously compared to those who act more conscientiously, SMU poses a higher risk of SI. These results demonstrate the robustness of the association between SMU and SI, and the variations in both SI and the risk that SMU poses for SI with individual differences in personality. They are generally consistent with the behaviors described by the personality characteristics. It will be important to study the mechanisms behind these associations. These results will be useful for making recommendations about personality and SMU with regard to SI, and for developing new interventions for SI.

#### References

Arnett, J. J., Zukauskienė, R., & Sugimura, K. (2014). The new life stage of emerging adulthood at ages 18–29 years: Implications for mental health. *The Lancet Psychiatry*, *1*(7), 569–576. [http://dx.doi.org/10.1016/S2215-0366\(14\)00080-7](http://dx.doi.org/10.1016/S2215-0366(14)00080-7).

Baker, R., Blumberg, S. J., Brick, J. M., Couper, M. P., Courtright, M., Dennis, J. M., ... Zahs, D. (2010). Research synthesis. *Public Opinion Quarterly*, *74*(4), 711–781. <http://dx.doi.org/10.1093/poq/nfq048>.

Cacioppo, J. T., & Hawley, L. C. (2009). Perceived social isolation and cognition. *Trends*

in *Cognitive Sciences*, *13*(10), 447–454. <http://dx.doi.org/10.1016/j.tics.2009.06.005>.

Cacioppo, J. T., Hawley, L. C., Norman, G. J., & Bernston, G. G. (2011). Social isolation. *Annals of the New York Academy of Sciences*, *1231*, 17–22. <http://dx.doi.org/10.1111/j.1749-6632.2011.06028.x>.

Chan, T. H. (2014). Facebook and its effects on users' empathic social skills and life satisfaction: A double-edged sword effect. *Cyberpsychology, Behavior and Social Networking*, *17*(5), 276–280. <http://dx.doi.org/10.1089/cyber.2013.0466>.

Choi, T. R., Sung, Y., Lee, J. A., & Choi, S. M. (2017). Get behind my selfies: The Big Five traits and social networking behaviors through selfies. *Personality and Individual Differences*, *109*, 98–101. <http://dx.doi.org/10.1016/j.paid.2016.12.057>.

Correa, T., Hinsley, A. W., & de Zúñiga, H. G. (2010). Who interacts on the Web?: The intersection of users' personality and social media use. *Computers in Human Behavior*, *26*(2), 247–253. <http://dx.doi.org/10.1016/j.chb.2009.09.003>.

Dang, Y. H., Liu, P., Ma, R., Chu, Z., Liu, Y. P., Wang, J. B., ... Gao, C. G. (2015). HINT1 is involved in the behavioral abnormalities induced by social isolation rearing. *Neuroscience Letters*, *607*, 40–45. <http://dx.doi.org/10.1016/j.neulet.2015.08.026>.

Eisinga, R., Grotenhuis, M. T., & Pelzer, B. (2013). The reliability of a two-item scale: Pearson, Cronbach, or Spearman-Brown? *International Journal of Public Health*, *58*(4), 637–642. <http://dx.doi.org/10.1007/s00038-012-0416-3>.

GfK KnowledgePanel® (2013). Knowledge panel design summary. Retrieved November 6, 2015, from <http://www.webcitation.org/6aAeLVY18>.

Gosling, S. D., Rentfrow, P. J., & Swann, W. B. (2003). A very brief measure of the Big-Five personality domains. *Journal of Research in Personality*, *37*(6), 504–528. [http://dx.doi.org/10.1016/S0092-6566\(03\)00046-1](http://dx.doi.org/10.1016/S0092-6566(03)00046-1).

Holt-Lunstad, J., Smith, T. B., Baker, M., Harris, T., & Stephenson, D. (2015). Loneliness and social isolation as risk factors for mortality: A meta-analytic review. *Perspectives on Psychological Science*, *10*(2), 227–237. <http://dx.doi.org/10.1177/1745691614568352>.

Hughes, D. J., Rowe, M., Batey, M., & Lee, A. (2012). A tale of two sites: Twitter vs. Facebook and the personality predictors of social media usage. *Computers in Human Behavior*, *28*(2), 561–569. <http://dx.doi.org/10.1016/j.chb.2011.11.001>.

Johnston, K. L., Lawrence, S. M., Dodds, N. E., Yu, L., Daley, D. C., & Plikonis, P. A. (2016). Evaluating PROMIS® instruments and methods for patient-centered outcomes research: Patient and provider voices in a substance use treatment setting. *Quality of Life Research*, *25*(3), 615–624. <http://dx.doi.org/10.1007/s11136-015-1131-3>.

Kessler, R. C., Chiu, W. T., Demler, O., Merikangas, K. R., & Walters, E. E. (2005). Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry*, *62*(6), 617–627. <http://dx.doi.org/10.1001/archpsyc.62.6.617>.

Lee, E., Ahn, J., & Kim, Y. J. (2014). Personality traits and self-presentation at Facebook. *Personality and Individual Differences*, *69*, 162–167. <http://dx.doi.org/10.1016/j.paid.2014.05.020>.

Mark, G., & Ganzach, Y. (2014). Personality and internet usage: A large-scale representative study of young adults. *Computers in Human Behavior*, *36*, 274–281. <http://dx.doi.org/10.1016/j.chb.2014.03.060>.

Marshall, T., Lefringhausen, K., & Ferenczi, N. (2015). The Big Five, self-esteem, and narcissism as predictors of the topics people write about in Facebook status updates. *Personality and Individual Differences*, *85*, 35–40. <http://dx.doi.org/10.1016/j.paid.2015.04.039>.

McCrae, R. R., & John, O. P. (1992). An introduction to the Five-Factor Model and its applications. *Journal of Personality*, *60*(2), 175–215. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,uid&db=aph&AN=9208170743&scope=site>.

Perrin, A. (2015). Social media usage: 2005–2015. Retrieved June 14, 2017, from <http://www.pewinternet.org/2015/10/08/social-networking-usage-2005-2015/>.

Pew Research Center (2015). Social media update 2015. Retrieved June 8, 2016, from <http://www.webcitation.org/6ajEhvS11>.

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879–903. <http://dx.doi.org/10.1037/0021-9010.88.5.879>.

Rammstedt, B., & John, O. P. (2007). Measuring personality in one minute or less: A 10-item short version of the Big Five Inventory in English and German. *Journal of Research in Personality*, *41*(1), 203–212. <http://dx.doi.org/10.1016/j.jrp.2006.02.001>.

Seidman, G. (2013). Self-presentation and belonging on Facebook: How personality influences social media use and motivations. *Personality and Individual Differences*, *54*(3), 402–407. <http://dx.doi.org/10.1016/j.paid.2012.10.009>.

Shensa, A., Sidani, J. E., Lin, L., Bowman, N., & Primack, B. A. (2016). Social media use and perceived emotional support among US young adults. *Journal of Community Health*, *41*(3), 541–549. <http://dx.doi.org/10.1007/s10900-015-0128-8>.

Stacciarini, J. M., Smith, R., Garvan, C. W., Wiens, B., & Cottler, L. B. (2015). Rural Latinos' mental wellbeing: A mixed-methods pilot study of family, environment and social isolation factors. *Community Mental Health Journal*, *51*(4), 404–413. <http://dx.doi.org/10.1007/s10597-014-9774-z>.

Thalmayer, A. G., Saucier, G., & Eigenhuis, A. (2011). Comparative validity of brief to medium-length Big Five and Big Six personality questionnaires. *Psychological Assessment*, *23*(4), 995–1009. <http://dx.doi.org/10.1037/a0024165>.

Valtorta, N. K., Kanaan, M., Gilbody, S., Ronzi, S., & Hanratty, B. (2016). Loneliness and social isolation as risk factors for coronary heart disease and stroke: Systematic review and meta-analysis of longitudinal observational studies. *Heart*, *102*(13), 1009–1016. <http://dx.doi.org/10.1136/heartjnl-2015-308790>.