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Loneliness and psychological distress before and during the COVID-19 pandemic: Relationships with social media identity bubbles

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ABSTRACT

Impacts of the COVID-19 pandemic on well-being and mental health are a concern worldwide. This article is based on two longitudinal studies that investigated the role of social media use in loneliness and psychological distress before and during the COVID-19 pandemic. Study 1 utilized nationally representative 3-point longitudinal data ($n = 735$) collected in 2017–2020 on the Finnish population. Study 2 utilized 5-point longitudinal data ($n = 840$) collected in 2019–2021 representing the Finnish working population. We analyzed the data using multilevel mixed-effects regression analysis. A longitudinal analysis of Study 1 showed that perceived loneliness did not increase among the Finnish population during the COVID-19 pandemic. Stronger involvement in social media identity bubbles predicted lower loneliness during the pandemic. Study 2 results showed that since the outbreak of the pandemic, psychological distress has increased among lonely individuals but not among the general working population. Involvement in social media identity bubbles predicted generally lower psychological distress during the COVID-19 pandemic, but it did not buffer against higher psychological distress among lonely individuals. The findings suggest that perceived loneliness is a risk factor for prolonged negative mental health effects of the pandemic. Social media identity bubbles can offer meaningful social resources during times of social distancing but cannot protect against higher psychological distress among those who perceive themselves as often lonely.

1. Introduction

In the COVID-19 era, concern about the mental health and social well-being effects of the pandemic are increasing worldwide (Moreno et al., 2020; Wu, 2020). Because of pandemic-related social restrictions (McQuaid et al., 2021; Oksanen et al., 2020), much of human interaction transferred to online environments in developed countries (Brown et al., 2021). Social media platforms such as Twitter, Facebook, and Instagram and instant message applications such as WhatsApp, Facebook Messenger, Telegram, and WeChat have increasingly become central means for people to communicate with each other (Limaye et al., 2020; Tsao et al., 2021). Involvement in such online environments can form identity-driven online cliques, i.e., social media identity bubbles that reinforce users' shared identities, perceived social homophily, and trust in information embedded within the cliques (Kaakinen et al., 2020). This new situation in people's social lives calls for up-to-date investigations on the role of involvement in social media identity bubbles in perceived loneliness and psychological distress.

Loneliness refers to a subjectively unpleasant experience that results from a perceived deficiency in one's social relationships (Peplau and Perlman, 1982). Concerns about increased loneliness have been expressed and reported in studies utilizing cross-sectional data sets during the COVID-19 pandemic (Beutel et al., 2021; Bu et al., 2020b; Cohn-Schwartz et al., 2021; Groarke et al., 2020), and, for example, a longitudinal study on the Dutch general population reported increased prevalence of emotional loneliness after the outbreak of the virus (van der Velden et al., 2021). However, some previous longitudinal investigations have reported no significant population-wide changes after the outbreak of the pandemic but have found some evidence of increased loneliness in subgroups such as single individuals living alone, older people, and extroverted youth while social distancing were in effect (Alt et al., 2021; Hansen et al., 2021; Luchetti et al., 2020; van Tilburg et al., 2021).

The need for meaningful social connections and a feeling of

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belonging are fundamental parts of being human (Baumeister and Leary, 1995; Cacioppo and Patrick, 2008). According to the cognitive approach (Peplau and Perlman, 1982), loneliness arises from the discrepancy between one's achieved and desired social relations. In Weiss' (1973) typology, social loneliness reflects the absence of an engaging social network such as friends or colleagues, and emotional loneliness concerns the absence of a close attachment figure such as a best friend or a partner. The evolutionary perspective views loneliness as a biological construct—an aversive signal similar to physical pain—that evolved to motivate people to pay more attention to their social needs and to seek out others (Cacioppo et al., 2006). Experiencing loneliness more chronically is connected to negative interpretations of social interactions (Qualter et al., 2015), which influence how a person engages with the social worlds (Cacioppo and Hawkley, 2009), such as by behaving in a more withdrawn or passive way in social interactions both offline and online (Nowland et al., 2018).

Loneliness is associated with numerous negative physical and mental health outcomes, such as morbidity, cardiovascular problems, anxiety, depression, and stress (Bzdok and Dunbar, 2020; Leigh-Hunt et al., 2017; McQuaid et al., 2021). One of the crucial mental health outcomes, psychological distress, refers to low mental well-being that is manifested through various symptoms, such as depression and fatigue (Drapeau et al., 2012). Studies have demonstrated increases in psychological distress among different populations during the COVID-19 pandemic compared to prepandemic times (Pierce et al., 2020; Shanahan et al., 2020). Some recent findings have pointed out that the highest level of psychological distress emerged in the early phases of the pandemic, but it declined relatively fast around the baseline (Daly and Robinson, 2021; Pierce et al., 2021). However, indications of a prolonged and pronounced deterioration in mental health have also been reported (Daly et al., 2020).

Previous studies have indicated that higher loneliness is associated with sociodemographic factors, such as age and gender, and other factors, such as living alone or not being in a relationship (Bu et al., 2020b; Dahlberg et al., 2021; Greenfield and Russell, 2011; Luhmann and Hawkley, 2016; Maes et al., 2019; McQuaid et al., 2021; Pinquart and Sörensen, 2003). Female gender and younger age also associate with higher psychological distress (Li and Wang, 2020), as does loneliness (Liu et al., 2021; Losada-Baltar et al., 2021).

Feelings of loneliness can expand through both offline and online social networks (Bzdok and Dunbar, 2020; Cacioppo and Hawkley, 2009). A systematic literature review by O'Day and Heimberg (2021) indicated that loneliness predicts problematic social media use, but a growing body of literature has also suggested a reverse direction—that problematic social media use predicts greater loneliness (Marttila et al., 2021; Meshi et al., 2020). Problematic social media use reflects a pattern of excessive use (Bányai et al., 2017; Wegmann et al., 2015) that is different from mere frequent use. Previous studies have indicated that frequent and extensive social media use are associated with higher perceived social isolation (Primack et al., 2017), and limited social media use with reduced loneliness (Hunt et al., 2018). Studies during the COVID-19 pandemic have found that social media use does not alleviate feelings of loneliness and their consequences (Cauberghe et al., 2021) and virtual contacts can even increase loneliness (Rumas et al., 2021).

Determining the relationship between loneliness and social internet use, however, requires more examination of how people use the internet (Nowland et al., 2018). According to a meta-analysis by Cheng et al. (2019), studies assessing certain use types revealed that for socially active people, social media offers more opportunities to interact with other people, in addition to offline encounters, but other people use it more to compensate the lack of social interaction offline. Certain activities such as browsing and interacting in visual image-based social media seem to be associated with lower loneliness (Pittman and Reich, 2016; Yang, 2016). Social internet use could increase loneliness when it is used for escaping from the offline social world and decrease loneliness when it is used for stimulating social connections (Nowland et al., 2018). Nowland et al. (2018) indicate that loneliness affects how a person interacts in the digital world, such as behaving more withdrawn or passive way in social interactions compared to nonlonely.

Lonely individuals with psychological and social problems are drawn by online communities (Sirola et al., 2019). The relevance of online communities has increased, especially with the rise of social networking sites and social media, during the last few decades (Keipi et al., 2017; Mikal et al., 2016). Online communities can serve as avenues for social contact and support (Robinson and Pond, 2019; Wang et al., 2015). Social support can have both direct and buffering effects on human health and well-being in stressful life events (Cohen and Wills, 1985). Particularly, positive and balanced social relationships are helpful in combating stress (Ellwardt et al., 2020). Recent studies have indicated that people perceived receiving more support from other people during the periods of social distancing (Luchetti et al., 2020; Philpot et al., 2021; Xu et al., 2020), and that such perceived support protected people from higher psychological distress and loneliness during the pandemic (Bu et al., 2020a; Yu et al., 2020).

Online communities enable social media identity bubbles that are identity-driven online cliques based on the human need to relate to other people, seek bonding with similar-minded others, and create and trust online peer support networks (Kaakinen et al., 2020; Keipi et al., 2017). The concept of social media identity bubbles was first introduced by Keipi et al. (2017) in the identity bubble reinforcement model. No prior studies have examined how social media identity bubbles function in relation to loneliness and psychological distress or if the pandemic affected these relationships.

The aim of this paper was to investigate the development of loneliness and psychological distress before and during the COVID-19 pandemic. We were interested in the role of people's involvement in social media identity bubbles during this time. Based on previous theories on loneliness, the need to belong, and social media identity bubbles (Baumeister and Leary, 1995; Keipi et al., 2017; Peplau and Perlman, 1982); empirical evidence on the social and mental health effects of the pandemic (Bu et al., 2020a; Daly et al., 2020; Liu et al., 2021; Losada-Baltar et al., 2021; Yu et al., 2020); and findings on the cognitive biases and behavior that the aversive state of loneliness can produce (Cacioppo and Hawkley, 2009; Nowland et al., 2018; Qualter et al., 2015) that could disconnect a person from potential benefits from the bubbles, we set the following hypotheses:

Hypothesis 1. Individuals who are in social media identity bubbles feel less lonely during the COVID-19 pandemic.

Hypothesis 2. Psychological distress increases among lonely individuals during the COVID-19 pandemic.

Hypothesis 3. Individuals who are in social media identity bubbles feel less psychologically distressed during the COVID-19 pandemic.

Hypothesis 4. Stronger involvement in social media identity bubbles does not buffer against higher psychological distress among often lonely individuals during the COVID-19 pandemic.

2. Study 1

2.1. Method

2.1.1. Participants and procedure

Study 1 used data from the longitudinal Digital Age in Finland survey. The data consisted of three measure points, of which the first measure point (T1) was conducted in December 2017 ($N = 3724$) and the second measure point (T2) in March–April 2019 ($N = 1134$). The third measure point (T3) was collected in May–June 2020 ($N = 735$), when multiple restrictions due to the first wave of the COVID-19 outbreak were still in place. The initial sample consisted of a random sample (66% of respondents) from the Finnish population register that was completed with panel data organized by Taloustutkimus Inc. T1

yielded a response rate of 30.8%. Compared to the number of respondents in T1, the response rate in T2 was 30.45%, and compared to the number of respondents in T2, the response rate in T3 was 64.81%. This study concerned the 735 respondents who participated in all three rounds of the longitudinal study. The final sample was representative of the Finnish population in terms of age ($M = 51.6$, $SD = 15.9$) and gender (males: 49.2%). In addition, it represented quite well the relative share of Finnish social media users. However, when compared to demographic figures, the data showed a strong emphasis on people with college or university degrees (48.3%) and retired people (32.4%). See Koivula et al. (2020) for a detailed description of the data collection and its representativeness.

2.1.2. Measures

Loneliness was measured with a single-item in which the participants were asked the question "Are you lonely?" and answered on a 5-point scale (1 = *never*, 2 = *rarely*, 3 = *sometimes*, 4 = *often*, 5 = *always*). Only 1% of the respondents "always" experienced loneliness during the time points, so we combined answers 4 and 5 to ensure sufficient observations for further analyses. A single-item technique has been a common way to measure loneliness in past research (e.g., Victor and Yang, 2012). It has also been found that the use of alternative measures produces similar results on the prevalence of loneliness in a population (Nicolaisen and Thorsen, 2014).

Involvement in social media identity bubbles was measured with the Identity Bubble Reinforcement Scale (IBRS). The IBRS is a cross-nationally validated scale that measures an individual's subjective tendency to be involved in identity-driven social cliques on social media. In this study, we used a six-item measure with a range of 6–42 (Kaakinen et al., 2020). The scale included statements on social identification (e.g., "In social media, I belong to a community or communities that I'm proud of"), homophily (e.g., "In social media, I prefer interacting with people who share similar interests with me"), and information bias (e.g., "In social media, I feel that people think like me"). The IBRS had relatively good internal consistency in all three measurement points based on McDonald's omega (T1: ω = 0.79; T2: ω = 0.79; T3: ω = 0.78).

Problematic social media use was controlled throughout the analyses. We used five items adapted from the Compulsive Internet Use Scale (Meerkerk et al., 2009). The initial items asked whether the respondents: "have difficulty stopping social media use," "have been told by others you should use social media less," "have left important work-, school-, or family-related things undone due to social media use," "used social media to alleviate feeling bad or stress," and "planned social media use beforehand." The respondents replied on a scale from 1 to 4 (1 = *never*, 2 = *less than weekly*, 3 = *weekly*, 4 = *daily*). We created a sum variable with a range of 5–20. The scale had sufficient consistency in all three time points (T1: ω = 0.73; T2: ω = 0.70; T3: ω = 0.67).

Frequency of social media use was also considered by combining two items measuring the respondents' use of social media platforms (e.g., Facebook, Twitter, Instagram) and instant message applications (e.g., WhatsApp, Facebook Messenger). Initially, the respondents were asked how often they used those applications or platforms according to a 5-point scale (1 = *never*, 2 = *less than weekly*, 3 = *weekly*, 4 = *daily*, 5 = *many hours per day*). For analysis, we recoded a new variable measuring the respondents' activities from *not at all* to *high* with a 4-point scale. "Not at all" referred to never use, "low activity" to weekly or less than weekly use, "medium activity" to daily use, and "high activity" to using applications, platforms, or both for many hours *per* day.

Sociodemographic characteristics included age in years, gender (0 = *male*, 1 = *female*), partnership status (0 = *not in a relationship*, 1 = *in a relationship*), and single household (0 = *no*, 1 = *yes*). Age and gender were time-invariant variables. Instead, we considered the within-individual variance of partnership status and single household over the observation periods.

2.1.3. Analysis

The analyses were performed with Stata (Version 16). We first examined how loneliness and involvement in social media identity bubbles developed during the observation period (2017–2020). In the second phase, we examined how involvement in social media identity bubbles was related to loneliness and how this relationship varied over time. We also adjusted the effects of the control variables, that is, problematic social media use, frequency of social media use, and socio-demographic factors. Because the dependent variable of loneliness was categorical with four levels and individuals were nested within time points, we conducted hierarchic mixed-effects generalized linear models by using the *meglm* command with an ordinal family and logit link function. To account for the correlated structure of the panel data, the models employed clustered standard errors. We then reported fixed within-effects for time-variant predictors and between-effects for time-invariant predictors with random intercepts. These results were plotted using the *coefplot* command (Jann, 2014).

2.1.4. Results

Descriptive details of the study variables are presented in Table 1. The results from the meglm models—presented in Table 2—suggested that the likelihood of perceived loneliness was slightly lower in T3 than T2 ($B = -0.271$, $p = .023$), but it was not significantly different from T1 ($B = -0.085$, $p = .440$). According to similar modeling, the tendency of the respondents to be involved in social media identity bubbles increased in T3 compared to T2 ($B = 0.930$, $p < .001$). The effect of T3 was also slightly insignificantly different from T1 ($B = 0.490$, $p = .059$).

In the second model, when we considered the effect of IBRS, loneliness did not decrease significantly in T3 ($B = -0.235$, $p = .096$). The results also indicated that increased IBRS was related to increased loneliness ($B = 0.029$, $p = .046$). The results of the third model including interaction between IBRS and time indicated that increased IBRS was related to increased loneliness ($B = 0.047$, $p = .019$). The effect of T3 was also reversed and now predicted increased loneliness ($B = 1.085$, $p = .025$). The model also showed the interaction effect between T3 and IBRS ($B = -0.064$, $p = .004$). While considering the control variables, the results of the fourth model showed that the interaction effect between T3 and IBRS remained significant ($B = -0.052$, $p = .026$). Of the control variables, increased loneliness was related to problematic social media use ($B = 0.305$, $p < .001$), single household ($B = 0.950$, $p = .001$), single partnership status ($B = 1.597$, $p < .001$), and younger age ($B = -0.052$, $p < .001$).

We plotted the results in Fig. 1 to show the predicted probabilities of often experiencing loneliness according to the IBRS at the different time points. The figure shows how before the COVID-19 pandemic (T1–T2),

Table 1
Descriptive details of the Study 1 variables.

Continuous variables	Range	T1 Mean (SD)	T2 Mean (SD)	T3 Mean (SD)	Within-person SD
IBRS	6–42	20.31 (7.07)	19.87 (6.89)	20.82 (7.02)	3.64
Problematic social media use	5–20	6.84 (2.21)	6.88 (2.16)	6.88 (2.03)	1.00
Frequency of social media use	1–5	3.54 (0.91)	3.66 (0.93)	3.74 (0.91)	1.65
Age in years	21–77	N/A	N/A	51.25 (15.88)	N/A
Categorical variables	Range	T1%	T2%	T3%	Within-person SD
Loneliness[1]	1–4	9.8	11.4	9.7	0.38
In a relationship	0–1	30.1	30.4	29.6	0.13
Living alone	0–1	31.6	32.7	32.3	0.16
Female gender	0–1	N/A	N/A	47.8	N/A

Note: [1]Often lonely share.
[a]N/A: Not applicable.

Table 2
Predicting changes in loneliness according to IBRS and control variables in Study 1.

	M1		M2		M3		M4	
VARIABLES	B	SE	B	SE	B	SE	B	SE
Within-person variables								
T1	−0.085	(0.126)	0.087	(0.138)	−0.005	(0.501)	−0.102	(0.526)
T3	−0.271*	(0.115)	−0.235	(0.142)	1.085*	(0.485)	0.889	(0.502)
IBRS			0.029*	(0.014)	0.047*	(0.020)	0.008	(0.020)
Interactions:								
T1 x IBRS					0.005	(0.024)	0.007	(0.025)
T3 x IBRS					−0.064**	(0.022)	−0.052*	(0.023)
Control variables								
Problematic social media use (within)							0.305***	(0.052)
Social media use (within)							0.149	(0.150)
Single household (within)							0.950**	(0.298)
Relationship (within)							1.597***	(0.326)
Age (between)							−0.052***	(0.010)
Sex (between)							0.128	(0.298)
cut 1	−3.379***	(0.232)	−2.749***	(0.365)	−2.390***	(0.470)	−0.784	(1.057)
cut 2	1.358***	(0.190)	1.962***	(0.363)	2.351***	(0.469)	3.987***	(1.063)
cut 3	5.314***	(0.266)	6.010***	(0.427)	6.424***	(0.511)	8.171***	(1.100)
Random effect parameters								
Constant	14.227***	(1.921)	13.779***	(2.039)	13.920***	(2.062)	11.193***	(1.829)
Time	0.346	(0.311)	0.457	(0.324)	0.450	(0.325)	0.369	(0.282)
Observations	2186		2186		1872		1778	
Participants	734		734		684		682	

Robust standard errors in parentheses.
***p < .001, **p < .01, *p < .05.

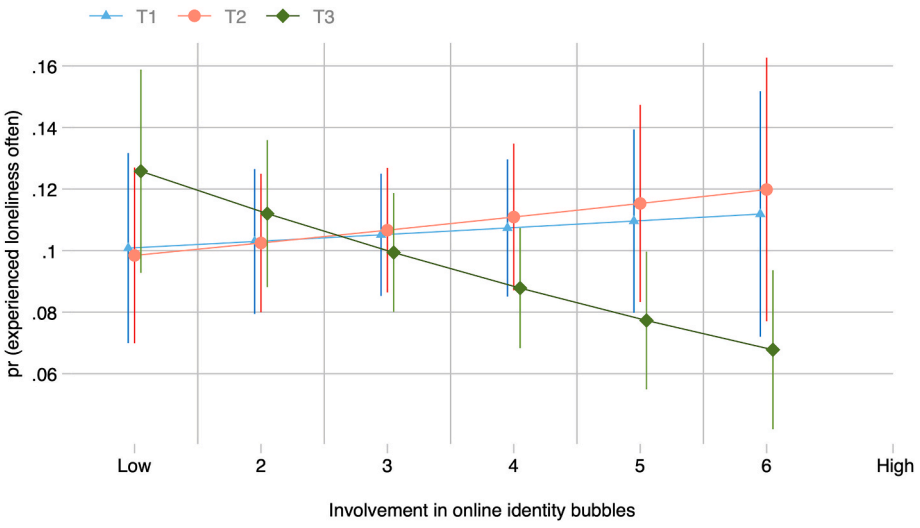

Fig. 1. The likelihood of experiencing loneliness often according to IBRS at the different time points of Study 1.

the respondents who were strongly involved in social media identity bubbles were more likely to experience loneliness often. However, this relationship was reversed in T3, with stronger involvement in social media identity bubbles predicting a lower probability of experiencing loneliness often.

3. Study 2

3.1. Method

3.1.1. Participants and procedure

For the second study, we utilized five rounds of the Social Media at Work in Finland survey data from 2019 to 2021. The surveys were collected in March–April 2019 (T1; N = 1817), September–October 2019 (T2; N = 1318), March–April 2020 (T3; N = 1081), September–October 2020 (T4; N = 1152), and March–April 2021 (T5; N = 1018). All data points were collected from a web-based research panel operated by Norstat. The third survey was sent only to those who responded to the second survey, but the second, fourth, and fifth surveys were sent to all original respondents. The response rate was 28.3% at (T1) and was good for all follow-up time points compared to the first one (T2: 72.54%; T4: 63.40%; T5: 56.03%) or in the case of T3, compared to the previous T2 (T3: 82.02%). For this study, we formed a five-time-point longitudinal data set comprised of respondents (n = 840) who had participated in each round of surveys, that is, 46.23% of the original survey respondents.

Participating in the survey was voluntary, and the participants were allowed to quit the survey at any point. However, we included only fully completed responses in the data sets. The Academic Ethics Committee of Tampere region in Finland confirmed prior the data collection that the research does not pose any ethical problems. The survey was designed to represent the Finnish working population. The respondents in T1 (N =

1817) closely represented the Finnish working population, according to statistics provided by Statistics Finland (2020a, 2020b) on Finnish workers. Participants taking part in all rounds of the survey ($n = 840$) were on average slightly older (M_{age}: 43.90 years), included fewer women (43.69%), and involved more people with a college or university degree (47.74%) compared to the figures on the Finnish working population from Statistics Finland (2020a, 2020b), which showed 41.81 years was the mean age, 48.15% were women, and 42.46% had a college or university degree.

3.1.2. Measures

Psychological distress was measured with the 12-item General Health Questionnaire (Goldberg et al., 1997). The questions included, for example, "Have you recently been able to enjoy your normal day-to-day activities?" and "Have you recently felt constantly under strain?" The respondents indicated their answers on a 4-point scale (1 = *more so than usual*, 2 = *same as usual*, 3 = *less so than usual*, 4 = *much less than usual*). Sum variables were created with a range of 0–36, where higher scores indicated higher psychological distress. The scale had an excellent interitem reliability in all five time points (T1: ω = 0.92; T2: ω = 0.91; T3: ω = 0.90; T4: ω = 0.91; T5: ω = 0.92).

Loneliness was measured with the three-item UCLA-3 Loneliness Scale (Hughes et al., 2004), which is a short version of the standard measure of loneliness designed for large-scale social surveys. The questions in the scale were "How often do you feel" (a) "that you lack companionship?" (b) "left out?" and (c) "isolated from others?" with answer options on a 3-point scale (1 = *hardly ever*, 2 = *some of the time*, 3 = *often*). We first summed up the results with a range of 3–9. Then we created a dummy variable using a cutoff point of greater than 6 to distinguish lonely individuals from nonlonely (0 = *nonlonely*, 1 = *lonely*). The loneliness measurements were taken from T5.

Involvement in social media identity bubbles was measured with the same six-item IBRS-6 (Kaakinen et al., 2020) as in the first study. The answers were given on a scale from 1 to 7 (1 = *does not describe me at all*, 7 = *describes me completely*). For analysis, we created a sum variable with a range of 6–42 that showed good internal consistency in all five time points (T1: ω = 0.84; T2: ω = 0.82; T3: ω = 0.83; T4: ω = 0.83; T5: ω = 0.85). For figures, we categorized the variables based on the means and standard deviations to illustrate the difference between those involved (standard deviation over mean) and not involved (standard deviation under mean) in social media identity bubbles.

Problematic social media use was measured with three items adapted from the Compulsive Internet Use Scale (Meerkerk et al., 2009). The following statements were used in this study: "I find it difficult to stop using social media when I am using it," "I think about social media, even when I am not on social media," and "I think I should use social media less often." The respondents indicated their answers on a scale from 1 to 7 (1 = *strongly disagree*, 7 = *strongly agree*). We created a sum variable with a range of 3–21. The scale had a good interitem reliability at all five measurement points (T1: ω = 0.86; T2: ω = 0.86; T3: ω = 0.87; T4: ω = 0.86; T5: ω = 0.88).

Frequency of social media use was measured by asking how often the respondents used various social media platforms (e.g., Facebook, Twitter, Instagram) and instant message applications (e.g., WhatsApp, Facebook Messenger). Their answers were given on a scale from 0 to 4 (0 = *I don't use it*, 1 = *less than weekly*, 2 = *weekly*, 3 = *daily*, 4 = *many times a day*). A dummy variable was created in which those who used at least one application or platform many times a day were categorized as frequent social media users (0 = *other*, 1 = *many times a day*). Frequency of social media use was measured at all five time points.

Sociodemographic characteristics included age in years, gender (0 = *male*, 1 = *female*), partnership status (0 = *not in a relationship*, 1 = *in a relationship*), and single household (0 = *no*, 1 = *yes*). Age and gender were treated as time-invariant predictors, whereas partnership status and single household were treated as time-variant predictors.

3.1.3. Analysis

Analyses were performed using Stata (Version 16). First, we collected descriptive statistics for the study variables and used cross-tabulation to descriptively elaborate the characteristics of lonely individuals in T5. Information on gender and age were derived from T1, whereas partnership status and single household were derived from T5. We tested statistical significances for categorical variables with the chi-squared test (χ^2) and for a continuous variable with two-tailed *t*-test. For the effect sizes, Cramér's V was computed for categorical variables and Cohen's *d* for a continuous variable.

Second, we performed hierarchical mixed-effects generalized linear models using the *mixed* command in Stata. We examined the longitudinal development of psychological distress during the observation period (2019–2021). We then examined the development of psychological distress over time based on loneliness. Similar modeling was performed for involvement in social media identity bubbles. Next, we tested the buffering effect of social media identity bubble involvement against psychological distress among lonely individuals. Last, we adjusted the effects of the control variables, that is, age, gender, single household, partnership status, problematic social media use, and frequent social media use.

The models were performed utilizing robust Huber-White standard errors to resolve potential problems in heteroscedasticity. The models also included random intercepts and random slopes for time with an unstructured covariance. For the time-variant predictors, we reported fixed within-effects, and for the time-invariant predictors, we reported between-effects. We plotted the results using the *coefplot* command.

3.1.4. Results

A descriptive overview of all study variables is presented in Table 3. As for the descriptive characteristics of lonely individuals in T5 ($n = 110$, 13.10%), we found that females (χ^2 [1] = 8.26, $p = .004$, V = 0.099), those not in a relationship (χ^2 [1] = 15.07, $p < .001$, V = −0.134), and those living alone (χ^2 [1] = 14.19, $p < .001$, V = 0.130) reported feeling lonely more often. No significant results were obtained for age ($p = .825$).

The results of the model predicting changes in psychological distress according to loneliness, IBRS, and the control variables are presented in Table 4. Assessments of the longitudinal development of psychological distress showed that compared to before the pandemic (T2; $M = 12.20$, $SD = 5.67$), there were no statistically significant changes in psychological distress during the COVID-19 pandemic (T3: $p = .254$, T4: $p = .608$, T5: $p = .431$). The second model showed that loneliness was positively associated with psychological distress ($B = 4.267$, $p < .001$) and that the interaction effect between T5 and loneliness was statistically significant ($B = 3.180$, $p < .001$). The third model considered the effects of IBRS, and results showed that IBRS was not related to psychological distress ($p = .699$) and that the interactions between IBRS and the different time points were not significant (T3: $p = .591$, T4: $p = .662$, T5: $p = .103$). However, when using T1 as a reference point, we found a significant negative interaction between T5 and IBRS ($B = -0.086$, $p = .006$), which indicated that involvement in social media identity bubbles predicted lower psychological distress in T5. The fourth model added the three-level interactions between time, loneliness, and IBRS and showed no significant results during the COVID-19 pandemic (T3: $p = .914$, T4: $p = .077$, T5: $p = .720$), indicating that IBRS did not predict lower psychological distress among those who were often lonely. In the final model, the interaction effects remained significant between T4 and loneliness ($B = 4.326$, $p = .029$) and T5 and loneliness ($B = 3.861$, $p = .035$) after adjusting for the effects of the control variables. Problematic social media use ($B = 0.197$, $p < .001$) and female gender ($B = 0.741$, $p = .008$) were positively associated with psychological distress.

As illustrated in Fig. 2, psychological distress increased during the COVID-19 pandemic among those feeling lonely. We found that as a trend, since the outbreak of the virus, psychological distress remained stable for those who were not involved in social media identity bubbles

Table 3
Descriptive overview of the Study 2 variables.

Continuous variables	Range	TI mean (SD)	T2 mean (SD)	T3 mean (SD)	T4 mean (SD)	T5 mean (SD)	Within-person SD
Psychological distress	0–36	13.06 (6.29)	12.20 (5.67)	12.41 (5.45)	12.10 (5.57)	12.36 (5.79)	3.58
IBRS	6–42	19.09 (7.17)	19.45 (6.98)	19.50 (7.07)	19.66 (6.92)	19.48 (7.03)	4.11
Problematic social media use	3–21	6.99 (4.19)	7.13 (4.25)	7.12 (4.25)	7.04 (4.19)	7.08 (4.32)	2.11
Age in years (T1)	18–64	43.90 (11.14)	N/A	N/A	N/A	N/A	N/A
Categorical variables	Range	TI %	T2%	T3%	T4%	T5%	Within-person SD
Loneliness[1] (T5)	0–1	N/A	N/A	N/A	N/A	13.10	N/A
Frequency of social media use[2]	0–1	55.36	55.24	61.90	62.38	63.69	0.30
In a relationship	0–1	65.60	64.88	65.48	65.83	66.31	0.13
Living alone	0–1	27.62	28.69	27.98	28.21	27.74	0.13
Female gender (T1)	0–1	43.69	N/A	N/A	N/A	N/A	N/A

Note: [1]Loneliness (0 = nonlonely, 1 = lonely), [2]Frequency of social media use (0 = other, 1 = many times a day).
[a]N/A: Not applicable.

Table 4
Predicting changes in psychological distress according to loneliness, IBRS and control variables in Study 2.

VARIABLES	M1		M2		M3		M4		M5	
	B	SE	B	SE	B	SE	B	SE	B	SE
T1	0.856***	(0.184)	0.818***	(0.192)	0.132	(0.561)	−0.011	(0.585)	−0.159	(0.581)
T3	0.206	(0.181)	0.221	(0.184)	0.506	(0.553)	0.453	(0.590)	0.493	(0.585)
T4	−0.098	(0.190)	−0.256	(0.193)	0.151	(0.606)	−0.588	(0.613)	−0.626	(0.607)
T5	0.155	(0.197)	−0.262	(0.196)	1.087	(0.604)	0.535	(0.629)	0.517	(0.624)
Loneliness (between)			4.267***	(0.673)			2.537	(1.415)	2.185	(1.417)
IBRS (within)					0.008	(0.022)	−0.005	(0.023)	−0.037	(0.023)
Interactions										
T1 x Loneliness			0.291	(0.616)			0.593	(1.788)	0.968	(1.806)
T3 x Loneliness			−0.111	(0.672)			0.096	(1.632)	0.365	(1.667)
T4 x Loneliness			1.211	(0.712)			4.298*	(1.977)	4.326*	(1.976)
T5 x Loneliness			3.180***	(0.725)			3.776*	(1.833)	3.861*	(1.827)
T1 x IBRS					0.038	(0.028)	0.043	(0.029)	0.052	(0.029)
T3 x IBRS					−0.015	(0.029)	−0.012	(0.030)	−0.014	(0.030)
T4 x IBRS					−0.013	(0.029)	0.017	(0.030)	0.021	(0.030)
T5 x IBRS					−0.048	(0.029)	−0.041	(0.031)	−0.039	(0.030)
Loneliness x IBRS							0.089	(0.066)	0.087	(0.068)
T1 x Loneliness x IBRS							−0.012	(0.094)	−0.034	(0.095)
T3 x Loneliness x IBRS							−0.010	(0.089)	−0.021	(0.092)
T4 x Loneliness x IBRS							−0.160	(0.090)	−0.166	(0.091)
T5 x Loneliness x IBRS							−0.031	(0.086)	−0.039	(0.086)
Control variables										
Problematic social media use (within)									0.197***	(0.030)
Frequent social media use (within)									−0.041	(0.174)
Single household (within)									−0.104	(0.420)
Relationship (within)									−0.172	(0.401)
Age (between)									−0.012	(0.012)
Gender (between)									0.741**	(0.281)
Constant	12.201***	(0.196)	11.642***	(0.195)	12.036***	(0.463)	11.746***	(0.489)	11.367***	(0.834)
Random effect parameters	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Constant	28.053	(2.819)	27.079	(2.737)	28.142	(2.848)	27.253	(2.803)	25.652	(2.735)
Time	0.881	(0.172)	0.836	(0.165)	0.879	(0.172)	0.835	(0.166)	0.829	(0.166)
Observations	4200		4200		4200		4200		4200	
Participants	840		840		840		840		840	

Robust standard errors in parentheses.
***p < .001, **p < .01, *p < .05.

but decreased for those were involved, especially in spring 2021. Fig. 3 shows that involvement in social media identity bubbles did not buffer against higher psychological distress among lonely individuals.

4. Discussion

In this paper, we investigated the development of loneliness, psychological distress, and involvement in social media identity bubbles before and during the COVID-19 pandemic using two longitudinal survey data sets. The results demonstrate that among the general population, the mean level of loneliness did not increase during the COVID-19 pandemic. Those strongly involved in social media identity bubbles reported lower loneliness during the COVID-19 pandemic compared to those not involved, supporting Hypothesis 1. Psychological distress increased during the COVID-19 pandemic among those feeling lonely, confirming Hypothesis 2. As a trend, individuals who were involved in social media identity bubbles reported generally less psychological distress during the COVID-19 pandemic, pointing towards Hypothesis 3. Involvement in social media identity bubbles did not buffer against higher psychological distress among often lonely individuals, which supports Hypothesis 4.

Our results on the longitudinal development of loneliness are in line with previous longitudinal investigations finding no significant population-wide increases after the outbreak of the pandemic (Hansen et al., 2021; Luchetti et al., 2020). One interpretation is that the pandemic has not negatively affected people's subjective perceptions of

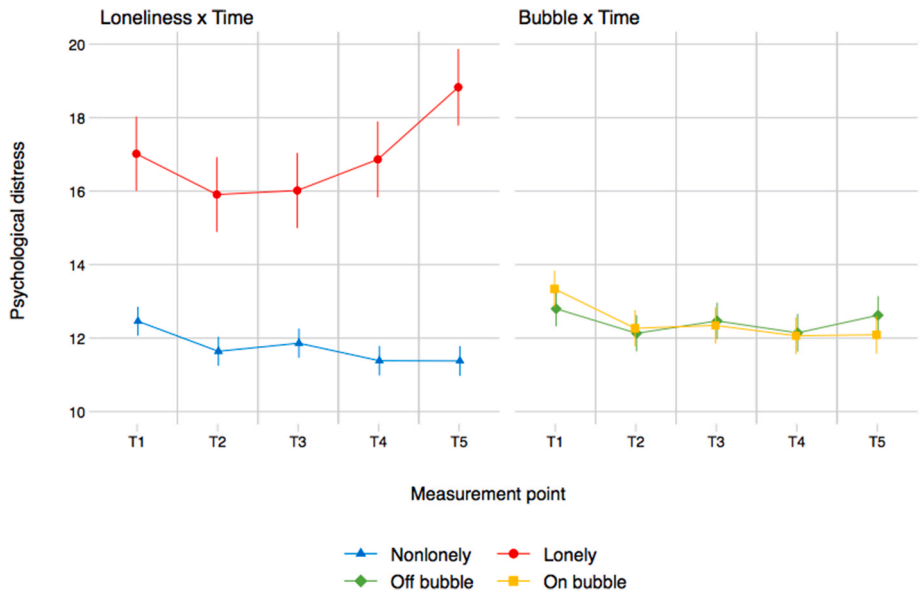

Fig. 2. Predicting psychological distress according to loneliness and involvement in social media identity bubbles over time in Study 2.

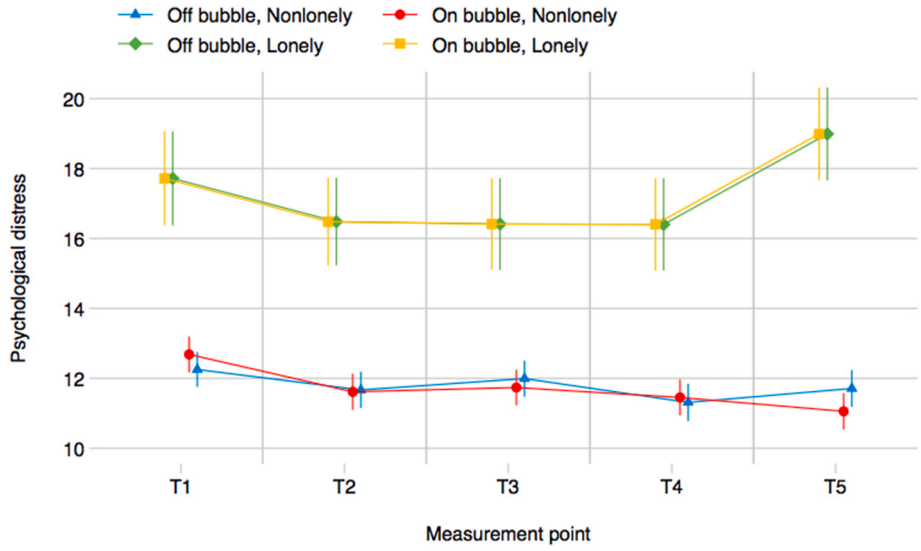

Fig. 3. Predicting psychological distress according to timepoints, loneliness, and involvement in social media identity bubbles in Study 2.

the match between desired and actualized social relations (Peplau and Perlman, 1982). People's perceptions of social support and social resources may also have become more prominent during the early phases of the pandemic (Luchetti et al., 2020; Philpot et al., 2021; Xu et al., 2020) and protected them from greater perceived loneliness (Bu et al., 2020a). One possibility is that the crisis may have enforced feelings of collective connectedness, which has been discussed as a dimension of loneliness alongside intimate and relational aspects (Cacioppo and Patrick, 2008).

Furthermore, our results showed that during the COVID-19 pandemic, higher involvement in social media identity bubbles predicted lower loneliness. Given that social media identity bubbles are formed based on the human need to relate to other people, seek bonding with similar-minded others, and create and trust online peer support networks (Kaakinen et al., 2020; Keipi et al., 2017), it is also likely that people have found supportive mechanisms in these social bubbles, such as perceptions of shared experiences, similarity with others, meaningfulness (Kamalpour et al., 2020; Wang et al., 2008), and sense of belonging. Moreover, belonging to an online community and interacting with like-minded people during the unusual times of social distancing could have provided meaningful social contact or support, which, in turn, could have protected from feelings of loneliness (Bu et al., 2020a).

No significant changes were observed in mean levels of psychological distress during the COVID-19 pandemic, which contradicts some prior longitudinal studies suggesting increases in psychological distress after the outbreak of the virus (Pierce et al., 2020; Shanahan et al., 2020). Similar to studies conducted during the COVID-19 pandemic (Liu et al., 2021; Losada-Baltar et al., 2021), we found that since the outbreak of the pandemic, psychological distress has increased among lonely individuals. The difference was notable compared to those who did not perceive themselves as often lonely, which emphasizes the negative mental health effects of loneliness experienced more frequently. Loneliness has been found to correlate with, for instance, higher stress appraisals (Hawkley et al., 2003), heightened feelings of vulnerability (Hawkley and Cacioppo, 2010), and stronger affective responses to COVID-19 health threats (Okruszek et al., 2020), which makes it plausible that lonely individuals have experienced the pandemic more psychologically distressing. Further, social restrictions imposed to due to

the pandemic have also limited the social encounters of everyday life and increased isolation from others, which may have strengthened the perceptions of being alone and lacking social support especially in those lonely who are less socially connected and resulted in greater psychological distress.

We found that as a trend, since the outbreak of the virus, psychological distress remained stable for those who were not involved in social media identity bubbles but decreased for those who were involved in them during the COVID-19 pandemic. Involvement in social media identity bubbles did not buffer against higher psychological distress among lonely individuals. This result underlines the complexity of the loneliness phenomena and the severity of the consequences of often feeling lonely and supports previous findings that lonely people engage with social online technologies differently compared to nonlonely (Nowland et al., 2018). Although experiencing loneliness motivates people to maintain social connections (Cacioppo and Patrick, 2008), it can influence how a person interprets and engages with the social world (Cacioppo and Hawkley, 2009; Qualter et al., 2015), such as in by experiencing social encounters as less uplifting and by behaving more passively in social interactions (Cacioppo and Patrick, 2008; Nowland et al., 2018). Hence, it is possible that identity bubbles could not buffer against higher psychological distress among those who perceive themselves as often lonely, because these patterns disconnect them from the potential social benefits of the bubbles. It is also possible that the social bubbles in which lonely individuals were involved did not provide positive and balanced social relations that could help them cope with stressful periods (Ellwardt et al., 2020), that their social ties to their online communities were not strong (Granovetter, 1973), or that lonely people were socially marginalized or excluded online, and therefore, did not find solace with others in social media identity bubbles.

Our analyses showed that living alone, not being in a relationship, and having problematic social media use predicted higher loneliness over time. The negative associations between loneliness and living alone (Greenfield and Russell, 2011) and being unpartnered (Dahlberg et al., 2021; Pinquart and Sörensen, 2003) have been found in prior studies as well. Our results are also in line with previous findings on the negative relationship between problematic social media use and loneliness (Marttila et al., 2021; Meshi et al., 2020). Frequent social media use was not associated with loneliness in our study. Hence, our results suggest that it is the excessive form of social media use that predicts higher loneliness rather than mere frequent use. Constantly spending time or thinking back to virtual environments can challenge a person to benefit fully from offline interactions and thus eventually contribute to greater loneliness, which is also in line with findings from previous studies (Cauberghe et al., 2021; Rumas et al., 2021).

Problematic social media use predicted higher psychological distress, which underlines the harmfulness of the addictive nature of social media services to mental health. Social media platforms are often designed with elements that keep users constantly coming back and prolonging usage time (Montag et al., 2019), which can, based on our results, have unfavorable consequences. Moreover, identifying strongly with online communities can also lead one to use the internet compulsively (Turel and Osatuyi, 2017). Hence, although we observed that higher involvement in social media identity bubbles predicted lower loneliness during the COVID-19 pandemic, it is not recommended that solutions for combating loneliness be limited to using social media platforms. Future intervention could, however, assess how social media can be used to promote inclusive and healthy social habits. That is, to enhance people's existing or new social relations, and to stress the benefits of in-person contacts while considering the restrictions due to unusual situations such as pandemics. Scholars may also investigate how loneliness affects motivations and ways of using social media across different interaction modalities.

This paper complements the current literature on longitudinal investigations of the social well-being and mental health effects of the pandemic and the complex relationship between loneliness and social media use. Our findings advance the theory of loneliness by providing evidence of its longitudinal social media use predictors, considering both positive and harmful aspects of how the use of social media influences loneliness during the pandemic. Moreover, the findings support earlier evidence of the effect of loneliness on individuals' interaction in the digital world (Nowland et al., 2018).

Although recent longitudinal studies on loneliness exist (e.g., Alt et al., 2021; Hansen et al., 2021; van der Velden et al., 2021), our study is one of the few to include data prior to the pandemic. Our results apply only to the Finnish context and thus are not directly generalizable to other populations. Future studies could validate our results with representative samples from other countries. The first study was limited by using a single-item measure for loneliness. The second study was limited by not having prepandemic measurements of loneliness. Our study did not focus on the types of social media communities people were involved in, which is also a potential avenue for future research.

5. Conclusions

The prolonging of the pandemic and the restrictions on people's social lives can have consequences of which the diversity and severity we are not yet fully aware. Our findings suggest that perceived loneliness is a risk factor for prolonged negative mental health effects from the pandemic, which calls for close monitoring of the situation. We also found that higher involvement in social media identity bubbles predicted lower loneliness during the COVID-19 pandemic. Involvement in social media bubbles predicted generally lower psychological distress during the COVID-19 pandemic, but it did not buffer against higher distress among lonely individuals. To conclude, social media identity bubbles can offer meaningful social resources during times of social distancing but cannot protect against higher psychological distress among those who often feel lonely.

Author contributions

R.L., A.K., R.O., N.S., A.O: Conceptualization; R.L., A.K., R.O., N.S., A.O: Data curation; R.L., A.K., N.S., A.O: Formal analysis; A.K., A.O., R.L.: Funding acquisition; R.L., A.K., R.O., N.S., A.O: Investigation; R.L., A.K., A.O: Methodology; A.K., A.O.: Project administration; R.L., A.K., R.O., N.S., A.O: Resources; R.L., A.K., A.O: Software; A.K., A.O.: Supervision; A.K., A.O.: Validation; R.L., A.K.: Visualization; R.L., A.K., R.O., N.S., A.O: Roles/Writing - original draft; R.L., A.K., R.O., N.S., A.O: Writing – review & editing.

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Declaration of competing interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2021.114674.

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