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Behavioural Aspects of the Use of Social Media and its Impact on Loneliness

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Abstract

Loneliness is one of the most present issues in young adults, loneliness-related afflictions being more prevalent than in previous generations. Loneliness might be triggered by societal behavioural mechanisms such as social shaming and social compliance. This prevalence of loneliness has occurred simultaneously as the rise of social media. In this paper, we observe whether social media enhances the effect of social shaming and social compliance in young adults. To answer this question, we perform a qualitative and quantitative analysis using different datasets. In the first analysis, we use publicly available social media data in the state of Michigan, United States, between the years 2008 and 2012. This analysis shows mixed results regarding the impact of social media on the perception of loneliness. Although the number of loneliness-related conversations increases, half of the sample argues feeling less lonely when connected. In the second analysis, we use a dataset of 1,003 women aged 18 to 22 years, living in the state of Michigan, United States, within the same time frame, i.e., 2008-2012. The second analysis performed consists of several ordinary least squares (OLS) regressions based on a novel loneliness index. The results do not demonstrate any significant effect of social media on loneliness. Furthermore, data shows that social media nullifies the effects of social shaming on loneliness.

Keywords: Loneliness, Mental Health, Social Media, Behavioural Implications, Perceived Loneliness

1. Introduction

Loneliness represents a growing concern in the mental health field. Impacting individuals at first, the issue, by its reach, also has repercussions on societies and their healthcare systems. Eighty percent of the world's population below the age of eighteen years and almost forty percent of adults have experienced it at least once in their lives. Hawkley and Cacioppo (2010) define it as being "a distressing feeling that accompanies the perception that one's social needs are not being met by the quantity or the quality of one's social relationships" [1, p.218]. The feeling of loneliness relies on a perception of social isolation rather than on tangible metrics such as a small number of friends. Loneliness substantially impacts several human functions, e.g., cognition, emotion, behaviour, and, in broader terms, mental health. It leads to personality disorders, cognitive decline, anxiety, and low self-esteem, to diseases such as Alzheimer's or to suicide. Studies have also highlighted a strong link between loneliness and depressive symptoms, which can be accompanied by a high intake of alcoholic beverages [1]. Furthermore, there has been a growing body of evidence concerning the physiological effects loneliness has on individuals. It indeed is responsible for immune, autonomic and endocrine impairments, which in turn promote the development of cardiovascular diseases, cancer and other serious physical illnesses [2].

In the context of our research, we investigate the existence of a relationship between loneliness, peers' acceptance of an individual's behaviour, and the use of social media within a sample of young American women. More precisely, we aim at answering the following research questions: *Is there a statistical relationship between loneliness and the amount of social media use? Does social media amplify the effects of social shaming and social compliance in our sample?*

This study incorporates both qualitative and quantitative methods. It gathers specific psychological insights together with an empirical measurement of this effect. First, social media data is analysed to understand perspectives and behavioural patterns from unbiased and unprompted online data sources. Then quantitative analysis is conducted using survey data from Barber, Kusunoku & Gatny's (2012) study (henceforth Michigan Study), in which we apply the PICOT framework to understand the association between increased social media use and loneliness, and to measure the effect of social media on engaging in approved or non-approved behaviour (i.e., social compliance and social shaming, which can lead to a decrease or an increase in the perception of loneliness respectively [3]).

This paper is organised in 8 sections. Following the introduction, Section 2 sets the scene by providing an academic literature review on the current state of knowledge on the matter. Articles tackling the link between loneliness and behaviour are first introduced, followed by the ones tackling the link between loneliness and social media. Section 3 sheds light on the data used whereas Section 4 describes the methodology applied in both the qualitative and quantitative analyses. Section 5 exposes the results of our research. Finally, we discuss the conclusive findings, the corresponding health policy implications, and the limitations of our research in Sections 6, 7, and 8.

2. Literature Review

2.1 Loneliness and behaviour acceptance

First of all, it is important to note that very few studies have targeted our population segment, i.e., young women, and their relationship to loneliness. Despite a peak estimated age of 19

years old, loneliness has received greater attention when it comes to the elderly, children, and adolescents [4]. Similarly, few articles have focused on the relationship between loneliness and peers' acceptance of specific behaviours, e.g., social shaming and social compliance. The following paragraphs therefore refer to these closely intertwined topics, often relating to a slightly younger population segment.

According to Woodhouse, Dykas, and Cassidy (2011), studies highlight that loneliness due to peer relations includes factors such as social acceptance, friendship, and behaviour. Regarding social acceptance, a study among adolescents showed that the more negative peer acceptance is, the more likely the person is to feel lonely [5]. Pakaslahti, Karjalainen, and Keltikangas-Järvinen (2002) argue that peer nomination leads to positive feelings such as self-confidence, while peer rejection often leads to loneliness, depression, and other psychological issues [6].

Billy, Rodgers, and Udry (1984) shed light on the tendency that both adults and adolescents become friends with people sharing similar attitudinal and behavioural characteristics. They have demonstrated that similar attitudes, values, and behaviours explain the attraction, with greater rewards for individuals connecting with others when they 'approve' them and when they feel 'approved'. Such similarities indeed reduce the risk of potential conflicts and therefore the feeling of hostility [7].

According to scholars, there is salient evidence that sexual behaviour is linked to friendships in female adolescents, as sexual behaviour is a more sensitive topic among women than men according to the 'double sexual standard'. This phenomenon indeed emphasises the fact that men are usually praised by their peers for their engagement in sexual activities, while women tend to be stigmatised when adopting similar behaviours [8]. Hence, having sex is a friendship factor among women and therefore explains why non-experienced women are more likely to choose non-experienced women as friends, whereas this factor is less important among men. Accordingly, experienced women might prefer having experienced friends [7, 8]. Although loneliness cannot be directly related to the number of friendships an individual has, as it is a matter of perception, this study remains interesting in our case as loneliness can be felt by a non-experienced woman within a group of experienced women, and vice versa. Similar results were observed by Klein (1998), whose study highlights the strong correlation between loneliness variables, e.g., self-esteem, shyness and social support, and adolescent pregnancy. Pregnant teenagers indeed tend to feel lonelier when they do not receive social support during their pregnancy. However, teenagers who feel lonely are more likely to get involved in sexual behaviours and pregnancies in order to cope with this distressing feeling [9].

Finally, the academic literature outlines sociometric variables, e.g., being popular or neglected, and demographic variables as being a key-factor playing on loneliness. Woodhouse et al. (2011) explain that popular individuals, i.e., the ones receiving many positive nominations from their peers, usually feel less lonely than others. However, no causality relation could yet be established from these arguments [5]. Similarly, Shovestul, Han, Germine and Dodel-Feder (2020) suggest the household income to be a potential source of loneliness, richer individuals being less likely to feel lonely. However, evidence remains scarce [4].

2.2 Loneliness and social media

Mixed results stem from studies observing the link between loneliness and social media. On the one hand, scholars argue that an intense use of the Internet and social media is often correlated to a greater feeling of loneliness, with social loneliness distinguished from emotional loneliness Moody (2001). While face-to-face networking lowers both feelings of loneliness, the use of the Internet only reduces the feeling of social loneliness, leaving people emotionally unsatisfied [10]. Despite evidence of correlation, no causality relationship has yet been established between loneliness, the Internet use, and social media. Two models remain. Some researchers argue that the intensive use of the Internet and other derived products lead to social isolation. However, other researchers argue that this intensive use stems from the users' personality, meaning that the lonelier a person feels, the more likely he or she is to use the Internet and social media [11]. Hunt, Marx, Lipson, and Young (2018) indicate that limiting the use of social media results in a decrease in anxiety and fear of missing out, which directly decreases loneliness and depression [12]. This finding is sustained by Wang, Frison, Eggermont, and Vandenbosch (2018), who report that low to moderate users of social media, e.g., Facebook, decrease both their social and emotional loneliness when using the platform, whereas heavy users tend to increase their emotional loneliness when active on the platform [13].

On the other hand, observational evidence suggests that being active on social media, i.e., by posting and updating statuses can instead lead to a decrease in the feeling of loneliness. Deters and Mehl (2012) demonstrate in their study that social media posting allows individuals to feel connected to their peers on a daily basis, notably by enabling them to converse and share experiences on a diverse range of topics. However unidirectional online activities such as likes, does not have an effect on the feeling of loneliness [14]. Pittman and Reich (2016) suggest that social media brings some emotional benefit and that the higher the number of platforms a person uses, the less likely loneliness feelings are. The author reports that this phenomenon is optimal when the time spent on social media is moderate, i.e., from half an hour to an hour per day, with loneliness levels increasing, if the threshold is exceeded [15].

3. Data

3.1 Social media data analysis

Publicly available online data of 461 conversations from specified study populations (females, 18-22 years, Michigan) was collected from social media sources, ensuring compliance with the data privacy policies. Conversations that were public only were considered for interpretations and were anonymised at source. Specific searches on social media platforms were made using a comprehensive taxonomy of keywords related to "loneliness" and "social media use" using Boolean combinations. A quantitative and qualitative analysis of the data was performed to derive insights.

3.2 Michigan study data analysis

A database retrieved from the *Harvard dataverse* was used. This cross-sectional database consists of 1,003 women aged 18-22 and based in Genesee County (Michigan, United States)

from 2008 to 2012, a period in which social media use was extended but not dominant, thereby giving us the opportunity to study differences among users and non-users. This database comes from an extensive survey of relationship dynamics and social life [3].

3.2.1 Dependent variable

To develop a measurement of loneliness, a set of loneliness-defined variables was selected. These were the answers to the following questions: *'Do you feel that you lack companionship?'; 'Do you feel that you are close to people?'; 'Do you feel left out?'* and *'Do you feel that you have people you can turn to (in case of need)?'.* All these variables ranged from 1 to 5, based on recurrence. These variables were used to develop an index through the Principal Component Analysis (PCA) methodology [16]. To create it, we first checked through the Bartlett test of sphericity if the variables were intercorrelated. The results of the test were highly conclusive and positive, indicating unbiasedness and robustness. Then, we calculated the eigenvectors of the components and built, with them, the Index of Loneliness. This methodology gives an index that follows a normal distribution. The lower values of the index indicate higher isolation, while the higher values indicate greater socialisation.

3.2.2 Independent variables

The majority of the independent variables are dummy variables that indicate the absence or presence of certain behaviours or situations in individuals. These are used to study the social shaming and social compliance phenomena, apart from social network use. We selected behaviours with a high risk of affecting esteem-related sex due to the consequences of pregnancy, and the perceived notions of status and self-esteem around it, which are subject to peer evaluation.

The variables are: The use of social networks in general; the specific use of social networks (Twitter, Facebook, Myspace, etc.); having sex; having friends who engage in sexual behaviours; having friends who disapprove having sex; using birth control; having friends who use birth control and having friends who disapprove using birth control. The other variables acting as controls are the number of social networks used, which is discrete and used to evade forms of collinearity, and household income, which is reported in thousands of dollars per month and is proven to have a positive effect on loneliness [4].

Table 3.1: Descriptive Statistics for the Panel Dataset.

Income in thousands of dollars	3.457
	(3.821)
Feel there is People You Can Turn To (from 1 to 5)	4.295
	(0.940)
Feeling of being Left Out (from 1 to 5)	2.217
	(0.959)
Feel Close To People (from 1 to 5)	3.960
	(0.885)
Feel they Lack Companionship (from 1 to 5)	2.250
	(1.053)
Lonely Index (from 1 to 5)	4.230
	(0.992)
Use of any social media	0.947
	(0.223)
Number of social media sites used	1.481
	(0.796)
Use of MySpace	0.474
	(0.499)
Use of Facebook	0.835
	(0.370)
Use of Twitter	0.103
	(0.304)
Use of Other social media site	0.067
	(0.251)
Have Sex	0.762
	(0.426)
Use birth control	0.756
	(0.429)
Have regular Unprotected Sex	0.816
	(0.387)
Friends engage in sex	0.252
	(0.434)
Friends use birth control	0.620
	(0.485)
Friends have Unprotected Sex	0.583
	(0.493)
Have Friends who do not approve having sex	0.723
	(0.447)
Have Friends who do not approve birth control	0.296
	(0.456)
Have friends who do not approve unprotected sex	0.898
	(0.302)
Observations	1003

4. Methods

4.1 Social media data analysis

A taxonomy of synonyms of loneliness and social media-related keywords was created after the literature review. The data was disidentified and anonymised at the source to ensure compliance with data privacy policies. The dataset was filtered in order to retrieve conversations from females aged 18 to 22 years, and living in Michigan, United States, between 2008 and 2012. The retrospective data of five years was further analysed to generate quantitative analysis on volume trends, sentiments, and emotions at different time intervals.

The conversation volume trends indicate the increase or the decrease in awareness levels of loneliness amongst the population. It is also an unbiased measure between the number of online users being intrinsically motivated to be vocal about their condition on social media. The conversation trends were segregated by week and 24-hour daily windows to control for time effects. The sentiment of online conversations measured tonality and was considered as an indicator of positive or negative social media experience. Emotions expressed in social media conversations indicate the emotions of the users writing on social media at that point in time. The emotions analysis classified the emotions expressed in the comments on social media use and loneliness that elaborated on the positive or negative experience in further detail. The parameters used to measure social media connectedness included the number of connections, which was mapped with the individual online activity and social media experience to understand whether an increase in the number of social connections decreases loneliness and vice versa. The sample contained 15 users. The dataset was then manually analysed to derive qualitative insights on conversations' themes and interpreted for behavioural implications as well as effects on the perception of loneliness.

4.2 Michigan study data analysis

To estimate and measure the relationship between social network use, social shaming, and social compliance on loneliness several Ordinary Least Square regressions were computed using Stata15 [17]. The design of the Michigan survey enabled us to measure loneliness by combining several loneliness indicators using principal component analysis. Our PCA-generated Index of Loneliness is the dependent variable in the regressions. This approach of regressing using interactions between variables enabled us to robustly estimate the effects of external factors onto loneliness and represents a widely used approach in the field [4]. First, three regressions were computed to investigate social network effects on loneliness,

$$lonelyindex_i = \alpha_0 + \alpha_1 socialnetworkuse_i + \alpha_2 income_i + e_i \quad (1)$$

$$lonelyindex_i = \beta_0 + \beta_1 facebookuse_i + \beta_2 twitteruse_i + \beta_3 myspaceuse_i \beta_4 otheruse_i + \beta_5 income_i + e_i \quad (2)$$

$$lonelyindex_i = \theta_0 + \theta_1 n^o socialnetworkuse_i + \theta_2 income_i + e_i \quad (3)$$

where *i* represents the individuals, "*socialnetworkuse"* the use of social networks, and "*n°socialnetworkuse"* the number of social networks used. Variables "*facebookuse", "twitteruse", "myspaceuse",* and "*otheruse"* report the use of specific social networks. The variable *i5* is the control for income, which appears in all regressions. Equation (3) shows that

nºsocialnetworkuse is the most relevant control for the latter analysis. Then, regressions to investigate social shaming effects were performed,

$$lonelyindex_i = \gamma_0 + \gamma_1 sex_i + \gamma_2 percepcionX sex_i + \gamma_3 birth_i + \gamma_4 perceptionX birth_i + \gamma_5 income_i + e_i \quad (4)$$

$$lonelyindex_i = \gamma_0 + \gamma_1 sex_i + \gamma_2 percepcionX sex_i + \gamma_3 birth_i + \gamma_4 perceptionX birth_i + \gamma_5 income_i + \gamma_6 n^o socialnetworkuse_i + e_i \quad (5)$$

$$lonelyindex_i = \gamma_0 + \gamma_1 sex_i + \gamma_2 percepcionX sex_i + \gamma_3 snXperceptionX sex_i + \gamma_4 birth_i + \gamma_5 perceptionX birth_i + \gamma_6 snXperceptionX birth_i + \gamma_7 income_i + e_i \quad (6)$$

$$lonelyindex_i = \gamma_0 + \gamma_1 sex_i + \gamma_2 percepcionX sex_i + \gamma_3 snXperceptionX sex_i + \gamma_4 birth_i + \gamma_5 perceptionX birth_i + \gamma_6 snXperceptionX birth_i + \gamma_7 income_i + \gamma_8 n^o socialnetworkuse_i + e_i \quad (7)$$

where *sex* represents having sex, *birth* using birth control, and *perception* the disapproval from friends of the interacted behaviour. Variables "*snXperceptionXbehavior"* represent the interaction between the use of social networks, negative perception, and either having sex or using birth control. Variables *sex* and *birth* operate as controls, while we are interested in the signs and significance of the interactions. As can be seen, these regressions were performed twice, once with the variable "*nºsocialnetworkuse"* acting as a control, and once without.

Finally, econometric analyses to investigate social compliance effects were performed,

$$lonelyindex_i = \delta_0 + \delta_1 sex_i + \delta_2 engagementXsex_i + \delta_3 birth_i + \delta_4 engagementXbirth_i + \delta_5 income_i + e_i \quad (8)$$

$$lonelyindex_i = \delta_0 + \delta_1 sex_i + \delta_2 engagementXsex_i + \delta_3 birth_i + \delta_4 engagementXbirth_i + \delta_5 income_i + \delta_6 n^o socialnetworkuse_i + e_i \quad (9)$$

$$lonelyindex_i = \delta_0 + \delta_1 sex_i + \delta_2 engagementXsex_i + \delta_3 snXengagementXsex_i + \delta_4 birth_i + \delta_5 engagementXbirth_i + \delta_6 snXengagementXbirth_i + \delta_7 income_i + e_i \quad (10)$$

$$lonelyindex_i = \delta_0 + \delta_1 sex_i + \delta_2 engagementXsex_i + \delta_3 snXengagementXsex_i + \delta_4 birth_i + \delta_5 engagementXbirth_i + \delta_6 snXengagementXbirth_i + \delta_7 income_i + \delta_8 n^o socialnetworkuse_i + e_i \quad (11)$$

(12)

where *engagement* represents having friends engaging in the interacted behaviour, and "*snXengagementXbehaviors"* being the interaction between the use of social networks, friends' engagement in the behaviour, and either having sex or using birth control. As before, in this part we use the behaviours as controls, and we are interested in the signs of the interactions. Again, these regressions were performed twice, once with the variable n°*socialnetworkuse* acting as a control, and once without.

After performing all the above regressions, we looked at the significance and signs of the variables to determine if there was a relationship between the variables.

5. Results

5.1 Results from social media data analysis

The social media analysis provides mixed results on the relationship between the increasing use of social media and loneliness. Firstly, Figure 5.1 displaying the conversation volume on loneliness over the five-year period considered shows a rising trend in the social media usage to discuss loneliness, stagnating at its minimum in 2008 and reaching its maximum at the end of 2012. Figure 5.2 considers weekly trends and shows that users were discussing loneliness more often during the near end of the week (Thursday) and the beginning of the week (Monday) indicating that they felt lonelier during these periods. Based on the statistics of daily moments represented in Figure 5.3, the feeling of loneliness slowly increased during the evening hours, with some fluctuations, and peaked between 10 and 11pm, while being much lower during the early morning hours.

Figure 5.1. Trend in online conversation volume on ‘loneliness’ and ‘social media use’ (Michigan, 2008-2012)

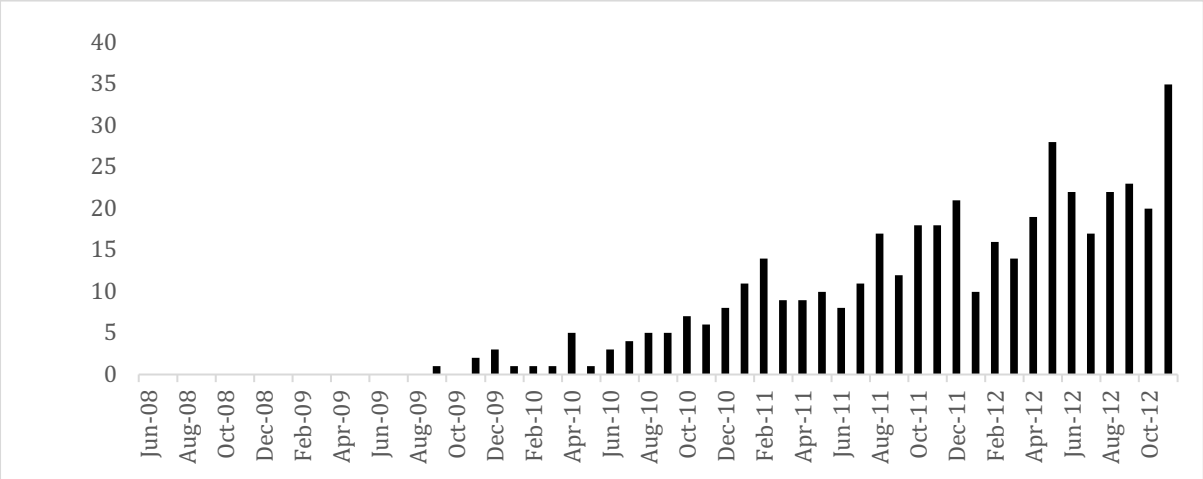


Figure 5.2. Weekly trend in online conversations on “loneliness”

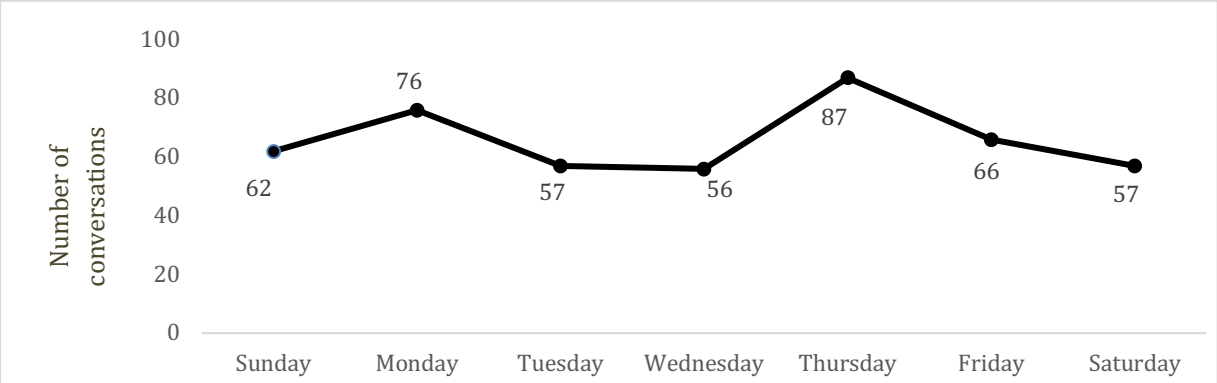


Figure 5.3. Daily moments of online conversations on “loneliness” within 24 hours

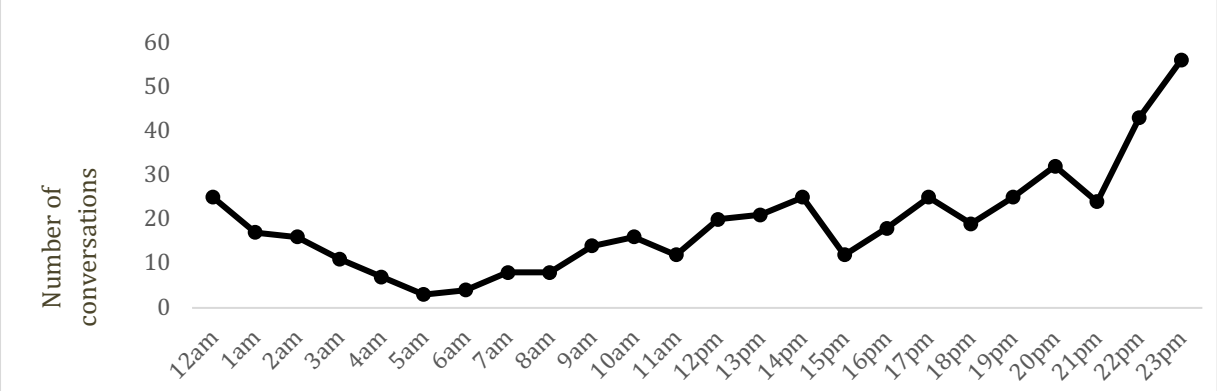


Figure 5.4. Trend in sentiment of online conversations on “loneliness” and “social media”

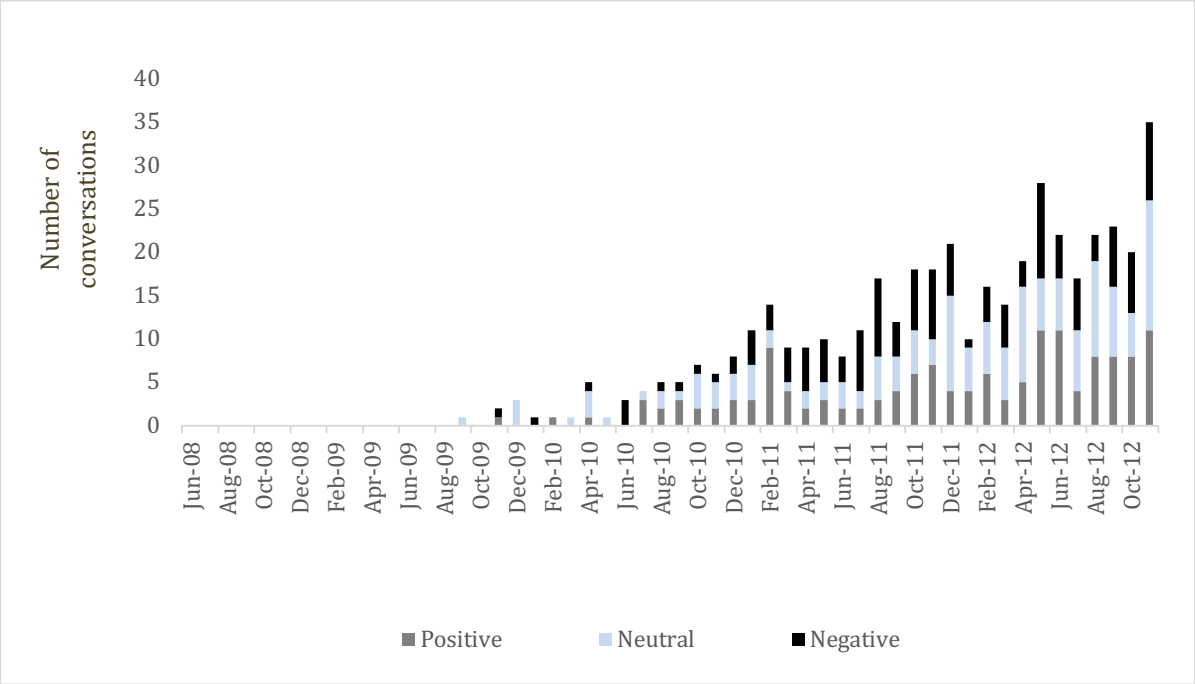
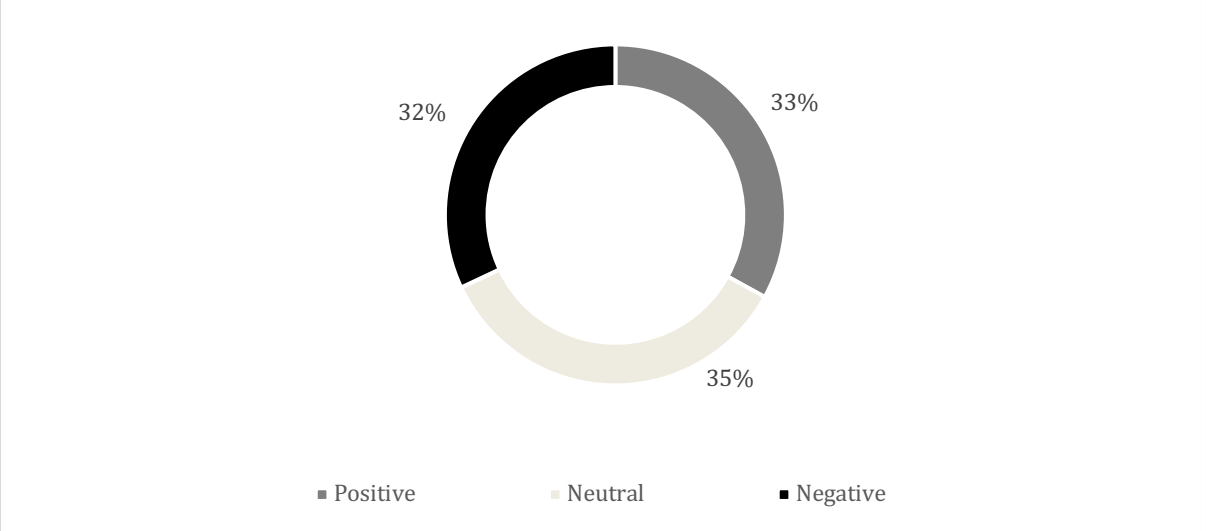


Figure 5.5. Sentiment analysis



Secondly, the automated sentiment analysis (Figure 5.4, 5.5) provides mixed results on the overall social media experience. The tonality of 32 percent of conversations was negative, suggesting perception of loneliness when using social media, compared to 33 percent of conversations having a positive tonality, hence suggesting happiness when using social media. Thirdly, despite equal percentages of positive and negative sentiments in social media use, the emotions analysis represented in Figure 5.6 and 5.7 shows that the predominant emotion expressed in 85 percent of conversations was sadness, followed by anger (8 percent) which suggests more loneliness in the population due to the increasing use of social media.

Figure 5.6. Emotions trend in online conversations on “loneliness” and “social media”

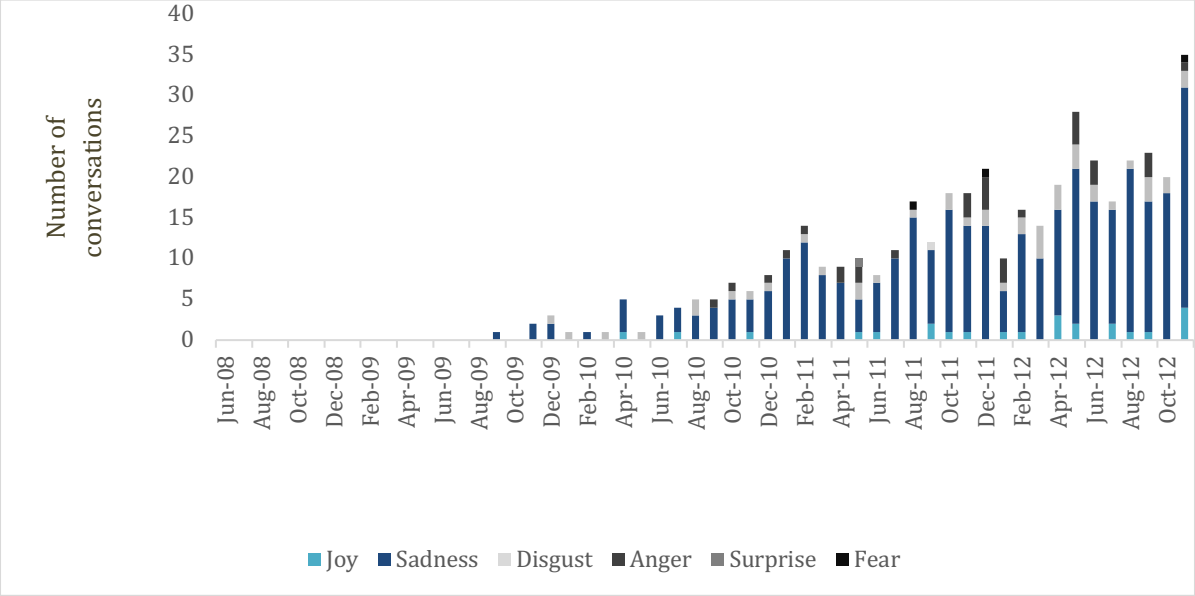
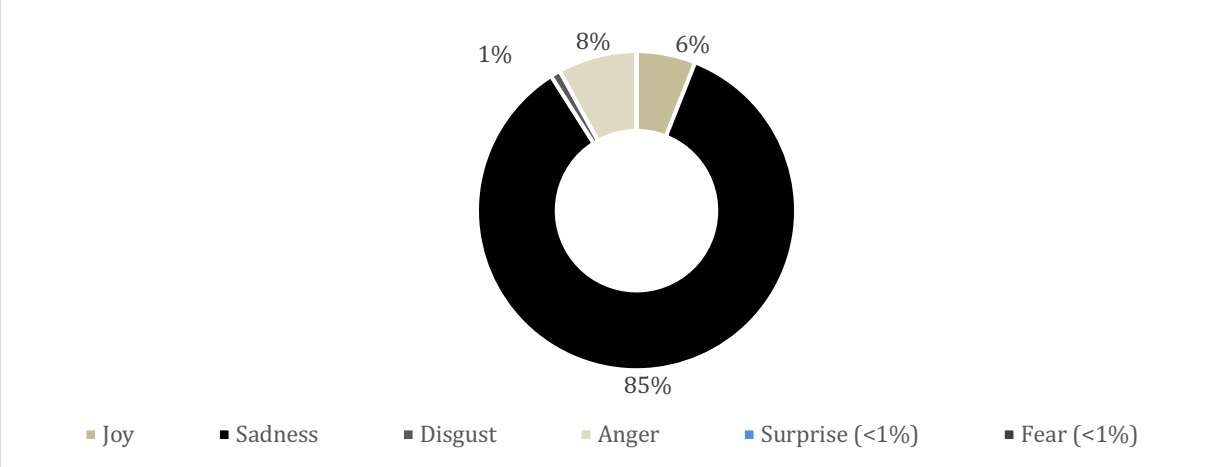
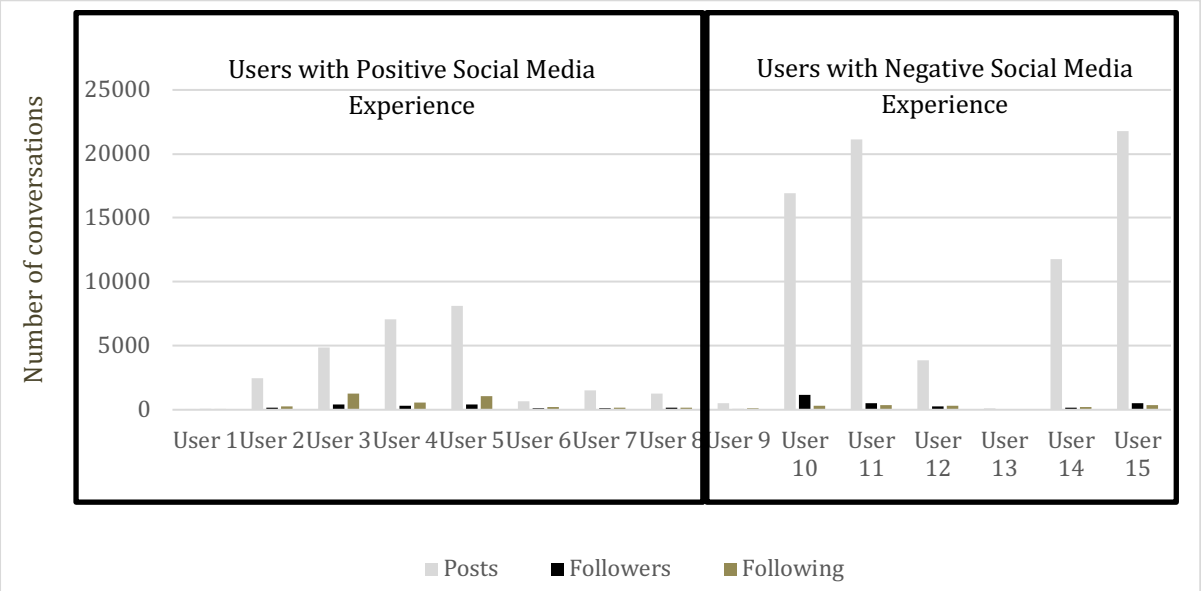


Figure 5.7. Emotions analysis



Fourthly, Figure 5.8 maps the online activity of 15 users who have expressed their positive or negative experiences on social media and shows interesting results. The users who felt less lonely when using social media and had a positive experience were comparatively less active online (number of posts ranging from 1,000 to 8,000). Whereas the users who felt lonelier on using social media and had a negative experience were starkly more active online (number of posts ranging from 3,000 to 22,000). This suggests that limited use of social media may significantly reduce the feeling of loneliness and increase the perception of being socially connected. In contrast, those who were extensively active on social media still felt lonely. Also, the number of connections was nearly similar in both groups of users and did not have any significant effect on the feeling of loneliness.

Figure 5.8. Social media activity and social connections of users with positive and negative experience



Finally, the qualitative analysis of social media data highlighted behavioural patterns as shown in Table 5. About 53 percent of the targeted population mentioned that social media makes them feel less lonely. This included those with positive online experiences. Nearly 13 percent of the online population felt more connected when using social media, and 21 percent mentioned that social media fulfils their social unmet need by making them feel more satisfied. However, this group expressed a need of being active on social media, which demonstrated signs of social media addiction. About 11 percent of the population also mentioned that being active on social media is a social norm and were thus adhering to socially compliance.

Furthermore, likes on Instagram and Facebook, as well as the number of replies to individual comments or posts appeared to be a source of instant gratification for 8 percent of the group, which made the individuals feel more satisfied due to identity payoffs, hence decreasing loneliness. On the contrary, 42 percent of the targeted population mentioned that social media made them feel lonelier. This group mostly included those with negative experiences. Nearly 18 percent of the online female population felt disconnected on social media, and 7 percent experienced loneliness by not receiving responses to their posts. A trend to engage or not in approved or non-approved behaviours by an individual's peers due to social media influence was also noticeable in the analysis. Almost 7 percent of the group reflected on social pretence, i.e., showing off extreme happiness or gaining sympathy by pretending to be lonelier. About 4 percent mentioned feeling envious of other people having relationships (partner or baby) and demonstrated a need of having a relationship for social conformity. Additionally, 6 percent of conversations consisted of commenting negatively on others' posts and indicated social shaming due to envy.

Table 5. Insights from qualitative analysis of social media data on 'loneliness' and 'use of social media'

Themes of conversations	Behavioural implication	Social media effect on loneliness	Number of conversations	Percentage of conversations
Feel connected on social media	Social connectedness	Decreases loneliness	58	13%
Relationship need	Social conformity	Increases loneliness	19	4%
Feel disconnected on social media	Loneliness	Increases loneliness	84	18%
Social media satisfies the unmet need	Social media addiction	Decreases loneliness	97	21%
No social acknowledgement (no response to posts)	Loneliness	Increases loneliness	32	7%
Social acknowledgement (replies/likes/comments)	Identity payoff	Decreases loneliness	39	8%
Social pretence (Show-off/gain sympathy)	Identity modulation, Identity loss	Increases loneliness	32	7%
More social media activity is sign of loneliness	Framing, Influencing behaviour	NA	19	4%
Being active on social media is a social norm	Social compliance	Decreases loneliness	52	11%
Social shaming due to envy	Engaging in negative behaviour, Identity loss	Increases loneliness	26	6%

5.2 Results from Michigan study data analysis

Regressions (1) to (3) studied the present estimates for different effects of social media over loneliness. As described above, there seems to be a correlation between social media use and loneliness. However, this does not seem to hold in the Michigan study. Results from regressions (1) and (2) (Table 5.1) show that no effect of social media on loneliness was found. Hence, neither the use of social media in general nor the use of a specific one makes an individual feel lonelier. However, regression (3) (Table 5.1) highlighted a relationship between the number of social media users and loneliness, which contradicts previous results.

Table 5.1: Regressions for social network use over loneliness.

	(1)	(2)	(3)
socialnetworkuse	-0.200		
	(0.129)		
myspaceuse		-0.135	
		(0.0836)	
facebookuse		0.142	
		(0.115)	
twitteruse		-0.248*	
		(0.144)	
otheruse		-0.259	
		(0.166)	
n°socialnetworkuse			-0.104**
			(0.0510)
Constant	4.411***	4.298***	4.458***
	(0.125)	(0.111)	(0.0886)
Observations	963	573	573
R^2	0.0027	0.0194	0.0072
Adjusted R^2	0.0007	0.0108	0.0037
F	1.396	2.169	2.087

Standard errors in parentheses
All models are controlled by income.
The Dependent variable is the lonely index.
Each column gives results for a different regression.
* p<0.10, ** p<0.05, *** p<0.01

Table 5.2 shows the coefficients of regressions (4) to (7), which looked at relationships between loneliness and social shaming, and the interaction between social shaming and the use of social media. In this correlation, we found that neither having sex nor using birth control are behaviours affected by social shaming. In the case of having sex, expectations were to find that engaging in sexual behaviours without peers' approval is a source of loneliness. Instead, we found out that having sex between the age of 18 and 22 is correlated to loneliness. Whether this is a way of coping or the source of it is yet to be determined. Results also showed that using birth control is a behaviour that makes you feel less lonely. Effects on sex and birth control were also found in regressions (8) to (11). Expectations for (4) to (7) were also that social shaming would be amplified when using social media. However, results showed that there is no effect altogether, which reveals that it takes no part in it on social shaming. This could be very well because of the taboo nature of the behaviours we study, as they are easy to conceal.

Table 5.2: Regressions for engagement in non approved behaviours over loneliness.

	(4)	(5)	(6)	(7)
n°socialnetworkuse		-0.107**		-0.135**
		(0.0511)		(0.0562)
sex	-0.417***	-0.304**	-0.413***	-0.295**
	(0.113)	(0.148)	(0.113)	(0.149)
badperceptionXsex	0.0421	-0.0321	-0.0702	-0.357
	(0.0819)	(0.110)	(0.234)	(0.253)
snXbadperceptionXsex			0.117	0.354
			(0.229)	(0.247)
birthcontrol	0.310***	0.379***	0.307***	0.372***
	(0.102)	(0.141)	(0.102)	(0.141)
badperceptionXbirthcontrol	-0.137	0.00373	0.395	0.332
	(0.0931)	(0.130)	(0.314)	(0.323)
snXbadperceptionXbirthcontrol			-0.554*	-0.354
			(0.324)	(0.343)
Observations	959	570	959	570
R^2	0.0172	0.0232	0.0188	0.0270
Adjusted R^2	0.0120	0.0128	0.0116	0.0132
F	3.591	2.088	2.985	1.942

Standard errors in parentheses. All models are controlled by income. Dependant variable is the created lonely index. Each column gives results for a different regressions.
* p<0.10, ** p<0.05, *** p<0.01

Table 5.3 shows the effects of social compliance on loneliness as well as the interaction between social media and social compliance on loneliness. Regressions (8) to (11) suggest that having sex when it is an approved behaviour is not a behaviour that makes you feel part of a group, and therefore has no effects on loneliness. So, having sex is not a behaviour that is part of the social compliance mechanism. Nevertheless, using birth control when your friends also do it appears to be a source of loneliness, which contradicts intuition, as using birth control does have the opposite significant effect in all regressions. This may be explained in different ways, e.g., the variable *having sex* when combined with birth control in a regression becomes a proxy for non-stable and stable relationships, which might explain why when their friends also use birth control they feel lonelier, as they have to share the time with friends with the time with their couple. Furthermore, no effects were found on the relationship between social media and social compliance. Therefore, the use of social media does not seem to have an effect on this social behaviour mechanism.

Table 5.3: Regressions for engagement of same behaviours over loneliness.

	(8)	(9)	(10)	(11)
n°socialnetworkuse		-0.113**		-0.115**
		(0.0512)		(0.0520)
sex	-0.382***	-0.301**	-0.397***	-0.317**
	(0.0967)	(0.124)	(0.108)	(0.138)
engagementXsex	0.0962	-0.0728	0.0947	-0.0756
	(0.0991)	(0.142)	(0.0992)	(0.142)
snXengagementXsex			0.0239	0.0275
			(0.0779)	(0.105)
birth	0.467***	0.539***	0.467***	0.538***
	(0.106)	(0.140)	(0.106)	(0.140)
engagementXbirth	-0.328***	-0.324***	-0.329***	-0.323***
	(0.0747)	(0.0988)	(0.0747)	(0.0992)
snXengagementXbirth			0	0
			(.)	(.)
Observations	959	570	959	570
R^2	0.0359	0.0442	0.0360	0.0444
Adjusted R^2	0.0309	0.0340	0.0300	0.0325
F	7.812	4.299	6.533	3.716

Standard errors in parentheses. All models are controlled by income. Dependant variable is the created lonely index. Each column gives results for a different regressions.
* p<0.10, ** p<0.05, *** p<0.01

6. Discussion

Increasing loneliness has become a concern in our society with the recurrence of loneliness incurred by an individual being associated with negative outcomes for this individual's mental and physical health. Consequently, phenomena such as isolation, depression, and self-harm have been reported in ever greater numbers. The latter has been found not only to be relevant to the elderly but also to young people. Today, a very young public is exposed to myriad ways of interacting with their peers and might affect the feeling of loneliness among this section of the population. The use of social media and its interplay with peer acceptance substantially contributes to mental health outcomes. This study highlights different findings concerning the use of social media, peer-accepted behaviours, and its effect on loneliness.

From the research carried out, it is argued that social media have a relatively limited impact on an individuals' feeling of loneliness, with the analysis demonstrating no significant effects of social media use on loneliness. The weak relationship between the use of social media and loneliness can be explained by considering that social media can also bring emotional benefits to individuals. It can also be argued that the use of social media makes people feel more interconnected and that it has become a coping tool for many. Notwithstanding, an opposing insight shows that there is a relationship between the number of social media outlets used and the feeling of loneliness. This highlights an important component, which is the approach that individuals have towards the use of social media. How social media is used by individuals,

such as the time spent on it and the number of platforms, does impact the feeling of loneliness perceived.

An important consideration brought forward by social media analysis is the individuals' perception of the role that the use of social media plays with regards to their loneliness. There has been growing concerns in mainstream media whether social media makes people feel less lonely. This might be because social media allows them to connect with each other and fulfil unmet social needs. It was also highlighted that the limited use of social media may have a significant reduction in loneliness, compared to those who extensively use social media, although the minority of the population felt that social media made them feel lonelier. This shows that individuals' perception is key to understanding whether the use of social media impacts the likelihood of feeling lonely.

Another contribution of the study concerns the relationship between social shaming and loneliness. Our quantitative study shows that social shaming is not amplified through the use of social media. In fact, it can be argued that social network usage cancels out the effects of social shaming related to loneliness, although this could be explained by the taboo nature of the variables used in the study. For instance, people that have specific interests and values, which can be considered to a certain extent as not peer-accepted behaviours, can connect with like-minded individuals through social media. This seems to have become prominent on social media platforms, where individuals participate in virtual communities where they can connect on the basis of their individual preferences, e.g., on blogs, forums, etc. Furthermore, we also studied the effect on social compliance behaviour of individuals. In this regard, no effect was found either. Societal behaviours towards identification with the group and adhesion to the beliefs of the group are not magnified by social media in our data.

7. Limitations

Firstly, the data considered in this study were derived from the publicly available datasets and therefore reflect the reality of the 2008-2012-time frame. However, we expect the use and proliferation of social media to have significantly increased since 2012, and we encourage further research to map more recent trends. Secondly, automated social media analysis was performed based on individual perceptions. The qualitative analysis adds an element of subjectivity to the results as it was based on individual interpretations from the online conversations. However, these inaccuracies were addressed through manual quality checks. Social media data demonstrate the magnitude of the perception of loneliness, but not necessarily the clinical loneliness per se. Finally, the study findings are limited to young females, aged 18 to 22, living in the state of Michigan, United States, and the behaviours studied are taboo behaviours that are easy to conceal from the group which might be exposed to confounding effects, thus diminishing the possible effect or concealing it. Further research with panels instead of cross-sectional data would be helpful in order to generalise the phenomenon, emphasise the divergences in trends, and better understand factors leading to loneliness**.**

8. Conclusion

Loneliness is a multi-faceted problem, one that is not resolved through the introduction of policies targeting a single specific cause. Although several initiatives are taken at the policy level for the elderly and adults, there are currently no policies targeting young adults and

adolescents in whom loneliness is equally or even more prevalent. It was shown by the study that inappropriate and excessive use of social media by individuals can create and enhance the feeling of loneliness. However, it was also demonstrated that social media can alleviate the phenomenon of social shaming. Hence, social media should be promoted as a tool that allows like-minded individuals to connect, and recommendations on how to use them healthily should be made publicly available. This study only investigates one potential factor explaining loneliness among young women, therefore it encourages further investigations to help understand the multiple factors that contribute to the increasing feeling of loneliness in the society and its repercussions on physical and mental health.

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