MASTER THESIS

Relationships of Well-Being and Depressive Mood with Social Contact in Students'
Daily Life: An Experience Sampling Study

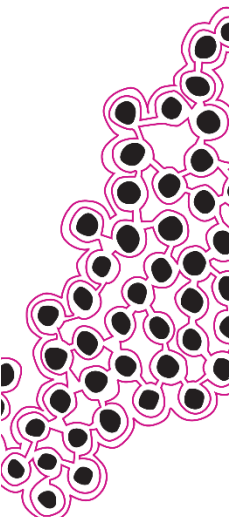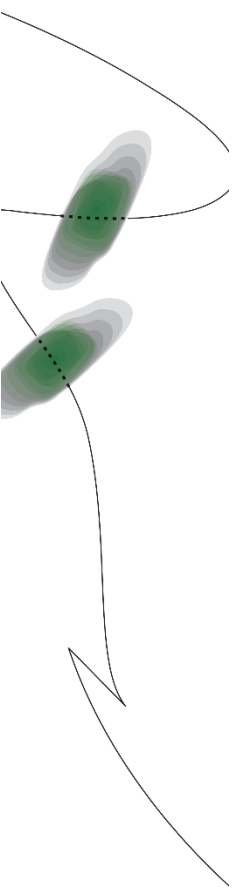Ronja Deiters

University of Twente

Faculty of Behavioural, Management, and Social Sciences

Department of Positive Psychology and Technology

First supervisor: Dr. J. T. Kraiss

Second supervisor: Dr. M. L. Noordzij

14.02.2022

UNIVERSITY OF TWENTE.

Abstract

Background: The high prevalence of depressive symptoms in students affects their academic and personal life, while high average well-being can enhance resilience and protect from the onset of mental disorders on the long term. It is widely assumed that social contact as a contextual factor plays a crucial role for students' well-being and depressive mood. Yet, it remains unclear to what extent those relationships are present also on an intraindividual level in students' daily lives and how different types of contact are related to mental health.

Objective: This study examined the relationships of well-being and depressive mood in students' daily life with their social contact frequency, including the overall association and associations distinguished into between- and within-person relationships. The type of social contact in relation with students' well-being and depressive mood was also analyzed.

Method: This experience sampling study was conducted among 34 students gathered via convenience sampling. For two weeks, participants answered questions about their amount and type of social contact, level of well-being (Short Warwick Edinburgh Mental Well-being Scale) and depressive mood (single-item depression scale) three times per day. The data were analyzed with linear mixed models and individual cases were investigated visually.

Results: The analyses revealed a positive association between social contact and well-being on the between- (β=.32, p<.001) and the within-person level (β=.22, p<.001). Depressive mood was not significantly related with social contact on the between-person level, but on the within-person level negatively (β=-.14, p=.002). Graphs of individual cases showed exceptions on several days on which those found relationships were reversed. In comparison with no contact, contact with family, close friends, partner, and acquaintances predicted higher well-being significantly, but contact with acquaintances less strongly. Only contact with close friends, family, and partner predicted lower depressive mood, but not contact with acquaintances.

Conclusion: Social contact is a predictor of students' well-being and depressive mood and should thus be used in interventions to enhance their mental health. For example, forming peer relationships should be supported at universities. However, intraindividual patterns indicate that social contact is not always related with better mental health, providing preliminary evidence that the quality of the contact may be a predictor, and that solitary time can also be beneficial. Therefore, interventions should be tailored to individual needs and further research is needed on which qualities of social contact predict momentary mental health. Also, a randomized controlled trial is needed to test causality.

Relationships of Well-Being and Depressive Mood with Social Contact in Students'
Daily Life: An Experience Sampling Study

"Mental health concerns everyone as it is generated in our everyday lives in homes, schools, workplaces, and in leisure activities" (World Health Organization, 2005, p.21). A population especially vulnerable to mental health problems are students, as they report significantly more depressive symptoms than the general population (Ibrahim, Kelly, Adams, & Glazebrook, 2013; Keyes, 2006; Stallman, 2010). Students' depressive symptoms are associated with lower academic performance (Kessler, Foster, Saunders, & Stang, 1995) and low quality of life (Alsubaie, Stain, Webster, & Wadman, 2019; Kasteenpohja et al., 2017), so they are an important concern. Well-being, a second dimension of mental health (Keyes, 2002), plays a crucial role for students' resilience and can act as a buffer against the onset of depressive symptoms on the long term (Schotanus-Dijkstra, ten Have, Lamers, de Greef, & Bohlmeijer, 2016). As well-being and depressive symptoms have often been associated with social contact (e.g., Rubin, Evans, & Wilkinson, 2016), this contextual factor should be investigated to better understand its links with mental health in daily life and to design tailored mental health interventions. For this purpose, research on processes within persons is of great value (Wichers, 2014). However, studies that can make inferences about the within-person relationships are rare (Pemberton & Tyszkiewicz, 2016), as the many existing cross-sectional designs can only collect between-person data (Curran & Bauer, 2011). An experience sampling study can thus valuably contribute to the understanding of the relationships of social contact with depressive mood and well-being in students' daily life.

Depressive Mood in Students

The risk for and prevalence of depressive symptoms in students are high. It can be expected that around one third of university students suffer from depressive symptoms, such as depressive mood and loss of pleasure (Ibrahim et al., 2013). Students' everyday life stressors such as academic pressure, isolation, and worries about the future are related to their depressive symptoms (Mikolajczyk, Maxwell, Naydenova, Meier, & El Ansari, 2008). Additional academic stress due to the Covid-19 pandemic from 2019 on, such as distant learning, can further increase those symptoms (De Man et al., 2021; Herbert, El Bolock, & Abdennadher, 2021). Therefore, students' mental health needs special attention, for example by enhancing students' well-being.

Well-Being as a Second Mental Health Dimension

For a complete understanding of students' mental health, it is not sufficient to only consider psychological symptoms such as depressive mood. Instead, well-being also plays a

major role, as research suggests that mental health has two dimensions (e.g., Keyes, 2002; 2005; 2007; Kinderman et al., 2015; Renshaw & Cohen, 2013; Suldo & Shaffer, 2008; Westerhof & Keyes, 2010). Well-being is comprised of emotional well-being and positive functioning. The latter is divided into psychological and social well-being (Keyes, 2002). The two-continua model of mental health implies that psychological symptoms and well-being constitute two negatively related but distinct dimensions both contributing to mental health (Keyes, 2002). Accordingly, people may not only experience depressive symptoms and low well-being at the same time, but also depressive symptoms and high well-being or low well-being and no depressive symptoms. People with high average well-being have shown higher resilience and perceived control over life (Keyes, 2007). The average well-being level has also been found to be a protective factor against the onset of mood disorders three years later (Schotanus-Dijkstra et al., 2016; Wood & Joseph, 2010) and general psychopathology three months later (Lamers, Westerhof, Glas, & Bohlmeijer, 2015). Accordingly, well-being can be a resilience factor for students at risk of or suffering from depressive symptoms.

Social Contact as a Contextual Factor

Well-being and depressive symptoms are influenced by genes and contextual factors. While genes have a moderate impact, contextual factors are involved to a great extent (Kendler, Gatz, Gardner, & Pedersen, 2006; Nes, Røysamb, Harris, & Reichborn-Kiennerud, 2006). The latter are valuable to investigate because they provide opportunities for mental health interventions, while genes do not. One important contextual factor related to well-being and depressive mood is social contact. Several theories propose that social relations are a crucial aspect of well-being (Keyes, 2002; Ryan & Deci, 2000; Seligman, 2011) and depressive symptomology (Allen & Badcock, 2003). This is supported by research associating a high quantity of social contact with well-being in students (Kinderman et al., 2015; Renshaw & Cohen, 2013; Rubin et al., 2016), better mood, even for depressed individuals (Merrick, 1992; Silk et al., 2011), and less depressive symptoms in students (Rubin et al., 2016). Social contact also seems to protect vulnerable individuals from developing depressive symptoms, as it moderates the relationship between early life stress and depressive symptoms (Nakamura, Kim, Rentscher, Bower, & Kuhlman, 2021). Conversely, social isolation was related to loneliness and depressive symptoms in young adults (Matthews et al., 2016). Explanations for those links between social contact and mental health are for example that contacts can provide support and increase stress coping resources (S. Cohen, 2004), help to regulate affect (S. Cohen, 1988), and foster positive emotions (Algoe, 2019). However, there is also strong evidence suggesting that negative contact,

characterized by insensitivity, anger, or interference, can have detrimental effects on mental health (Finch, Okun, Pool, & Ruehlman, 1999). Together, those findings indicate that social contact is mainly positively associated with well-being and negatively with depressive mood in students, with exceptions for contact with negative qualities.

As social contact is a versatile factor it is important to be precise about which aspects of it play a role for well-being and depressive mood (S. Cohen, 2004; Ryan & Deci, 2001). Several studies have revealed a positive association between relationship quality and well-being (Ryan & Deci, 2001). For example, Keyes (2007) reported that people with high well-being perceived their relationships as most intimate. This is supported by Brown, Strauman, Barrantes-Vidal, Silvia, and Kwapil (2011) who suggest that the closeness of social contact is a crucial aspect for mental health, including depressive symptoms. Therefore, social contacts with familiar people may be stronger related with well-being and depressive mood in students than social contact with less familiar acquaintances.

Between- and Within-Person Relationships and Experience Sampling

When investigating those relationships, the type of inference that can be drawn from the studies needs to be specified. While most research has studied the relationships of social contact with well-being and depressive mood on the between-person level, less is known about those on a within-person level (Pemberton & Tyszkiewicz, 2016). The former level informs about relationships across persons (Curran & Bauer, 2011), while the latter informs about microprocesses in which states fluctuate and covary over time within persons (Hamaker, 2012). A state is the observed deviation from the person's trait level (Hamaker, Nesselroade, & Molenaar, 2007). Insights about those microprocesses not only help to increase the theoretical understanding of mental health but can also be applied for tailored interventions (Wichers, 2014). Many theoretical models in psychology already make predictions about processes within people. However, most studies on those topics are cross-sectional and can only be used to draw inferences about the between-person level (Curran & Bauer, 2011). Drawing inferences from those studies about processes within people might therefore not be valid and can be an ecological fallacy (Robinson, 1950). According to Simpson's paradox (Simpson, 1951), relationships observed on the between-person level are not necessarily the same as the corresponding within-person relationships (Fisher, Medaglia, & Jeronimus, 2018). For example, the between-person level shows whether people with more social contact on average also have higher average well-being, while the within-person level shows whether a person reporting higher social contact than usual also reports higher well-

being in that moment. Therefore, a different study design is needed to study the relationships of well-being and depressive mood with social contact on the within-person level.

A suitable design to investigate the relationships on a within-person level is the experience sampling methodology (ESM) (Conner & Lehman, 2012; Myin-Germeys et al., 2018). ESM gathers individuals' subjective experiences and their context immediately as they occur in daily life by prompting short questionnaires several times per day over a longer period (Hektner, Schmidt, & Csikszentmihalyi, 2007). Retrospective recall biases are therefore avoided (Myin-Germeys et al., 2018) and ecological validity increases (Hektner et al., 2007; Wichers, 2014). ESM relies on self-report data and can be a valid and reliable method to study psychological states and daily activities (Csikszentmihalyi & Larson, 2014; Hektner et al., 2007). Therefore, an ESM study is suitable to investigate the relationships of students' depressive mood and well-being with their social contacts in daily life.

Some first evidence from ESM studies suggests that social contact may also relate to well-being and depressive mood states within individuals. For example, the quality of social contact has been found to predict depressive mood states (Pemberton & Tyszkiewicz, 2016) and relatedness has been found to predict well-being states (Reis, Sheldon, Roscoe, & Ryan, 2000). Until now, only one study was found which statistically differentiated between- and within-person effects. Here, close social contact was positively related with positive affect and negatively with negative affect on the within-person level (Brown et al., 2011). However, research also suggests that students' social contact can have varying impact on mental health. For example, a student seeking contact to feel better through others' approval may be more depressed after the contact when the need was not fulfilled (Jorgensen & Nelson, 2018). Also, young people often wish to be with others when experiencing depressive symptoms (Brown et al., 2011), so some students may seek much social contact while feeling depressed as a coping strategy. Having close contact with a depressed person can also involve a contagion effect, in which depressive symptoms are experienced by the initially non-depressed partner (Orden & Joiner, 2006). These examples would imply a positive within-person association between depressive mood and social contact. Consequently, it remains unclear how daily social contact is associated with well-being states and depressive mood states within students.

The Current Study

To investigate these relationships, and also how different types of social contact are involved, this study aims to explore the following research questions using ESM:

(1) What is the association between social contact frequency and well-being and between social contact frequency and depressive mood on a between-person and a within-person level in students' daily life?

(2) How is the type of social contact associated with well-being and depressive mood in students' daily life?

Based on the literature review, the following hypotheses were established: For the first research question, it was predicted that momentary well-being is positively associated with students' average social contact frequency (between-person) as well as with their momentary deviation from that average (within-person). It was also predicted that students' momentary depressive mood is negatively associated with their average social contact frequency (between-person) and with their momentary deviation from that average (within-person). However, it was expected that there are also individual cases in which momentary social contact is positively related with depressive mood states and negatively with well-being states. These exceptions were expected because research has shown that social contact may not always fulfill people's expectations and because of the possibility that students who do not feel well especially seek social contact to feel better. For the second research question, it was predicted that students' level of social contact with a partner, close friend, or family member is stronger associated with well-being and depressive mood than social contact with acquaintances.

Method

Design

An intensive longitudinal design over two weeks using ESM was chosen. The collected data were quantitative self-report data and consisted of baseline measures as well as daily momentary assessments. They have already been collected by two bachelor students from the University of Twente in April 2020. This study comprises a secondary analysis of the data.

Participants

In total, $N=34$ participants were recruited for this study with convenience sampling. Persons from the researchers' social networks were asked on social media platforms or in person to participate. The three inclusion criteria were (1) speaking sufficiently English, (2) having an iOS or Android smartphone available, and (3) being enrolled as a university student. Practicability and the reliance on other studies can be considered to determine the sample size in ESM studies (Kirtley, Lafit, Achterhof, Hiekkaranta, & Myin-Germeys, 2019). When looking at the average sample size in ESM studies, $N=19$ is a representative size (van

Berkel, Ferreira, & Kostakos, 2017). Therefore, this study's sample size still allowed for non-compliance, which is often a problem in ESM studies (Black, Harel, & Matthews, 2012), to still be in line with common ESM practice. The final sample consisted of $N=25$ participants, as those with a response rate of <50% in the daily momentary questionnaires ($N=6$) and those who did not fill in the baseline questionnaires ($N=3$) were excluded for analysis. This <50%-criterion is usually used in ESM studies (Conner & Lehmann, 2012).

Procedure

After receiving ethical approval for the study by the Ethics Committee BMS at the University of Twente (request number 191314), the study was pilot tested. Next, invitation emails with a download link for the Ethica app, with which the study was conducted, were sent to all participants. They had to download the app on their phone and register on the same day to participate in the study on the following day. In the app, participants actively had to give informed consent to participate, and they were informed about the process of the study. Amongst others, they were instructed to regularly check their phone for notifications from the app to answer the questionnaires as soon as possible (Appendix E).

On the following 14 days after the registration (April 06, 2020 – April 19, 2020), the participants were asked to fill in the daily momentary questionnaires three times per day. Conner and Lehman (2012) recommend using between four and six measures per day over a period between three days to three weeks. It was chosen to use three measures per day to reduce participant burden, as students already face many daily stressors (Mikolajczyk et al., 2008). To still have enough measurements, a long study duration of two weeks was opted for. This length is also in line with similar mobile-based ESM studies (van Berkel et al., 2017). Interval-contingent sampling was used for the timing of the questionnaires, with a fixed schedule. Questionnaires were triggered at 10 am (valid until 1 pm), 3 pm (valid until 6 pm), and 8 pm (valid until 12 am). This sampling strategy is the most convenient one for participants, as it is predictable (Conner & Lehman, 2012) and can thus enhance compliance (Vachon, Viechtbauer, Rintala, & Myin-Germeys, 2019). At each of the three daily time points, participants received a reminder notification from the app to fill in the questionnaire, which was expected to take about three minutes. This lies within the recommended duration for an ESM questionnaire (Kimhy, Myin-Germeys, Palmier-Claus, & Swendsen, 2012). When a questionnaire was not completed after 90 minutes, participants received a second reminder. Including reminders in the study design is recommended to enhance compliance (Black et al., 2012; Conner & Lehman, 2012). After three hours of non-response to a questionnaire, it expired. The questionnaires measured well-being and depressive mood

before social context, so that the more robust context could not easily influence the less stable psychological states (Palmier-Claus et al., 2010).

When receiving the first momentary questionnaire on the first day, participants additionally were asked to fill in the baseline questionnaires. This took approximately ten minutes. An overview of the measurements per fixed time point is depicted in Figure 1.

Figure 1

Measurements per Fixed Time Point during the Study Period
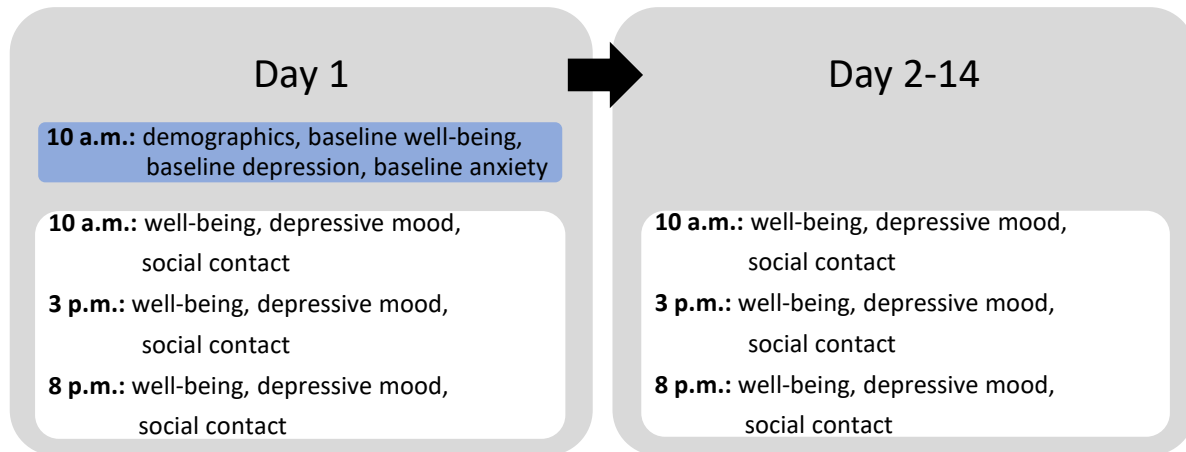
Note. Baseline measures are depicted in the blue box and daily momentary measures in the white boxes.

Materials

For the data collection, participants used their own iOS or Android smartphones. This increases convenience for participants as well as the ecological validity of the study, as people often carry their smartphones with them which makes it more natural for them to answer some questions on it during the day and they can immediately answer without having to recall information (van Berkel et al., 2017). Data were collected via the Ethica Data application, which allows anonymized data collection for ESM studies with a function to send reminders (Ethica Data, 2021a; Ethica Data, 2021b). The app provided participants with the questionnaires. Only relevant questionnaires for this study are described here, as the initial research project collected many different data that were not all used in the current study.

Baseline Questionnaires

Demographics. Participants were asked to report their age, gender, nationality, highest level of education, and field of study.

Well-being. The Short Warwick-Edinburgh Mental Well-being Scale (SWEMWBS) was used to measure well-being at baseline (Stewart-Brown et al., 2009). The questionnaire consisted of seven items that were answered on a five-point Likert-scale, ranging from 1

(*none of the time*) to 5 (*all of the time*). It asked participants about their feelings and thoughts during the last two weeks with statements such as "I've been feeling useful" and "I've been dealing with problems well" (Appendix A). A high total score on the range from 7 to 35 indicated high baseline well-being. The general population in the age range comparable to this study's participants scored on average 23.37 on this scale (Ng Fat, Scholes, Boniface, Mindell, & Stewart-Brown, 2017). Psychometric investigations of the SWEMWBS confirmed the validity and internal consistency of the scale (McKay & Andretta, 2017; Ng Fat et al., 2017). However, in the current study the reliability was poor (α=.55).

Depression and anxiety. To measure the depression and anxiety level at baseline, the Hospital Anxiety and Depression Scale (HADS) was used (Zigmond & Snaith, 1983). Participants were asked to indicate how they have been feeling during the past week on 14 items. Seven items measured the depression level, including statements such as "I can laugh and see the funny side of things" and "I look forward with enjoyment to things". The other seven items measured the anxiety level with items such as "Worrying thoughts go through my mind" and "I can sit at ease and feel relaxed". Per item, participants had to choose one of four answers describing how much it applied to them. The answer options were scored from 0 to 3 and were worded differently for each item, for example indicating *not at all* and *most of the time*. The items 2, 4, 6, 7, 12, and 14 were reversed and scored from 3 (similar to: *not at all*) to 0 (similar to: *most of the time*). The lowest total score indicating low levels of depression or anxiety was 0, while the highest score indicating high levels of depression or anxiety was 21. According to the classification by Zigmond and Snaith (1983), a total score of ≤7 means no depression or anxiety, a score of 8-10 means an in-between level and a score of ≥11 is indicative for caseness of depression or anxiety. In previous studies, the reliability of the HADS was on average good for the depression scale (α=.82) as well as for the anxiety scale (α=.83) and both scales showed good concurrent validity (Bjelland, Dahl, Haug, & Neckelmann, 2002). The reliability in the current study was questionable for the depression scale (α=.67) and acceptable for the anxiety scale (α=.79).

Daily Momentary Questionnaires

Momentary Well-being. The SWEMWBS was also used to measure daily momentary well-being. For this purpose, participants were asked about their feelings and thoughts during the last two hours instead of during the last two weeks. The overall reliability of the SWEMBS for the momentary measurements in the current study was good according to Cranbach's alpha (α=.84). However, for ESM research, the internal consistency needs to be

determined on the between- and the within-person level separately using confirmatory factor analysis (Eisele, Kasanova, & Houben, 2021).

Momentary Depressive Mood. A single-item visual analogue scale (VAS) was used for the daily momentary assessments of depressive mood. The question "To what extent do you feel down right now?" could be answered on a scale with a slider from 0 (*not down at all*) to 100 (*extremely down*) (Appendix C). This type of measurement has been used in another ESM study to measure anxiety states (Cox, Sterba, Cole, Upender, & Olatunji, 2018) and was adapted for the measurement of depressive mood in this study. Measuring depressive mood with a single-item VAS has revealed acceptable validity in a study by Killgore (1999). Similarly, ESM single-items have been shown to enable stable measurements of psychological states but with a decreased variance in response around a participant's mean over time. Individual consistency over the week was given, as well as situational validity (Csikszentmihalyi & Larson, 2014). As it is important to keep participants motivated and their burden low in ESM studies (Conner & Lehman, 2012), it was chosen to keep the number of items minimally low. However, in the current study, the momentary depressive mood scores were not significantly related with the baseline depression scores, suggesting questionable validity of the scale.

Social Contact. To identify the social context of the momentary assessments, participants were asked "Who did you spend time with within the last 2 hours?". They were able to choose from five answer options to identify whether contact took place and with whom, including *partner*; *close friend(s)*; *family member(s)*; *acquaintances (e.g., colleagues / fellow students)*, and *this does not apply, I was by myself.* Participants were instructed to choose the person they felt most connected with if several answer options applied (Appendix D). ESM items assessing activities such as social contact have shown good sampling accuracy but were not stable over the week in a student sample (Csikszentmihalyi & Larson, 2014).

Data Analysis

The data were analyzed with the software IBM SPSS Statistics, version 27, using Linear mixed model (LMM) analyses. LMMs can analyze the between-person level as well as the within-person level (Curran & Bauer, 2011) with multilevel regression. The multilevel model in this study comprised two levels. The first level consisted of the repeatedly measured momentary well-being, depressive mood, and social contact within participants and the second level consisted of the participants. A first-order autoregressive covariance structure was used for the LMM analyses. This type was chosen as it assumes that values are more strongly correlated when they are close in time (Fidell & Tabachnick, 2003). To separate

within-person data and between-person data, person-mean (PM) scores and person-mean centered (PMC) scores were computed for the social contact variable after transforming it into a continuous variable. The PM represents a participant's trait level, or average score of all measurements, whereas the PMC represents a participant's state, or the within-person variation (Curran & Bauer, 2011). The latter is calculated by subtracting the PM from the observed momentary score.

The data were checked for outliers by calculating the cumulative percent of values that were extreme cases ($z>3.29$), probable outliers ($z>2.58$), and potential outliers ($z>1.96$). For the data to be normally distributed, probable outliers should not be more than 5% and extreme cases should not be more than 1% of the values (Field, 2018). Additionally, the skewness and kurtosis were calculated to check whether the data were significantly skewed or tailed. When a z-score of skewness or kurtosis was >1.96, it was interpreted as significant (Field, 2018). Also, the three most important assumptions of multilevel models were checked, including linearity, homogeneity of variance, and normality of residuals (Maas & Hox, 2004; Palmeri, 2016). Firstly, the standardized residuals of the models were plotted against the standardized predicted values to see whether the distribution was random. Secondly, QQ-plots of the residuals were generated to see whether they were normally distributed.

To answer the first research question, two LMM analyses were conducted. For this purpose, the variables well-being, depressive mood, and social contact were prepared to obtain values on the level of days. This was done because on the level of measurement occasion, the social contact variable would only have two values (0 or 1), while on the level of days it can have four values, ranging from 0-3 contacts per day. Firstly, a new variable representing the sum of social contact per day per participant was computed from the dummy social contact variable. On days on which participants had filled out the social contact question on <2 measurement occasions, the daily sum score was replaced with a missing value. Secondly, to calculate the PM on the level of days, the sum of all summed social contact scores per day was computed for each participant and divided by the number of days. Only the days on which a participant filled out ≥2 questionnaires about social contact were included in the number of days variable. The PM score for daily social contact ranged from 0-3, as there were three measurement occasions per day. The third step was to calculate the PMC for daily contact. For this purpose, the PM for daily social contact was subtracted from the sum of social contact per day per participant. For the well-being and depressive mood variable, the daily means of the three scores per participant were computed. Before conducting the LMM analysis, a filter was created which ensured that the variables were only

used once per day per participant to avoid a unit-of-analysis error. In the first LMM, the mean of momentary well-being scores per day per participant was the dependent variable (DV) with day being the repeated variable and the scores of daily contact PM and daily contact PMC being the covariates. In the second LMM, the same analysis was conducted with the mean of momentary depressive mood scores per day per participant as DV. To check the overall association between well-being and social contact and between depressive mood and social contact, two additional LMMs were conducted with the daily social contact sum per participant as covariate and once well-being and once depressive mood as DV.

For the second research question, two LMM analyses were conducted. In the first LMM, the momentary well-being scores were the DV, while the dummy variables for different types of social contact (contact with partner, contact with close friend, contact with family, and contact with acquaintance) were the fixed factors. Afterwards, a second LMM was conducted with the same fixed factors but with the momentary depressive mood scores as DV. The answer option *This does not apply, I was by myself* from the social contact question, indicating no social contact, was used as reference category. The confidence intervals (CIs) were compared to check whether the effects of the predictors differed significantly. When the CIs of two predictors did not overlap, their effects were interpreted as significantly different (Field, 2018).

In all analyses, z-scores of the variables were used to aid interpretation. Afterwards, the resulting standardized β coefficients were interpreted according to J. Cohen (1988), with values >0.50 indicating a strong association, 0.30-0.50 indicating a moderate association, and 0.10-0.29 indicating a weak association.

Results

Sample Characteristics and Descriptive Statistics

The average depression and anxiety scores of the sample lay within the category of no depression and anxiety (Zigmond & Snaith, 1983), while their average well-being score was slightly higher than in comparable populations (Ng Fat et al., 2017). Regarding the momentary questionnaires, the sample had a response rate of 90% in the morning, 85% in the afternoon, and 92.8% in the evening. The average momentary well-being of the sample was slightly higher than the average baseline well-being and showed higher variability. Also, their momentary depressive mood showed some variability. On average, participants in the sample reported approximately 28 social contacts during the measurement period (see Table 1).

Table 1

Overview of the Sample's Characteristics (N=25)

Demographic variable	n (%)	M (SD)	Range	Skewness (SE=.08)	Kurtosis (SE=.16)
Gender					
Female	14 (56)				
Male	11 (44)				
Nationality					
German	22 (88)				
Australian	1 (4)				
Other	2 (8)				
Level of completed education					
High school	15 (60)				
Bachelor	10 (40)				
Field of study					
Social sciences	18 (72)				
Natural sciences	1 (4)				
Arts	1 (4)				
Other	4 (16)				
Not applicable	1 (4)				
Age		23.52 (2.82)	19-32		
Baseline measurements					
Depression		4.40 (2.47)	1-11		
Anxiety		7.08 (3.23)	2-13		
Well-being		24.28 (2.79)	19-29		
Momentary measurements					
Depressive mood		16.53 (20.02)	0-100	1.78	3.39
Well-being		25.50 (4.50)	7-35	-0.76	0.65
Social contact		27.56 (7.61)	12-40	-0.72	-0.43

Assumption Checks

The well-being scores were approximately normally distributed, with 94.8% in the normal range and 0.4% extreme cases. The scores were slightly but significantly negatively skewed ($z>1.96$) and tailed ($z>1.96$). Also, 94.5% of the social contact scores lay in the

normal range and there were no extreme cases. These values were significantly negatively skewed ($z>1.96$) and only lightly tailed ($z>1.96$). However, the depressive mood scores were not completely normally distributed with 93.5% in the normal range and 1.2% extreme cases. The distribution was significantly positively skewed ($z>1.96$) and extremely tailed ($z>1.96$). For all models with well-being, the assumptions linearity and homogeneity of variance were met, as the scatterplot of predicted values and residuals showed no pattern (Appendix F, Figure 1). For the models with depressive mood, only the linearity assumption was met. The plot showed a slightly heteroscedastic pattern (Appendix F, Figure 2). In the QQ- plots, the residuals were approximately normally distributed for all models with well-being (Appendix F, Figure 3). The distribution of the residuals for all models with depressive mood was not normal but positively skewed (Appendix F, Figure 4). A non-normal distribution of residuals on the group level does usually not affect the fixed effects of a multilevel model much, but significance tests on the within-person level can be limited (Maas & Hox, 2004).

Associations of Social Contact with Well-being and Depressive Mood

Visualization of the Associations

In the bar chart in Figure 2, participants are ordered based on estimated marginal means (EMMs) of their average social contact level. Participants with higher social contact mostly scored higher on well-being, indicating a positive association. However, there were also exceptions from this pattern, for example participant 9 who showed a below-average well-being level but an average social contact frequency. An association between depressive mood and social contact frequency is less visible. Some participants with fewer social contact on average had high average depressive mood scores (e.g., participant 2 and 21) and some with more social contact had low depressive mood scores (e.g., participant 5), indicating a negative association. However, there were also participants with higher depressive mood levels and higher social contact frequency (e.g., participant 8) or with lower depressive mood levels and lower social contact frequency (e.g., participant 10), indicating a positive association. Overall, the bar chart indicates that there was variance in the variables between participants.

In the line graph in Figure 3, a positive association between social contact and well-being is visible, with very small exceptions on days 6, 10, 11, and 13. Also, the line graph suggests a negative association between social contact and depressive mood on day 3-5,8-9, and 12-14. However, on days 2, 6-7, and 10-11, there seems to be a positive association. As the daily differences are small (all z-scores on an average level), the graph suggests that there are no significant day effects in the data.

Figure 2

Well-Being, Depressive Mood, and Social Contact EMMs by Participant
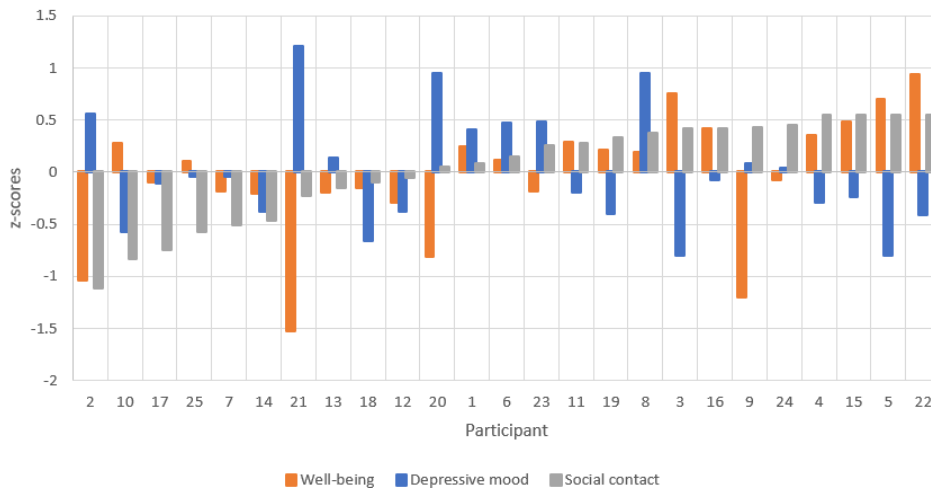
Figure 3

Well-Being, Depressive Mood, and Social Contact EMMs by Day
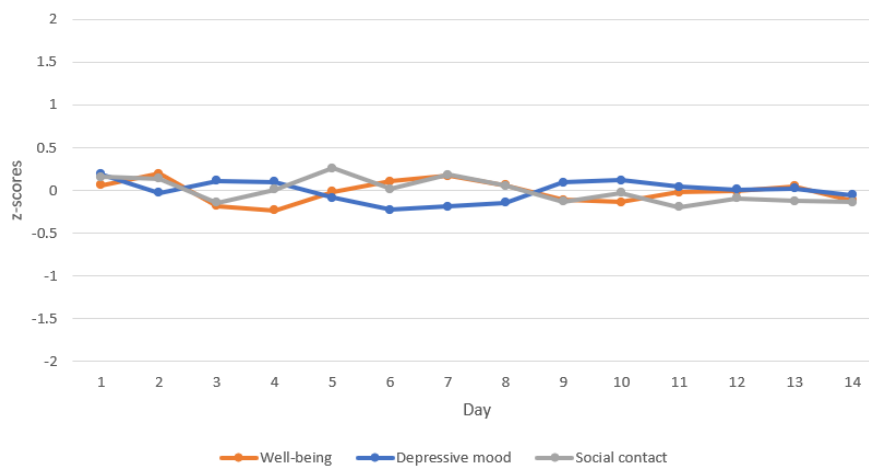
LMM Analyses

The overall LMM analysis revealed that social contact frequency was moderately positively associated (β=.31) with well-being, $F(1, 318.10) = 36.51$, $p<.001$. The more specific LMM showed that the social contact PM significantly predicted well-being, $F(1, 89.17) = 18.89$, $p <.001$, indicating a moderate positive association (β=.32) between well-being and social contact on the between-person level. Also, the social contact PMC significantly predicted well-being, $F(1, 266.85) = 25.17$, $p <.001$, showing a weak positive association (β=.22) between well-being and social contact on the within-person level (see Table 2). These results indicate that students' daily well-being is higher when their average social contact level is high as well as when their daily contact level is higher than their average.

Table 2

Estimated Fixed Effects of Social Contact Frequency on Well-being

							95% CI	
Parameter	*b*	*β*	*SE*	*df*	*t*	*p*	*LL*	*UL*
Contact frequency overall	1.33	.31	.05	318.10	6.04	<.001	.209	.410
Contact frequency between-person	2.16	.32	.07	89.17	4.35	<.001	.172	.461
Contact frequency within-person	1.18	.22	.04	266.85	5.02	<.001	.133	.305

Note. Total *N* = 25; CI = confidence interval; *LL* = lower limit; *UL* = upper limit

The overall LMM analysis with depressive mood and social contact revealed a weak negative association ($β$=-.17), $F(1, 308.09)$=9.97, p=.002. The next LMM showed that social contact PM did not significantly predict depressive mood, $F(1, 87.22) = .74$, p =.392, so that social contact and depressive mood were not associated on the between-person level. However, social contact PMC significantly predicted depressive mood, $F(1, 256.01) = 9.86$, p =.002, indicating a weak negative association ($β$=-.14) between social contact and depressive mood on the within-person level (see Table 3). Accordingly, students' average social contact level is not associated with their average daily depressive mood, but if they have more social contact on a day than their average level, their depressive mood tends to decrease on that day.

Table 3

Estimated Fixed Effects of Social Contact Frequency on Depressive Mood

							95% CI	
Parameter	*b*	*β*	*SE*	*df*	*t*	*p*	*LL*	*UL*
Contact frequency overall	-2.97	-.17	.05	308.09	-3.16	.002	-.272	-.063
Contact frequency between-person	-2.10	-.07	.09	87.22	-.86	.392	-.247	.098
Contact frequency within-person	-3.09	-.14	.04	256.00	-3.14	.002	-.226	-.052

Note. Total *N* = 25; CI = confidence interval; *LL* = lower limit; *UL* = upper limit

Visualization of the Associations for Individual Participants

The line graphs visualize EMMs of the variables for participants with an intermediate, low, and high average social contact level. Participant 5 had an intermediate contact level

(*N*=28). The graph in Figure 4 shows that the social contact level and the well-being level were average, while the depression level varied between average and below average. A positive association between well-being and social contact is visible on day 3-5, 8, 9, 12, and 13, but a negative association on day 2, 6, 7, 10, 11, and 14. At the well-being low on day 3, the participant also showed the lowest level of social contact and one of the highest levels of depressive mood. A negative association between depressive mood and social contact is visible on all days, except from a weak positive association on day 13 and 14.

Participant 2 had the lowest contact level (*N*=12), with values mainly below average (see Figure 5). The well-being level was also mainly below average, while the depressive mood level was average. On day 3-5, 8, 9, and 12 there is a positive association between social contact and well-being visible. But on day 6, 7, 10, 11, 13, and 14 the association looks negative. Between day 12 and 13, the social contact level dropped strongly, while the well-being and depressive mood level increased slightly. On day 3-5, 8, 9, and 12-14 the graph shows a negative association between depressive mood and social contact, but a positive association on day 6, 7, and 11.

Participant 4 had the highest contact level (*N*=40), with values on an average level (see Figure 6). The well-being and depressive mood levels also fluctuated on an average level, with well-being being constantly higher than depressive mood. On day 3-5, 8, 9, 12, and 13 the graph shows a positive association between well-being and social contact, but on day 2, 6, 7, 10, and 11 a negative association. For depressive mood, the graph shows a positive association with social contact on day 2, 6, 7, 11, and 13, but a negative on day 3-5, 8, 9, and 12. At the social contact peaks on day 5 and 7, the well-being was also almost at the peak and the depressive mood at the low.

Figure 4

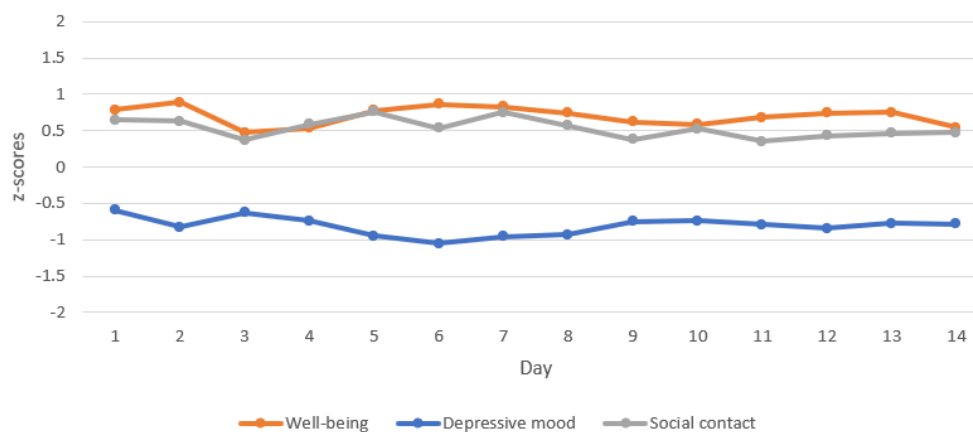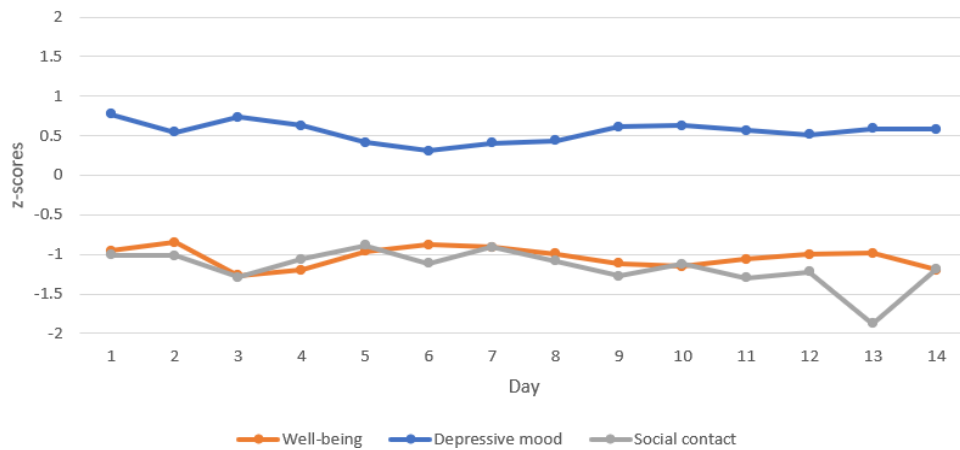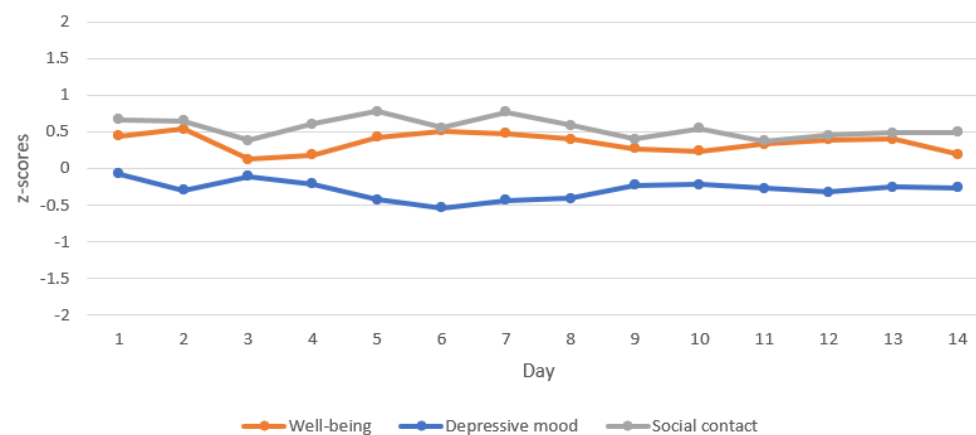*Depressive Mood, Well-Being and Social Contact EMMs of Participant 5*

Figure 5

Depressive Mood, Well-Being and Social Contact EMMs of Participant 2

Figure 6

Depressive Mood, Well-Being and Social Contact EMMs of Participant 4

These three examples indicate that the relationships of social contact with well-being and with depressive mood vary between and within participants in strength and direction.

Association of Type of Social Contact with Well-being and Depressive Mood

The first LMM indicated that all types of social contact significantly predicted well-being (see Table 4). Well-being was weakly positively associated with contact with a partner, $F(1, 872.75) = 34.36$, $p < .001$, contact with a close friend ($F(1, 860.98) = 74.38$, $p < .001$), and contact with an acquaintance ($F(1, 828.41) = 16.97$, $p < .001$) in comparison to no social contact. A moderate positive association was found between well-being and contact with family ($F(1, 879.10) = 66.69$, $p < .001$) in comparison to no contact. When comparing the CIs, all were overlapping except for the one of acquaintance contact. It did not overlap with the CI of contact with a close friend and contact with family. This suggests that the effect of contact

with an acquaintance significantly differs from the other two. For a visualization of the association between type of social contact and well-being, see Appendix G, Figure 1.

Table 4

Estimated Fixed Effects of Social Contact Type on Well-being

Parameter	b	β	SE	df	t	p	95% CI LL	UL
Intercept (no contact)	23.03	-.07	.05	179.70	-1.43	.154	-.159	.025
Partner contact	2.57	.23	.04	872.75	5.86	<.001	.153	.306
Close friend contact	3.92	.29	.03	860.98	8.63	<.001	.225	.358
Family contact	3.56	.32	.04	879.10	8.17	<.001	.244	.398
Acquaintance contact	2.15	.13	.03	828.41	4.12	<.001	.067	.189

Note. Total $N = 25$; CI = confidence interval; *LL* = lower limit; *UL* = upper limit

The second LMM revealed that three types of social contact significantly predicted depressive mood (see Table 5). There was a negligibly low negative association of depressive mood with contact with a partner, $F(1, 887.72) = 4.01$, $p =.046$, and a weak negative association between depressive mood and contact with a close friend, $F(1, 855.07) = 29.00$, $p≤.001$, and contact with family, $F(1, 890.52) = 6.25$, $p =.013$, in comparison to no social contact. However, contact with an acquaintance was no significant predictor of depressive mood, $F(1, 821.59) = 3.84$, $p =.051$. The CIs of the predictors overlapped so there was no significant difference in their effect. For a visualization of the association between type of social contact and depressive mood, see Appendix G, Figure 2.

Table 5

Estimated Fixed Effects of Social Contact Type on Depressive Mood

Parameter	b	β	SE	df	t	p	95% CI LL	UL
Intercept (no contact)	20.89	.02	.05	178.92	.47	.639	-.075	.122
Partner contact	-3.84	-.08	.04	887.72	-2.00	.046	-.159	-.002
Close friend contact	-10.64	-.19	.03	855.07	-5.39	<.001	-.253	-.118
Family contact	-4.77	-.10	.04	890.52	-2.50	.013	-.180	-.022
Acquaintance contact	-4.44	-.06	.03	821.59	-1.96	.051	-.124	.0001

Note. Total $N = 25$; CI = confidence interval; *LL* = lower limit; *UL* = upper limit

Discussion

The goal of this study was to examine the association of well-being and depressive mood in students' daily life with their social contact. For this purpose, the overall association between social contact and the two variables was examined and associations on the between- and within-person level were disaggregated from each other. Afterwards, the type of students' social contact was analyzed in relationship with their well-being and depressive mood.

Social Contact Frequency and Well-being

Firstly, the results indicated that the higher students' level of social contact was, the higher their daily well-being. More specifically, students' average social contact level as well as their daily deviation from their average predicted their daily well-being. These findings support the hypothesis and match with previous studies which also found a general positive association between social contact and well-being (Kinderman et al., 2015; Renshaw & Cohen, 2013; Rubin et al., 2016). The found positive within-person relationship extends findings of a positive association between relatedness and well-being on a state level (Reis et al., 2000) by showing that the momentary deviation from one's average contact level is a statistically significant predictor. This corroborates with similar findings of a positive association between relatedness and positive affect on an intraindividual level when statistically differentiating the PM and the PMC (Brown et al., 2011).

The findings are in line with and may extend several theories. Firstly, the self-determination theory by Ryan and Deci (2000) proposes that relatedness is one of three basic needs for self-realization which affects well-being on both levels, within- and between-persons. However, the existing evidence for the within-person association is not sufficient as the PM and the PMC were not distinguished in the study (Reis et al., 2000). This current study contributes to the validation of the theory on both levels. The found between-person association may indicate that students with many social contacts on average have a high satisfaction of their need of relatedness and thus have higher well-being. The within-person association may show that on days on which students have more contacts than usual, they feel especially related and consequently feel well. Similarly, according to the belongingness hypothesis, people are naturally driven to have some meaningful and lasting social relationships. One important aspect to fulfill this need is a high frequency of social contact (Baumeister & Leary, 1995). This can explain why students who on average had frequent social contacts scored higher on daily well-being. The within-person findings suggest that this theory could also be extended to the intraindividual level, meaning that the belongingness need may also be fulfilled by having more contact than usual on a day. Furthermore, feeling

socially included elicits different positive emotions (Baumeister & Leary, 1995). When students had more contact than usual on a day, it may be that they feel strongly socially included and thus the well-being level is higher than on days on which they have less contacts and may feel less included. Positive relations also seem to foster other positive emotions such as amusement, joy and gratitude, and the more often those positive contacts take place, the higher may be their impact on general well-being (Algoe, 2019). In line with the broaden-and-build-theory, positive emotions can enhance individuals' attention span and thus help to build resources, including positive relations (Fredrickson, 1998; Fredrickson, Cohn, Coffey, Pek, & Finkel, 2008). Together, this suggests a bi-directional relationship between well-being and social contact in which a high average frequency of social contact elicits higher daily well-being, which in turn helps to gain more positive relations. Possibly, this also happens on an intraindividual level, so that the positive emotions gained from a social contact provide a student with the energy and skills to engage in further good contacts on that day.

Beyond that, graphs of individual cases in this study indicated, as hypothesized, that students did not always experience higher well-being when having more social contact on one day. There were also many days on which their well-being decreased while their level of social contact increased. These findings underline the importance to closely look at the individual trajectories, as the between-person associations can only provide information about the average and thus do not represent the actual daily patterns. Even the within-person associations can only represent the average of relationships within participants and not individual exceptions. Therefore, the findings extend past research by showing that the daily patterns not always resemble the overall relationship found but can also be of opposite direction.

Explanations can be that, when students are aware that social contact can help them to feel well, they choose to have contact on days on which they do not feel well as an adaptive coping strategy. Research has shown that support seeking is an effective strategy to adjust to stressful university settings (Fullerton, Zhang, & Kleitman, 2021). Another point can be that a contact did not go as hoped and thus did not fulfill the student's needs (Jorgensen & Nelson, 2018). This is in line with research emphasizing that the quality of social contact is a decisive factor for its relationship with well-being and not solely the quantity (Ryan & Deci, 2001). Findings from the second research question in this study also support this, as they show that not every contact is equally good for well-being, dependent on with whom the contact is. Besides, being alone can also have benefits for well-being. According to Jorgensen and Nelson (2018), a balance between connecting with others and connecting with the self is

beneficial for mental health. For example, solitude does not necessarily mean being lonely and can instead also be used for self-discovery, spirituality, inner peace, or intimacy (Long, Seburn, Averill, & More, 2003), Also, solitude was found to be an opportunity to experience autonomy which increased people's well-being (Weinstein, Nguyen, & Hansen, 2021). It seems that when young people voluntarily choose solitude time, their well-being profits but when they are involuntarily alone, their well-being can suffer (Corsano, Majorano, & Champretavy, 2006). This suggests that on days, on which students showed low social contact levels but high well-being, they may have chosen to use solitary time for their own benefit.

Social Contact Frequency and Depressive Mood

Secondly, the results revealed that the higher students' social contact level was, the lower their daily depressive mood. However, only students' daily deviations from their average contact level predicted their depressive mood, but not their average level. These findings only partly support the hypothesis because only the within-person relationship was significant. When not separating the two levels, the findings are in line with previous research suggesting that students with a high level of social contact have in general fewer depressive symptoms (Rubin et al., 2016). An explanation for the lacking relationship on the between-person level can be the measurement used for momentary depressive mood. There was a floor effect in the distribution, and it was not related with participants' baseline depression level, suggesting low validity. Possibly, the question whether one feels down can be interpreted in different ways, such as feeling exhausted or tired and not necessarily feeling depressed. On the within-person level, the findings match previous findings of a negative association between social contact and negative affect (Brown et al., 2011). They also extend the finding that on a state level, high-quality social contact and depressive mood are related (Pemberton & Tyszkiewicz, 2016) by indicating that the frequency of social contact predicts depressive mood states within persons when separating between-and within-person data.

Again, graphs of individual cases showed that there were also exceptions from those found relationships, as there were also cases in which students had higher depressive mood on a day on which they had more social contact. This again highlights the importance to closely investigate intraindividual patterns instead of only relying on overall associations to not miss important daily phenomena. The exceptions found can for example be explained by research showing that people with depressive symptoms are especially reactive to social interactions (Steger & Kashdan, 2009). This implies that when students with depressed mood encounter a negative interaction, their mood decreases strongly on that day. Negative interactions can be those in which students did not get the social approval they hoped to get, which can increase

depressive mood (Jorgensen & Nelson, 2018). Also, insensitivity, anger, or interference can be part of negative interactions that predict lower mental health (Finch et al., 1999). Another explanation would be that students in a depressive mood often feel the need for company (Brown et al., 2011) and thus may meet others to deal with their mood. Students stated that seeking support from their peers is a helpful strategy to deal with their depressive mood in a university setting (Chang, Eddins-Folensbee, & Coverdale, 2012). Consequently, a student with high depressive mood on one day may seek especially much social contact to cope. Having contact with a depressive person can also predict higher depressive mood for oneself (Orden & Joiner, 2006), which may also explain some exceptions in the association.

Type of Social Contact and Well-being

Thirdly, the results showed that students had higher well-being when having contact with a partner, close friend, family, or an acquaintance in comparison to being alone. Contact with an acquaintance predicted higher well-being less strongly than contact with a close friend or family. Therefore, the hypothesis is mainly supported. The findings corroborate with several studies indicating a positive association between relationship quality and well-being (Ryan & Deci, 2001) and a perception of intimacy and well-being (Keyes, 2007). In comparison to acquaintances, family and peers have been found to have an important impact on students' need satisfaction of relatedness, competence, and autonomy, which is crucial for their well-being (Basson & Rothmann, 2018). Students especially value in their friendships the emotional and academic support, positive emotions, and having the same interests (O'Rourke, Harms, & Cohen, 2019), which make them an important resource for well-being.

However, contact with a partner was not statistically different from contact with an acquaintance for well-being. This part of the findings does not completely match with the hypothesis and suggests reinvestigating the proposed role of intimacy for well-being. According to Gómez-López, Viejo, and Ortega-Ruiz (2019), romantic relationships are related with higher well-being in young adults only when they are of good quality and can be challenging for those who still need the skills required for a high-quality romantic relationship. This is because partnerships can also involve risk factors, such as violence and low authenticity. In this study, students may still experiment with their partnerships and be in a process of acquiring those skills needed for a high-quality relationship.

Type of Social Contact and Depressive Mood

Fourthly, the results revealed that students had lower depressive mood when having contact with a partner, close friend, or family member than when being alone. However, students' depressive mood did not change when they had contact with an acquaintance. This

partly supports the hypothesis because it was expected that contact with an acquaintance is negatively related with depressive mood but to a lesser extent. The findings support Brown et al. (2011) by indicating that close social contact is accompanied by less depressive mood. Contact with acquaintances may not be as close as contact with friends, family or partner and thus not be related to depressive mood. When it comes to those psychological symptoms, research on the belongingness hypothesis supports the idea that only caring social bonds are helpful and not any social contact (Baumeister & Leary, 1995). The link between contact with family and depressive mood is in line with findings that perceived support from the family predicts lower depressive symptoms in students (Chang, Chang, Martos, & Sallay, 2018), as well as a close bond with parents does (Obradović, Tirado-Strayer, & Leu, 2013). Also, support from friends predicted lower depressive symptoms in students (Obradović et al., 2013). Therefore, only close, supportive relationships seem to be a helpful resource for students' depressive mood.

Strengths and Limitations

Due to the ESM used, this study has several advantages. The first is that the data were collected from everyday life situations and by using students' own smartphones which is expected to be a natural act in their everyday lives. This increased the ecological validity of this study (Hektner et al., 2007; van Berkel et al., 2017; Wichers, 2014). Also, recall bias was reduced (Myin-Germeys et al., 2018) as the data were collected in the moment. Secondly, the study design allowed for a distinction of within- and between-person relationships. As there can be differences between those levels (Fisher et al., 2018), this study allowed a more differentiated interpretation of the relationships on each level and pointed to patterns that were only visible on an intraindividual level. A third strong point is the high response rate for the momentary questionnaires in the final sample. In other ESM studies, high response rates were reached by explicitly rewarding compliance (Carr et al., 2020). As participants were not rewarded in this study, the high response rate may indicate that the design fitted the needs of the student sample and that the participants were committed to the study.

However, there are also drawbacks limiting the generalizability of the findings. While convenience sampling is a resource-saving way to gather participants, there is a high probability that the participants share the same factors, especially in ESM studies (Napa Scollon, Prieto, & Diener, 2009), which can influence the external validity of the results (Emerson, 2015). Almost three-quarter of the students studied social sciences, so the results can hardly be generalized to all students. Another limitation is that causality cannot be assumed from the type of analysis used (Larson, Delespaul, & deVries, 1992). A randomized

controlled trial is needed to test whether social contact can cause well-being and depressive mood or whether these psychological variables cause the level of social contact. Thirdly, it is questionable whether the sample was sufficiently large to answer the second research question. Some categories of type of contact only included a few occasions, so only small effects were investigated, and the wide confidence intervals suggest that the statistical power was low (Field, 2018). Furthermore, the investigated contact frequency was limited to a maximum of three contacts per day which may underestimate the contacts of students on socially active days. The social contact question also did not ask about the perceived contact quality which would have been valuable for the interpretation of the relationships on individual occasions. Lastly, this study was conducted during the first lockdown of the COVID-19 pandemic, in which students' social contact was restricted. As it makes a difference for mental health whether one has social contacts or actually meets those contacts (Baumeister & Leary, 1995), the altered social interaction patterns might have influenced the relationships with well-being and depressive mood. The relationships may have become stronger because real-life contacts were rare and thus might have had a higher importance for students' mental health than if they met many different people per day as usual.

Implications and Future Research

The findings highlight the link of social contact with students' mental health. Also, they point to occasional differences in how social contact is related with momentary well-being and depressive mood and emphasize the need for personalized mental health interventions. This is important because in the real lives of students, patterns have been found to vary daily so that students may have different needs at different times. At universities, students should be sensitized to identify their current needs and have constant opportunities to socialize with others so that they can freely decide whether they currently need social contact or not. One example to support this from the beginning is a social belonging intervention for incoming students which can increase social integration (De Clercq, Michel, Remy, & Galand, 2019). Furthermore, a social skills training might be especially helpful for students with depressed mood, as it may help them to improve the quantity and quality of their contacts. For example, interventions with practical skills training can increase students' social self-efficacy, a skill needed for social interactions (Olaz, Medrano, & Cabanillas, 2014). With those interventions students have different opportunities to form strong social bonds with their peers, an important resource to handle the different stressors of university life.

Theories which emphasize the importance of social contact for mental health (e.g., Keyes, 2002; Ryan & Deci, 2000; Seligman, 2011) should, however, not be overgeneralized.

The clear distinction in this study of within- and between-person relationships allows for a more nuanced view on those theories and possible extensions to the within-person level. But the individual trajectories also showed that, on an intraindividual level, the theories may not always be applicable, and attention should also be paid to potential pitfalls of social contact and to benefits of solitary time. It can be valuable to give trainings to students how to beneficially use time they have on their own for their well-being so that they are not dependent on the presence of others.

It is recommended to replicate this study with a randomized controlled trial and with different questions about social contact. For example, an item could ask participants how often they had social contact since they answered the last question. This would offer more precise data about contact frequency. Additionally, a question should be added about how participants perceived the contact to gather information about the quality. Variables such as intimacy, emotional support, authenticity, positive emotions, and academic support may be included. To identify whether contact is used as a strategy to feel better, participants can be asked whether they are currently in need of support. Also, solitary time can be investigated as a contextual factor by asking questions about the motivation to be alone and what participants did with their solitary time. Furthermore, the directions of the relationships should be investigated on the within-person level to see for example whether the broaden-and-build hypothesis is also applicable on the microlevel.

Conclusion

This ESM study contributed to the investigation of students' mental health in their daily life contexts by looking at associations on a group level as well as on an intraindividual level. Frequent social contact was accompanied by higher well-being on both levels, while it was accompanied by lower depressive mood only on an intraindividual level. Contact with close friends and family may be most strongly linked with students' health, followed by contact with a partner. Acquaintances seem to be less associated, which supports the idea that high-quality relationships provide the best support for students. Also, the exceptions on several days, on which the relationships of social contact with well-being and depressive mood were reversed, suggest that the quality of social contact is crucial, and that solitary time can also be beneficial for students' mental health. These insights support the need for social interventions at universities and can inform new interventions tailored to individual patterns of social contact, acquisition of social skills, and effective use of solitary time. Future ESM research can explore the different potential qualities of social contact further to specify their relationship with well-being and depressive mood also on the within-person level.

References

Algoe, S. B. (2019). Positive interpersonal processes. *Current Directions in Psychological Science, 28*(2), 183-188. https://doi.org/10.1177/0963721419827272

Allen, N. B., & Badcock, P. B. T. (2003). The social risk hypothesis of depressed mood: Evolutionary, psychosocial, and neurobiological perspectives. *Psychological Bulletin, 129*(6), 887–913. https://doi.org/10.1037/0033-2909.129.6.887

Alsubaie, M. M., Stain, H. J., Webster, L. A. D., & Wadman, R. (2019). The role of sources of social support on depression and quality of life for university students. *Journal of Adolescence and Youth, 24*(4), 484-496. https://doi.org/10.1080/02673843.2019.1568887

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin, 117*(3), 497–529. https://doi.org/10.1037/0033-2909.117.3.497

Basson, M. J., & Rothmann, S. (2018). Antecedents of basic psychological need satisfaction of pharmacy students: The role of peers, family, lecturers and workload. *Research in Social & Administrative Pharmacy, 14*(4), 372-381. https://doi.org/10.1016/j.sapharm.2017.04.015

Bjelland, I., Dahl, A. A., Haug, T. T., & Neckelmann, D. (2002). The validity of the Hospital Anxiety and Depression Scale. An updated literature review. *Journal of Psychosomatic Research, 52*(2), 69-77. https://doi.org/10.1016/S0022-3999(01)00296-3

Black, A. C., Harel, O., & Matthews, G. (2012). Techniques for analyzing intensive longitudinal data with missing values. In M. R. Mehl & T. S. Conner (Eds.), *Handbook of research methods for studying daily life* (pp. 339-356). The Guilford Press.

Brown, L. H., Straumann, T., Barrantes-Vidal, N., Silvia, P. J., & Kwapil, T. R. (2011). An experience-sampling study of depressive symptoms and their social context. *The Journal of Nervous and Mental Disease, 199*(6), 403-409. https://doi.org/10.1097/NMD.0b013e31821cd24b

Carr, D. J., Adia, A. C., Wray, T. B., Celio, M. A., Pérez, A. E., & Monti, P. M. (2020). Using the internet to access key populations in ecological momentary assessment research: Comparing adherence, reactivity, and erratic responding across those enrolled remotely versus in-person. *Psychological Assessment, 32*(8), 768-779. https://doi.org/10.1037/pas0000847

Chang, E. C., Chang, O. D., Martos, T., & Sallay, V. (2018). Loss of hope and suicide risk in Hungarian college students: How the presence of perceived family support makes a positive difference. *The Family Journal, 26*(1), 119-126. https://doi.org/10.1177/1066480718756595

Chang, E., Eddins-Folensbee, F., & Coverdale, J. (2012). Survey of the prevalence of burnout, stress, depression, and the use of supports by medical students at one school. *Academic Psychiatry, 36*(3), 177. https://doi.org/10.1176/appi.ap.11040079

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences. 2nd edition.* Hillsdale, NJ: Erlbaum.

Cohen, S. (1988). Psychosocial models of the role of social support in the etiology of physical disease. *Health Psychology, 7*(3), 269–297. https://doi.org/10.1037/0278-6133.7.3.269

Cohen, S. (2004). Social relationships and health. *American Psychologist, 59*(8), 676–684. https://doi.org/10.1037/0003-066x.59.8.676

Conner, T. S., & Lehman, B. J. (2012). Getting started. Launching a study in daily life. In M. R. Mehl & T. S. Conner (Eds.), *Handbook of research methods for studying daily life* (pp. 89-107). The Guilford Press.

Corsano, P., Majorano, M., & Champretavy, L. (2006). Psychological well-being in adolescence: The contribution of interpersonal relations and experience of being alone. *Adolescence, 41*(162), 341-353.

Cox, R. C., Sterba, S. K., Cole, D. A., Upender, R. P., & Olatunji, B. O. (2018). Time of day effects on the relationship between daily sleep and anxiety: An ecological momentary assessment approach. *Behavior Research and Therapy, 111,* 44-51. https://doi.org/10.1016/j.brat.2018.09.008

Csikszentmihalyi, M., & Larson, R. (2014). Validity and reliability of the experience-sampling method. In: *Flow and the foundations of positive psychology* (pp. 35-54). Dordrecht: Springer.

Curran, P. J., & Bauer, D. J. (2011). The disaggregation of within-person and between-person effects in longitudinal models of change. *Annual Review of Psychology, 62*(1), 583-619. https://doi.org/10.1146/annurev.psych.093008.100356

De Clercq, M., Michel, C., Remy, S., & Galand, B. Providing freshmen with a good "starting-block". Two brief social-psychological interventions to promote early adjustment to the first year at university. *Swiss Journal of Psychology, 78*(1-2), 69-75. https://doi.org/10.1024/1421-0185/a000217

De Man, J., Buffel, V., van de Velde, S., Bracke, P., Van Hal, G. F., & Wouters, E. (2021).

Disentangling depression in Belgian higher education students amidst the first COVID-19 lockdown (April-May 2020). *Archives of Public Health, 79*(3). https://doi.org/10.1186/s13690-020-00522-y

Eisele, G., Kasanova, Z., & Houben, M. (2021). Questionnaire design and evaluation. In I. Myin-Germeys & P. Kuppens (Eds.), *The open handbook of experience sampling methodology: A step-by-step guide to designing, conducting, and analyzing ESM studies.* Leuven: Center for Research on Experience Sampling and Ambulatory Methods Leuven.

Emerson, R. W. (2015). Convenience sampling, random sampling, and snowball sampling: How does sampling affect the validity of research? *Journal of Visual Impairment & Blindness, 109*(2), 164–168. https://doi.org/10.1177/0145482x1510900215

Ethica Data (2021a). *Notes on privacy and ethics.* https://learn.ethicadata.com/privacy/

Ethica Data (2021b). *Features.* https://ethicadata.com/features/experience-sampling

Fidell, L. S., & Tabachnick, B. G. (2003). Preparatory data analysis. In J. A. Schinka & W. F. Velicer (Eds.), *Handbook of psychology. Vol. 2: Research methods in psychology* (pp. 115–142). Hoboken, NJ: Wiley.

Field, A. (2018). *Discovering statistics using IBM SPSS statistics.* London: SAGE.

Finch, J. F., Okun, M. A., Pool, G. J., & Ruehlman, L. S. (1999). A comparison of conflictual and supportive social interactions on psychological distress. *Journal of Personality, 67*(4), 581-621. https://doi.org/10.1111/1467-6494.00066

Fisher, A., Medaglia, J. D., & Jeronimus, B. F. (2018). Lack of group-to-individual generalizability is a threat to human subjects research. *PNAS, 115*(27), 6106-6115. https://doi.org/10.1073/pnas.1711978115

Fredrickson, B. L. (1998). What good are positive emotions? *Review of General Psychology, 2,* 300–319. https://doi.org/10.1037/1089-2680.2.3.300

Fredrickson, B. L., Cohn, M. A., Coffey, K. A., Pek, J., & Finkel, S. M. (2008). Open hearts build lives: Positive emotions, induced through lovingkindness mediation, build consequential personal resources. *Journal of Personality and Social Psychology, 95,* 1045–1062. https://doi.org/10.1037/a0013262

Fullerton, D. J., Zhang, L. M., & Kleitman, S. (2021). An integrative process model of resilience in an academic context: Resilience resources, coping strategies, and positive adaptation. *PLoS ONE, 16*(2), e0246000. https://doi.org/10.1371/journal.pone.0246000

Gómez-López, M., Viejo, C., & Ortega-Ruiz, R. (2019). Well-being and romantic

relationships: A systematic review in adolescence and emerging adulthood. *International Journal of Environmental Research and Public Health, 16*(13), 2415. https://doi.org/10.3390/ijerph16132415

Hamaker, E. L. (2012). Why researchers should think „within-person": A paradigmatic rationale. In M. R. Mehl & T. S. Conner (Eds.), *Handbook of research methods for studying daily life* (pp. 43–61). The Guilford Press.

Hamaker, E. L., Nesselroade, J. R., & Molenaar, P. C. M. (2007). The integrated trait-state model. *Journal of Research in Personality, 41*(2), 295-315. https://doi.org/10.1016/j.jrp.2006.04.003

Hektner, J. M., Schmidt, J. A., & Csikszentmihalyi, M. (2007). Epistemological foundations for the measurement of experience. In J. M. Hektner, J. A. Schmidt & M. Csikszentmihalyi (Eds.), *Experience sampling method* (pp. 3-15). SAGE Publications. https://doi.org/10.4135/9781412984201

Herbert, C., El Bolock, A., & Abdennadher (2021). How do you feel during the COVID-19 pandemic? A survey using psychological and linguistic self-report measures, and machine learning to investigate mental health, subjective experience, personality, and behaviour during the COVID-19 pandemic among university students. *BMC Psychology 9*(1). https://doi.org/10.1186/s40359-021-00574-x

Ibrahim, A. K., Kelly, S. J., Adams, C. E., & Glazebrook, C. (2013). A systematic review of studies of depression prevalence in university students. *Journal of Psychiatric Research, 47*(3), 391-400. https://doi.org/10.1016/j.jpsychires.2012.11.015

Jorgensen, N. A., & Nelson, L. J. (2018). Moving toward and away from others: Social orientations in emerging adulthood. *Journal of Applied Developmental Psychology, 58,* 66-76. https://doi.org/10.1016/j.appdev.2018.09.001

Kasteenpohja, T., Marttunen, M., Aalto-Setälä, T., Perälä, J., Saarni, S. I., & Suvisaari, J. (2017). Outcome of depressive and anxiety disorders among young adults: Results from the Longitudinal Finnish Health 2011 Study. *Nordic Journal of Psychiatry, 72*(3), 205–213. https://doi.org/10.1080/08039488.2017.1418429

Kendler, K. S., Gatz, M., Gardner, C., Pedersen, N. (2006). A Swedish national twin study of lifetime major depression. *American Journal of Psychotherapy, 163*(1),109–114. https://doi.org/10.1176/appi.ajp.163.1.109

Kessler, R. C., Foster, C., Saunders, W., & Stang, P. (1995). The social consequences of psychiatric disorders. I. Educational attainment. *American Journal of Psychiatry,*

152(7), 1026–1032. https://doi.org/10.1176/ajp.152.7.1026

Keyes, C. L. M. (2002). The mental health continuum: From languishing to flourishing in life. *Journal of Health and Social Behavior, 43*(2), 207–222. https://doi.org/10.2307/3090197

Keyes, C. L. M. (2005). Mental illness and/or mental health? Investigating axioms of the complete state model of health. *Journal of Consulting and Clinical Psychology, 73*(3), 539–548. https://doi.org/10.1037/0022-006X.73.3.539

Keyes, C. L. M. (2006). Mental health in adolescence: is America's youth flourishing? *American Journal of Orthopsychiatry, 76*, 395–402. https://doi.org/10.1037/0002-9432.76.3.395

Keyes, C. L. M. (2007). Promoting and protecting mental health as flourishing: A complementary strategy for improving national mental health. *American Psychologist, 62*(2), 95–108. https://doi.org/10.1037/0003-066x.62.2.95

Killgore, W. D. S. (1999). The Visual Analogue Mood Scale: Can a single-item scale accurately classify depressive mood state? *Psychological Reports, 85*(3_suppl), 1238–1243. https://doi.org/10.2466/pr0.1999.85.3f.1238

Kimhy, D., Myin-Germeys, I., Palmier-Claus, J., & Swendsen, J. (2012). Mobile assessment guide for research in schizophrenia and severe mental disorders. *Schizophrenia Bulletin, 38*(3), 386-395. https://doi.org/10.1093/schbul/sbr186

Kinderman, P., Tai, S., Pontin, E., Schwannauer, M., Jarman, I., & Lisboa, P. (2015). Causal and mediating factors for anxiety, depression and well-being. *The British Journal of Psychiatry, 206*(6), 456–460. https://doi.org/10.1192/bjp.bp.114.147553

Kirtley, O., Lafit, G., Achterhof, R., Hiekkaranta, A. P., & Myin-Germeys, I. (2019). Making the black box transparent: A template and tutorial for (pre-) registration of studies using Experience Sampling Methods (ESM). *Advances in Methods and Practices in Psychological Science.* https://doi.org/10.31234/osf.io/seyq7

Lamers, S. M. A., Westerhof, G. J., Glas, C. A. W., & Bohlmeijer, E. T. (2015). The bidirectional relation between positive mental health and psychopathology in a longitudinal representative panel study. *The Journal of Positive Psychology, 10*(6), 553– 560. https://doi.org/10.1080/17439760.2015.1015156

Larson, R., Delespaul, P., & deVries, M. (1992). Analyzing experience sampling data: a guidebook for the perplexed. In M. W. DeVries (Ed.), *The experience of psychopathology: investigating mental disorders in their natural settings* (pp. 58-78). New York, NY: Cambridge University Press.

Long, C. R., Seburn, M., Averill, J. R., & More, T. A. (2003). Solitude experiences: Varieties, settings, and individual differences. *Personality and Social Psychology Bulletin, 29*(5), 578-583. https://doi.org/10.1177/0146167203029005003

Maas, C. J. M., & Hox, J. J. (2004). The influence of violations of assumptions on multilevel parameter estimates and their standard errors. *Computational Statistics & Data Analysis, 46*(3), 427–440. https://doi.org/10.1016/j.csda.2003.08.006

Matthews, T., Danese, A., Wertz, J., Odgers, C. L., Ambler, A., Moffitt, T. E., & Arseneault, L. (2016). Social isolation, loneliness, and depression in young adulthood: A behavioural genetic analysis. *Social Psychiatry and Psychiatric Epidemiology, 51*(3), 339–348. https://doi.org/10.1007/s00127-016-1178-7

McKay, M. T., & Andretta, J. R. (2017). Evidence for the psychometric validity, internal consistency and measurement invariance of Warwick Edinburgh Mental Well-being Scale scores in Scottish and Irish adolescents. *Psychiatry Research, 255*, 382-386. https://doi.org/10.1016/j.psychres.2017.06.071

Merrick, W. A. (1992). Dysphoric moods in depressed and nondepressed adolescents. In M. W. deVries (Ed.), *The experience of psychopathology: Investigating mental disorders in their natural settings* (pp. 148-156). NY: Cambridge University Press.

Mikolajczyk, R. T., Maxwell, A. E., Naydenova, V., Meier, S., & El Ansari, W. (2008). Depressive symptoms and perceived burdens related to being a student: Survey in three European countries. *Clinical Practice and Epidemiology in Mental Health, 4*(19). https://doi.org/10.1186/1745-0179-4-19

Myin-Germeys, I., Kasanova, Z., Vaessen, T., Vachon, H., Kirtley, O., Viechtbauer, W., & Reininghaus, U. (2018). Experience sampling methodology in mental health research: new insights and technical developments. *World Psychiatry, 17*, 123-132. https://doi.org/10.1002/wps.20513

Nakamura, J. S., Kim, E. S., Rentscher, K. E., Bower, J. E., & Kuhlman, K. R. (2021). Early-life stress, depressive symptoms, and inflammation: the role of social factors. *Aging and Mental Health.* https://doi.org/10.1080/13607863.2021.1876636

Napa Scollon, C., Prieto, C. K., & Diener, E. (2009). Experience sampling: Promises and pitfalls, strength and weaknesses. In E. Diener (Ed.), *Assessing well-being. The collected works of Ed Diener.* Dordrecht: Springer.

Nes, R. B., Røysamb, E., Tambs, K., Harris, J. R., & Reichborn-Kjennerud, T. (2006). Subjective well-being: genetic and environmental contributions to stability and change. *Psychological Medicine, 36*(7), 1033-1042.

https://doi.org/10.1017/s0033291706007409

Ng Fat, L., Scholes, S., Boniface, S., Mindell, J., & Stewart-Brown, S. (2017). Evaluating and establishing national norms for mental wellbeing using the short Warwick–Edinburgh Mental Well-being Scale (SWEMWBS): findings from the Health Survey for England. Quality of *Life Research, 26*(5), 1129–1144. https://doi.org/10.1007/s11136-016-1454-8

Obradović, J., Tirado-Strayer, N., & Leu, J. (2013). The importance of family and friend relationships for the mental health of Asian immigrant young adults and their nonimmigrant peers. *Research in Human Development, 10*(2), 163-183. https://doi.org/10.1080/15427609.2013.786559

Olaz, F. O., Medrano, L. A., & Cabanillas, G. (2014). Effectiveness of social skills training experiential method to strengthening social self-efficacy of university students. *International Journal of Psychology & Psychological Therapy, 14*(3), 379-396.

Orden, K. A. V., & Joiner, T. E. (2006). A role for the contagion of emotion? A comment on Segrin (2004). *Journal of Social and Clinical Psychology, 25*(8), 825–832. https://doi.org/10.1521/jscp.2006.25.8.825

O'Rourke, J., Harms, C., & Cohen, L. (2019). They're always there for me! Friendship and meaning in young people's lives? *Scandinavian Journal of Psychology, 60*, 596-608. https://doi.org/10.1111/sjop.12570

Palmeri, M. (2016). Chapter 18: Testing the assumptions of multilevel models. In A. Demos & C. Salas (Eds.), *A language, not a letter: Learning statistics in R.* https://ademos.people.uic.edu/Chapter18.html

Palmier-Claus, J. E., Myin-Germeys, I., Barkus, E., Bentley, L., Udachina, A., Delespaul, P., Lewis, S. W., & Dunn, G. (2010). Experience sampling research in individuals with mental illness: Reflections and guidance. *Acta Psychiatrica Scandinavica, 123*(1), 12–20. https://doi.org/10.1111/j.1600-0447.2010.01596.x

Pemberton, R., & Tyszkiewicz, M. D. F. (2016). Factors contributing to depressive mood states in everyday life: A systematic review. *Journal of Affective Disorders, 200,* 103-110. https://doi.org/10.1016/j.jad.2016.04.023

Reis, H. T., Sheldon, K. M., Gable, S. L., Roscoe, J., & Ryan, R. M. (2000). Daily well-being: the role of autonomy, competence, and relatedness. *Personality and Social Psychology Bulletin, 26*(4), 419–435. https://doi.org/10.1177/0146167200266002

Renshaw, T. L., & Cohen, A. S. (2013). Life satisfaction as a distinguishing indicator of college student functioning: Further validation of the two-continua model of mental

health. *Social Indicators Research, 117*(1), 319–334. https://doi.org/10.1007/s11205-013-0342-7

Robinson, W. S. (1950). Ecological correlations and the behavior of individuals. *American Sociological Review, 15*(3), 351-357. https://doi.org/10.2307/2087176

Rubin, M., Evans, O., & Wilkinson, R. B. (2016). A longitudinal study of the relations among university students' subjective social status, social contact with university friends, and mental health and well-being. *Journal of Social and Clinical Psychology, 35*(9), 722–737. https://doi.org/10.1521/jscp.2016.35.9.722

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*(1), 68–78. https://doi.org/10.1037/0003-066X.55.1.68

Ryan, R. M., & Deci, E. L. (2001). On happiness and human potentials: A review of research on hedonic and eudaimonic well-being. *Annual Review of Psychology, 52*(1), 141–166. https://doi.org/10.1146/annurev.psych.52.1.14

Schotanus-Dijkstra, M., Ten Have, M., Lamers, S. M., de Graaf, R., & Bohlmeijer, E. T. (2017). The longitudinal relationship between flourishing mental health and incident mood, anxiety and substance use disorders. *The European Journal of Public Health, 27*(3), 563-568. https://doi.org/10.1093/eurpub/ckw202

Seligman, M. E. P. (2011). *Flourish: a visionary new understanding of happiness and well-being.* NY: Free Press.

Silk, J. S., Forbes, E. E., Whalen, D. J., Jakubcak, J. L., Thompson, W. K., Ryan, N. D., … Dahl, R. E. (2011). Daily emotional dynamics in depressed youth: a cell phone ecological momentary assessment study. *Journal of Experimental Child Psychology, 110*(2), 241–257. https://doi.org/10.1016/j.jecp.2010.10.007

Simpson, E. H. (1951). The interpretation of interaction in contingency tables. *Journal of the Royal Statistical Society. Series B (Methodological), 13*(2), 238-241. http://www.jstor.org/stable/2984065

Stallman, H. M. (2010). Psychological distress in university students: A comparison with general population data. *Australian Psychologist, 45*(4), 249–257. https://doi.org/10.1080/00050067.2010.482109

Steger, M. F., & Kashdan, T. B. (2009). Depression and everyday social activity, belonging, and well-being. *Journal of Counseling Psychology, 56*(2), 289-300. https://doi.org/10.1037/a0015416

Stewart-Brown, S., Tennant, A., Tennant, R., Platt, S., Parkinson, J., & Weich, S. (2009).

Internal construct validity of the Warwick-Edinburgh Mental Well-being Scale (WEMWBS): a Rasch analysis using data from the Scottish Health Education Population Survey. *Health and Quality of Life Outcomes, 7*(15). https://doi.org/10.1186/1477-7525-7-15

Suldo, S. M., & Shaffer, E. J. (2008). Looking beyond psychopathology: The dual-factor model of mental health in youth. *School Psychology Review, 37*(1), 52–68. https://doi.org/10.1177/0829573512443669

Vachon, H., Viechtbauer, W., Rintala, A., & Myin-Germeys, I. (2019). Compliance and retention with the experience sampling method over the continuum of severe mental disorders: Meta-analysis and recommendations. *Journal of Medical Internet Research, 21*(12), e14475. https://doi.org/10.2196/14475

van Berkel, N., Ferreira, D., & Kostakos, V. (2017). The experience sampling method on mobile devices. *ACM Computing Surveys, 50*(6), 1–40. https://doi.org/10.1145/3123988

Weinstein, N., Nguyen, T.-v., & Hansen, H. (2021). What time alone offers: Narratives of solitude from adolescence to older adulthood. *Frontiers in Psychology, 12*. https://doi.org/10.3389/fpsyg.2021.714518

Westerhof, G. J., & Keyes, C. L. M. (2010). Mental illness and mental health: The two continua model across the lifespan. *Journal of Adult Development 17,* 110-119. https://doi.org/10.1007/s10804-009-9082-y

Wichers, M. (2014). The dynamic nature of depression: A new micro-level perspective of mental disorder that meets current challenges. *Psychological Medicine, 44*(7), 1349-1360. https://doi.org/10.1017/S0033291713001979

Wood, A. M., & Joseph, S. (2010). The absence of positive psychological (eudaimonic) well-being as a risk factor for depression: A ten year cohort study. *Journal of Affective Disorders, 122*(3), 213-217. https://doi.org/10.1016/j.jad.2009.06.032

World Health Organization (2005). *Promoting mental health: Concepts, emerging evidence, practice.* Geneva, World Health Organization.

Zigmond, A. S., & Snaith, R. P. (1983). The Hospital Anxiety and Depression Scale. *Acta Psychiatrica Scandinavica, 67*(6), 361–370. https://doi.org/10.1111/j.1600-0447.1983.tb09716.x

Appendix A

The Short-Warwick-Edinburgh Mental Well-being Scale (SWEMWBS)

Below are some statements about feelings and thoughts.

Please tick the box that best describes your experience of each over the last 2 weeks

STATEMENTS	None of the time	Rarely	Some of the time	Often	All of the time
I've been feeling optimistic about the future	1	2	3	4	5
I've been feeling useful	1	2	3	4	5
I've been feeling relaxed	1	2	3	4	5
I've been dealing with problems well	1	2	3	4	5
I've been thinking clearly	1	2	3	4	5
I've been feeling close to other people	1	2	3	4	5
I've been able to make up my own mind about things	1	2	3	4	5

Appendix B

The Hospital Anxiety and Depression Scale (HADS)

This questionnaire is designed to help your doctor know how you feel. Read each item and circle the reply which comes closest to how you have been feeling in the past week. Don't take too long over your replies: your immediate reaction to each item will probably be more accurate than a long thought out response.

I feel tense or 'wound up':	A
Most of the time	3
A lot of the time	2
Time to time, occasionally	1
Not at all	0

I feel as if I am slowed down:	D
Nearly all of the time	3
Very often	2
Sometimes	1
Not at all	0

I still enjoy the things I used to enjoy:	D
Definitely as much	0
Not quite so much	1
Only a little	2
Not at all	3

I get a sort of frightened feeling like 'butterflies in the stomach':	A
Not at all	0
Occasionally	1
Quite often	2
Very often	3

I get a sort of frightened feeling like something awful is about to happen:	A
Very definitely and quite badly	3
Yes, but not too badly	2
A little, but it doesn't worry me	1
Not at all	0

I have lost interest in my appearance:	D
Definitely	3
I don't take as much care as I should	2
I may not take quite as much care	1
I take just as much care as ever	0

I can laugh and see the funny side of things:	D
As much as I always could	0
Not quite so much now	1
Definitely not so much now	2
Not at all	3

I feel restless as if I have to be on the move:	A
Very much indeed	3
Quite a lot	2
Not very much	1
Not at all	0

Worrying thoughts go through my mind:	A
A great deal of the time	3
A lot of the time	2
From time to time but not too often	1
Only occasionally	0

I look forward with enjoyment to things:	D
A much as I ever did	0
Rather less than I used to	1
Definitely less than I used to	3
Hardly at all	2

I feel cheerful:	D
Not at all	3
Not often	2
Sometimes	1
Most of the time	0

I get sudden feelings of panic:	A
Very often indeed	3
Quite often	2
Not very often	1
Not at all	0

I can sit at ease and feel relaxed:	A
Definitely	0
Usually	1
Not often	2
Not at all	3

I can enjoy a good book or radio or TV programme:	D
Often	0
Sometimes	1
Not often	2
Very seldom	3

Questions relating to anxiety are indicated by an 'A' while those relating to depression are shown by a 'D'. Scores of 0-7 in respective subscales are considered normal, with 8-10 borderline and 11 or over indicating clinical 'caseness'

Appendix C

The Single-Item Visual Analogue Scale for State Depressive Mood

To what extent do you feel down right now?

0: Not down at all 100: Extremely down

PREVIOUS NEXT

Appendix D

The Question about Social Contact

Who did you spend time with **within the last 2 hours**? *(select the one category of people that you personally feel most connected to if you spent time with multiple people)*

○ Partner

○ Close friend(s)

○ Family member(s)

○ Acquaintances (e.g., colleagues / fellow students)

○ This does not apply, I was by myself

Appendix E

Participant Information and Informed Consent

Dear participant,

Thank you for your participation in this study. Before you participate, it is important that you understand the goal of this research and what the study will ask from you. The purpose of this study is to find out how different components of mental health are related to each other. To explore this relationship, we want to measure fluctuations in mental health in daily life to gather a more detailed picture of the dynamics of mental health.

For this study, we will ask you to fill in several questionnaires on your mobile phone. All questionnaires will be completed in the Ethica app. The study will start with a questionnaire concerning your demographics and general mental health. This initial questionnaire will take about 10 minutes to complete. After that, you will receive three daily (short) questionnaires each day for a period of two weeks. Notifications will remind you about the next questionnaire. The questionnaires will be provided in the morning, afternoon and evening. One daily questionnaire takes approximately 2 minutes to complete.

For the purpose of this study, it is important that you answer the questionnaires as soon as possible after the notification. Make sure that you have switched on your notifications for the Ethica app on your mobile device, as you will receive a notification on your mobile device when to fill in the questions. We would also like to ask you to regularly check the Ethica application to see whether new questionnaires to answer are ready.

The information that we collect from this research project will be kept confidential. This means that only the researchers have insight into your answers. All personal data (such as age, gender etc.) will be anonymized and will not be published and/or given to a third party. Also, for the researchers it will not be possible to determine which data belongs to which participant. Your participation in this study is voluntary. You are free to withdraw from this study at any time and without giving a reason.

Contact information

If you have any questions regarding this study, you can contact the principal investigators of this project Sina Völker (s.volker@student.utwente.nl) and Jonas Möller (j.moller@student.utwente.nl).

Consent

I have read and understood the information provided and had the opportunity to ask questions. I understand that my participation is voluntary and that I am able to withdraw at any time, without a reason or cost. I hereby voluntarily agree to take part in this study.

Appendix F

Figure 1

Standardized Residuals Plotted Against Standardized Predicted Values of Well-Being

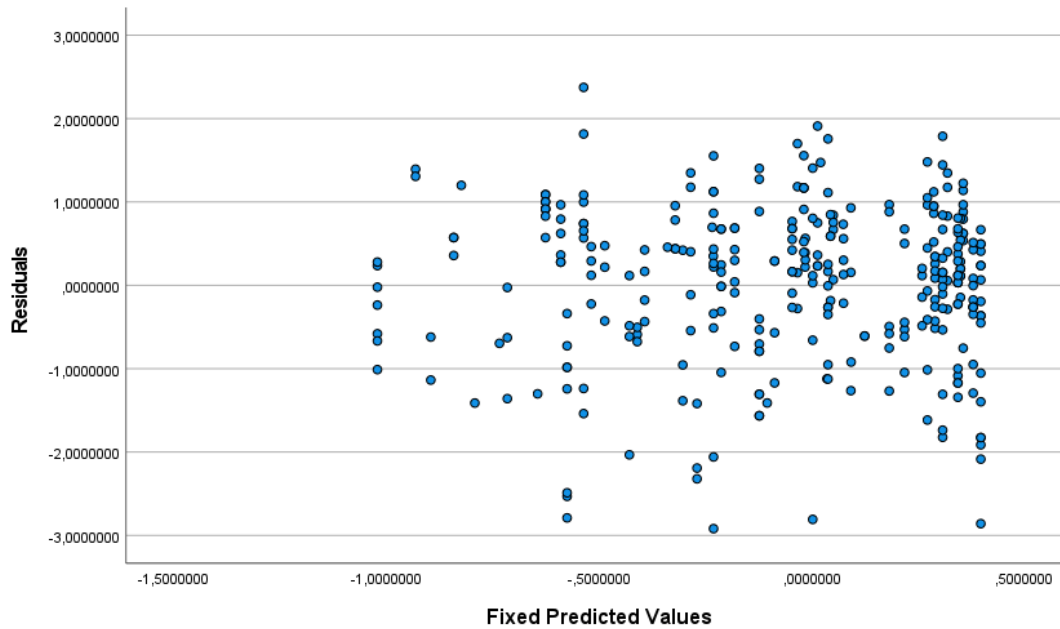*(Example Model: Well-Being Predicted by Social Contact PM and Social Contact PMC, RQ*

1)

Figure 2

Standardized Residuals Plotted Against Standardized Predicted Values for Depressive Mood

(Example Model: Depressive Mood Predicted by Social Contact PM and Social Contact
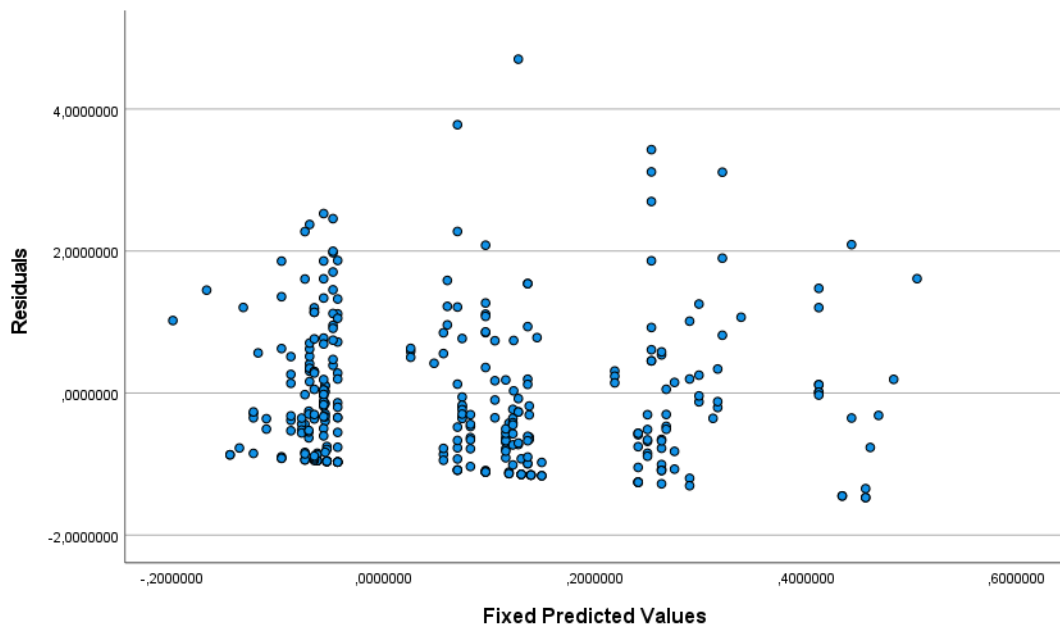
PMC, RQ 1)

Figure 3

Normal QQ-Plot of Standardized Residuals for Well-Being (Example Model: Well-Being Predicted by Daily Social Contact Frequency, RQ 1)
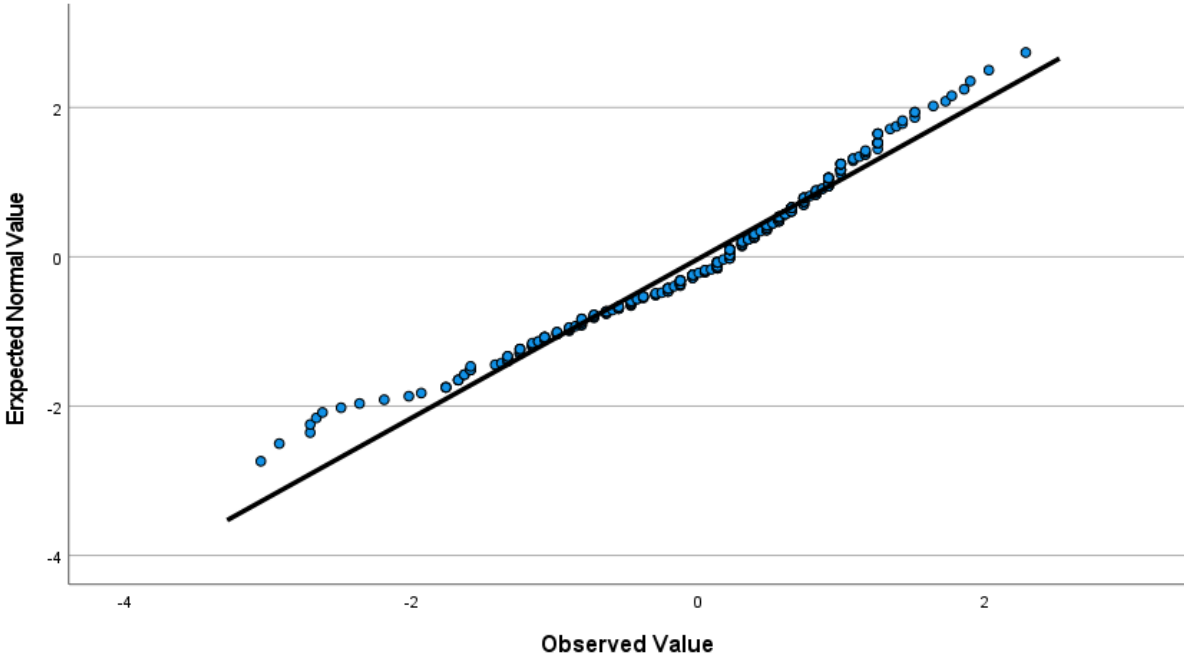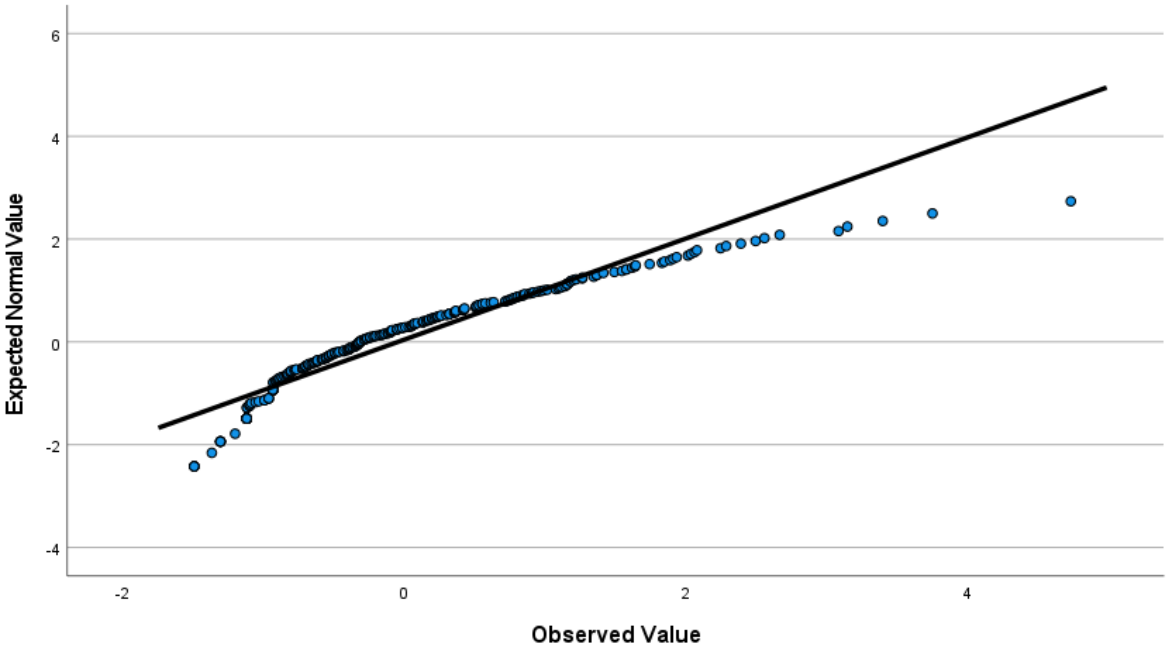

Figure 4

Normal QQ-Plot of Standardized Residuals for Depressive Mood (Example Model: Depressive Mood Predicted by Daily Social Contact Frequency, RQ 1)

Appendix G

Figure 1

Well-Being and Type of Social Contact EMMs by Day Ordered by Well-Being
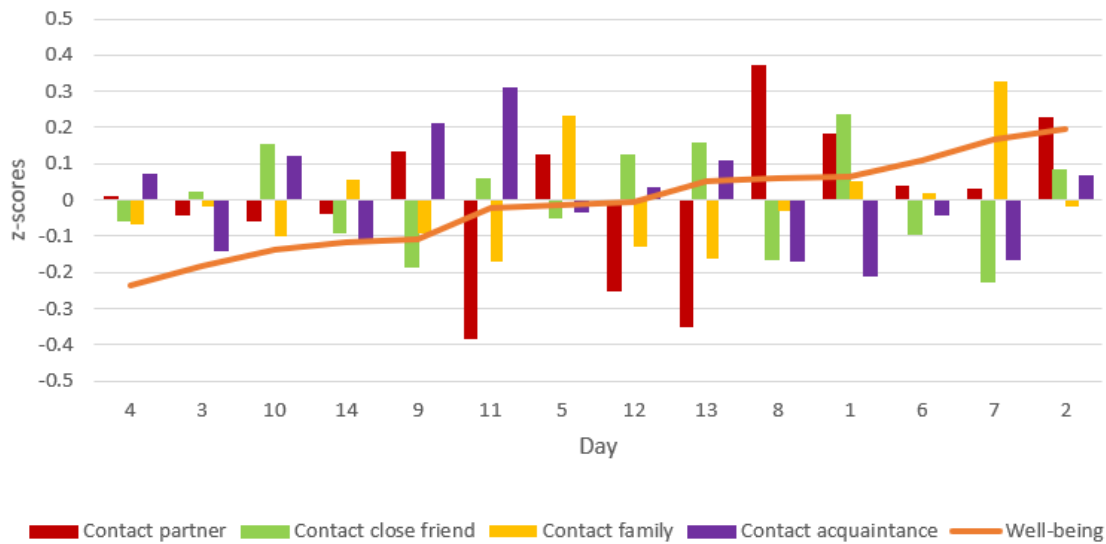

Figure 2

Depressive Mood and Type of Social Contact EMMs by Day Ordered by Depressive Mood