



# Prospective relations between loneliness in different relationships, metacognitive beliefs, worry and common mental health problems

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## ABSTRACT

**Background:** This study investigated prospective relations between loneliness in family, romantic and social relationships and common mental health problems measured as symptoms of anxiety and depression. How these relations are mediated by metacognitive beliefs and worry in a serial mediation model in a full SEM was also tested.

**Materials and methods:** Data were collected at two time points, separated by three months among students at the Norwegian University of Science and Technology. In total, 241 (Females = 65%) students completing both waves of data collection were included for analyses.

**Results:** Loneliness in family relationships was only concurrently associated with worry whereas loneliness in social and romantic relationships showed concurrent and prospective relations. Overall, the results highlighted that for loneliness in social and romantic relationships, their prospective relations with anxiety and depressive symptoms depended on how an individual responded with metacognitive beliefs or worry or both. However, social loneliness might be an exception since it also had a direct effect on levels of depressive symptoms.

**Conclusions:** To prevent or reduce loneliness and common mental health problems, evidence provided show that interventions may incorporate components that target self-focused negative thinking in the form of worry or beliefs about the contents of negative thinking in the form of metacognitive beliefs, underlying loneliness and mental health problems.

## 1. Introduction

Among the general population in some developed countries the feeling of loneliness is rapidly increasing with deleterious mental health effects. Clinicians have yet to find ways to effectively deal with loneliness (Cacioppo & Cacioppo, 2018). It has been suggested the reason loneliness has become a growing burden on emotional and somatic health is that the effects of loneliness are not peculiar to a subgroup of people who are lonely and so-called loneliness reduction interventions designed to improve social skills through training, enhancing social support, or increasing opportunities for social contact have proven ineffective (Masi, Chen, Hawkey, & Cacioppo, 2011). To address the problem of loneliness, recent interventions are beginning to focus on community programmes, behavioural interventions, and online resources (Cacioppo & Cacioppo, 2018). Some authors have suggested that to combat the feelings of loneliness, efforts should aim at designing interventions that empower patients to focus inward and address negative thoughts underlying loneliness as result of maladaptive social cognitions (Masi et al., 2011). An expansive body of knowledge exists on how maladaptive thinking and beliefs about maladaptive thinking according to the Metacognitive theory and the Self-regulatory Executive functions (S-REF) model (Wells, 2009; Wells & Matthews, 1994, 1996) contribute to anxiety, depression and other mental health problems. The present study investigated how loneliness in different

relationships prospectively relates to symptoms of anxiety and depression through metacognitive beliefs and worry.

### 1.1. Loneliness in different relationships

Loneliness has been defined as the discrepancy between desired and actual levels of social relationships where an individual perceives that social needs are not met due to deficits in social ties and relationships (DiTommaso & Spinner, 1997; Lasgaard, Goossens, Bramsen, Trillingsgaards, & Elklit, 2011; Perlman & Peplau, 1981). Weiss (1998) proposed two distinct types of loneliness. Emotional loneliness resulted from deficiencies in attachments to close intimate relationships such as in romantic relationships and child-caregiver relationships. Social loneliness was thought to be the result of a perceived lack in affiliative needs such as friendships and workplace relationships. Attempts to define a measurement model of loneliness have advanced the definition further. During the development of the Social and Emotional Loneliness Scale for Adults (SELSA) based on Weiss' conceptualization of loneliness, the authors further differentiated emotional loneliness into family and romantic loneliness (DiTommaso & Spinner, 1993). Thus, the

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current version has three subtypes of loneliness in different relationships – family, romantic and social relationships.

Loneliness in different relationships and the absence of relational provisions lead to more loneliness, which in turn, leads to different emotional and mental health problems (Lasgaard et al., 2011). An investigation of the associations between loneliness in different social relationships and indicators of psychopathology in a nationally representative sample of high school students in Denmark concluded that different sources of loneliness have different effects on different psychopathologies such as anxiety, depression, suicide ideation and risky behaviour (Lasgaard et al., 2011). Different relations between family, romantic and social loneliness and symptoms of mental health problems have also been found among undergraduate students (Ditommaso, Brannen, & Best, 2004). Existing studies have mainly relied on cross-sectional samples, which pose several limitations to establishing potential intersections and pathways among variables in prospective relations. In addition, studies which investigate factors that contribute to the relation between loneliness in different relationships and mental health problems both as a process, using mediator variables and as result of potential dispositional attributes, using moderator variables are lacking. Thus, investigating whether worry or metacognitive beliefs contribute as mediators of the relation between loneliness in family, romantic and social relationships, and symptoms of anxiety and depression will greatly expand the body of knowledge on which to design interventions. The present study contributes to understanding relations between negative thinking in the form of worry or beliefs about the contents of negative thinking in the form of metacognitive beliefs underlying loneliness and mental health problems.

### 1.2. Worry, metacognition and mental health problems

Worry is defined as repetitive thinking about future events and the central defining feature of anxiety disorders, especially generalized anxiety disorder (Borkovec, 1994). Worry typically reflects uncertainty about anticipated threats, thus, resulting in underestimation of personal agency, abilities and controllability of future events as well as implications of uncontrollable past events for the future (Nolen-Hoeksema et al., 2008; Papageorgiou & Wells, 2001). The S-REF (Wells & Matthews, 1994; 1996) views worry and rumination as a cognitive attentional syndrome that has counterproductive effects that feeds into sustaining anxiety and depression. According to the S-REF model, maladaptive thinking related to negative information processing such as “Worry helps me to cope”, is sustained by positive metacognitive beliefs due to potential benefits of worry whereas negative metacognitive beliefs sustain the underestimation of personal agency, abilities and the overestimation of the uncontrollability of the worry process when a person is worrying (Wells, 2009; Wells & Matthews, 1996). It is the beliefs, appraisal and monitoring of preservative thinking that is central to developing or maintaining anxiety or depression more than the content of negative thoughts and thinking. Anxiety is predominantly related to worry, while depression is linked to both rumination and worry (Wells, 2009). Therefore, to understand the prospective relation between loneliness in different relationships and symptoms of anxiety and depression, it is important to investigate whether metacognitive beliefs contribute to worry as serial mediators in the relations.

Only few studies were found to have examined research questions closely related to the relations between loneliness, worry, metacognitive beliefs and mental health problems. Theeke, Mallow, Gianni, Legg and Glass (2015) explored loneliness among adults with chronic conditions and found that among other negative emotional conditions, there was a relation between loneliness and worry. The authors argued that the relation between loneliness and worry has rarely been examined and it was an important finding that negative emotional experiences stemming from loneliness contributed to worry and sadness. Similar to diminished personal ability for controllability, lonely people engage in self-focused negative self-assessment of their ability to

initiate and maintain social relationships thinking that others will criticise and reject their company, hence seek protection from isolation, which rather reinforces loneliness (Rokach, 2015). The relations between worry, metacognitive beliefs and anxiety have recently been studied. Using mixed-effects model with repeated assessments, (Ryum et al., 2017) investigated whether worry, metacognitive beliefs or their interaction predicted anxiety in a University student sample ( $N = 190$ ). It was found that metacognitive beliefs predicted the development of anxiety over time, even when controlling for worry. Similarly worry predicted anxiety and there was no interaction effect between worry and metacognitive beliefs, suggesting that the effects were independent.

### 1.3. The present study

Despite the links between loneliness and mental health problems, and potential intersections and pathways connecting loneliness through metacognitive beliefs and worry to anxiety and depression, to the best of our knowledge, these relations have not been investigated neither cross-sectionally nor prospectively. The present study expands the shortcomings of existing literature by using prospective data to investigate the relations between loneliness in family, romantic and social relationships and mental health problems measured as anxiety and depressive symptoms. This study also goes beyond oversimplifying mechanisms that may indirectly exist in the relations between loneliness and anxiety and depressive symptoms by investigating mediators of the relations. Mediator variables are causally located as intervening between a focal predictor and an outcome variable to explain how the focal predictor exerts its effect on the outcome variable in an indirect effects model (Anyan, 2019; Hayes, 2013). Thus, in the present study, we also seek to explain how loneliness prospectively relates with symptoms of anxiety and depression through metacognitive beliefs and worry. Because metacognitive beliefs provide the supporting framework for negative thinking such as worry (Papageorgiou & Wells, 2003), the theoretical foundations suggest the potential for multiple steps (or serial) mediation. Serial mediation assumes a putative causal relation linking different mediators with specified causal direction (Hayes, 2013). Therefore, model testing in the relations between family, romantic and social relationships and symptoms of anxiety must first focus on addressing metacognitive beliefs before worry (i.e., Loneliness  $\rightarrow$  Metacognitive beliefs  $\rightarrow$  Worry  $\rightarrow$  Symptoms of anxiety/depression).

Theoretically, this investigation could lead to greater understanding of how metacognitive beliefs and worry contribute to the relations between a social-cognitive schema such as loneliness and common mental health problems. Interventions which aim to reduce loneliness and mental health problems may incorporate components that target metacognitive beliefs more than worry or vice-versa or both. Social support and skills training interventions against loneliness have proven ineffective (Masi et al., 2011), shifting the focus now to addressing self-focused negative thoughts underlying loneliness. Practically, the present study is therefore, very important as a first step to guiding the proposed shift in interventions.

## 2. Material and methods

### 2.1. Participants and procedure

Participants were students at the Norwegian University of Science and Technology who were invited to take part in the study at two different times, separated by three months. Participation was voluntary and participants could withdraw their informed consent at any time, without consequences. Participants who did not participate in both waves of data collection were not included (T1:  $n = 199$ ; T2:  $n = 42$ ). Participants included for analyses were two hundred and forty-one ( $N = 241$ ) students completing both waves of data collection. One participant was removed due to no information at all on any variable. Mean age was 26 years. One hundred and fifty-five, 155 (65%) were females, 85 (35%) were males, and 178 (74%) were studying at the time of data collection. Participants created their own personal code

unrelated to personal information which was used to match data from the two waves. The project was approved by the Norwegian Ethics committee 2016/339.

## 2.2. Measures

The Social and Emotional Loneliness Scale for Adults (SELSA-S) (Ditomaso et al., 2004), was used to assess loneliness. The SELSA-S has 15 items rated on a 7-point Likert-type scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*) and measures the nature and duration of loneliness in family (e.g., “I feel alone when I am with my family”), romantic (e.g., “I have an unmet need for a close romantic relationship”), and social (e.g., “I do not have any friends who understand me, but I wish I did”) relationships. High scores indicate high levels of loneliness. In this study, Cronbach's alpha,  $\alpha$  for SELSA-S total was  $\alpha = .88$ , Family loneliness,  $\alpha = .88$ , Romantic Loneliness,  $\alpha = .94$ , and Social loneliness,  $\alpha = .85$ .

The Penn State Worry Questionnaire (PSWQ) (Meyer, Miller, Metzger, & Borkovec, 1990) was used to assess worry. The PSWQ has 16 items that assess the degree to which individuals typically perseverate about upcoming life events (e.g., “My worries overwhelm me”), from 1 (*not at all typical of me*) to 5 (*very typical of me*). The PSWQ has been observed to have high internal consistency as well as test-retest reliability (Meyer et al., 1990). The PSWQ has been translated to Norwegian (Pallesen, Nordhus, Carlstedt, Thayer, & Johnsen, 2006) and found to have adequate psychometric properties in terms of reliability and validity. In this study, Cronbach's alpha was,  $\alpha = .66$ .

The Metacognitions Questionnaire-30 (MCQ-30) (Wells & Cartwright-Hatton, 2004) is a generic questionnaire used to assess dysfunctional metacognitive beliefs according to metacognitive theory. Each item is rated on a 4 Likert-type scale ranging from 1 (*Do not agree*) to 4 (*Agree very much*). The MCQ-30 consists of five subscales namely, lack of cognitive confidence, positive beliefs about worry, cognitive self-consciousness, negative beliefs about uncontrollability and danger, and need to control thoughts. Example items include “Worrying helps me to solve problems” and “When I start worrying, I cannot stop”. High scores indicate more dysfunctional metacognitive beliefs. The MCQ has been translated to Norwegian and demonstrated good psychometric properties including good internal consistency, concurrent- and convergent validity (Grøtte et al., 2016). In this study, Cronbach's alpha was,  $\alpha = .90$ .

The Hopkins Symptom Checklist-short form (HSCL-10) (Nguyen, Attkisson, & Stegner, 1983) is a self-report inventory for the assessment of symptoms of anxiety (e.g., “Suddenly scared for no reason”) and depression (e.g., “Feelings of worthlessness”). It is rated on a 4-point Likert-type scale ranging from 1 (*Not at all*) to 4 (*Extremely*). Four of the ten questions are about anxiety and six are about depression (Kleppang & Hagquist, 2016). The HSCL-10 has been translated to Norwegian and demonstrated good psychometric properties including good internal consistency and construct validity (Haavet, Sirpal, Haugen, & Christensen, 2011; Nguyen et al., 1983). In this study, Cronbach's alpha was,  $\alpha = .75$  for anxiety symptom subscale and  $\alpha = .87$  for the depressive symptom subscale.

## 2.3. Statistical analyses

Basic correlation analyses were performed in SPSS version 25. All other analyses were performed in Mplus version 7.4 (Muthén & Muthén, 1998-2012), using the maximum likelihood estimator. The measurement model of SELSA-S at T1 was modelled as a latent variable and estimated to directly predict symptoms of anxiety and depression at T2. Metacognitive beliefs and Worry at T1 were estimated as serial mediators so that a full indirect effects SEM model was estimated. Gender and age were also included as control variables. Although model fit indices may point to adequate fit (MacCallum, Browne, & Sugawara, 1996), a good model fit was evaluated with the following indices: Standardized Root Mean Square Residual (SRMR) (Browne & Cudeck, 1993) and Root Mean Square Error of Approximation (RMSEA)

(Hu & Bentler, 1999) values less than .08 and values equal to or less than .06 (upper 90% CI close to or  $< .08$ ) respectively, a Comparative Fit Index (CFI) and a non-Normed Fit index (NNFI; aka TLI) greater than .95 (Hu & Bentler, 1999).

## 3. Results

Preliminary comparisons were conducted between participants who completed only one wave (i.e., T1 or T2) and those who completed both waves (i.e., T1 and T2). Significant difference was found in years of education for participants who completed only T1 ( $M = 16.08$ ) and those who completed both waves ( $M = 16.76$ ),  $t(438) = -2.541$ ,  $p < .05$ . Practically, this difference of .68 of a year is very small and adds no information to the present study.

### 3.1. Concurrent and prospective relations

Descriptive statistics and correlations are presented in Table 1 for the repeated assessments. As observed, loneliness in the different relationships at T1 and T2 were strongly intercorrelated, as were prospective correlations between worry and metacognitive beliefs. The concurrent and prospective relations between loneliness in the different relationships with worry and metacognitive beliefs were moderate, but moderate to strong with symptoms of anxiety and depression. At T2, correlations between worry and metacognitive beliefs with symptoms of anxiety and depression were strong.

### 3.2. Estimation of structural relations and mediated pathways in SEM

The initial model specified reached adequate fit ( $\chi^2 = 361.064$ ,  $df = 168$ ,  $p < .001$ ; SRMR = .067; RMSEA = .069 [90% CI = 0.059, 0.079]; CFI = .938; TIL = .923). According to MacCallum et al. (1996) as the RMSEA which penalizes for model misspecification in relation to model complexity and sample size was below .08 as was its upper limit of the 90% C.I., the model was retained (See Fig. 1). Therefore, we proceeded to examine and interpret direct and indirect paths for their statistical significance displayed in Table 2.

### 3.3. Concurrent and prospective direct effects

At T1, loneliness in family and social relationships as well as metacognitive beliefs were concurrently significantly associated with worry at T1. Loneliness in romantic and social relationships at T1 were significantly associated with metacognitive beliefs at T1. When examining direct prospective relations (T1→T2), only loneliness in social relationships at T1 significantly predicted depressive symptoms at T2. Both worry and metacognitive beliefs at T1 significantly predicted anxiety symptoms at T2, but only metacognitive beliefs at T1 significantly predicted depressive symptoms at T2.

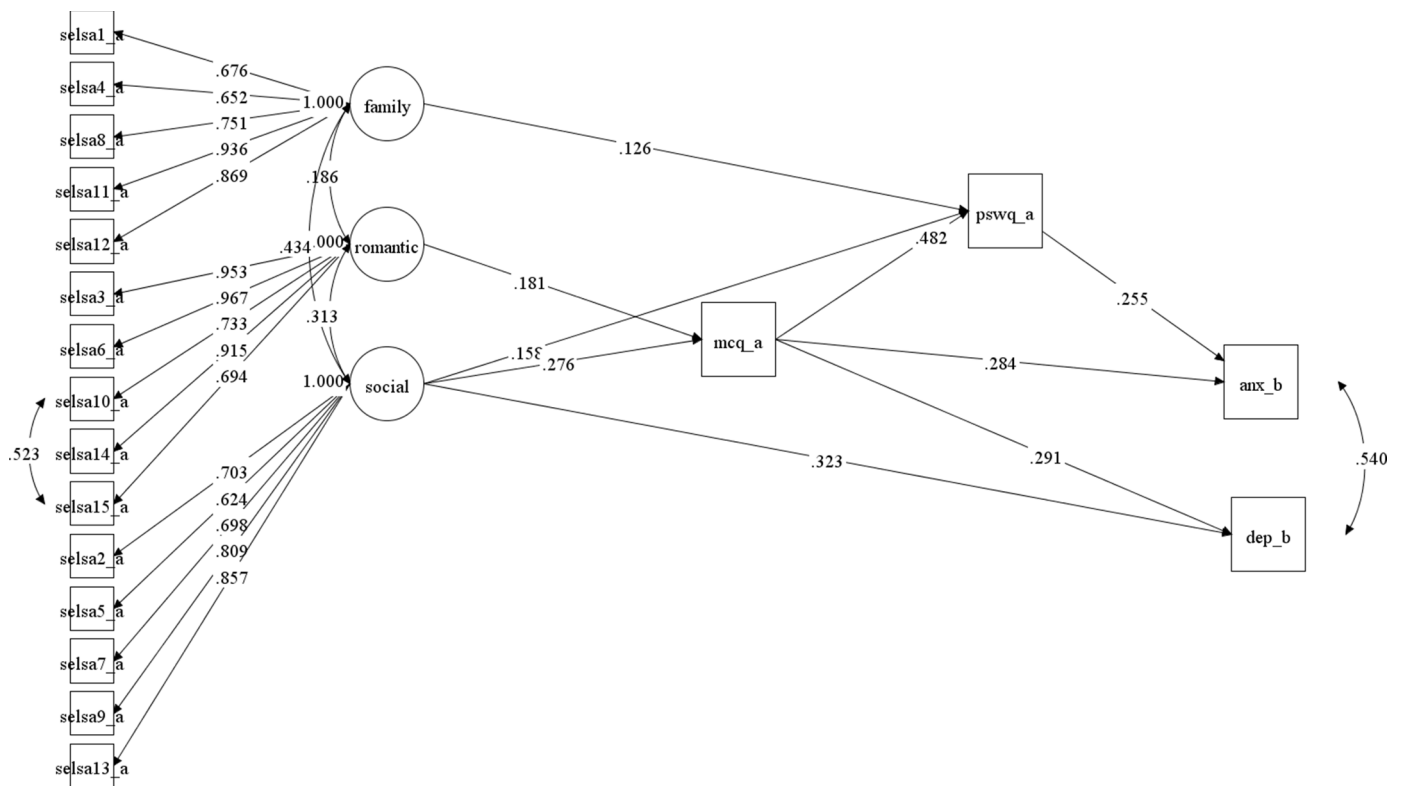
### 3.4. Prospective indirect effects

For the serial mediation, two pathways were significant: (i) Romantic loneliness → Metacognitive beliefs → Worry → Symptoms of anxiety and (ii) Social loneliness → Metacognitive beliefs → Worry → Symptoms of anxiety. In other words, higher levels of loneliness in romantic and social relationships were associated with more metacognitive beliefs that in turn, was associated with higher worry, predicting more symptoms of anxiety at T2. When controlling for metacognitive beliefs, worry contributed to prospective relations between loneliness in social relationships and symptoms of anxiety at T2 (i.e., Social loneliness → Worry → Anxiety symptoms). Whereas, when controlling for worry, metacognitive beliefs contributed to the prospective relations between loneliness in romantic and social relations on anxiety at T2 (i.e., Romantic loneliness → Metacognitive beliefs → Anxiety symptoms, and Social loneliness → Metacognitive beliefs → Anxiety

**Table 1**  
Descriptive statistics and correlations for variables in repeated assessments.

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Gender																			
2	Age	25.84	5.74	-.03	-															
3	Loneliness Total T1	41.50	16.75	.01	-.07	-														
4	Family Loneliness T1	12.59	6.59	.08	-.04	.70 <sup>†</sup>	-													
5	Romantic Loneliness T1	16.78	10.25	-.03	-.12	.81 <sup>†</sup>	.25 <sup>†</sup>	-												
6	Social Loneliness T1	12.13	5.60	-.02	.07	.69 <sup>†</sup>	.44 <sup>†</sup>	.30 <sup>†</sup>	-											
7	Worry T1	39.89	7.93	.26 <sup>†</sup>	-.08	.40 <sup>†</sup>	.34 <sup>†</sup>	.24 <sup>†</sup>	.35 <sup>†</sup>	-										
8	Metacognition T1	51.69	12.57	.14 <sup>*</sup>	-.11	.39 <sup>†</sup>	.28 <sup>†</sup>	.28 <sup>†</sup>	.32 <sup>†</sup>	.58 <sup>†</sup>	-									
9	Anxiety T1	6.73	2.27	.25 <sup>†</sup>	-.15	.34 <sup>†</sup>	.31 <sup>†</sup>	.20 <sup>†</sup>	.27 <sup>†</sup>	.56 <sup>†</sup>	.49 <sup>†</sup>	-								
10	Depression T1	11.22	4.49	.21 <sup>†</sup>	-.02	.54 <sup>†</sup>	.49 <sup>†</sup>	.33 <sup>†</sup>	.45 <sup>†</sup>	.59 <sup>†</sup>	.61 <sup>†</sup>	.71 <sup>†</sup>	-							
11	Loneliness Total T2	42.06	16.43	.04	.00	.84 <sup>†</sup>	.60 <sup>†</sup>	.67 <sup>†</sup>	.56 <sup>†</sup>	.33 <sup>†</sup>	.37 <sup>†</sup>	.34 <sup>†</sup>	.52 <sup>†</sup>	-						
12	Family Loneliness T2	12.60	6.12	.08	.05	.61 <sup>†</sup>	.83 <sup>†</sup>	.24 <sup>†</sup>	.41 <sup>†</sup>	.34 <sup>†</sup>	.29 <sup>†</sup>	.32 <sup>†</sup>	.44 <sup>†</sup>	.74 <sup>†</sup>	-					
13	Romantic Loneliness T2	17.03	9.86	.03	-.13	.71 <sup>†</sup>	.26 <sup>†</sup>	.85 <sup>†</sup>	.27 <sup>†</sup>	.18 <sup>†</sup>	.24 <sup>†</sup>	.22 <sup>†</sup>	.31 <sup>†</sup>	.81 <sup>†</sup>	.31 <sup>†</sup>	-				
14	Social Loneliness T2	12.43	5.54	-.01	.17 <sup>†</sup>	.54 <sup>†</sup>	.42 <sup>†</sup>	.22 <sup>†</sup>	.73 <sup>†</sup>	.28 <sup>†</sup>	.34 <sup>†</sup>	.25 <sup>†</sup>	.49 <sup>†</sup>	.71 <sup>†</sup>	.54 <sup>†</sup>	.28 <sup>†</sup>	-			
15	Worry T2	39.52	7.77	.24 <sup>†</sup>	-.09	.39 <sup>†</sup>	.33 <sup>†</sup>	.25 <sup>†</sup>	.33 <sup>†</sup>	.70 <sup>†</sup>	.58 <sup>†</sup>	.53 <sup>†</sup>	.58 <sup>†</sup>	.39 <sup>†</sup>	.34 <sup>†</sup>	.25 <sup>†</sup>	.32 <sup>†</sup>	-		
16	Metacognition T2	50.84	12.89	.10	-.11	.35 <sup>†</sup>	.26 <sup>†</sup>	.24 <sup>†</sup>	.29 <sup>†</sup>	.53 <sup>†</sup>	.79 <sup>†</sup>	.40 <sup>†</sup>	.53 <sup>†</sup>	.38 <sup>†</sup>	.30 <sup>†</sup>	.24 <sup>†</sup>	.37 <sup>†</sup>	.68 <sup>†</sup>	-	
17	Anxiety T2	6.58	2.21	.26 <sup>†</sup>	-.09	.32 <sup>†</sup>	.35 <sup>†</sup>	.14 <sup>*</sup>	.28 <sup>†</sup>	.51 <sup>†</sup>	.49 <sup>†</sup>	.63 <sup>†</sup>	.59 <sup>†</sup>	.37 <sup>†</sup>	.39 <sup>†</sup>	.15 <sup>†</sup>	.40 <sup>†</sup>	.56 <sup>†</sup>	.53 <sup>†</sup>	-
18	Depression T2	10.83	4.29	.17	-.05	.49 <sup>†</sup>	.43 <sup>†</sup>	.27 <sup>†</sup>	.46 <sup>†</sup>	.47 <sup>†</sup>	.52 <sup>†</sup>	.53 <sup>†</sup>	.78 <sup>†</sup>	.55 <sup>†</sup>	.46 <sup>†</sup>	.30 <sup>†</sup>	.59 <sup>†</sup>	.58 <sup>†</sup>	.57 <sup>†</sup>	.69 <sup>†</sup>

Note: \* $p < .05$ ; † $p < .01$ .



**Fig. 1.** Path model with only significant paths included to preserve readability of the figure. Table 2 provides other path relations. Latent constructs in circles reflect loneliness in family, romantic and social relationships. pswq\_a = T1 Worry; mcq\_a = T1 Metacognitive beliefs; anx\_b and dep\_b = Symptoms of anxiety and depression at T2, respectively.

symptoms), and depressive symptoms at T2 (i.e., Romantic loneliness → Metacognitive beliefs → Depressive symptoms, and Social loneliness → Metacognitive beliefs → Depressive symptoms).

#### 4. Discussion

The overarching aim in this study was to investigate whether metacognitive beliefs contribute to worry as serial mediators in the prospective relationships between loneliness in family, romantic and social relationships and common mental health measured as anxiety and depressive symptoms. A full SEM was estimated to examine direct and indirect prospective

relations among loneliness in the different relationships, metacognitive beliefs and worry, and symptoms of anxiety and depression.

Loneliness in social relationships showed the broadest effect on anxiety and depressive symptoms being mediated by metacognitive beliefs on both anxiety and depressive symptoms and mediated by worry on only anxiety symptoms. Thus, it seems plausible to argue that when experiencing social loneliness metacognitive beliefs affect both anxiety and depressive symptoms, while the intensity and duration of worrying may only affect levels of anxiety symptoms. Social loneliness also directly predicted symptoms of depression supporting the notion as humans are social the lack of affiliative needs and social contact can be detrimental to mental health (Harandi,

**Table 2**  
Path coefficients for direct and indirect relations in the full SEM.

Path	B	SE	p	beta	95% C. I
<b>Direct Contemporaneous Relations</b>					
Family → Worry	<b>0.788</b>	<b>0.382</b>	<b>.039</b>	.126	
Romantic → Worry	0.079	0.197	.690	.022	
Social → Worry	<b>1.072</b>	<b>0.459</b>	<b>.020</b>	<b>.158</b>	
Family → Metacognition	0.839	0.698	.229	.085	
Romantic → Metacognition	<b>1.009</b>	<b>0.358</b>	<b>.005</b>	<b>.181</b>	
Social → Metacognition	<b>2.967</b>	<b>0.834</b>	<b>.000</b>	<b>.276</b>	
Metacognition → Worry	<b>0.304</b>	<b>0.036</b>	<b>.000</b>	<b>.482</b>	
<b>Direct Time 1 → Time 2 Effects</b>					
Family → Anxiety	0.188	0.110	.088	.110	
Romantic → Anxiety	-0.059	0.057	.298	-.061	
Social → Anxiety	0.175	0.134	.193	.094	
Family → Depression	0.325	0.207	.116	.096	
Romantic → Depression	0.014	0.106	.895	.007	
Social → Depression	<b>1.177</b>	<b>0.262</b>	<b>.000</b>	<b>.323</b>	
Worry → Anxiety	<b>0.070</b>	<b>0.020</b>	<b>.000</b>	<b>.255</b>	
Metacognition → Anxiety	<b>0.049</b>	<b>0.012</b>	<b>.000</b>	<b>.284</b>	
Age → Anxiety	-0.017	0.020	.399	-.047	
Gender → Anxiety	<b>0.711</b>	<b>0.249</b>	<b>.004</b>	<b>.157</b>	
Worry → Depression	0.063	0.036	.082	.117	
Metacognition → Depression	<b>0.099</b>	<b>0.022</b>	<b>.000</b>	<b>.291</b>	
Age → Depression	-0.022	0.038	.558	-.030	
Gender → Depression	0.799	0.467	.087	.090	
<b>Specific Indirect Effects</b>					
Family → Metacognition → Worry → Anxiety	0.018	0.016	.259	.010	[-0.008, 0.028]
Family → Worry → Anxiety	0.055	0.031	.074	.032	[-0.003, 0.067]
Family → Metacognition → Anxiety	0.041	0.036	.247	.024	[-0.016, 0.064]
Romantic → Metacognition → Worry → Anxiety	<b>0.021</b>	<b>0.010</b>	<b>.032</b>	<b>.022</b>	<b>[0.002, 0.042]</b>
Romantic → Worry → Anxiety	0.005	0.014	.692	.006	[-0.022, 0.034]
Romantic → Metacognition → Anxiety	<b>0.049</b>	<b>0.021</b>	<b>.021</b>	<b>.051</b>	<b>[0.008, 0.095]</b>
Social → Metacognition → Worry → Anxiety	<b>0.063</b>	<b>0.077</b>	<b>.015</b>	<b>.034</b>	<b>[0.007, 0.060]</b>
Social → Worry → Anxiety	<b>0.075</b>	<b>0.038</b>	<b>.050</b>	<b>.040</b>	<b>[0.001, 0.080]</b>
Social → Metacognition → Anxiety	<b>0.145</b>	<b>0.054</b>	<b>.007</b>	<b>.078</b>	<b>[0.024, 0.133]</b>
Family → Metacognition → Worry → Depression	0.016	0.016	.326	.005	[-0.005, 0.014]
Family → Worry → Depression	0.049	0.037	.186	.015	[-0.007, 0.036]
Family → Metacognition → Depression	0.083	0.072	.247	.025	[-0.017, 0.066]
Romantic → Metacognition → Worry → Depression	0.019	0.013	.147	.010	[-0.004, 0.024]
Romantic → Worry → Depression	0.005	0.013	.698	.003	[-0.011, 0.016]
Romantic → Metacognition → Depression	<b>0.100</b>	<b>0.042</b>	<b>.017</b>	<b>.053</b>	<b>[0.010, 0.096]</b>
Social → Metacognition → Worry → Depression	0.057	0.037	.125	.016	[-0.004, 0.035]
Social → Worry → Depression	0.067	0.047	.151	.018	[-0.007, 0.043]
Social → Metacognition → Depression	<b>0.293</b>	<b>0.102</b>	<b>.004</b>	<b>.081</b>	<b>[0.028, 0.133]</b>

Note: Statistically significant paths are shown in boldface

Taghinasab, & Nayeri, 2017). Further, metacognitive beliefs contributed to worry, which in turn contributed to explain the relation between social loneliness and anxiety. This result lends support to previous findings that metacognitive beliefs determine whether worry is maintained and exacerbated in contributing to mental health problems (Papageorgiou & Wells, 2003). Additionally, social loneliness indicate a perceived lack in affiliative needs such as friendships and workplace relationships (DiTommaso & Spinner, 1993, 1997), and because lonely people often have self-focused negative perceptions of their ability to initiate and maintain social relationships, believing that their behaviour is ineffective (Rokach, 2015). It is possible that the way people who feel social loneliness respond together with metacognitive beliefs and worry could lead to counterproductive effects. Ultimately, this will give way to social inadequacy and behavioural difficulties in social circumstances, predicting the relation with anxiety symptoms as tested in the serial mediation model.

Loneliness in romantic relationships did not show any direct relations with anxiety and depressive symptoms. Instead, it was mediated by metacognitive beliefs on both anxiety and depressive symptoms. To understand the results for the relations between romantic loneliness and symptoms of anxiety and depression, one may consider how metacognitive beliefs affect the relations. Thus, it may be that when feeling romantic loneliness, metacognitive beliefs about the lack of intimate, close relationships may explain the relations with anxiety and depressive symptoms whereas metacognitive beliefs may contribute to worry to explain the relation with anxiety

symptoms. For example, participants who were involved in a recent romantic relationship breakup and reported feeling sad about the breakup showed symptoms related to major depression (Stoessel et al., 2011), and heartbreak due to sudden loss or lack of positive affect in romantic relationships were also associated with depressive symptoms (Verhallen, Renken, Marsman, & Ter Horst, 2019). Loneliness in family relationship was only associated with worry but not metacognitive beliefs, anxiety and depressive symptoms. This was not surprising for a sample of young adults with a mean age of 26 years, transitioning to older adulthood. At this developmental stage, young adults pursue independence from their families to explore new roles, establish their own families and households, seeking separateness (Aquilino, 2009), thus, loneliness may not exert too much effects in family relationships to account for the variance in anxiety or depressive symptoms.

This study has some limitations. Although when specified as a latent variable, measurement errors are accounted for in the focal predictor or independent variable, mediator variables like independent variables are also a predictor variable (Anyan, 2019). Therefore, when measurement errors in mediator variables are ignored it can pose the same shortcomings just like ignoring measurement errors in the focal predictor can lead to unstable direct and indirect parameter estimates (Muthén & Asparouhov, 2015). The theoretical foundation of metacognitive beliefs suggests the potential for multiple steps (or serial) mediation. In this way, model testing in the relations between family, romantic, social

relationships and symptoms of anxiety/depression (i.e., Loneliness → Metacognitive beliefs → Worry → Symptoms of anxiety/depression) would require four waves of data collection. However, due to practical constraints two waves of data were collected for the present study. When using two waves of data collection Cole and Maxwell (2003) proposed to control for autoregressive effects when predicting the mediator and outcome variable in order to attenuate bias in cross-lagged effects. We abandoned such a model for not reaching acceptable fit even after several re-specifications to estimate a model where Time 1 contemporaneous relations between the predictors and mediators are used to predict anxiety and depressive symptoms at Time 2. As such this study inherits the biases in half-longitudinal designs described by Cole and Maxwell (2003). Future studies should improve on this limitation by using four or more waves of data collection. Two error variances were correlated to reach adequate fit for the factor structure of the loneliness scale. The model re-specifications may limit generalizations beyond the sample. Despite these limitations this study offers several theoretical and practical implications. Theoretically, this study has expanded our limited knowledge about loneliness in different relationships and common mental health problems as well as how metacognitive beliefs and worry contribute to their relations, as no other empirical studies existed. This study also adds to fidelity in informed preventive interventions in the shift to designing interventions that empower patients to focus inward and address negative thoughts underlying loneliness and mental health problems as result of maladaptive social cognitions. This is a potential great gain for incorporating components of interventions that target metacognitive beliefs and/or worry in applied and professional practice.

## 5. Conclusion

It is interesting to note that for loneliness in social and romantic relationships, their relations with anxiety and depressive symptoms depends on how an individual responds with metacognitive beliefs and/or worry or both to the feeling of loneliness. However, social loneliness might be an exception since it also had a direct effect on levels of depressive symptoms. To prevent or reduce loneliness and common mental health problems, evidence provided show that interventions may incorporate components that target self-focused negative thinking in the form of worry or beliefs about the contents of negative thinking in the form of metacognitive beliefs underlying loneliness and mental health problems.

## Declarations of Competing Interest

None.

## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.mhp.2020.200186](https://doi.org/10.1016/j.mhp.2020.200186).

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