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Understanding the Effect of Loneliness on Quality of Life in Older Adults from Longitudinal Approaches

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A B S T R A C T

Aim: To study the longitudinal relationship between loneliness and quality of life (QoL) in adults to identify key mechanisms to better design future psychosocial interventions. *Method:* 13,222 participants from three consecutive waves of the Survey of Health, Ageing, and Retirement in Europe (SHARE), aged 65 or older, 56.3% women. They were analyzed using cross-lagged panel model (CLPM), random intercept cross-lagged panel model (RI-CLPM), and multi-group models disaggregated by gender. *Results:* The RI-CLPM provided a better fit than the CLPM. Both models showed the stability of QoL and loneliness. All autoregressive paths were significant, and a negative association between concurrent QoL and loneliness was observed across all waves. The CLPM supported a reciprocal relationship, while the RI-CLPM only confirmed the effects of loneliness on QoL. Women reported higher levels of loneliness and poorer QoL, but no gender differences were identified in the longitudinal association. *Conclusions:* Addressing loneliness in early stages could be a better preventive measure to promote quality of life in both genders.

The aging global population poses a significant challenge to society, particularly in Europe, where 20.6% of the population is aged 65 or over (Eurostat, 2020). Old age is accompanied by various challenges, such as retirement, increasing functional limitations, loss of social roles, and the death of significant others. These changes, inherent to old age, can alter the structural and functional components of social networks, putting older adults at risk of experiencing loneliness (Beridze et al., 2020; Moreno-Tamayo et al., 2020). From a social capital perspective, loneliness could be considered the discrepancy between the people desired and perceived quality and quantity of social relationships (Cacioppo & Hawkley, 2009), the negative subjective feeling of lacking social or intimate connections (De Jong-Gierveld & Havens, 2004), or the perceived social isolation (Hawkley et al., 2010). In our study, we base the defintion of loneliness on Hughes et al. (2004), who describe the indirect experience of loneliness as the absence of companionship, a sense of being left out, and feelings of isolation from others.

Regardless of the definition, loneliness has emerged as a significant health concern, impacting both physical and mental well-being, as well as the QoL for older adults (Courtin & Knapp, 2017). Gerontological research has shown that loneliness is longitudinally associated with losses in memory function (Ayalon et al., 2016) and feelings of hopelessness (Gum et al., 2017). In addition, loneliness is related to sleep disorders (Griffin et al., 2020), depression (van Zutphen et al., 2021), frailty (Sha et al., 2022) and predicts increased blood pressure (Hawkley et al., 2010) and mortality risk (Kristensen et al., 2023).

Loneliness is considered one of the 'geriatric giants', and several studies suggest that loneliness leads to impaired quality of life (QoL) in later life (K. Singh & Srivastava, 2014). QoL has been considered one of the pivotal outcomes in social gerontology (Hughes, 1999) and has multiple definitions (Fernández-Ballesteros & Rocío, 1997). For this study, we employed the QoL definition of Hyde et al. (2003) that was based on the "needs satisfaction model". This model supports that older adults have a set of basic needs that must be satisfied to achieve high QoL and encompasses four domains particularly relevant in old age: control, autonomy, self-realization, and pleasure. QoL is also the ultimate outcome in models aiming to understand the aging process, such as the Comprehensive Preventive Corrective Proactive (PCP) model (Kahana et al., 2003). The PCP considers QoL as a complex and multifaceted concept that could be affected by health-related and social stressors as loneliness. Many cross-sectional studies have reported a negative association between loneliness and well-being or QoL in older people (Holt-Lunstad et al., 2015; Theeke et al., 2012; Tobiasz-Adamczyk et al., 2017; Zhu et al., 2018). However, little is known about the longitudinal associations between loneliness and QoL in the old age.

Some studies, as the one from Beridze et al. (2020), found that higher loneliness at baseline predicted a decreased in QoL two years later in older people from Sweden. Similarly, Boehlen et al. (2022) conducted a study on older individuals from Germany and discovered that loneliness is associated with lower QoL after three years.

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Table 1. Sociodemographic Characteristics

		Time 1	Time 2	Time 3
Frecuency				
% Living with partner		67.7	65.5	60.4
% Economic situation	Very difficult	10.3	10.7	10.3
	Somewhat difficult	25.7	24.7	23.9
	Fairly easy	26.3	29.1	31.4
	Easy	37.7	35.5	34.5
Mean (*SD*)				
Cronic diseases		2.04 (1.59)	2.15 (1.65)	2.29 (1.69)
Quality of life		37.62 (6.22)	37.32 (6.35)	37.16 (6.34)
Loneliness		3.91 (1.33)	3.99 (1.43)	4.00 (1.43)

Note. Economic situation is asked as the percentage of people who say that their household is able to make ends meet very difficult, somewhat difficult, fairly easy, easy.

Furthermore, they observed gender differences, with loneliness having a greater impact on women QoL. Also, Tobiasz-Adamczyk et al. (2017) found gender-related differences in the associations between social networks, social support, social participation, and QoL and highlight the importance of study gender differences in the process of ageing to improve the interventions in this population. These previous studies revealed that there is a potential longitudinal relationship between loneliness and QoL. However, three or more waves are recommended to test the reciprocal relations and confirm the direction of the association (Burkholder & Harlow, 2003). Given that evidence to date comes from only two time points, the longitudinal association of loneliness and QoL remains unclear.

To examine reciprocal relationships, the cross-lagged panel model (CLPM) has traditionally been used, but some authors criticized this approach for not separating between and within-person variance and for assuming that there are no trait-like individual differences (Hamaker et al., 2015). This latter assumption could generate inaccurate conclusions and is especially problematic for stable individual psychological constructs such as loneliness (Mund et al., 2020). To address this concern, Hamaker et al. (2015) developed the random intercepts cross-lagged panel model (RI- CLPM) as one alternative that incorporates a latent variable to capture the trait-like component of each variable. However, some authors recommend to use the CLPM when focused on between-person effects and the RI-CLPM when focused on within-person effects (Orth et al., 2021). Since CLPM and RI-CLPM answer different research questions and use different causal estimation (Lüdtke & Robitzsch, 2021), analyzing both methods may be a useful strategy to obtain the maximum information on the longitudinal relationship between the study variables.

Therefore, to address the gap in the literature regarding the longitudinal relationship of QoL and loneliness, the main objectives of this study are to determine if the variables have a significant effect on each other, to study which variable is causally dominant, and to find out if each variable positively or negatively influences the other. Two longitudinal model approaches, CLPM and RI-CLPM, will be employed and the differences between the models, and the type of information they are given will be analyzed. Furthermore, given that the literature supports that there is a different impact of loneliness on QoL between men and women, multi-group models by gender will be tested.

Method

Data and Participants

This study is based on data from the 6th, 7th and 8th waves of the Survey of Health, Ageing, and Retirement in Europe (SHARE). The SHARE project presents a longitudinal collecting data every 2 years since 2004, with probabilistic sampling. The waves employed in this study were collected between 2015 and 2020 (wave 6 in 2015, wave 7 in 2017, and wave 8 in 2019 until March 2020). The participants of the project are people aged 50 and older from several European countries and Israel. Börsch-Supan (2022) and Börsch-Supan et al. (2013) offer additional information about the SHARE survey design.

Regarding the sample for this study, we included a subsample of 13,222 people that participate in the three waves of SHARE (6th, 7th, and 8th wave), aged 65 years or more at the first time in order to focus our investigation on the older population; 56.3% of the participants were women and 43.7% were men. At the beginning of the study, the majority of the participants were either married or in a registered partnership (67.1%). Some were widowers (21.1%), divorced (7.4%) or had never been married (4.4%). The participants had a mean of 10.94 years of education (*SD* = 4.25). Regarding the distribution by country, a total of 15 European countries and Israel were represented in the data: Austria (6.1%), Germany (10.4%), Sweden (10.9%), Spain (2.9%), Italy (2.9%), France (8.3%), Denmark (7.2%), Switzerland (3.1%), Belgium (5.6%), Israel (1.2%), Czech Republic (3.7%), Luxembourg (2.3%), Slovenia (8.7%), Estonia (12.4%), Greece (8.1%), Poland (2.9%), and Croatia (3.5%); 38,502 participants completed wave 6, 23,767 of them completed wave 7, and 13,222 also completed wave 8. In addition, we analyzed background characteristics such as the economic situation, whether the respondent live with their partner, or the number of chronic diseases. This information is presented in Table 1.

As time progresses, we observe a decrease in the number of participants living with their partners, an increase in the prevalence of chronic diseases, lower averages in their quality of life, and higher averages in their reported loneliness.

The ethical approval for gathering of the data used in this study was made by the ethics council of the Max Planck Society in Munich and it can be publicly consulted at:

http://www.shareproject.org/fileadmin/pdf_documentation/MPG_Ethics_Council_SHARE_overall_approval_29.05.2020__en_.pdf.

All participants provided informed consent.

Instruments

The Three-Item Loneliness Scale (Hughes et al., 2004) was employed to measure loneliness. It contains three items related to the frequency of feeling lack of companionship, exclusion, and isolation, on a three-point Likert scale (*often, some of the time, hardly ever or never*). The minimum score of the scale is 3 (not lonely) and the maximum score is 9 (very lonely). The internal consistency estimated with alpha and omega provided identical score values, were .72 for time 1, .74 for time 2, and, .74 for time 3. There is enough evidence of psychometric properties of the UCLA scale, including criterion-related validity and internal consistency (Neto et al., 2014; Russell, 1996; Sancho et al., 2020).

To assess quality of life, we used the CASP-12 (Control, Autonomy, Self-realization, and Pleasure scales) (Hyde et al., 2003), a 12-item version with a four-point Likert scale (*often, sometimes, rarely, never*). The total scale is composed of 4 domains: control, defined as the ability to influence one's own environment; autonomy, defined as the freedom that an individual enjoys; and self-realization and pleasure, which captures reflections about the activities that bring them happiness. The score ranges between 12 and 48. The scale showed adequate internal consistency in this sample, α = .73, ω = .74 for time 1, α = .76, ω = .77 for time 2, and α = .77, ω = .78 for time 3. There is evidence from research (Kerry 2018; Oliver et al., 2021) that the CASP-12's global score is appropriate for substantive interpretation and meaningful use in older adults.

Statistical Analyses

Analyses were conducted with SPSS 28 and Mplus 8.7 (Muthén & Muthén, 2017). SPSS was used to calculate sociodemographic statistics, zero-order correlations between the variables included in the model, and independent samples *t*-tests to assess gender and Europe regions differences, with the Cohen's *d* to estimate the effect size.

To satisfy the main objective of the study, two panel models, a cross-lagged panel model (CLPM) and a random intercept cross-lagged panel model (RI-CLPM) (Hamaker et al., 2015) were used. In the CLPM, the autoregressive paths were used to test the stability of the variables over time and cross-lagged paths were employed to test if the change in one variable was related to the change in another variable over time. However, the CLPM has some limitations, as it does not distinguish between within and between-person variance, so, causal paths may be over-estimated (Mulder & Hamaker, 2021). Therefore we also tested a RI-CLPM and compared the fit indices of both models. In the RI-CLPM the between-person variances were represented by two random intercepts (RI), one composed by the three observed scores of QoL (QoL-RI) and the other by the three observed scores of loneliness (LON-RI). The within-person variance is captured by latent factors that are composed by each observed score of QoL and loneliness regressed on its own latent factor, with factor loading constrained to 1. This latent factors contain the within-person change around an individual's expected score (mean). Therefore, these are person-centered variables.

Models fit was assessed with the recommended indices (Kline, 2016; Tanaka, 1993): robust chi-square (χ^2), comparative fit index (CFI), standardized root mean residual (SRMR), and root mean square error of approximation (RMSEA). A reasonable fit of the model to the data was considered if the CFI is higher than .90, and the SRMR or RMSEA are lower than .08 (Bentler & Bonett, 1980; Hu & Bentler, 1999). Furthermore, to test the differences in fit between different models, we used CFI differences (ΔCFI) considering that differences greater than .01 indicated a significant deterioration of the model (Cheung & Rensvold, 2002) and the robust chi-square differences test (Satorra & Bentler, 2010). The effect-size of the standarized regression lagged effects of the cross-lagged panel models were interpreted with the guidelines from Orth et al. (2022) that consider values between .03 and .07 small, higher than .07 medium, and higher than .12 large.

Results

Zero-order correlations between QoL and loneliness are shown in Table 2. As expected, we found significant positive correlations between one variable and the same variable in a different time and significant negative correlations between QoL and loneliness across times (waves).

Table 2. Correlations Between the Variables Included in the Cross-Lagged Models

	QoL1	QoL 2	QoL 3	Lon1	Lon2	Lon3
QoL 1	-					
QoL 2	.623	-				
QoL 3	.591	.641	-			
Lon 1	-.505	-.356	-.352	-		
Lon 2	-.417	-.558	-.420	.553	-	
Lon 3	-.344	-.374	-.524	.425	.558	-
Age	-.131	-.137	-.182	.097	.123	.130

Note. QoL = quality of life; Lon = loneliness.
All correlations were significant at $p < .001$.

CLPM and RI-CLPM

To clarify the temporal directional relationship between quality of life and loneliness, the CLPM and the RI-CLPM analyses were examined. The goodness-of-fit of the models are compared in Table 3. Altough the two models fitted the data well, all the model fit indicators suggest the RI-CLPM is a better fitting model than the CLPM.

In addition, the comparison between CLPM and RI-CLPM models indicates substantial variation in the model parameters. Figure 1 shows the results of the CLPM and RI-CLPM, both adjusted for equal autoregressive and cross-lagged effects. The CLPM proved the stability of both QoL and loneliness since all autoregressive paths were positive, significant and large. The association between concurrent QoL and loneliness feelings was also substantial, significant, and negative at all waves. Examining the cross-lagged parameters, the standardized regression coefficients between all variables were significant, showing a significant negative reciprocal relationship between quality of life and loneliness over time. The effect of QoL at time 1 on loneliness at time 2 (β = -.171, $p < .001$) and the effect of loneliness at time 2 on QoL at time 3 (β = -.137, $p < .001$) could be considered large and the other effects could be considered medium.

Figure 1 also shows the results of the RI-CLPM. There is a number of parameters of interest in the RI-CLPM. Firstly, the random intercepts represent the between-individual differences across the six years. The variances of the random intercepts, if statistically significant, point out that there are inter-individual differences in the average level in the variables (variance of QoL = 23.43, $p < .001$ and variance of loneliness = .72 $p < .001$). Additionally, a significant negative association between the random intercepts (β = -.782 $p < .001$) indicates that individuals with higher levels quality of life across the time also reported lower loneliness.

Secondly, the within wave associations between QoL and loneliness are also of interest. Specifically, the two variables were significantly and negatively related in each wave. This indicates that

Table 3. Model Fit Statistics for Model Comparision

	χ^2	df	CFI	SRMR	RMSEA	90% CI	$\Delta\chi^2$	Δdf	ΔCFI
CLPM	1157.721	4	.921	.045	.148	.141, .155	-	-	-
RI-CLPM	2.963	1	1.000	.003	.012	.000, .029	1154.758	3	.079

Note. CLPM = cross-lagged panel model; RI-CLPM = random intercept, cross-lagged panel model; CFI = comparative fit index; SRMR = standardized root mean square residual; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation.

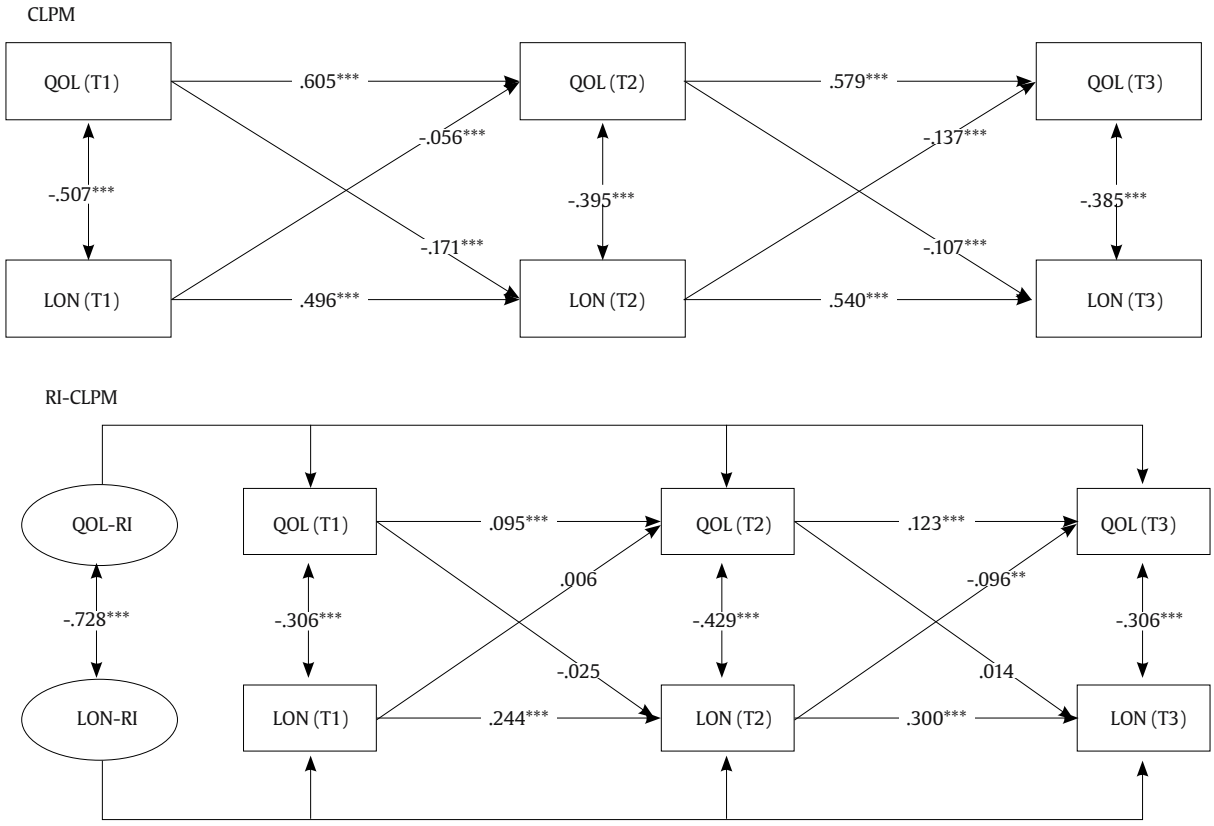

Figure 1. Standarized Regression Coefficients in the Models
QOL = quality of life; Lon = loneliness; T1 = time 1, T2 = time 2, T3 = time 3.
$^{**}p < .01$, $^{***}p < .001$.

at the same point in time, lower scores in loneliness are associated with higher scores in QoL within-persons. Thirdly, autoregressive paths for QoL and loneliness were positive and significant, indicating that within-person deviation on QoL or loneliness carries over to the next measurement occasion. However, the substantive magnitude of these autoregressive parameters was attenuated in this model, with respect to the CLPM.

Finally, the cross-lagged parameters are of interest. There was a significant effect of loneliness at time 2 to QoL at time 3 (β = -.096, p = .003). This negative effect means that individuals higher than their own average in loneliness at time 2 will be lower than their own expected (average) level of QoL in time 3. Significant positive cross-lagged effects were found in only one direction, from loneliness to QoL, suggesting that the relationship between QoL and loneliness is not mutual or reciprocal. In this model the other cross-laggeed parameters were not statistically associated.

Gender Differences

The quality of life and loneliness distribution across time between genders is shown in Table 4. In both genders as the time pass loneliness showed an increasing trend and quality of life a decreasing trend. Futhermore, there are significant gender differences consistent over time: older women tend to feel more loneliness than men in all waves and men tend to exhibit higher quality of life scores than women. Based on Cohen's (1992) guidelines, for small, medium, and large effects (d = 0.02, 0.13, 0.26), the effect size of all these differences could be considered medium or large.

We tested for the existence of moderation gender effects in the longitudinal relationship of loneliness and QoL by comparing a constrained (equal regression weights of all variables) model to an unconstrained model (regression weights freely estimated). We tested these models under both paradigms CLPM and RI-CLPM –

Table 4. Quality of Life and Loneliness Between Gender and Distribution of Screen Time

		Men	Women	t	d
Quality of Life	Time 1	38.30 (5.94)	37.10 (6.38)	10.81	0.194
	Time 2	37.89 (6.19)	36.89 (6.43)	8.77	0.158
	Time 3	37.61 (6.20)	36.81 (6.43)	6.94	0.126
Loneliness	Time 1	3.73 (1.18)	4.04 (1.43)	13.16	0.233
	Time 2	3.82 (1.28)	4.12 (1.52)	6.70	0.214
	Time 3	3.86 (1.31)	4.11 (1.50)	9.71	0.173

Note. All analysis are $p < .001$.

Table 5. Model Fit Statistics for Gender Multigroup Model

	χ^2	df	CFI	SRMR	RMSEA	90% CI	Δdf	ΔCFI	$\Delta\chi^2$
CLPM Uncostrained mopdel	1196.460	8	.917	.045	.150	.143, .157	-	-	-
CLPM Constrained model	1029.950	16	.929	.050	.098	.093, .103	8	.012	166.510
RI-CLPM Uncostrained model	6.104	2	1.000	.004	.018	.002, .034	-	-	-
RI-CLPM Constrained model	12.250	10	1.000	.010	.006	.000, .015	8	.000	6.146

Note. CFI = comparative fit index; SRMR = standardized root mean square residual; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation.

the standarized regression coefficients by gender are listed in the Supplemental Material (Figure S1 and Figure S2). All models fitted the data well – the parameter estimates are displayed in Table 5.

Regarding the gender differences, in the CLPM, the constrained model fit better than the unconstrained model, and in the RI-CLPM the Satorra-Bentler scaled chi-square difference test = 6.845 was not statistically significant (p = .55), so we cannot consider that there are gender differences. In addition, the parameters estimated for the gender multimodel CLPM and multimodel RI-CLPM were largely consistent with the models that included all the sample, indicating no gender differences.

Discussion

The aim of this study was to investigate the temporal directional relationship between quality of life (QoL) and loneliness in older adults. Since there is not much previous research on the longitudinal relationship of these two variables, we employed two analytical approaches (CLPM and RI-CLPM) to obtain detailed information. Comparing the goodness-of-fit of both models, we found that the RI-CLPM had a better fitting than the CLPM, although the latter produced more consistent cross-lagged effects. However, this result is not surprising, as it is often observed when comparing these models (Hamaker, 2018).

Consistent with previous cross-sectional research, both models showed that quality of life was negatively correlated with feelings of loneliness at each time point, and that this relationship remained stable over time. The CLPM analysis suggested that the relationship between loneliness and quality of life was bidirectional. However, when using the RI-CLPM, the bidirectional relationship disappeared at the within level and only the path from loneliness at T2 to quality of life at T3 remained significant, so directionality is from loneliness to quality of life.

In terms of gender differences, we noticed that women scored higher on loneliness and lower on quality of life across all time points. Women tend to live longer than men and have a higher likelihood of experiencing challenges that compromise their quality of life and predispose them to loneliness, including widowhood, relocation, living alone, or developing diseases (Beridze et al., 2020; Henning-Smith, 2016; B. Singh & Kiran, 2013). Therefore, our findings are consistent with prior research that has reported higher loneliness and lower quality of life in older women than in older men (Arslantaş et al., 2015; Vozikaki et al., 2018).

We also found a stronger effect of loneliness on quality of life among women in both models, which is in line with the findings reported by Boehlen et al. (2022). Despite this, our analysis using a constrained multigroup gender model did not uncover any moderation effects, indicating that gender does not significantly alter the relationship between loneliness and QoL. Therefore, our results suggest that although older women tend to be more affected by loneliness and report lower QoL, the association between these variables remains consistent across genders over time. One possible explanation for the lack of significant gender differences in the relationship between loneliness and QoL is that both men and women may benefit from different social mechanisms that moderate this relationship. For example, a study by Tobiasz-Adamczyk et al. (2017) found that men benefited more from social networks and social support, whereas women benefited more from social participation in relation to QoL. Further research could help explore these gender-specific social mechanisms and their potential moderating effects on the relationship between loneliness and QoL.

Our findings highlight the importance of using longitudinal models to elucidate the temporal directional relationship between QoL and loneliness. The impact of loneliness on quality of life in the adult population has become a major concern for the scientific community, particularly in light of the COVID-19 pandemic, which has exacerbated feelings of loneliness (Buecker et al., 2021; Macdonald & Hülür, 2021). There is an adaptive transitional loneliness which triggers emotional distress with social disconnection, as it supports the development and maintenance of social connections (Cacioppo et al., 2006), though, when becomes chronic, boosting neurobiological and behavioural mechanisms drives to adverse health consequences (Cacioppo & Hawkley, 2009).

Consequently, understanding the lagged effects between QoL and loneliness can help implement effective prevention and intervention strategies. It is imperative to implement measures that enhance quality of life and well-being in older adults, allowing them to actively participate in social, economic, and cultural activities (Buedo-Guirado et al., 2019; Galinha et al., 2021). Initiatives aiming to reduce feelings of loneliness have become a priority (Hickin et al., 2021; Williams et al., 2021) and, given that loneliness allows for intervention, it should be done better before it becomes chronic. Therefore, knowing its long-term implications, how it impacts quality of life, and whether loneliness precedes a deterioration in quality of life can be helpful (Hickin et al., 2021). Based on previous evidence (Galinha et al., 2021) and our results, we suggest that prevention and intervention strategies aimed at reducing loneliness in older people can be effective in improving QoL.

This study had several strengths. First, we used a large, representative, population-based sample of older adults, which enhances the generalizability of the findings. Second, the longitudinal design allowed us to investigate the temporal relationship between QoL and loneliness over a period of six years. Additionally, to compare the models, we used several adjustment indices to avoid misuse (Mayrhofer & Hutmacher, 2020; Zitzmann & Loreth, 2021) and employed the RI-CLPM, which allowed us to disentangle the within- and between-individual effects. The contribution regarding how to use and report results from new methodologies, as the two types of longitudinal cross-lagged panels considered, could be as challenging as recent contributions (Turner et al., 2023), providing a sort of introduction to the development of method guidance for researchers working in the psychosocial interventions area.

However, this study also had several limitations. Because it primarily focused on older people from Europe, our findings cannot be automatically generalized to the entire older population. Another possible limitation could stem from the gender-related bias in reporting loneliness. Although our study concludes that

gender does not moderate the relationship between loneliness and quality of life, it is important to recognize that our results could be influenced by the fact that men may have a lower propensity than women to admit loneliness. This difference in reporting loneliness could potentially lead to distorted estimates (Yu et al., 2023). In addition, further research is needed to investigate the temporal directional relationship between QoL and feelings of loneliness in other countries with different cultural and social circumstances. We examined gender differences in the relationship, but we did not investigate variations based on other relevant variables, such as country. This represents a potential avenue for future research. While we concentrated on the relations between QoL and loneliness, we did not account for unadjusted factors, such as mental or physical conditions, that may influence QoL and loneliness in old age. Therefore, despite the longitudinal design of the study, we cannot assert causality.

Conclusion

Addressing loneliness could serve as a promising preventive measure to promote quality aging. This study is unique in its longitudinal exploration of loneliness and quality of life, as well as in its use of more than two assessments of each variable across time points. We examined reciprocal relations between feelings of loneliness and QoL using both a CLPM and an RI-CLPM. The CLPM supported a reciprocal relation, while the RI-CLPM only confirmed the effects of loneliness on QoL. Although women showed higher levels of loneliness and poorer QoL, we did not identify gender differences in the effects of loneliness on QoL.

Conflict of Interest

The authors have no relevant financial or non-financial interests to disclose.

Note

This paper uses data from SHARE Waves 6, 7 and, 8 (DOIs: 10.6103/SHARE.w6.800, 10.6103/SHARE.w7.800, 10.6103/SHARE.w8.800,) see Börsch-Supan et al. (2013) for methodological details. The SHARE data collection has been funded by the European Commission, DG RTD through FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARELIFE: CIT4-CT-2006-028812), FP7 (SHARE-PREP: GA N°211909, SHARE-LEAP: GA N°227822, SHARE M4: GA N°261982, DASISH: GA N°283646) and Horizon 2020 (SHARE-DEV3: GA N°676536, SHARE-COHESION: GA N°870628, SERISS: GA N°654221, SSHOC: GA N°823782, SHARE-COVID19: GA N°101015924) and by DG Employment, Social Affairs & Inclusion through VS 2015/0195, VS 2016/0135, VS 2018/0285, VS 2019/0332, and VS 2020/0313. Additional funding from the German Ministry of Education and Research, the Max Planck Society for the Advancement of Science, the U.S. National Institute on Aging (U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04-064, HHSN271201300071C, RAG052527A) and from various national funding sources is gratefully acknowledged (see www.share-project.org).

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References

Arslantaş, H., Adana, F., Ergin, F. A., Kayar, D., & Gülçin, A. C. A. R. (2015). Loneliness in elderly people, associated factors and its correlation with quality of life: A field study from Western Turkey. *Iranian Journal of Public Health, 44*(1), 43-50. http://ijph.tums.ac.ir

Ayalon, L., Shiovitz-Ezra, S., & Roziner, I. (2016). A cross-lagged model of the reciprocal associations of loneliness and memory functioning. *Psychology and Aging, 31*(3), 255-261. https://doi.org/10.1037/pag0000075

Bentler, P. M., & Bonett, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin, 88*(3), 588-606. https://doi.org/10.1037/0033-2909.88.3.588

Beridze, G., Ayala, A., Ribeiro, O., Fernández-Mayoralas, G., Rodríguez-Blázquez, C., Rodríguez-Rodríguez, V., Rojo-Pérez, F., João Forjaz, M., & Calderón-Larrañaga, A. (2020). Are loneliness and social isolation associated with quality of life in older adults? Insights from Northern and Southern Europe. *International Journal of Environmental Research And Public Health, 17*(22), Article 8637. https://doi.org/10.3390/ijerph17228637

Boehlen, F. H., Maatouk, I., Friederich, H. C., Schoettker, B., Brenner, H., & Wild, B. (2022). Loneliness as a gender-specific predictor of physical and mental health-related quality of life in older adults. *Quality of Life Research, 31*(7), 1-11. https://doi.org/10.1007/s11136-021-03055-1

Börsch-Supan, A. (2022). Survey of Health, Ageing and Retirement in Europe (*SHARE*) Wave 8. Release version 8.0.0. SHARE-ERIC. Data set https://doi.org/10.6103/SHARE.w8.800

Börsch-Supan, A., Brandt, M., Hunkler, C., Kneip, T., Korbmacher, J., Malter, F., Schaan, B., Stuck, S., & Zuber, S. (2013). Data resource profile: The Survey of Health, Ageing and Retirement in Europe (*SHARE*). *International Journal of Epidemiology, 42*(4), 992-1001. https://doi.org/10.1093/ije/dyt088

Buecker, S., & Horstmann, K. T. (2021). Loneliness and social isolation during the COVID-19 pandemic A systematic review enriched with empirical evidence from a large-scale diary study. *European Psychologist, 26*(4), 272-284. https://doi.org/10.1027/1016-9040/a000453

Buedo-Guirado, C., Rubio, L., Dumitrache, C. G., & Romero-Coronado, J. (2020). Active aging program in nursing homes: Effects on psychological well-being and life satisfaction. *Psychosocial Intervention, 29* (1), 49-57. https://doi.org/10.5093/pi2019a18

Burkholder, G. J., & Harlow, L. L. (2003). An illustration of a longitudinal cross-lagged design for larger structural equation models. *Structural Equation Modeling, 10*(3), 465-486. https://doi.org/10.1207/S15328007SEM1003_8

Cacioppo, J. T., & Hawkley, L. C. (2009). Perceived social isolation and cognition. *Trends in Cognitive Sciences, 13*(10), 447-454. https://doi.org/10.1016/j.tics.2009.06.005S13646613(09)00147-8

Cacioppo, J. T., Hughes, M. E., Waite, L. J., Hawkley, L. C., & Thisted, R. A. (2006). Loneliness as a specific risk factor for depressive symptoms: Cross-sectional and longitudinal analyses. *Psychology and Aging, 21*(1), 140-151. https://doi.org/10.1016/j.cpr.2021.102066

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling, 9*(2), 233-255. https://doi.org/10.1207/S15328007SEM0902_5

Cohen, J. (1992). Quantitative methods in psychology: A power primer. *Psychological Bulletin, 112*(1), 155-159. https://doi.org/10.1037/0033-2909.112.1.155

Courtin, E., & Knapp, M. (2017). Social isolation, loneliness and health in old age: A scoping review. *Health & Social Care in the Community, 25*(3), 799-812. https://doi.org/ 10.1111/hsc.12311

De Jong-Gierveld, J., & Havens, B. (2004). Cross-national comparisons of social isolation and loneliness: introduction and overview. *Canadian Journal on Aging – Revue Canadienne du Vieillissement, 23*(2), 109-113. https://doi.org/10.1353/cja.2004.0021

Eurostat. (2020). *Ageing Europe – looking at the lives of older people in the EU.* Publications Office of the European Union.

Fernández-Ballesteros García, R., & Macía Antón, A. (1997). Calidad de vida en la vejez. *Psychosocial Intervention, 6*(1), 21-35.

Galinha, I., Pinal, D., Lima, M. L., & Labisa-Palmeira, A. (2021). The role of social and physiological variables on older adults' cognitive improvement after a group singing intervention: The Sing4health randomized controlled trial. *Psychosocial Intervention, 30*(3), 123-138. https://doi.org/10.7440/res64.2018.03

Griffin, S. C., Williams, A. B., Mladen, S. N., Perrin, P. B., Dzierzewski, J. M., & Rybarczyk, B. D. (2020). Reciprocal effects between loneliness and sleep disturbance in older Americans. *Journal of Aging and Health, 32*(9), 1156-1164. https://doi.org/10.1177/0898264319894486

Gum, A. M., Shiovitz-Ezra, S., & Ayalon, L. (2017). Longitudinal associations of hopelessness and loneliness in older adults: Results from the US health and retirement study. *International Psychogeriatrics, 29*(9), 1451-1459. https://doi.org/10.1017/S1041610217000904

Hamaker, E. L. (2018). How to run a multiple indicator RI-CLPM with Mplus. *Special Mplus Topics,* 1-6.

Hamaker, E. L., Kuiper, R. M., & Grasman, R. P. (2015). A critique of the cross-lagged panel model. *Psychological Methods, 20*(1), 102-116. https://doi.org/10.1037/a0038889

Hawkley, L. C., Thisted, R. A., Masi, C. M., & Cacioppo, J. T. (2010). Loneliness predicts increased blood pressure: 5-year cross-lagged analyses in middle-aged and older adults. *Psychology and Aging, 25*(1), 132-142. https://doi.org/10.1037/a0017805

Henning-Smith, C. (2016). Quality of life and psychological distress among older adults: The role of living arrangements. *Journal of Applied Gerontology, 35*(1), 39-61. https://doi.org/10.1177/0733464814530805

Hickin, N., Käll, A., Shafran, R., Sutcliffe, S., Manzotti, G., & Langan, D. (2021). The effectiveness of psychological interventions for loneliness: A systematic review and meta-analysis. *Clinical Psychology Review, 88,* Article 102066. https://doi.org/10.1016/j.cpr.2021.102066

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

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*(1), 1-55. https://doi.org/10.1080/10705519909540118

Hughes, B. (1999). *Gerontological approaches to quality of life.* SAGE Publications.

Hughes, M. E., Waite, L. J., Hawkley, L. C., & Cacioppo, J. T. (2004). A short scale for measuring loneliness in large surveys: Results from two population-based studies. *Research on Aging, 26*(6), 655-672. https://doi.org/10.1177/0164027504268574

Hyde, M., Wiggins, R. D., Higgs, P., & Blane, D. B. (2003). A measure of quality of life in early old age: the theory, development and properties of a needs satisfaction model (CASP-19). *Aging & Mental Health, 7*(3), 186-194. https://doi.org/10.1080/1360786031000101157

Kahana, E., Kahana, B., & Kercher, K. (2003). Emerging lifestyles and proactive options for successful ageing. *Ageing International, 28*(2), 155-180. https://doi.org/10.1007/s12126-003-1022-8

Kerry, M. J. (2018). Bifactor model of the CASP-12's general factor for measuring quality of life in older patients. *Journal of Patient-Reported Outcomes, 2,* Article 57. https://doi.org/10.1186/s41687-018-0078-x

Kline, R. B. (2016). *Principles and practice of structural equation modeling* (4th Ed.). Guilford Press.

Kristensen, S. M., Urke, H. B., Larsen, T. B., & Danielsen, A. G. (2023). Hello darkness, My old friend: Moderating a random intercept cross-lagged panel model of loneliness and symptoms of anxiety and depression. *Research on Child and Adolescent Psychopathology, 51*(3), 383-397. https://doi.org/10.1007/s10802-022-00995-1

Lüdtke, O., & Robitzsch, A. (2021). A critique of the random intercept cross-lagged panel model. *PsyArxiv.* https://doi.org/10.31234/osf.io/6f85c

Macdonald, B., & Hülür, G. (2021). Well-being and loneliness in Swiss older adults during the COVID-19 pandemic: The role of social relationships. *The Gerontologist, 61*(2), 240-250. https://doi.org/10.1093/geront/gnaa194

Mayrhofer, R., & Hutmacher, F. (2020). The principle of inversion: Why the quantitative-empirical paradigm cannot serve as a unifying basis for psychology as an academic discipline. *Frontiers in Psychology, 11,* Article 596425. https://doi.org/10.3389/fpsyg.2020.596425

Moreno-Tamayo, K., Manrique-Espinoza, B., Ramírez-García, E., & Sánchez-García, S. (2020). Social isolation undermines quality of life in older adults. *International Psychogeriatrics, 32*(11), 1283-1292. https://doi.org/10.1017/S1041610219000310

Mulder, J. D., & Hamaker, E. L. (2021). Three extensions of the random intercept cross-lagged panel model. *Structural Equation Modeling: A Multidisciplinary Journal, 28*(4), 638-648. https://doi.org/10.1080/10705511.2020.1784738

Mund, M., Freuding, M. M., Möbius, K., Horn, N., & Neyer, F. J. (2020). The stability and change of loneliness across the life span: A meta-analysis of longitudinal studies. *Personality and Social Psychology Review, 24*(1), 24-52. https://doi.org/10.1177/1088868319850738

Muthén, L. K., & Muthén, B. (2017). *Mplus user's guide: Statistical analysis with latent variables, user's guide.* Muthén & Muthén.

Neto, F. (2014). Psychometric analysis of the short-form UCLA Loneliness Scale (ULS-6) in older adults. *European Journal of Ageing, 11*(4), 313-319. https://doi.org/10.1007/s10433-014-0312-1

Oliver, A., Sentandreu-Mañó, T., Tomás, J. M., Fernández, I., & Sancho, P. (2021). Quality of life in european older adults of share wave 7: Comparing the old and the oldest-old. *Journal of Clinical Medicine, 10*(13), Article 2850. https://doi.org/10.3390/jcm10132850

Orth, U., Clark, D. A., Donnellan, M. B., & Robins, R. W. (2021). Testing prospective effects in longitudinal research: Comparing seven competing cross-lagged models. *Journal of Personality and Social Psychology, 120*(4), 1013-1034. https://doi.org/10.1037/pspp0000358

Orth, U., Meier, L. L., Bühler, J. L., Dapp, L. C., Krauss, S., Messerli, D., & Robins, R. W. (2022). Effect size guidelines for cross-lagged effects. *Psychological Methods.* Advance online publication. https://doi.org/10.1037/met0000499

Russell, D. W. (1996). UCLA Loneliness Scale (Version 3): Reliability, validity, and factor structure. *Journal of Personality Assessment, 66*(1), 20-40. https://doi.org/10.1207/s15327752jpa6601_2

Sancho, P., Pinazo-Hernandis, S., Donio-Bellegarde, M., & Tomás, J. M. (2020). Validation of the University of California, Los Angeles Loneliness Scale (version 3) in Spanish older population: An application of exploratory structural equation modelling. *Australian Psychologist, 55*(3), 283-292. https://doi.org/10.1111/ap.12428

Satorra, A., & Bentler, P. M. (2010). Ensuring positiveness of the scaled difference chi-square test statistic. *Psychometrika, 75*(2), 243-248. https://doi.org/10.1007/s11336-009-9135-y

Sha, S., Pan, Y., Xu, Y., & Chen, L. (2022). Associations between loneliness and frailty among older adults: Evidence from the China Health and Retirement Longitudinal Study. *BMC Geriatrics, 22*(1), Article 537. https://doi.org/10.1186/s12877-022-03044-0

Singh, B., & Kiran, U. V. (2013). Loneliness among elderly women. *International Journal of Humanities and Social Science Invention, 2*(2), 10-14.

Singh, K., & Srivastava, S. K. (2014). Loneliness and quality of life among elderly people. *Journal of Psychosocial Research, 9*(1), 11-18.

Tanaka, J. S. (1993). Multifaceted conceptions of fi t in structural equation models. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 10-40). Sage.

Theeke, L. A., Goins, R. T., Moore, J., & Campbell, H. (2012). Loneliness, depression, social support, and quality of life in older chronically ill Appalachians. *The Journal of Psychology, 146*(1-2), 155-171. https://doi.org/10.1080/00223980.2011.609571

Tobiasz-Adamczyk, B., Galas, A., Zawisza, K., Chatterji, S., Haro, J. M., Ayuso-Mateos, J. L., Koskinen, S., & Leonardi, M. (2017). Gender-related differences in the multi-pathway effect of social determinants on quality of life in older age—the COURAGE in Europe project. *Quality of Life Research, 26*(7), 1865-1878. https://doi.org/10.1007/s11136-017-1530-8

Turner, W., Morgan, K., Hester, M., Feder, G., & Cramer, H. (2023). Methodological challenges in group-based randomised controlled trials for intimate partner violence perpetrators: A meta-summary. *Psychosocial Intervention, 32*(2), 123-136. https://doi.org/10.5093/pi2023a9

Van Zutphen, E. M., Kok, A. A., Rijnhart, J. J., Rhebergen, D., Huisman, M., & Beekman, A. T. (2021). An examination of reciprocal effects between cardiovascular morbidity, depressive symptoms and loneliness over time in a longitudinal cohort of Dutch older adults. *Journal of Affective Disorders, 288,* 122-128. https://doi.org/10.1016/j.jad.2021.03.081

Vozikaki, M., Papadaki, A., Linardakis, M., & Philalithis, A. (2018). Loneliness among older European adults: Results from the survey of health, aging and retirement in Europe. *Journal of Public Health, 26*(6), 613-624. https://doi.org/10.1007/s10389-018-0916-6

Williams, C. Y., Townson, A. T., Kapur, M., Ferreira, A. F., Nunn, R., Galante, J., Phillips, V., Gentry, S., & Usher-Smith, J. A. (2021). Interventions to reduce social isolation and loneliness during COVID-19 physical distancing measures: A rapid systematic review. *PloS one, 16*(2), Article e0247139. https://doi.org/10.1371/journal.pone.0247139

Yu, X., Zahodne, L. B., Gross, A. L., Needham, B. L., Langa, K. M., Cho, T., & Kobayashi, L. C. (2023). Could differential under-reporting of loneliness between men and women bias the gender-specific association between loneliness and memory aging? A quantitative probabilistic bias analysis. *Alzheimer's & Dementia, 19*(S22), 1-2. https://doi.org/10.1002/alz.073192

Zhu, Y., Liu, J., Qu, B., & Yi, Z. (2018). Quality of life, loneliness and health-related characteristics among older people in Liaoning province, China: A cross-sectional study. *BMJ open, 8*(11), e021822. https://doi.org/10.1136/bmjopen-2018-021822

Zitzmann, S., & Loreth, L. (2021). Regarding an "almost anything goes" attitude toward methods in psychology. *Frontiers in Psychology, 12,* Article 612570. https://doi.org/10.3389/fpsyg.2021.612570

Supplemental Material

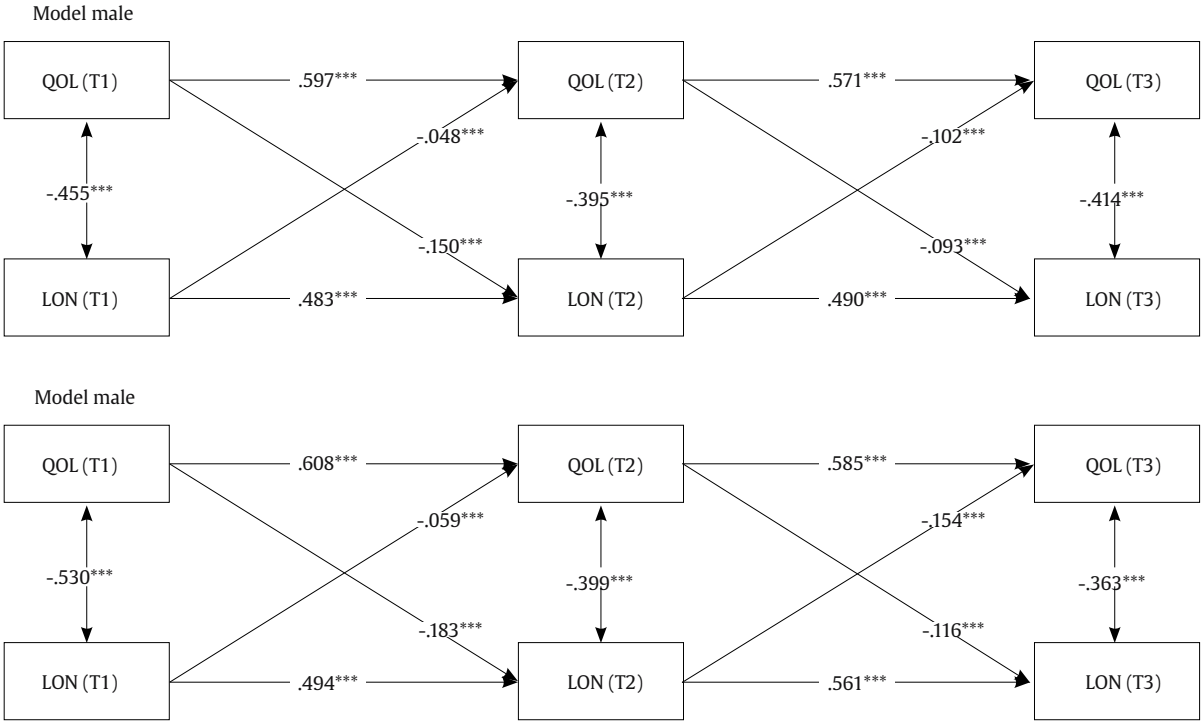

Figure S1. Standarized Regression Coefficients in the CLPM by Gender.

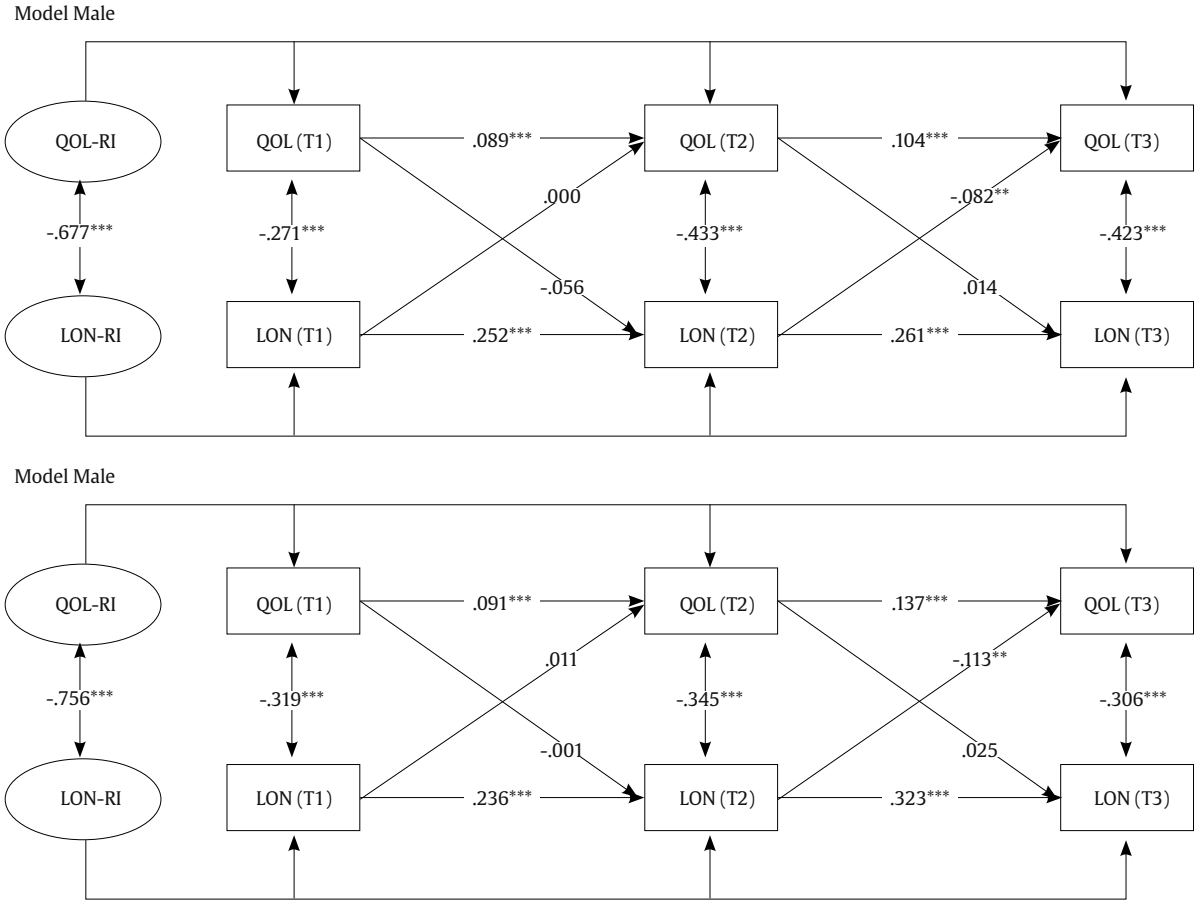

Figure S2. Standarized Regression Coefficients in the RICLPM by Gender.