

A Propensity-Score Matched Study of Changes in Loneliness Surrounding Major Life Events

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Major life events are often discussed as triggers of loneliness. However, longitudinal studies with frequent assessments investigating changes in loneliness surrounding major life events are lacking. This preregistered study investigated the associations between various family- and work-related major life events and changes in loneliness, using propensity-score matched data from a Dutch nationally representative prospective longitudinal study. We applied mixed-effects models to describe average loneliness trajectories before, during, and after 10 major life events. Event-related loneliness trajectories differed between events and individuals. Most changes in loneliness were found in reaction to family-related major life events. We found immediate and long-lasting increases in loneliness after the transition into parenthood, marital separation, widowhood, but also after a job loss. Further gradual changes in loneliness were found after marriage, marital separation, and job loss. On average, transition into paid employment, reemployment after unemployment, retirement, and cohabitation did not trigger changes in loneliness. For some major life events, we found that event-related loneliness trajectories differed between individuals who experienced an event at an average age and individuals who experienced an event younger or older than average. Overall, our results highlight the importance of considering major life events as possible triggers of loneliness but also point to some general methodological challenges when studying the effects of major life events.

Keywords: life events, loneliness, longitudinal study, propensity-score matching

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People feel lonely when they perceive a discrepancy between their desired and actual quality or quantity of their social relations (Hawkey & Cacioppo, 2010; Peplau & Perlman, 1982). Loneliness is often assumed to be triggered by major life events such as getting divorced or widowed because these events can change one's social network, which may in turn result in reduced satisfaction with one's social relationships (e.g., Hensley et al., 2012; Wrzus, Hänel, Wagner, & Neyer, 2013). Indeed, cross-sectional

studies consistently found that divorced or widowed people are on average lonelier than married people (Pinquart, 2003). However, these studies did not reveal whether these group differences are a direct consequence of major life events (e.g., the transition from being married to being divorced/widowed) or existed already before the major life events. Furthermore, it is unknown whether people eventually adapt after the major life event (i.e., return to prevent loneliness levels) and whether there are anticipatory changes in loneliness before the event occurs. To address these open questions, this study investigated the relations between various major life events and changes in loneliness using nationally representative prospective longitudinal data across the adult life span.

Loneliness and Major Life Events

Major life events are defined as “time-discrete transitions that mark the beginning or the end of a specific status” (Luhmann, Hofmann, Eid, & Lucas, 2012, p. 594). Major life events strongly predict patterns of everyday activities and social network compositions (for a meta-analysis see Wrzus et al., 2013) which, in turn, can affect loneliness (Green, Richardson, Lago, & Schatten-Jones, 2001).

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Please note that we registered a preregistration of this meta-analysis via the Open Science Framework (OSF; <https://osf.io/by4de>). The whole OSF project, including a comprehensive summary of all deviations from the preregistration as well as further materials, can be found here: <https://osf.io/kh7xr/>.

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Below, we review previous research on specific major life events and loneliness. In evaluating this research, we examine to what extent the research designs fulfill general requirements for studies investigating changes in psychological outcomes in the context of major life events (Bleidorn et al., 2020; Luhmann, Orth, Specht, Kandler, & Lucas, 2014). First, longitudinal studies are needed that not only provide information on mean-level differences *between* individuals (e.g., married and divorced individuals) but also on changes *within* individuals. Second, the temporal resolution of measurements needs to be appropriate to detect both short-term and long-term changes in an outcome before and after the event. Third, to interpret loneliness differences after a major life event as causal, one has to assume that there were no preexisting differences in loneliness or in correlates of loneliness between individuals before the major life event. However, major life events do not occur at random but are associated with person characteristics such as personality traits or life satisfaction and possibly also with loneliness (Diener, Nickerson, Lucas, Sandvik, & Diener, 2011; Kandler, Bleidorn, Riemann, Angleitner, & Spinath, 2012; Lucas, 2005; Lüdtke, Roberts, Trautwein, & Nagy, 2011; Marks & Fleming, 1999). For that reason, it is unrealistic to assume an absence of preexisting differences. Major life events should therefore be investigated with prospective longitudinal studies and a control group comprised of individuals that were followed for the same time but did not experience the event. Such a control group is crucial for two aims: (a) to investigate selection effects (e.g., individuals high in loneliness might be more likely to get divorced) and (b) to disentangle changes that are event-induced from normative age-related changes (e.g., age might predict both the occurrence of an event as well as systematic changes in loneliness).

Loneliness in the Context of Family-Related Major Life Events

Cohabitation and Loneliness

In most Western countries, the prevalence of cohabitation has increased over the last decades (Sánchez Gassen & Perelli-Harris, 2015). Whereas marriage is often examined in relation to loneliness, research on cohabitation and loneliness is scarce. However, some associations between cohabitation and loneliness-related constructs can be considered as indirect evidence. For example, cohabiting individuals report less relationship commitment than married couples (Kline et al., 2004). Among other possibilities, this could imply that living together has a weaker impact on loneliness than marriage. Others found that the type of partnership played only a minor role, such that both nonmarried cohabitation and marriage were positively associated with well-being (Perelli-Harris & Styrac, 2018), which is in turn related to loneliness. Hence, cohabitation could have positive effects on loneliness that are comparable to those of marriage. However, longitudinal studies of changes in loneliness surrounding cohabitation are lacking thus far.

Marriage and Loneliness

In cross-sectional studies, married participants generally reported larger social networks and less loneliness than singles

(Pinquart, 2003; Wrzus et al., 2013). Being married could protect against loneliness because married individuals are less likely to be objectively isolated (de Jong Gierveld, 2004; Dugan & Kivett, 1994; van Baarsen & van Groenou, 2001; von Soest, Luhmann, Hansen, & Gerstorf, 2020). However, it is also possible that selection effects are responsible for cross-sectional differences in loneliness between married and never-married individuals. For example, lonely individuals may be less likely to find someone to marry. Few longitudinal studies have investigated changes in loneliness surrounding marriage (or the beginning of a new partnership). In a longitudinal study on older adults aged between 55 and 84 years, Dykstra, van Tilburg, and De Jong Gierveld (2005) found that a new partnership after the death of a spouse was not accompanied by decreases in loneliness. However, finding a new partner after widowhood in old age is likely to be characteristically different from the first marriage, which is the focus of the current study.

Marital Separation, Divorce, and Loneliness

In cross-sectional studies, divorcees were found to have the highest mean level of loneliness compared with (re-)married people (e.g., Dykstra & Fokkema, 2007; van Tilburg, Aartsen, & van der Pas, 2015). Among divorcees, average loneliness levels tend to be lower among people who got divorced a long time ago than for people who became recently divorced. In a longitudinal study on older adults, a change in marital status from married to unmarried (which could also include widowhood besides marital separation and divorce) was associated with increases in loneliness (Victor & Bowling, 2012).

Research on marital separation and loneliness is almost nonexistent. However, marital separation could be a more distinct event compared with divorce because it can happen well before the legal divorce and marks the actual end of a romantic relationship. Halford and Sweeper (2013) found that that loneliness was initially higher in individuals separating from nonmarried but cohabiting relationships, compared with those separating from marriages. For both nonmarried cohabiting and married participants, loneliness linearly declined during the first two years after the separation. In sum, the existing literature suggests that both marital separation and divorce could be associated with changes in loneliness; however, a fine-grained examination is lacking thus far.

Transition Into Parenthood and Loneliness

Transition into parenthood is often described as an influential event for both men and women, with significant (and mostly negative) consequences especially for relationship satisfaction (Keizer, Dykstra, & Poortman, 2010; Mortensen, Torsheim, Melkevik, & Thuen, 2012; Perini, Ditzen, Fischbacher, & Ehlert, 2012; van Scheppingen, Denissen, Chung, Tambs, & Bleidorn, 2018). Research on loneliness surrounding the transition into parenthood presents an ambiguous and complex picture. Some research found that mothers report lower loneliness during the first year after childbirth compared with women who were neither pregnant nor new mothers (Rokach, 2004). Others found that the transition into parenthood did not influence women's life satisfaction, loneliness, or positive affect but did increase negative affect (Keizer et al., 2010). Keizer et al. (2010) showed that men become

lonelier after the transition into parenthood, especially those men who recently also married. Moreover, the transition into parenthood was found to decrease the family network size but to increase the frequency of contacts with remaining relatives (Bost, Cox, Burchinal, & Payne, 2002). Processes explaining these changes in social network size include reduced time for social contacts, changing daily routines, and a stronger focus on the child and the partner instead of on larger friendship- or work-related networks (for a meta-analysis see Wrzus et al., 2013). In sum, the existing studies indicate that the transition into parenthood might be associated with changes in loneliness. However, inconsistent findings obscure the exact understanding of these effects.

Widowhood and Loneliness

Unlike for marriage and divorce, direct longitudinal evidence is available for widowhood, indicating that losing a partner is associated with changes in loneliness (e.g., Aartsen & Jylhä, 2011; Stroebe, Stroebe, Abakoumkin, & Schut, 1996; Utz, Bearson, Caserta, Lund, & De Vries, 2011; van Baarsen, van Duijn, Smit, Snijders, & Knipscheer, 2002; van der Houwen et al., 2010). Widowhood is associated with decreases in the personal network and also with slight reductions of the family network (Wrzus et al., 2013). In a prospective study, individuals who experienced widowhood reported increased loneliness at a follow-up measurement occasion (Aartsen & Jylhä, 2011). However, the exact pattern of change in loneliness surrounding widowhood remains unclear. In a U.S. sample, loneliness longitudinally declined over the first year and a half after experiencing widowhood (Utz et al., 2011), whereas loneliness did not decline at all over two and a half years after widowhood for about 30% of the participants in a Dutch sample (van Baarsen et al., 2002).

Loneliness in the Context of Work-Related Major Life Events

Transition Into Paid Employment and Loneliness

The transition into paid employment goes along with expanded access to new people who may become part of one's social network as coworkers or friends (Morrison, 2002), but also with decreasing time to cultivate existing friendships (Shaver, Furman, & Buhrmester, 1985). Job entry has been associated with increases in the social network size (for a meta-analysis Wrzus et al., 2013). A recent study on partnership dynamics in school-to-work transitions found that the transition into paid employment of young men stabilized their partnerships whereas this transition had no effect on partner stability for young women (Heintz-Martin & Zabel, 2018). However, loneliness has largely been neglected as an outcome in the literature on the transition into paid employment. In the present study, the transition into paid employment includes every change from any other occupational status to paid employment (e.g., first job after school, employment after parental leave). Because this event category is rather broad, we additionally included the event *reemployment after unemployment*, which describes the status change from unemployment to paid employment. Previous longitudinal research with a diverse sample of Dutch adults showed that reemployed individuals were more likely to change from poor to good quality of life compared with those who

continued to be unemployed (Carlier et al., 2013). This study offers the first indications that loneliness might decrease after reemployment.

Job Loss and Loneliness

Only a few studies have investigated the relation between job loss and loneliness. Mandal and Roe (2008) found that the negative impact of involuntary job loss on loneliness was similar to the impact of the death of a child but less severe than the impact of the death of a spouse. However, in a cross-sectional study, Creed and Reynolds (2001) found that people who were currently unemployed but had access to part-time or casual paid work were least lonely.

This suggests that job loss involves losing work-related social contacts but also gaining time for other social contacts. A longitudinal Europe-wide study found that becoming unemployed did not itself increase the risk of objective social isolation. Instead, differences between unemployed persons and others were probably attributable to selection effects, such that lower sociality (i.e., lower frequency of contacts with neighbors and friends, less participation in clubs, living alone) predated the occurrence of job loss (Gallie, Paugam, & Jacobs, 2003). It remains unclear whether and how loneliness changes in anticipation of and reaction to job loss.

Retirement and Loneliness

The transition into retirement is accompanied by a drastic change in everyday routines and calls for greater personal initiative in maintaining or expanding the social network (Segel-Karpas, Ayalon, & Lachman, 2018). Retirement is associated with changes in social networks (Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015; van Tilburg, 1992). Although work ties might decrease after the transition into retirement, retirees might engage in new commitments such as voluntary work or interactions with children and grandchildren (Dykstra et al., 2005). However, especially retirees without marital support tend to miss the social dimensions of work (Damman, Henkens, & Kalmijn, 2015). Women with better-quality relationships reported less fear in anticipation of retirement (Sherry, Tomlinson, Loe, Johnston, & Feeney, 2017). Additionally, still being (part-time) employed during retirement years was found to be related to a greater social network (Mor-Barak, Scharlach, Birba, & Sokolov, 1992). For those who were already lonely before retirement but whose working contacts buffered complete objective social isolation, retirement posed a particular risk for the development of depression (Segel-Karpas et al., 2018). In sum, the existing literature does not allow robust conclusions about average changes in loneliness surrounding retirement.

Age-Normative Effects of Major Life Events

Previous research on major life events and loneliness frequently produced inconclusive and inconsistent findings, raising the possibility that the effects of major life events on loneliness might depend on unaccounted moderator variables. In this study, we focused on age as a potentially important moderator. Experiencing an event at a typical age (e.g., widowhood in old age) might have different effects on loneliness compared with experiencing an

event at an atypical age (e.g., early widowhood or late marriage). Both biological maturation and social norms about age-appropriate behavior create a developmental timetable including developmental goals that are considered to be age-normative at certain life stages (Heckhausen, Wrosch, & Schulz, 2010; Hutteman, Hennecke, Orth, Reitz, & Specht, 2014). Passing a developmental deadline without attaining the developmental goal (e.g., fertile phase passes without having children) can result in frustration and depression (Heckhausen et al., 2010).

There is some evidence that the relation between major life events and loneliness differs among age groups. For example, partnership status and employment status (working full-time vs. working not at all) were more strongly related to loneliness in middle-aged adults compared with young or old adults (Luhmann & Hawkey, 2016). These patterns are consistent with the idea that the failure to achieve social norms and expectations at a particular life stage is likely to increase the risk of loneliness. Individuals who experience a major life event non-normatively—especially those who experience an event younger than average—might have fewer role models for adjusting to the transition and less access to peer and institutional support (Wrosch & Freund, 2001). This lack of (social) resources might produce greater social challenges that can result in loneliness. In the present study, we investigated whether experiencing an event age-normatively (i.e., at an average age) has different effects on changes in loneliness than experiencing an event non-normatively.

The Current Study

From all studies available thus far, drawing robust and nuanced conclusions about whether and how loneliness changes surrounding major life events is not yet possible. The current study aimed to fill this gap by examining changes in loneliness in the context of family-related major life events (cohabitation, marriage, transition into parenthood, marital separation, divorce, and widowhood) and work-related major life events (transition into paid employment, reemployment after unemployment, job loss, and retirement). We used prospective longitudinal data with up to 10 measurement occasions of loneliness. The event occurrence was assessed monthly, which allowed a high temporal resolution of changes in loneliness surrounding the event.

We were interested in the effect of preexisting loneliness levels on the occurrence of major life events, anticipatory effects of major life events on loneliness as well as changes in loneliness in reaction to major life events. Reaction effects can represent both an initial change in loneliness after the event and adaptation (i.e., a return to the preevent level of loneliness). We expect the change patterns in loneliness surrounding major life events to be rather complex. Owing to multiple time points in our data set, we are able to differentiate among these complex change patterns, such as gradual linear changes in loneliness before and after the event, abrupt long-term shifts in loneliness in reaction to the event, or the distinction of the first year after an event from all other years (Denissen, Luhmann, Chung, Bleidorn, & Chung, 2019; Luhmann et al., 2014). Moreover, we examined whether individuals who experienced an event age-normatively differ in their average event-related trajectory of loneliness from individuals who did not experience an event age-normatively. To disentangle event-induced effects from normative age-related effects, we com-

pared event groups to propensity-score matched control groups (Thoemmes & Kim, 2011).

Method

Participants

We used data from the prospective nationally representative Dutch Longitudinal Internet Studies for the Social Sciences (LISS) panel administered by CentERdata (Tilburg University, The Netherlands).¹ Because this study used secondary data it was exempt from IRB review. Our sample included every person participating in the LISS panel who had reported their loneliness at least once ($N = 13,945$ participants nested in 8,685 independent households; 54.3% females). At the beginning of the survey, the age range was between 16 and 100 years ($M_{\text{age}} = 44.57$ years, $SD_{\text{age}} = 17.52$). About 80% of the sample had a Dutch background, 9% were first-generation migrants, and 10% were second-generation students. For 1% of the sample, no information about the origin was available.

LISS data have been used in previous publications on personality development and major life events (Bleidorn & Schwaba, 2018; Denissen et al., 2019; Luhmann, Buecker, Kaiser, & Beer-mann, 2020; Schwaba & Bleidorn, 2019) but have not yet been used to study changes in loneliness in the context of major life events. We are aware of one published study that used the loneliness data from the LISS panel, but no associations to major life events were examined in this article (van der Velden, Setti, van der Meulen, & Das, 2019).²

Event Samples

For each event, we selected a sample of individuals who reported that they did not have a specific status at the beginning of the survey and changed that status at some point during the survey (e.g., a sample that was not married at the start of the survey and got married at some point during the survey). The sample size of each event sample, the mean age at the event occurrence, and the *SD* are presented in Table 1.

Control Sample

For each event sample, we selected corresponding control samples of people who did not experience the life event (e.g., for marriage, the control sample consisted of people who began the survey unmarried and remained unmarried for the duration of the study). To make the groups comparable, we matched individuals of the event samples to individuals of the control samples using 1:1 nearest neighbor propensity score matching. No maximum tolerated difference between matched subjects (caliper width) was specified for the nearest neighbor matching. We selected sex, age, income, education level, the Big Five personality traits, social contact frequency, the total number of participated waves, the year

¹ The LISS panel can be accessed free of charge for research purposes upon signing a data usage agreement (for details see <https://www.lissdata.nl/access-data>).

² A full list of publications that used the LISS panel is available here: <https://www.dataarchive.lissdata.nl/publications>.

Table 1
Descriptive Statistics for the Event Samples

Event	<i>N</i>	<i>M</i> _{age at the event}	<i>SD</i> _{age at the event}
Cohabitation ^a (total)	310	42.85	13.87
Young adults (≤30 years)	114	29.39	4.13
Middle-aged adults (31–60 years)	155	45.95	6.71
Older adults (>60 years)	41	68.59	5.69
Marriage (total)	649	36.95	12.61
Young adults (≤30 years)	383	28.85	3.54
Middle-aged adults (31–60 years)	221	44.41	7.33
Older adults (>60 years)	45	69.24	6.84
Transition into parenthood ^b (total)	580	33.43	4.57
Young adults (≤30 years)	414	31.30	2.92
Middle-aged adults (31–60 years)	165	38.61	3.04
Older adults (>60 years)	1	61	N/A
Marital separation (total)	131	49.56	12.98
Young adults (≤30 years)	17	31.59	2.32
Middle-aged adults (31–60 years)	90	47.21	6.19
Older adults (>60 years)	24	71.08	7.57
Divorce (total)	222	47.09	12.52
Young adults (≤30 years)	43	30.58	3.6
Middle-aged adults (31–60 years)	151	47.50	6.6
Older adults (>60 years)	28	70.21	5.53
Widowhood (total)	164	69.77	10.95
Young adults (≤30 years)	1	29.00	N/A
Middle-aged adults (31–60 years)	31	54.55	6.31
Older adults (>60 years)	132	73.66	7.57
Transition into paid employment (total)	1633	35.09	13.21
Young adults (≤30 years)	901	24.71	4.43
Middle-aged adults (31–60 years)	672	46.40	6.90
Older adults (>60 years)	60	64.23	4.72
Re-employment after unemployment (total)	591	41.53	11.37
Young adults (≤30 years)	192	28.27	4.47
Middle-aged adults (31–60 years)	379	47.16	6.92
Older adults (>60 years)	20	62.3	1.53
Job loss (total)	884	43.09	12.18
Young adults (≤30 years)	252	27.65	4.61
Middle-aged adults (31–60 years)	566	47.70	7.10
Older adults (>60 years)	66	62.47	2.25
Retirement (total)	908	65.86	5.44
Young adults (≤30 years)	0	N/A	N/A
Middle-aged adults (31–60 years)	66	57.41	5.05
Older adults (>60 years)	842	66.52	4.89

^a For this event only the household head was used, because the monthly item used to measure the occurrence of cohabitation was “The household head lives together with a partner (wedded or unwedded).” ^b For this event only the household head and its wedded or unwedded partner were used, as the monthly item used to measure the occurrence of transition into parenthood referred to the “Number of living-at-home children in the household, children of the household head or his/her partner.” All other monthly items used to measure the occurrence of a major life event referred to each individual living in a household separately (e.g., regarding paid employment, the household head could select the response option “Is too young to have an occupation” for their child).

of the first and the last participation, and loneliness at the first measurement occasion as predictors of the event occurrence. Note that income was operationalized as personal net monthly income in categories ranging from “no income” to “more than 7,500 EUR” in 500 Euro increments.

For some events, such as divorce, marital separation, and widowhood, we additionally ensured that the control sample was married but did not experience divorce/marital separation/widowhood during the study (using an exact matching method on this variable). For job loss and retirement, we likewise ensured that the control samples remained employed. For marriage, we ensured that in each matched pair, either both participants or no-one experienced the transition into parenthood before or during the survey. For transition into parenthood, we ensured that in each

matched pair either both or no-one experienced marriage before or during the survey. Moreover, for all work-related events, we included dichotomous matching variables indicating whether a person experienced the different family-related events either before or during the survey. Similarly, for all family-related events, we included dichotomous variables indicating whether a person experienced different work-related events either before or during the survey.

Using propensity score matching, each subject received an individual propensity score reflecting the likelihood that a person with certain characteristics will experience an event during the study. Next, the event sample and the control sample were matched so that they had a similar propensity score (cf. Anusic, Yap, & Lucas, 2014; Yap, Anusic, & Lucas, 2012). The same

individuals could be part of different control samples for different major life events. We used the *matchit* function of the *MatchIt* package Version 3.0.2 in R (Ho, Imai, King, & Stuart, 2011). The number of matched/discarded people, the percent balance improvement, and the distribution of propensity scores (distance) before and after matching are presented in the [online supplemental materials](#).

Procedure

Participants in the LISS panel completed monthly surveys about their demographic status (e.g., marital status, occupational status, number of children in the household), which were used to obtain information about the occurrence of the major life events under investigation in this study. In addition, participants reported their loneliness once every year. There were always two opportunities to fill out the survey: one primary opportunity and then a redo a few months later. In 2008, the primary opportunity was in February, and the redo was in May. From 2009 until 2014, the primary opportunity was in February and the redo was in March. From 2015 until 2017, the loneliness measure switched to October for the primary opportunity and to November for the redo. To take the shifting of data collection time into account, we modeled time on a continuous scale. We had to exclude the 2012 data, as a different response format for the loneliness scale was used in the LISS panel in 2012.³ We cannot exactly determine how participants interpreted this other response format.

Measures

Loneliness was measured annually with the six-item De Jong Gierveld Loneliness Scale (De Jong Gierveld & van Tilburg, 2006). Participants responded on a 3-point scale (1 = *yes*, 2 = *more or less*, 3 = *no*). Scale scores were processed in two steps (De Jong Gierveld & van Tilburg, 2010). First, each item was converted into a dichotomous format, with 0 indicating no loneliness (e.g., “no”) and 1 indicating at least some loneliness (e.g., “yes” or “more or less”). Second, all items were summed to an overall loneliness score where higher scores reflect higher levels of loneliness. Cronbach’s alphas in the current sample were above .75 across all waves.

Major life events were derived from monthly surveys including questions about various topics such as participants’ primary occupation, marital status, and the number of living-at-home children in the household. A status change from one measurement occasion to the other indicated the occurrence of a major life event. For example, the event “transition into parenthood” was coded if an increase in the number of children living in a household occurred and if the year of birth of this additional child was the same as the year of data collection (to ensure that it is a newly born child and not an older child that moved back in). The event “reemployment after unemployment” was coded if a change from the status of unemployment to the status paid employment occurred.

Demographic variables such as age, sex, education level, and monthly income were assessed. Education level was measured with the following response categories: primary school, intermediate secondary education, higher secondary education, intermediate vocational education, higher vocational education, university, other, not (yet) completed any education. Sex was coded with the following response categories: 0 = male, 1 = female.

Personality traits were measured with the 50-item version of the IPIP Big-Five Inventory (Goldberg, 1992). The following response categories were used: 1 = *very inaccurate*, 2 = *moderately inaccurate*, 3 = *neither inaccurate nor accurate*, 4 = *moderately accurate*, 5 = *very accurate*. Cronbach’s alpha for extraversion was .87, for agreeableness .81, for conscientiousness .78, for emotional stability .88, and for openness .76.

Social contact frequency was measured with three independent items asking how often one spends an evening with family members outside the household, neighbors, or friends outside the neighborhood. The following response categories were used for the three single items: 1 = *almost every day*, 2 = *once or twice a week*, 3 = *a few times per month*, 4 = *about once a month*, 5 = *a number of times per year*, 6 = *about once a year*, 7 = *never*. Both personality traits and social contact frequency were only used in the propensity score matching as matching variables.

Statistical Analyses

We followed our preregistered two-step analysis plan (<https://osf.io/by4de>). For methodological and theoretical reasons, we deviated from our preregistration in some points. A comprehensive summary of all deviations as well as further materials can be found at <https://osf.io/kh7xr/>. As preregistered, we first modeled the average trajectory of loneliness using generalized additive models (GAMM; Wood, 2006, 2011) using the *gam* function in the R package *mgcv* Version 1.8–26 (Wood, 2017). These analyses are reported in the [online supplemental materials](#) as requested during the review process of this article. Second, we used mixed-effect models with measurement occasions nested within individuals to estimate the changes in loneliness surrounding the 10 different major life events. We conducted all multilevel analyses in R using the *lme4* package Version 1.1–21 (Bates, Maechler, Bolker, & Walker, 2015) and using the *lmerTest* package Version 3.0–1 for significance tests of fixed effects (Kuznetsova, Brockhoff, & Christensen, 2017). The R code is provided at <https://osf.io/9drqa/>.

Time-Variant Predictors of Loneliness on Level 1

We included six event-related time variables were included as predictors of loneliness to model within-person changes in loneliness. These event-related time variables were used as predictors of loneliness in the mixed-effect models. The coding of these variables was adapted from Denissen et al. (2019) and extended.

1. The linear anticipation variable (preLin) was a linear variable indicating the time ahead of the event in years. This variable was coded with negative values on all occasions prior to the event (e.g., –1 if the loneliness measurement took place one year prior to the event, –2 if the loneliness measurement took place two years prior to the event, etc.) and with 0 on all occasions after the event. This variable indicated the rate of linear increase or decrease in loneliness leading up to the event, over and above all other covariates in the model.

³ Instead of using the original response format of the De Jong Gierveld Loneliness Scale, the three possible response categories in this year were *yes*, *no*, *don't know/don't want to say*.

2. The quadratic anticipation variable ($\text{preLin.sq} = \text{preLin} * \text{preLin}$) indicated the rate of quadratic increase or decrease in loneliness leading up to the event, over and above all other covariates in the model.
3. The linear reaction variable (postLin) was a linear variable indicating the time after the event in years. This variable was coded with positive values on all measurement occasions after the event (e.g., +1 if the loneliness measurement took place one year after the event, +2 if the loneliness measurement took place two years after the event, etc.) and with 0 at the event and on all occasions prior to the event. This variable indicated the rate of linear change in loneliness in reaction to the event, over and above all other covariates in the model.
4. The quadratic reaction variable ($\text{postLin.sq} = \text{postLin} * \text{postLin}$) indicated the rate of quadratic increase or decrease in loneliness following the event, over and above all other covariates in the model.
5. The postevent baseline change variable (postD) was a dummy variable coded with 1 for any loneliness assessment that took place after the event and with 0 for all assessments prior to the event. This variable indicated an immediate and lasting baseline shift in loneliness after the event.
6. The event-year variable (firstYear) was a dummy variable coded with 1 for any loneliness assessment that took place within one year after the event and with 0 for all other assessment points. A significant coefficient of this variable indicates immediate and short-term changes in loneliness during the first year that were not predicted by the other postevent time variables (i.e., postLin , postD).

For control-group participants, we created the time coefficients “as-if” that person had also experienced the event, centered around the time at which their matched event-group partner experienced the event. This approach allowed us to model loneliness trajectories for the control group with the same parameters as for the event group. This was necessary to ensure that we could in principle model the same trajectories for the control group as for the event group. Furthermore, this approach allowed us to directly test whether the loneliness trajectory observed in a particular time frame (e.g., after the event) differed between the event group and the control group by modeling interactions between the group variable and the respective time variable (see below for details).⁴

The intercept reflected the predicted loneliness level for a person of average age and male sex who never experienced the event either before or during the survey (control group) at the time at which the event-group participant experienced the event. We further included a variable indicating testing effects (Baird, Lucas, & Donnellan, 2010; Choquette & Hesselbrock, 1987): Linear changes in loneliness scores that can be explained by the repeated measurement of loneliness using the same questionnaire. This variable was coded with 0 for the first assessment, 1 for the second

assessment, 2 for the third assessment, and so on (for a similar procedure see Denissen et al., 2019).

Time-Invariant Predictors of Loneliness on Level 2

We included sex, age at the event (centered on the average age at the event), and age at the event² as time-invariant covariates. Individuals who experienced a major life event may have certain characteristics before, during, or after the event that distinguish them from others that do not experience the event. To account for these effects, we included a dummy-coded group variable in all linear mixed-effects models that was coded with 1 for the event group and with 0 for the propensity-score matched control group.

Modeling Strategy

Estimation of loneliness trajectories. We used the following modeling strategy separately for each major life event: Model A included the two linear time variables (preLin and postLin), the postevent baseline change variable (postD), the event-year variable (firstYear), the demographic covariates (age at the event; age at the event²; sex, with 0 = male and 1 = female), a variable accounting for testing effects (testing), and a variable indicating whether it is an event or control group participant (group , with 0 = control group and 1 = event group). Moreover, we included two-way interaction terms between the group and the time variables to test whether the loneliness trajectories differ among participants who did or did not experience the event during the survey. In Model B, we added the two nonlinear time variables (preLin.sq and postLin.sq) and the two-way interaction between the group and these nonlinear time variables. In a next step, we then determined which model fit the data best by comparing the models using a χ^2 deviance test (with a significant test indicating that Model B fit significantly better than Model A) and the goodness-of-fit indices Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC, with lower values indicating better fit). The primary element of interest in these models were the interactions between the time variables and the group variable as they indicate differences in the average loneliness trajectories between those who experienced the event during the survey (event group) and those who did not experience the event either before or during the survey (control group). Because we matched the event and the control group on a broad set of background characteristics, differences in the average loneliness trajectories surrounding the event (as indicated by the time coefficients) are likely attributable to the major life event occurrence in the event group.

It may seem odd to assume that the control group could also change in loneliness before or after a specific time point at which the matched event group member experienced the event, although the control group members themselves did not experience the event. However, allowing the control group to also change in loneliness over time and comparing these changes with changes in the event group is necessary if one is interested in change that is actually attributable to the event occurrence. Changes that occur in

⁴ The creation of time coefficients for the control group members “as-if” they had also experienced the event, centered around the time at which their matched event-group partner experienced the event, was a result of the review process of this article.

both the event and the control group could represent age-normative changes in loneliness, independent of a major life event. Moreover, changes in loneliness that occur in both groups may represent that a “social clock” ticks similarly in both groups because of the similar propensity to experience a certain event. However, there may also be other reasons for this increase. Thus, to separate the causal effects of the major life event on changes in loneliness from the other effects described above, a propensity-score matched control group is essential.

In the above models, Level 1 effects were first modeled as fixed, meaning no individual differences in trajectories between people (random intercept models). To test whether anticipation and reaction effects differed between individuals, we tested whether modeling random effects significantly improved the model fit (random slopes models). Because it was computationally impossible to model all random effects simultaneously, we added one random effect for one Level 1 predictor at a time and compared this model to the model without any random effect using a χ^2 deviance test (for a similar procedure see Denissen et al., 2019). In the cases in which the random slope models failed to converge, random intercept models were reported. A general model equation for the estimated models is provided in the online supplemental materials.

Estimation of age-normative effects. For the examination of age-normative effects, the primary element of interest was the change in loneliness of participants who experienced a major life event. Therefore, only the event group participants were included in these analyses. To estimate age-normative effects, we added two-way interaction terms of age at the event and age at the event² with preLin and postLin to the mixed-effect models. Significant

two-way interactions with age at the event and/or age at the event² and one or both linear time variables indicate the occurrence of age-normative effects of a certain major life event.

Results

For all major life events, means and standard deviations of loneliness for each year of assessment are presented separately for the event and the control group in the online supplemental materials (Tables S1–S10).

Cohabitation

For cohabitation, the best model fit was achieved with Model A, which did not include any quadratic time predictors. The model-estimated average loneliness trajectories for the event group and the control group surrounding cohabitation are visualized in Figure 1A. The event group and the propensity-score matched control group did not differ significantly in average loneliness at the time of the event (Table 2, b_3), controlling for the testing effect. Moreover, both groups did not significantly differ in their average trajectories before or after the time point at which the event-group participants experienced cohabitation, as indicated by the nonsignificant interactions between the time variables and the dummy-coded group variable (Table 2, b_{12-17}). Before the event, there was no significant linear change in loneliness (Table 2, b_6); however, in both the event and the control group, we found a significant linear increase in loneliness after the time point at which the event-group participants experienced cohabitation (Table 2, b_8). Moreover,

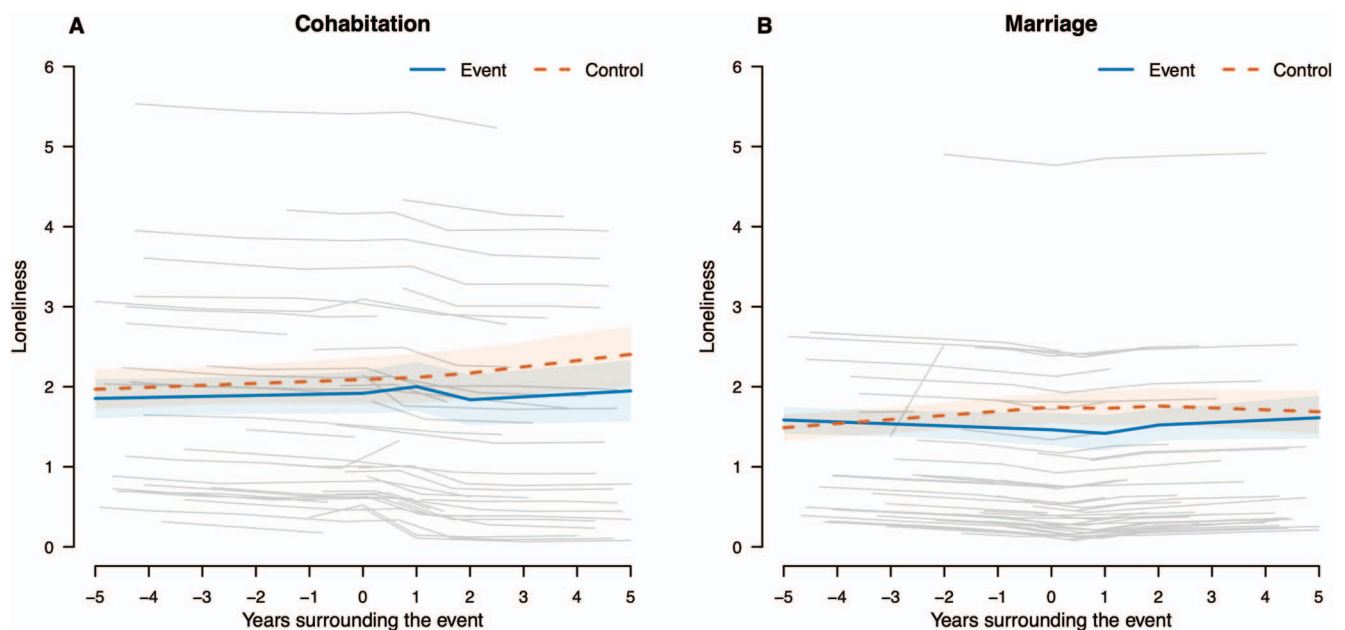


Figure 1. Model-estimated average and individual-level loneliness trajectory for the event group surrounding cohabitation (A) and marriage (B). Blue (solid bold) lines represent the model-estimated average trajectory for the event group, red (dashed bold) lines represent the model-estimated average trajectory for the control group, gray (solid thin) lines represent individual-level trajectories for 50 randomly selected sample participants from the event group. Shaded areas (light blue and light red) around the bold lines represent bootstrapped 95% confidence bands of the average trajectories. See the online article for the color version of this figure.

Table 2
Changes in Loneliness in the Context of Family-Related Life Events

Variable	Cohabitation		Marriage		Transition into parenthood		Marital separation		Divorce		Widowhood	
	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI
Intercept (<i>b</i> ₀)	2.090*	[1.809, 2.371]	1.744*	[1.547, 1.941]	1.573*	[1.392, 1.754]	2.226*	[1.706, 2.745]	1.859*	[1.448, 2.269]	1.760*	[1.364, 2.156]
Testing (<i>b</i> ₁)	-0.059*	[-0.108, -0.010]	-0.014	[-0.047, 0.020]	-0.035	[-0.075, 0.005]	-0.099*	[-0.180, -0.019]	-0.017	[-0.079, 0.045]	0.007	[-0.058, 0.073]
Female sex (<i>b</i> ₂)	-0.346*	[-0.590, -0.101]	-0.229*	[-0.384, -0.074]	0.038	[-0.110, 0.185]	-0.174	[-0.554, 0.206]	-0.242	[-0.539, 0.056]	-0.025	[-0.352, 0.299]
Group (<i>b</i> ₃)	-0.173	[-0.461, 0.115]	-0.282*	[-0.478, -0.085]	-0.315*	[-0.528, -0.102]	0.368	[-0.098, 0.833]	0.609*	[0.178, 1.040]	0.052	[-0.319, 0.421]
Age at the event (<i>b</i> ₄)	0.013*	[0.003, 0.022]	0.007	[-0.001, 0.014]	0.010	[-0.001, 0.021]	0.013	[-0.001, 0.027]	-0.002	[-0.013, 0.010]	-0.005	[-0.023, 0.013]
Age at the event ² (<i>b</i> ₅)	<-0.001	[-0.001, <0.001]	<0.001	[-0.001, 0.001]	<0.001	[-0.001, <0.001]	<0.001	[-0.001, 0.001]	<0.001	[-0.001, 0.001]	-0.001	[-0.002, <0.001]
Linear anticipation (<i>b</i> ₆)	0.024#	[-0.022, 0.071]	0.051*	[0.019, 0.084]	0.042	[-0.001, 0.085]	0.056#	[-0.021, 0.132]	-0.149*	[-0.285, -0.013]	0.012	[-0.048, 0.071]
Quadratic anticipation (<i>b</i> ₇)												
Linear reaction (<i>b</i> ₈)	0.078*	[0.023, 0.133]	-0.024#	[-0.065, 0.018]	0.069##	[0.030, 0.109]	0.085#	[-0.006, 0.176]	<0.001	[-0.210, 0.211]	-0.057	[-0.135, 0.021]
Quadratic reaction (<i>b</i> ₉)												
Postevent baseline change (<i>b</i> ₁₀)	-0.075	[-0.307, 0.157]	0.063#	[-0.098, 0.223]	-0.138#	[-0.293, 0.118]	-0.343#	[-0.688, 0.004]	0.004	[-0.019, 0.026]	0.118#	[-0.155, 0.391]
Event year (<i>b</i> ₁₁)	0.023	[-0.213, 0.259]	-0.054	[-0.218, 0.109]	0.150	[-0.008, 0.308]	0.084	[-0.263, 0.430]	0.137	[-0.220, 0.495]	-0.126	[-0.412, 0.161]
Linear Anticipation × Group (<i>b</i> ₁₂)	-0.012	[-0.061, 0.038]	-0.076*	[-0.112, -0.040]	-0.045	[-0.099, 0.009]	0.095*	[0.019, 0.170]	0.337*	[0.150, 0.525]	-0.027	[-0.080, 0.025]
Quadratic Anticipation × Group (<i>b</i> ₁₃)									0.035*	[0.014, 0.057]		
Linear Reaction × Group (<i>b</i> ₁₄)	-0.041	[-0.103, 0.021]	0.054*	[0.007, 0.102]	-0.013	[-0.053, 0.027]	-0.132*	[-0.230, -0.034]	-0.167	[-0.459, 0.125]	-0.020	[-0.109, 0.069]
Quadratic Reaction × Group (<i>b</i> ₁₅)									0.011	[-0.021, 0.042]		
Postevent Baseline Change × Group (<i>b</i> ₁₆)	-0.078	[-0.408, 0.252]	-0.064	[-0.291, 0.162]	0.255*	[0.035, 0.475]	0.663*	[0.170, 1.157]	0.354	[-0.259, 0.967]	0.442*	[0.056, 0.828]
Event Year × Group (<i>b</i> ₁₇)	0.178	[-0.161, 0.516]	-0.020	[-0.250, 0.210]	-0.344*	[-0.566, -0.123]	-0.163	[-0.656, 0.328]	-0.183	[-0.689, 0.322]	0.383	[-0.019, 0.784]

Note. Statistically significant fixed effects ($p < .05$) are flagged with an asterisk (*). Significant random effects are flagged with a hashtag (#). Regression coefficients are numbered (b_0 - b_{17}) to refer to them within the text more easily. Sex: 0 = male and 1 = female; group: 0 = control group and 1 = event group.

there was no significant postevent baseline change (Table 2, b_{10}) and no significant immediate change in loneliness after cohabitation (Table 2, b_{11}) over and above the linear reaction and the postevent baseline change effects. Beyond the loneliness changes reflected in the time variables, we also found significant testing effects in this sample, indicating that loneliness levels decreased from measurement occasion to measurement occasion (Table 2, b_1).

People who were older than average at the event reported higher average loneliness than people who were younger than average (Table 2, b_4). Age-normative effects were examined in a separate analysis using only the event group. Among those who experienced cohabitation during the survey, there were no significant age-normative effects, as indicated by the nonsignificant interactions between the linear time variables and both age at the event and age at the event² (see Table 3).

Overall, starting cohabitation does not appear to be associated with any substantial changes in loneliness, as the effects did not significantly differ between the event and the control group.

Marriage

For marriage, the best model fit was achieved with Model A, which did not include any quadratic time predictors. The model-estimated average loneliness trajectories for the event group and the control group surrounding marriage are visualized in Figure 1B. Individuals in the event group reported lower average loneliness scores than individuals in the propensity-score matched control group at the time of the event (Table 2, b_3), controlling for the testing effect. Moreover, we found significant differences in the loneliness trajectories between the event and the control group. Among those who got married during the survey, loneliness increased less strongly or even decreased prior to the event compared with the control group, as indicated by the significant interaction between the linear anticipation variable and the group variable (Table 2, b_{12}). In the control group, however, we found a significant linear increase in loneliness during this period (Table 2, b_6), as indicated by the significant conditional main effect of the linear anticipation variable (preLin). After the event, loneliness gradually decreased less strongly or even increased among those who got married during the survey compared with the control group (Table 2, b_{14}).

Age-normative effects were examined in a separate analysis using only the event group (see Figure 2). There was a significant positive interaction between age at the event occurrence and the linear anticipation effect as well as between age at the event² and the linear anticipation effect, indicating that being older than average when getting married was associated with a less strong decrease in loneliness prior to the event, whereas being younger than average when getting married was associated with a stronger decrease in loneliness prior to the event, compared with those who married at an average (normative) age (Table 3, b_9). This effect was more pronounced the greater the gap between the age at the event and the average age (Table 3, b_{10}). Moreover, there was a significant negative interaction between age at the event and the linear reaction effect, indicating that being older than average when getting married was associated with a less strong increase or even a decrease in loneliness after the event, whereas being younger than average when getting married was associated with a

Table 3
Age-Normative Effects of Family-Related Major Life Events for Event-Group Participants

Variable	Cohabitation		Marriage		Transition into parenthood		Marital separation		Divorce		Widowhood	
	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI
Intercept (<i>b</i> ₀)	1.916*	[1.579, 2.253]	1.511*	[1.277, 1.744]	1.166*	[0.952, 1.381]	2.571*	[1.928, 3.214]	2.552*	[2.062, 3.043]	1.584*	[1.030, 2.138]
Testing (<i>b</i> ₁)	-0.057	[-0.125, 0.010]	-0.012	[-0.058, 0.034]	-0.039	[-0.095, 0.018]	-0.045	[-0.165, 0.075]	-0.028	[-0.117, 0.061]	0.063	[-0.032, 0.159]
Female sex (<i>b</i> ₂)	-2.209	[-0.554, 1.136]	-0.161	[-0.372, 0.048]	0.140	[-0.060, 0.339]	-0.097	[-0.657, 0.462]	-0.451*	[-0.869, -0.034]	0.066	[-0.423, 0.554]
Age at the event (<i>b</i> ₃)	0.015*	[0.001, 0.028]	0.020*	[0.007, 0.033]	0.025*	[0.001, 0.050]	0.029*	[0.001, 0.057]	0.013	[-0.007, 0.033]	-0.009	[-0.036, 0.018]
Age at the event ² (<i>b</i> ₄)	<-0.001	[-0.001, <0.001]	<-0.001	[-0.001, <0.001]	0.002*	[0.001, 0.004]	-0.001	[-0.002, 0.001]	<-0.001	[-0.001, 0.001]	-0.001	[-0.002, 0.001]
Linear anticipation (<i>b</i> ₅)	0.032	[-0.030, 0.094]	<-0.001	[-0.042, 0.042]	-0.003	[-0.065, 0.060]	0.169*	[0.063, 0.275]	0.115*	[0.037, 0.193]	-0.060	[-0.143, 0.022]
Linear reaction (<i>b</i> ₆)	0.038	[-0.032, 0.107]	0.020	[-0.030, 0.070]	0.071*	[0.020, 0.122]	-0.103	[-0.225, 0.019]	-0.047	[-0.138, 0.044]	-0.119*	[-0.222, -0.016]
Postevent baseline change (<i>b</i> ₇)	-0.152	[-0.388, 0.084]	0.002	[-0.158, 0.161]	0.115	[-0.042, 0.272]	0.344	[-0.017, 0.707]	0.151	[-0.130, 0.431]	0.514*	[0.217, 0.811]
Event year (<i>b</i> ₈)	0.200	[-0.044, 0.442]	-0.068	[-0.229, 0.093]	-0.195*	[-0.350, -0.040]	-0.065	[-0.424, 0.292]	0.115	[-0.171, 0.402]	0.274	[-0.027, 0.575]
Linear Anticipation × Age at the Event (<i>b</i> ₉)	<-0.001	[-0.003, 0.002]	0.002*	[<0.001, 0.005]	-0.003	[-0.009, 0.004]	<0.001	[-0.005, 0.005]	<-0.001	[-0.004, 0.004]	-0.002	[-0.005, 0.002]
Linear Anticipation × Age at the Event ² (<i>b</i> ₁₀)	<-0.001	[-0.001, <0.001]	<-0.001*	[-0.001, <0.001]	<-0.001	[-0.001, <0.001]	<-0.001*	[-0.001, <0.001]	<-0.001*	[-0.001, <0.001]	<0.001	[-0.001, <0.001]
Linear Reaction × Age at the Event (<i>b</i> ₁₁)	<0.001	[-0.003, 0.003]	-0.006*	[-0.009, -0.004]	0.002	[-0.002, 0.006]	-0.003	[-0.007, 0.002]	-0.003*	[-0.007, <0.001]	0.004	[-0.002, 0.010]
Linear Reaction × Age at the Event ² (<i>b</i> ₁₂)	<-0.001	[-0.001, <0.001]	<-0.001	[-0.001, <0.001]	<-0.001	[-0.001, <0.001]	<-0.001	[-0.001, <0.001]	<-0.001	[-0.001, <0.001]	<-0.001	[-0.001, <0.001]

Note. Statistically significant fixed effects ($p < .05$) are flagged with an asterisk (*). Regression coefficients are numbered (b_0 - b_{13}) to refer to them within the text more easily. Sex: 0 = male and 1 = female; group: 0 = control group and 1 = event group.

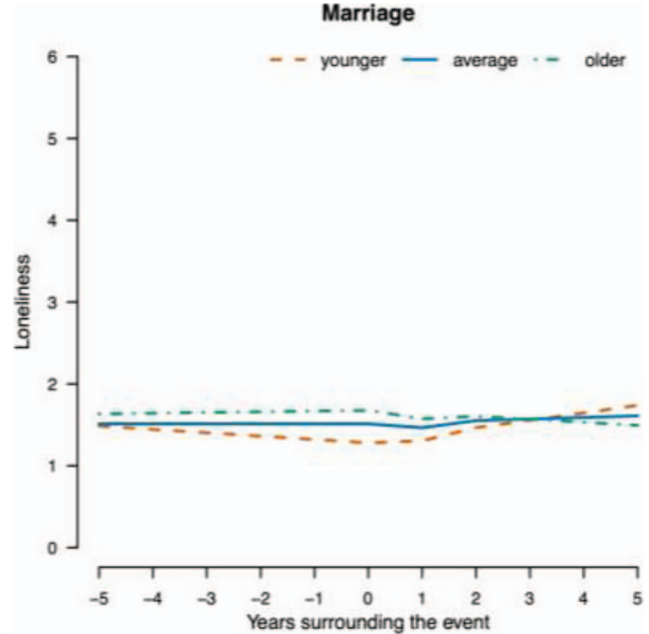


Figure 2. Predicted values of loneliness surrounding marriage for individuals 10 years younger than average at the event occurrence, for individuals of average age at the event occurrence, and for individuals 10 years older than average at the event occurrence. See the online article for the color version of this figure.

stronger increase in loneliness after the event, compared with those who married at an average age (Table 3, b_{11}).

Overall, getting married was associated with weaker increases or even decreases in loneliness before marriage and weaker decreases or even increases after marriage, compared with those who did not get married. Moreover, our results show that the loneliness trajectories surrounding marriage differ depending on whether the event was experienced at an average age or younger or older than average.

Transition Into Parenthood

For transition into parenthood, the best model fit was achieved with Model A, which did not include any quadratic time predictors. The estimated average loneliness trajectories for the event group and the control group surrounding transition into parenthood are visualized in Figure 3A. Individuals who reported having their first child during the survey reported significantly lower levels of loneliness than the propensity-score matched control group at the time of the event (Table 2, b_3), controlling for testing effects. Moreover, we found significant differences in the loneliness trajectories between the event and the control group. Among those who transitioned into parenthood during the survey, loneliness showed an immediate and lasting increase after the event compared with the control group (Table 2, b_{16}). However, during the first year after transiting into parenthood, loneliness was lower in the event group compared with the control group (Table 2, b_{17}), beyond the linear reaction and the postevent baseline change effect—in effect temporarily canceling out the longer-term increase. Both in the event and the control group, we found a

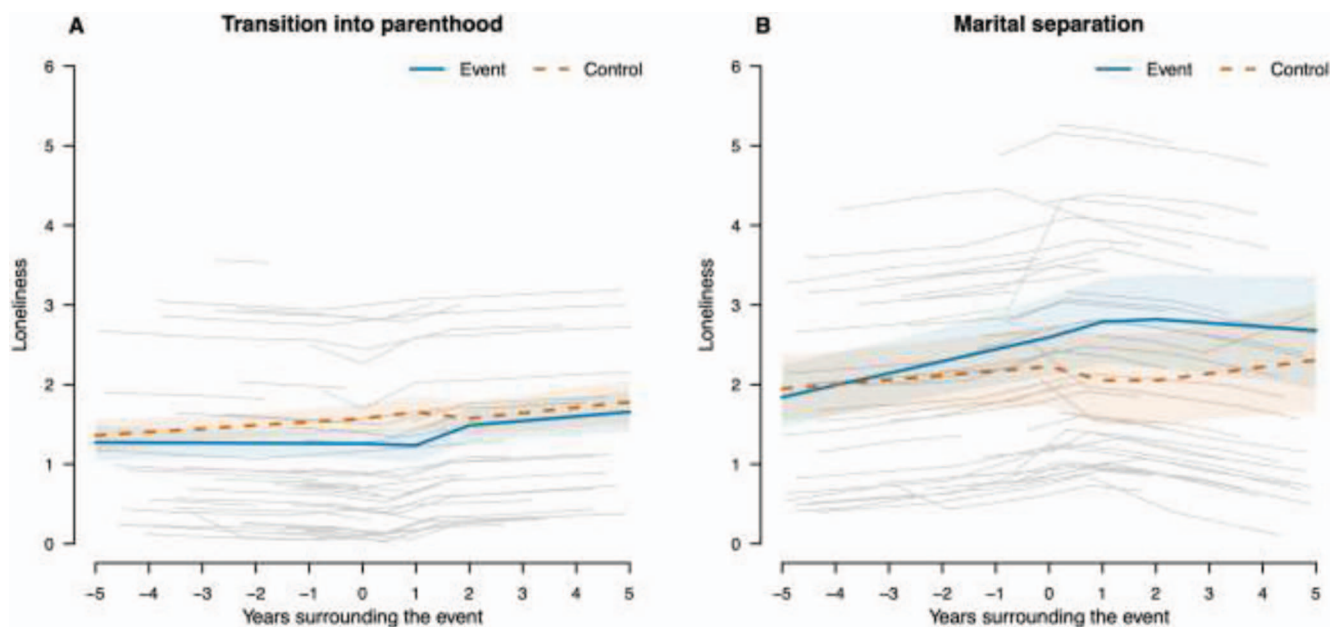


Figure 3. Model-estimated average and individual-level loneliness trajectory surrounding transition into parenthood (A) and marital separation (B). Blue (solid bold) lines represent the model-estimated average trajectory for the event group, red (dashed bold) lines represent the model-estimated average trajectory for the control group, gray (solid thin) lines represent individual-level trajectories for 50 randomly selected sample participants from the event group. Shaded areas (light blue and light red) around the bold lines represent bootstrapped 95% confidence bands of the average trajectories. See the online article for the color version of this figure.

significant linear increase in loneliness after the time point at which the event-group participants experienced the transition into parenthood (Table 2, b_8), and there were no significant group differences for this gradual change after the transition into paid employment (Table 2, b_{14}).

We did not find any significant testing effects in this sample (Table 2, b_1). Age-normative effects were examined in a separate analysis using only the event group. For transition into parenthood, no such age-normative effects were found (see Table 3).

Overall, becoming a parent was associated with a longer-lasting increase in loneliness after the event that started not immediately after the event, but delayed, as loneliness levels were lower in the first year after childbirth.

Marital Separation

For marital separation, the best model fit was achieved with Model A, which did not include any quadratic time predictors. The model-estimated average loneliness trajectories for the event group and the control group surrounding marital separation are visualized in Figure 3B. The event group and the propensity-score matched control group did not differ significantly in average loneliness at the time of the marital separation (Table 2, b_3), controlling for testing effects. However, both groups differed significantly in the average loneliness trajectories surrounding the marital separation. In anticipation of the marital separation, loneliness increased more strongly among individuals who separated during the survey compared with the propensity-score matched control group (Table 2, b_{12}). Moreover, among those who separated during the survey,

loneliness showed an immediate and lasting increase after the event (Table 2, b_{16}), followed by a gradual decrease (Table 2, b_{14}). Beyond the loneliness changes reflected in the time variables, we also found testing effects in this sample, indicating that loneliness levels decreased linearly from measurement occasion to measurement occasion (Table 2, b_1).

Age-normative effects were examined in a separate analysis using only the event group (see Figure 4). Among those who experienced the marital separation younger or older than average, loneliness increased less strongly in anticipation of the event than among those who experienced the marital separation at an average age (Table 3, b_{11}).

Overall, marital separation was associated with a gradual loneliness increase in anticipation of the event, and a longer-lasting postevent increase followed by a gradual loneliness decrease in reaction to the event. Moreover, our results indicated that the loneliness trajectories in anticipation of marital separation differ depending on whether the event was experienced at an average age or younger or older than average.

Divorce

For divorce, the best model fit was achieved with Model B, which included linear and quadratic time predictors. The model-estimated average loneliness trajectories for the event group and the control group surrounding divorce are visualized in Figure 5A. Individuals who experienced divorce during the survey reported significantly higher average loneliness at the time of the event than individuals in the propensity-score matched control group (Table

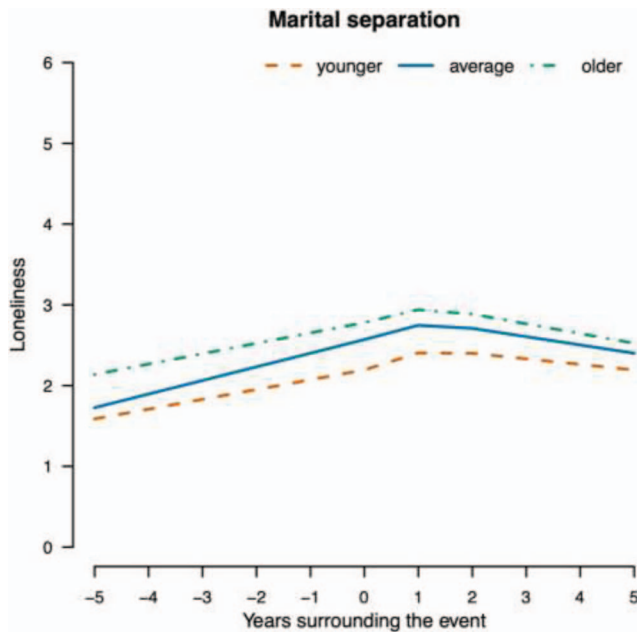


Figure 4. Predicted values of loneliness surrounding marital separation for individuals 10 years younger than average at the event occurrence, on average age at the event occurrence, and 10 years older than average at the event occurrence. See the online article for the color version of this figure.

2, b_3), controlling for testing effects. Moreover, we found significant differences in the average loneliness trajectories between the event and the control group. Before the divorce, loneliness gradually increased more strongly among those who experienced the event during the survey compared with those who did not (Table 2, b_{12}). In the control group, loneliness gradually decreased before the time point at which the event-group participants experienced divorce (Table 2, b_6) with a stronger decrease closer to the event occurrence (Table 2, b_7), which is indicated by the significant conditional main effects of the linear anticipation (preLin) and the quadratic anticipation (preLin.sq) variables. No significant differences between the event and the control group after the event were found.

Age-normative effects were examined in a separate analysis using only the event group (see Figure 6). Among those who experienced divorce younger or older than average, loneliness increased less strongly before the event compared with those who experienced the event at an average age (Table 3; b_{11}). Among those who experienced divorce older than average, loneliness decreased more strongly after the event compared with those who experienced the event at an average age (Table 3; b_{12}).

Overall, divorce was associated with a gradual loneliness increase prior to the event that was stronger closer to the event occurrence, as indicated by a quadratic effect. On average, no substantial changes in loneliness in reaction to divorce were found. However, our results indicated that the loneliness trajectories surrounding divorce differ depending on whether the event was experienced at an average age or younger or older than average.

Widowhood

For widowhood, the best model fit was achieved with Model A, which did not include any quadratic time predictors. The model-estimated average loneliness trajectories for the event group and the control group surrounding widowhood are visualized in Figure 5B. The event group and the propensity-score matched control group did not significantly differ in average loneliness at the time of the event (Table 2, b_3), controlling for testing effects. However, we found significant group differences in the average loneliness trajectories after the event. Among those who experienced widowhood during the survey, a stronger long-lasting increase in loneliness was found compared with those who did not experience widowhood (Table 2, b_{16}). Both in the event and control group, we did not find any significant change in loneliness prior to the time point at which the event-group participants experienced widowhood (Table 2, b_6). Testing effects were also not significant in this sample (Table 2, b_1).

Age-normative effects were examined in a separate analysis using only the event group. Among those who experienced widowhood during the survey, there were no significant age-normative effects, as indicated by the nonsignificant interactions between the linear time variables and both age at the event and age at the event² (see Table 3).

Overall, widowhood appears to be associated with a long-lasting postevent increase in loneliness.

Transition Into Paid Employment

For transition into paid employment, the best model fit was achieved with Model A, which did not include any quadratic time predictors. The model-estimated average loneliness trajectories for the event group and the control group surrounding transition into paid employment are visualized in Figure 7A. The event group and the propensity-score matched control group did not differ significantly in average loneliness at the time of the event (Table 4, b_3) nor in their average trajectories before or after the event, as indicated by the nonsignificant interactions between the time variables and the dummy-coded group variable (Table 4, b_{12-17}). We found significant testing effects in this sample, indicating that loneliness levels decreased linearly from measurement occasion to measurement occasion (Table 4, b_1).

Those who were younger or older than average at the time of the event reported lower average loneliness (Table 4, b_5). Age-normative effects were examined in a separate analysis using only the event group (see Figure 8). Among those who experienced the event older than average, loneliness increased less strongly after the event (Table 5, b_{11}). This effect was even more pronounced when individuals deviated more from the normative age of the event (Table 5, b_{12}).

Overall, starting paid employment does—on average—not appear to be associated with any substantial changes in loneliness. However, our results indicated that the loneliness trajectories after the transition into paid employment differ depending on whether the event was experienced at an average age or younger or older than average.

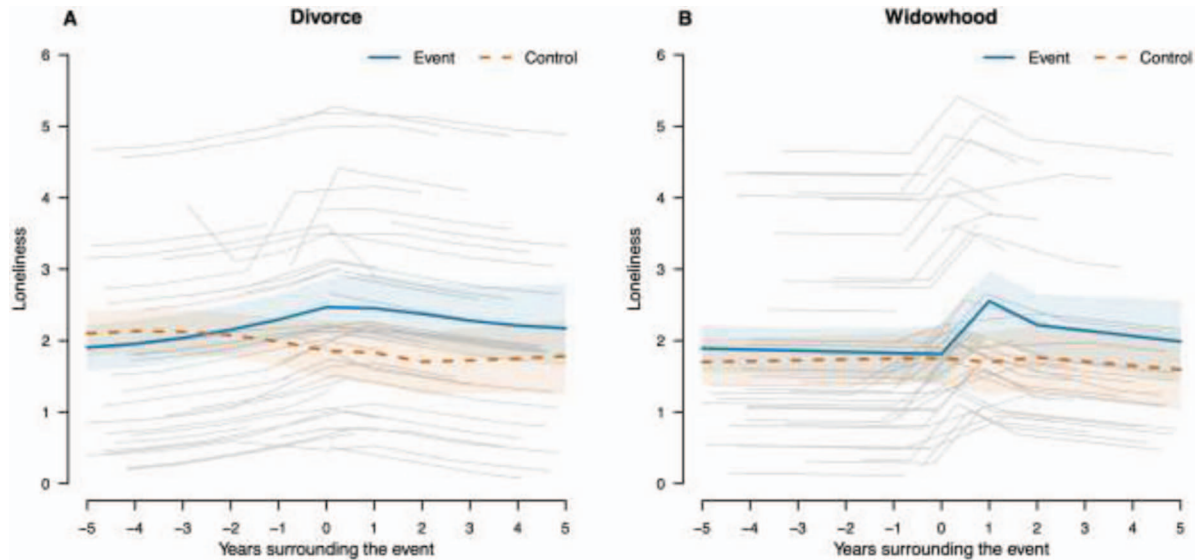


Figure 5. Model-estimated average and individual-level loneliness trajectory surrounding divorce (A) and widowhood (B). Blue (solid bold) lines represent the model-estimated average trajectory for the event group, red (dashed bold) lines represent the model-estimated average trajectory for the control group, gray (solid thin) lines represent individual-level trajectories for 50 randomly selected sample participants from the event group. Shaded areas (light blue and light red) around the bold lines represent bootstrapped 95% confidence bands of the average trajectories. See the online article for the color version of this figure.

Reemployment After Unemployment

For reemployment after unemployment, the best model fit was achieved with Model A, which did not include any quadratic time predictors. The model-estimated average loneliness trajectories for the event group and the control group surrounding reemployment

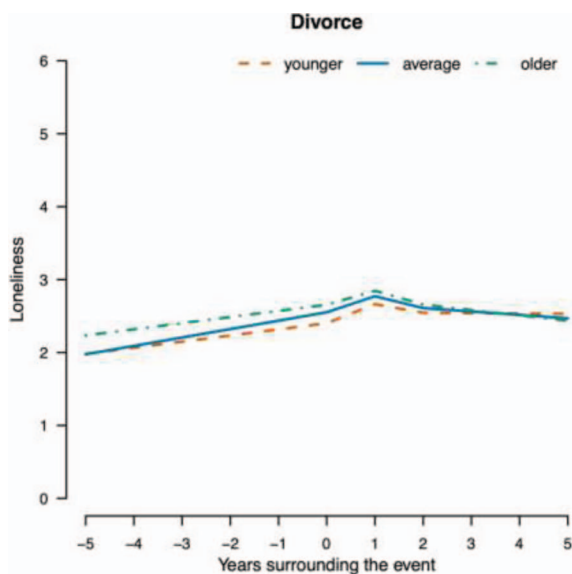


Figure 6. Predicted values of loneliness surrounding divorce for individuals 10 years younger than average at the event occurrence, for individuals of average age at event occurrence, and for individuals 10 years older than average at an event occurrence. See the online article for the color version of this figure.

after unemployment are visualized in [Figure 7B](#). The event group and the propensity-score matched control group did not differ significantly in average loneliness at the time of the event ([Table 4, \$b_3\$](#)) nor in their average trajectories before or after the event, as indicated by the nonsignificant interactions between the time variables and the dummy-coded group variable ([Table 4, \$b_{12-17}\$](#)). Beyond the (lack of) loneliness changes reflected in the time variables, we also found no testing effects in this sample, indicating that loneliness levels did not change from measurement occasion to measurement occasion ([Table 4, \$b_1\$](#)). Individuals who were younger or older than average at the event occurrence were on average lonelier than individuals at average age ([Table 4, \$b_5\$](#)).

Age-normative effects were examined in a separate analysis using only the event group (see [Figure 9](#)). Among those who experienced the event older than average, loneliness increased less strongly after the event ([Table 5, \$b_{11}\$](#)). This effect was more pronounced the greater the gap between the age at the event and the average age ([Table 5, \$b_{12}\$](#)).

Overall, starting employment after previous unemployment did not appear to be associated with any substantial changes in loneliness. However, our results indicated that the loneliness trajectories after reemployment after unemployment differ depending on whether the event was experienced at an average age or younger or older than average.

Job Loss

For job loss, the best model fit was achieved with Model B, which included the linear and quadratic time predictors. The model-estimated average loneliness trajectories for the event group and the control group surrounding job loss are visualized in [Figure 10A](#). Individuals who experienced job loss during the survey

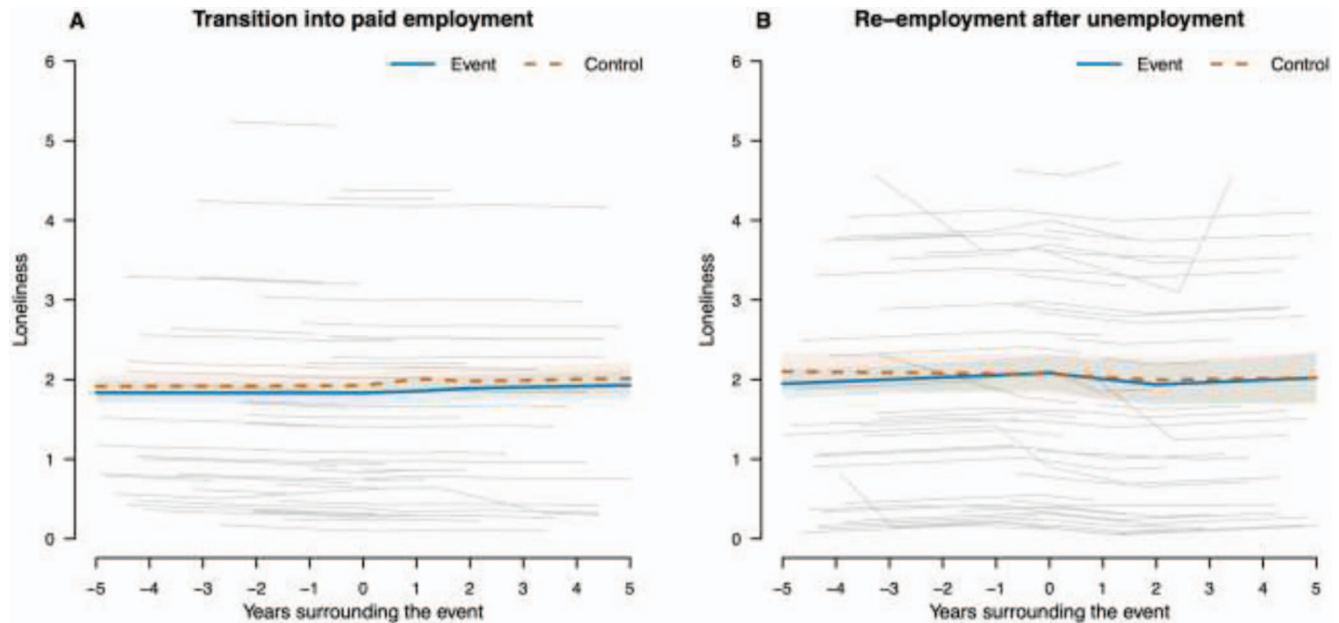


Figure 7. Model-estimated average and individual-level loneliness trajectory surrounding transition into paid employment (A) and reemployment after unemployment (B). Blue (solid bold) lines represent the model-estimated average trajectory for the event group, red (dashed bold) lines represent the model-estimated average trajectory for the control group, gray (solid thin) lines represent individual-level trajectories for 50 randomly selected sample participants from the event group. Shaded areas (light blue and light red) around the bold lines represent bootstrapped 95% confidence bands of the average trajectories. See the online article for the color version of this figure.

reported significantly higher loneliness than individuals in the propensity-score matched control sample who were never unemployed (Table 4, b_3), controlling for testing effects. Moreover, we found differences in the average loneliness trajectories surrounding job loss between the event and the control group. Among those who experienced job loss during the survey, loneliness showed a stronger longer-lasting postevent increase (Table 4, b_{16}) which was followed by a—compared with the control group—less strong and stagnating increase in loneliness (Table 4, b_{14-15}). The immediate and short-term change in loneliness that lasted only one year after the event was lower in the event group compared with the control group (Table 4, b_{16}), indicating a delay of the longer-lasting postevent increase. In the control group, loneliness gradually increased after the time where the event group experienced job loss, as indicated by the significant conditional main effect of the linear reaction (postLin) variable (Table 4, b_8). Beyond the loneliness changes reflected in the time variables, we also found significant testing effects in this sample, indicating that loneliness levels linearly decreased from measurement occasion to measurement occasion (Table 4, b_1).

Age-normative effects were examined in a separate analysis using only the event group (see Figure 11). Among those who experienced job loss at an older age than average, loneliness increased less strongly after the event (Table 5, b_{11}). This effect was more pronounced the greater the gap between the age at the event and the average age (Table 5, b_{12}).

Overall, job loss was associated with a long-lasting baseline change in loneliness: After a job loss, individuals reported higher

average loneliness levels than before. Moreover, this baseline change in loneliness after job loss was followed by a further stagnating increase in loneliness. Our results indicated that the loneliness trajectories after job loss differ depending on whether the event was experienced at an average age or younger or older than average.

Retirement

For retirement, the best model fit was achieved with Model A, which did not include any quadratic time predictors (see Table 4). The model-estimated average loneliness trajectories for the event group and the control group surrounding cohabitation are visualized in Figure 10B. The event group and the propensity-score matched control group did not differ significantly in average loneliness at the time of the event (Table 4, b_3) nor in their average trajectories before or after the event, as indicated by the nonsignificant interactions between the time variables and the dummy-coded group variable (Table 4, b_{12-17}). We found no significant testing effects in this sample (Table 4, b_1).

Age-normative effects were examined in a separate analysis using only the event group (see Figure 12). Among those who were younger or older than average at retirement, loneliness increased more strongly after retirement compared with those who retired at an average age (Table 5, b_{12}).

Overall, retirement did not on average appear to be associated with any substantial changes in loneliness. However, our results indicate that the loneliness trajectories after retirement differ de-

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Table 4
Associations Between Work-Related Life Events and Loneliness Development

Variable	Transition into paid employment		Re-employment after unemployment		Job loss		Retirement	
	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI
Intercept (<i>b</i> ₀)	1.923*	[1.773, 2.074]	2.067*	[1.806, 2.328]	1.830*	[1.633, 2.026]	1.689*	[1.536, 1.842]
Testing (<i>b</i> ₁)	-0.030*	[-0.055, -0.004]	0.003	[-0.036, 0.042]	-0.065*	[-0.096, -0.034]	-0.019	[-0.044, 0.006]
Female sex (<i>b</i> ₂)	-0.066	[-0.175, 0.043]	-0.215*	[-0.403, -0.026]	-0.116	[-0.260, 0.029]	-0.163*	[-0.277, -0.049]
Group (<i>b</i> ₃)	-0.091	[-0.230, 0.047]	0.015	[-0.221, 0.251]	0.314*	[0.111, 0.516]	0.048	[-0.111, 0.206]
Age at the event (<i>b</i> ₄)	-0.001	[-0.005, 0.002]	-0.005	[-0.012, 0.001]	-0.001	[-0.007, 0.005]	-0.009	[-0.019, 0.001]
Age at the event ² (<i>b</i> ₅)	<-0.001*	[-0.001, <-0.001]	-0.001*	[-0.001, <-0.001]	<0.001	<-0.001, 0.001]	<0.001	<-0.001, 0.001]
Linear anticipation (<i>b</i> ₆)	0.002#	[-0.023, 0.027]	-0.007	[-0.045, 0.031]	0.020	[-0.049, 0.090]	0.008#	[-0.016, 0.031]
Quadratic anticipation (<i>b</i> ₇)	0.011#	[-0.017, 0.038]	0.008#	[-0.036, 0.053]	-0.005	[-0.013, 0.003]	0.008	[-0.021, 0.038]
Linear reaction (<i>b</i> ₈)	0.035#	[-0.069, 0.139]	-0.087#	[-0.257, 0.084]	-0.220#	[-0.435, -0.005]	-0.009#	[-0.118, 0.100]
Postevent baseline change (<i>b</i> ₉)	0.038	[-0.067, 0.143]	0.040	[-0.136, 0.216]	0.093	[-0.081, 0.267]	-0.050	[-0.165, 0.065]
Event year (<i>b</i> ₁₁)	-0.003	[-0.029, 0.024]	0.034	[-0.005, 0.073]	0.079	[-0.015, 0.174]	0.004	[-0.018, 0.026]
Linear Anticipation × Group (<i>b</i> ₁₂)					0.009	[-0.002, 0.020]		
Quadratic Anticipation × Group (<i>b</i> ₁₃)					-0.232*	[-0.377, -0.088]	0.011	[-0.022, 0.043]
Linear Reaction × Group (<i>b</i> ₁₄)					0.025*	[0.009, 0.041]		
Quadratic Reaction × Group (<i>b</i> ₁₅)					0.451*	[0.151, 0.751]	-0.144	[-0.298, 0.010]
Postevent Baseline Change × Group (<i>b</i> ₁₆)					-0.114	[-0.355, 0.127]	0.051	[-0.111, 0.213]
Event Year × Group (<i>b</i> ₁₇)					-0.056	[-0.191, 0.304]		

Note. Statistically significant fixed effects ($p < .05$) are flagged with an asterisk (*), whereas significant random effects are flagged with a hashtag (#). Regression coefficients are numbered (b_0 - b_{17}) to refer to them within the text more easily. Sex: 0 = male and 1 = female; group: 0 = control group and 1 = event group.

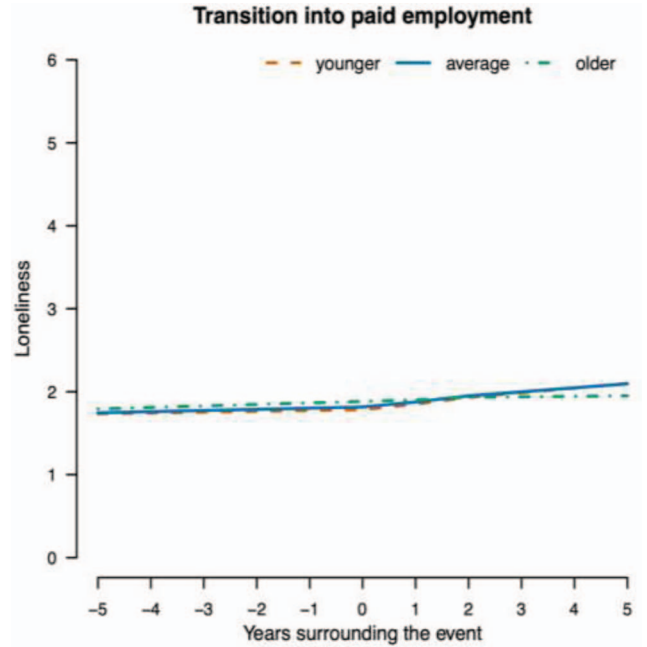


Figure 8. Predicted values of loneliness surrounding transition into paid employment for individuals 10 years younger than average at the event occurrence, for individuals of average age at the event occurrence, and for individuals 10 years older than average at the event occurrence. See the online article for the color version of this figure.

pending on whether the event was experienced at an average age or younger or older than average.

Discussion

This study examined whether and how loneliness changes surrounding family- and work-related major life events. Overall, our findings emphasize the importance of major life events—especially family-related major life events—as possible triggers of loneliness. However, our results also indicate several nuances to this conclusion. We found that different major life events differed in their relation to loneliness changes. Moreover, we found that the average loneliness trajectories surrounding some major life events were moderated by the age at which the event occurred, indicating age-normative effects of certain major life events on loneliness.

Summary of Main Results and Implications

We investigated average loneliness trajectories surrounding 10 major life events and compared these trajectories between an event group that experienced the event and a propensity-score matched control group who did not experience the event. If a major life event triggers changes in loneliness prior to or after the event, one would expect these groups to differ in the average loneliness trajectory observed in a particular time frame (e.g., after the event). Such group differences in the loneliness trajectories were found for marriage, transition into parenthood, marital separation, divorce, widowhood, and job loss. No such differences in the loneliness trajectories were found for cohabitation, transition into paid employment, reemployment after unemployment, and retirement,

Table 5
Age-Normative Effects of Work-Related Major Life Events for Event-Group Participants

Variable	Transition into paid employment		Re-employment after unemployment		Job loss		Retirement	
	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI	<i>b</i>	95% CI
Intercept (<i>b</i> ₀)	1.815*	[1.627, 2.004]	2.174*	[1.886, 2.461]	2.138*	[1.907, 2.369]	1.738*	[1.560, 1.917]
Testing (<i>b</i> ₁)	-0.048*	[-0.084, -0.013]	-0.051	[-0.106, 0.004]	-0.065*	[-0.109, -0.017]	-0.038*	[-0.072, -0.004]
Female sex (<i>b</i> ₂)	-0.087	[-0.244, 0.070]	-0.293*	[-0.559, -0.028]	-0.166	[-0.380, 0.046]	-0.133	[-0.292, 0.026]
Age at the event (<i>b</i> ₃)	0.005	[-0.002, 0.013]	-0.005	[-0.021, 0.010]	-0.007	[-0.018, 0.003]	-0.017	[-0.039, 0.006]
Age at the event ² (<i>b</i> ₄)	<0.001	[-0.001, 0.001]	<0.001	[-0.001, 0.001]	<0.001	[-0.001, 0.001]	0.002*	[0.001, 0.003]
Linear anticipation (<i>b</i> ₅)	0.014	[-0.021, 0.049]	0.064*	[0.011, 0.117]	0.080*	[0.037, 0.122]	0.022	[-0.008, 0.052]
Linear reaction (<i>b</i> ₆)	0.048*	[0.012, 0.085]	0.087*	[0.029, 0.144]	0.056*	[0.008, 0.103]	0.027	[-0.007, 0.061]
Postevent baseline change (<i>b</i> ₇)	0.039	[-0.068, 0.147]	-0.199*	[-0.375, -0.023]	0.040	[-0.099, 0.180]	-0.154*	[-0.260, -0.049]
Event year (<i>b</i> ₈)	-0.026	[-0.133, 0.081]	0.096	[-0.084, 0.276]	-0.024	[-0.165, 0.118]	0.001	[-0.109, 0.111]
Linear Anticipation × Age at the Event (<i>b</i> ₉)	<0.001	[-0.001, 0.002]	<0.001	[-0.002, 0.002]	<0.001	[-0.002, 0.002]	<0.001	[-0.003, 0.003]
Linear Anticipation × Age at the Event ² (<i>b</i> ₁₀)	<0.001	[-0.001, <0.001]	<0.001	[-0.001, <0.001]	<0.001	[-0.001, <0.001]	<0.001	[-0.001, <0.001]
Linear Reaction × Age at the Event (<i>b</i> ₁₁)	-0.003*	[-0.004, -0.001]	-0.004*	[-0.007, -0.002]	-0.005*	[-0.007, -0.003]	-0.003	[-0.008, 0.001]
Linear Reaction × Age at the Event ² (<i>b</i> ₁₂)	<-0.001*	[-0.001, <-0.001]	<-0.001*	[-0.001, <-0.001]	<-0.001*	[-0.001, <-0.001]	0.001*	[-0.001, 0.001]

Note. Statistically significant fixed effects ($p < .05$) are flagged with an asterisk (*). Regression coefficients are numbered (b_0 - b_{13}) to refer to them within the text more easily. Sex: 0 = male and 1 = female; group: 0 = control group and 1 = event group.

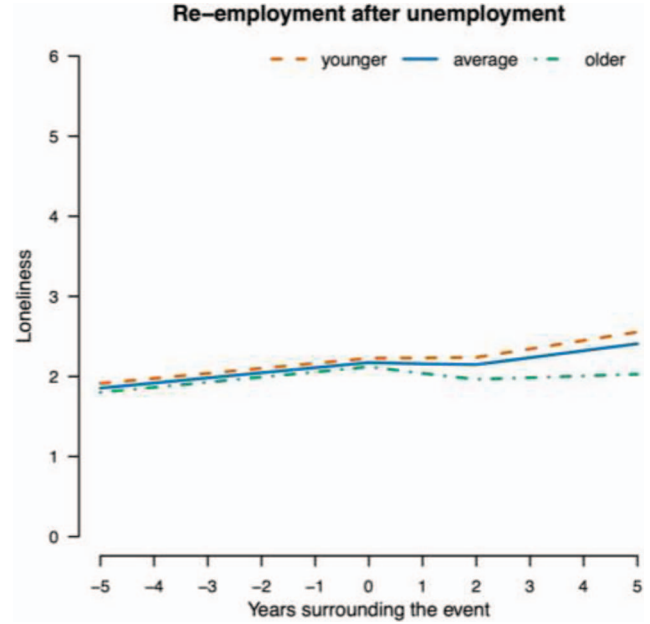


Figure 9. Predicted values of loneliness surrounding reemployment after unemployment for individuals 10 years younger than average at the event occurrence, of average age at the event occurrence, and 10 years older than average at the event occurrence. See the online article for the color version of this figure.

suggesting that these major life events did not trigger changes in loneliness.

To identify a larger pattern: Most family-related life events seemed to be associated with changes in loneliness, whereas most work-related life events did not. A deviation from this larger pattern was job loss. Individuals who lost their job during the survey showed a stronger longer-lasting postevent increase in loneliness compared with the control group. Job loss may result in financial difficulties which are typically found to be positively associated with loneliness (Luhmann & Hawkey, 2016). Moreover, job insecurity and financial concerns have far-reaching consequences on family-related outcomes (Mauno, Cheng, & Lim, 2017). This may explain, why job loss is—similar to other family-related events—associated with increases in loneliness.

In 1981, Perlman and Peplau stated: “The ending of a close emotional relationship is a common *cause* of loneliness so that, for example, widowhood has been associated with loneliness by several researchers.” (Perlman & Peplau, 1981, p. 38; italics were added for emphasis). However, empirical evidence for this causal effect of major life events on loneliness has been rare. In the present study, the majority of differences in the average loneliness trajectories between the event group and the control group were found after the event, indicating that loneliness changed in reaction to a major life event. The only exception was marriage, which was preceded by a less pronounced increase in loneliness or even a decrease among the event-group participants. Marriage is a major life event that is typically predictable to a certain extent, which might explain why it affected loneliness even before the event occurs. Although we were not able to experimentally manipulate the occurrence of a major life event, we approached the question

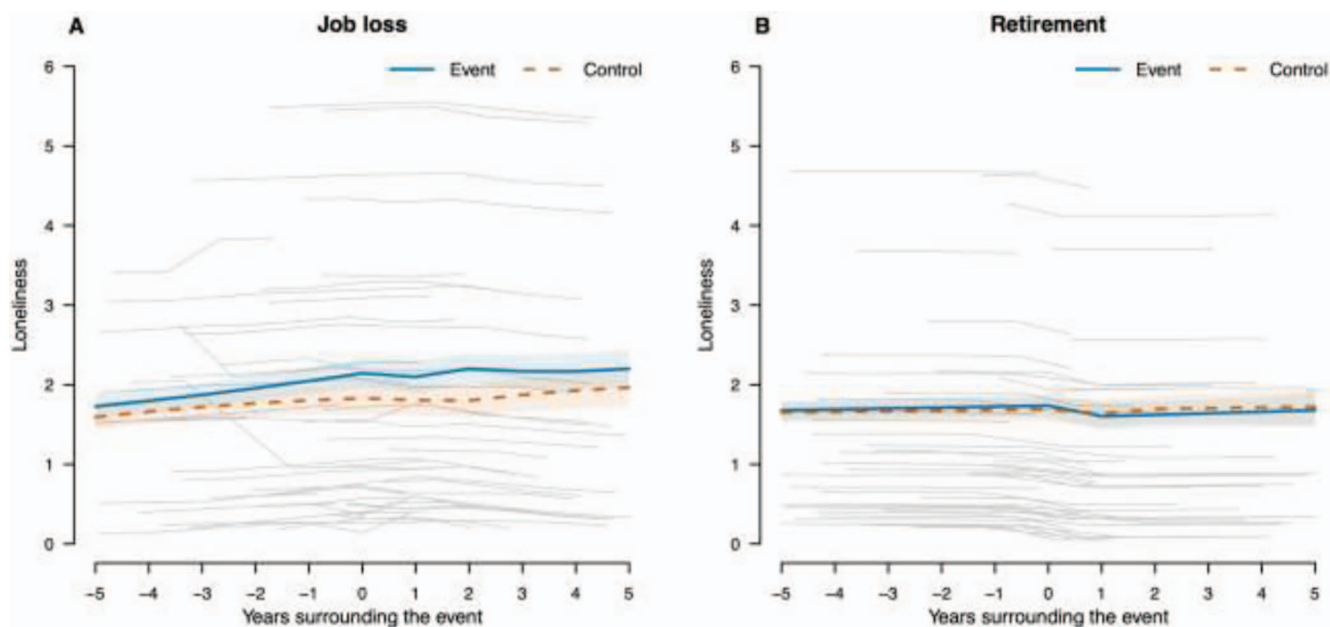


Figure 10. Model-estimated average and individual-level loneliness trajectory surrounding job loss (A) and retirement (B). Blue (solid bold) lines represent the model-estimated average trajectory for the event group, red (dashed bold) lines represent the model-estimated average trajectory for the control group, gray (solid thin) lines represent individual-level trajectories for 50 randomly selected sample participants from the event group. Shaded areas (light blue and light red) around the bold lines represent bootstrapped 95% confidence bands of the average trajectories. See the online article for the color version of this figure.

of causality by including a propensity-score matched control group in our analyses. Moreover, the idea that major life events trigger changes in loneliness is based on strong theoretical considerations assuming that major life events either affect one's actual or desired social relationships and thus lead to loneliness (Peplau & Perlman, 1979; Perlman & Peplau, 1981). Consequently, we conclude that the present study does support the idea of major life events as a possible cause of changes in loneliness.

Timing of Change in Loneliness Surrounding Major Life Events

The change patterns in loneliness after different major life events were rather complex. Loneliness increased for a long time (at least for the duration of the study) after the transition into parenthood, marital separation, widowhood, and job loss. Short-term changes in loneliness during the first year after the event that were not already captured by the long-term postevent baseline change or the linear reaction variable were found for a transition into parenthood and job loss. Both events were associated with a delayed increase in loneliness after the event, with lower loneliness levels immediately after the event. Further gradual changes in loneliness were found after marriage, marital separation, and job loss. These diverse change patterns emphasize the importance of studying change surrounding major life events with multiple measurement occasions so that complex trajectories such as linear change prior to and after an event as well as immediate short- and long-term change after an event can be adequately modeled.

In our data, we found few short-term changes in loneliness within the first year that were not already captured by the long-

lasting baseline change and linear reaction effects. This finding raises the question of the most appropriate timing for measuring a change in psychological constructs surrounding major life events (Bleidorn et al., 2020). Regarding the transition into parenthood, previous research found lower levels of loneliness during the first year after the event (Rokach, 2004), which is consistent with the findings in the present study. Moreover, research on changes in subjective well-being after major life events showed that most changes occurred during the first year after the event (Luhmann et al., 2012). For loneliness, the dummy variable indicating the first year after the event was statistically significant only in rare cases, leaving it an open question whether other time intervals might be better to capture short-term change after an event. An important future research direction would be to systematically investigate the appropriate timing to measure a change in psychological constructs such as loneliness surrounding major life events to better understand the temporal dynamics of these short- and long-term change processes.

Age-Normative Effects of Major Life Events

For some major life events, the age-normativity of the event occurrence played a role, meaning the effect of a specific major life event depends on when (i.e., at what age) the event was experienced. Experiencing an event age-normatively was not always associated with more positive effects on loneliness. Being older than average when getting married was associated with a weaker increase or even a decrease in loneliness after the event, whereas being younger than average when getting married was associated with a stronger increase in loneliness after the event,

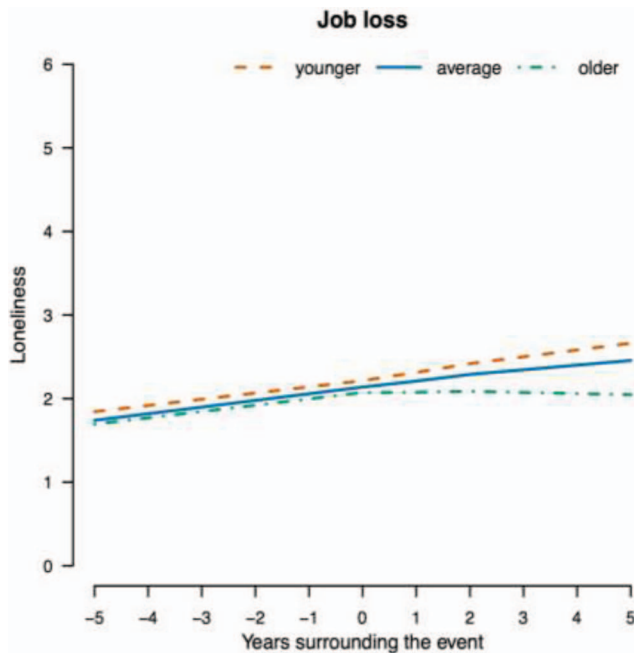


Figure 11. Predicted values of loneliness surrounding job loss for individuals 10 years younger than average at the event occurrence, of average age at the event occurrence, and 10 years older than average at the event occurrence. See the online article for the color version of this figure.

compared with those who married at an average age. Among those who experienced marital separation younger and older than average, loneliness increased less strongly in anticipation of the event. Moreover, being older than average when getting divorced was associated with a stronger decrease in loneliness after the event compared with experiencing divorce at an average age. Among those who experienced the transition into paid employment, reemployment after unemployment, or job loss at an older age than average, loneliness increased less strongly after the event compared with those who experienced the event at an average age.

We can only speculate on reasons for the “protective effect” of experiencing an event older than average. Individuals who experience an event older than average may have more mature personality traits than younger individuals (Costa, McCrae, & Löckenhoff, 2019). Consequently, these individuals may be better able to handle major life events and cope with potentially stressful experiences. Moreover, individuals who experience an event older than average may know more other people that have already experienced the event and can provide social support or advice on how to adjust to such an event. However, for some events such as retirement, experiencing the event at an average age was associated with more positive effects compared with experiencing retirement younger or older than average. For these people, loneliness increased more strongly after retirement compared with those who retired at an average age. However, early retirement (e.g., due to illness) may be a characteristically different event from the more regular retirement, which may explain why loneliness increases more after early retirement than after regular retirement at the legal retirement age.

Changes in Loneliness in the Propensity-Score Matched Control Group

In some cases, we found significant conditional main effects of certain time variables in the propensity-score matched control groups, indicating that although these participants did not experience the event of interest, their loneliness levels changed. We did not expect such results; however, they were also not surprising. As described in the introduction, for some events, it does make sense to assume that if similar others experience a certain event (e.g., marriage), this event occurrence may not only affect their loneliness levels but also the loneliness levels of those who do not experience the event. This idea has been discussed in the literature on change in subjective well-being and personality traits associated with “missed events” (Luhmann, Buecker, et al., 2020). However, in the present study, we cannot rule out the possibility that something else (e.g., another major life event) happened that caused the change in loneliness in the control group. Moreover, changes in loneliness found for the event and the control group could be normative age-related changes or effects indicating that a “social clock” is ticking for both groups.

Limitations, Strengths, and Future Research Directions

The LISS data set is one of the largest available longitudinal data sets on loneliness, covering a timespan of over 9 years. Still, sample sizes were rather low for some events (e.g., widowhood), limiting the statistical power to detect weaker effects such as moderating effects of age at the event on changes in loneliness. Future research should focus on these

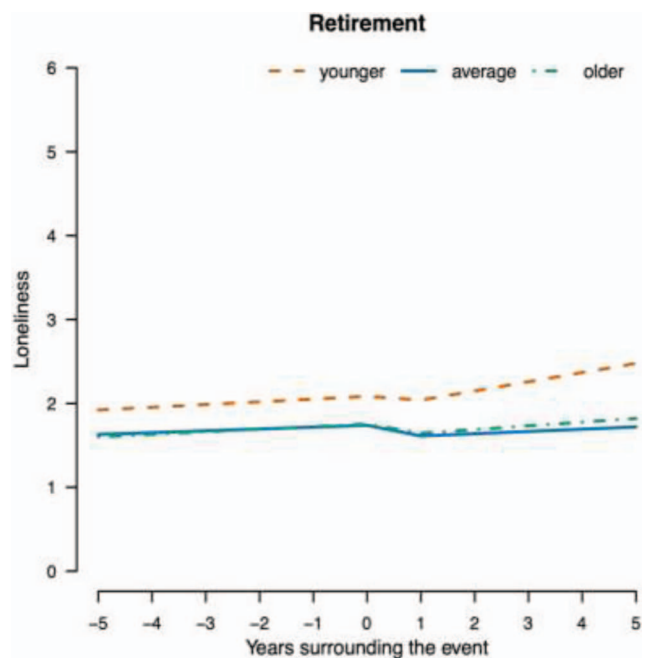


Figure 12. Predicted values of loneliness surrounding retirement for individuals 10 years younger than average at the event occurrence, of average age at the event occurrence, and 10 years older than average at the event occurrence. See the online article for the color version of this figure.

effects in more detail using larger samples. In this context, it seems sensible to reflect on how future research on major life events can be optimized. Although the LISS panel tracks a large sample over many years, the effective sample sizes for some event samples were even lower than the total sample size suggests. This is partly attributable to the combinatory nature of some life events. For example, to be part of the widowhood event, individuals first had to be married. Second, they had to be relatively old, as this event is usually experienced in old age. Another reason for the lower sample size for some events is that the mean age at the beginning of the participation in the LISS survey was around midlife. Conversely, for many individuals, certain major life events (e.g., transition into parenthood) had occurred already before they entered into the survey. To investigate changes in psychological outcomes surrounding major life events, longitudinal data are needed that measure individuals early enough and follow them long enough to prospectively track their trajectories in the context of different life transitions.

Additionally, we solely investigated the first occurrence of an event and did not examine changes that may occur when different events occur together. Future research should address whether the repetition of an event occurrence (e.g., getting divorced several times) or the combination of experiencing different events (e.g., becoming a parent and losing the job) affects loneliness. Regarding divorce, it is also noteworthy that recent research found that compared with 1992, divorcees in 2002 and 2012 were less lonely, which indicates that the social position of divorced persons in today's society might have improved (van Tilburg et al., 2015). To better understand changes in loneliness surrounding divorce but also other life events, a more fine-grained analysis of cohort effects in future research would be desirable.

Another limitation of our study is that we only studied objective event occurrences, without considering the subjective interpretation of the event. This procedure has some advantages because it likely avoided demand characteristics within the survey (e.g., participants feeling compelled to report greater well-being or reduced loneliness after childbirth because this fits cultural narratives Luhmann et al., 2014). However, it also has some disadvantages (e.g., marital separation can be a positive, releasing, and extricating experience for people being very unhappily married; Bleidorn, Schwaba, Denissen, & Hopwood, 2019; Spanier & Thompson, 2011; Strohschein, 2005). For these individuals, the effect of marital separation on changes in loneliness might look very different compared with others perceiving the event as drastically negative. Following the idea that the individual perception of an event may affect the emotional reaction to such an event, we found significant individual differences in the event-related change in loneliness. However, our data do not include any information about the controllability of and the choice for certain major life events. For example, loneliness after a romantic separation might be less severe for the person initiating the separation than for the person being left. Future research should take individuals' idiographic experiences (e.g., perceived controllability, emotional significance, or valence) of major life events into account (Luhmann, Fassbender, Alcock, & Haehner, 2020). For example, previous research found that the lower the opportunity to anticipate the death of a spouse, the higher the loneliness after

bereavement (van Baarsen, Smit, Snijders, & Knipscheer, 1999).

Conclusion

The current study provides a rigorous and systematic examination of whether family- and work-related major life events are associated with changes in loneliness. Our results indicate that some major life events, particularly family-related events, can trigger changes in loneliness. Moreover, we showed that for some major life events, the timing of the event occurrence (i.e., the age-normativity) seemed to play a role for loneliness, producing a complex pattern of effects. It remains a task of future research to replicate these trajectories in other samples and to investigate different moderators and mediators. Such studies will shed more light on the mechanisms that trigger loneliness after experiencing major life events and identify subgroups of people who might be especially vulnerable and could therefore be targeted by interventions. In sum, greater awareness and recognition that different major life events (and not just the obvious candidates like widowhood) in different stages of the life course can cause loneliness may help existing services to provide appropriate support for those who experienced such events and to prevent loneliness becoming chronic.

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