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Evidence from Norway and Sweden

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Abstract

Depression and loneliness are widespread problems in modern European and North American societies. Although there are several reasons to expect mental health to affect fertility, the topic is so far underexplored. This study examines how depression and loneliness are associated with three fertility outcomes: the propensity to report a positive short-term fertility intention, the propensity to realize a positive fertility intention, and the propensity to abandon rather than postpone a positive fertility intention. The study uses data from the Norwegian and Swedish Generations and Gender Surveys from 2007/2008 and 2012/2013, together with their follow-ups based on population registers. Results show that depression is negatively associated with the propensity to report a positive fertility intention among Norwegian women. Among Swedish women, both depression and loneliness are negatively associated with the propensity to realize a positive fertility intention. Among Swedish men, depression is associated with an elevated propensity to abandon, rather than postpone, a positive fertility intention. To our knowledge, this study is the first to show how depression and loneliness relate to fertility intentions and their realization. The study contributes to the understanding of both the determinants of fertility and the consequences of two common mental health issues.

Keywords: mental health, fertility preferences, Generations and Gender Survey, wellbeing, abandonment, postponement

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1. Introduction

Depression and loneliness are two widespread mental health issues in modern European and North American societies (Arias-de la Torre et al., 2021; Berlingieri et al., 2023; Ettman et al., 2020). Both depression and loneliness can have negative consequences in many different domains of life, including physical health (Hare et al., 2014; Leigh-Hunt et al., 2017), labour market performance (Mokros et al., 2022; Morrish et al., 2022; Whooley et al., 2002), and quality of social interactions and relationships (Elmer & Stadtfeld, 2020; Joosten et al., 2022; Mund & Johnson, 2021; Oppenheimer & Hankin, 2011). Although there are several reasons to expect that mental health problems could also affect childbearing behaviour, few earlier studies have explored mental health as a predictor of fertility. The present study aims to address this research gap by analysing how two specific mental health issues, depression and loneliness, are associated with fertility intentions and their realization in Norway and Sweden. Exploring how depression and loneliness affect childbearing is important because it improves the understanding of both the determinants of fertility and the consequences of two common mental health issues.

There are several potential mechanisms through which depression and loneliness may affect fertility. First, depression and loneliness may alter childbearing plans, both positively and negatively. Depressed individuals may lose interest in pursuing childbearing as a life goal. One of the defining characteristics of depression is a loss of interest in previously enjoyable activities (American Psychiatric Association 2020). Depressed and lonely people may also choose to postpone childbearing until their depression or loneliness status improves or alternatively bring it forward if they believe that having a child could help them feel less depressed or lonely. Second, depression and loneliness may have an indirect negative effect on fertility by influencing factors such as employment and partnership status, which in turn affect fertility. Third, depression may influence fertility negatively through biological mechanisms. Severe depression is associated with reduced fecundity (Nillni et al. 2016), whereas antidepressant use is associated with an increased risk of miscarriage (Almeida et al. 2016; Evans-Hoeker et al. 2018; Nakhai-Pour et al. 2010). In sum, most of these potential mechanisms would suggest a negative effect of depression and loneliness on fertility. However, a positive effect is also possible.

Earlier research has examined the association between having received a depression diagnosis and fertility outcomes (Golovina et al., 2022; Power et al., 2013). A major weakness of these studies is that they do not examine the time ordering of the depression diagnosis and fertility,

meaning the direction of causality remains unclear. Studies adopting a longitudinal approach have shown that greater happiness, subjective well-being, and life satisfaction positively predict both higher actual fertility and higher fertility preferences (Aassve et al., 2016; Cetre et al., 2016; Le Moglie et al., 2015; Luppi & Mencarini, 2018; Mencarini et al., 2018; Perelli-Harris, 2006; Spéder & Kapitány, 2009). General well-being measures correlate with mental health but are also influenced by a broad set of other factors (Das et al., 2020; Fleche et al., 2011; Lombardo et al., 2018). Thus, findings that broad well-being measures can explain fertility patterns do not necessarily mean that specific mental health issues, such as depression and loneliness, also influence fertility.

The present study analyses how depression and loneliness are associated with three fertility outcomes: the propensity to state a positive parity-progression fertility intention for the upcoming three years, the propensity to realize a positive fertility intention within three years of interview, and the propensity to abandon rather than postpone a positive fertility intention that was not realized within the three-year time frame. The study contributes to the understanding of how mental health affects fertility in two main ways. First, we focus on two specific mental health issues, i.e. loneliness and depression, rather than more general well-being concepts. To our knowledge, this is the first study to examine how depression relates to fertility preferences and the first overall to examine how loneliness may affect childbearing. Second, in analysing parity-specific fertility intentions and especially the realization and postponement/abandonment of fertility intentions, we employ a longitudinal approach that facilitates the determination of the time ordering of depression/loneliness and fertility.

The study uses data from the Norwegian and Swedish Generations and Gender Surveys (GGS) from 2012/2013 and 2007/2008 together with their population register-based follow-ups. Depression is measured through the shortened version of the Center for Epidemiologic Studies Depression Scale (CES-D Scale) (Levine, 2013; Radloff, 1977). Loneliness is measured through the De Jong Gierveld short scale for emotional and social loneliness (De Jong Gierveld & Van Tilburg, 2010). The Norwegian and Swedish GGS data are uniquely well-suited for studying the realization and postponement/abandonment of fertility intentions since the use of register-based follow-ups to the initial survey wave resulted in minimal attrition between waves. Earlier research on the realization and postponement/abandonment of fertility intentions has primarily relied on data where Wave 1 respondents were re-interviewed at follow-ups, an approach that is associated

with considerably higher attrition than register-based follow-ups (Buber-Ennser, 2014; Carlsson 2023; Kapitány and Spéder, 2012).

The paper is structured as follows. Section 2 provides some background information on the concepts of depression and loneliness, including definitions and estimated prevalence in Norway, Sweden, and other European and North American countries. Section 3 discusses earlier research on the association between mental health and fertility, as well as related research on the effect of life satisfaction, subjective well-being, and happiness on fertility. Section 4 describes the research design, while results are presented in section 5 and discussed in section 6.

2. Depression and loneliness: definition and prevalence

Depression is a mental illness characterized by persistent sadness and a lack of interest in or pleasure derived from previously enjoyable activities. Other common symptoms of depression include disturbances to sleep and appetite, lack of energy, concentration difficulties, and low self-esteem (American Psychiatric Association, 2020).

Estimates of the prevalence of depression vary depending on how it is measured. Using data from a survey conducted in 31 European countries in the period 2013-2015, Arias-de la Torre et al. (2021) find that national prevalence rates of current depressive disorder vary between 3 and 10 %. The prevalence in Sweden (9 %) was higher than that in Norway (5 %). Johansson et al. (2013) used data from a 2009 survey and found that 5 % of Sweden's adult population experienced major depressive disorder, whereas 11 % of Swedish adults suffered from at least moderate depressive disorder. In both Norway and Sweden, as well as in other countries, depression is more common among women than men (Arias-de la Torre et al., 2021; Bretschneider et al., 2018; Ettman et al., 2020; Johansson et al., 2013).

An often-cited definition of loneliness is that “loneliness is the unpleasant experience that occurs when a person's network of social relationships is deficient in some important way, either quantitatively or qualitatively” (Perlman & Peplau, 1981). Loneliness is about the subjective feeling of being alone, which may or may not coincide with social isolation in the objective sense (de Jong-Gierveld, 1998). Loneliness is not considered a mental illness in itself, but is an important risk factor for several types of mental health problems, such as depression, anxiety, and suicidal ideation (Beutel et al., 2017; Cacioppo et al., 2006; Erzen & Çikrikci, 2018).

Similar to depression, estimates of the prevalence of loneliness vary depending on the measurement instrument. An EU-wide survey conducted by the European Commission in 2022 using different measurement approaches found that 12-13 % of respondents could be classified as very lonely, whereas 36-40 % of respondents were lonely at least some of the time (Berlingieri et al., 2023). The 2016 European Quality of Life Survey conducted in all EU countries indicates that 12 % of adult EU citizens felt lonely at least half of the time during the last two weeks (Baarck et al., 2022). Data from the European Social Surveys (ESS) from 2006, 2010, 2012, and 2014 indicate that 9 % of Europe's adult population felt lonely most or all of the time during the last week (d'Hombres et al., 2021). Contrary to stereotypes that loneliness primarily affects older individuals, research has shown that loneliness is present in all age groups, with a higher prevalence among young adults than among middle-aged individuals (Barreto et al., 2021; Hansen et al., 2021; Luhmann & Hawkey, 2016; Office for National Statistics, 2018).

According to ESS data, the prevalence of loneliness in Sweden is below the European average, with 5 % of the adult population having felt lonely most or all of the time during the last week (d'Hombres et al., 2021). A 2008 survey found that 42 % of Swedish adults were feeling lonely at least sometimes (Tornstam et al., 2010). Survey data from Norway collected in 2019 and early 2020 Norway showed that about 20 % of 18-44-year-olds assessed their level of loneliness to be 6 or higher on a 10-unit scale (Hansen et al., 2021).

3. Earlier research on the association between mental health and fertility

Research based on population registers in the Nordic countries have found that having been diagnosed with depression tends to be associated with low fertility outcomes. In Finland, men and women who had either been hospitalized with depression or had visited a specialist about their depression were both less likely to have children and had fewer children on average than individuals without a depression diagnosis (Golovina et al. 2022). Power et al. (2013) used data that cover all hospitalizations and partially cover specialist visits in Sweden and found that having been diagnosed with depression is associated with a lower number of children among men but not among women. However, neither Golovina et al. (2022) or Power et al. (2013) examined the time ordering of the hospitalization event/specialist visit and fertility, meaning the direction of causality is unclear.

There is little research adopting a longitudinal approach to analyse whether mental health status can predict fertility. Combining data from a self-administered survey among Swedish adolescents with follow-up data from population registers, Jonsson et al. (2011) found that depression status during adolescence was not associated with the probability of having at least one child at age 30.

A stream of research which is related to the study of the association between mental health and fertility has examined how happiness, subjective well-being, and life satisfaction relate to fertility. Analyses of longitudinal data from a large set of European, North American, and East Asian countries have shown that greater happiness, subjective well-being, and life satisfaction often positively predict the propensity to transition to the next parity (Cetre et al., 2016; Le Moglie et al., 2015; Luppi & Mencarini, 2018; Mencarini et al., 2018; Perelli-Harris, 2006). The positive effect of happiness, subjective well-being, and life satisfaction on fertility exists for both men and women (Aassve et al., 2016; Le Moglie et al., 2015; Mencarini et al., 2018). However, analyses of couple data in the UK showed that the female partner's level of happiness matters more than the male partner's happiness for the transition to first birth (Aassve et al., 2016). Whether the effect of happiness, subjective well-being, and life satisfaction on fertility is stronger at parity 0 or 1 seems to vary across contexts (Aassve et al., 2016; Le Moglie et al., 2015; Mencarini et al., 2018).

In addition to actual fertility, it has been shown that happiness, subjective well-being, and life satisfaction also relate positively to fertility intentions and desires (Billari 2009; Perelli-Harris 2006; Vignoli et al. 2020). Analysing European Social Survey data from a large set of European countries, Billari (2009) found that the association between happiness, subjective well-being, and life satisfaction on the one hand and short-term fertility intentions on the other is positive for both men and women but stronger for women. Billari (2009) also analysed how the association between happiness and the propensity to state a positive short-term fertility intention varied by parity. Among both men and women, a positive association exists at parity 0 and 1 but is relatively small and non-significant at parity 2. Among women, the magnitude of the association is similar at both parity 0 and 1, while it is stronger at parity 0 than at parity 1 among men.

Using survey data from Hungary, Spéder and Kapitány (2009) analysed how the propensity to either realize, postpone, or abandon a positive short-term fertility intention varied by the level of life satisfaction. Individuals with higher life satisfaction were more likely to realize their

intention than to abandon it, whereas the propensities to realize and postpone the intention did not differ by life satisfaction.

4. Data and methods

4.1. Data

The study uses data from the Round I Generations and Gender Surveys in Norway and Sweden together with their respective population register-based follow-ups. Initial data collection (Wave 1) took place through telephone interviews and a self-administered questionnaire in 2007-2008 in Norway and 2012-2013 in Sweden. Among the 19 countries where the GGS Round I were conducted, Norway and Sweden were unique in collecting follow-up data entirely from population registers. The follow-up data to the Norwegian GGS stretches until 2011, while the follow-up data to the Swedish GGS stretches until 2021 (including both Wave 2 and 3 of the Swedish GGS). The response rates for the interview parts of Wave 1 were 60 % for the Norwegian GGS and 54 % for the Swedish GGS. Among the interviewed respondents, 72 % in Norway and 70 % in Sweden also answered the self-administered questionnaire. As a result, the response rate for the complete Wave 1 survey (i.e. interview + questionnaire) was 43 % for the Norwegian GGS and 39 % for the Swedish GGS. Since items on depression and loneliness were part of the questionnaire, this study only includes respondents who participated in both the interview and questionnaire parts of Wave 1 data collection. The register-based follow-ups ensure that all respondents who did not die or emigrate can be followed until the end year of the respective follow-ups. This minimal attrition from Wave 1 to follow-ups make the Norwegian and Swedish GGSs uniquely well-suited to study the realization of short-term fertility intentions (Carlsson, 2023).

The study population includes both men and women. Female respondents are included if they were 18-44 years and not pregnant at the Wave 1 interview. Male respondents are included if they were 18-49 years and were either single or had a female partner who was 18-44 years old and not pregnant at the Wave 1 interview. Female respondents who were not physically able to have a child or male respondents whose female partner was not physically able to have a child are excluded from the study population. We exclude individuals in same-sex relationships because their process of intention realization is not easily comparable to that of individuals in heterosexual relationships. We also exclude individuals who intended to adopt or take a foster child within the

next three years. The sample size varied at different steps of the analysis. See Tables 3-7 for the number of respondents included for each analysis.

4.2. Variables

4.2.1. Fertility outcomes

The study uses three outcome variables. First, the short-term, parity-progression fertility intention is measured by asking respondents whether they want a/another child within the upcoming three years. Second, the realization of the fertility intention is measured through population register data on children born to the respondent within the 36 months that follow the Wave 1 interview. Third, abandonment/postponement of the fertility intention is measured as follows: Respondents with a positive short-term intention at interview who did not realize their intention within the three-year time frame but had a child during the subsequent five years (i.e. month 37-96 after the interview) are considered to have postponed their intention. Respondents with a positive short-term fertility intention at the Wave 1 interview who neither realized the intention within the three-year time frame nor had a child during the subsequent five years (i.e. month 37-96 after the interview) are considered to have abandoned their intention.

4.2.2. Depression and loneliness

Our main independent variables are depression and loneliness. We measure depression by using the shortened version of the Centre for Epidemiologic Studies Depression Scale (CES-D Scale, Radloff, 1977). The original CES-D scale contains 20 items, and the shortened version included in the GGS 2012 survey contains 7 items. The shortened version has been validated as suitable for screening for suspected major depression disorder (Levine, 2013). Respondents were asked how frequently they experienced the following feelings during the previous week: “Had difficulty shaking off the blues”, “Felt depressed”, “Thought that your life has been a failure”, “Felt fearful”, “Felt lonely”, “Had crying spells”, and “Felt sad.” There were four response alternatives: “seldom or never”, “sometimes”, “often” and “most or all of the time.” We used the CES-D scale following Levine (2013). Thus, we assigned 0, 1, 2, and 3 points to the different response alternatives, where higher points represent a higher frequency of negative feelings. The total score ranges between 0 and 21. We created a dichotomous variable based on this total score and set 8 as the cut-off for indicating depression. Thus, individuals who score 8 or above on the total score are considered to be depressed while individuals who score 7 or lower on the total score

are considered to be non-depressed. The cut-off of 8 is suggested and validated by Levine (2013), therefore we also followed this suggestion. In our sample, 11.3% of Swedish respondents and 6.9% of Norwegian respondents are considered depressed.

We measure loneliness by using the De Jong Gierveld short scale for emotional and social loneliness (De Jong Gierveld & Van Tilburg, 2010). The original scale (De Jong-Gierveld & Kamphuis, 1985) contains 6 items for measuring emotional loneliness and 5 items for social loneliness. The shortened version contains 3 items for emotional and social loneliness respectively, i.e., 6 items in total. The short scale has been validated (De Jong Gierveld & Van Tilburg, 2010). Social loneliness items are positively formulated (“There are plenty of people that I can lean on in case of trouble”, “There are many people that I can count on completely” and “There are enough people that I feel close to”), while emotional loneliness items are negatively formulated (“I experience a general sense of emptiness”, “I miss having people around” and “Often, I feel rejected”).

Unfortunately, the Norwegian and Swedish GGSs did not use the same set of response alternatives for the loneliness items, which limits comparability between the two countries. In the Swedish GGS, each item had three response alternatives: “yes”, “more or less” and “no”. In line with De Jong Gierveld and Van Tilburg (2010), we calculated the total loneliness score for the Swedish GGS as follows. First, each item was dichotomized by giving the category representing the highest level of loneliness together with the middle category value 1 (thus indicating loneliness) while the remaining category which represents the lowest level of loneliness was given value 0. Thus, the social loneliness items were reverse coded compared to the emotional loneliness items. Second, the score on each of the six items was summarized to produce a total loneliness score ranging from 0 to 6, where 0 indicates the lowest level of loneliness and 6 indicates the highest level of loneliness.

In the Norwegian GGS, there were five possible response alternatives to the loneliness items: “strongly agree”, “somewhat agree”, “neither agree nor disagree”, “somewhat disagree” and “strongly disagree.”. Compared to respondents to the Swedish GGS, a considerably smaller share of respondents to the Norwegian GGS chose the middle category. Based on the distribution of responses in the two countries, it seems that many Norwegian respondents who would have chosen the middle category (i.e. “more or less”) if presented with three alternatives instead chose the category representing the second lowest level of loneliness (i.e. “somewhat agree/disagree”) when

presented with five alternatives.¹ Although the middle category does not carry the same meaning with three and five response alternatives, we chose to follow De Jong Gierveld and Van Tillburg (2010) in classifying the middle category together with the response alternatives that represent more loneliness than the middle category when calculating the overall loneliness score. Thus, we calculated the total loneliness score for the Norwegian GGS as follows. Each item was first dichotomized by giving the middle category together with the two categories representing more loneliness than the middle category value 1 and the two categories representing less loneliness than the middle category value 0. Similar to the Swedish GGS, we then calculated the total loneliness score by summarizing the score for each item.

Table 1 shows the distribution of respondents across different levels of the total loneliness score in the Norwegian and Swedish GGSs. A considerably larger share of respondents in the Norwegian GGS scores 0 on the loneliness scale, while a considerably smaller share scores 2 and above on the scale. This discrepancy likely results from the difference in response alternatives to the loneliness items between the Norwegian and Swedish GGSs.

Table 1. Distribution of respondents across different levels of the total loneliness score (%)

Total loneliness score	0	1	2	3	4	5	6
Norway	58.0	20.0	10.7	5.8	3.0	1.6	0.9
Sweden	26.3	17.6	17.7	13.8	10.4	7.4	6.7

Source: Norwegian GGS from 2007/2008 and Swedish GGS from 2012/2013, Wave 1

4.2.3. Control variables

We control for a set of covariates that are likely to be associated with both loneliness/depression and the three fertility outcomes. All control variables are measured at interview. *Age* is categorized as “under 25 years”, “25 to 34 years”, and “35 years or more” at most steps of the analysis. When stratifying the sample by parity for the analysis of the relationship between depression/loneliness and the propensity to report a positive fertility intention, age is dichotomized as “under 35 years” and “35 years or more” for respondents at parity 1 and 2+ due to small cell size. We also estimated all regression models with age (integer) and age squared

¹ For the positively formulated items, e.g. “There are plenty of people that I can lean on in case of trouble”, “somewhat agree” represents the second lowest level of loneliness. For the negatively formulated items, e.g. “I experience a general sense of emptiness”, “somewhat disagree” represents the second lowest level of loneliness.

instead of the categorical age variable, with very little change to the point estimates for depression and loneliness. *Parity* is categorized as “0 children”, “1 child”, and “2 or more children.” *Partnership status* is categorized as “coresidential” (including both married individuals and individuals in non-married cohabitation), “non-coresidential”, and “single”. *Educational attainment* is dichotomized as “with/without university education degree”. *Employment status* is dichotomized as “employed” and “other”. See Appendix Tables 1-2 for descriptive statistics for the different samples.

In addition to demographic and socioeconomic factors, physical health may also be a confounder in the relationship between depression/loneliness and the three fertility outcomes. Unfortunately, there were no items asking specifically about the respondent’s physical health in the Swedish GGS. As a robustness check, we include *general health* as an additional control variable, which is measured through the item “Are you limited in carrying out normal everyday activities because of physical or psychological health problems or disabilities?” with two response alternatives: “yes” and “no”. Controlling for this variable does not change our main findings (see Appendix Tables 3a, 4a, 5a, 6a, and 7a).

4.3. Statistical analysis

We use multiple logistic regression to estimate the relationship between depression/loneliness and the propensity to report a positive fertility intention, to realize a positive fertility intention, and to abandon rather than postpone a positive fertility intention. We estimate separate regression models for the relationship between depression and the three outcome variables and between loneliness and the three outcome variables. For the analyses of the propensity to report and realize a positive fertility intention, we stratify the full sample by gender and survey country and estimate separate regressions for each gender*country combination. The analysis of the propensity to abandon rather than postpone a positive fertility intention only includes respondents from the Swedish GGS. Similar to the previous steps of the analysis, we estimate separate regressions for men and women.

To examine whether the association between depression/loneliness and the propensity to report a positive fertility intention varies by parity, we estimated separate logistic regressions at parities 0, 1, and 2+. Due to sample size considerations, stratifying the sample by parity was not possible for the analyses of realization and postponement/abandonment. For all parts of the analyses, we estimated one model for respondents in all partnership types (i.e., coresidential, non-

coresidential, and single) and a second model where we only included respondents in coresidential partnerships.

We report regression results as average marginal effects (AMEs) to facilitate comparison between subgroups and models. For each regression model, we only show the AMEs for depression/loneliness, not the control variables. To make the interpretation of the AMEs easier, we also estimated average predicted probabilities for respondents who were non-depressed and whose loneliness score was zero (see Appendix Tables 3b, 4b, 5b, 6b, and 7b).

5. Results

5.1. Descriptive findings

Tables 2a and 2b show bivariate relationships between depression status and the three fertility outcomes (i.e., the propensities to report, realize, and abandon a positive fertility intention) in the Norwegian and Swedish samples, separately for men and women.

Among Swedish men and Norwegian women, the share reporting a positive fertility intention for the upcoming three years is smaller among depressed than among non-depressed individuals, whereas differences between depressed and non-depressed individuals are small among Norwegian men and Swedish women. Patterns are clearer when it comes to the propensity to realize a positive fertility intention within the three-year time frame. Among all four groups, the realization probability is considerably lower among depressed than among non-depressed individuals. Due to data restrictions, the propensity among individuals who do not realize a positive fertility intention within the stipulated three-year time frame to abandon as opposed to postponing the intention is only analysed among respondents to the Swedish GGS. Among men, depressed individuals are clearly more likely than non-depressed individuals to abandon the intention, whereas depressed and non-depressed women are equally likely to abandon the intention. It should be stressed that the sample size is relatively small for the realization and especially the postponement/abandonment steps of the analysis, meaning numbers should be interpreted with caution.

Table 2a. Share reporting, realizing, and abandoning a positive fertility intention among separately for depressed and non-depressed individuals, by country. Men.

	Norway		Sweden	
	non-depressed	depressed	non-depressed	depressed
share reporting a positive intention	23.1	23.8	27.2	19.2
share realizing a positive intention within 3 years	49.6	30.0	44.8	26.7
share abandoning a positive intention			56.1	90.9

Source: Norwegian and Swedish GGS, Wave 1 + register follow-ups

Table 2b. Share reporting, realizing, and abandoning a positive fertility intention among separately for depressed and non-depressed individuals, by country. Women.

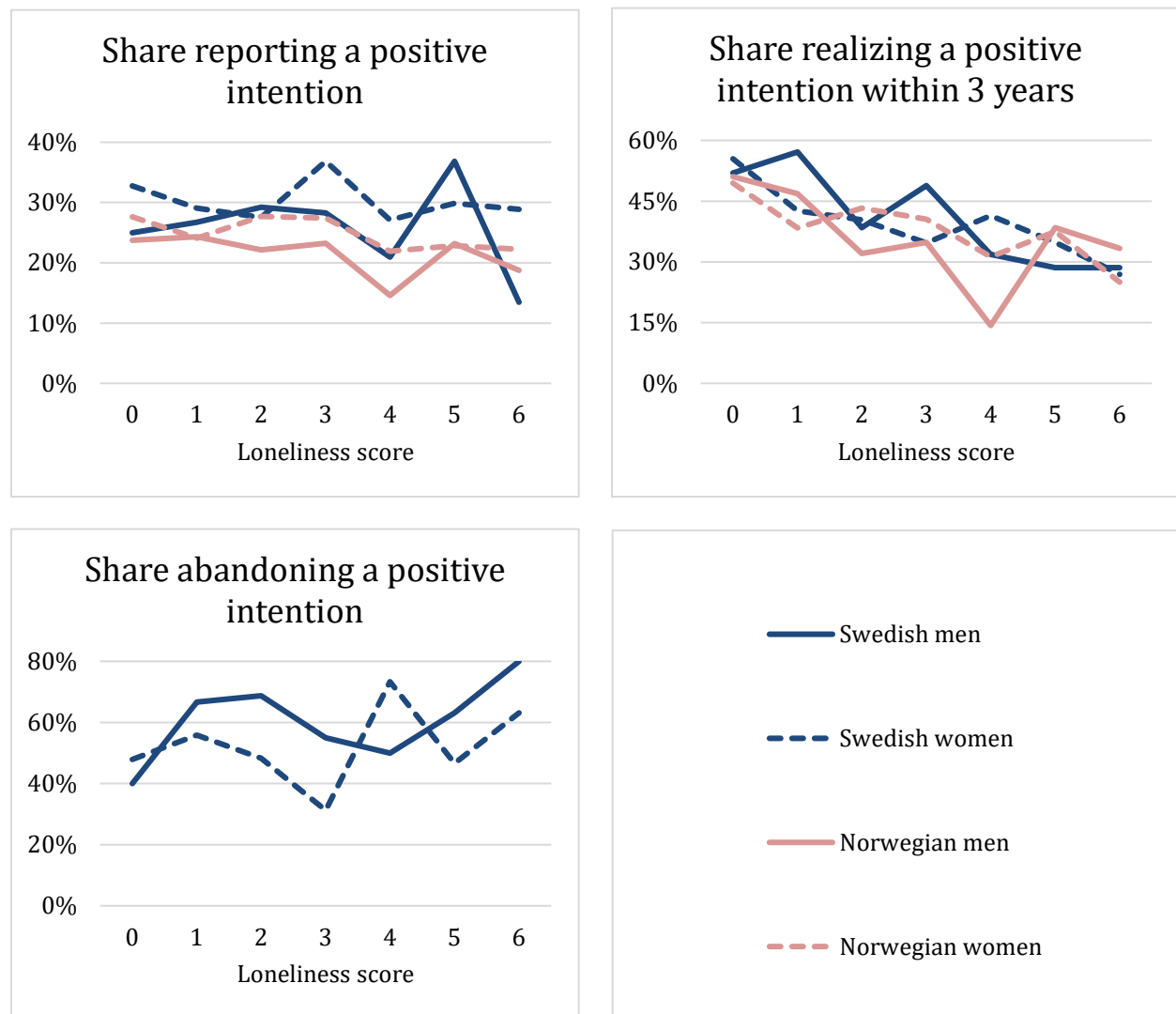
	Norway		Sweden	
	non-depressed	depressed	non-depressed	depressed
share reporting a positive intention	27.2	21.3	30.4	30.7
share realizing a positive intention within 3 years	49.3	27.8	45.7	23.9
share abandoning a positive intention			50.6	48.6

Source: Norwegian and Swedish GGS, Wave 1 + register follow-ups

Figure 1 shows bivariate relationships between loneliness and the three fertility outcomes, separately for men and women in Sweden and Norway. The lines are somewhat bumpy, reflecting the relatively small sample size available for the study. Yet, some overall patterns are discernible.

The relationship between loneliness and the propensity to report a positive fertility intention for the upcoming three years is unclear but tentatively negative for all four groups. In contrast, it is clear that a negative association between loneliness and the propensity to realize a positive fertility intention within the three-year time frame exists among all four groups. The realization rate is about 50-56 % for individuals whose loneliness score is zero but about 25-33 % for individuals whose loneliness score is 6. The association between loneliness and the propensity to abandon rather than postpone a positive fertility intention that was not realized within the stipulated three years is unclear but tentatively positive for both Swedish men and women.

Figure 1. Share reporting, realizing, and abandoning a positive fertility intention at different levels of the total loneliness score, by country and gender.



Source: Norwegian and Swedish GGS, Wave 1 + register follow-ups

5.2. Regression analyses

5.2.1 Fertility intentions

Table 3 presents the association between depression and the probability to report a positive fertility intention, separately by gender and country. Among Norwegian women, the probability to report a positive fertility intention was 5.9 percentage points lower among depressed than among non-depressed individuals. This result is statistically significant at the 5% level. Depression is also negatively associated with the propensity to report a positive fertility intention among both men

and women in Sweden. However, the AMEs are smaller and not statistically significant. Among Norwegian men, depressed individuals were instead slightly more likely than non-depressed individuals to report a positive fertility intention. However, this result is not statistically significant.

For all groups except Swedish women, the negative association between depression and the propensity to report a positive fertility intention is most evident at parity 1. For example, whereas depressed Norwegian women were less likely than non-depressed Norwegian women to report a positive fertility intention at all three parities, the difference between depressed and non-depressed women was 15.3 percentage points at parity 1, but only 6.2 percentage points at parity 0 and 2.7 percentage points at parity 2+. The result for Swedish men at parity 1 is missing because no depressed one-child father in the Swedish sample reported a positive fertility intention.

The statistically significant negative association between depression and the propensity to report a positive fertility intention found among Norwegian women remains when individuals who are not in coresidential partnerships are excluded from the analysis.

Table 3. Propensity to state a positive fertility intention by depression status. Separate logistic regressions for men in Sweden, men in Norway, women in Sweden, and women in Norway. Average marginal effects.

				Stratified by parity			Only Rs in coresidential partnerships
			Full sample	Parity 0	Parity 1	Parity 2+	
Men	Sweden	Depressed	-0.020	-0.016	—	0.004	-0.047
		n	925	455	119	351	565
	Norway	Depressed	0.024	0.042	-0.033	0.034	-0.007
		n	1690	781	211	698	1002
Women	Sweden	Depressed	-0.012	-0.020	-0.003	0.036	0.047
		n	1136	548	143	445	734
	Norway	Depressed	-0.059*	-0.062	-0.153 [†]	-0.027	-0.084*
		n	1964	835	295	834	1233

Note: Covariates in the full model: age, parity, partnership status, educational attainment, and economic activity status. The parity-stratified models include the same covariates as the full model except parity. The model that only includes respondents in coresidential partnerships include the same covariates as the full model except partnership status. The result for Swedish men at parity 1 is missing because no depressed one-child father in the Swedish sample reported a positive fertility intention.

[†] p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Source: Norwegian GGS from 2007/2008 and Swedish GGS from 2012/2013, Wave 1

Table 4 presents the association between loneliness and the probability to report a positive fertility intention, separately by gender and country. When interpreting the results, it is important to take into consideration that differences between the Norwegian and Swedish GGS in how loneliness was measured means that results for Sweden and Norway are not directly comparable.

Results do not indicate that loneliness is associated with the propensity to report a positive fertility intention among any of the analysed groups. The association is strongest among Swedish men, for whom a one-unit increase in the loneliness scale is associated with a 1.1 percentage point increase in the probability to report a positive fertility intention. However, it should be stressed that this result is not statistically significant. For Norwegian men and women and Swedish women, the AMEs are close to zero and not statistically significant.

Unlike the previous results regarding the association between depression and the propensity to report a positive fertility intention, there are no clear differences between parities in the association between loneliness and the propensity to report a positive fertility intention. Among both men and women in both Norway and Sweden, the AMEs are relatively close to zero and not statistically significant at all examined parities. The association between loneliness and the propensity to report a positive fertility intention remains weak and non-significant when excluding respondents who are not in coresidential partnerships.

Table 4. Propensity to state a positive fertility intention by loneliness score. Separate logistic regressions for men in Sweden, men in Norway, women in Sweden, and women in Norway. Average marginal effects.

				Stratified by parity			Only Rs in
			Full	Parity	Parity	Parity	coresidential
			sample	0	1	2+	partnerships
Men	Sweden	Loneliness	0.011	0.014	0.014	-0.000	0.012
		n	928	456	119	353	571
	Norway	Loneliness	0.006	-0.005	-0.002	0.007	-0.005
		n	2988	1513	357	1118	1598
Women	Sweden	Loneliness	-0.002	-0.002	-0.024	0.007	-0.000
		n	1142	554	141	447	739
	Norway	Loneliness	-0.001	-0.016	-0.019	0.007	-0.007
		n	2716	1144	405	1167	1650

Note: Covariates in the full model: age, parity, partnership status, educational attainment, and economic activity status. The parity-stratified models include the same covariates as the full model except parity. The model that only includes respondents in coresidential partnerships include the same covariates as the full model except partnership status.

† p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Source: Norwegian GGS from 2007/2008 and Swedish GGS from 2012/2013, Wave 1

5.2.2 The realization of positive fertility intentions

Table 5 presents the association between depression and the probability to realize a positive fertility intention, separately by country and gender. Results differ considerably between the groups. Among Swedish women, the probability to realize a positive fertility intention is 20.1 percentage points lower among depressed individuals than among non-depressed individuals. The AME remains largely unchanged when excluding women who are not in a coresidential partnership, indicating that the observed association for the full sample is not driven by single women and women in non-coresidential partnerships. Results for both the full sample of Swedish women and the sample that only include individuals in coresidential partnerships are statistically significant at the 5 % level.

A negative association between depression and the propensity to realize a positive fertility intention also exists among Norwegian women, among whom depressed individuals are 15.4 percentage points less likely than non-depressed individuals to realize a positive fertility intention. This result is not statistically significant at the 5 % level but at the 10 % level. When excluding

individuals who are not in a coresidential partnership, the association is slightly weaker and not statistically significant.

Among Swedish and Norwegian men, the association between depression and the probability to realize a positive fertility intention is weaker than for women and not statistically significant. For both Swedish and Norwegian men, the association between depression and intention realization is considerably stronger within the subsample that only includes individuals in a coresidential partnership compared to the full sample. However, these results do not reach statistical significance.

Table 5. Propensity to realize a positive fertility intention, by depression status. Separate logistic regressions for men in Sweden, men in Norway, women in Sweden, and women in Norway. Average marginal effects.

			Full sample	Only Rs in coresidential partnerships
Men	Sweden	Depressed	0.000	0.080
		n	245	180
	Norway	Depressed	-0.078	-0.255
		n	391	271
Women	Sweden	Depressed	-0.201*	-0.216*
		n	346	265
	Norway	Depressed	-0.154 [†]	-0.113
		n	523	381

Note: Covariates in the full model: age, parity, partnership status, educational attainment, and economic activity status. The model that only includes respondents in coresidential partnerships include the same covariates as the full model except partnership status.

[†] p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Source: Norwegian GGS from 2007/2008 and Swedish GGS from 2012/2013, Wave 1 + register follow-ups

Table 6 presents the association between loneliness and the probability to realize a positive fertility intention, separately by gender and country. It is important to take into consideration that results for Sweden and Norway are not directly comparable due to differences between the Norwegian and Swedish GGS in how loneliness was measured.

Loneliness is negatively associated with intention realization among all groups, i.e. both men and women in both Norway and Sweden. Among Swedish women, a one-unit increase in the loneliness scale is associated with a 3.2 percentage point decrease in the probability to realize a positive fertility intention. This result is statistically significant at the 5 % level. The AME remains

largely unchanged and statistically significant when excluding individuals who are not in a coresidential partnership. Thus, the association observed for the full sample is not driven by single women and women in non-coresidential partnerships.

For the other groups (i.e., Norwegian men and women and Swedish men), the AMEs vary between -1.4 and -2.8 percentage points. However, these results are not statistically significant. Similar to Swedish women, the AMEs remain relatively similar when individuals who are not in a coresidential partnership are excluded.

Table 6. Propensity to realize a positive fertility intention, by loneliness score, country, and gender. Logistic regressions, average marginal effects.

			Full sample	Only Rs in coresidential partnerships
Men	Sweden	Loneliness	-0.028 [†]	-0.031
		n	246	182
	Norway	Loneliness	-0.023	-0.028
		n	691	449
Women	Sweden	Loneliness	-0.032*	-0.033*
		n	350	270
	Norway	Loneliness	-0.014	-0.007
		n	722	507

Note: Covariates in the full model: age, parity, partnership status, educational attainment, and economic activity status. The model that only includes respondents in coresidential partnerships include the same covariates as the full model except partnership status.

[†] p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Source: Norwegian GGS from 2007/2008 and Swedish GGS from 2012/2013, Wave 1 + register follow-ups

5.2.3 Abandonment and postponement of non-realized positive fertility intentions

Table 7 presents the association between depression/loneliness and the probability to abandon rather than postpone a positive fertility intention that was not realized within the three-year time frame. Due to data restrictions, this part of the analysis only uses data from the Swedish GGS. Results should be interpreted with caution due to the small sample size.

Depressed Swedish men were 32.6 percentage points more likely than non-depressed Swedish men to abandon their intention. This result is statistically significant at the 5 % level but should be interpreted with great caution due to small cell size (there was only one case of postponement among depressed men in the full sample). Results point in the same direction for women but are not statistically significant. Loneliness is associated with an increased probability

of intention abandonment, among both men and women. However, these results are not statistically significant. The AMEs increase somewhat when respondents who are not in a coresidential partnership are excluded. We do not report results for the association between depression and the propensity to abandon a positive fertility intention among men due to small cell size (no case of postponement among depressed men in a coresidential partnership).

Table 7. Propensity to abandon a positive fertility intention, by depression status/loneliness score and gender. Only Swedish respondents. Logistic regressions, average marginal effects.

		Full sample	Only Rs in coresidential partnerships
Men	Depressed	0.326*	–
	n	134	76
Women	Depressed	0.025	0.037
	n	195	129
Men	Loneliness	0.014	0.036
	n	133	79
Women	Loneliness	0.026	0.028
	n	195	130

Note: Covariates in the full model: age, parity, partnership status, educational attainment, and economic activity status. The model that only includes respondents in coresidential partnerships include the same covariates as the full model except partnership status. The result for the association between depression and postponement/abandonment among men is missing because no depressed man in a coresidential partnership postponed their intention.

† p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Source: Swedish GGS from 2012/2013, Wave 1 + register follow-ups

6. Discussion and conclusion

This study examined how depression and loneliness are associated with three fertility outcomes: the propensity to state a positive fertility intention for the upcoming three years, the propensity to realize a positive fertility intention within the stipulated three-year time frame, and the propensity to abandon rather than postpone a positive fertility intention that was not realized within the three-year time frame.

Results show that depression and loneliness can have negative effects on fertility. To summarize, the statistically significant results are as follows. First, depression is negatively associated with the propensity to report a positive fertility intention among Norwegian women (Table 3). Second, both depression and loneliness are negatively associated with the propensity to realize a positive fertility intention among Swedish women (Tables 5 and 6). Third, depression is

associated with an increased propensity to abandon rather than postpone a positive fertility intention that was not realized within the given three-year time frame among Swedish men (Table 7). Mostly, the non-significant results also point in the same direction, i.e. that depression and loneliness are negatively associated with fertility.

We suggested three mechanisms through which depression and loneliness may affect fertility: (1) altered childbearing plans, (2) indirect effects via partnership status, employment status, and other factors, and (3) reduced fecundity (at least for the effect of depression on intention realization and postponement/abandonment). The negative association between depression and the propensity to report a positive fertility intention observed among Norwegian women indicates that changes to childbearing plans can be at least part of the explanation. This association holds when controlling for both partnership and employment status, as well as other demographic and socioeconomic factors that are known to influence fertility intentions, which suggests that indirect effects cannot fully explain the lower propensity to report a positive fertility intention among depressed individuals.

Except for Swedish men, both depression and loneliness have a larger negative effect on the propensity to realize a positive fertility intention than on the propensity to report a positive fertility intention. A possible interpretation is that many depressed and lonely individuals with a fertility desire report a positive intention at interview in the hope that their mental health status will improve within the three-year period to which the intention refers. However, the hope for future improvement in mental health status may turn out to be over-optimistic, leading to postponement or abandonment and thus non-realization of the intention expressed at interview. The negative associations between depression/loneliness and the propensity to realize a positive fertility intention observed among Swedish women hold when controlling for relevant demographic and socioeconomic factors. However, these factors are only measured at interview, whereas changes to demographic and socioeconomic conditions between interview and follow-up are unobserved. Similarly, we did not have data on fecundity after interview. To identify which of the three suggested mechanisms matter more for intention realization and postponement/abandonment of fertility intentions, longitudinal data where depression and loneliness status, fertility intentions, and potential mediating demographic, socioeconomic, and fecundity-related variables are measured at multiple time points are needed.

For all groups except Swedish women, the effect of depression on the propensity to state a positive fertility intention seems to be more negative at parity 1 than at other parities. A possible explanation is the strong two-child norm present in Sweden and Norway, especially at the time of interview. Since the great majority of one-child parents progress to have a second child, the potential impact of a factor that tends to affect the propensity to report a positive intention negatively may be most noticeable at parity 1. It is possible that the parity-specific effect of depression varies across contexts depending on parity-specific fertility norms and behaviours. The parity-specific effect of happiness, subjective well-being, and life satisfaction on fertility have been shown to vary across contexts, with the effect being stronger at parity 0 in some contexts but stronger at parity 1 in others (Aassve et al., 2016; Le Moglie et al. 2015; Mencarini et al. 2018).

Results do not indicate that effects of depression/loneliness on the three fertility outcomes are stronger among singles and individuals in non-coresidential partnerships than among individuals in coresidential partnerships. In most cases, point estimates are similar for the full sample and the subsample that only includes individuals in coresidential partnerships. The finding that the effect of loneliness on fertility is similar for individuals with and without a coresident partner is especially interesting since the meaning of being lonely should differ between the two groups.

Another interesting finding relates to gender differences in the effect of depression. In Norway, there is a negative association between depression and the propensity to report a positive fertility intention among women but not among men. In Sweden, the negative association between depression and the propensity to realize a positive fertility intention is stronger among women than among men. Furthermore, controlling for demographic and socioeconomic factors explains the association between depression and the propensity to realize a positive fertility intention among Swedish men whereas the association remains among Swedish women. Further research is needed to explore the reasons for such gender and country differences in the relationship between mental health and fertility.

Since causality may run in both directions between mental health and fertility, we adopted an analytical setup that facilitates the establishment of the time ordering of depression/loneliness status and fertility. This contrasts to earlier studies that examined the association between depression and fertility which did not seek to determine the time ordering (Golovina et al., 2022; Power et al., 2013). In our study, it is clear that the measurement of depression and loneliness

status at interview precedes the realization and postponement/abandonment, which are measured months or years after interview. Whereas depression, loneliness, and the fertility intention are all measured at interview, relevant theory, such as the Theory of Planned Behavior, suggests that a fertility intention should incorporate consideration of current circumstances (Ajzen & Klobas, 2013). If the fertility intention for the upcoming three years is expressed taking current depression or loneliness status into consideration, depression and loneliness status should precede the fertility intention.

There are both advantages and disadvantages associated with the data used in the study. First, future research should aim to use data that include longitudinal measurement of both mental health status and the fertility indicator in question. This would facilitate the establishment of the time ordering between mental health status and fertility to an even greater extent than was possible in the present study. Moreover, since depression and loneliness are only measured at a single time point, our estimates of their associations with intention realization and postponement/abandonment are likely to be conservative. If mental health status affects the propensity to realize a positive fertility intention and the propensity to either postpone or abandon a non-realized positive intention, not only the status at interview but also the status at subsequent time points should matter for the fertility outcome.

Second, the present study uses data where depression is measured through a self-administered questionnaire rather than measures based on evaluations by a medical professional, such as diagnosis, prescriptions of antidepressants, or specialist visits. Both type of measure may be associated with different types of bias. Measures originating in the healthcare system may be biased because individuals who are registered with depression in the healthcare system may not be fully representative of the overall depressed population. A large set of factors may influence health-seeking behaviour among depressed individuals, for example gender, socioeconomic status, urban/rural residence, and comorbidities (Magaard et al., 2017). Survey-based measures of depression may also be biased due to unrepresentative response patterns and self-report bias on the relatively sensitive topic of mental wellbeing. Future research should use data on depression from multiple types of sources to substantiate findings.

Third, the relatively small sample size reduced statistical power especially for the realization and postponement/abandonment parts of the analysis. This should be taken into consideration when interpreting the results. However, the register-based follow-ups to the Swedish and

Norwegian GGSs are an important strength of the data since they ensured minimal attrition between interview and follow-up. The register-based follow-ups meant both that the sample size was maintained at reasonable levels at follow-ups and that non-response bias at follow-up was completely avoided.

Whereas earlier research has identified a wide set of factors that may influence childbearing patterns (Balbo et al., 2013), the potential effect of mental health status on fertility is an underexplored topic. To our knowledge, the present study is the first to examine the effect of loneliness on fertility. Whereas earlier research has explored the association between depression and actual fertility, this study is to our knowledge the first to examine how depression relate to fertility preferences and the realization of fertility preferences. By analysing how two specific mental health issues may affect fertility, our study extends earlier research that have found general well-being measures, such as life satisfaction, subjective well-being, and happiness, to have a positive effect on fertility (Aassve et al., 2016; Cetre et al., 2016; Le Moglie et al., 2015; Luppi & Mencarini, 2018; Mencarini et al., 2018; Perelli-Harris, 2006; Spéder & Kapitány, 2009). In addition to bringing attention to an underexplored predictor of childbearing patterns, our study also contributes to the understanding of the consequences of depression and loneliness, which are two common mental health issues in European and North American societies (Arias-de la Torre et al., 2021; Berlingieri et al., 2023; Ettman et al., 2020).

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Appendix Table 1. Descriptive statistics of the respective samples, Norway. Values for categorical variables represent percentages.

	Intention, depression sample		Intention, loneliness sample		Realization, depression sample		Realization, loneliness sample	
	Men	Women	Men	Women	Men	Women	Men	Women
Depression								
no	95.03	91.40	95.13	91.41	94.88	93.12	95.36	93.10
yes	4.97	8.60	4.87	8.59	5.12	6.88	4.64	6.90
Loneliness								
mean	0.73	0.91	0.74	0.93	0.65	0.85	0.70	0.87
(standard dev.)	(1.20)	(1.31)	(1.20)	(1.34)	(1.09)	(1.26)	(1.17)	(1.28)
Partnership status								
coresidential	59.29	62.78	53.48	60.75	69.31	72.85	64.98	70.22
non-coresid.	12.43	12.42	14.49	12.81	15.09	13.58	17.22	14.40
single	28.28	24.80	32.03	26.44	15.60	13.58	17.80	15.37
Parity								
childless	46.21	42.52	50.64	42.12	56.01	57.55	57.89	56.65
1 child	12.49	15.02	11.95	14.91	27.11	31.55	26.19	30.61
2+ children	41.30	42.46	37.42	42.97	16.88	10.90	15.92	12.74
Age								
<25 years	18.58	21.79	22.79	22.53	9.46	18.55	12.30	20.91
25-34 years	28.58	31.57	28.85	31.48	56.01	62.72	53.84	59.97
35+ years	52.84	46.64	48.36	45.99	34.53	18.74	33.86	19.11
Education level								
no univ. educ.	61.95	45.77	66.27	49.93	56.01	34.23	61.07	40.03
univ. educ.	37.81	53.67	33.33	49.52	43.48	65.01	38.35	59.14
missing	0.24	0.56	0.40	0.55	0.51	0.76	0.58	0.83
Employment status								
employed	82.54	73.27	81.26	72.79	89.77	77.82	90.01	77.84
other	17.40	26.58	18.71	27.10	9.97	21.99	9.84	22.02
missing	0.06	0.15	0.03	0.11	0.26	0.19	0.14	0.14
n	1964	1690	2716	2988	523	391	722	691

Source: Norwegian GGS from 2007/2008, Wave 1 + register follow-up

Appendix Table 2. Descriptive statistics of the respective samples, Sweden. Values for categorical variables represent percentages.

	Intention sample				Realization sample				Postponement/abandonment sample			
	Depression		Loneliness		Depression		Loneliness		Depression		Loneliness	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Depression												
no	91.57	86.80	91.81	86.76	93.88	86.71	94.24	86.88	91.79	82.05	92.42	81.96
yes	8.43	13.20	8.19	13.24	6.12	13.29	5.76	13.12	8.21	17.95	7.58	18.04
Loneliness												
mean	2.23	2.05	2.24	2.05	2.21	1.99	2.22	2.00	2.44	2.29	2.43	2.29
(s.d.)	(1.80)	(1.93)	(1.80)	(1.93)	(1.74)	(1.92)	(1.73)	(1.92)	(1.79)	(1.97)	(1.78)	(1.96)
Partnership status												
coresidential	61.08	64.61	61.53	64.71	73.47	76.59	73.98	77.14	58.96	66.15	59.40	66.67
non-coresid.	9.51	11.27	9.70	10.95	8.16	10.40	8.54	10.00	12.69	13.85	13.53	13.33
single	29.41	24.12	28.77	24.34	18.37	13.01	17.48	12.86	28.36	20.00	27.07	20.00
Parity												
childless	49.19	48.24	49.14	48.51	57.55	57.23	57.72	57.71	68.66	66.15	68.42	65.64
1 child	12.86	12.59	12.82	12.35	28.16	27.17	28.05	26.29	17.16	17.44	17.29	17.44
2+ children	37.95	39.17	38.04	39.14	14.29	15.61	14.23	16.00	14.18	16.41	14.29	16.92
Age												
<25 years	20.22	26.50	20.37	26.44	12.65	17.34	12.60	16.86	18.66	21.03	18.05	20.51
25-34 years	29.62	35.04	29.63	35.29	53.88	68.21	53.66	68.86	43.28	62.05	43.61	62.56
35+ years	50.16	38.47	50.00	38.27	33.47	14.45	33.74	14.29	38.06	16.92	38.35	16.92
Education level												
no univ. educ.	62.70	56.34	63.04	56.30	53.88	46.24	54.47	46.00	59.70	49.23	60.15	49.23
univ. educ.	37.30	43.66	36.96	43.70	46.12	53.76	45.53	54.00	40.30	50.77	39.85	50.77
missing												

(continued)

Appendix Table 2, continued

Employment												
status												
employed	78.92	65.67	78.77	65.32	82.45	64.16	82.52	64.00	79.85	62.56	80.45	62.05
other	21.08	34.33	21.23	34.68	17.55	35.84	17.48	36.00	20.15	37.44	19.55	37.95
missing												
n	925	1136	928	1142	245	346	246	350	134	195	132	194

Source: Swedish GGS from 2012/2013, Wave 1 + register follow-ups

Appendix Table 3a. Propensity to state a positive fertility intention by depression status. Separate logistic regressions for men in Sweden, men in Norway, women in Sweden, and women in Norway. Average marginal effects. Models controlling for general health in addition to the control variables included in the main analysis.

				Stratified by parity			Only Rs in
			Full	Parity	Parity	Parity	coresidential
			sample	0	1	2+	partnerships
Men	Sweden	Depressed	-0.016	-0.006	—	-0.000	-0.039
		n	925	455	119	351	565
	Norway	Depressed	0.018	0.046	-0.049	0.015	-0.02
		n	1690	781	211	698	1002
Women	Sweden	Depressed	-0.009	-0.015	-0.001	0.056	0.051
		n	1136	548	143	445	734
	Norway	Depressed	-0.053*	-0.054	-0.128	-0.026	-0.074*
		n	1964	835	295	834	1233

Note: Covariates in the full model: age, parity, partnership status, educational attainment, economic activity status, and general health. The parity-stratified models include the same covariates as the full model except parity. The model that only includes respondents in coresidential partnerships include the same covariates as the full model except partnership status. The result for Swedish men at parity 1 is missing because no depressed one-child father in the Swedish sample reported a positive fertility intention.

† p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Source: Norwegian GGS from 2007/2008 and Swedish GGS from 2012/2013, Wave 1

Appendix Table 3b. Average predicted probability to state a positive fertility intention for non-depressed respondents. Separate logistic regressions for men in Sweden, men in Norway, women in Sweden, and women in Norway.

			Full sample	Stratified by parity			Only Rs in coresidential partnerships
				Parity 0	Parity 1	Parity 2+	
Men	Sweden	Depressed	0.266	0.311	0.603	0.099	0.321
		n	925	455	119	351	565
	Norway	Depressed	0.230	0.278	0.504	0.094	0.271
		n	1690	781	211	698	1002
Women	Sweden	Depressed	0.306	0.365	0.658	0.118	0.356
		n	1136	548	143	445	734
	Norway	Depressed	0.273	0.368	0.577	0.070	0.316
		n	1964	835	295	834	1233

Note: Covariates in the full model: age, parity, partnership status, educational attainment, and economic activity status. The parity-stratified models include the same covariates as the full model except parity. The model that only includes respondents in coresidential partnerships include the same covariates as the full model except partnership status.

Source: Norwegian GGS from 2007/2008 and Swedish GGS from 2012/2013, Wave 1

Appendix Table 4a. Propensity to state a positive fertility intention by loneliness score. Separate logistic regressions for men in Sweden, men in Norway, women in Sweden, and women in Norway. Average marginal effects. Models controlling for general health in addition to the control variables included in the main analysis.

				Stratified by parity			Only Rs in
			Full	Parity	Parity	Parity	coresidential
			sample	0	1	2+	partnerships
Men	Sweden	Loneliness	0.011	0.015	0.015	-0.000	0.012
		n	928	456	119	353	571
	Norway	Loneliness	0.005	-0.005	-0.001	0.005	-0.005
		n	2988	1513	357	1118	1598
Women	Sweden	Loneliness	-0.001	-0.001	-0.024	0.009	0.001
		n	1142	554	141	447	739
	Norway	Loneliness	-0.001	-0.017	-0.015	0.008	-0.006
		n	2716	1144	405	1167	1650

Note: Covariates in the full model: age, parity, partnership status, educational attainment, economic activity status, and general health. The parity-stratified models include the same covariates as the full model except parity. The model that only includes respondents in coresidential partnerships include the same covariates as the full model except partnership status.

† p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Source: Norwegian GGS from 2007/2008 and Swedish GGS from 2012/2013, Wave 1

Appendix Table 4b. Average predicted probability to state a positive fertility intention for respondents whose loneliness score was zero. Separate logistic regressions for men in Sweden, men in Norway, women in Sweden, and women in Norway.

			Full sample	Stratified by parity			Only Rs in coresidential partnerships
				Parity 0	Parity 1	Parity 2+	
Men	Sweden	Loneliness	0.242	0.281	0.550	0.100	0.296
		n	928	456	119	353	571
	Norway	Loneliness	0.227	0.271	0.511	0.093	0.285
		n	2988	1513	357	1118	1598
Women	Sweden	Loneliness	0.310	0.370	0.699	0.113	0.366
		n	1142	554	141	447	739
	Norway	Loneliness	0.268	0.371	0.564	0.074	0.313
		n	2716	1144	405	1167	1650

Note: Covariates in the full model: age, parity, partnership status, educational attainment, and economic activity status. The parity-stratified models include the same covariates as the full model except parity. The model that only includes respondents in coresidential partnerships include the same covariates as the full model except partnership status.

Source: Norwegian GGS from 2007/2008 and Swedish GGS from 2012/2013, Wave 1

Appendix Table 5a. Propensity to realize a positive fertility intention by depression status. Separate logistic regressions for men in Sweden, men in Norway, women in Sweden, and women in Norway. Average marginal effects. Models controlling for general health in addition to the control variables included in the main analysis.

			Full sample	Only Rs in coresidential partnerships
Men	Sweden	Depressed	0.001	0.077
		n	245	180
	Norway	Depressed	-0.079	-0.257
		n	391	271
Women	Sweden	Depressed	-0.201*	-0.216*
		n	346	265
	Norway	Depressed	-0.154 [†]	-0.110
		n	523	381

Note: Covariates in the full model: age, parity, partnership status, educational attainment, economic activity status, and general health. The parity-stratified models include the same covariates as the full model except parity. The model that only includes respondents in coresidential partnerships include the same covariates as the full model except partnership status.

[†] p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Source: Norwegian GGS from 2007/2008 and Swedish GGS from 2012/2013, Wave 1 + register follow-ups

Appendix Table 5b. Average predicted probability to realize a positive fertility intention for non-depressed respondents. Separate logistic regressions for men in Sweden, men in Norway, women in Sweden, and women in Norway.

			Full sample	Only Rs in coresidential partnerships
Men	Sweden	Depressed	0.437	0.558
		n	245	180
	Norway	Depressed	0.490	0.620
		n	391	271
Women	Sweden	Depressed	0.454	0.538
		n	346	265
	Norway	Depressed	0.488	0.563
		n	523	381

Note: Covariates in the full model: age, parity, partnership status, educational attainment, and economic activity status. The parity-stratified models include the same covariates as the full model except parity. The model that only includes respondents in coresidential partnerships include the same covariates as the full model except partnership status.

Source: Norwegian GGS from 2007/2008 and Swedish GGS from 2012/2013, Wave 1 + register follow-ups

Appendix Table 6a. Propensity to realize a positive fertility intention by loneliness score. Separate logistic regressions for men in Sweden, men in Norway, women in Sweden, and women in Norway. Average marginal effects. Models controlling for general health in addition to the control variables included in the main analysis.

			Full sample	Only Rs in coresidential partnerships
Men	Sweden	Loneliness	-0.029 [†]	-0.032
		n	246	182
	Norway	Loneliness	-0.023	-0.026
		n	691	449
Women	Sweden	Loneliness	-0.033*	-0.033*
		n	350	270
	Norway	Loneliness	-0.013	-0.004
		n	722	507

Note: Covariates in the full model: age, parity, partnership status, educational attainment, economic activity status, and general health. The parity-stratified models include the same covariates as the full model except parity. The model that only includes respondents in coresidential partnerships include the same covariates as the full model except partnership status.

[†] p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Source: Norwegian GGS from 2007/2008 and Swedish GGS from 2012/2013, Wave 1 + register follow-ups

Appendix Table 6b. Average predicted probability to realize a positive fertility intention for respondents whose loneliness score was zero. Separate logistic regressions for men in Sweden, men in Norway, women in Sweden, and women in Norway.

			Full sample	Only Rs in coresidential partnerships
Men	Sweden	Loneliness	0.503	0.630
		n	246	182
	Norway	Loneliness	0.476	0.607
		n	691	449
Women	Sweden	Loneliness	0.498	0.580
		n	350	270
	Norway	Loneliness	0.466	0.541
		n	722	507

Note: Covariates in the full model: age, parity, partnership status, educational attainment, and economic activity status. The parity-stratified models include the same covariates as the full model except parity. The model that only includes respondents in coresidential partnerships include the same covariates as the full model except partnership status.

Source: Norwegian GGS from 2007/2008 and Swedish GGS from 2012/2013, Wave 1 + register follow-ups

Appendix Table 7a. Propensity to abandon a positive fertility intention, by depression status/loneliness score and gender. Only Swedish respondents. Logistic regressions, average marginal effects. Models controlling for general health in addition to the control variables included in the main analysis.

		Full sample	Only Rs in coresidential partnerships
Men	Depressed	0.326*	–
	n	134	76
Women	Depressed	0.023	0.032
	n	195	129
Men	Loneliness	0.013	0.034
	n	133	79
Women	Loneliness	0.026	0.027
	n	195	130

Note: Covariates in the full model: age, parity, partnership status, educational attainment, economic activity status, and general health. The model that only includes respondents in coresidential partnerships include the same covariates as the full model except partnership status. The result for the association between depression and postponement/abandonment among men is missing because no depressed man in a coresidential partnership postponed their intention.

† p<0.1, * p<0.05, ** p<0.01, *** p<0.001

Source: Swedish GGS from 2012/2013, Wave 1 + register follow-ups

Appendix Table 7b. Average predicted probability to abandon a positive fertility intention for respondents who were non-depressed or whose loneliness score was zero. Separate logistic regressions for men in Sweden, men in Norway, women in Sweden, and women in Norway.

		Full sample	Only Rs in coresidential partnerships
Men	Depressed	0.565	0.487
	n	134	76
Women	Depressed	0.498	0.504
	n	195	129
Men	Loneliness	0.553	0.423
	n	133	79
Women	Loneliness	0.441	0.452
	n	195	130

Note: Covariates in the full model: age, parity, partnership status, educational attainment, and economic activity status. The parity-stratified models include the same covariates as the full model except parity. The model that only includes respondents in coresidential partnerships include the same covariates as the full model except partnership status.

Source: Swedish GGS from 2012/2013, Wave 1 + register follow-ups

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