

ARTICLE

Selection into maternity leave length and long-run maternal health in Germany

Lara Bister¹ , Peter Eibich², Roberta Rutigliano^{3,4}, Mine Kühn^{5,6} and Karen van Hedel⁷

¹Population Research Centre, Faculty of Spatial Sciences, University of Groningen, Groningen, Netherlands, ²LEDa-LEGOS, Université Paris Dauphine, Paris, France, ³Department of Sociology and Social Work, University of the Basque Country (UPV/EHU), Leioa, Spain, ⁴Research Group on Social Determinants of Health and Demographic Change—OPIK, Leioa, Spain, ⁵Department of Sociology, School of Social and Behavioral Sciences, Tilburg University, Tilburg, Netherlands, ⁶Max Planck Institute for Demographic Research, Rostock, Germany and ⁷Faculty of Social and Behavioural Sciences, Utrecht University, Utrecht, Netherlands

Corresponding author: Lara Bister; Email: l.bister@rug.nl

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Abstract

Existing literature shows the importance of maternity leave as a strategy for women to balance work and family responsibilities. However, only a few studies focused on the long-run impact of maternity leave length on maternal health. Therefore, how exactly they are related remains unclear. We examine women's selection into different lengths of maternity leave as a potential explanation for the inconclusive findings in the literature on the association between maternity leave and maternal health. This study aims to unravel the association between maternity leave length and mothers' long-term health in Germany. Drawing on detailed data from the German Statutory Pension Fund (DRV), we estimated the association between maternity leave length and sick leave from 3 years following their child's birth for 4,243 women living in Germany in 2015 by applying discrete-time logistic regression. Our results show a negative relationship between maternity-leave length and long-term maternal health, likely driven by negative health selection. Long maternity leaves of more than 24 months were associated with worse maternal health in the long run, while a positive association emerged for vulnerable women with pre-existing health problems.

Keywords: maternal health; maternity leave

Introduction

Maternity leave, i.e., a period of absence from work granted to mothers before and after their child's birth, represents a common work-family reconciliation strategy to allow women to recover from childbirth and handle their new care responsibilities for the newborn (Grace et al., 2006).

The literature shows that maternity leave has a positive and relieving impact on maternal health for new mothers (see Aitken et al., 2015 for review; Butikofer et al., 2018), yet there is no clear consensus on how the *maternity leave length* affects

maternal health and through which mechanisms. Most previous findings range from positive to no association between maternity leave length and maternal health (Avendano et al., 2015; Baker & Milligan, 2007; Chatterji & Markowitz, 2012; Courtin et al., 2022; Dagher et al., 2014; Heshmati et al., 2023; Kornfeind & Sipsma, 2018; B. C. Lee et al., 2020; Mandal, 2018; Staehelin et al., 2007). However, there is also evidence for a negative association between maternity leave length and maternal health (cf. Chuard, 2023; Guertzgen & Hank, 2018). Specifically, extended maternity leave entitlements may allow women with poor health a more extended recovery period after the child's birth and eventually to return to their work. In contrast, these women might drop out of the labour market if only entitled to a shorter recovery period. Hence, more vulnerable women's return to work after an extended leave potentially fosters adverse health selection and might drive the negative association between maternity leave length and health.

These mixed findings may be attributed to (1) differences in the approaches used to operationalise maternal health, i.e. short- (e.g., McGovern et al., 1997) versus long-term health (e.g., Avendano et al., 2015; Butikofer et al., 2018); (2) differences in the cultural and policy contexts of the leave entitlements provided by maternity protection policies (e.g., Avendano et al., 2015; Baker & Milligan, 2007; Chuard, 2023; Guertzgen & Hank, 2018); and (3) the length of leave taken or available (e.g., Chatterji & Markowitz, 2012; Dagher et al., 2014).

While the literature agrees on a positive relationship between (paid) maternity leave and maternal health (cf. Bullinger, 2019; B. C. Lee et al., 2020), only a few studies evaluated the effects of extending maternity leave entitlements (Avendano et al., 2015; Baker & Milligan, 2007; Chuard, 2023; Courtin et al., 2022; Guertzgen & Hank, 2018). Therefore, research on how the maternity leave length affects maternal health is currently lacking. Furthermore, most of these studies focused either on mothers' health outcomes in the immediate period up to several months after the child's birth or at a specific point later in life, e.g., in later adulthood (50 years and older). Little is known about how long-term health outcomes develop over several years directly following women's maternity leave. Understanding the relationship between the actual maternity leave length and mothers' long-term health is highly relevant to implement effective policies and protect maternal health in the long run.

We address these research gaps by investigating the role of maternity leave length on long-term maternal health after the transition to motherhood. Building on Guertzgen and Hank (2018), we also explore the role of possible selection mechanisms into different lengths of maternity leave for long-term maternal health with a particular focus on women's health status before motherhood.

We aim to answer the following research questions:

- (1) What is the association between maternity leave length and maternal health in the medium- and long-run (i.e., between 3 and 27 years after the child's birth)?
- (2) How does the association vary with women's characteristics (e.g., socioeconomic background, health status)?

Taking advantage of monthly administrative data from the German Statutory Pension Fund (DRV), we determined the exact maternity leave length each woman

took. We measured maternal health using the incidence of long-term sick leave (>6 weeks). This health indicator provides an objective and reliable health measure through its controlled implementation by an official physician-certified sick leave (Guertzgen & Hank, 2018; Knieps & Pfaff, 2015). Moreover, this unique data allows us to follow mothers' cohorts born between 1960 and 1979 (who were exposed to different legislations and maternity leave policies) starting 3 years after the transition to motherhood with a maximum followup of 27 years for first-time mothers in Germany.

Our study makes three contributions to the existing literature: First, we consider the actual maternity leave length rather than legal entitlements; second, we study women's medium- and long-run health outcomes after taking maternity leave of different lengths; and third, we consider relevant selection mechanisms into different maternity leave lengths, in particular pre-existing health problems. We find that, in general, the probability of experiencing a long-term sick leave from work increases with the maternity leave length. This pattern likely reflects selection effects because women with pre-existing health problems tend to take more extensive maternity leave and are more likely to experience health problems after the transition to motherhood. However, when focusing on women with pre-existing health problems, we found that the probability of experiencing a long-term sick leave decreased with the maternity leave length, thus indicating a protective effect of more extensive maternity leave for vulnerable women.

Background

The selection into different lengths of maternity leave

Differences in the maternity leave length arise partly due to different legal entitlements of maternity leave across cohorts and between countries. However, the actual length of leave taken might be influenced by women's characteristics and their social environment. The literature on selection mechanisms into different lengths of maternity leave has identified several drivers, including *opportunity costs*, *negative health selection*, and *mothering ideology*. *Opportunity costs* can be monetary and non-monetary (Gebel, 2010; McIntosh et al., 2012). Monetary opportunity costs include wages lost for the time taken off work for maternity leave (Barnes, 2014; Spiess & Wrohlich, 2008). Non-monetary opportunity costs include foregone career opportunities or professional disadvantages suffered due to absence from work (Gebel, 2010; McIntosh et al., 2012). These monetary and non-monetary systematic disadvantages mothers experience have been referred to collectively as the *motherhood penalty* (see Collins, 2020 and Guzzo & Hayford, 2020 for review). The motherhood penalty can result in long-term gaps in pay and career advancement between mothers and non-mothers (Budig & England, 2001; Correll et al., 2007; Cukrowska-Torzewska & Matysiak, 2020; Hipp, 2020). Depending on a woman's career level, the prospect of suffering a motherhood penalty might strongly influence the length of her maternity leave (cf. England et al., 2016) and, as a result, her maternal health.

Negative health selection might entice women with poor health to choose a more extensive maternity leave. Women who would have otherwise dropped out of the

labour force might aim to use their leave to recover from the transition into motherhood as much as possible to return to the labour market (Guertzgen & Hank, 2018).

Moreover, the selection into a certain maternity leave length may be influenced by individual expectations of motherhood, personal preferences, and mothering ideologies (Johnston & Swanson, 2006; Spiess & Wrohlich, 2008). The latter, in particular, is a powerful social force. For example, an *intensive mothering* ideology transmits women a child-centred and absolutistic approach to motherhood, under which their own needs are subordinated (Hays, 1998). Subsequently, women may feel pressured to meet the social expectations of being a 'good mother' and, because of that, take more extensive maternity leave. On the other hand, societal norms may also pressure mothers to put preschool children in full-time formal childcare and return to work early on (Ellingsæter et al., 2017), regardless of their own desires and needs.

Maternity leave and maternal health

Following a broader definition, maternity leave refers to a mother's temporary absence from work due to childrearing and care responsibilities and is traditionally granted to mothers for a limited period around the time of their child's birth. For mothers who give birth, maternity leave aims to protect the pregnant woman's and foetus' health and, later in the post-partum period, allow her to recover from physical changes experienced during pregnancy and childbirth. However, irrespective of biological motherhood, maternity leave is also fundamental to mothers in supporting the emotional adaptation to the new situation, bonding with the newborn, and facilitating the reconciliation of motherhood with existing commitments (e.g., work) (Gornick & Meyers, 2005). Furthermore, nearly all previous studies that analysed maternal health across countries with substantial variation in maternity leave entitlements found that taking any maternity leave is positively associated with maternal health compared to not taking maternity leave (Burgess et al., 2008; Dagher et al., 2014; Grace et al., 2006; McGovern et al., 1997; see Aitken et al., 2015 and Staehelin et al., 2007 for review).

Maternity leave length and health

A growing body of research suggests that women who became mothers through childbirth have not fully recovered from giving birth by the end of the post-partum period (defined as 6 weeks starting about an hour after the delivery of the placenta), but that they can experience physical and mental health problems up to 2 years after childbirth (e.g., see Cheng & Li, 2008 and Gaynes et al., 2005 for review).

Carlander and colleagues (2015) found that maternal health complaints such as sleeping problems, negative emotional well-being and impairments in family functioning were more prevalent 5 years after than immediately after their child's birth. Thus, it seems plausible that not only the availability but also the length of the leave period matters for maternal health, as more extended leaves offer women more time for recovery and adaptation to their new role.

Studies on the short-run health consequences mainly examined short maternity leaves of up to 6 months. For example, taking maternity leave shorter than 12 weeks is associated with increased rates of post-partum depression (Kornfeind & Sipsma, 2018) and a higher risk of physical and mental illness (Dagher et al., 2014). Furthermore, taking a maternity leave longer than 6 weeks – regardless of whether paid or unpaid – was associated with decreased depressive symptoms in the U.S. (Chatterji & Markowitz, 2012). Similarly, Mandal (2018) found an alleviating effect of paid short-term maternity leave on mothers' mental health. In addition, McGovern and colleagues (1997) found positive effects on women's vitality for maternity leaves of more than 12 weeks, their mental health for 15 weeks or longer, and their role function for 20 weeks and longer. Finally, the extension of maternity leave entitlements with financial benefits in California in 2004 from 4 to 6 weeks improved a mother's mental health and general health, probably because it enabled her to care for her child (Bullinger, 2019; B. C. Lee et al., 2020).

In the long run, more extensive maternity leaves might be more beneficial for maternal health than shorter maternity leaves because the more extended leave period helps to prevent the accumulation of physical or mental stress (cf. Bullinger, 2019). Avendano and colleagues (2015) investigated mothers' later-life mental health effects of taking maternity leave in Europe. Their results suggested that, on average, taking more weeks than the statutory leave (8–16 weeks, depending on the country), reduced a mother's stress in the time their child was born and improved her long-term mental health measured at age 50 (Avendano et al., 2015). Beuchert and colleagues (2016) reported similar results for a sample of Danish women. However, only one study by Courtin and colleagues (2022) analyses the short- and long-term mental health effects of an extension of maternity leave entitlements in the 1980s in mothers in Denmark with a 30-year follow-up after their children's birth. Their findings suggest a protective effect of more extensive maternity leave entitlements for women's post-birth mental health, especially for disadvantaged women such as women with lower education and single mothers (Courtin et al., 2022).

Although many studies find a positive relationship between maternity leave length and maternal health, a few studies showed mixed and inconclusive findings: First, Chuard studied the effect of the extension of paid parental leave on short- to medium-run maternal health among several indicators exploiting a policy reform in Austria in the year 2000. Her findings show that extended leave entitlements by 1 year are associated with an overall decline in maternal health, driven by deteriorating mental health in the affected women (Chuard, 2023). Second, Guertzgen and Hank (2018) examined the effects of the extension of job-protected maternity leave in the 1979-reform from 8 weeks to 6 months on maternal health in Germany. They found an increase in the maternity leave period after this reform and that women with a more extended absence period from work were also more likely to experience a sick leave later in life, which implies a negative association between the maternity leave expansion and women's health. However, this counterintuitive finding is primarily attributed to compositional effects. Taking a more extended absence period from work allowed mothers who indicated health problems before the transition to motherhood to resume work despite their poor health status. At the same time, these women also had a higher likelihood of being sick again after returning to work (Guertzgen & Hank, 2018).

The institutional context in Germany

Maternity leave legislation in Germany consists of two pillars: (1) job protection during the maternity leave period that guarantees the right of mothers to return to their previous position and workplace, and (2) financial benefits during maternity leave. This study considers women who became first-time mothers between 1980 and 2010 (see section “Other controls”). Based on significant changes in legal entitlements, we can distinguish three different maternity leave reform periods, namely the *pre-1992*, the *1992–2006* and the *post-2006 periods*.

In all maternity leave reform periods, pregnant women in employment have received fully paid and statutory leave for 6 weeks before and 8 weeks after childbirth (also known as statutory maternity leave). All mothers (irrespective of their biological motherhood) are entitled to utilise the following maternity leave period across the different post-statutory maternity leave reform periods pre-1992, 1992–2006, and post-2006. For the *pre-1992 reform period*, mothers could extend their job-protected maternity leave up to 6 months, with monthly benefits between €300 to €450 per month. With the parental leave *reform of 1992*, the job-protected leave was extended to 36 months after the child’s birth and could be taken up by mothers and fathers, yet not simultaneously (BMFSFJ, 2006; Ondrich et al., 2003). Parental leave benefits of around €300 per month were paid for a maximum of 24 months; alternatively, higher monthly benefits of around €450 per month could be received for a maximum of 12 months.

The parental leave *reform of 2007* introduced reimbursement at the level of 67% of net earnings up to a maximum of €1,800 or a minimum of €300 per month. A family could receive these benefits for a maximum of 12 months for one parent or 14 months if both parents took at least 2 months of leave (Spiess & Wrohlich, 2008; see Kluge & Tamm, 2013 for further details on the German maternity leave legislation). The maternity leave *reform of 2007* and the expansion of formal childcare for children under the age of three were designed to alleviate women’s family-work conflicts. The reform incentivised especially mothers with high labour market attachment and human capital to return to the labour market much more quickly than they did before these reforms were implemented (Geyer et al., 2015).

These changes in maternity leave regulations, as well as the ongoing differences in gender norms in the former East and West Germany, make Germany a fascinating case for studying the relationship between maternity leave and maternal health. Before the fall of the Berlin Wall, women (including mothers) in East Germany had high levels of full-time employment, as the state-socialist system expected women to be employed. In contrast, the policies of the West German government supported the male breadwinner model, which resulted in low levels of maternal employment (Borck, 2014; Maurer, 2006). After German reunification in 1990, maternal employment in East Germany converged towards West German patterns, with a high prevalence of part-time employment among mothers (Konietzka & Kreyenfeld, 2010). Although there is empirical evidence that the most recent reforms have led to increases in working hours and labour market participation among mothers in both regions (Geyer et al., 2015), East-West differences in work-care cultures – with greater acceptance of maternal employment and higher availability of institutional childcare in East than in West Germany – seem to have persisted, particularly for mothers with children under age

three (Statistisches Bundesamt, 2019). We, therefore, provide sensitivity analyses with separate samples for East and West German mothers to consider potential regional differences in the association between maternity leave length and maternal health.

Methods

Data

The current study used employment biographies from administrative pension records provided by the German Statutory Pension Fund (DRV), the FDZ-Biografiedatensatz für die Biografiedaten der Versicherten (VSKT) [pension dataset on the biography data of insured persons] for the year 2015 (DRV, 2018a). The dataset represents a stratified random sample of all pension accounts for Germans born between 1948 and 1985 living in Germany. In addition to a fixed part with basic demographic information, the dataset contains detailed employment biographies for each individual for every month between January of the year in which the person turns 14 years old and December of the year in which they turn 67.

The administrative data provide rich and detailed information on employment that are relevant for calculating pension entitlements. Unfortunately, as educational or social background (including marital status) is not used to calculate entitlements, the data does not include this information. However, pension records offer other advantages. First, the dataset includes objective measures only and thus prevents reporting biases. Second, it contains very few missing values, which have been tested positively for randomness, and were case-wise deleted. Third, unlike previous studies, we could observe and analyse younger cohorts using the 2015-drawn sample of the VSKT. Moreover, our observation window covers several maternity leave policies and includes East and West German women.

This study only reports results from secondary analyses of existing administrative data using the anonymised scientific use file provided by the German Statutory Pension Fund's research data centre. Ethical approval of this study was therefore not deemed necessary.

Measures

The dependent variable was a binary outcome variable indicating the occurrence of a post-maternity leave *sick leave* for each observation month. This variable refers to any recorded case of severe sickness that caused a woman (a) to be absent from work for at least 6 weeks (which could be spread across multiple absences if the underlying condition was the same) or (b) to attend rehabilitation measures. This information is based on official sick leave reporting and is, therefore, objective and reliable (DRV, 2018b). We started the observation of the sick leave measure after month 36 following the child's birth until the occurrence of sick leave. We censored all observations either 9 months before the birth of a second child or on the woman's 50th birthday if no sick leave occurred before (see Figure 1). In addition, we included a covariate measuring the *time* in months to estimate the exact timing of the sick leave, as well as the *time squared* to account for a quadratic time trend.

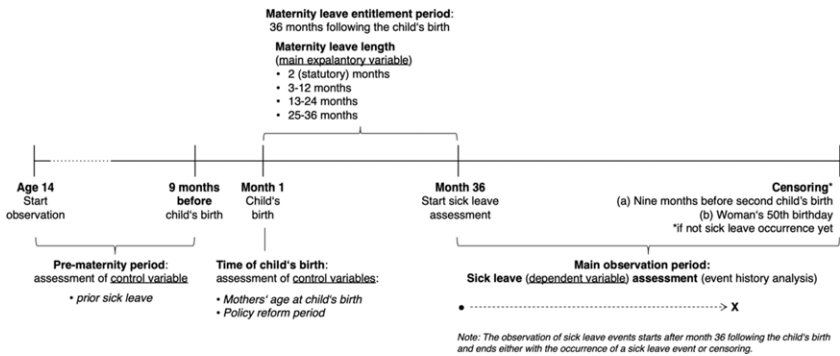


Figure 1. Conceptual diagram of study design.

The main explanatory variable was the *length of the maternity leave* in months. Because the data do not include information on the maternity leave benefits each woman received, we adopted a broader definition of maternity leave in our paper. We defined maternity leave as the period a mother takes off from work within the first 3 years after their first child's birth, as this period corresponds to the legal framework for parental leave in Germany. In German legislation, this period is more commonly described as childcare leave. We defined each maternity leave as the period between the child's birth and the last month during which a women's social employment situation was registered as "childrearing and household" with the German Pension Fund. The maternity leave length variable was coded categorically to reflect the different maternity leave entitlements (see supplemental Table S1). The categories were 2 months leave (the minimum statutory leave duration, used as a reference category throughout the analysis), 3–12 months (paid maternity leave at regular monthly benefits), 13–24 months (paid leave at reduced monthly benefits) and 25–36 months of maternity leave (unpaid leave during the third year with job protection). With the reference category of two fully paid months of statutory leave, our study alludes to the particularity of the German maternity and parental leave policy (see supplemental Table S1) and differs from previous studies comparing the length of maternity leave taken with either no leave (cf. Kornfeind & Sipsma, 2018), shortest available leave before a policy reform (cf. Avendano et al., 2015; Bullinger, 2019; Chuard, 2023; Courtin et al., 2022; Guertzgen & Hank, 2018), or no paid leave (cf. Dagher et al., 2014).

Other controls

We additionally controlled for other factors that could influence the probability of women's sick leave occurrence, such as *maternal age at first child's birth*, *prior sick leave*, and the *maternity leave reform of 1992* (see Table 1). *Maternal age at the first child's birth* was defined using age categories of 20–24, 25–29, 30–34 and 35–39 years. Higher maternal age at the first child's birth is correlated with the socioeconomic status and the career stage, as older age means an increased likelihood of an advanced career level. Thus, controlling for maternal age at the first child's birth should partly capture socioeconomic differences between women and

Table 1. Sample description and summary statistics of main measures

Measure	Mean/%	Std. dev.	Min	Max
Post-maternity leave sick leave	22.70 %			
Maternity leave in months	13.77	11.05	2	36
In categories				
Two months (statutory)	25.66 %			
3–12 months	30.83 %			
13–24 months	25.64 %			
25–36 months	17.87 %			
Reform period				
Pre-1992	14.67 %			
1992–2006	68.01 %			
Post-2006	17.32 %			
Age at child's birth in years	28.69	4.42	20	39
Prior sick leave	19.39 %			
Observation time in months	192.11	121.86	1	508

Note: Summary statistics are presented for $N = 737,194$ observations clustered in $n = 4,243$ individuals. Observation time in months refers to the mean observation time per woman, i.e., the number of months between the birth of their children and either the experience of a post-maternity leave sick leave or censoring (see section "Measures").

systematic differences in labour market attachment and the opportunity cost of maternity leave.

We defined women's *prior sick leave* as having experienced an episode of sick leave anytime between their first appearance in the data and 9 months before their first child's birth (to account for the anticipation of the transition into motherhood, if applicable). This measure served as a proxy for their general health status to account for possible negative health selection. The *maternity leave reform* of 1992 was a dummy variable for births after 1992 (reference: *maternity leave reform* period before 1992) to control for changes in the entitlements to the job-protection period (see supplemental Table S1). Using the *maternity leave reform* period, we also indirectly controlled for birth cohorts and cohort differences in mothering ideologies and labour market attachment, as women in the older birth cohorts mostly transitioned to motherhood within the pre-1992 reform period.

Sample

We restricted our sample to women who transitioned to motherhood between the ages of 20 and 39, were born between 1960 and 1979, were employed 9 months before their child's birth and continued to be employed for at least four of the last 6 months before their child's birth. We further excluded women who took more than 36 months of maternity leave and took sick leave, or had a second child before the

end of their maternity leave for their first child. Our final sample consisted of $n = 4,243$ women whom we observed over $N = 737,194$ person-months.

Study design and analytic strategy

We applied discrete-time logistic regression analysis to estimate the association between the maternity leave length and monthly sick leave probabilities (see Figure 1 for study design). First, we regressed our indicator of sick leave in a given month on maternity leave length while controlling for time since birth using a quadratic trend. We then iteratively added additional control variables for age at the first child's birth, prior sick leave and the maternity leave reform period, as well as interaction effects between maternity leave length and these control variables. For this study, we report results from our preferred specification, which included all control variables and their interaction effects with maternity leave length. All model specifications are available upon request.

The regression model can be written as follows:

$$\begin{aligned} \text{logit}(P(\text{sick}_{it} = 1)) = & \beta_0 + \sum_{j=1}^3 \text{leave}_{j,it} \beta_j + \delta_1 \text{time}_{it} + \delta_2 \text{time}_{it}^2 + \sum_{k=1}^m x_{k,it} \gamma_k \\ & + \sum_{j=1}^3 \sum_{k=1}^m \text{leave}_{j,it} x_{k,it} \theta_{jk} + u_{it} \end{aligned}$$

with

$$\text{logit}(P(\text{sick}_{it} = 1)) = \log\left(\frac{P(\text{sick}_{it} = 1)}{1 - P(\text{sick}_{it} = 1)}\right)$$

$\text{leave}_{j,it}$ are binary variables for the three maternity leave categories (3–12 months, 13–24 months, 25–36 months, with 2 months as the reference category) and β_j the corresponding parameters. $x_{k,it}$ are the m different control variables with γ_k as the corresponding parameters. θ_{jk} are the parameters on the interaction effects between maternity leave length and covariates and u_{it} is the error term of the model.

The substantial increase of the job-protected maternity leave length from 6 months to 36 months after the child's birth with the maternity leave reform of 1992 might have increased the likelihood of mothers with poor pre-motherhood health returning to work. Subsequently, the composition of mothers with prior sick leave in our sample differs in the pre- and post-1992 periods might introduce negative health selection to our analysis. An interaction effect between prior sick leave and the maternity leave reform period was therefore included in a further step to capture this potential selection effect. We report estimates from our discrete-time logit regression analysis as average marginal effects (AME) (Mood, 2010). The AMEs refer to the average change in the probability of sick leave for women that took maternity leave of a certain length, holding all other covariates constant at their sample average. Therefore, we derive AME estimates for specific subgroups of the sample by fixing covariates (e.g., prior sick leave) at a defined value instead of the sample average.

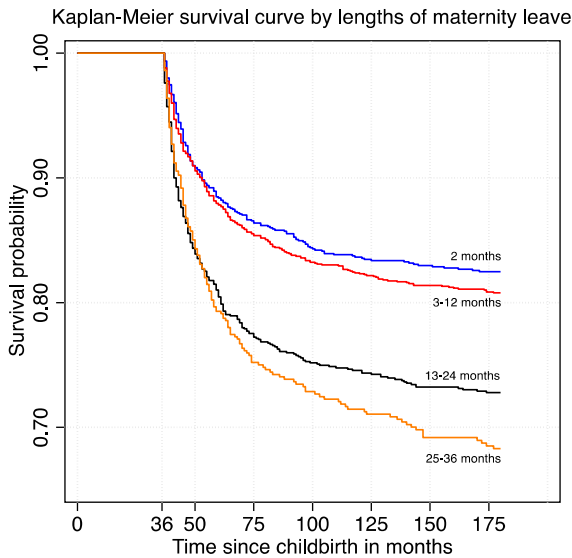


Figure 2. Kaplan-Meier survival curves by lengths of maternity leave for 36–180 months (i.e., up to 15 years) after the child's birth.

Note: Kaplan-Meier survival curves indicating the survival probability of experiencing a sick leave over time since the child's birth in months by four lengths of maternity leave. See supplemental Table S2 for summary statistics of survival analysis.

Results

Descriptive results

Summary statistics of all included variables can be found in Table 1. The plurality of the sample (35.7%) took a maternity leave of 3–12 months, followed by leaves of 2 months (26.1%), 13–24 months (24.6%), and 25–36 months (13.6%). 22.7% of our sample experienced a sick leave during the observation period that started 3 years after the child was born. These sick leaves occurred on average 2.5 years after start of the observation, i.e., 5.5 years after child's birth.

The survival curves for the different maternity leave categories are shown in Figure 2. The Kaplan-Meier estimates suggest that the incidence of sick leave increases with maternity leave length. These survival curves do not, however, adjust for observable differences across these groups, e.g., in the incidence of prior sick leave. To adjust for differences in these covariates, a discrete-time logistic regression model was estimated.

Maternity leave length and maternal health

Table 2 shows the average marginal effect (AME) of the maternity leave length on monthly probabilities of taking sick leave based on the discrete-time logistic regression results (see supplemental Table S3). The AME is highest for 13–24 months with 0.0003161, followed by 25–36 months with 0.0002582 and 3–12 months with 0.0000496. This corresponds to an increase of 24% over the average

Table 2. Average marginal effects on the monthly probabilities of sick leave of maternity leave length categories

Independent variable	Main explanatory variable	Average marginal effects (AMEs)		Percentage change over mean sick leave probability
Post-maternity leave sick leave	Maternity leave length in months (ref.: 2 months (statutory))			
	3 to 12	0.0000496	(0.0000908)	3.7386%
	13 to 24	0.0003161**	(0.0000960)	23.8360%
	25 to 36	0.0002582*	(0.0001122)	19.4618%

Note: Standard errors in parentheses, corrected for $n = 4,243$ clustered individuals over $N = 737,194$ observations. ** $p < .001$, * $p < .01$, $p < 0.05$.

rate of sick leave occurrence (overall AME = 0.001307, see supplemental Table S4) for the 13–24 months group, and an increase of 20% for the 25–36 months leave group.

Considering the average marginal effects of the included covariates (see supplemental Table S4), we note that in the post-1992 reform period the monthly probability of sick leave was significantly lower (-0.000402 , $p < 0.001$). Women with a period of prior sick leave were significantly more likely to experience a spell of sick leave after birth (0.000447 , $p < 0.001$), and the risk of sick leave after birth decreased with age at first child's birth (-0.000293 for ages 25–29, $p < 0.01$; -0.000586 for ages 30–34, $p < 0.001$; -0.000841 for ages 35–39, $p < 0.001$; all relative to the reference group of ages 20–24).

Heterogeneity in the association between maternity leave length and long-term health

We examined how the association between maternity leave length and long-term health varies between different groups of women by comparing the AMEs of experiencing sick leave for different maternity leave length at different values for certain covariates. Figure 3 (panel a) shows that maternity leaves of 13 months and longer are only statistically associated with a higher probability of a sick leave in the post-1992 maternity leave reform period. However, in the pre-1992 period no difference in sick leave between maternity leave length is observed, but the AMEs were less precisely estimated, suggesting that this may be the result of the lower sample size in the pre-1992 period. Similarly, the low sample size of women who had experienced prior sick leave led to less precisely estimated AMEs in panel b (Figure 3).

The AMEs reveal an interesting pattern for prior sick leave from work: Taking a maternity leave of 25–36 months was only significantly associated with a higher probability of a sick leave after birth for women without prior health problems. Women who experienced a sick leave before the transition into motherhood and took an extended maternity leave of 25–36 months were as likely to experience a spell of sick leave after birth as women taking only the statutory maternity leave of 2 months (i.e., the reference group in our model). Women who experienced a prior sick leave and took a maternity leave between 3 and 24 months showed increased – yet not significant – probabilities to experience a sick leave. This suggests that

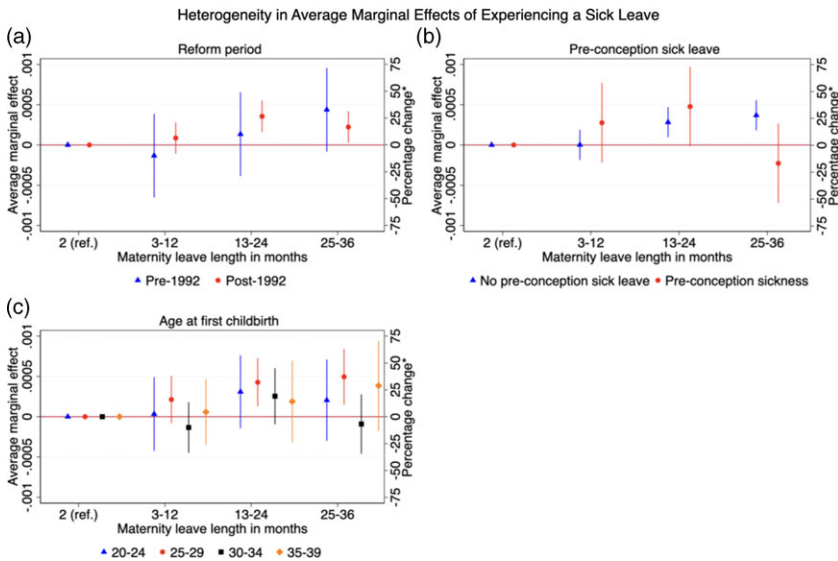


Figure 3. Heterogeneity in average marginal effects of experiencing a post-maternity leave sick leave. *Note:* Monthly average marginal effects (AME) were calculated based on discrete-time logistic regression (see supplemental Table S3) while holding variables indicating the post-1992 reform period, prior sick leave, and age at first child's birth fixed at the values specified in the respective panels. The second y-axis shows monthly percentage changes over the mean sick leave probability for reference.

vulnerable women's health might benefit particularly from very long maternity leaves. Finally, panel c of Figure 3 shows differences in the AMEs by age at first child's birth. There is no clear pattern noticeable – while the AMEs of maternity leave length are only statistically significant in the 25–29 age group, confidence intervals for all age groups are large and substantially overlap.

Policy extension of maternity leave length entitlements and maternal health selection

The reform of 1992 substantially increased the job protected maternity leave length from 6 months to 36 months after the child's birth. This reform might have affected women with and without prior sick leave differently, e.g., by allowing vulnerable women that might not have returned to work in the pre-1992 period to return to work after taking an extended maternity leave to recover from pregnancy and giving birth – if applicable – and the transition into motherhood. Consequently, the reform may have changed the composition of women in our sample, possibly introducing negative health selection.

To examine this, we calculated the predicted probabilities of sick leave after birth for women with and without prior sick leave both before 1992 and after the 1992 reform (Figure 4). For women with no prior sick leave, the monthly sick leave probabilities were lower for the post-1992 than for the pre-1992 reform period across all maternity leave lengths. Independent from the reform period, the monthly sick leave probabilities of these women increase with more extensive maternity

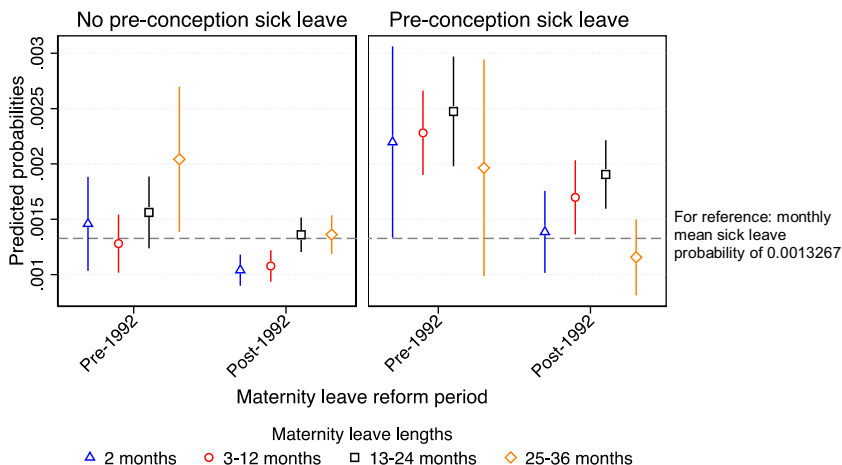


Figure 4. Interaction effect between prior sick leave and reform period over maternity leave lengths on monthly sick leave probabilities.
 Note: Monthly predicted probabilities were calculated based on discrete-time logistic regression (see supplemental Table S3).

leaves from 3 to 12 to 25 to 36 months. However, the differences for the post-1992 reform period are smaller and less pronounced.

The trends between the reform periods for women with prior sick leave are strikingly different: For both reform periods, we observe an increase of the monthly sick leave probabilities from maternity leave lengths of 2 to 13 to 24 months, while the ones for the 25 to 36 months leave are lower. The lower monthly sick leave probabilities are more pronounced in the post-1992 reform period. As for women without prior sick leave, the monthly probabilities of sick leave are generally lower in the post-1992 reform period, yet not statistically significant.

Sensitivity analyses

We assessed the sensitivity of our results for (1) the starting point of our observation, (2) the East and West German subpopulations and (3) the censoring 9 months prior to a second child’s birth.

First, analyses where the observation period started at 36 months after the child’s birth might miss potential cases of sick leave for all women who took shorter maternity leaves and thus returned to work before 36 months. In a sensitivity analysis (see supplemental Table S5), we adjusted the observation start times and show the estimates when the observation period starts at the time each woman’s maternity leave ended. These results lead to similar conclusions as our original analysis, confirming the robustness of the observation start time we chose.

Second, we examined women living in East and West Germany separately to account for differences in mothering cultures and gender norms. Since monthly sick leave records in the VSKT are only available from June 1990 for East German women, we restricted our analysis to cohorts born between 1970 and 1979 to maximise comparability between groups. From this sensitivity analysis (see

supplemental Table S6) we conclude that our findings hold for both East and West German women.

Third, since we censored women 9 months prior to a second child's birth, we tested the robustness of our results for this censoring by examining a subsample of only-child mothers (see supplemental Table S7). We find that our censoring strategy does not influence the results, and therefore we can conclude that our results are robust for all women investigated.

Discussion

We examined the associations between maternity leave length and maternal health over a prolonged period by investigating the uptake of sick leave from 3 years to up to 27 years after the first birth. We contribute to the literature by, first, considering the actual maternity leave length; second, assessing medium- and long-run health outcomes after taking maternity leave of different lengths; and third, exploring relevant selection mechanisms into different maternity leave lengths, in particular pre-existing health problems. Our study shows evidence of a negative association between long maternity leaves and maternal health. Specifically, women who took 13 months or more of maternity leave were significantly more likely to experience sick leave than women taking between 2 and 12 months. Many previous studies showed a beneficial effect of women's maternity leave uptake on their maternal health status (Aitken et al., 2015; Staehelin et al., 2007). However, these studies do not necessarily contradict our findings as their comparison groups range from mothers taking no or any unpaid leave (e.g., Dagher et al., 2014; Kornfeind & Sipsma, 2018) to shorter available leave periods (cf. Avendano et al., 2015; Bullinger, 2019; Chuard, 2023; Courtin et al., 2022; Guertzgen & Hank, 2018), whereas our reference category was a statutory and fully paid minimum maternity leave of 2 months. We are not able to consider a reference group of women taking no maternity leave in our study because employees in the social security systems are not allowed to return to work within the first 2 months after birth in Germany.

In addition, the definition of extended maternity leaves gains importance in view of the current state of research. Most studies examining the association between maternity leave length and mothers' health found that more extensive maternity leaves are beneficial for maternal health, both in the short-run (Chatterji & Markowitz, 2012; Dagher et al., 2014; Kornfeind & Sipsma, 2018; Mandal, 2018) and in the long-run (Avendano et al., 2015; Beuchert et al., 2016; Courtin et al., 2022). Our findings suggest a positive relationship between the maternity leave length and the probability of a sick leave, which seemingly contradicts previous studies. However, we note that, first, most of these studies consider relatively short maternity leaves of between 6 (Chatterji & Markowitz, 2012) and 16 weeks (Avendano et al., 2015), and second, all of the mentioned studies investigating short-run health effects of maternity leave except the one of Courtin and colleagues (2022) were conducted in the U.S. (Bullinger, 2019; Chatterji & Markowitz, 2012; Dagher et al., 2014; Kornfeind & Sipsma, 2018; B. C. Lee et al., 2020; R. Lee, 2020; Mandal, 2018; McGovern et al., 1997) – a context with only limited availability of paid maternity leave and other welfare supporting new mothers. Studies based on

contexts with more generous maternity leaves – such as Denmark (Beuchert et al., 2016; Courtin et al., 2022) – also suggested a positive relationship between more extended leaves and maternal health.

However, the reforms considered by Beuchert et al. (2016) and Courtin et al. (2022) extended the average maternity leave length by 32 days and 6 weeks only. In contrast, our study does not focus on extended days in the maternity leave length but instead compares more broadly defined leave categories. In this comparison, we observed a negative relationship with maternal health when more extended leaves of 13 months or more were compared to leaves of less than 12 months. In contrast, we did not observe a significant difference between the statutory leave of 2 months and maternity leave between 3 and 12 months. While we still cannot replicate the positive association between more extensive maternity leaves and maternal health for leaves of less than 12 months, there may be several reasons for this. One example is that our health measure reflects relatively severe illnesses rather than less severe changes in health. However, studies showing a wider range of mothers' health outcomes in a similar maternity leave policy and welfare setting as the German one (cf. Chuard, 2023), confirm our result among several health markers.

There are at least two potential explanations for the difference observed between leave lengths below 12 months and leave lengths of 13 months or more: First, it is possible that beyond 1 year, the health benefits of more extensive maternity leave (i.e., a more extensive recovery period) are outweighed by the disadvantages of being out of employment (e.g., smaller social networks, fewer financial resources). Second and perhaps more importantly, there is likely health selection into more extensive maternity leave. In particular, women whose health status was already comparatively poor prior to the transition into motherhood might be more likely to return to work after an extended maternity leave. In contrast, women in better health choose to return earlier. Such selection would result in a negative association between the maternity leave length and maternal health because women with poor health prior to motherhood will likely have worse health outcomes after birth as well.

Guertzen and Hank (2018) report evidence for such selection effects using the German Statutory Pension Fund data. Our analysis of heterogeneity provides further evidence for such selection: For women with pre-existing health problems, the probability of sick leave for the most extended leave length of 25–36 months is lower than the probability of sick leave for a shorter leave of 3–12 and 13–24 months and not statistically different from the 2 months statutory leave reference group. These results suggest that when we consider only women with pre-existing health problems, a prolonged maternity leave might be beneficial for their long-term health. Thus, our study provides evidence complementary to Guertzen and Hank (2018) using the same data source but including additional and younger cohorts. Moreover, our findings are relevant for institutional settings beyond the German context studied here, as we provide evidence for four different lengths of leave covering periods ranging from 2 to 36 months.

The unique, detailed administrative pension dataset we used in our study has significant advantages: It provides monthly coverage of women's employment and sick leave statuses throughout their entire employment history. This dataset allowed us to base our analysis on accurate measures of maternity leave lengths and occurrences of severe sickness, which are free from self-reporting or selection biases.

On the other hand, our sickness measure – the occurrence of a continuous sick leave – does not provide any information on the underlying medical reasons for taking sick leave, and it refers to cases of severe sickness only. This lack of information on short but recurrent sickness (e.g., flu) might have led us to underestimate the relationship between long-term maternal health and the maternity leave length if more extended periods of maternity leave reduce the incidence of shorter, less severe spells of illness.

Another data-driven limitation of the current study is that our data did not capture women's educational background, household income, partners' employment characteristics or parental leave endeavours (cf. Valentova et al., 2022) and the mothers' and child's health. Mothers' post-maternity leave health is essential because it is possible that both the length of maternity leave and the occurrence of sick leave later on might be driven by post-partum health problems (e.g., mental health disorders, see Chuard, 2023). Subsequently, the negative association between longer maternity leaves and later sickness absence potentially overstates the effect of maternity leave length. In our analysis, we aimed to mitigate the influence of negative health selection by focusing on a more homogenous sample of women with pre-existing health issues. This attempt does not address negative health selection from post-maternity leave health issues, yet given that we do not find a negative association between long maternity leaves and later life health in this analysis, we can conclude that in the presence of negative health selection from post-partum health problems, the actual relationship between maternity leave length and long-run maternal health might very well be positive.

Conclusion

The latest maternity leave policy reforms introduced in Germany aimed to encourage women to take shorter periods of maternity leave and to return earlier to the labour market while also granting fathers extensive paternity leave. However, our results suggest that at least for specific subgroups of vulnerable women, e.g., women with poor general health, taking more extensive maternity leave can improve their health in the long run and may ultimately support their participation in the labour market. This finding should be considered by those seeking to incorporate health protection into work and family policy designs.

Future research should address the question of which other vulnerabilities may select women into adverse post-maternity leave health and how increased maternity leave lengths may protect these women. Moreover, the extension of parental leave to fathers and the increased financial benefits, which again increase the attractiveness of parental leave for men, raise the question of how maternal health might be affected by those recently increasing trends (cf. Goldacker et al., 2022; Twamley & Schober, 2019). Further research is needed to explore how paternal uptake of parental leave relates to the length of women's maternity leave period and their subsequent health alongside the influence of gender roles and their implications for the discrimination of mothers in the labour market and gender equality within parental relationships.

Supplementary material. To view supplementary material for this article, please visit <https://doi.org/10.1017/S0047279423000429>

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Competing interests. The authors declare none.

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