Paternity leave uptake and parental post-partum depression: findings from the ELFE cohort study

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Summary

Background Several countries are expanding their paternity leave policies, which can have positive effects on parental mental health. We examined whether 2 weeks of paid paternity leave are associated with post-partum depression in mothers and fathers at 2 months after the birth of their child.

Methods We used data from the Etude Longitudinale Française depuis l'Enfance (ELFE) cohort study. Participating mothers gave birth in 2011 in a representative sample of 320 maternity hospitals in mainland France. Inclusion criteria were single or twin livebirths born after at least 33 weeks' gestation; mother's age at least 18 years; no plans to leave metropolitan France within 3 years. Mothers were interviewed face-to-face shortly after the child's birth. Fathers and mothers were both interviewed by telephone 2 months after the child's birth, reporting whether the father had the right to paternity leave and if yes, if he had taken or intended to take it. We used the Edinburgh Postnatal Depression Scale to assess post-partum depression among fathers and mothers at 2 months. Logistic regression models, using survey-weighted data and adjusted for confounders using inverse probability weights, yielded odds ratios (ORs).

Findings We included 10 975 fathers and 13 075 mothers with reported information on paternity leave and post-partum depression at 2 months in the statistical analyses. Fathers had a median age of 32·6 years (IQR 36·9–22·6) and mothers had a median age of 30·5 years (34·0–27·1) at the time of the ELFE child's birth. The prevalence of depression in fathers according to paternity leave status was 4·5% among those who used paternity leave, 4·8% among those who intended to use paternity leave, and 5·7% among those who did not use paternity leave. For mothers, the prevalence of post-partum depression was 16·1% among those whose partner used paternity leave, 15·1% among those whose partner intended to use paternity leave, and 15·3% among those whose partner did not use paternity leave. Fathers who took paternity leave had reduced odds of post-partum depression (OR 0·74 [95% CI 0·70–0·78]) as did fathers who intended to take paternity leave (0·76 [0·70–0·82]) compared with fathers who did not take paternity leave. However, we did not find such beneficial effects for mothers whose partners took (1·13 [1·05–1·20]) or intended to take paternity leave (1·02 [0·96–1·08]).

Interpretation Taking and intending to take 2-weeks' paid paternity leave was associated with a reduced likelihood of reporting post-partum depression in fathers. However, offering 2-weeks' paternity leave might place mothers at a greater risk of post-partum depression, suggesting that optimal length and timing of the leave, among other factors, need further investigation.

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Introduction

Following the EU Work-life Balance Directive in 2019, the European Parliament encouraged policies promoting the equal sharing of caring responsibilities between mothers and fathers to decrease the amount of unpaid caring responsibilities in women and allow women to have more opportunities in the workforce.[1] Paid paternity leave following a child's birth might be a policy that can meet these objectives because it can advance gender equity in the labour market and increase fathers' involvement in parenting, childcare, and household-related tasks.[2,3] Feeling socially supported as well as reporting overall relationship satisfaction have been associated with reduced odds of post-partum depression among mothers and fathers.[4–6] Because paternity leave can provide fathers with the opportunity to support their partner in the household and in child-rearing tasks as well as increase opportunities for father-child bonding moments,[4,5] its use might be a protective factor against post-partum depression onset in mothers and fathers.[4]

According to two meta-analyses done in 2010[8] and 2018,[7] post-partum depression is common in new parents. 17% (95% CI 15·0–20·0) of healthy mothers had post-partum depression during the year following their child's birth.[7] For fathers, the prevalence of post-partum depression varied in the year following their child's birth: 8·0% (5·0–11·0) from birth to 3 months, 26·0% (17·0–36·0) at 3–6 months, and 9·0% (5·0–15·0) at 6–12 months. Considering the detrimental consequences of post-partum depression on family health and

Research in context

Evidence before this study

We searched Google Scholar, PubMed, and Science Direct databases for articles published in English and French between Jan 1, 2000, and Feb 1, 2022, using the search terms "paternity leave (family leave, parental leave)" and "depression (post-partum depression, mental health)." Narrowing our search to articles looking at paid paternity leave with no risk of job loss, we found only two articles specifically focusing on paid paternity leave and maternal or parental depression, with most articles focusing on the effect of mothers taking family leave. Studies have shown that paternity leave uptake is associated with fathers' involvement in family activities, chores, and bonding with the child, but evidence of the relationship with parental post-partum depression is scarce. No studies have investigated the effects of paternity leave use on post-partum depression risk in fathers, with one study exploring paternity leave use on post-partum depression in mothers in France.

Added value of this study

In a nationally representative study of parents with a partner eligible for paternity leave, controlling for family socioeconomic and health characteristics, we found that paternity leave use, even as short as 2 weeks, as well as intention to use paternity leave can was associated with reduced post-partum depression in fathers. Also, we found an association between paternity leave use and mother's post-partum depression in which mothers showed a higher risk of post-partum depression at two months if their partners took paternity leave. To our knowledge, this is the first study to assess the effects of 2-weeks' paid paternity leave use in France on post-partum depression risk in mothers and fathers.

Implications of all the available evidence

Our findings highlight the effects that family policies targeted at fathers can have regarding parental mental health. Studies have already shown that paid paternity leave use is associated with fathers' increased involvement in household and child-rearing tasks, improved family dynamics, improved relationship satisfaction, and positive consequences in terms of child's emotional development. Adding to this past research, our study suggests that paid paternity leave might be beneficial for mental health in fathers. For mothers, paid paternity leave of 2 weeks might not be sufficient to provide them with the support necessary at the time of the child's birth. Overall, these findings can encourage policy makers to expand paternity leave provision to increase the chances of healthy family dynamics and children's development. Also, further research can examine the effect that duration as well as timing of paternity leave can have on parental mental health and children's developmental outcomes.

children's development,[9] including marital and sibling conflict,[5,6] difficulty breastfeeding,[5,10] lack of mother-child bonding,[5,11] and slowed emotional development in children,[9,10] policies that can contribute to reducing the burden of post-partum depression, are important and need to be investigated.

We aimed to examine whether paternity leave uptake is associated with post-partum depression in mothers and fathers 2 months after their child's birth. In 2021, 27 (71%) of 38 Organisation for Economic Co-operation and Development (OECD) countries offered some form of paid paternity leave, which on average was 2 weeks with a wage replacement rate of 70–100%.[11] France is a relevant setting to examine this question because, during our study window, fathers were entitled to 2 weeks of paid paternity leave, which corresponds to the average duration of paternity leave in most OECD countries as of 2021.[11]

Methods

Study design and data collection

The Etude Longitudinale Française depuis l'Enface (ELFE) cohort study is a French, national cohort of children followed from birth to adulthood to study family, economic, and sociocultural factors that might influence children's development.[12] Participating mothers gave birth in 2011 in a representative sample of 320 maternity hospitals in mainland France, and inclusion criteria for the ELFE cohort were single or twin livebirths born after at least 33 weeks' gestation; mother's age at least 18 years; no plans to leave France within 3 years; and informed consent signed by the parents or solely the mother, with the father being informed of his right to deny consent for participation. For this study, children whose parents received longer parental leave, such as fathers of twins,[13] non-cohabiting fathers, or fathers not eligible for paternity leave, were further excluded as well as parents who did not provide information on their post-partum depression status at 2 months. Mothers were interviewed face-to-face shortly after the child's birth. Then, fathers and mothers were both interviewed by telephone 2 months after the child's birth. Attrition rates in the ELFE cohort were low, with a mean of 4·4% of mothers or fathers not completing the questionnaire for each wave of data collection. Compared with participating mothers, those who did not complete the questionnaire at 2 months were more likely to be younger than 25 years at the time of the child's birth, have no university degree, be unemployed or out of the labour force, have been born outside of France, or be single mothers.[12] The groups did not differ in parity, maternal health status before or after pregnancy, type of birth, or mean birthweight. Ethics approvals for data collection in maternity units and for each data collection wave during follow-up were obtained from the national advisory committee on information processing in health research, the national data protection authority, and, in case of invasive data collection such as biological

sampling, the committee for protection of persons engaged in research.

Survey weights were previously calculated[14,15] to make the ELFE cohort study comparable to all children born in 2011 in metropolitan France, the year of study inception. The survey weights were calculated for each study wave of the ELFE cohort study by taking into account characteristics of respondent versus non-respondent parents in each survey wave. Details regarding survey weights and how non-participation in each study wave was incorporated have been described elsewhere.[14,15]

Measures

Paternity leave

At the time of the study, fathers in France were entitled to 2 consecutive weeks of paid paternity leave, at 80–100% of their gross wages, with a daily limit of €81·27.[2,16] Fathers were eligible for paternity leave if they were registered for social protection for at least 10 months and had worked either 200 h in the past 3 months or accumulated wages within 6 months greater than €1015 (equivalent to the standard minimum hourly wage).[2,16] Fathers had 4 months following the birth of their child to use their paternity leave. In the ELFE cohort, mothers reported in the 2-month questionnaire whether the ELFE child's father had the right to paternity leave and if yes, if he had taken or intended to take it. The variable was categorised into three groups: "yes, has taken", "yes, intention to take", and "no".

Outcomes

Fathers' and mothers' post-partum depression

We used the Edinburgh Postnatal Depression Scale[16,17] to assess post-partum depression among fathers and mothers 2 months after the ELFE child's birth, a period crucial in terms of post-partum depression risk.[18] The scale consists of ten questions that assess if the parent has shown symptoms of post-partum depression in the past week. Each question is scored 0, 1, 2, or 3 depending on the frequency of symptoms experienced, and the sum of the scores is used to screen post-partum depression.[16,17] In accordance with previous literature, fathers[19] who scored above 10 and mothers[20] who scored above 11 were classified as having post-partum depression.

Covariates

Parental characteristics

Fathers' and mothers' characteristics that were self-reported 2 months after the child's birth were age at the time of the ELFE child's birth; citizenship (French or other); highest educational level (no diploma, below bachelor's degree, associate's degree, bachelor's degree, or master's degree or higher); occupational grade[21] (low, medium, or high); type of work contract (student, permanent contract, temporary contract, independent worker, other salaried work, or not working); type of employment sector (not working [eg, student or retired], independent worker, private sector, or public sector); and desire to have a child (no, yes, or hesitated or did not know). Additionally, fathers reported if they attended the ELFE child's birth (yes or no). Mothers also reported employment during pregnancy (yes or no), first pregnancy (yes or no); psychological difficulties during pregnancy (yes or no); depression during a previous pregnancy (yes or no), and severe chronic condition or disability during pregnancy other than hypertension or gestational diabetes (yes or no).

ELFE child characteristics

Characteristic data pertaining to the ELFE child that we collected were sex (male, female, or did not disclose); birth season (spring, summer, autumn, or winter); number of siblings at baseline (only child, 1–2 siblings, or >2 siblings); feeding practices (exclusively breastfed, breastfed and baby formula fed, or baby formula fed exclusively); gestational week of birth; Apgar score at 5 min;[22] or presence of health problems requiring hospitalisation during the first 2 months after birth (yes or no).

Family and household characteristics

Family and household characteristic data that we collected were family's region of residence (based on French regions defined by the National Institute of Statistics[23]), number of individuals living in the household, household income, and parental conflict (assessed before, during, and after pregnancy [never or rarely, sometimes, or frequently]).

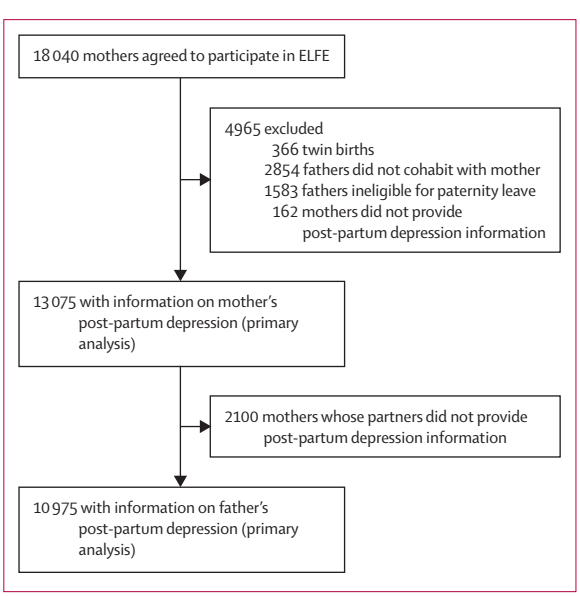

Figure 1: **Study profile**
ELFE=Etude Longitudinale Française depuis l'Enfance cohort study.

	Yes, taken (n=382 565 [64·3%])	Yes, intention to take (n=101 432 [17·0%])	No (n=111 310 [18·7%])	p value*
Paternal characteristics				
Age, years	32·4 (29·1–36·4)	32·9 (29·5–37·3)	33·4 (29·3–38·3)	<0·0001
French citizenship	358 311 (65·6%)	91 398 (16·7%)	96 623 (17·7%)	<0·0001
Educational level				
No diploma	20 393 (55·3%)	4 900 (13·3%)	11 578 (31·4%)	<0·0001
>Bachelor's degree	101 855 (62·7%)	26 246 (16·1%)	34 424 (21·2%)	..
Associate's degree	80 869 (65·5%)	21 137 (17·1%)	21 408 (17·3%)	..
Bachelor's degree	72 355 (69·1%)	16 480 (15·7%)	15 843 (15·1%)	..
≥Master's degree	107 094 (63·8%)	32 669 (19·5%)	28 058 (16·7%)	..
Occupational grade				
Low	98 357 (59·2%)	28 667 (17·2%)	39 225 (23·6%)	<0·0001
Medium	55 867 (64·6%)	16 276 (18·8%)	14 264 (16·5%)	..
High	228 351 (66·6%)	56 489 (16·5%)	57 822 (16·9%)	..
Type of work contract				
Student	5631 (51·3%)	2068 (18·9%)	3266 (29·8%)	<0·0001
Permanent contract	318 368 (72·1%)	78 577 (17·8%)	44 656 (10·1%)	..
Temporary contract	17 006 (49·0%)	4808 (13·8%)	12 918 (37·2%)	..
Independent worker	9832 (40·9%)	3528 (14·7%)	10 674 (44·4%)	..
Other salaried work	20 749 (38·4%)	8 553 (16·0%)	24 114 (45·1%)	..
Not working	10 978 (35·9%)	3 897 (12·7%)	15 682 (51·3%)	..
Employment sector				
Not working [eg, student or retired)	16 610 (40·0%)	5966 (14·4%)	18 948 (45·6%)	<0·0001
Independent worker	20 749 (38·8%)	8553 (16·0%)	24 114 (45·1%)	..
Private sector	262 439 (68·5%)	67 172 (17·5%)	53 668 (14·0%)	..
Public sector	82 768 (70·7%)	19 741 (16·9%)	14 580 (12·4%)	..
Attended ELFE child's birth	330 188 (65·6%)	86 883 (17·3%)	86 048 (17·1%)	<0·0001
Desire to have a child				
No	15 833 (58·2%)	4039 (14·8%)	7350 (27·0%)	<0·0001
Yes	346 497 (64·7%)	91 233 (17·0%)	97 492 (18·2%)	..
Hesitated or did not know	20 235 (61·6%)	97 492 (18·2%)	6469 (19·7%)	..
Post-partum depression at 2 months	19 170 (57·2%)	5739 (17·1%)	8577 (25·6%)	<0·0001
Maternal characteristics				
Age, years	30·6 (27·7–33·8)	30·7 (27·7–34·2)	31·0 (27·1–34·7)	0·18
French citizenship	352 672 (65·2%)	91 785 (17·0%)	96 410 (17·8%)	<0·0001
Married or civil union	243 057 (65·5%)	62 758 (16·9%)	64 998 (17·5%)	<0·0001
Educational level				
No diploma	18 840 (56·6%)	3 825 (11·5%)	10 592 (31·8%)	<0·0001
>Bachelor's degree	81 568 (60·2%)	21 443 (15·8%)	32 392 (23·9%)	..
Associate's degree	71 048 (65·6%)	17 688 (16·3%)	19 484 (18·0%)	..
Bachelor's degree	83 546 (68·1%)	20 966 (17·1%)	18 166 (14·8%)	..
≥Master's degree	127 562 (65·2%)	37 510 (19·2%)	30 676 (15·7%)	..
Occupational grade				
Low	238 879 (63·9%)	59 518 (15·9%)	74 954 (20·1%)	<0·0001
Medium	80 571 (66·2%)	22 906 (18·8%)	18 191 (14·9%)	..
High	63 115 (62·9%)	19 008 (18·9%)	18 165 (18·1%)	..

(Table 1 continues on next page)

Statistical analysis

Using data[13,14] that were weighted to be representative of all families in which the father was eligible for paternity leave in 2011 in metropolitan France, we tested the association between paternity leave uptake and parental post-partum depression (mothers' and fathers' post-partum depression) at 2 months after the child's birth. Mothers had 4·2% missing data on covariates and fathers had 2·3%. For each of the two study samples, missing data were imputed using fully conditional specification.[24] As per

	Yes, taken (n=382 565 [64·3%])	Yes, intention to take (n=101 432 [17·0%])	No (n=111 310 [18·7%])	p value*
(Continued from previous page)				
Type of work contract				
Student	14 857 (56·9%)	5185 (19·9%)	6071 (23·2%)	<0·0001
Permanent contract	239 783 (67·4%)	62 265 (17·5%)	53 612 (15·1%)	..
Temporary contract	16 031 (66·3%)	3249 (13·4%)	4882 (20·2%)	..
Independent worker	2934 (54·4%)	1334 (24·8%)	1121 (20·8%)	..
Other salaried work	13 205 (57·5%)	4310 (18·8%)	5432 (23·7%)	..
Not working	95 754 (59·5%)	25 089 (15·6%)	40 195 (25·0%)	..
Employment sector				
Not working (eg, student or retired)	110 611 (59·1%)	30 273 (16·2%)	46 265 (24·7%)	<0·0001
Independent worker	13 205 (57·5%)	4310 (18·8%)	5432 (23·7%)	..
Private sector	163 632 (66·7%)	42 840 (17·5%)	38 957 (15·9%)	..
Public sector	95 116 (68·0%)	24 009 (17·2%)	20 657 (14·8%)	..
Employed during pregnancy	301 213 (65·8%)	79 516 (17·4%)	76 818 (16·8%)	<0·0001
First pregnancy	258 771 (63·4%)	68 222 (16·7%)	80 895 (19·8%)	<0·0001
Desire to have a child				
No	20 338 (58·2%)	5861 (16·8%)	8670 (24·9%)	<0·0001
Yes	359 741 (64·6%)	94 946 (17·1%)	101 803 (18·3%)	..
Hesitated or did not know	2486 (63·4%)	626 (16·0%)	807 (20·6%)	..
Psychological difficulties during pregnancy	46 844 (63·8%)	13 097 (17·8%)	13 449 (18·3%)	<0·0001
Depression during a previous pregnancy	40 268 (62·0%)	11 393 (17·5%)	13 282 (20·4%)	<0·0001
Chronic illness (other than diabetes or hypertension)	34 776 (63·6%)	8490 (15·5%)	11 445 (20·9%)	<0·0001
Post-partum depression at 2 months	60 756 (63·6%)	15 558 (16·3%)	19 135 (20·1%)	<0·0001
ELFE child characteristics				
Sex				
Male	195 556 (63·6%)	54 362 (17·7%)	57 525 (18·7%)	<0·0001
Birth season				
Spring	84 334 (62·8%)	24 793 (18·4%)	25 229 (18·8%)	<0·0001
Summer	100 094 (64·0%)	26 668 (17·1%)	29 550 (18·9%)	..
Autumn	97 856 (63·1%)	29 325 (18·9%)	27 912 (18·0%)	..
Winter	100 280 (67·1%)	20 646 (13·8%)	28 619 (19·1%)	..
Siblings				
Only child	168 817 (66·3%)	44 219 (17·4%)	41 689 (16·4%)	<0·0001
1–2 siblings	193 115 (63·6%)	51 570 (17·0%)	58 779 (19·4%)	..
>2 siblings	20 634 (55·6%)	5642 (15·2%)	10 842 (29·2%)	..
Feeding practices at 2 months				
Breastfed exclusively	112 400 (63·6%)	33 466 (18·9%)	30 986 (17·5%)	<0·0001
Breastfed and baby formula fed	59 863 (62·9%)	17 857 (18·7%)	17 519 (18·4%)	..
Baby formula fed exclusively	210 302 (65·1%)	50 109 (15·5%)	62 805 (19·4%)	..
Gestational week of birth	39 (39–40)	39 (39–40)	39 (39–40)	<0·0001
Apgar score at 5 min	10 (10–10)	10 (10–10)	10 (10–10)	0·91
Hospitalised for health complications	17 324 (65·6%)	4117 (15·6%)	4975 (18·8%)	<0·0001

(Table 1 continues on next page)

Von Hippel's two-stage procedure, 14 imputed datasets were recommended and generated for each sample.[24] We did Bivariate analyses to test differences between the three exposure groups using χ^2 tests and Kruskal-Wallis tests, and we calculated global p values. Additionally, we did pairwise comparison χ^2 tests, in which each category in the exposure variable was compared with the other categories, and we calculated p values.

Fathers who take paternity leave were likely to differ from those who did not as well as those who intended to take paternity leave along a number of dimensions, potentially biasing the association between paternity leave and parental mental health. To partly address this issue, we calculated propensity scores of paternity leave using generalised boosted models (GBM),[25] a form of machine learning that has been shown to outperform

	Yes, taken (n=382 565 [64·3%])	Yes, intention to take (n=101 432 [17·0%])	No (n=111 310 [18·7%])	p value*
(Continued from previous page)				
Household characteristics				
Region of residence				
Paris and suburban region	77 774 (61·1%)	24 285 (19·1%)	25 157 (19·8%)	<0·0001
Central France	66 160 (63·9%)	18 292 (17·7%)	19 079 (18·4%)	..
Northern France	25 912 (65·9%)	5863 (14·9%)	7556 (19·2%)	..
Eastern France	32 656 (66·3%)	7699 (15·6%)	8926 (18·1%)	..
Western France	58 392 (68·7%)	14 230 (16·7%)	12 316 (14·5%)	..
Southwestern France	31 616 (64·2%)	9375 (19·0%)	8283 (16·8%)	..
Central East France	45 160 (67·5%)	10 722 (16·0%)	11 063 (16·5%)	..
South France	44 896 (60·0%)	10 966 (14·7%)	18 930 (25·3%)	..
Number of individuals in the household	4 (3–4)	4 (3–4)	4 (3–4)	<0·0001
Monthly household income	€3000 (2500–4000)	€3000 (2450–4000)	€2700 (2000–3700)	<0·0001
Parental conflict				
Never or rarely	219 669 (64·7%)	57 467 (16·9%)	62 539 (18·4%)	<0·0001
Sometimes	152 808 (64·0%)	41 469 (17·4%)	44 598 (18·7%)	..
Frequently	10 047 (60·1%)	2497 (14·9%)	4172 (25·60%)	..

Data are n (%) or median (IQR), unless otherwise indicated. *p value refers to χ^2 tests for categorical variables and Kruskal-Wallis tests for continuous variables. ELFE=Etude Longitudinale Française depuis l'Enfance cohort.

Table 1: **Comparison of parental, ELFE child, and household characteristics among mothers who reported post-partum depression status by paternity leave uptake status (n=13 075), on survey-weighted data**

traditional methods of propensity score calculations.[26,27] Our GBM included parental, household, and child characteristics that might influence paternity leave use; full details on the propensity score generation for each sample are given in the appendix (pp 7–9). We used Kolmogorov-Smirnov means below 0·10 and absolute standardised mean differences below 0·20 to estimate adequate balance across exposure groups (appendix pp 10–12).[25] After applying propensity score weights, all known covariates were sufficiently balanced.[25] Then, crude and weighted-logistic regression models, weighted by the product of the inverse probability weights (IPWs) and survey weights,[26,27] yielded odds ratios (ORs) with the associated 95% CI, and a p value of less than 0·05 denoted statistical significance.

See Online for appendix

In subsequent analyses, we tested differences between non-participating fathers (defined as fathers who were eligible for paternity leave but did not complete follow-up [n=2262]) and non-participating mothers (defined as mothers whose partners were eligible for paternity leave but who did not complet follow-up [n=162]) using χ^2, Fisher's exact, and Kruskal-Wallis tests (appendix pp 13–14). Additionally, we tested if the association between paternity leave uptake and the odds of post-partum depression varied between father's education level, type of work contract, and the number of children in the family (appendix p 15). Lastly, we did a sensitivity analysis, using the same approach that has been outlined for the primary analysis (appendix pp 16–17), to assess the association between paternity leave uptake and mothers' post-partum depression among mothers whose partners also provided information on post-partum depression. No differences were observed from the primary results (appendix pp 16–17).

Data management, statistical analyses, and GBM balance plots were done using SAS (version 9.4) and R studio (version 4.0.5). Forest plots were created using Microsoft Excel (2016) Python (version 3.6.9).

Role of the funding source

The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report

Results

We included 18 040 mothers in the ELFE cohort study (figure 1). Children whose parents received longer parental leave longer than the standard 2 weeks, such as fathers of twins (n=366),[16] non-cohabiting fathers (n=2854), or fathers not eligible for paternity leave (n=1583), were excluded from the study. Furthermore, mothers (n=162) and fathers (n=2100) who did not provide information on their post-partum depression status at 2 months (n=162) were excluded. We included 13 075 mothers and 10 975 fathers in the primary analysis (figure 1).

Fathers had a median age of 32·6 years (IQR 36·9–22·6) at the time of childbirth, 272 499 (45·7%) of 595 309 had at least a bachelor's degree, and 441 601 (74·1%) had a permanent work contract (table 1; unweighted baseline characteristics of participants by paternity leave uptake

	Yes, taken (n=319 730 [66·3%])	Yes, intention to take (n=84 298 [17·5%])	No (n=78 638 [16·3%])	p value*
Paternal characteristics				
Age, years	32·4 (29·1–36·4)	32·9 (29·5–37·3)	33·4 (29·3–38·3)	<0·0001
French citizenship	304 577 (66·9%)	79 270 (17·4%)	71 332 (15·7%)	<0·0001
Educational level				
No diploma	14 895 (57·6%)	3790 (14·6%)	7247 (27·8%)	<0·0001
>Bachelor's degree	79 859 (64·0%)	21 225 (17·0%)	23 672 (19·0%)	..
Associate's degree	67 901 (68·2%)	16 547 (16·6%)	15 230 (15·2%)	..
Bachelor's degree	61 798 (71·3%)	16 547 (16·1%)	15 230 (12·7%)	..
≥Master's degree	95 276 (65·5%)	28 799 (19·8%)	21 449 (14·7%)	..
Occupational grade				
Low	183 382 (69·0%)	44 974 (16·9%)	37 448 (14·1%)	<0·0001
Medium	50 430 (65·6%)	14 782 (19·2%)	11 656 (15·2%)	..
High	85 917 (61·4%)	24 542 (17·3%)	29 534 (21·1%)	..
Type of work contract				
Student	4751 (51·0%)	1818 (19·4%)	2784 (29·8%)	<0·0001
Permanent contract	269 748 (74·1%)	65 804 (18·1%)	28 601 (7·8%)	..
Temporary contract	13 764 (56·2%)	3903 (15·9%)	6818 (27·8%)	..
Independent worker	8185 (51·1%)	2722 (17·0%)	5099 (31·9%)	..
Other salaried work	15 447 (35·5%)	5099 (15·7%)	21 181 (48·7%)	..
Not working	7834 (31·1%)	3222 (12·8%)	14 154 (56·1%)	..
Employment sector				
Not working (eg, student or retired)	12 585 (36·2%)	5040 (14·6%)	16 939 (49·0%)	<0·0001
Independent worker	15 447 (35·5%)	6829 (15·7%)	21 181 (48·7%)	..
Private sector	220 989 (71·6%)	55 289 (17·9%)	32 364 (10·5%)	..
Public sector	70 709 (73·6%)	17 140 (17·8%)	8154 (8·4%)	..
Attended ELFE child's birth	281 188 (67·0%)	74 112 (17·7%)	64 277 (15·2%)	<0·0001
Desire to have a child				
No	13 284 (63·3%)	3190 (15·2%)	4502 (21·5%)	<0·0001
Yes	290 566 (66·5%)	76 478 (17·5%)	69 715 (16·0%)	..
Hesitated or did not know	15 879 (63·6%)	4631 (18·6%)	4421 (17·7%)	..
Post-partum depression at 2 months	14 114 (56·6%)	4127 (16·6%)	6683 (26·8%)	<0·0001
Maternal characteristics				
Age, years	30·5 (27·4–33·7)	30·5 (27·7–34·1)	30·8 (27·0–34·8)	0·060
French citizenship	297 845 (67·0%)	77 410 (17·4%)	68 993 (15·5%)	<0·0001
Married or civil union	206 816 (67·6%)	52 134 (17·0%)	46 986 (15·4%)	<0·0001
Educational level				
No diploma	12 756 (61·1%)	2573 (12·3%)	5531 (26·5%)	<0·0001
>Bachelor's degree	61 679 (63·1%)	15 563 (15·9%)	20 547 (21·0%)	..
Associate's degree	57 803 (67·7%)	14 378 (16·8%)	13 186 (15·4%)	..
Bachelor's degree	72 322 (69·2%)	18 008 (17·2%)	14 102 (13·5%)	..
≥Master's degree	115 169 (66·1%)	115 169 (19·4%)	25 273 (14·5%)	..
Occupational grade				
Low	56 063 (64·6%)	16 421 (18·9%)	14 243 (16·4%)	<0·0001
Medium	72 032 (67·2%)	20 832 (19·4%)	14 240 (13·3%)	..
High	191 635 (66·3%)	47 045 (16·3%)	50 154 (17·4%)	..

(Table 2 continues on next page)

given in the appendix [pp 1–6]). Mothers had a median age of 30·5 years (34·0–27·1) at the time of childbirth, 318 426 (53·4%) of 595 309 had a bachelor's degree or higher, and 355 660 (59·7%) had a permanent work contract (table 1). The ELFE child was the first child for 254 725 (42·8%) mothers. At 2 months, 328 565 (64·3%) fathers had already taken paternity leave, 101 432 (17·0%) reported intending to take paternity leave, and 111 310 (18·7%) did not take paternity leave (table 1). Fathers' characteristics varied according to paternity

	Yes, taken (n=319 730 [66·3%])	Yes, intention to take (n=84 298 [17·5%])	No (n=78 638 [16·3%])	p value*
(Continued from previous page)				
Type of work contract				
Student	12 338 (59·4%)	4190 (20·2%)	4250 (20·4%)	<0·0001
Permanent contract	208 125 (68·9%)	54 132 (17·9%)	39 997 (13·2%)	..
Temporary contract	12 437 (65·5%)	2811 (14·8%)	3744 (19·7%)	..
Independent worker	2336 (60·7%)	975 (25·4%)	535 (13·9%)	..
Other salaried work	11 877 (60·0%)	3689 (18·6%)	4218 (21·3%)	..
Not working	72 616 (62·1%)	18 500 (15·8%)	25 894 (22·1%)	..
Employment sector				
Not working (eg, student or retired)	197 273 (61·7%)	13 825 (16·4%)	17 221 (21·9%)	<0·0001
Independent worker	192 158 (60·1%)	15 679 (18·6%)	16 749 (21·3%)	..
Private sector	219 015 (68·5%)	15 089 (17·9%)	10 695 (13·6%)	..
Public sector	219 334 (68·6%)	15 089 (17·9%)	10 616 (13·5%)	..
Employed during pregnancy	258 436 (67·5%)	67 356 (17·6%)	57 291 (15·0%)	<0·0001
First pregnancy	213 618 (65·0%)	55 815 (17·1%)	56 695 (17·4%)	<0·0001
Desire to have a child				
No	15 840 (61·8%)	4602 (17·9%)	5189 (20·2%)	<0·0001
Yes	301 834 (66·5%)	79 139 (17·4%)	72 917 (16·1%)	..
Hesitated or did not know	2055 (65·4%)	557 (17·7%)	531 (16·9%)	..
Psychological difficulties during pregnancy	39 179 (64·9%)	10 735 (17·8%)	10 448 (17·3%)	<0·0001
Depression during a previous pregnancy	34 561 (64·6%)	9286 (17·4%)	9619 (18·0%)	<0·0001
Chronic illness (other than diabetes or hypertension)	28 603 (65·2%)	7129 (16·2%)	8152 (18·6%)	<0·0001
Post-partum depression at 2 months	50 414 (66·4%)	12 203 (16·1%)	13 262 (17·5%)	<0·0001
ELFE child characteristics				
Sex				
Male	162 369 (65·9%)	44 581 (18·1%)	39 574 (16·0%)	<0·0001
Birth season				
Spring	71 482 (64·6%)	21 163 (19·1%)	18 010 (16·3%)	<0·0001
Summer	82 198 (66·3%)	21 145 (17·0%)	20 687 (16·7%)	..
Autumn	82 941 (69·2%)	25 361 (19·8%)	19 666 (15·4%)	..
Winter	83 108 (69·2%)	16 629 (13·9%)	20 274 (16·9%)	..
Siblings				
Only child	144 241 (68·0%)	37 788 (17·8%)	30 228 (14·2%)	<0·0001
1–2 Siblings	160 452 (65·8%)	42 285 (17·3%)	41 137 (16·9%)	..
>2 Siblings	15 037 (56·7%)	4225 (15·9%)	7273 (27·4%)	..
Feeding practices at 2 months				
Breastfed exclusively	98 134 (64·8%)	28 763 (19·0%)	24 476 (16·2%)	<0·0001
Breastfed and baby formula fed	49 138 (65·3%)	14 029 (18·6%)	12 111 (16·1%)	..
Baby formula fed exclusively	172 458 (67·4%)	41 506 (16·2%)	42 051 (16·4%)	..
Gestational week of birth	39·0 (39·0–40·0)	39·0 (38·0–40·0)	39·0 (39·0–40·0)	0·15
Apgar score at 5 min	10 (10–10)	10 (10–10)	10 (10–10)	0·67
Hospitalised for health complications	15 259 (68·5%)	3609 (16·2%)	3422 (15·5%)	<0·0001

(Table 2 continues on next page)

leave uptake: compared with fathers who took paternity leave, those who did not take paternity leave differed in terms of type of work sector (p<0·0001), attendance of their child's birth (p<0·0001), the number of children they had (p<0·0001), and household income (p<0·0001; tables 1, 2). Fathers who intended to take paternity leave differed from those who did take paternity leave in terms of type of work sector (p<0·0001; tables 1, 2).

At 2 months, the prevalence of post-partum depression in fathers according to paternity leave status was 4·5% among those who used paternity leave, 4·8% among those who intended to use paternity leave, and 5·7% among those who did not use paternity leave (figure 2). Fathers who took paternity leave (OR 0·49 [95% CI 0·48–0·51] as well as those who intended to take paternity leave (0·55 [0·53–0·57]) had decreased odds of

	Yes, taken (n=319 730 [66·3%])	Yes, intention to take (n=84 298 [17·5%])	No (n=78 638 [16·3%])	p value*
(Continued from previous page)				
Household characteristics				
Region of residence				
Paris and suburban region	62 272 (64·7%)	18 769 (19·5%)	15 128 (15·7%)	<0·0001
Central France	55 729 (64·5%)	16 135 (18·7%)	14 543 (16·8%)	..
Northern France	21 065 (66·3%)	4810 (15·1%)	5906 (18·6%)	..
Eastern France	27 445 (67·4%)	6737 (16·5%)	6537 (16·1%)	..
Western France	50 034 (69·6%)	12 402 (17·3%)	9400 (13·1%)	..
Southwestern France	27 385 (65·9%)	7716 (18·6%)	6436 (15·5%)	..
Central East France	38 560 (69·0%)	9558 (17·1%)	7796 (13·9%)	..
South France	37 241 (63·8%)	8171 (14·0%)	12 892 (22·1%)	..
Individuals in household	4 (3–4)	4 (3–4)	4 (3–4)	<0·0001
Monthly household income	€3000 (2500–4000)	€3000 (2500–4000)	€2700 (2000–3700)	<0·0001
Parental conflict				
Never or rarely	183 699 (66·3%)	48 267 (17·4%)	44 988 (16·2%)	<0·0001
Sometimes	127 650 (66·4%)	34 095 (17·7%)	30 532 (15·9%)	..
Frequently	8380 (62·4%)	1936 (14·4%)	3118 (23·2%)	..

Data are n (%) or median (IQR), unless otherwise indicated. *p value refers to χ^2 tests for categorical variables and Kruskal-Wallis tests for continuous variables. ELFE=Etude Longitudinale Française depuis l'Enfance cohort.

Table 2: **Comparison of parental, ELFE child, and household characteristics among fathers who reported post-partum depression status by paternity leave uptake status (n=10 975), on survey-weighted data**

post-partum depression compared with fathers who did not take paternity leave (figure 3).

After IPW adjustment, fathers who took paternity leave (OR 0·74 [95% CI 0·70 -0·78]) and those who intended to take paternity leave (0·76 [0·70–0·82]) also had significantly decreased odds of post-partum depression compared with fathers who did not take paternity leave (figure 3).

At 2 months, the prevalence of post-partum depression in mothers according to paternity leave status was 16·1% among those whose partner used paternity leave, 15·1% among those whose partner intended to use paternity leave, and 15·3% among those whose partner did not use paternity leave (figure 2). Mothers whose partners took paternity leave (OR 0·91 [95% CI 0·89–0·92]) as well as those whose partners intended to take paternity leave (0·87 [0·84–0·88]) had lower odds of post-partum depression compared with those whose partners did not take paternity leave (figure 2).

After IPW adjustment, mothers had higher odds of post-partum depression at 2 months if their partners took paternity leave compared with those whose partners did not take paternity leave (OR 1·13 [95 CI% 1·05–1·20]; figure 3). For mothers whose partners intended to take paternity leave the finding was not statistically significant (1·02 [95% CI 0·96–1·08]; p=0·52; figure 3).

Compared with participating fathers, non-participating fathers differed in their occupational grade (p<0·0001), type of work sector (p=0·02), type of work contract (p=0·007), household income (p<0·0001), and educational level (p<0·0001; appendix p 14). Compared with participating mothers, non-participating mothers differed in their occupational grade (p<0·0001), type of work sector (p<0·0001), type of work contract (p<0·0001), household income (p<0·0001), and educational level (p<0·0001; appendix p 14).

In additional analyses, we tested interactions between paternity leave uptake and fathers' education level (yes, taken p=0·19; yes, will take p=0·21), fathers' type of employment (yes, taken p=0·50; yes, will take p=0·20), and number of children in the family (yes, taken p=0·23; yes, will take p=0·60). None of the interactions reached statistical significance (p>0·05; appendix p 15).

Lastly, we found no statistically significant differences between the primary results and the population of mothers whose partners also provided information on post-partum depression. Mothers whose partners took paternity leave (OR 0·92 [95% CI 0·90–0·94]) as well as those whose partners intended to take paternity leave (0·83 [0·81–0·86]) had lower odds of post-partum depression compared with those whose partners did not take paternity leave (appendix p 16).

After IPW adjustment, mothers had higher odds of post-partum depression at 2 months if their partners took paternity leave compared with those whose partners did not take paternity leave (OR 1·08 [95 CI% 1·02–1·15] (appendix p 17). For mothers whose partners intended to take paternity leave the finding was not statistically significant (0·93 [95% CI 0·86–1·00]; p=0·06; appendix p 17).

Discussion

Using survey-weighted data[14,15] from a large, nationally representative cohort study of families in which the

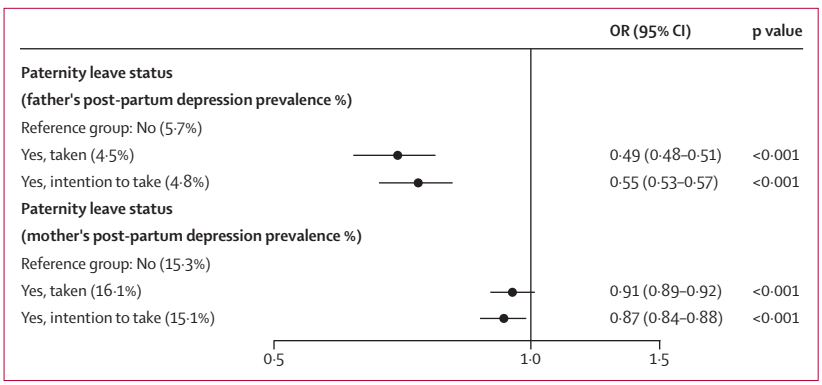

Figure 2: **Association between paternity leave uptake and father's (n=10 975) and mother's (n=13 075) post-partum depression at 2 months**
Figure shows inverse probability weighted-logistic regression models. Adjusted by father's age, father's nationality, father's educational level, father's occupational grade, father's type of work contract, father's employment sector, whether father attended ELFE child's birth, whether father desired to have a child, mother's age, mother's nationality, mother's relationship status, mother's level of education, mother's occupational grade, mother's type of work contract, mother's employment sector, mother's employment status during pregnancy, mother's first pregnancy, mother's desire to have a child, mother's psychological state during pregnancy, whether mother had depression during a past pregnancy, mother's chronic illness status, mother's post-partum depression at 2 months, ELFE child's sex, ELFE child's birth season, ELFE child's sibling status, ELFE child's feeding practices, ELFE child's gestational age in weeks, ELFE child's Apgar score at 5 min, whether ELFE child was hospitalised for health complications, parents' region of residence, number of adults in household, household income, and parental conflict. ELFE=Etude Longitudinale Française depuis l'Enfance cohort study.

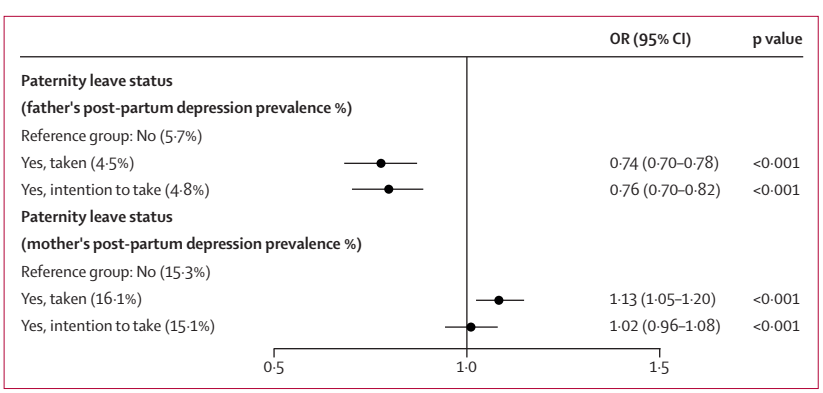

Figure 3: **Association between paternity leave uptake and father's (n=10 975) and mother's (n=13 075) post-partum depression at 2 months**
Figure shows crude logistic regression models.

father was eligible for paternity leave, we tested the association between 2-weeks' paid paternity leave and post-partum depression at 2 months in fathers and mothers. Our results suggest that after adjusting for differences in several observed parental, family, and children's characteristics, fathers who took paternity leave as well as fathers who intended to take paternity leave had a lower likelihood of reporting post-partum depression at 2 months after their child's birth. This finding suggests that in addition to the benefits that paternity leave can confer in terms of family dynamics[2] and children's development,[4] paternity leave could also yield positive effects in terms of fathers' mental health. Moreover, we also found that mothers showed higher odds of reporting post-partum depression at 2 months if their partners took paternity leave, suggesting that paid, 2-week paternity leave might benefit fathers against post-partum depression onset but might not be a sufficient to protect mothers against post-partum depression onset.

Some limitations of our study need to be acknowledged before interpreting the results. First, parents self-reported paternity leave uptake and post-partum depression, which could induce response error; however, we found the prevalence of paternity leave and post-partum depression in the ELFE data to be consistent with other national estimates.[7,8] Second, fathers who take paternity leave are likely to differ from those who do not, making the use of observational data to test the health consequences potentially complicated. The ELFE cohort study collected data regarding participants' personal, family, and child's characteristics, which we accounted for in our statistical analyses. Although we were able to statistically balance paternity leave groups on many observed characteristics, some potential confounders were unmeasured, such as fathers' history of depression, physical health, attitudes, and personality traits, as well as engagement in the mother's prenatal care and birth preparation during pregnancy.[29] These characteristics might partly explain the relationship between paternity leave and parental depression during the postnatal period, although we believe that by controlling for other characteristics, including fathers' demographic and socioeconomic features, we accounted for part of the underlying variability in study outcomes. Lastly, non-respondents differed in terms of certain socioeconomic characteristics, which might lead to bias. However, because depression is most frequent among men who experience socioeconomic disadvantage, the role of paternity leave might be stronger than we report.

Our study had several strengths. First, data were from a large nationally representative cohort of families in which the father was eligible for paternity leave based in France, which includes participants from different social backgrounds. The use of survey weights allowed us to make our results generalisable to all families in which the father was eligible for paternity leave in France. Second, we were able to include a substantial number of confounding factors in our IPW-adjusted analyses, allowing us to account for major selection and confounding characteristics.

Paternity leave might help to reduce the risk of fathers' post-partum depression, which can not only improve the quality of life for fathers but might also have positive effects on their children's development, depending on the quality and quantity of interactions fathers share with their children.[29] Paternity leave allows fathers to spend time with their children early on and engage in activities such as skin-to-skin contact and infant feeding.[30] These moments can reduce the odds of post-partum depression for fathers[30] but also reduce the odds of the child having conduct and emotional disorders, hyperactivity, anxiety and depression, or language delays

later in adolescence.[29,31] Additionally, studies have reported that fathers who took paternity leave were more engaged in their children's lives across their lifespan compared with fathers who did not take paternity leave.[32] Increased father involvement has been linked to children's decreased behavioural problems in adolescence, increased social and relational functioning in childhood and adulthood, increased educational outcomes, and decreased likelihood of regular smoking in adolescence.[33]

Studies have also shown that paternity leave, even as short as 2 weeks, can increase fathers' involvement in house-related chores.[2,32,33] Fathers' involvement might help couples implement a more equal division of parenting and domestic tasks,[2,32,33] which is associated with reduced levels of conflict and a feeling of social support for both parents.[2] Fathers can have the opportunity to reduce relationship conflict by learning and applying the parenting knowledge gained during paternity leave as well as feel socially supported as they explore their new roles as fathers, which are all protective factors against the onset of post-partum depression.[32]

Fathers might also have the opportunity to improve their general health outcomes and stress management during paternity leave, which have been linked to post-partum depression.[32,34] Fathers can find a routine that will help balance work and home life, hence reducing paternal stress.[31,35] Also, fathers might be encouraged to take up healthy behaviours such as increased physical activity, reduced alcohol consumption, smoking cessation, and reduction of other risky health behaviours.[31,35]

Fathers who intended to take paternity leave did not statistically differ from those who had taken paternity leave at the time of the study: both had decreased odds of post-partum depression compared with fathers who did not take paternity leave. Other studies exploring the determinants of paternity leave use found that compared with fathers who took paternity leave, fathers who did not take paternity leave had poor self-reported health, poor psychological health, and more engagement in risky behaviours such as daily smoking and high alcohol consumption, which could contribute to post-partum depression.[36,37] Another study found that fathers' work environments and positions at work influence their uptake of paternity leave.[38] Fathers who do not use paternity leave might have certain workplace stressors or work in environments that discourage them from taking leave. One qualitative study found that fathers did not take their paternity leave or only took a portion of it because of pressing work deadlines, the inability to be replaced during their leave, or a risk of missing out on potential work promotions. Some fathers even reported not taking paternity leave because of negative judgments from colleagues (such as being considered as less dedicated to the job) as well as not having any other fathers as examples.[38,39]

After IPW adjustment, the direction of the association between paternity leave use and mothers' post-partum depression at 2 months changed, revealing that mothers whose partners took paternity leave had an increased likelihood of developing post-partum depression at 2 months. Possible explanations for this association could be selection bias as well as the unequal division of childcare time allotted due to shorter paternity than maternity leave.[2] Research should also explore if a longer paid paternity leave (such as ≥30 days) is a protective factor against post-partum depression in mothers.[35] Additionally, most fathers take paternity leave the first month following their child's birth in France,[35] but further research should explore if the exact timing when fathers take paternity leave influences maternal mental health outcomes following their child's birth. Lastly, understanding the motives behind why fathers take paternity leave and their engagement in household and child-related tasks would be further informative.

In conclusion, paternity leave is associated with decreased odds of post-partum depression at 2 months among fathers after controlling for many family and child-related characteristics associated with paternity leave uptake. Providing fathers with paid paternity leave—even as short as 2 weeks—could thus reduce their odds of depression during the postnatal period, in addition to other benefits in terms of family dynamics and children's development. Mothers, however, showed higher odds of reporting post-partum depression if their partners took paternity leave. This finding might have many interpretations, such as that the paternity leave duration was not sufficient to protect mothers against post-partum depression onset, or that the timing was not optimal to benefit the mother. Also,, the nature of the father´s involvement during paternity leave, his motivations to take leave, his mental health history, and the social support given to him and his partner during paternity leave are other mechanisms that might explain this association. As of July, 2021, France increased the amount of time for paternity leave to 28 consecutive days.[13] This policy change might be a propitious way of improving the chances of parental mental wellbeing and gender equity.

Contributors

KMB conceptualised and designed the study, carried out the formal analyses and data management, and wrote, reviewed, and revised the manuscript. RG assisted in study design and data management, verified formal analyses, and reviewed and revised the manuscript. XB and M-ND reviewed and revised the manuscript for important intellectual content. EC conceptualised the study design and reviewed and revised the manuscript for important intellectual content. MM conceptualised the study, oversaw the statistical analyses, and reviewed and revised the manuscript for important intellectual content. All authors had full access to the data in the study, approved the final manuscript as submitted, agreed to be accountable for all aspects of the work, and decided to submit the manuscript. RG and MM directly accessed and verified the underlying data reported in the manuscript.

Declaration of interests
We declare no competing interests.

Data sharing
To access data, researchers can make a request to the ELFE data access committee. Researchers who are interested in accessing ELFE questionnaires or data can refer to https://elfe-france.fr/en/the-research/access-to-data-and-questionnaires/. Enquiries about the data used for this study can be addressed to the corresponding author.

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