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Research paper

Longitudinal trajectories and associated risk factors of paternal mental illness in the nine years surrounding the transition to fatherhood

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ABSTRACT

Background: The arrival of one's first child is a known risk factor for mental illness, yet investigations on fathers' mental health are limited. We conducted a longitudinal investigation on paternal depression and anxiety in the nine years surrounding the transition to fatherhood.
Methods: Using a national cohort of French men (CONSTANCES, $n = 6299$), we investigated the prevalence and associated risk factors of mental illness amongst first-time fathers. Responses to the Center for Epidemiological Studies Depression (CES-D) and 12-item General Health Questionnaire (GHQ-12) scales were used to identify clinically significant symptom scores. Self-declared mental illness was also reported by participants. Group-based modelling was used to identify latent trajectory groups for both measures.
Results: Levels of self-declared anxiety (averaging 4.9 % pre-fatherhood, 7.8 % post) exceeded that of depression (1.9 % pre- fatherhood, 3.3 % post) or other disorders. However, rates of clinically significant symptom scores (17–27 %) were consistently higher. Participants' mental health appeared to worsen from two-years prior to their child's arrival and improve from two-years after. We identified three trajectory groups for fathers' self-declared mental illness: Low stable (90.3 %); Low risk with high temporary increase (5.6 %); and Consistent high risk (4.1 %). Risk factors associated with worsening mental health trajectories were unemployment, not living with one's partner, having had adverse childhood experiences and foregoing healthcare due to financial reasons.
Limitations: All measures of mental illness relied on participant self-reports and are thus subject to bias.
Conclusions: This study reveals an important period of heightened psychological vulnerability amongst first-time fathers, emphasising the need for increased and better adapted paternal mental health screening.

1. Introduction

The arrival of a child, and preparation towards, encompasses a significant amount of personal, lifestyle, and financial adjustments. Whilst for many men this entails primarily positive feelings, it is also common to struggle with such a significant transition, resulting in negative repercussions on their mental health. Research shows that increased work-family conflicts (Philpott et al., 2019) and the deterioration of previous lifestyle and sexual relationships (Williamson et al., 2008), alongside sleep deprivation (Baafi et al., 2001), create an emotionally taxing environment for fathers following their first child's arrival, with labour itself often triggering feelings of helplessness and anxiety (Genesoni and Tallandini, 2009; Philpott et al., 2017). This experience is not exclusive to the postnatal period; a review of qualitative studies on the transition to fatherhood found pregnancy to be the most demanding period for the fathers' psychological needs, entailing a core shift in identity as well as increased disconnection with their partner (Genesoni and Tallandini, 2009). Both pre and postnatal periods may entail feelings of powerlessness and unmet expectations amongst first-time fathers (Philpott et al., 2017; Finnbogadóttir et al., 2003), and for several the pleasure, pride and excitement typically accompanying this new stage of life becomes obscured.

Global research suggests that approximately 5–10 % of fathers are susceptible to depression in the perinatal period (Paulson and Bazemore, 2010; Demontigny et al., 2013). And whilst the current literature focuses almost exclusively on paternal depression, there is accumulating evidence indicating that perinatal stress and anxiety are even more prevalent amongst fathers (Demontigny et al., 2013; Skari et al., 2002), with a systematic review showing levels of paternal anxiety during the perinatal period to range 2.4 %–51.0 % (Philpott et al., 2019). Paternal

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depression and anxiety are frequently comorbid (Leray et al., 2011; Kiviruusu et al., 2020; Philpott et al., 2022), however the inclusion of both is particularly important in investigations on paternal mental health. Not only does anxiety appear more prevalent than depression amongst fathers, but certain differences exist between the two, such as differing levels of negative effect (Rutter et al., 2024) as well as disparities in the risk factors associated with each during the perinatal period (Chhabra et al., 2022; Leach et al., 2008). Interestingly, one study (Berger et al., 2012) saw that perceived social stigma amongst men was less pervasive for paternal anxiety, when compared to depression. This is particularly relevant, as research indicates that current diagnostic methods may be underestimating the rates of mental illness amongst men (Shi et al., 2021; Branney and White, 2008). Including anxiety-related disorders in psychiatric research amongst men might partially counteract this apparent underdiagnosis (Bradley and Slade, 2011). The current research focus on paternal depression, alongside certain public health campaigns targeting fathers (Rochlen et al., 2005), may have obscured a significant proportion of the male population struggling with their mental health (Fisher et al., 2021).

The method with which paternal anxiety is assessed has been found to strongly associate with declared prevalence (Philpott et al., 2019). Symptom-based measures appear to result in a more even representation of the various types of anxiety diagnoses than using self-declared diagnoses (Davies et al., 2022), with another study highlighting that a disparity between self-report symptoms versus declared mental illness is also apparent for depression (Glanville et al., 2021). Employing multiple measures within a study may thus provide a more reliable investigation. The use of structured check-lists during diagnosis has also been found to provide more accurate assessments of men's mental health than therapists conducting diagnosis without, indicating a currently present clinical bias (Cwik et al., 2016). Structured questionnaires designed for the perinatal period, however, focus primarily on maternal symptomology, often due to a lack of knowledge surrounding fathers' mental health during this period (Berg et al., 2022). They thus risk overlooking symptoms more commonly seen amongst men, such as increased aggression or alcohol consumption, thereby under-reporting the real prevalence of paternal mental illness (Madsen, 2019). Until the nuances between paternal diagnostic methods are better understood, collaborative assessment using multiple methods may counteract some of the heterogeneity seen amongst psychological assessments of fathers.

Even more lacking than general prevalence data are investigations into the longitudinal trajectories of paternal mental health (Bruno et al., 2020). Research on the long-term progression of fathers' mental illness may reveal important variations in the timing, severity and chronicity of symptoms. Meta-analyses show rates of paternal mental illness to vary significantly with time (Paulson and Bazemore, 2010), with perinatal studies commonly finding depression amongst new fathers to peak 3–6 months postpartum (Paulson and Bazemore, 2010; Tokumitsu et al., 2020). Interestingly, a meta-analysis on paternal anxiety saw no difference between pre and postpartum rates (Leiferman et al., 2021). However, a key limitation surrounding the available prevalence studies for both depression and anxiety is that they concentrate almost exclusively on the two years following birth. Moreover, the few studies to investigate beyond the perinatal period are contradictory (Garfield et al., 2014; Giallo et al., 2012). Another particularly understudied period are the years prior to birth, which could provide valuable insight into what precedes changes in mental health postpartum. Clearly research across longer timeframes is needed, as paternal mental illness does not stop being relevant beyond the perinatal window (Scarlett et al., 2023).

Investigation of the longitudinal progression of fathers' mental health is also necessary to better target prevention methods. Certain potential risk-factors for paternal psychopathology, such as financial insecurity, risk worsening overtime. Socioeconomic factors including low income, job insecurity and access to paid paternity leave have already been seen to associate with paternal perinatal depression and anxiety (Philpott et al., 2022; Bradley and Slade, 2011; Pedersen et al., 2021; Nath et al., 2016). In a meta-analysis on paternal postpartum depression spanning 14 countries, the largest effect sizes were seen for paternal unemployment, alongside financial instability and low levels of paternal education (Ansari et al., 2021). However, young, first-time fathers show a greater risk of depression than older fathers that remains significant even when controlling for socioeconomic factors (Bergström, 2013). This may be partly explained by other factors, such as a lack of informal social support (Lähteenmäki et al., 2019; Nakamura et al., 2020) or relationship status (Philpott et al., 2022), both of which associate with paternal mental illness. Being a first-time father, compared to having subsequent children, has also been found to increase the risk of trait anxiety symptoms in the first four days postpartum (Philpott et al., 2022). Most longitudinal studies on the risk factors for paternal mental illness, however, have relied on data from UK or Australian cohorts, and thus might not be generalisable to other settings. Cultural and social factors may reveal different patterns when explored in the French context. Only two studies have investigated paternal mental health in France, however both investigated exclusively paternal depression, and did not extend beyond four months postpartum (Nakamura et al., 2020; Séjourné et al., 2012).

This article aims to provide a unique investigation on the longitudinal trajectories of paternal mental illness, extending four years before and after fathers' first child's arrival. The assessment of fathers' mental health will incorporate both depression and anxiety. Due to the apparent heterogeneity seen amongst the methods currently used to assess paternal mental illness, paternal trajectories will be assessed using both clinically significant symptom scores and self-declared mental illness to identify any potential disparities between the two. Alongside this, sociodemographic, lifestyle and psychosocial risk factors will be explored in relation to these longitudinal patterns to identify potential risk factors for paternal mental illness during this period.

2. Methods

2.1. Population

The population for this study came from the Constances cohort, a large-scale, prospective observational cohort, designed to cover a broad scope of public health domains (Zins, 2019). It comprises a sample of 200,000 adults, aged 18–69 years at study inception. Recruitment was conducted throughout France, from 2012 to 2020, through a random-sampling scheme designed to enlist a sample representative of those enrolled in the National Health Insurance Fund (~85 % of the general population). For this study, we focused exclusively on male participants that became first-time fathers during the data collection period (n = 6299).

2.2. Study design

The data for this study is based on yearly self-administered questionnaires, starting from inclusion. Questionnaires were a mix of paper-and-pencil (sent to participants' homes) and internet based, to better accommodate participants and minimise selection bias. Some questionnaire data were collected annually (e.g., health status, life events) whilst others collected across longer intervals (e.g., family income, level of education). Data were linked anonymously, and all confidentiality procedures approved by the French national authorities.

2.3. Measures

2.3.1. Fatherhood status

First-time fatherhood status was determined based on the response to two questions: 1) whether or not they were a father, asked at inclusion 2) whether or not they had welcomed a child (birth, adoption and/or spouse's children from a previous union) within the past 12 months,

asked over the subsequent data waves (from 2013 to 2020). The arrival of additional children was recorded via the same question. Those who were fathers prior to inclusion in the cohort were excluded as the date of their first child's arrival was not recorded.

2.3.2. Paternal mental illness

Two measures were used to assess fathers' mental health. Firstly, at every year since inception, participants declared the presence of mental illness (yes/no), alongside their specific pathology as indicated in the questionnaire (subsequently grouped into "depression"; "anxiety"; other (bipolar, manic-depressive syndrome, "nervous breakdown")). Data from the 2013 wave were excluded due to deviations in categorisation. This measure is described henceforth as "self-declared mental illness".

Additionally, continuous symptom scales were used. Symptoms were measured at several data waves, using either the Center for Epidemiologic Studies Depression scale (CES-D) (Radloff, 1977) or the 12-item General Health Questionnaire (GHQ-12) (Goldberg, 1978). The CES-D is a 20-item, self-report questionnaire used to measure depressive moods, thoughts or feelings via a 4-item Likert scale. Total scores range from 0 to 60, with higher scores indicating the presence of increased depressive symptomatology. The GHQ-12 is the 12-item version of the GHQ, originally adopted as a screening tool for an international study on mental health conducted by the World Health Organization (WHO) (Goldberg et al., 1997). Recommended to screen common mental disorders such as depressive, anxious and somatic disorders (Goldberg et al., 1988), it also uses a self-report, 4-item Likert scale, with scores ranging 0 to 12 when using binary scoring. Both the CES-D (Nishimura and Ohashi, 2010; Mangialavori et al., 2020; Yin et al., 2018) and GHQ-12 (Tran et al., 2012; Haem and Doostfatemeh, 2022) have been validated for use in new fathers. For reporting the prevalence of paternal mental illness, binary scoring was used. For the GHQ-12, the corrected scoring method (C-GHQ) was applied (Anjara et al., 2020) and a cut-off score of $\geq$6 used, resulting in the highest combination of sensitivity and specificity for the C-GHQ (Lundin et al., 2016). In line with the literature and for greater congruency with the GHQ-12, a CES-D cut-off score of $\geq$16 was used (Nishimura and Ohashi, 2010; Mangialavori et al., 2020). For all other analyses, scales were treated as continuous, to reduce the risk of over-simplification and loss of information often resulting from dichotomising mental health scores. For continuous scoring, both scales were standardised before combining. This measure is described henceforth as "clinically significant symptom scores".

The overall reliability and internal consistency (Cronbach α) of the CES-D was 0.702 and the GHQ-12 was 0.874, indicating acceptable to good internal consistency and reliability.

2.3.3. Associated factors

Based on a review of the literature, we identified several sociodemographic, psychosocial and lifestyle characteristics for inclusion as potential factors associated with paternal mental health. The following variables were considered: Fathers' age at child's arrival (Giallo et al., 2012; Nath et al., 2016; Bergström, 2013); Marital status (Married/Civil partnership; Divorced/Separated; Unmarried (never married)) (Philpott et al., 2022; Baldwin et al., 2019; Matthey et al., 2000); Living with one's partner (yes/no) (Garfield et al., 2014; Bronte-Tinkew et al., 2007); Living with children (biological or otherwise) (yes/no) (Garfield et al., 2014; Bronte-Tinkew et al., 2007); Close relationship satisfaction (combined variable of close friends/family satisfaction and/or relationship satisfaction) (Demontigny et al., 2013; Philpott et al., 2022; Bergström, 2013; Lähteenmäki et al., 2019); Employment status (Employed; Unemployed; Retired; Student/Other) (Philpott et al., 2022; Bradley and Slade, 2011; Pedersen et al., 2021; Nath et al., 2016; Ansari et al., 2021); Spouse's employment status (Employed; Unemployed; Retired; Student/Other) (Nath et al., 2016; Ballard et al., 1994); Financial difficulties within the past year (food, rent, electricity, loans, etc.) (yes/no) (Philpott et al., 2022; Bradley and Slade, 2011; Pedersen et al., 2021; Nath et al., 2016; Bergström, 2013; Rosenthal et al., 2013); Having foregone healthcare due to financial reasons within the past year (yes/no) (Bergström, 2013; Rosenthal et al., 2013); The arrival of subsequent children at any time point (yes/no) (Philpott et al., 2022); and daily alcohol use according to recommended (WHO) guidelines (Moderate consumption; No consumption; Non-recommended consumption) (World Health Organization, 2023).

Where possible, variables were taken at either the same year of participants' child's arrival (for chi-square and multivariable models), or, for longitudinal trajectory analyses, the same year as each time-point in relation to the child's arrival. For several variables, data was only recorded at inclusion, but was deemed reliable and thus retained in analyses. These were as follows: Participants' region of birth (France; Europe; Africa; Other) (Doyle et al., 2012); French nationality status (French by birth; Naturalised French; Foreign national) (Bulford et al., 2022); Level of education (No diploma; Primary, Professional/vocational certificate (9–11 years); Baccalaureate or equivalent diploma; and Baccalaureate +2–3 years; +4 years; +5 or more) (Ansari et al., 2021); Parental history of serious psychiatric illness (yes/no) (Ramchandani et al., 2008); Parental history of suicide (yes/no) (Ramchandani et al., 2008).

Factors excluded due to the proportion of missing data, in all instances due to long intervals between data collection points, were: Family's average net monthly income; Average number of hours of sleep per night; Sleep difficulties over the past month; Level of physical activity on/off work; Deprivation index (EPICES score); and participants socio-professional category. Full detail on missing data is available in Supplementary Material T1.

2.4. Data analysis

To assess longitudinal patterns of fathers' mental illness, the arrival of participants' children was taken as "time-point 0" and mental health data extrapolated, either from questionnaires or imputation, from four-years prior to four-years post. Latent class modelling - a semi-parametric group-based modelling strategy used to identify homogeneous latent trajectory classes – was conducted using PROC TRAJ in SAS (Nagin and Odgers, 2010; Jones and Nagin, 2007). Models were created respectively for both self-declared mental illness (depression, and/or anxiety), and clinically significant symptom scores, spanning four-years pre- to four-years post-fatherhood. Binary logit models were used for self-declared mental illness (yes/no) and censored normal distribution models (CNORM) for symptom scores. Participants were excluded if failing to have responses for at least two out of the nine time-points. The number and forms of latent class trajectories were determined using the Bayesian Information Criterion (BIC), posterior probabilities of class membership (AvePP), odds of correct classification (OCC), and the theoretical interpretation of the class solutions (Jones and Nagin, 2007; Jones et al., 2001). Missing mental illness data between time-points was imputed in R using either interpolation (linear or spline), weighted moving averages, or Kalman smoothing (Package: imputeTS (Moritz and Bartz-Beielstein, 2017)) (Armstrong et al., 2009). All methods were tested and the most suitable chosen based on graphical interpretation. Trajectory analyses were also rerun using the SAS-generated imputation, and models compared. Based on model fit statistics, R-based imputation was chosen.

To determine the variables to be tested against trajectory groups, factors were selected using the following steps. First, chi-square analyses were run independently for both self-declared mental illness and clinically significant symptom scores, in the year of the child's arrival (time-point 0). Significance at $p < 0.05$ for either outcome was considered relevant for retention in subsequent multivariable logistic regressions. For these models, all variable data were also taken from the year of the child's arrival (time-point 0). Prior to inclusion, potential risk factors were also tested for within-variable correlation and covariate pairs with $r > 0.7$ reduced to the most relevant factor (Nettleton, 2014). The arrival of subsequent children was also included as a covariate in all trajectory

regression models (Philpott et al., 2022).

Variables identified through these steps were then used in multinomial regression models, fitted to test associations between significant risk-factors and the longitudinal trajectory groups for both self-declared mental illness and symptom scores. For these trajectory analyses, time-dependent variables (employment status; the arrival of a subsequent child; living status with partner; having forgone healthcare due to financial reasons) were taken as separate events at each year.

Thus, data were taken from the same year of the time-point created based on participants' first child's arrival. All missing data were imputed using Multivariate Imputation by Chained Equations (MICE) (Buuren and Groothuis-Oudshoorn, 2011), performed using R version 4.2.2 (R Core Team, 2022).

3. Results

3.1. Demographics

The final number of included participants at each phase of analysis is shown in Fig. 1. Comparison between included and an age-matched sample of excluded participants is available in Supplementary Material T2. Compared to excluded men of the same age, key significant differences were that included participants were more likely to be married (84.3 % vs 57.6 %), live with their partner (74.0 % vs 95.4 %) and be satisfied in their close relationships (partner and/or friends and family) (92.6 % vs 85.5 %).

The demographics of our sample of first-time fathers are shown in Table 1. On average, participants were aged 38 years old at inclusion. 96 % of participants had French nationality. At inclusion, 88 % of participants were living with their partners, and 66–67 % married or legally partnered. The majority of participants had completed their baccalaureate, or equivalent diploma, with roughly half (49–50 %) holding 16+ years of education. 85 % of participants were employed.

3.2. Mental illness prevalence

The estimated prevalence of mental illness during the nine years surrounding the transition to fatherhood is shown in Fig. 2. The overall rate of self-declared mental illness across the study period averaged 7.9 %, with approximately 6.5 % suffering from anxiety, 2.7 % depression and 1.4 % multiple diagnoses (comorbid anxiety, depression and/or other diagnoses). In all instances, rates of mental illness were higher following participants' child's arrival (9.7 % general; 7.8 % anxiety; 3.3 % depression), when compared to before (5.6 % general; 4.9 % anxiety; 1.9 % depression).

Levels of clinically significant symptom scores averaged 23.2 % during the study period. The average rate was 18.3 % pre-fatherhood and 25.2 % following the child's arrival.

3.3. Repeated measures latent class analysis

Two to four group, general linear models were run to assess best fit on both outputs (self-declared mental illness; symptom scores). All model fit statistics are shown in Supplementary Material T3–4.

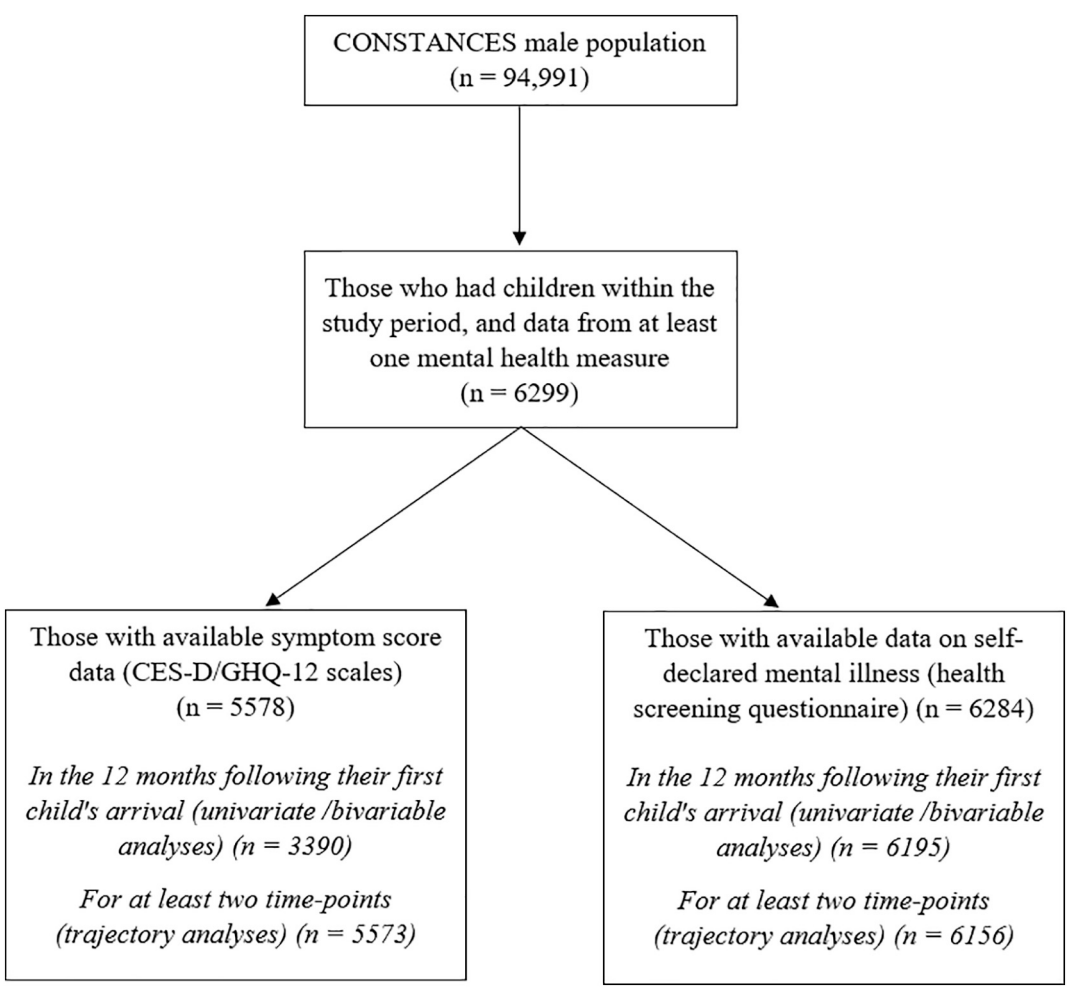

Fig. 1. Flow chart detailing the participant n values used within this study. *Constances cohort.*

Table 1
Demographic and socioeconomic information of the population of fathers with data available for analysis on either self-declared mental illness ($n = 6284$) or symptom scores (CES-D/GHQ-12 scales) ($n = 5578$), based on data taken at participants' inclusion. *Constances cohort*.

		Participants with available data on			
		Self-declared mental illness		Symptom scores	
		n	%	n	%
Age at inclusion	Mean (SD)	37.9 (10.9)		37.8 (10.8)	
Age group (years)	Under 30	1059	17 %	971	17 %
	30–34	1994	32 %	1765	32 %
	35–39	1329	21 %	1167	21 %
	40–44	650	10 %	574	10 %
	45–49	287	5 %	260	5 %
	50–59	445	7 %	391	7 %
	60 and over	514	8 %	445	8 %
Region of birth	France (including overseas territory)	5606	90 %	5016	90 %
	Europe	229	4 %	208	4 %
	Africa	296	5 %	245	4 %
	Other	103	2 %	81	2 %
French nationality status	French by birth	5721	92 %	5119	93 %
	Naturalised French	257	4 %	209	4 %
	Foreign national	237	4 %	207	4 %
Level of education (completed)	Baccalaureate + 4 or more years (16+ years)	3046	49 %	2736	50 %
	Baccalaureate + 2–3 years (14–15 years)	1514	25 %	1359	25 %
	Baccalaureate or equivalent diploma (12–13 years)	785	13 %	693	13 %
	Primary, Professional/ vocational certificate (9–11 years)	756	12 %	654	12 %
	No diploma (<8 years)	82	1 %	65	1 %
Marital status	Married/civil partnership	3879	67 %	3437	66 %
	Divorced/separated	360	6 %	316	6 %
	Unmarried (never married)	1589	27 %	1437	28 %
Living with partner	Yes	5174	88 %	4605	88 %
	No	698	12 %	620	12 %
Close relationship satisfaction[a]	Satisfied	4942	92 %	4409	92 %
	Unsatisfied	430	8 %	382	8 %
Employment status	Employed	4912	85 %	4406	85 %
	Retired	394	7 %	344	7 %
	Training/education/ other	178	3 %	158	3 %
	Unemployed	309	5 %	264	5 %
Spouse employment status	Employed	4369	81 %	3899	81 %
	Retired	219	4 %	189	4 %
	Training/education/ other	254	5 %	234	5 %
	Unemployed	527	10 %	470	10 %
Financial difficulties[b]	No	5586	91 %	4999	91 %
	Yes	587	10 %	506	9 %
Foregone healthcare due to financial reasons[b]	No	5547	90 %	4968	90 %
	Yes	636	10 %	548	10 %
Alcohol consumption	No consumption	571	10 %	509	10 %
	Moderate consumption	4545	79 %	4063	79 %
	Non-recommended consumption	635	11 %	569	11 %
Adverse childhood experiences	None	1438	32 %	1270	32 %
	Yes, at least one	3073	68 %	2720	68 %
No. of adverse childhood experiences	Mean (SD)	1.76 (1.9)		1.76 (1.9)	
Parent history of psychiatric illness	No	6127	98 %	5437	98 %
	Yes	157	3 %	141	3 %
Parent history of suicide	No	6227	99 %	5528	99 %
	Yes	57	1 %	50	1 %

N values based on participants with available data for each respective measure.
[a] Romantic partner and/or friends and family.
[b] Over the past 12 months.

3.4. Self-declared mental illness (depression, anxiety and/or other)

Relative fit indices indicated that a 3-class model was the best fit for self-declared mental illness data. Groups for mental illness trajectories over time were as follows: Low risk with high temporary increase (5.6 % of fathers); consistent low risk (90.3 %); and consistent high risk (4.1 %) (Fig. 3).

3.5. Clinically significant symptom scores (CES-D/GHQ-12 scores)

Relative fit indices indicated that a 2-class model was the most appropriate fit for symptom data. Groups for symptom trajectories were as follows: Low with small temporary increase (75.1 %); and moderate with small temporary increase (24.9 %) (Fig. 3).

3.6. Associated factors

Factors associated with either self-declared mental illness or symptom scores in the year following participants' first child's arrival are shown in Table 2. Factors that were significantly associated with either measure, as well as the arrival of subsequent children over time, were taken and tested against all trajectory groups.

3.7. Self-declared mental illness (depression and/or anxiety)

When compared to mental illness trajectory Group 2 (consistent low risk), risk factors for Group 1 (low risk with high temporary increase) were as follows: Being aged 35–39 [aOR: 1.61; 95 % CI: 1.02–2.57]; Being unemployed (as opposed to employed) [aOR: 3.01; 95 % CI: 1.63–5.32]; Having had at least one adverse childhood experience (ACE) [aOR: 2.26; 95 % CI: 1.49–3.55]; and having forgone healthcare due to financial reasons [aOR: 1.75; 95 % CI: 1.02–2.87] (Table 3). Risk factors for Group 3 (consistent high risk) – when compared to Group 2 – were: Being aged 40–44 [aOR: 2.48; 95 % CI: 1.29–4.72]; Being aged 60+ [aOR: 4.79; 95 % CI: 1.79–12.07]; Not living with one's partner (if in a relationship) [aOR: 2.59; 95 % CI: 1.25–5.07]; being unemployed [aOR:

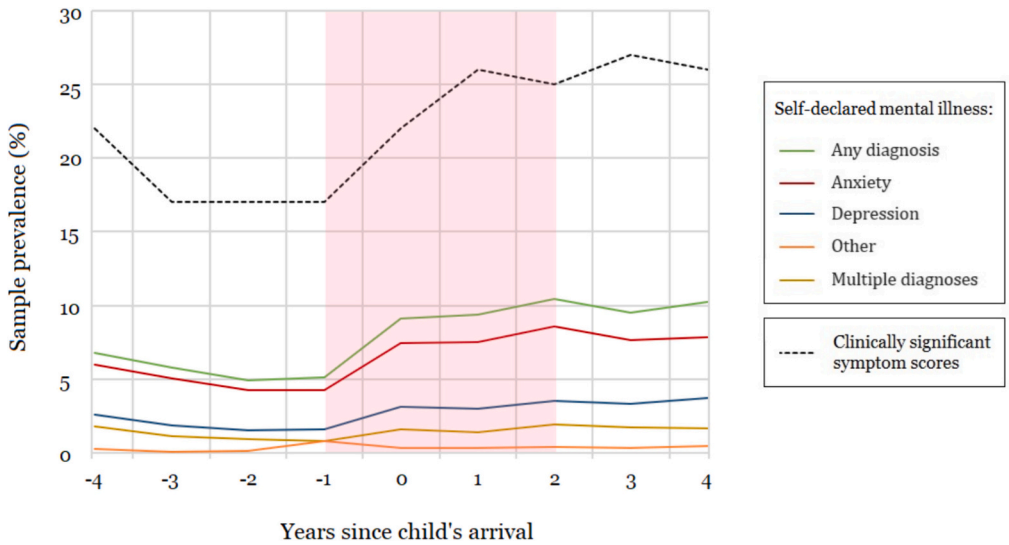

Fig. 2. The prevalence of self-declared mental illness and clinically significant symptom scores (CES-D/GHQ-12 scales) in the nine years surrounding the transition to fatherhood. Time Point 0 represents the year participants' first child arrived (birth, adoption and/or spouse's children from another union). *Constances cohort.*

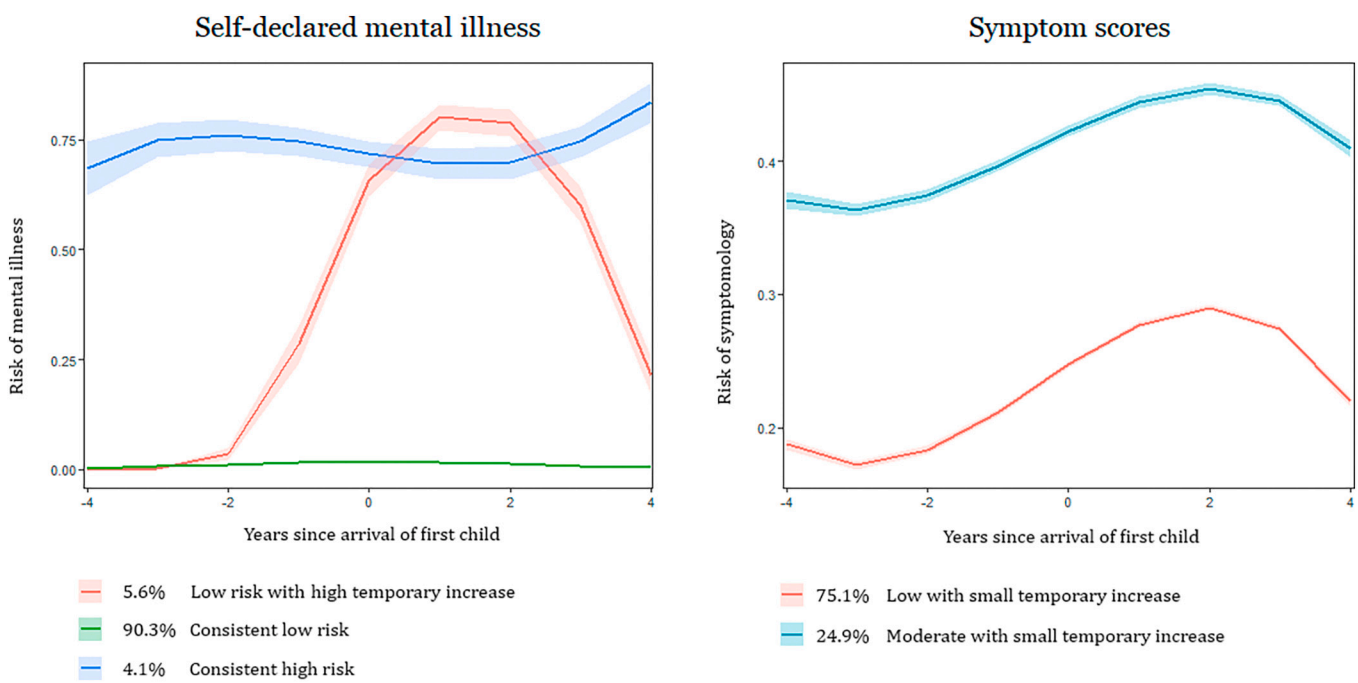

Fig. 3. Longitudinal trajectories of self-declared mental illness (n = 6156) and clinically significant symptom scores (CES-D/GHQ-12 scales) (n = 5573) amongst first-time fathers in the nine years surrounding their first child's arrival (four years prior until four years after). Area surrounding curves indicates 95 % confidence intervals. *Group-based trajectory modelling, Constances cohort.*

2.62; 95 % CI: 1.22–5.23], and having subsequent children in the years following [aOR: 1.85; 95 % CI: 1.08–3.06].

3.8. Symptom scores (CES-D/GHQ-12 scores)

When compared to symptom trajectory Group 1 (low with small temporary increase), risk factors for Group 2 (moderate with small temporary increase) were as follows: Not living with one's partner [aOR: 2.41; 95 % CI: 1.48–3.93]; Having had at least one adverse childhood experience (ACE) [aOR: 1.47; 95 % CI: 1.16–1.88]; and having forgone healthcare due to financial reasons [aOR: 2.30; 95 % CI: 1.57–3.35].

4. Discussion

This study provides a nine-year, longitudinal investigation on mental illness amongst first-time fathers. To our knowledge, it is one of few studies to have studied the mental health of new fathers across such an extended time period, encompassing four-years before to four-years following the child's arrival. Paternal anxiety was consistently more prevalent than depression. And whilst overall prevalence data showed relatively low rates of self-declared mental illness (averaging 8 %), the rates of depression and anxiety, as well as clinically significant symptom scores, were consistently higher following participants' child's arrival. Trajectory analyses revealed clear differential patterns for both self-declared mental illness and symptom scores, with all symptom score

Table 2
Adjusted risk factors for self-declared mental illness (n = 6195) or clinically significant symptom scores (CES-D/GHQ-12 scales) (n = 3390) amongst fathers, recorded in the same year as their first child's arrival. *Constances cohort. Multivariate logistic regression.*

		Self-declared mental illness		Clinically significant symptom	
		aOR	CI	aOR	CI
Age at child's arrival (years)	Under 30	1	–	1	–
	30–34	0.68	1.00–2.10	1.05	0.67–1.35
	35–39	1.07	1.21–2.00	1.57	1.20–1.86
	40–44	1.06	1.10–2.03	1.37	0.95–1.65
	45–49	1.06	0.98–2.16	1.34	0.85–1.75
	50–59	1.08	1.09–2.33	1.40	0.95–2.03
	60 and over	1.04	0.89–2.86	1.00	0.51–1.78
Region of birth[a]	France	1	–	1	–
	Europe	0.99	0.54–1.65	0.93	0.56–1.52
	Africa	0.45	0.24–0.83	0.96	0.59–1.58
	Other	1.34	0.70–2.88	1.64	0.82–3.17
French nationality status[a]	French by birth	1	–	1	–
	Naturalised French	1.07	0.60–1.84	1.38	0.83–2.26
	Foreign national	0.82	0.44–1.60	1.20	0.73–2.09
Level of education[a]	Baccalaureate + 4 or more years (16+ years)	1	–	1	–
	Baccalaureate + 2–3 years (14–15 years)	0.98	0.80–1.27	1.06	0.86–1.31
	Baccalaureate or equivalent diploma (12–13 years)	1.15	0.89–1.53	0.94	0.75–1.27
	Primary, professional/ vocational certificate (9–11 years)	1.05	0.78–1.43	1.07	0.81–1.43
	No diploma (<8 years)	1.19	0.57–2.26	1.47	0.70–2.95
Marital status	Married/civil partnership	1	–	1	–
	Unmarried (never married)	1.20	0.92–1.55	1.10	0.82–1.34
	Divorced/ separated	0.89	0.67–1.82	1.08	0.66–1.75
Living with partner	Yes	1	–	1	–
	No	1.84	1.08–2.63	1.73	1.19–2.91
Close relationship satisfaction[b]	Satisfied	1	–	1	–
	Unsatisfied	1.17	0.77–1.35	1.08	0.92–1.56
Living with a child	Yes	1		1	–
	No	0.91	0.66–1.71	1.01	0.56–1.36
Employment status	Employed	1	–	1	–
	Training/ education/other	1.12	0.67–1.66	1.29	0.82–1.83
	Retired	1.11	0.57–1.82	1.17	0.55–2.02
	Unemployed	1.97	1.42–2.77	1.85	1.30–2.57
Spouse employment status	Employed	1	–	1	–
	Training/ education/other	1.29	0.82–1.92	0.90	0.63–1.45
	Retired	1.02	0.64–1.71	1.27	0.92–2.74
	Unemployed	1.07	0.84–1.43	1.13	0.88–1.44
Financial difficulties[c]	No	1	–	1	–
	Yes	1.10	0.83–1.42	1.23	0.93–1.51
Foregone healthcare due to financial reasons[c]	No	1	–	1	–
	Yes	1.47	1.04–1.83	1.29	1.02–1.75
Adverse childhood experiences (ACEs)	None	1	–	1	–
	Yes, at least one	1.57	1.25–1.91	1.43	1.10–1.61
Parent history of psychiatric illness[a]	No	1	–	1	–
	Yes	1.50	0.78–2.53	1.44	0.79–2.60
Parent history of suicide[a]	No	1	–	1	–
	Yes	1.39	0.59–3.56	0.80	0.30–2.04

[a] Information recorded at inclusion.
[b] Romantic partner and/or friends and family.
[c] Over the past 12 months aOR: adjusted odds ratio; CI: 95 % confidence intervals.

trajectories showing a temporary increase in symptomology during the transition to fatherhood. Key factors associated with these changes over time were being unemployed, not living with one's partner, adverse childhood experiences, and having forgone healthcare due to financial reasons.

4.1. Prevalence and trajectories of mental illness amongst new fathers

Rates of anxiety amongst new fathers were consistently higher than that of depression. In agreement with this, research shows the prenatal period to be a particularly anxious period for first-time fathers, with Wöckel et al. (2007) finding 80 % of expectant fathers to be fearful about the upcoming birth. Condon et al. (2001) also found young men to hold more idealised views of pregnancy and parenthood than young women. Whilst depression and anxiety are frequently comorbid (Philpott et al., 2022), this finding is important as the majority of literature on paternal mental illness focuses on depression. Greater inclusion of anxiety-related symptoms should be encouraged during perinatal assessments in men. It has also been theorised that the low rates of depression seen amongst male populations are partly due to current assessment tools lacking certain indicators more common to men (Shi et al., 2021; Branney and White, 2008). Gender-sensitive screening methods, such as (Kondou et al., 2021; Gemayel et al., 2021), may permit more accurate rates of diagnosis amongst fathers, thus better enabling appropriate support. Alternatively, a more encompassing "Perinatal Mood Disorder" has been proposed as a response to the highly heterogeneous prevalence of depressive and anxious disorders amongst fathers, as well as the consistently strong association between the two (Fletcher et al., 2006; Chen et al., 2019; O'Brien et al., 2017). In support of this, research shows that fathers may benefit from therapies targeting both anxious and depressive disorders mutually (O'Brien et al., 2017). Replacing the current focus on paternal depression with a more general target of paternal emotional distress may target a wider range of fathers in need of support.

For self-declared mental illness, the majority of fathers (90.3 %) showed consistent low risk. This aligns with previous trajectory studies, which find stable low or moderate trajectories to be the most frequent majority group. The one study to look across a seven-year timeline saw paternal mental illness to progressively decrease from birth, but only depression was considered, and data collected at 2-year intervals (Nath et al., 2016). 5.6 % of participants demonstrated a dramatic, temporary increase in self-declared mental illness from two years pre-fatherhood. Interestingly, as seen with the clinically significant symptom scores, the risk of mental illness returned progressively towards overall baseline value two years following the child's arrival. A potential explanation for this is that compulsory education in France begins at age three, which ~98 % of children attend (Insee (The National Institute of Statistics and Economic Studies / L'Institut national de la statistique et des études économiques), 2023). The initial reorganisation required in the run up to the child's arrival is often particularly demanding for first-time fathers and can result in dramatic changes to their quality of life. With the child in school, certain elements of daily life may return to a more 'normal' pre-fatherhood state.

Table 3
Associations between relevant risk factors and identified trajectories of self-declared mental illness and continuous symptom scores (CES-D/GHQ-12 scales), during the nine years surrounding the transition to fatherhood (four years prior to the arrival of participants' first child, until four years post). *Group-based trajectory modelling, Constances cohort.*

		Self-declared mental illness (n = 6156)				Symptom scores (n = 5573)	
	Trajectory control:	"Consistent low risk"				"Low with small temporary increase"	
	Trajectory test group:	"Low risk with high temporary increase"		"Consistent high risk"		"Moderate with small temporary increase"	
		aOR	CI	aOR	CI	aOR	CI
Age at child's birth (years)	30–34	reference		reference		reference	
	Under 30	2.01	0.96–3.93	0.80	0.19–2.39	0.78	0.44–1.30
	35–39	1.61	1.02–2.57	1.42	0.78–2.62	1.22	0.90–1.64
	40–44	1.02	0.53–1.90	2.48	1.29–4.72	1.11	0.76–1.61
	45–49	1.37	0.63–2.75	1.07	0.34–2.78	1.06	0.65–1.70
	50–59	1.31	0.64–2.57	1.08	0.38–2.67	1.20	0.76–1.86
	60 and over	1.12	0.38–2.99	4.79	1.79–12.07	1.90	0.99–3.62
Region of birth	France	reference		reference		reference	
	Europe	0.82	0.30–1.89	0.55	0.13–1.59	1.06	0.55–1.97
	Africa	0.54	0.13–1.52	1.24	0.45–2.86	1.21	0.67–2.11
	Other	0.80	0.18–2.44	–	–	0.57	0.19–1.51
Living with partner	Yes	reference		reference		reference	
	No	1.69	0.83–3.24	2.59	1.25–5.07	2.41	1.48–3.93
Employment status	Employed	reference		reference		reference	
	Training/education/other	1.34	0.48–4.01	0.57	0.22–1.55	0.98	0.50–1.90
	Retired	1.39	0.56–2.96	0.72	0.17–2.07	1.41	0.80–2.43
	Unemployed	3.01	1.63–5.32	2.62	1.22–5.23	1.55	0.96–2.46
Foregone healthcare due to financial reasons	No	reference		reference		reference	
	Yes	1.75	1.02–2.87	1.82	0.95–3.28	2.30	1.57–3.35
Adverse childhood experiences (ACEs)	No	reference		reference		reference	
	Yes	2.26	1.49–3.55	1.46	0.93–2.38	1.47	1.16–1.88
Arrival of subsequent children	No	reference		reference		reference	
	Yes	0.83	0.48–1.35	1.85	1.08–3.06	0.77	0.56–1.03

However, within our study, participants' symptom trajectories may provide an arguably more accurate reflection of fathers' mental health at each time-point, as they are exempt from certain potential logistical barriers, such as the waiting times and financial constraints to receiving a diagnosis. All symptom trajectories showed fathers experience deteriorating mental health in the run up to their first child's arrival. One potential explanation for this increase in negative symptoms is self-discrepancy theory (Higgins, 1987; Shorey and Chan, 2020). This describes the feeling of misalignment of fathers' expected self (the 'ideal' father) with their actual behaviour, due to the unrealistic expectations created pre-fatherhood, thereby resulting in a progressive feeling of disappointment and low self-worth. In support of this, research from Australia and Sweden found overly optimistic ideals for parenthood amongst young, childless men, with expectations including stable partner relationships and financial security (Thompson and Lee, 2011; Lampic et al., 2006). The increase in negative symptoms could also stem from a genuine lack of preparedness. Research has shown that "feeling prepared at birth" significantly associates with less state anxiety amongst first-time fathers (Daire et al., 2022). All paternal symptom trajectories started improving from two-years onwards. It may be that, with time, fathers begin to progressively feel more comfortable and secure in their capacity as a parent.

4.2. Associated risk factors

Fathers' age was a recurring relevant factor, with those aged over 60 showing an over four-times greater likelihood of having a consistent high-risk trajectory for self-declared mental illness. Within the French general population, the opposite is seen; the prevalence of both depression (Anon, 2020) and anxiety disorders (Leray et al., 2011) appear to, generally, decrease with age. Thus, our result may be specific to first-time parents. However, several studies on fathers also found increased rates of depression amongst younger fathers (Giallo et al., 2012; Nath et al., 2016; Bergström, 2013). Within these studies, young fatherhood associates with low socioeconomic status. The disparity between their results and our study may thus be explained by our sample's demographics, as socioeconomic indicators such as participants' average income and education level were relatively high. Our findings might also be explained by the means of reproduction. Within our questionnaire, the means of the child's arrival was not specified. Fathers using alternative methods, such as surrogacy or assisted reproduction, are likely be older at the time of their child's arrival (Halifax and Villeneuve-Gokalp, 2005). Parents who undergo the process of assisted reproduction are often at greater risk of mental illness (Courbiere et al., 2020). Another possibility is that psychiatric illness amongst fathers increases the chance of delayed parenthood. The elevated risk of psychiatric disorders amongst children exposed to paternal mental illness is significantly higher in children of older fathers (Filatova et al., 2021). When taken into consideration together with the current trend of increasing parental age in industrialised countries, this highlights the importance in further investigating this increased vulnerability amongst older fathers (Sobotka, 2010).

The relevance of not living with one's partner, particularly in such close proximity to their first child's arrival, is also a particularly important finding, as the current literature lacks investigation on non-resident fathers (Baldwin et al., 2018). Whilst this finding may result from reverse causality, in that fathers may live apart from their child due to their psychological problems, our results could indicate that non-resident fathers are indeed more susceptible to mental illness. Unsatisfactory mother-father relationships have been highlighted as a risk factor for paternal mental health problems, with French data showing that couples in which both parents are depressed postpartum were more likely to report insufficient partner support than non-depressed couples (28 % vs. 7 %) (Nakamura et al., 2020). And indeed, rates of paternal depression vary significantly based on family structure, with single, separated or divorced fathers at a higher risk for depression than those in a romantic relationship with their child's mother (Baldwin et al., 2019; Matthey et al., 2000). This may be partly explained by fathers' support networks. It has been shown that fathers perceive informal support to be a primary source of support during parenthood (Lähteenmäki et al.,

2019), with one French study finding that informal (couple) support decreased the odds of joint parental postpartum depression more so than that offered by midwives or healthcare professionals (Nakamura et al., 2020). However, it is important to acknowledge that a harmonious relationship between co-parents is not always possible. Increasing extra-familial support for fathers may partially offset this pressure placed on the surrounding family for care.

The presence of adverse childhood experiences also associated with trajectories showing higher symptom scores and a temporary increase in self-declared mental illness. This aligns with numerous studies on adult mental health (Hughes et al., 2017; Daníelsdóttir et al., 2024; Nelson et al., 2017; Li et al., 2016). Maltreatment during childhood has been found to associate with subsequent parenting stress (Granner et al., 2023), which in turn increases the likelihood of maltreating one's child (Rodriguez and Richardson, 2007). This association may thus potentially contribute to cycles of intergenerational trauma, highlighting the possibility of paternal mental health as a protective factor. Finally, having forgone healthcare in the past year due to financial difficulties associated with both increased risk of self-declared mental illness and clinically significant symptom trajectories. Financial factors, such as unemployment, household income, and access to paid paternity leave, are already consistent risk factors for depression amongst fathers (Bradley and Slade, 2011; Pedersen et al., 2021; Nath et al., 2016; Bronte-Tinkew et al., 2007). Moreover, fathers with, or at-risk of, postpartum depression have significantly higher healthcare costs when controlling for potential confounders (Edoka et al., 2011). Yet unemployed fathers, and those from lower socioeconomic groups, are under-represented in perinatal research (Baldwin et al., 2019). Within this study, unemployment was also seen to increase the likelihood of self-declared mental illness trajectories. Whilst this finding is likely to partially result from reverse causality, in that fathers' with diagnosed mental illness may be more likely to take time off work or be excluded from the job market, this factor will only accentuate financial barriers to healthcare access. Letablier et al. (2009) describe numerous policy-based approaches that would better enhance the equitable wellbeing of families. As access to healthcare appears to have a protective effect on fathers' mental health, greater accessibility is needed.

4.3. Implications for research and practice

The rates of self-declared mental illness, when compared to clinically significant symptom scores, suggest a considerable level of under-diagnosis amongst new fathers (9.7 % self-declared vs 25.2 % symptomatic). Whilst this investigation did not extend to mothers, and thus the same phenomenon may be present for both parents, men are often more reluctant than women to seek professional help (Johansson et al., 2020; Seidler et al., 2016). Fathers are also less likely to register depression symptomology as poor mental health when compared to mothers (Johansson et al., 2020). This may be rooted in a lack of awareness; fathers are often uninformed of the signs of perinatal mental illness, expressing in interviews that they had not heard of postpartum depression before becoming a parent or receiving a diagnosis themselves (Armstrong et al., 2009). Qualitative research shows a clear desire amongst fathers for increased information about perinatal mental illness, such as descriptions of the signs and triggers (Baldwin et al., 2019). Increases to the duration and accessibility of paid paternity leave may also increase the uptake of mental health services amongst fathers postnatally. At the time of this study, fathers in France were entitled to two weeks paid paternity leave, matching the average of OECD countries offering paternity leave (The Bipartisan Policy Center, 2023). Thus, when employed, fathers' work obligations, alongside parental responsibilities, often leave them with little time for themselves (Baldwin et al., 2019). Such obligations are also likely to reduce the opportunities in which fathers can be screened for mental illness during this period, alongside hindering the time available for help-seeking behaviours or external support (Pedersen et al., 2021).

We also saw increases in all measures of mental illness in the run up to fatherhood. If stemming from a lack of preparedness, increasing the support and educational tools available to first-time fathers in the run up to their child's arrival could thus better prevent the onset of initial anxiety. Little research has been done on prenatal care and interventions for fathers, however several studies have shown beneficial effects of parenthood preparation sessions (Matthey et al., 2004), prenatal classes (Wöckel et al., 2007; Li et al., 2009) and male discussion forums (Friedewald et al., 2005) on fathers' postnatal adjustment. Studies on first-time fathers reveal a desire to be more involved during their partners pregnancy (Smyth et al., 2015), indicating that prenatal interventions may be well received. Interestingly, one study consisting solely of African American participants saw perinatal coparenting programs to have no effect on fathers' depression or anxiety at 6-months postpartum (Feinberg and Kan, 2008). Research on such interventions should make a concerted effort to include a wider demographic range, as Black and minority ethnic groups, when compared with White, have been highlighted as less likely to be offered antenatal education classes, as well as male partners being less likely to attend (Redshaw et al., 2007).

4.4. Strengths and limitations

The Constances cohort is currently the biggest general population cohort in France, thereby enabling us to study a large number of participants. In using this cohort, we managed to include fathers who were not necessarily in a relationship with the child's mother, and/or living with their child. This is particularly valuable, as non-resident or single fathers are commonly excluded from research. In including this population, we were able to identify the significance of these factors, thus highlighting the increased vulnerability of non-resident fathers to mental illness. The comprehensive range of variables from Constances also allowed our analyses to account for a wide and detailed range of personal, lifestyle, and occupational factors. Through this, we were also able to employ two different approaches to mental health screening (self-declared mental illness and continuous symptom scores). Self-report symptom scales are often argued to provide a more accurate representation of mental illness prevalence, due to lack of bias from under-diagnosis and under-reporting (Public Health England, 2020). However, the use of self-declared mental illness allowed us to see a clear gap in the rates of probable diagnoses compared to actual symptomology.

Arguably this study's largest limitation is the combined use of the CES-D and GHQ-12 in longitudinal modelling. Due to the nature of this cohort, the measure of mental health varied over time. Whilst studies show strong correlation between the two measures (Chin et al., 2015), including amongst fathers (Yin et al., 2018; Kondou et al., 2021; Gemayel et al., 2021), they intend to measure varying degrees of mental illness (Yin et al., 2018; Baumann et al., 2008). To counteract this, scores were standardised and both scales kept as continuous in trajectory modelling, to prevent incompatibility due to binary scoring. In addition, all our analyses were also conducted on participants' self-declared prevalence of mental illness, which was tested using the same question at every included time-point. Due to low respective prevalence rates, we were unable to conduct trajectory analyses on distinct mental health diagnoses (depression/anxiety/other). In relying on self-administered questionnaires, we also risk selection bias due to the voluntary participation of cohort members. Thus, this study has most likely underrepresented hard-to-reach subjects e.g. undocumented migrants. Finally, we did not have access to fathers' partners, thus could not control for maternal factors. Current available evidence reveals maternal/partner mental illness to be one of the most frequently cited risk factors for paternal depression, both pre- and post-partum (Philpott et al., 2019; Demontigny et al., 2013). However, within our study, both relationship status and satisfaction were included covariates. As maternal mental illness has been seen to correlate strongly with risk factors such as partner conflict and decreased intimacy (Paulson and

Bazemore, 2010), these may have thus acted as a partial proxy for mothers' mental health.

5. Conclusion

We conducted a nine-year analysis of fathers' mental health in the years surrounding their first child's arrival. Whilst the majority of fathers showed a consistently low risk of self-declared mental illness, roughly 10 % showed an either temporary or consistent high risk. Moreover, all participants showed an increase in symptom scores indicative of mental illness during the run up to fatherhood, starting two-years prior to their child's arrival. Risk factors seemed to be shared between trajectory groups, with financial factors shown to be particularly significant, as well as living alone, being older in age, and having had adverse childhood experiences. Our results indicate a potential under-diagnosis of mental illness amongst men, which has been highlighted by numerous studies. Paternal anxiety was consistently more prevalent than depression, arguing for an increased focus on anxiety related symptoms and associated disorders amongst fathers. Increased awareness of the relevance of mental health care, both formal and informal, starting prior to the transition to fatherhood is necessary. Here we provide evidence for a clear period of vulnerability which could help mental healthcare providers better target fathers in need for support.

Author statement

Legal

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. All procedures were approved by the Institutional Review Board of the French Institute of Health (INSERM) (Opinion n°01-011, then n°21-842), and authorized by the French Data Protection Authority ("Commission Nationale de l'Informatique et des Libertés", CNIL) (Authorization #910486). All information and regulatory authorizations relating to the publication are available on the French version page 'Rights and data protection'. The Constances Cohort study has also been approved by the French Data Protection Authority ("Commission Nationale de l'Informatique et des Libertés", CNIL). Written informed consent was obtained from all participants.

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CRediT authorship contribution statement

Honor Scarlett: Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Emmanuel Wiernik:** Writing – review & editing, Validation, Project administration, Data curation. **Judith van der Waerden:** Writing – review & editing, Validation, Supervision, Project administration, Methodology, Conceptualization.

Declaration of competing interest

No conflicts of interest to declare.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jad.2024.07.008.

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