

Bente Kjær Lyngsøe, Claus Høstrup Vestergaard, Dorte Rytter, Mogens Vestergaard, Trine Munk-Olsen and Bodil Hammer Bech

Attendance of routine childcare visits in primary care for children of mothers with depression:

a nationwide population-based cohort study

Abstract

Background

Depression is a common and potentially debilitating illness worldwide. Attendance to routine childcare appointments is a key point of interest in the effort to improve the health and care for families facing depression.

Aim

To evaluate the association between maternal depression and offspring non-attendance to the Danish childcare and vaccination programme (CCP) for children from 0–5 years of age. The CCP consists of seven separate visits and several vaccinations. To investigate if exposure to recent and previous depression may affect attendance differently.

Design and setting

Population-based cohort study using Danish nationwide registers.

Method

Participants were all live-born children ($n = 853\,315$) in Denmark in the period from 1 January 2000 until 31 August 2013, and their mothers. The outcome of interest was non-attendance of each one of the seven scheduled childcare visits and two vaccination entities in the CCP. Exposure was maternal (both previous and recent) depression. All information was obtained from Danish national registries.

Results

The risk of not attending CCP was higher for children of mothers with depression. For children of mothers with previous depression, the relative risk (RR) was 1.01 [95% confidence interval (CI) = 0.98 to 1.03] at the 5-week childcare visit, and 1.12 [95% CI = 1.09 to 1.14] at the 5-year childcare visit. For children of mothers with recent depression, the RR was 1.07 [95% CI = 1.03 to 1.13] at the 5-week visit, and 1.15 [95% CI = 1.13 to 1.17] at the 5-year visit. Furthermore, the risk of missing at least four of the seven childcare visits was higher for children of females with maternal depression (RR = 1.16, 95% CI = 1.13 to 1.19).

Conclusion

Maternal depression seems to compromise CCP attendance. These findings suggest a need for careful clinical attention to these vulnerable families, even years after a diagnosis of depression.

Keywords

child care; delivery of health care; depression; Denmark; general practice; maternal.

INTRODUCTION

Depression is a common mental illness with a lifetime prevalence of 16–18%, and it progresses to a chronic state (depressive symptoms for >2 years) in 10–30% of affected individuals.^{1,2} The risk of depression among females is approximately twice that of males, a risk that increases further during and after pregnancy.^{2–5} The negative adverse effects of maternal depression on offspring development and behaviour have been studied extensively. Existing research has found that maternal depressive symptoms correlate with higher rates of insecure attachment between mother and child,⁶ emotional insensitivity, and negative parenting behaviour.^{7–10} All of these factors can lead to internalising and externalising behaviour problems in the children.^{11–13} Maternal depression has been found to be associated with increased childhood illnesses, lower immunisation rates, poorer cognitive development, and higher likelihood of underweight in the offspring.^{14–18} A British review described maternal depression as the mental disorder with the highest public health impact, and highlighted the importance of this topic in the global agenda.¹⁹

The long-term health consequences of growing up with a parent suffering from depression are less well studied.

Raposa *et al* found that maternal depression during pregnancy was associated with increased health problems among offspring before age 5 years, greater health-related stress and poorer social adjustment at age 20 years, and difficulties with social functioning and higher rates of youth depressive symptoms at ages 22–25 years.²⁰ These results imply a need for early identification of symptoms and development of interventions to reduce the negative trajectories for the offspring. Routine maternal depression screening during childcare visits has been found to be feasible, and provides opportunity in the consultation to address troublesome issues.²¹ In Denmark, routine maternal depression screening is not included in the childcare visit. The childcare visit includes an evaluation of the growth and welfare of the child, and also provides opportunity to detect, for example, signs of abuse, malnourishment, and obesity. The visits are performed by the GP and include physical examination of the child, evaluation of age-relevant milestones (motor and cognitive functions), and the child's wellbeing and thriving in the family and in day care, as well as advice on nutrition and precautions. It remains unclear how often children of mothers with depression attend these visits. Some studies have found no association

B Kjær Lyngsøe, MD, PhD student;
CH Vestergaard, MSc, statistician, Research Unit for General Practice; **M Vestergaard**, MD, professor, Research Unit for General Practice, and Section for General Medical Practice; **B Hammer Bech**, MD, associate professor, Research Unit for General Practice, and Section for Epidemiology; **D Rytter**, MSc, associate professor, Section for Epidemiology, Department of Public Health, Aarhus University, Aarhus, Denmark. **T Munk-Olsen**, MHS, senior researcher, National Centre for Register-Based Research, Aarhus School of Business and Social Science, Aarhus University, Aarhus, Denmark.

Address for correspondence
Bente Kjær Lyngsøe, Research Unit for General

Practice, Department of Public Health, Aarhus University, Bartholins Allé 2, 8000 Aarhus, Denmark.

Email: bkl@ph.au.dk

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How this fits in

Extant research in this area has yielded ambiguous results. To the authors' knowledge, no previous study has included data from an entire country or explored the difference in impact of maternal recent and previous depression on attendance of routine childcare appointments. This study provides novel knowledge on the association between maternal depression and offspring attendance to routine childcare appointments, and reveals a link that could serve to improve the general welfare of both.

between maternal depression or anxiety and attendance to routine well-child visits and/or vaccinations,²²⁻²⁴ whereas others have found that children of mothers with depression or anxiety had a higher risk of either starting a vaccination programme late or not at all.²⁵ Additionally, decreased odds of receiving age-appropriate well-child visits have been reported.²⁶ To the authors' knowledge, no previous study has explored the impact of recent depression compared to previous depression for contact to primary care.

This study aims to explore attendance to the Danish routine childcare and vaccination programme (CCP), and to examine the potential association between attendance and exposure to maternal depression. Furthermore, the study aims to investigate whether exposure to recent and previous depression affects attendance differently.

METHOD

Study design

All information for this population-based cohort study was obtained through Danish national registries. All citizens in Denmark are assigned a unique personal identification number (PIN) at birth or immigration. This PIN was used to link information at

the personal level from different national registries.

All children eligible for inclusion were live-born children with Danish residency born from 1 January 2000 to 31 August 2013 ($n = 853\,315$). The children were linked to their mothers through the Danish Civil Registration System.²⁷ Children or mothers who died, emigrated, or disappeared during follow-up were censored from the analysis after the date of departure, and children with an inactive PIN were excluded from all analyses ($n = 3072$). The children were followed until their sixth birthday or 31 December 2013, whichever came first. The main study thus included a total of 850 243 children and 517 107 mothers.

Exposure

Maternal depression was defined by the following three criteria:

- one or more hospital admission owing to a main diagnosis of depression;
- two or more outpatient contacts to a hospital owing to a main diagnosis of depression within 6 months;
- reimbursement of two or more prescriptions of antidepressant medications within 6 months. (Box 1).

Information on hospitalisations and outpatient contacts was obtained from the Danish Psychiatric Central Research Register.²⁸ The Danish Register of Medicinal Product Statistics provided the authors with information on the use of antidepressant drugs.²⁹ The control group 'never depressed' was defined as not meeting any of the three depression criteria in the 60-month period before the date of the childcare visit. Exposure was divided into two groups: 'previous depression' when meeting at least one of the criteria during a period of 6-60 months before the relevant childcare visit, and 'recent depression' when meeting at least one of the criteria during the 6-month period before the relevant childcare visit (Box 1).

Outcomes

The primary outcome of interest was non-attendance to routine childcare visits. In Denmark, seven childcare visits are scheduled in general practice from age 0-5 years, and each is registered with a specific service code in the National Health Insurance Service Register (NHRSR).³⁰ All GP consultations are free of charge. Non-compliance was defined as no record of childcare visit during a specific compliance window.

Box 1. Criteria for exposure, and description of exposure groups

Exposure measures	Criteria required for depression	Groups of depression
<ul style="list-style-type: none">• Antidepressant medications	<ul style="list-style-type: none">• ≥ 2 prescriptions reimbursed within 6 months	<ul style="list-style-type: none">• Never (control group): not meeting any depression criteria in a 60-month period before date of childcare visit
<ul style="list-style-type: none">• Admission to a hospital	<ul style="list-style-type: none">• ≥ 1 admission to a hospital within 6 months scheduled childcare visit	<ul style="list-style-type: none">• Previous: meeting at least one of the criteria from 6-60 months before
<ul style="list-style-type: none">• Outpatient contact to a hospital	<ul style="list-style-type: none">• ≥ 2 outpatient contacts to a hospital within 6 months childcare visit	<ul style="list-style-type: none">• Recent: meeting at least one of the criteria during the 6 months before scheduled

The secondary outcome of interest was non-attendance to the recommended vaccination programme. Vaccination-specific codes were obtained from the NHR. The Danish vaccination programme consists of two types of vaccination: diphtheria/tetanus/pertussis/olio (DiTe), and measles, mumps, and rubella (MMR).³¹

Vaccination for pneumococcus was introduced in 2007, and the codes for *Haemophilus influenza* changed during the study period. As these vaccines are administered simultaneously with the others mentioned above, they were ignored in further analyses.

Covariates

A Danish register-based study revealed that several factors are associated with lower participation in the CCP.³² These risk factors included household income, the parents' occupational and educational level, and the number of older siblings. Information on maternal age at birth and parity was obtained from the Danish Civil Registration System.²⁷ From Statistics Denmark, the authors received information on maternal cohabitation status, income, and education.³⁰ Furthermore, the authors included information on maternal mental comorbidity, including drug abuse, alcoholism, eating disorders, schizophrenia, dementia, and bipolar disorder. These were identified using the algorithm developed by Prior *et al.*³³ Paternal depression, defined by the same criteria as maternal depression, was also included as a covariate. Participants with missing values in any of the covariates were included in the analyses by adding an 'unknown' category to the categorical variables. In the multivariate analyses, adjustments were made dynamically, as the covariates for a child can change between two childcare visits. The covariates were measured 5 years before the start of the compliance windows. This was incorporated to minimise residual confounding and to ensure that covariates were measured before exposure to prevent them from acting as intermediaries in the causal chain.

Statistical analysis

To assess the timing of the exposure, maternal depression was categorised into three groups — never depressed, previous depression, and recent depression. The compliance windows were made asymmetrical, as a right-skewed distribution was seen for child age at the childcare visits; CCP that is, the children tended to be older than the scheduled age when attending the CCP. To maximise

the possibility of attendance, the windows were defined as widely as possible without overlap. Poisson regression with robust variance estimation (sandwich estimator) was used in the analyses.³⁴ Analyses were run separately for each of the seven childcare visits and the two vaccination groups. Crude analyses are presented with adjustments for calendar year, as the authors found a time trend in childbirths and attendance rates.

To assess whether maternal depression was associated with repeated absence from childcare visits, Poisson regression with robust variance was performed to determine the risk of missing at least 50% of the scheduled visits (that is, missing four or more visits). In this analysis, exposure was defined as 'never' versus 'ever' (previous or recent depression), and the authors included data for children born in 2000–2008 to ensure comprehensive follow-up.

Sensitivity analyses

Females admitted to a hospital with depression tend to have more severe depression than females treated with antidepressant medications in primary health care. Hence, in one sub-analysis, exposure was restricted to include mothers treated only with medications, and mothers treated through hospital admission or outpatient contacts, regardless of medication use.

Antidepressant medications may be prescribed for other illnesses and mental illnesses other than depression. From 2004 and onwards, Danish physicians could indicate a diagnosis when prescribing certain medicines. In a sub-analysis, the authors included only prescriptions containing the indication code 'depression'. Participants in this analysis were children born in 2006–2013 and their mothers.

RESULTS

The overall numbers of children in each exposure group at all visits/vaccinations are shown in Table 1. Depression was, in both groups, associated with shorter education, lower income, more divorces, and a greater number of other mental conditions in addition to depression (Table 2). The authors found an unequal distribution of missing values across the three exposure categories. Sub-analyses revealed that the main part of these missing values belonged to mothers without residency in Denmark. These mothers do not appear in the Danish registries, which may explain why most were 'never' depressed. Sub-analyses including only children of mothers

Table 1. Non-attendance of CCP childcare visits and vaccinations^a

Childcare visit	Compliance windows	Depression categories	Children in the study, <i>n</i>	Children missing CCP, <i>n</i>	Non-attendance, %
5 weeks	3 weeks to 3.9 months	Never	795 597	116 871	15
		Previous	42 754	5375	13
		Recent	11 892	1502	13
		Total	850 243	123 748	15
5 months	4 months to 10.9 months	Never	764 443	54 289	7
		Previous	37 930	2744	7
		Recent	14 330	1061	7
		Total	816 703	58 094	7
12 months	11 months to 22.9 months	Never	708 354	51 102	7
		Previous	29 982	2482	8
		Recent	20 360	1780	9
		Total	758 696	55 364	7
2 years	23 months to 34.9 months	Never	645 074	169 894	26
		Previous	25 588	8373	33
		Recent	27 057	9186	34
		Total	697 719	187 453	27
3 years	35 months to 46.9 months	Never	580 206	195 855	34
		Previous	25 500	10 520	41
		Recent	28 192	11 929	42
		Total	633 898	218 304	34
4 years	47 months to 58.9 months	Never	517 572	164 308	32
		Previous	24 515	9130	37
		Recent	28 896	10 995	38
		Total	570 983	184 433	32
5 years	59 months to 6 years	Never	453 635	88 209	19
		Previous	25 127	6486	26
		Recent	27 909	7062	25
		Total	506 671	101 757	20
DiTe	11 months to 21 months	Never	716 622	153 965	21
		Previous	30 526	6702	22
		Recent	20 678	4723	23
		Total	767 826	165 390	22
MMR	14 months to 24 months	Never	701 134	115 719	17
		Previous	28 802	5405	19
		Recent	23 019	4594	20
		Total	752 955	125 718	17

^aThe number of children in all exposure categories at each visit. Since the mother can change status from one visit to the next, some children will also alter status in the depression categories. CCP = the Danish childcare and vaccination programme. DiTe = diphtheria/tetanus/pertussis vaccination. MMR = measles, mumps, and rubella vaccination.

with residency in Denmark at least 5 years before birth did not alter the final results.

Crude regression analysis showed that exposed children had a higher risk of non-attendance, both in terms of childcare visits and vaccinations (Figure 1). Adjustments generally attenuated the association. Exposure to recent maternal depression was associated with a statistically significantly higher risk of non-attendance of up to 16%, depending on the specific childcare visit. Exposure to previous maternal depression was also associated with a statistically significantly higher risk in the analyses for 2-year, 3-year, 4-year, and 5-year follow-up. A vague trend towards

higher risk of non-attendance was seen with increasing age of the child. The risk of not receiving vaccination was highest for the MMR vaccination (Figure 1).

Defining maternal depression solely by reimbursement of prescriptions for antidepressant drugs did not alter the results considerably (results not shown).

Defining maternal depression solely by hospitalisations or outpatient contacts broadened the confidence intervals (CIs), as a lower number was exposed. The patterns of associations were the same, but the association between depression and early visits (up to 12 months) was no longer significant, and the difference in risk

between recent and previous depression was not statistically significant (results not shown).

In one sensitivity analysis, the authors included only reimbursements with the depression-specific prescription code, but these results did not differ markedly from the original analysis (results not shown). However, the CIs broadened due to the smaller sample size, and some of the results fell below the threshold of significance.

Children of mothers with depression attended fewer childcare visits compared to children of mothers without depression. A total of 34% of the unexposed children attended all childcare visits, whereas the corresponding figure was 27% for the exposed children (Figure 2). In the adjusted analyses, children of mothers with depression had a 12% higher risk of missing >50% of the childcare visits (that is, more than four out of seven visits) compared to children of mothers without depression during childhood, relative risk

(RR) 1.16, 95% CI = 1.13 to 1.19).

DISCUSSION

Summary

Children of mothers with depression were less likely to attend childcare visits and the vaccination programme. Recent depression yielded the highest risk of non-attendance, but exposure to previous depression also affected the attendance significantly. Furthermore, exposure to depression was associated with a significantly higher risk of missing more than 50% of the childcare visits during childhood.

Strengths and limitations

A major strength of the present study was that it included the entire birth population in Denmark from 1997–2013 and had virtually complete follow-up, owing to the valid information in the Danish registries. Therefore, selection bias is unlikely to have been introduced.^{27–30,35,36}

A potential limitation was that depression

Table 2. Maternal characteristics at the 5-week childcare visit^a

	Never depressed	Previous depression	Recent depression	Total	P-value
n (%)	795 597 (93.6)	42 754 (5.0)	11 892 (1.4)	850 243	
Year of birth, n (column %)					
2000–2004	308 532 (38.8)	9562 (22.4)	2032 (17.1)	320 126	
2005–2008	236 869 (29.8)	13 540 (31.7)	3867 (32.5)	254 276	
2009–2013	250 196 (31.4)	19 652 (46.0)	5993 (50.4)	275 841	<0.001
Age of mother, mean (SD)	30.6 (4.8)	30.5 (5.2)	31.3 (5.0)	30.6 (4.9)	<0.001
Parity, n (column %)					
1	350 925 (44.1)	19 912 (46.6)	5316 (44.7)	376 153	
2	299 219 (37.6)	14 021 (32.8)	4208 (35.4)	317 448	
3	108 916 (13.7)	6121 (14.3)	1657 (13.9)	116 694	
+4	36 537 (4.6)	2700 (6.3)	711 (6.0)	39 948	<0.001
Education, n (column %)					
≤10 years	198 891 (25.0)	17 572 (41.1)	4170 (35.1)	220 633	
>10 and ≤15 years	389 956 (49.0)	18 051 (42.2)	5382 (45.3)	413 389	
>15 years	142 546 (17.9)	5613 (13.1)	1890 (15.9)	150 049	
Unknown ^b	64 204 (8.1)	1518 (3.6)	450 (3.8)	66 172	<0.001
Income decile, n (column %)					
Low	286 508 (36.0)	17 498 (40.9)	4592 (38.6)	308 598	
Moderate	352 020 (44.2)	20 366 (47.6)	5848 (49.2)	378 234	
High	113 798 (14.3)	4367 (10.2)	1216 (10.2)	119 381	
Unknown ^b	43 271 (5.4)	523 (1.2)	236 (2.0)	44 030	<0.001
Civil status, n (column %)					
Widow	500 (0.1)	40 (0.1)	9 (0.1)	549	
Divorced	14 719 (1.9)	1325 (3.1)	363 (3.1)	16 407	
Married	127 794 (16.1)	7142 (16.7)	2025 (17.0)	136 961	
Unmarried	602 013 (75.7)	33 524 (78.4)	9198 (77.3)	644 735	
Unknown ^b	50 571 (6.4)	723 (1.7)	297 (2.5)	51591	<0.001
Mental comorbidities (Yes), n (column %)^c	2583 (0.3)	996 (2.3)	411 (3.5)	3990	<0.001

^a The covariates for this analysis are measured 5 years before the visit in order to avoid the covariates being intermediate factors. One way Anova (analysis of variance) and Kruskal-Wallis test is used to generate P-values. ^b Unknown represents missing data. ^c Mental comorbidities include drug abuse, alcoholism, eating disorders, schizophrenia, dementia, and bipolar disorder. SD = standard deviation.

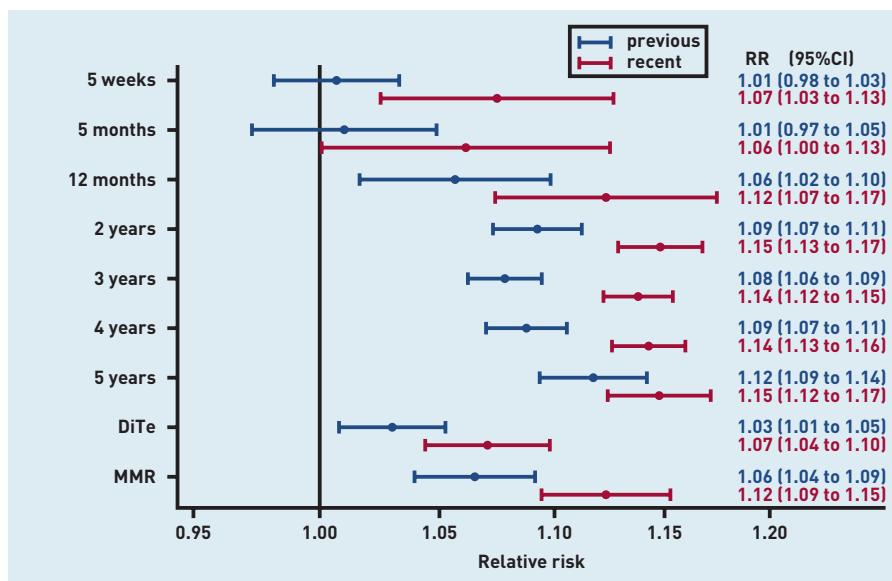
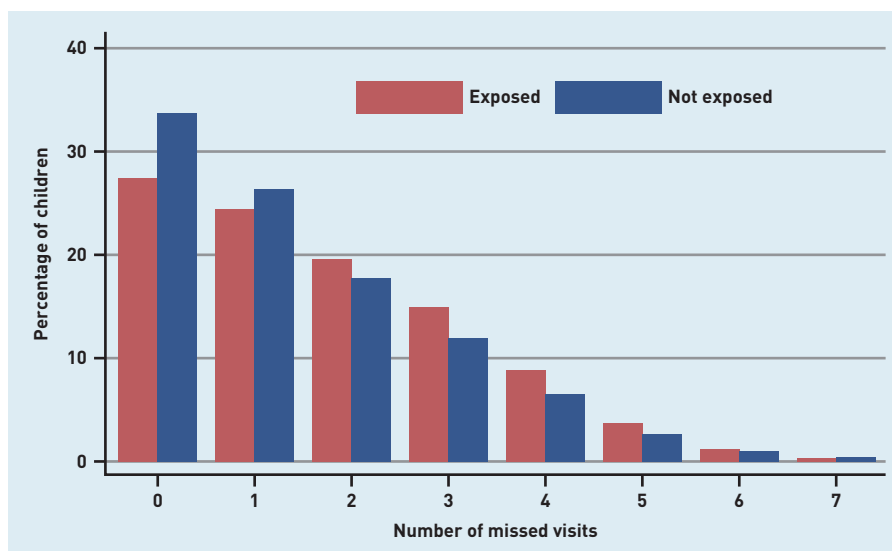


Figure 1. Relative risk of not attending the Danish childcare and vaccination programme (CCP) visits. Reference group is 'never depressed' mothers. The adjusted analysis includes the covariates maternal age at birth (sextiles), maternal education (three groups), maternal income (deciles), cohabitation status (four groups), calendar year (indicator variables), paternal depression (three groups), maternal mental comorbidities (indicator for any of six diagnoses), parity (four groups). See groups in Table 2.

was only defined by medication or hospital contacts, such that females with depression with no medication prescriptions and no hospital contact would be categorised in the control group as 'never depressed'. More GPs may now prefer non-pharmacological treatment. Additionally, some females may have difficulties complying with medical treatment. This information was not available for the present study, which might have introduced misclassification and could have biased the results towards no association, but does not explain the findings of higher non-attendance in the exposed group. Random misclassifications cannot be entirely excluded in a register-based study. To minimise this, the authors required the mother to reimburse at least two prescriptions for antidepressant medication within 6 months in order to

Figure 2: Percentage of children with 0–7 missed visits for exposed and non-exposed. Exposed: children of mothers with either previous or recent depression. Not exposed: children of mothers with no registered diagnosis of depression during the previous 60 months.



be considered exposed in the analyses. Antidepressant medication could also be prescribed for anxiety and other illnesses. The sensitivity analysis, which included only information on reimbursement of antidepressants with the depression-specific prescription code, did not alter the overall results. The completeness of the services registered is generally regarded as high.^{27–30,35,36} However, a recent study found discrepancies between register data and medical records, which revealed an underestimation of the coverage of the MMR vaccination.³⁷ Although relevant, it is unlikely that this misclassification is dependent on the exposure groups. Consequently, this cannot explain the authors' findings of a higher risk of non-compliance in the exposed group.

Comparison with existing literature

Existing literature on maternal depression and offspring varies in quality and findings. A structured literature search yielded six relevant articles on well-child visits. Andersen *et al*³⁰ and Goldman *et al*²⁴ found no significant association between maternal depression and offspring attendance to routine childcare. Both studies were based on considerably smaller cohorts and shorter follow-up (first year of the child's life). In addition, their designs (data collection based on questionnaires) were prone to recall bias and selection bias, which the authors themselves also acknowledge. Farr *et al* performed a cohort study in Portland and found no difference in the attendance to well-child visits and vaccination programmes, but they reported slightly higher use of emergency visits for infants of mothers with prenatal and postpartum depression or anxiety.²² Their definition of vaccination status was similar to the one in this study. However, they dichotomised the attendance to well-child visits into less than five visits or five or more visits. The study provided no record of previous maternal depression which might have affected the results. Minkovitz *et al* performed a study with a design similar to the present study.²⁶ Follow-up was extended to 3 years of age and the outcome to six childcare visits. They found that children of mothers reporting depressive symptoms had decreased odds of receiving age-appropriate well-child visits and vaccinations. Turner *et al* added the perspective that children of mothers with mental disabilities generally attended vaccinations late or not at all, despite strong intentions to have the child vaccinated.²⁵ To the authors' knowledge, no previous studies have explored the difference between

recent and previous depression for non-attendance in childcare visits.

In line with the present study, Sills *et al* found parental depression to be associated with a lower attendance to planned well-child visits, although only statistically significant among adolescents.³⁸ The setting in their study was Kaiser Permanente, which is a health insurance system in the US. This system provides care for a large population and offers a broad spectrum of valid information, but it is still not generalisable to an entire nation. Among many structural differences, the population at Kaiser Permanente is younger, better educated, and wealthier than the average Danish population.³⁹ Furthermore, Sills *et al* did not adjust for socioeconomic status, which has been shown to affect attendance.³²

Alternative diagnoses may pollute the exposure group. Nevertheless, the results presented indicate that either depression is responsible for the majority of the risk, or people with other conditions treated with antidepressant medications behave similarly. Furthermore, the sub-analyses suggest that even mild cases of depression are also associated with higher risk of non-attendance to routine childcare visits.

When a mother is ill with depression, contacts without incitement (such as childhood illnesses) may have low priority. The core symptoms of depression are suppressed motivation, reduced energy, and low mood. The authors interpret the finding that recent depression impairs the compliance to all childcare visits as a sign of impaired parental energy. They found it of great interest that previous maternal depression affects the attendance significantly. A possible explanation could be that cognition and memory can be affected even years after recovery. Previous depression did not seem to significantly affect attendance to the first three visits. Important features mark the first year of a

child's life. Communication is non-verbal, which requires emotional sensitivity from parents in the interpretation of symptoms. In mothers with previous depression, parental insecurity might prompt the mother to attend the early visits but, as the child ages, the symptoms of depression may dominate increasingly, and persistent effort cannot be exercised. Previous research has implied that maternal depression is associated with both physical and psychological adverse effects in offspring.¹⁹

Implications for research and practice

The present study shows that maternal depression impairs attendance to routine childcare, even years after a diagnosis. This is important knowledge for GPs. Well childcare and pregnancy programmes are important aspects in public health care. Children of depressed mothers are at greater risk of adverse consequences and thus require increased attention in childcare. Two aspects of the present findings require special consideration. First, mothers known to have depression may benefit from proactive attention from health personnel and the social network. Second, GPs may consider non-attendance at childcare visits as a potential concern, and maternal depression should be considered as a potential reason. Routine childcare visits form part of a comprehensive scheme based on continuous contact between the GP and the mother from conception, during pregnancy, and through the first 5 years of the child's life. It may be beneficial to explore the history of mental health when assessing these pregnant women and their children to ensure that extra support is provided to the ones that need it the most.

Future research could include designs that are capable of exploring the reasons behind non-attendance in routine childcare visits.

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Ethical approval

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Competing interests

The authors have declared no competing interests.

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