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Family policy, the mental health of parents, and children's development

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Family policy, the mental health of parents, and children's development

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Abstract

Family policies in Europe have undergone significant changes in the last few decades, improving the well-being, functioning, and responsibilities of families with children. This thesis aims to investigate how paternity leave policies impact parental mental health as well as explore how Early Childhood Education and Care (ECEC) impacts children's socio-emotional development throughout childhood.

The first article of this thesis examines the relationship between paternity leave uptake in France and mothers' and fathers' postpartum depression (PPD) two months post-birth, using data from a nationally representative birth cohort. Fathers who took paternity leave as well as fathers who intended to take paternity leave had lower odds of PPD compared to fathers who did not take paternity leave. Conversely, mothers whose partner took paternity leave had higher odds of PPD.

The second article of this thesis explores the relationship between different types of ECEC attendance (centre-based childcare, informal childcare, and exclusive parental care) prior to primary school on children's internalizing and externalizing symptoms from 5-13 years across five European countries. The study found that children who attended centre-based childcare have slightly lower levels of internalizing and externalizing symptoms between 7-13 years, but children who attended informal childcare had higher levels of internalizing and externalizing symptoms between 7-13 years.

This thesis highlights the importance of family policies in shaping patterns of mental health and psychomotor development. Further research is needed to understand the effects of a longer paternity leave on mother's PPD. Additionally, policies that enhance

access to affordable, subsidized centre-based childcare prior to primary school can be one step in improving children's socio-emotional development.

Résumé

Les politiques familiales en Europe ont connu des changements significatifs au cours des dernières décennies, améliorant le bien-être et le fonctionnement des familles avec de jeunes enfants. Cette thèse vise à étudier comment les politiques de congé de paternité influencent la santé mentale des parents et à explorer comment l'accès à un mode de garde avant l'entrée à l'école impacte le développement socio-émotionnel des enfants tout au long de leur enfance.

Le premier article de cette thèse examine la relation entre la prise de congé de paternité en France et la dépression postpartum des mères et des pères deux mois après la naissance, en utilisant des données de la cohorte ELFE, nationale et représentative des enfants nés en 2011 et de toutes les familles où le père avait droit à un congé de paternité. Les résultats ont montré que les pères qui ont pris un congé de paternité ainsi que ceux qui avaient l'intention de le prendre avaient une probabilité plus faible de souffrir de dépression postpartum par rapport aux pères qui n'avaient pas pris de congé de paternité. En revanche, les mères dont le partenaire a pris un congé de paternité avaient des chances plus élevées de souffrir de dépression postpartum.

Le deuxième article de cette thèse explore la relation entre la fréquentation de différents types de mode de garde (crèche, garde informelle tels qu'avec une nounou, un ami, des membres de la famille, ou parents) avant l'école primaire et les symptômes internalisés et externalisés des enfants de 5 et 13 ans dans cinq pays européens. L'étude a révélé que les enfants qui fréquentaient une crèche présentaient des niveaux de symptômes internalisés et externalisés légèrement plus faibles entre 7 et 13 ans que ceux qui étaient gardés par leur parents, tandis que les enfants qui étaient gardés de

manière informelle présentaient des niveaux de symptômes internalisés et externalisés plus élevés entre 7 et 13 ans.

Cette thèse souligne l'importance des politiques familiales comme déterminant de la santé mentale et de développement psychomoteur des enfants. Des recherches supplémentaires sont nécessaires pour comprendre pourquoi les femmes sont plus déprimées si leur partenaire prend deux semaines de congé de paternité et pour comprendre les effets d'un congé de paternité plus long sur la dépression post-partum chez les pères et chez les mères. De plus, les politiques qui facilitent l'accès à une crèche abordable et subventionnée avant l'école primaire jouer un rôle essentiel dans l'amélioration du développement socio-émotionnel des enfants.

Résumé long

Introduction

Les politiques familiales, qui peut être définies comme des politiques axées sur le bien-être, le fonctionnement et les responsabilités des familles avec enfants, ont connu des changements radicaux au cours des dernières décennies [1]. Les politiques de congé parental, principalement orientées vers les mères, visent désormais à permettre aux pères de s'impliquer davantage au sein de leur famille dès l'arrivée d'un enfant. De même, la garde des jeunes enfants a connu une transition majeure en Europe, certains pays s'orientant vers un modèle plus universel de garantie de garde d'enfants après la fin du congé parental comme le Danemark.

Dans ce chapitre, nous étudierons l'évolution de la participation des femmes au marché du travail et son influence sur les politiques familiales. Ensuite, nous étudierons plus particulièrement le rôle du congé paternité rémunéré en tant que forme de politique familiale et son impact sur le développement des enfants, la satisfaction des relations et l'équilibre entre vie professionnelle et vie privée. Ensuite, nous analyserons la prévalence de la dépression postpartum chez les mères et les pères, les critères de diagnostic de la dépression postpartum et les conséquences négatives que la dépression postpartum peut avoir sur la famille, en considérant le congé de paternité comme une solution potentielle pour prévenir la dépression postpartum chez les parents.

Nous étudierons ensuite les différents types de mode de garde avant l'entrée à l'école primaire en tant qu'autre forme de politique familiale pouvant avoir des effets sur la santé mentale des enfants. Nous comparerons le financement, la gouvernance, l'accès,

les exigences en matière de personnel et d'éducation, les lignes directrices en matière d'éducation, l'évaluation et le suivi dans ces cinq pays et nous définissons ce qui fait que les modes de garde sont de « haute qualité » [2]. Enfin, nous étudierons la relation entre l'accueil lors de la petite enfance et les résultats cognitifs des enfants, en tenant compte de la nécessité de mener des recherches sur la relation entre l'accueil lors de la petite enfance et les niveaux de symptômes internalisés et externalisés chez les enfants.

Inégalités entre les genres et travail non rémunéré

La Seconde Guerre mondiale a marqué un moment charnière pour les femmes sur le marché du travail. Les femmes ont commencé à occuper des postes traditionnellement réservés aux hommes, et la vision sociétale selon laquelle les pères étaient les seules sources de revenus de la famille a changé. Entre les années 1960 et le début des années 2000, la participation des femmes au marché du travail a augmenté [1].

Si l'on examine les différents secteurs d'emploi, la majorité des femmes dans le monde travaillent plus dans des emplois de service par rapport aux hommes. Ces emplois sont souvent moins bien payés que les emplois occupés majoritairement par les hommes et bénéficient de moins d'avantages sociaux et de possibilités, d'accès à des postes de responsabilité, de promotions et d'augmentation de salaire [1,3]. Dans le travail non rémunéré, défini comme la cuisine et le ménage, la recherche des produits de première nécessité, la garde d'enfants ou de personnes âgées, ou toute autre tâche familiale non rémunérée, on trouve également des inégalités de temps consacré à ces tâches entre les femmes et les hommes [4].

Ce travail non rémunéré, qui incombe souvent aux femmes, reflète le manque de services disponibles pour soutenir les familles, redistribuer le travail non rémunéré des femmes et des filles, développer les emplois dans les services de soins, ainsi que fournir

une protection sociale et des infrastructures de base essentielles aux femmes d'entrer et de rester sur le marché du travail rémunéré s'elles le souhaitent [5]. La politique familiale est un domaine qui peut améliorer l'égalité des sexes sur le marché du travail et à la maison, et aider les ménages à deux revenus à trouver un équilibre entre travail et vie privée. Plus précisément, les politiques de congé parental destinées aux pères ainsi que les congés de paternité peuvent constituer des stratégies visant à accroître la participation des pères au travail non rénuméré.

Historique du congé parental en France

L'approche française du congé parental a progressivement évolué, notamment en ce qui concerne le rôle du père. De 1938 à 1978, les politiques familiales encourageaient les mères à rester au foyer, reflétant la doctrine sociale catholique [6]. Cela a été soutenu par l'allocation aux mères au foyer (AMF), qui favorisait les ménages à revenu unique dans lesquels le père était le principal soutien financier et encourageait les familles plus nombreuses [6]. Sous le régime de Vichy, l'« allocation unique de salaire » (ASU) a été instaurée, offrant une aide financière aux familles monoparentales en fonction du nombre d'enfants qu'elles avaient. L'ASU a également été accordée aux couples nouvellement mariés pendant deux ans pour les inciter à avoir des enfants avec la mère restant au foyer [6]. Les changements intervenus en 1967 ont exclu des prestations de l'ASU les jeunes couples sans enfants et les familles avec un enfant plus âgé. En 1978, l'AMF et l'ASU ont été remplacées par la prestation « complément familial » [6]. En 1977, une nouvelle loi a accordé aux mères qui travaillent un congé parental payé, étendu ensuite aux deux parents en 1984, reconnaissant l'importance de l'implication parentale partagée [6]. Les politiques ultérieures, en 1985 et plus tard, ont autorisé le travail à temps partiel et une aide financière pour aider les parents à concilier travail et vie de famille [6]. Malgré ces progrès, le congé parental a été et rester

majoritairement pris par les femmes, ce qui a entraîné une diminution de la participation des femmes au marché du travail [6].

Congé de paternité payé

Un type de politique familiale créé pour accroître la participation du père à la parentalité est le congé de paternité. Le congé de paternité peut être défini comme le fait que le ou la conjoint(e) salarié de la mère se voit accorder un nombre défini de jours de congé (rémunérés ou non selon les pays) après la naissance de son(ses) nouveau-né(s) (également accordé en cas de mortinatalité) [7]. En 2019, une loi issue de la directive sur l'équilibre entre vie professionnelle et vie privée obligeait les États membres de l'Union Européenne (UE) à faire respecter le droit à un congé de paternité d'au moins 2 semaines, sans risque de perte d'emploi [7].

En 2001, la France a connu sa première réforme concernant le congé de paternité [6]. Une loi adoptée lors de la Conférence des Familles accorde aux pères un congé de paternité payé de 2 semaines, 18 jours en cas de naissances multiples, à prendre dans les 4 mois suivant la naissance de leur enfant [6]. Le congé paternité était pris en charge à 100 % par la Sécurité Sociale, avec un plafond de financement [6]. La dernière réforme de septembre 2020 a étendu le congé de paternité à 25 jours calendaires, avec l'obligation pour les pères de prendre 4 jours immédiatement après la naissance de leur enfant et les 21 jours restants devant être pris en une seule fois ou divisés en 2 périodes d'une durée minimale de 5 jours [6]. Même s'il existe encore un énorme écart en matière d'égalité de congé parental payé entre les pères et les mères, les avantages découlant de l'offre d'un congé de paternité payé pourraient encourager les décideurs politiques à élargir davantage les possibilités de participation des pères à l'éducation des enfants et aux tâches familiales [8,9].

Avantages de la participation du père dans la vie familiale

Des recherches antérieures ont mis en évidence de nombreux avantages positifs liés à l'implication du père dans la famille. Les enfants dont les pères sont engagés et présents dans leur vie ont un meilleur développement social et émotionnel et ont des meilleurs résultats dans leurs études scolaires par rapport aux enfants dont les pères ne sont pas engagés ou complètement absents dans leur vie [9,10]. Pour les résultats scolaires des enfants, ces avantages restent significatifs même après ajustement en fonction de l'implication de la mère ainsi que de diverses caractéristiques socio-économiques et démographiques [9]. On constate également une plus grande satisfaction relationnelle entre la mère et le père ainsi qu'une répartition plus équitable des tâches ménagères lorsque le père prend un congé parental et/ou de paternité, selon la disponibilité et la durée du congé pris [11]. Par ailleurs, une étude a révélé que si un congé de paternité d'une durée modérée et bien rémunéré (ou un congé parental destiné aux pères) est proposé et pris, il y a plus d'égalité entre les sexes non seulement dans les tâches ménagères mais aussi sur le marché du travail [11].

Congé de paternité et dépression parentale postpartum

Le congé de paternité peut offrir aux couples la possibilité d'établir une plus grande satisfaction relationnelle, davantage de liens père-enfant et une plus grande égalité dans les tâches ménagères et éducatives concernant les enfants, qui à leur tour constituent des facteurs de protection contre le développement de la dépression postpartum (DPP) maternelle et paternelle [12]. Les pères peuvent exprimer la DPP différemment et développer la DPP plus tard que les mères, ce qui peut entraîner un sous-diagnostic chez les pères [13]. Une méta-analyse a révélé qu'environ 8,75 % (intervalle de confiance (IC) à 95 % 6,68 %-11,07) des pères reçoivent un diagnostic de

DPP au cours de la première année suivant la naissance de l'enfant [14]. Pour les mères, la prévalence globale de la DPP est d'environ 17,22 % (IC à 95 % : 16,00-18,51) au cours de la première année suivant la naissance de l'enfant (mais en excluant la première semaine après la naissance pour éviter le diagnostic de baby blues) [15]. Il est important de prévenir l'apparition de la DPP chez les mères et les pères en raison des conséquences négatives que celle-ci peut avoir sur la relation parent-enfant [16,17], relation de couple [18], dynamique familiale [18], et le bien-être général de la mère et du père [18]. La DPP des mères et des pères a été associé à une augmentation des problèmes de comportement et à des retards dans le développement cognitif et socio-émotionnel chez les enfants d'âge scolaire, ainsi qu'à un risque accru de développer un style d'attachement insécure [19,20]. Il semble également y avoir une relation bidirectionnelle entre les symptômes de DPP chez les parents et la satisfaction relationnelle des parents [21]. Enfin, la DPP peut avoir un impact sur le bien-être à long terme des mères et des pères, car les parents peuvent être sujets à un mauvais sommeil, à un abus d'alcool et de drogues, à de mauvaises habitudes alimentaires, à une diminution de l'activité physique et à une mauvaise santé mentale globale [17,22].

Services de garde d'enfants en Europe

Une autre dimension importante des politiques familiales aujourd'hui concerne les services de garde d'enfants. Les modes de garde peuvent être définis comme toute garde reçue en dehors du parent et sont souvent divisés en deux catégories : la garde d'enfants formelle, qui comprend des services de garde en centre, des crèches, des écoles maternelles et des assistantes maternelles agréées, et la garde d'enfants informelle, qui comprend des grands-parents, des proches., des nounous, et/ou assistantes maternelles non enregistrées [23]. Les modes de garde en dehors de la famille sont apparus afin de permettre aux femmes de participer au marché du travail,

d'aider les enfants ayant des besoins spécifiques, et de protéger les enfants issus de milieux plus défavorisés [23,24].

Pour le deuxième article de cette thèse, nous nous sommes concentrés sur les modes de garde accessible avant l'école primaire en Grande-Bretagne, aux Pays-Bas, au Danemark, en France et en Espagne. Il existe de grandes différences entre l'accueil proposé avant 3 ou 4 ans, selon les pays et l'accueil des enfants d'âge préscolaire – c'est-à-dire entre 4 ans et le début de l'école primaire – en termes de financement, gouvernance, accès, de personnel et de contenu, de directives pédagogiques, d'évaluation et de suivi [2].

Garderie de la petite enfance et développement des enfants

Comprendre l'impact des modes de garde sur le développement des enfants est crucial pour optimiser à la fois le bien-être de la famille et le développement de l'enfant. La recherche indique que les modes de garde peuvent influencer positivement les résultats cognitifs des enfants, améliorant potentiellement leurs résultats scolaires ultérieurs par rapport aux enfants gardés uniquement par leurs parents [25]. Ces bénéfices cognitifs sont généralement de courte à moyenne durée [25]. Cependant, les recherches sur les effets des modes de garde sur le développement socio-émotionnel des enfants donnent des résultats mitigés, se limitent souvent aux études nord-américaines et manquent de perspectives à moyen et long terme. Les résultats socio-émotionnels sont généralement mesurés par les symptômes internalisés (ex. dépression, anxiété) et externalisés (ex. agressivité, trouble des conduites). Ces deux types de difficultés peuvent nuire à la qualité de vie, à la réussite scolaire et à la santé mentale d'un enfant et persister jusqu'à l'âge adulte. Par conséquent, il est essentiel de

prévenir ces comportements le plus tôt possible pour améliorer le devenir des enfants à long terme [25,26].

Objectifs de la thèse

Le premier article de ma thèse examine l'impact d'un congé de paternité payé de deux semaines sur la DPP chez les mères et les pères à deux mois après la naissance de leur enfant. Des recherches antérieures suggèrent que la prise d'un congé de paternité payé par les pères profite au développement de l'enfant, aux liens père-enfant et à la satisfaction relationnelle, qui sont des facteurs protecteurs contre la DPP. Par conséquent, cette étude vise à déterminer si le congé de paternité rémunéré peut également avoir des effets protecteurs contre la DPP paternelle et maternelle.

Le deuxième article étudie comment différents types de mode de garde (crèche, garde informelle) et la garde parentale exclusive avant l'entrée à l'école primaire influent sur les symptômes internalisés et externalisés des enfants (5-6 ans, 7-9 ans, 10-13 ans). Compte tenu des effets positifs de l'accès à un mode de garde de haute qualité sur l'apprentissage et les résultats cognitifs des enfants, cette étude vise à comprendre si une telle garde d'enfants peut également avoir un effet protecteur contre les problèmes socio-émotionnels [25].

Hypothèses:

1. Les pères qui prennent un congé de paternité rémunéré ont moins de risques de DPP deux mois après la naissance que ceux qui ne le prennent pas (**article 1**).
2. Les mères dont les partenaires prennent un congé de paternité rémunéré ont un risque plus faible de DPP deux mois après la naissance de leur enfant que celles dont les partenaires ne le font pas (**article 1**).

3. Les enfants qui fréquentent une crèche avant l'école primaire présentent moins de symptômes internalisés et externalisés dans tous les groupes d'âge (**article 2**).

Méthodes générales

Cohorte ELFE

Pour le premier article de ma thèse, les données sont issues de la cohorte Étude Longitudinale Française depuis l'Enfance (ELFE) [27], une cohorte représentative nationale formée en 2011 pour étudier divers facteurs environnementaux et sociaux susceptibles d'avoir un impact sur le développement des enfants nés en France. L'étude a inclus des mères et/ou des pères répondant aux critères suivants : avoir eu une naissance vivante unique ou gémellaire à 33 semaines de gestation ou après, avoir au moins 18 ans, ne pas avoir l'intention de quitter la France métropolitaine dans les trois ans et avoir signé un consentement éclairé. L'étude a porté sur 18 329 bébés, dont 289 paires de jumeaux, et a utilisé des pondérations d'enquête pour garantir la représentativité nationale. Les parents ont été interrogés à plusieurs moments : peu de temps après la naissance, 2 mois après la naissance, entre 3 et 10 mois, à 2 ans, 3,5 ans, entre 4 et 5 ans et à 5 ans. Pour cette étude particulière, les données des questionnaires à la naissance et à 2 mois ont été analysées.

Réseau de cohortes d'enfants de l'UE

Pour le deuxième article de ma thèse, les données proviennent de cinq cohortes de naissance qui font partie du EU Child Cohort Network (EUCCN) [28]. L'EUCCN a été créé par le projet Horizon 2020 Lifecycle, qui comprend 19 cohortes de grossesses et d'enfants comptant plus de 250 000 enfants et leurs parents [28]. La cohorte ELFE, la cohorte Avon Longitudinal Study of Parents and Children (ALSPAC), la Generation R Study (GenR), la Danish National Birth Cohort (DNBC), le projet Environment and

Childhood (Infancia y Medio Ambiente) (INMA), et l'étude de cohorte générale française sur les déterminants pré- et postnatals précoces du développement psychomoteur et de la santé de l'enfant (EDEN) ont été inclus dans cette étude et les informations sur la conception de l'étude ont été décrites ailleurs [27,29–37].

Expositions

Le premier article de la thèse a examiné le congé de paternité rémunéré en demandant aux mères, dans le questionnaire ELFE de deux mois, si le père avait pris ou comptait prendre le congé de deux semaines qui lui était imparti. Les réponses ont été classées en : « oui, j'ai pris un congé de paternité », « oui, j'ai l'intention de prendre un congé de paternité » et « non ».

Le deuxième article a étudié les types de fréquentation des mode de garde préscolaires en interrogeant les parents sur les modalités de garde de leurs enfants avant l'entrée à l'école primaire. Les parents ont été interrogés à différents moments entre 0 et 4 ans. Les modes de garde ont été classés en trois groupes : la garde parentale exclusive (groupe de référence), la garde d'enfants en crèche et la garde d'enfants informelle (y compris les garderies, les professionnels de la garde d'enfants, les amis, les nounous, les baby-sitters, les filles au pair et autres). Si l'enfant fréquentait une crèche, cette réponse était considérée prioritaire; si seules des garderies informelles étaient utilisées, ils étaient placés dans ce groupe.

Résultats

Le premier article de la thèse a évalué la DPP maternelle et paternelle à deux mois à l'aide de l'échelle de dépression postnatale d'Édimbourg (EPDS) [38,39]. Cette échelle d'auto-évaluation en 10 items, validée pour la population française, mesure les sentiments ressentis au cours de la semaine écoulée. Des scores supérieurs à 11 pour

les mères et à 10 pour les pères indiquent une DPP. La variable a été dichotomisée : « oui » pour les signes de DPP et « non » dans le cas contraire.

Le deuxième article a examiné les niveaux de symptômes internalisés et externalisés des enfants à différents stades de l'enfance. Ces symptômes ont été mesurés à l'aide soit de l'échelle du *Child Behavior Checklist* (CBCL), soit du *Strengths and Difficulties Questionnaire* (SDQ) [40,41]. Le CBCL, composé de 113 questions évaluées sur une échelle de Likert à trois points, mesure l'ensemble des problèmes, les symptômes d'intériorisation et les symptômes d'extériorisation, et comprend huit sous-échelles de syndrome [1]. Le SDQ, composé de 24 éléments, mesure les symptômes émotionnels, les problèmes de conduite, l'hyperactivité-inattention, les problèmes avec les pairs, et le comportement prosocial [2]. Les symptômes internalisés combinent des sous-échelles de problèmes émotionnels et de problèmes avec les pairs, tandis que les symptômes externalisés combinent des sous-échelles de problèmes de conduite et d'hyperactivité-inattention, toutes deux notées sur une échelle de Likert à trois points.

Les symptômes internalisés et externalisés ont été harmonisés en scores de 0 à 100 pour tenir compte des différentes échelles entre les cohortes. Les données manquantes ont été considérées comme manquantes si 25 % ou plus des questions restaient sans réponse ; sinon, un score au prorata a été calculé [42].

Covariables

Pour le premier article de la thèse, des scores de propension ont été calculés afin d'équilibrer les groupes d'exposition. Dans le modèle de score de propension, de nombreuses caractéristiques maternelles, paternelles, infantiles, et familiales ont été incluses dans le modèle. Pour le deuxième article de la thèse, les caractéristiques maternelles et infantiles qui pouvaient influencer la relation entre le type de mode de

garde et les symptômes internalisé et externalisé ont été incluses dans les modèles ajustés.

Analyses statistiques

Pour le premier et le deuxième article de la thèse, les données manquantes ont été traitées à l'aide de l'imputation multiple avec spécification entièrement conditionnelle (FCS), également connue sous le nom d'imputation multivariée par équations en chaîne (MICE) [43,44]. Pour le premier article de la thèse, des scores de propension ont été générés à l'aide de modèles de boosting généralisés (GBM) [45,46] et les scores de propension ont été inversés. Ensuite, des modèles de régression logistique à pondération par probabilité inverse (IPW) ont été exécutés et les rapports de cotes (OR) accompagnés de leurs IC à 95 % ont été fournis. Pour le deuxième article de la thèse, une méta-analyse des données individuelles des participants (IPD) en deux étapes a été réalisée : des régressions linéaires ajustées ont été effectuées sur chaque cohorte séparément, les coefficients bêta et les erreurs standard ont été collectés, puis les résultats ont été combinés à l'aide d'une méta-analyse à effets aléatoires avec une estimation restreinte du maximum de vraisemblance (REML) afin d'obtenir des résultats globaux.

Article 1: Congé de paternité et dépression parentale postpartum : résultats de l'étude de cohorte ELFE

En Europe, la durée moyenne du congé de paternité rémunéré est de deux semaines. Le congé de paternité est lié à une plus grande implication du père dans l'éducation des enfants et les tâches ménagères, ainsi qu'à une meilleure satisfaction relationnelle. Cependant, la relation entre le recours au congé de paternité et la DPP n'avait pas été étudiée de manière approfondie. La DPP peut avoir un impact négatif sur le

développement des enfants et sur le bien-être à long terme des deux parents. Cette étude a examiné la relation entre le congé de paternité (catégorisé comme non-congé, congé prévu et congé pris) et le DPP chez les mères et les pères en utilisant les données de la cohorte ELFE, une cohorte de naissance française représentative au niveau national créée en 2011.

L'étude a porté sur 13 075 mères et 10 975 pères, hors familles avec jumeaux et pères ne vivant pas avec la mère ou non éligibles au congé de paternité. L'imputation multiple a été utilisée pour corriger les données de covariables manquantes, et les scores de propension au recours au congé de paternité ont été générés et ajustés à l'aide des poids d'enquête de l'étude. Des modèles de régression logistique pondérée, fournissant des ORs et des ICs à 95 %, ont été utilisés pour analyser l'association entre le congé de paternité et le DPP.

Les résultats multivariés ont montré que les pères qui avaient l'intention de prendre ou qui ont pris un congé de paternité présentaient un risque réduit de DPP à deux mois (OR 0,74 [IC à 95 % : 0,70 -0,78]) ; (OR 0,76 [IC à 95 % : 0,70–0,82], respectivement). À l'inverse, les mères dont les partenaires ont pris un congé de paternité présentaient un risque plus élevé de DPP à deux mois : OR 1,13 [IC à 95 % : 1,05–1,20].

Ces résultats suggèrent que les pères qui planifient ou prennent un congé de paternité pourraient avoir une moindre probabilité de DPP, favorisant ainsi un équilibre entre vie professionnelle et vie privée et des comportements de santé. Pour les mères, un congé de paternité de deux semaines peut s'avérer insuffisant pour qu'elle se sentent soutenues ou pour ne pas être programmé de manière optimale pour se protéger contre la DPP.

Article 2 : Les modes de garde des jeunes enfants et les symptômes internalisés et externalisés chez les enfants : une méta-analyse des données individuelles de six cohortes de naissance prospectives en Europe

Une garde non parentale précoce, définie comme toute garde reçue en dehors de la famille avant l'école primaire, peut avoir un impact positif sur le développement cognitif des enfants notamment si elle est de qualité [25]. La garde d'enfants en lieu d'accueil collectif conduit souvent à de meilleurs résultats scolaires et à une meilleure acquisition du langage que la garde parentale exclusive. Cependant, la recherche sur le développement socio-émotionnel est incohérente et souvent axée sur l'Amérique du Nord [25].

Cette étude a examiné la relation entre différentes modalités de garde d'enfants (crèche, garde informelle et garde parentale exclusive) et les symptômes internalisés et externalisés chez des enfants âgés de 5 à 6 ans, de 7 à 9 ans et de 10 à 13 ans, à l'aide de données harmonisées de cohortes européennes : ALSPAC (Grande-Bretagne), ELFE et EDEN (France), DNBC (Danemark), GenR (Pays-Bas) et INMA (Espagne). Nous avons également pris en compte les interactions avec la dépression maternelle postpartum, le faible niveau de diplôme de la mère et le sexe de l'enfant. L'étude a inclus 87 208 participants après exclusions. Les données manquantes ont été traitées par imputations multiple. Des modèles de régression linéaire ajustés et une méta-analyse à effets aléatoires ont été utilisés pour analyser les données.

Les résultats ont montré que les enfants placés en crèche présentent des niveaux de symptômes internalisés inférieurs dans tous les groupes d'âge par rapport à ceux placés sous la garde parentale exclusive : (5-6 ans : β : -1,78 (IC à 95 % : -3,39, -0,16) ; 7-9 ans : β : -0,55 (IC à 95 % : -0,88, -0,73) ; 10-13 ans : β : -0,76 (IC à 95 % : -1,15, -0,37).

Il existe un lien entre la prise en charge informelle et des niveaux de symptômes externalisés plus importants chez les enfants âgés de 7 à 9 ans et de 10 à 13 ans : (7-9 ans : β : 1,65 (IC à 95 % : 1,25, 2,06) ; 10-13 ans : β : 1,25 (IC à 95 % : 0,96, 1,54). La garde d'enfants informelle était également liée à des symptômes d'extériorisation plus élevés à 7-9 ans et 10-13 ans : (7-9 ans : β : 2,84 (IC à 95 % : 1,41, 4,26) ; 10-13 ans : β : 2,19 (IC à 95 % : 0,54, 3,84).

Le faible niveau de diplôme de la mère était un facteur d'interaction positif significatif, affectant les niveaux de symptômes internalisés et externalisés chez les enfants fréquentant des services de garde collectifs et informels. De plus, la garde d'enfants informelle et le sexe de l'enfant (filles) ont montré une interaction négative avec les symptômes externalisés entre 10 et 13 ans.

L'étude suggère qu'une garde d'enfants en lieu collectif de haute qualité peut protéger les enfants contre le développement de symptômes internalisés possiblement grâce à des interactions positives avec les professionnels de la petite enfance et les pairs. À l'inverse, les services de garde informels peuvent augmenter le risque de symptômes externalisés des symptômes en raison de ratios de soignants inadéquats et de contextes d'âge mixtes. Enfin, les enfants issus de milieux socio-économiques défavorisés ne bénéficient peut-être pas autant des services de garde de la petite enfance que ceux issus de milieux plus favorables.

Dans l'ensemble, la garde d'enfants en centre avant l'école primaire est associée à des symptômes internalisés moindres, favorisant un meilleur développement psychologique chez les enfants âgés de 5 à 13 ans.

Discussion générale

Résumé des principales conclusions

Dans cette thèse, nous avons exploré l'impact de deux types de politiques familiales – le congé de paternité rémunérés et les modalités de garde de la petite enfance sur la santé mentale des pères et des mères et sur le développement socio-émotionnel des enfants, respectivement.

Dans le premier article de cette thèse, nous avons constaté que les pères qui prenaient un congé de paternité payé de deux semaines ainsi que les pères qui avaient l'intention de prendre un congé de paternité présentaient un risque réduit de dépression postpartum à deux mois après la naissance de leur enfant (**article 1**). Pour les mères, si leur partenaire prenait un congé de paternité, elles avaient un risque plus élevé de dépression postpartum à deux mois (**article 1**). Dans le deuxième article de cette thèse, nous avons exploré différents types de modalités de garde de la petite enfance – crèche, garde informelle et garde parentale exclusive – et leur impact sur les niveaux de symptômes internalisés et externalisés des enfants à différents moments de l'enfance (**article 2**). Nous avons constaté que le fait de fréquenter une crèche était associé à une diminution des niveaux de symptômes internalisés entre 7 et 9 ans et entre 10 et 13 ans. Le fait de fréquenter un mode de garde informel était associé à une augmentation des niveaux de symptômes internalisés et externalisés pour les mêmes tranches d'âge (**article 2**).

Qui sont les pères qui prennent un congé de paternité payé ?

Dans le premier article de la thèse, aucune différence significative n'a été constatée entre les pères ayant pris un congé de paternité et ceux ayant l'intention d'en prendre un; les deux groupes présentaient un risque plus faible de dépression postpartum à deux mois par rapport aux pères qui n'avaient pas pris de congé (**article 1**). Cette analyse a pris en compte diverses caractéristiques des parents, du ménage et des

enfants. L'étude a soulevé des questions sur les types de pères qui décident de prendre ou non un congé de paternité, strictement dans les couples hétérosexuels. Les études qualitatives suggèrent plusieurs facteurs influençant cette décision, notamment les attitudes personnelles à l'égard de la parentalité, les rôles traditionnels de genre et la culture du lieu de travail [47]. Les pères qui considèrent le rôle parental comme passionnant et qui s'impliquent avant la naissance sont plus susceptibles de prendre un congé, tandis que ceux qui adhèrent aux rôles traditionnels ou craignent des conséquences négatives sur leur carrière sont moins susceptibles de le faire. De plus, les normes du lieu de travail et peuvent dissuader certains de le faire [47].

Dans d'autres études qualitatives, d'autres comparaisons ont été faites entre les pères prenant un congé parental prolongé (plus de trois semaines) et ceux prenant un congé parental plus court [47]. Les pères ne prenant pas de congé prolongé ont cité des raisons telles que se sentir inefficaces, la sensation qu'ils constituaient un fardeau pour la mère, la perception que la phase néonatale est monotone ou le souhait que la mère prenne plus de congé [47]. Ces résultats mettent en évidence l'influence des rôles parentaux genrés, de l'environnement de travail et de la politique familiale sur les décisions des pères en matière de congé de paternité et parental (**article 1**).

Comment définir l'implication du père et qu'est-ce qui la détermine ?

Comprendre l'implication du père auprès de ces enfants nécessite de reconnaître la nature multidimensionnelle de ce comportement et de savoir comment la mesurer. Pleck a développé la théorie de Lamb sur l'implication paternelle, identifiant cinq domaines clés [48,49]: 1. engagement positif: interactions directes telles que le jeu, les activités éducatives et la prise en charge de l'enfant; 2. contrôle : suivi des activités de l'enfant, participation aux prises de décision et définition de règles de vie ; 3. chaleur

et réactivité : qualité émotionnelle de la relation père-enfant 4. prise en charge indirecte : tâches telles que acheter des produits de première nécessité, emmener l'enfant à des activités parascolaires et des visites chez le médecin ; 5. responsabilité du processus : réflexion aux besoins de l'enfant et supervision de sa vie quotidienne et de ses besoins futurs [48,49]. L'implication et l'engagement des pères sont influencés par divers déterminants. Allport et al. ont développé un modèle comportemental intégré pour explorer ces facteurs d'influence [49].

Les facteurs qui influencent l'implication du père auprès de ses enfants comprennent les caractéristiques de l'enfant (sexe, tempérament), le lien biologique avec l'enfant et les croyances du père concernant son rôle, ses croyances religieuses, son origine ethnoraciale, sa relation avec ses propre parents, sa satisfaction relationnelle avec le conjoint, son statut concernant la garde de l'enfant, sa santé mentale, son niveau de diplôme et sa situation professionnelle. Ces facteurs façonnent les croyances, les attitudes, les normes perçues et l'action personnelle du père, affectant finalement son intention de s'impliquer dans la parentalité et la coparentalité [49].

Les pères sont généralement plus engagés avec les garçons qu'avec les filles et sont moins susceptibles d'interagir avec des fils qui ont des problèmes de tempérament ou des filles qui sont socialement en retrait [48,50]. Les enfants biologiques reçoivent généralement plus d'attention que les enfants non biologiques [48,50]. Les pères de niveau socio-économique plus élevé s'engagent davantage dans les soins indirects, tandis que les pères de niveau socio-économique plus faible s'engagent davantage dans un engagement positif [48,50]. Les pères ayant un niveau de diplôme plus élevé que la mère ont tendance à jouer moins avec leurs enfants, tandis qu'un niveau d'éducation égal est corrélé à davantage de jeux père-enfant et de coparentalité [48,50].

Les croyances du père, influencées par la culture, la religion et la relation avec la mère, déterminent s'il adopte un rôle de soutien de famille, de discipline ou d'encadrant [49]. Les normes perçues façonnées par la culture, la société, la race, l'origine ethnique et la religion jouent également un rôle. Les pères très religieux fournissent souvent des soins plus indirects mais moins de soins directs [49]. Les pères qui ont assisté à l'accouchement ou coupé le cordon ombilical montrent une implication globale plus élevée, reflétant leur attitude d'engagement [48,50]. Les expériences positives de l'enfance avec leurs propres parents augmentent l'implication des pères [48,50].

L'auto-efficacité du père, ou sa confiance dans le rôle parental, est influencée par la dynamique de la relation mère-père [48,50]. Les conflits relationnels réduisent l'implication du père, tandis que la coparentalité positive l'augmente [48,50]. La santé mentale des pères a un impact significatif sur leur implication, les pères déprimés ou anxieux étant moins interactifs [16,17]. En revanche, si la mère est déprimée, les pères compensent souvent en augmentant leur implication [51].

D'autres facteurs d'influence comprennent les connaissances et les compétences du père, la pertinence de sa propre implication selon le père, les habitudes issues d'expériences parentales antérieures et les contraintes environnementales telles que le contrôle maternel, la non-résidence avec la mère et l'enfant et le stress au travail [128]. Les pères avec moins de stress au travail, moins d'heures et plus de stabilité d'emploi sont plus impliqués [48,50].

Enfin, les politiques familiales, comme celles influant la durée et le calendrier du congé de paternité et les incitations à prendre un tel congé, ont un impact significatif sur l'implication du père auprès de son enfant.

Implication paternelle et effets sur les enfants

Les pères qui prennent un congé de paternité et/ou un congé parental peuvent passer plus de temps père-enfant de qualité, ce qui, peut avoir des impacts positifs sur le développement cognitif, physiologique et socio-émotionnel des enfants (**article 1**)[52]. Des études montrent que les pères qui prennent un congé de paternité ou un congé parental plus long s'impliquent davantage auprès de leurs enfants que ceux qui ne le font pas [53]. En France, les pères ayant pris un congé de paternité de deux semaines effectuaient davantage de tâches ménagères deux ans après l'accouchement que ceux qui n'en prenaient pas, bien que la répartition des tâches ménagères et des soins aux enfants entre la mère et le père reste très inégale [53].

Les pères jouent généralement avec leurs enfants pendant environ 29 minutes les jours de travail et 38 minutes les jours fériés, leur implication culminant de la naissance à environ huit ans avant de diminuer progressivement [8]. Le jeu père-enfant diffère du jeu mère-enfant, impliquant souvent des activités plus physiques comme la lutte et le jeu de culbutes [8]. Une revue systématique a révélé qu'un tel jeu physique affecte positivement l'autorégulation des enfants, réduisant les problèmes émotionnels et comportementaux, l'hyperactivité, les problèmes de conduite et les problèmes avec les pairs chez les enfants âgés de 0 à 3 ans.

Une autre revue systématique a souligné qu'une moindre implication du père est corrélée à une augmentation de l'agressivité entre enfants et pairs, quelle que soit la qualité de la relation mère-enfant. Ces résultats soulignent les contributions uniques et significatives des pères au développement socio-émotionnel de leur enfant, en soulignant les rôles complémentaires des deux parents dans l'éducation des enfants [50].

Maladie mentale du père et développement socio-émotionnel des enfants

Les problèmes de santé mentale chez les pères, tels que la dépression postpartum et l'anxiété, peuvent avoir un impact négatif sur le développement de ses enfants [16]. Une revue générale des revues systématiques et des méta-analyses a montré que les enfants dont le père souffre de ces problèmes de santé mentale présentent un risque plus élevé de difficultés internalisés et externalisés, un développement du langage plus faible et des niveaux de problèmes émotionnels et de comportement en général. Certains effets sont évidents dès l'âge de deux mois [16].

Article 1 de cette thèse a révélé que le congé de paternité pourrait avoir un effet protecteur contre la dépression paternelle postpartum à deux mois, offrant ainsi un temps permettant aux pères à s'adapter à la parentalité. En France, les pères qui ont pris un congé de paternité se sont davantage impliqués auprès de leur enfants et dans les tâches ménagères au fil du temps, augmentant potentiellement leur efficacité personnelle en tant que parent [53]. Par conséquent, rendre obligatoires les congés de paternité et parentaux pour les pères pourrait encourager une plus grande implication des pères et contribuer à les protéger contre l'apparition de la dépression postpartum.

Congé de paternité de deux semaines et développement d'une dépression maternelle postpartum : pourquoi y a-t-il plus de risque ?

Article 1 de cette thèse a révélé que les mères couraient un risque plus élevé de dépression postpartum à deux mois quand le père prenait un congé de paternité. Cette association a été examinée en tenant compte de diverses caractéristiques maternelles, paternelles, du ménage et de l'enfant. Les mécanismes sous-jacents possibles comprennent les traits de personnalité paternels et maternels, les dynamiques relationnelles et parentales et les rôles genrés. Une hypothèse suggère qu'un congé de paternité de deux semaines pourrait ne pas suffire pour que les pères développent un

rôle de coparentalité, défini par l'accord parental concernant l'éducation des enfants, la répartition des tâches liés aux soins apportés aux enfants, le soutien mutuel dans la parentalité et la gestion conjointe des conflits.

La coparentalité positive est liée à un meilleur développement de l'enfant, à une réduction du stress parental, à une plus grande confiance parentale et à des relations de couple plus satisfaisantes [54]. Les pères prenant des congés de paternité plus longs présentent davantage de comportements de coparentalité. À l'inverse, un congé de courte durée peut ne pas permettre aux pères de comprendre les besoins du bébé, ce qui entraîne un sentiment d'incapacité et de dépendance à l'égard de la mère, qui peut alors se sentir dépassée et sans soutien, augmentant ainsi son risque de dépression postpartum.

Une étude française a révélé que les pères en congé de paternité effectuaient davantage de tâches liées à l'éducation des enfants, mais qu'ils présentaient toujours une différence significative dans les responsabilités ménagères par rapport aux mères [53]. Le congé de paternité n'a pas eu d'impact significatif sur la répartition des tâches ménagères comme les courses, la cuisine, la lessive ou les réparations, même si certaines tâches comme la vaisselle et le ménage ont été partagées de manière plus équitable. Ainsi les pères en congé de courte durée pourraient se concentrer davantage sur la garde des enfants, laissant aux mères davantage de tâches domestiques.

Une étude allemande a indiqué que les pères prenant plus de deux mois de congé parental étaient plus impliqués dans les tâches ménagères et la garde des enfants, en particulier lorsqu'ils prenaient un congés seul [55]. Cela contraste avec le congé de deux semaines souvent pris en concomitance avec le congé de la mère, limitant l'implication du père dans les activités domestiques et le soutien à la partenaire.

Le manque de soutien du partenaire est associé à des niveaux plus élevés de symptômes dépressifs chez la mère [56]. Les mères courent déjà un risque accru de maladie mentale pendant et après la grossesse, et un soutien insuffisant de la part des pères pendant et après le congé de paternité peut contribuer à l'apparition de dépression postpartum. L'étude française a également révélé que les couples dans lesquels le père prenait un congé de paternité connaissaient moins de conflits et que les mères étaient plus satisfaites de la contribution du père aux tâches ménagères et à l'éducation des enfants [53].

Dans l'ensemble, les résultats suggèrent que les congés de paternité courts pourraient ne pas laisser suffisamment de temps aux pères pour assumer pleinement et partager les responsabilités, ce qui pourrait augmenter le stress maternel et le risque de dépression postpartum (**article 1**).

Dépression maternelle postpartum, santé maternelle et développement socio-émotionnel des enfants

Si un congé de paternité rémunéré de deux semaines ne peut pas protéger les mères contre la dépression postpartum, il est crucial de trouver d'autres politiques familiales pour soutenir les mères en raison des graves conséquences sur leur santé physique et mentale et sur le développement de leurs enfants. Une revue systématique a révélé que les mères souffrant de dépression postpartum sont confrontées à des risques accrus de problèmes de poids, de toxicomanie, de mauvaises relations sociales, de difficultés d'allaitement et de dépression persistante [56]. Elles réagissent également de manière neutre aux stimuli négatifs et courent un risque plus élevé de se retrouver sans abri, de fumer et d'avoir des pensées d'automutilation.

Les enfants de mères souffrant de dépression postpartum présentent des taux de maladie problèmes de santé, un risque de mortalité double jusqu'à l'âge de 12 mois, un développement cognitif et langagier plus faible, des tempéraments plus difficiles et plus de comportements d'intériorisation [56]. Une dépression postpartum sévère conduit les mères à consulter plus fréquemment des médecins généralistes, tandis que celles dont les dépressions sont plus modérées peuvent ne pas recevoir un soutien adéquat [56].

Compte tenu des conséquences négatives considérables sur les mères, les enfants et les familles, des solutions sont nécessaires pour fournir un meilleur soutien postpartum aux mères. Un congé de paternité à court terme peut ne pas suffire à lui seul, ce qui souligne la nécessité de politiques familiales globales pour lutter contre la dépression maternelle postpartum (**article 1**).

Qu'est-ce qui influence la décision des familles de recourir à certains services de garde ?

Dans l'**article 2** de cette thèse, il a été constaté que l'accueil informel était la forme de garde de la petite enfance la plus fréquemment utilisée avant l'école primaire (50,9%), suivie de l'accueil en garderie (27,1%) et de l'accueil parental exclusif (22%). Cela concorde avec des recherches antérieures indiquant que diverses caractéristiques maternelles, parentales, socio-économiques et infantiles influencent les modalités de garde d'enfants [57]. Les familles défavorisées, telles que les familles à faible revenu ou celles ayant un faible niveau d'éducation, ont tendance à opter davantage pour la garde d'enfants à domicile que les familles aisées [57]. Les familles monoparentales sont également plus susceptibles de recourir à des services de garde informels que les ménages biparentaux. Les parents préfèrent souvent la garde d'enfants à domicile ou

assurée par des proches en raison de la familiarité et du confort, en particulier pour les nourrissons.

L'accessibilité influence considérablement les choix en matière de garde d'enfants. Dans de nombreux pays européens, les enfants n'ont pas de place garantie en crèche avant l'âge de 3 ans, ce qui conduit les parents à recourir à des services de garde informels [2]. L'accessibilité financière est un autre facteur essentiel ; alors que des subventions ou des services publics de garde d'enfants sont disponibles pour les enfants de plus de 3 ans dans la plupart des pays européens, les parents supportent souvent le coût pour les enfants de moins de 3 ans. La garde informelle des enfants est souvent une option plus abordable, et le fait que des proches s'en chargent peut encore réduire les coûts pour les nouveaux parents.

Garde d'enfants en centre et développement socio-émotionnel des enfants

Dans **l'article 2** de cette thèse, il a été constaté que les enfants fréquentant une garderie en crèche entre 0 et 4 ans présentaient une légère diminution des symptômes d'intériorisation entre 5 et 13 ans. Cela pourrait être dû à l'impact positif des amitiés précoces nouées dans de tels contextes, où les enfants acquièrent des compétences sociales et développent de solides relations avec leurs pairs [58]. Ces amitiés précoces peuvent conduire à ce que les enfants aient moins de symptômes internalisés et externalisés, bien que la relation puisse être bidirectionnelle, les enfants qui présentent moins de symptômes nouant de meilleures amitiés.

Le personnel professionnel des services de garde en crèche contribue également à réduire les symptômes d'intériorisation. Des relations positives entre le personnel et les enfants peuvent aider les enfants à acquérir des compétences sociales, à améliorer les interactions avec leurs pairs et à améliorer leur développement socio-émotionnel

[58-61]. Le personnel peut enseigner aux enfants les émotions, le consentement et les comportements sociaux appropriés, fournissant ainsi des facteurs de protection contre de futurs problèmes de développement socio-émotionnel [58-61]. De plus, les ratios enfants/personnel élevés requis dans les services de garde en crèche permettent une attention personnalisée, améliorant la qualité des soins et favorisant des liens sûrs entre les enfants et les tuteurs. Cet attachement sécurisé et ces soins individualisés peuvent réduire le risque de problèmes de développement socio-émotionnel [63].

Garde d'enfants informelle et développement socio-émotionnel des enfants

Article 2 de cette thèse a révélé que la garde informelle des enfants avant l'école primaire était associée à davantage de symptômes internalisés et externalisés pendant l'enfance. Cela peut être dû à la qualité et aux normes inférieures à celles des services de garde en crèche [2,64]. Les soignants informels, souvent sans formation professionnelle, peuvent s'appuyer sur leurs convictions personnelles plutôt que sur leurs qualifications pour discipliner et enseigner les enfants [2,64]. De plus, les enfants pris en charge à domicile appartiennent souvent à des groupes d'âge mixtes, ce qui peut influencer les comportements et obliger les soignants à adapter leurs méthodes d'enseignement, ce qui peut ne pas convenir à tous les âges [2,64].

Les aidants informels sont confrontés à des facteurs de stress au travail tels que de longues heures de travail, de faibles salaires, des ressources limitées, une sous-évaluation sociétale et un ratio enfants/aidants élevé, qui peuvent tous affecter la qualité des soins [65]. Les soignants qui dispensent des soins à domicile sont également confrontés au stress lié à la transformation de leur espace de vie en crèche et à l'absence de séparation entre leur vie professionnelle et leur vie familiale. Ces facteurs de stress peuvent conduire à l'épuisement professionnel, réduisant la qualité

des soins et augmentant le roulement du personnel soignant [65]. Un roulement de personnel élevé et des changements fréquents dans les modalités de garde d'enfants peuvent avoir un impact négatif sur le développement linguistique et émotionnel des enfants.

Limites

Bien que les articles de cette thèse présentent de nombreux points forts, plusieurs limites doivent être prises en compte.

Dans les **articles 1** et **2**, le biais du rapporteur peut être présent car les deux articles s'appuient sur des résultats déclarés par les parents. **L'article 1** a utilisé les symptômes de dépression postpartum déclarés par les parents, tandis que **l'article 2** a utilisé les symptômes d'intériorisation et d'extériorisation des enfant déclarés par les parents. Il n'y avait pas de dossiers cliniques pour vérifier ces rapports. De plus, les facteurs de confusion non mesurés dans les deux articles, tels que les antécédents de santé mentale du père, la qualité du sommeil, les attitudes et les croyances, la violence du partenaire intime, les comportements de coparentalité, l'environnement de travail, les expériences parentales dans l'enfance, les opinions politiques, les croyances religieuses, le contexte culturel et les complications liées à la grossesse ou à l'accouchement pour **l'article 1**, et en outre, les informations sur les pères, telles que leur implication et les congés pris n'ont pas été incluses dans **l'article 2**. D'autres facteurs non mesurés dans **l'article 2** comprennent les réseaux sociaux parentaux, le soutien financier, l'allaitement, la grossesse planifiée, la santé des parents, le tempérament du nourrisson et le stress lié au travail. Ces facteurs pourraient fausser la relation entre le type d'accueil de la petite enfance et les symptômes d'intériorisation et d'extériorisation des enfants.

Dans **l'article 2**, la variable relative au type de garde d'enfants comportait des informations limitées, ne tenant pas compte de la durée ou de l'âge auquel l'enfant a commencé à être gardé, ni de l'existence de plusieurs types de garde d'enfants. La garde d'enfants informelle incluait diverses formes sans distinguer leurs impacts spécifiques. En outre, alors que **l'article 1** incluait des données représentatives au niveau national sur les pères éligibles en France, **l'article 2** ne disposait pas de données totalement représentatives, principalement constituées de familles de la classe moyenne occidentale. Les résultats ne peuvent donc pas être généralisés à d'autres populations. Ces limites soulignent la nécessité de poursuivre les recherches pour comprendre précisément les relations entre le congé de paternité, les types de garde d'enfants et leur impact sur les parents et les enfants.

Implications et futures recherches

De « l'aide-maman » à la coparentalité

Les mères et les pères entrent dans la parentalité différemment, et les politiques familiales telles que les congés de maternité et de paternité renforcent souvent l'idée selon laquelle les mères sont les principales dispensatrices de soins tandis que les pères sont des assistants. Des études sur les ménages de pères célibataires et de pères au foyer montrent que les pères peuvent présenter les mêmes comportements attentionnés que les mères au cours des premiers mois, remettant en question l'idée selon laquelle les mères seraient naturellement plus attentionnées [47].

Les interventions et les cours prénatals visant à accroître l'implication des pères et la coparentalité échouent souvent parce qu'ils n'exigent pas ou n'incluent pas les pères, et négligent des facteurs tels que la culture, l'identité, la santé mentale et l'éducation. Les pères peuvent se sentir marginalisés dans la garde d'enfants, c'est pourquoi il est

crucial de modifier les politiques et les interventions visant à les impliquer pour accroître leur implication et prévenir la dépression parentale.

Une revue systématique a révélé que les interventions renforçant la relation de coparentalité amélioreraient la réussite scolaire des enfants, réduisaient les symptômes dépressifs ainsi que les problèmes de conduite [10]. La coparentalité réduit l'anxiété des deux parents et améliore la qualité des relations parentales et parent-enfant. Les interventions efficaces incluent souvent des groupes de soutien réservés aux pères, qui offrent un espace sûr où les pères peuvent discuter des difficultés et évitent que l'accent soit mis uniquement sur les mères [66,67].

Parmi les exemples de programmes réussis figurent le Minnesota Early Learning Design for Young Dads, qui utilise des modèles positifs et des groupes de soutien réservés aux pères, ainsi que le programme australien SMS4Dads [67,68]. SMS4Dads envoie de brefs messages aux pères sur l'interaction père-enfant, le soutien à la mère et les soins personnels, ainsi que des questions de suivi de l'humeur [68]. Si les pères déclarent se sentir mal, ils sont dirigés vers une ligne d'assistance téléphonique en matière de santé mentale périnatale. Ces programmes visent à encourager la participation des pères, la coparentalité et les soins personnels tout en dépistant les problèmes de santé mentale [68].

Dépistage de la santé mentale paternelle et approche centrée sur la famille

Les visites prénatales et pédiatriques offrent des opportunités d'impliquer directement les pères, d'évaluer leur santé mentale et d'aborder la qualité de la relation de couple [49]. Actuellement centrées sur les mères, ces visites pourraient être restructurées pour inclure une « triade mère-père-enfant » incitant les deux parents à y assister [49]. Cette approche permet aux médecins de communiquer directement avec les pères, en leur

fournissant des informations sur la coparentalité, l'implication paternelle, les défis parentaux et la garde des enfants. Cela favorise également un sentiment d'appartenance chez les pères [49]. De plus, les médecins peuvent dépister les pères pour la dépression, la toxicomanie et s'assurer que leurs vaccins sont à jour.

Politiques de congé de paternité

L'article 1 de cette thèse a démontré qu'un congé de paternité de deux semaines réduit le risque de dépression postpartum chez les pères à deux mois mais augmente le risque chez les mères dont les partenaires prennent ce congé. Cela suggère que la durée et le moment du congé de paternité ne sont peut-être pas optimaux pour prévenir la dépression maternelle postpartum. Augmenter la durée du congé de paternité et promouvoir le congé parental spécifiquement pour les pères (que les mères ne peuvent pas réclamer) pourraient renforcer la participation des pères [69].

Une étude allemande a révélé que les pères prenant plus de deux mois de congé parental présentaient davantage de comportements de coparentalité et d'égalité dans les tâches liées aux enfants et à la maison [55]. Les pères qui prennent un mois de congé pendant que la mère reprend le travail s'impliquent également davantage dans les tâches ménagères, ce qui n'est pas le cas de ceux qui prennent leur congé en même temps que la mère.

Des options flexibles de congé de paternité, permettant aux pères de fractionner leurs périodes de congé, pourraient accroître leur recours en permettant aux pères de choisir les moments optimaux pour leur vie familiale et professionnelle [69]. Il est crucial de surmonter les obstacles tels que les problèmes financiers et les opportunités de carrière. Des politiques garantissant une rémunération à 100 % et la sécurité de l'emploi pourraient encourager davantage de pères à prendre des congés [47,69,70].

Les environnements de travail devraient fournir des informations sur le congé de paternité et favoriser une culture qui le soutient, en évitant toute discrimination à l'égard des pères prenant ce congé.

Des incitations pour les pères de plusieurs enfants et des directives administratives claires peuvent également accroître la participation [69]. L'éligibilité au congé de paternité et au congé parental devrait être conçue exclusivement pour les pères, indépendamment des droits de la mère, afin de garantir que les pères reçoivent leurs prestations [69].

Accessibilité et qualité des services de garde pour les moins de 3 ans

Presque aucun pays ne garantit aux familles une place pour leur enfant en crèche de moins de 3 ans [2]. En outre, la plupart des services de garde d'enfants de moins de 3 ans peuvent être coûteux, avec des subventions limitées pour les familles issues d'une situation défavorisée [2]. Offrir aux familles une place garantie dans des services de garde en crèche (ou dans des services de garde à domicile qui répondent aux mêmes normes et réglementations que les services de garde en crèche) qui sont accessibles tant en termes d'emplacement que de coût peut offrir aux parents les meilleures options d'équilibre travail-vie personnelle. En outre, de nombreux services de garde d'enfants offerts aux enfants de 3 ans et plus sont très réglementés et ont des directives strictes sur le ratio enfants-personnel et les qualifications du personnel et reçoivent des évaluations régulières pour garantir que le service de garde d'enfants respecte le protocole [2]. Ces exigences peuvent également s'appliquer aux services de garde d'enfants offerts aux enfants de moins de 3 ans afin de garantir aux enfants les meilleurs soins qui favorisent leur développement socio-émotionnel.

Cibler les familles issues de milieux les plus défavorisés

Les enfants issus de milieux défavorisés ont souvent un accès limité aux services de mode de garde. Pour y remédier, il est essentiel de développer des interventions qui améliorent l'accès et créent des environnements de mode de garde culturellement inclusifs. Archambault et al. ont proposé un cadre conceptuel pour aider les décideurs politiques à comprendre et à surmonter les obstacles, en promouvant l'équité dans l'accès aux services de mode de garde et la qualité des soins [71].

Les facteurs et stratégies clés sont les suivants

1. Accessibilité : Informer les familles de l'existence et des avantages des programmes de mode de garde. Cette démarche est essentielle pour les personnes vivant dans la pauvreté ou les immigrants récents, qui peuvent avoir des opinions divergentes sur la garde des enfants [71]. Les campagnes de sensibilisation doivent cibler les organisations communautaires et les bibliothèques locales et fournir des informations en plusieurs langues. Les centres de mode de garde doivent communiquer quotidiennement avec les familles dans la langue de leur choix afin d'instaurer un climat de confiance.
2. Formation du personnel et représentation : Le personnel des centres de mode de garde doit être formé à l'accueil des familles d'origines diverses [71]. L'embauche d'assistants maternels issus de groupes minoritaires et parlant plusieurs langues contribue à créer un environnement diversifié et représentatif.
3. Flexibilité administrative : La simplification des procédures d'inscription et la réduction de la documentation légale requise peuvent contribuer à abaisser les barrières [71].
4. Systèmes d'inscription : L'abandon du principe du "premier arrivé, premier servi" au profit de critères fondés sur le revenu, l'origine ethnique et la situation familiale peut permettre à un plus grand nombre de familles défavorisées d'avoir accès aux services d'accueil de la petite enfance [71]. Des évaluations régulières par les instances dirigeantes peuvent contribuer à maintenir l'accessibilité pour les familles socialement diversifiées.
5. Accessibilité financière : La

gratuité des services de mode de garde pour les familles à faibles revenus est essentielle, car même les tarifs réduits peuvent être prohibitifs [71].

La mise en œuvre de ces stratégies peut contribuer à rendre les services de mode de garde plus accessibles et plus adaptables aux besoins d'enfants issus de milieux différents, garantissant ainsi à tous les enfants la possibilité de bénéficier d'une éducation et d'une prise en charge précoces de qualité.

Conclusion

Article 1 de cette thèse a examiné l'impact d'un congé de paternité payé de deux semaines sur la santé mentale des mères et des pères. Cependant, il n'existe actuellement aucune recherche sur la manière dont la durée des congés de paternité affecte la santé mentale des parents. De futures études dans les pays où les congés de paternité et parentaux sont prolongés devraient étudier leurs associations avec la dépression postpartum, l'implication du père et la coparentalité. En outre, la recherche devrait explorer les effets du congé de paternité des pères simultanément et séparément du congé de maternité des mères afin d'informer les décideurs politiques sur les structures de congé optimales pour la santé mentale des parents.

Article 2 a exploré la relation entre différents types de garde d'enfants avant l'école primaire et les comportements d'intériorisation et d'extériorisation des enfants. Des recherches plus approfondies devraient s'adapter à la qualité des services de garde d'enfants, notamment aux méthodes d'enseignement, aux ratios professionnels/enfants et aux ressources disponibles. Il convient également de mesurer la durée et l'âge de début de la garde d'enfants, et de déterminer si les enfants ont eu recours à plusieurs types de garde d'enfants. Comprendre les types spécifiques

de soins informels liés à des symptômes internalisés et externalisés plus élevés chez les enfants est également crucial.

Remarques finales

L'impact des politiques familiales sur l'économie a été largement étudié, mais leurs effets sur la santé mentale des parents et le développement des enfants nécessitent davantage d'attention. En France, le congé paternité est passé de deux semaines à un mois en juillet 2021, une étape vers une plus grande égalité femmes-hommes à la maison et au travail. Les politiques encourageant la participation des pères et valorisant leur rôle à la maison peuvent protéger les mères de la dépression postpartum et améliorer le développement socio-émotionnel et cognitif des enfants.

Donner accès à des services de garde d'enfants professionnels peut favoriser une dynamique familiale équilibrée, en réduisant la charge reposant exclusivement sur les mères, principales dispensatrices de soins. Les enfants bénéficient du fait d'être élevés par les communautés, et pas seulement par leurs parents. Les structures qui favorisent le développement des enfants sont essentielles.

Les familles sont multidimensionnelles et les politiques doivent répondre à leurs divers besoins. Cette thèse met en évidence comment les politiques familiales affectent la santé mentale des parents et le développement des enfants. Elle vise à encourager les décideurs politiques à prendre en compte des facteurs allant au-delà de l'impact économique lors de l'élaboration de lois sur la famille, de la promotion de l'égalité des sexes dans la parentalité et de la garantie de l'accès à des services de garde d'enfants professionnels. L'objectif est que les pères se considèrent aussi comme principaux acteurs qui prodiguent de soins, au même titre que les mères, et que les familles créent un environnement équilibré et favorable au bien-être des enfants et des parents.

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Scientific value

Thesis articles

- Barry, K. M., Gomajee, R., Benarous, X., Dufourg, M. N., Courtin, E., & Melchior, M. (2023). Paternity leave uptake and parental postpartum depression: findings from the ELFE cohort study. *The Lancet. Public health*, 8(1), e15–e27. [https://doi.org/10.1016/S2468-2667\(22\)00288-2](https://doi.org/10.1016/S2468-2667(22)00288-2)
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- Melchior, M., Barry, K., Cohen, D., Plancoulaine, S., Bernard, J. Y., Milcent, K., Gassama, M., Gomajee, R., & Charles, M. A. (2022). TV, computer, tablet and smartphone use and autism spectrum disorder risk in early childhood: a nationally-representative study. *BMC Public Health*, 22(1), 865. <https://doi.org/10.1186/s12889-022-13296-5>

- Formal childcare attendance predicts a lower probability of developmental delay at age 3.5 years in France: data from the ELFE mother-child cohort. Alexandre Ramchandrar GOMAJEE, MSc; Katharine Michelle BARRY, MSc; Eloi CHAZELAS, PhD; MSc; Marie-Noëlle DUFOURG, PhD; Florencia BARRETO-ZARZA, PhD; Maria MELCHIOR, ScD, submitted to the *European Journal of Pediatrics*
- The combined effect of socioeconomic position and neighborhood deprivation on smoking in France: a propensity score analysis, Ms.Kate Dotsikas; Katharine Barry; Solène Wallez; Filiz Eren; Maria Melchior; Murielle Mary-Krause, Submitted to *Social Science and Medicine*, Manuscript Number: SSM-D-23-04804
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Abbreviations

- Diabetes National Research Program (through a collaboration with the French Association of Diabetic Patients) (Programme National de Recherche sur le Diabète (en collaboration avec l'Association Française des Diabétiques in French) (AFD)
- the French-speaking association for the study of diabetes and metabolism (Association de Langue Française pour l'Étude du Diabète et des Maladies Métaboliques in French) (ALFEDIAM)
- The Avon Longitudinal Study of Parents and Children (ALSPAC)
- Stay-at-Home Mother allowance (Allocation de Mère au Foyer in French) (AMF)
- National Agency for Research (ANR)
- National Agency for Food, Environmental and Occupational Health Safety (Agence Nationale de Sécurité Sanitaire de l'Alimentation, de l'Environnement et du Travail in French) (ANSES)
- Activity Pulse Grimace Appearance Respiration (APGAR)
- Parental Education Allowance (Allocation Parentale d'Éducation in French) (APE)
- Support Allowance for Units (Allocation de Soutien aux Unités in French) (ASU)
- Child Behaviour Checklist (CBCL)
- Child-Completed Questionnaires (CCQs)
- Supplement for Free Choice of Activity (Complément de Libre Choix d'Activité in French) (CLCA)

- Supplement for Free Choice of Childcare (Complément de libre choix du mode de garde in French) (CPE)
- Confidence Intervals (CI)
- the Danish National Birth Cohort (DNBC)
- the Diagnostic and Statistical Manual of Mental Disorders (DSM-5)
- EU Child Cohort Network (EUCCN)
- European Union (EU)
- the European Union FP7 programmes (FP7/2007-2013, HELIX, ESCAPE, ENRIECO, Medall projects)
- EPDS Edinburgh Postnatal Depression Scale (EPDS)
- General cohort study conducted in France on the early pre- and postnatal determinants of the psychomotor development and health of the child (Étude de cohorte généraliste menée en France sur les Déterminants pré- et postnatals précoces du développement psychomoteur et de la santé de l'Enfant in French) (EDEN)
- French Longitudinal Study from Childhood (Etude Longitudinale Française depuis l'Enfance in French) (ELFE)
- Fully Conditional Specification (FCS)
- Foundation for Medical Research (FRM)
- French Ministry of Health (Direction Générale de la Santé in French) (DGS)
- The Generation R Study (GenR)
- The Municipal Health Services (Gemeentelijke Gezondheidsdiensten in Dutch) (GGD)
- Generalized Boosting Models (GBM)

- Her Majesty's Chief Inspector of Education, Children's Services and Skills (HMCI)
- International Standard Classification of Education (ISCED)
- National Institute of Statistics and Economic Studies (Institut national de la statistique et des études économiques in French) (INSEE)
- Inverse Probability Weights (IPW)
- The Environment and Childhood project (INfancia y Medio Ambiente in Spanish) (INMA)
- French National Institute for Health Education (Institut National de Prévention et d'Éducation pour la Santé in French) (INPES)
- French National Institute for Population Health Surveillance (Institut de Veille Sanitaire in French) (InVS)
- National Institute for Research in Public Health (Institut de Recherche en Santé Publique in French) (IRESP)
- Middle East and North Africa (MENA)
- General Mutual of National Education (Mutuelle Générale de l'Éducation Nationale in French) (MGEN)
- Multivariate Imputation by Chained Equations (MICE)
- Obsessive Compulsive Disorder (OCD)
- Organization for Economic Co-operation and Development (OECD)
- the Office for Standards in Education, Children's Services, and Skills (OFSTED)
- Odds Ratios (ORs)
- Postpartum Depression (PPD)

- French Ministry of Research, Inserm Bone and Joint Diseases National Research (Ministère de la Recherche, Inserm Programme National de Recherche sur les Maladies Osseuses et Articulaires in French) (PRO-A)
- Restricted Estimate Maximum Likelihood (REML)
- Strengths and Difficulties Questionnaire (SDQ)
- The Toolkit for Weighting and Analysis of Nonequivalent Groups (TWANG)

1. Introduction

Family policy, defined as policy which focuses on the well-being, functioning, and responsibilities of families with children, has seen drastic changes in the last few decades [1]. Parental leave policies, which were mostly oriented towards mothers, now look to extend more leave to fathers as well as provide paternity leave to encourage fathers to be more involved in child rearing. Also, Early Childcare Education and Care (ECEC) has seen a major transition in Europe, in which some countries are moving towards a more universal model of guaranteed childcare provision after the end of parental leave.

In this introduction, we will explore the evolution of women's participation in the workforce and its influence on family policy. Then, we will explore the history of parental leave in France, paid paternity leave, and its impact on children's development, relationship satisfaction, and work-life balance. Finally, we will look at the prevalence of postpartum depression (PPD) among mothers and fathers, diagnostic criteria for PPD, and the negative consequences PPD can have on families, with paternity leave being a potential solution to prevent PPD in parents.

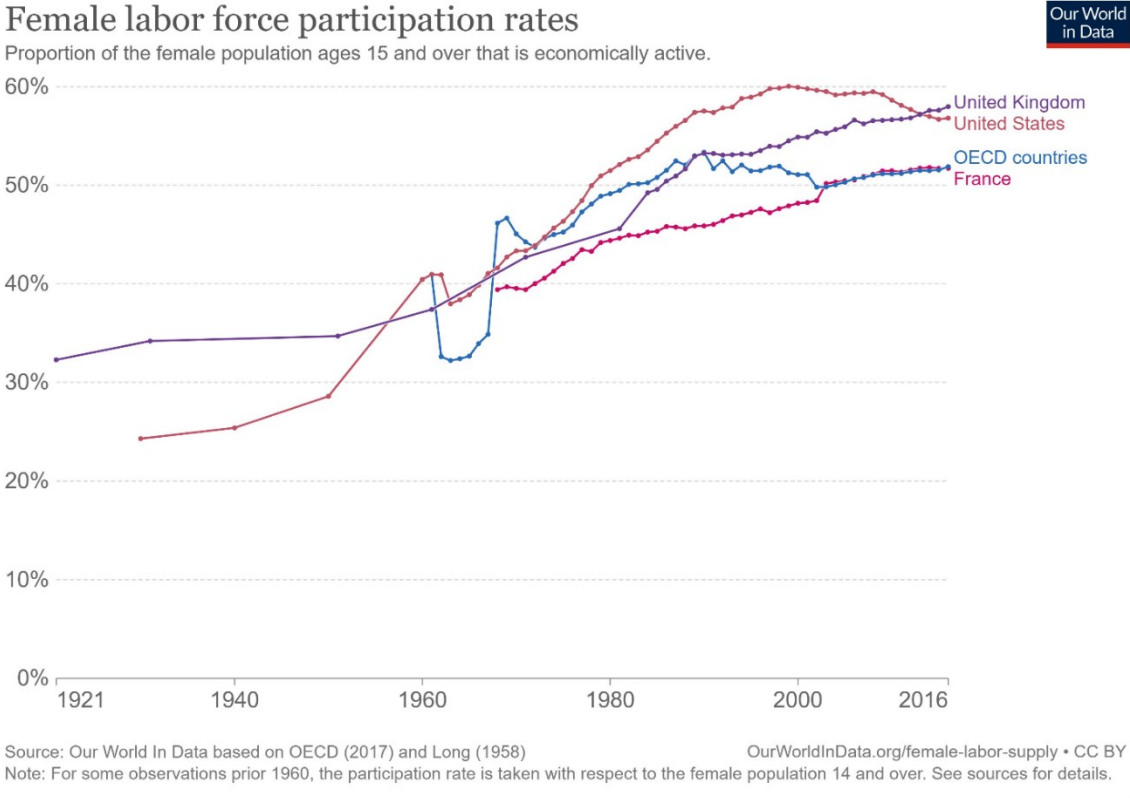
Secondly, we will explore early childcare structures prior to primary school entry as another form of family policy across five European countries. We will compare the funding, governance, access, staff and educational requirements, as well as educational guidelines, evaluation, and monitoring across these five countries and define what makes early childcare 'high quality' [2]. Lastly, we will explore the relationship between early childcare and children's cognitive outcomes, emphasizing

the need for research to explore the relationship between early childcare and internalizing and externalizing behaviors among children.

1.1 Gender inequality in paid and unpaid work

World War II marked a pivotal moment for women in the labor market. Women began filling job positions traditionally held only by men and thereby shifted the societal view of fathers being the only breadwinners of the family. From the 1960s to the beginning of the 2000s, countries have witnessed a general upward trend in female participation in the labor market (**Figure 1**) [1].

Figure 1: Female labor participation rates, published by Our World in Data, 2018 [1]

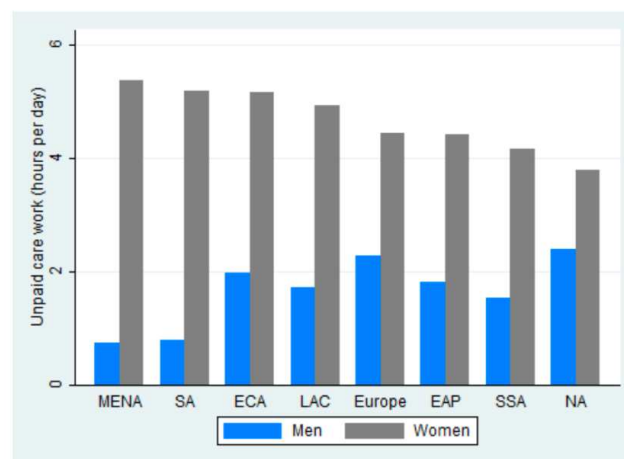


Although women’s participation in the labor force has been steadily increasing, the types of jobs and roles they fill in the paid labor force remain very divided [1]. When

viewing different job sectors, the majority of women around the world work in service jobs compared with men (retail trade, restaurants, hotels, transport, storage, communications, financing, insurance, real estate, business services, community social and personal services, 61.5% in 2016) [3]. These jobs are often paid less than industry jobs, contributing to the pay gap we find between men and women. They also provide fewer social benefits and opportunities for seniority positions, promotions, and pay increase [1,3].

In addition to the gender inequality that we see in the workforce, we also find inequalities in the amount of time women spend doing unpaid work compared to men **(Figure 2)** [4,73].

Figure 2: Time spent on unpaid care work varies by gender and region, as published by the OECD, 2014 [4]



Note: This chart presents the average hours per day spent on unpaid care work by women and men by regions of the world: Middle East and North Africa (MENA), South Asia (SA), Eastern Europe and Central Asia (ECA), Latin America and the Caribbean (LAC), East Asia and Pacific (EAP), Sub-Saharan Africa (SSA) and North America (NA).
Source: OECD (2014), Gender, Institutions and Development Database .

Unpaid work can be defined as cooking and cleaning, household shopping, caregiving for children or the elderly, or any other family task that goes unpaid [4]. This unpaid work, most often the responsibility of women, reflects the lack of social services

available to support families, redistribute women's unpaid work, expand jobs in care services as well as provide social protection and basic infrastructure essential for women to enter and remain in the paid labor force if so desired [5]. In the Organization for Economic Co-operation and Development (OECD) countries in 2014, women were recorded as spending an average of three to six hours on unpaid work per day compared to men, who spent an average of half an hour to two hours [4]. When looking at the division of unpaid work between men and women by region in the world, women in Europe doing more than a two-fold amount of unpaid work compared to men, and in the Middle East and North Africa (MENA) the difference is almost 6-fold (**Figure 2**) [4]. Women continue to work less hours than men in paid employment and do the majority of the unpaid work in the household [4]. Taking into account the number of hours women spend in paid employment and unpaid work, we find that women have longer work days on average than employed men (with a gender gap of 73 minutes to 33 minutes per day in developing and developed countries, respectively) [4]. This work load may limit women's capacity to increase their paid work hours and advance in their careers as well as limit their free time to take care of their physical and mental needs [4]. As a consequence, women are more likely to work part-time (57% of women) compared to men, also contributing to the pay gap we see between men and women [4].

1.2 Family policy

One area that can increase gender equality in the workforce and in the home, while also helping two-wage earner households find better work-life balance, is effective family policies. To understand how family policies are created, it is important to understand the various motives behind the policies. For most developed countries, the family is

viewed as a social and economic institution. It is a social institution because families are raising children and passing down their beliefs, values, and norms to their children as well as love, companionship, and a sense of identity in healthy homes [74]. The family can also be seen as an economic institution as families are creating people who will enter the work force and participate in consumerism [74]. Seeing families as a social and economic institution explains the main motivators that drive family policies, as outlined by Kauffman et al (**Table 1**). These motivators may enable policy makers to find ways to increase the birth rate of the country (natalist motive), increase consumerism and economic spending (economic motive), increase the independence and sustainability of families (socioeconomic motive), establish the family as the center of society (societal motive), compensate the costs people have put into raising a family (sociopolitical motive), preserve the family’s traditional role in society (institutional motive), equalize the distribution of resources, opportunities, and roles between genders (gender equality), and ensure children receive all of the resources they need to thrive (children’s welfare motive) (**Table 1**) [74].

Table 1: Motivators that influence family policy, as written by Daly, Mary 2015 [74,75]

Natalist motive	To keep the birth rate up and managing demographic change
Economic motive	To improve the stock of human capital and bolstering the family’s contribution to economic functioning
Socioeconomic motive	To balance employment (self-sufficiency) and support for the family

Societal motive	To maintain the significance of the family as a form of social capital and a source of social stability
Sociopolitical motive	To Compensate for the costs of having families
Institutional motive	To protect the family as a valued institution
Gender equality motive	To affect the distribution of resources and roles between women and men
Children’s welfare motive	To ensure that children are reared with sufficient resources and to improve their welfare through a range of services and provisions

With these motivators in mind, we can explore what types of parental leave policies were designed in France depending on the time period.

1.3 Parental leave history in France

France has seen a slow evolution in the father’s role in parental leave. Between 1938 and 1978, France’s family policy reflected the social doctrine of the Catholic church, which aimed to keep mothers at home to pursue their “maternal vocation” [6]. Even though women were beginning to enter the workforce more and more in the 20th century, France established a stay-at-home mother allowance (AMF in French) to encourage a “single-allowance” household where the father worked and the mother stayed at home [6]. This AMF policy also reflected a “pro-birth” stance, encouraging families to have more than one child by canceling family benefits for the first child.

During the Vichy regime (1940-1944), the “single salary benefit” (ASU in French) was established which followed the AMF policy but with some significant additions [6]. First, it allowed single-income families to have 25% financial aid depending on how many children they had (for one child: 20% of monthly salary; two children: 25% of monthly salary; three children: 30% of monthly salary) [6]. The ASU was provided to families upon their marriage, before the couple had children, over a two-year period, to encourage couples to have children with the mother staying at home [6]. In 1967, we see an evolution in the ASU policy in which young couples with no children were not allotted ASU as well as families with one child over the age of 5 years old [6]. On January 1st 1978, France cancelled the AMF and ASU for a new benefit titled the “family complement” [6]. On July 1977, a new “educational parental leave” (CPE in French) passed in which working mothers were allotted paid parental leave (paid by the employer) for a maximum of two years, with the right to return to work or receive a similar job of equal pay [6]. The CPE then followed different evolutions and included benefiting both parents after 1984, acknowledging the importance of both parental involvement for children’s development [6]. The parental education allowance (APE in French) in 1985 and the free choice of activity supplement (CLCA in French) opened opportunities for part-time work for parents to find work-life balance as well as provide financial support to parents under certain conditions [6]. Despite these advances, most of the parental leave policies were used by women, which was reflected in women’s decreased participation in the work force.

In 2001, France saw its first reform addressing paternity leave [6]. During the Family Conference, a policy was established which allotted fathers a two-week paid paternity leave, 18 days in the case of multiple births, to be taken during the four months following their child’s birth [6]. Paternity leave was 100% covered by the social

security, with a funding cap [6]. The latest reform in September 2020 extended paternity leave to 25 calendar days, with a requirement of fathers to take four days immediately after their child's birth and the remaining 21 days to be taken at once or split into two periods with a minimum duration of 5 days [6]. Though there is still a huge gap in the amount of paid parental leave equality between fathers and mothers, the benefits that have come out of offering a paid paternity leave may encourage policy makers to further expand opportunities for father involvement in child rearing and family-related tasks [8,9].

1.4 Paid paternity leave

As mentioned above, paternity leave can be defined as the time allotted to the salaried spouse or partner of the mother for a set number of days off from work (paid or unpaid depending on the country) after the birth of their newborn child(ren) (also allotted for stillbirths) [7]. In 2019, a law, originating from the work-life balance directive, required European Union (EU) member states to enforce the right to a minimum of two weeks paternity leave, with no job loss risk [7]. As of March 2023, Finland had the longest allotted days (a max of 160 days for fathers with the ability to give 63 days to the mother), with Spain having the longest paid paternity leave (16 weeks, 100% of salary covered by the social security) (**Figure 3**) [7].

Figure 3: Number of paid paternity leave by weeks offered in each country in the European Union, as published by European Parliamentary Research Service [9]

Paternity leave

Number of weeks		Payment
BG	2	90 %
HR*	2	100 %
CY	2	72 %
CZ	2	70 %
DK	2	Variable
DE*	2	N/A
EL	2	100 %
HU*	2	100 %
IE*	2	● Flat rate
IT	2	100 %
LV*	2	80 %
LU	2	▼ Variable
MT*	2	100 %
PL	2	100 %
RO*	2	100 %
SK*	2	★ Flat rate
SE	2	78 %
AT	4	▲ Flat rate
BE*	4	◆ Variable
EE	4	100 %
FR	4	100 %
LT	4	78 %
SI	4	100 %
NL	7	100 %
PT*	9	100 %
ES	16	100 %
FI*	19	Variable

Current EU legislation
2
 weeks minimum
 * See additional
 information overleaf

BG: Bulgaria; HR: Croatia; CY: Cyprus; CZ: Czech

▲ AT 'family time bonus' amounting to €717 per month

◆ BE 100 % for 3 days (paid by the employer), 82 % of earnings for the remaining period

● IE weekly rate of €250

▼ LU 100 % for 2 days (paid by the employer), up to 5 times the social minimum wage (€11 284.77 per month)

★ SK €39 on average per day

Republic; DK: Denmark; DE: Germany; EL: Greece;

HU: Hungary; IE: Republic of Ireland; IT: Italy; LV:

Latvia; LU: Luxembourg; MT: Malta; PL: Poland; RO: Romania; SK: Slovakia; SE: Sweden; AT: Austria; BE: Belgium; EE: Estonia; FR: France; LT: Lithuania; SI: Slovenia; NL: The Netherlands; PT: Portugal; ES: Spain; FI: Finland

*BE: From 1 January 2023, paternity leave increased from 15 days to 20 days. The extension applies to employees as well as to self-employed workers and civil servants. HR: As of 1 January 2023, employed and self-employed fathers may take 10 business days' paternity leave within the first six months of the child being born. EE: On 1 April 2022, a new law entered into force for mothers, which provides for 60 to 100 days' leave; the rest (40 days) can be added to parental leave. DE: From 2024, fathers are to be given two weeks off after the birth of the child. It will be paid leave and will be enshrined in the Maternity Protection Act. HU: From 1 January 2023 (retrospectively for all babies born as of 2 August 2022), fathers are entitled to two weeks' leave. FI: A new Act reforming parental benefits came into effect on 1 August 2022. Paternity leave ceased to exist in its original form. Instead, the reform gave both parents an equal quota of 160 parental allowance days. Parents can agree to give up as many as 63 days of their entitlement to the other parent or some other person who provides care for the child. IE: An additional three weeks of parent's leave and parent's benefit are available to each parent of a child born or adopted on or after 1 November 2019 (bringing the total to five weeks). LU: From 1 January 2023, paternity

benefits are calculated on the basis of working days (10) rather than calendar days. All paternity benefits already granted for children born from 2 August 2022 will be reviewed. MT: From 2 August 2022, employees (fathers or equivalent second parents) have the right to 10 working days' paternity leave, to be taken immediately after the birth or adoption of a child. PT: There is no maternity or paternity leave, only parental leave. There is an option to take 120 or 150 days of leave: 120 days are paid at 100 % and 150 days at 80 %. An extra 30 days are available if parents share the leave period. The father can take any part except the initial parental leave reserved for the mother. RO: For any paternity leave request submitted on or after 29 August 2022, employees are entitled to 10 working days, to which five working days can be added. SI: From 1 November 2022, fathers are entitled to two weeks of paid leave, even if the mother receives maternity or parental allowance at the same time.

1.5 Father involvement benefits

Providing fathers with more leave may be one method to increase father involvement in their child's life, and previous research has reflected many positive benefits of father involvement in the family. Children whose fathers are engaged and present in their lives, they have better social and emotional development as well as excel in their school studies compared to children whose fathers are not engaged or completely absent in their lives [9,10]. In children's academic achievements, these benefits remain significant even after adjusting for the mother's involvement as well as various socioeconomic and demographic characteristics [9]. One systematic review explored the types of father-child play that took place when the child was an infant to understand how the child's future development was impacted [8]. An important aspect of this systematic review was that fathers who engage in playtime with their infants tend to increase the frequency of such interactions as their children grow older (looking at time points: 9 months, 2, years, 4 years) [8]. This can demonstrate to policy makers the importance of paternity leave as fathers would have more opportunity to develop a father-child bond during early infancy, potentially leading to sustained engagement

and involvement with their child. However, one study highlighted that fathers of 3- to 7-year-old children engaged in more play time with their child compared to fathers with children between 8 to 13 years old, demonstrating that fathers may increase their father-child engagement when the child is very young but this may taper out as children reach adolescence [8]. The systematic review also found that children who engaged in frequent play time with their fathers were positively linked to less aggression, better self-regulation, and better peer competence, particularly for boys [8]. However, the study also noted that fathers who engaged in overly intrusive behavior during playtime led to poorer self-regulation skills in their children [8]. Another study looking at internalizing and externalizing behaviors in children at age 15 years and father involvement (using mother-reported father engagement at age 5 years and 9 years, youth-reported father engagement at age 9 years, and youth-reported closeness to their fathers at age 9 years) found that children had decreased internalizing and externalizing behaviors if the father was reported to be involved in the child's life as well as if the child reported feeling close to their father [76].

We also see greater relationship satisfaction between the mother and father as well as more equal division of household tasks when the father takes parental and/or paternity leave, depending on the availability and duration of leave taken [11]. For example, one study found that if a well-paid moderate duration of paternity leave (or parental leave targeted towards fathers) was offered and taken, there was more gender equality not only in household tasks but also in the workforce [11]. Conceptually speaking, we can look to the role theory to explain why mothers and fathers may have more relationship satisfaction as the parental and paternity leave policies expand [11]. In the role theory, different roles are assigned to mothers and fathers, such as fathers being the “breadwinner” of the family while mothers are the “homemakers” and “primary

caretakers” of their children while also balancing a career [11]. This can lead to an overwhelming number of roles for the mother to take on for herself, adding stress and decreased satisfaction in her relationship with her spouse/partner [11]. To counteract these negative effects that assigning specific roles within the relationship can have, we can look to paternity leave policies to balance out the distribution of roles.

Some qualitative studies have found that fathers who took parental leave shifted in their beliefs of the role that a father plays in the family and were more engaged with their family [47]. We find similar results in quantitative studies which indicate that a mother’s perception of father participation in child rearing as well as household tasks is positively associated with relationship satisfaction for both mothers and fathers [77]. Another study conducted in France found that fathers who took even just a two-week paid paternity leave ended up doing more household tasks with mothers reporting more satisfaction in how the father helped in the household two years later, though the division of time spent on household labor remained largely inequal [53]. Lastly, one study in Germany found that mothers’ relationship satisfaction increased as solo maternity leave decreased [11]. This may also shed light on the fact that parental leave policies which move towards gender equality may have a positive impact on the mother’s satisfaction in her relationship with her spouse/partner [78].

1.6 Paternity leave and postpartum depression (PPD)

Paternity leave may provide couples with the opportunity to establish greater relationship satisfaction, more father-child bonding, and more equality in household and childrearing tasks, which in turn are protective factors against the development of maternal and paternal PPD [12]. According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), PPD is present when at least five of the depressive

symptoms are present for at least two weeks and occur with the onset of pregnancy or within four weeks of delivery (**Table 2**):

Table 2: Postpartum depression symptoms according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) [79]

- Persistent feelings of sadness or a low mood, experienced personally or observed by others, throughout most of the day
- Diminished interest or enjoyment in activities
- Difficulty sleeping or excessive sleeping
- Slowed thinking or movement, or restlessness
- Persistent feelings of guilt or a sense of worthlessness
- Constant tiredness or lack of energy
- Thoughts of suicide or death, or attempts at suicide

Though fathers can also exhibit these symptoms of PPD, these criteria are mostly based on mothers' PPD, and fathers may express PPD symptoms differently [13,80,81]. Additionally, fathers may experience different patterns of PPD which could manifest more gradually and become more noticeable towards the end of the first year post-birth [13,80,81]. One study highlighted the various symptoms that fathers may have which could identify paternal PPD (**Table 3**) [13].

Table 3: Symptoms of paternal postpartum depression, as written by Musser et al, 2013 [13]

- Withdrawal or avoidance (from social situations, work, or family)
- Indecisiveness

- Cynicism
- Anger attacks
- Self-criticism
- Irritability
- Alcohol/drug use
- Increased marital conflict
- Partner violence
- Somatic symptoms (e.g., indigestion, changes in appetite and weight, diarrhea, constipation, headache, toothache, nausea, and insomnia)
- Negative parenting behaviors (e.g., decreased positive emotions, warmth, and sensitivity and increased hostility, intrusiveness, and disengagement)

Due to these differences, fathers may go underdiagnosed with PPD [13]. For mothers, the global prevalence of PPD is approximately 17.22% (95% CI 16.00, 18.51) within the first year of the child's birth (but excluding the first week after birth to prevent diagnosis of baby blues) [15]. For fathers, an average of 8.75% (95% CI 6.68, 11.07) are diagnosed with PPD within the first year of the child's birth [14]. In a systematic review which included only meta-analyses and systematic reviews of risk factors of PPD in mothers, the study found several risk factors for PPD: violence and abuse, immigration status, gestational diabetes, cesarean section, depression history, vitamin D deficiency, obesity and overweight, postpartum sleep disruption and poor postpartum sleep, lack of social support, traditional dietary pattern (Japanese, Indian, United Kingdom, and Brazilian dietary pattern), multiple births, preterm and low-birth-weight infants, postpartum anemia, and negative birth experience [82]. Other studies have also

concluded that having a partner with PPD is significantly correlated with mother's PPD [80]. For fathers, risk factors include: previously having obsessive compulsive disorder (OCD) or anxiety, changes in certain hormone levels (testosterone, estrogen, cortisol, vasopressin, prolactin), feelings of isolation from mother-infant bonding, lack of positive father-infant bonding, marital conflict, poor sleep quality, history of psychological difficulties, lower perceived social support, financial stressors in the preceding six months after child's birth, paternal employment status, paternal education status, having their first child, and immigration status [80,83–85].

1.7 Negative consequences of postpartum depression (PPD)

Preventing the onset of PPD in mothers and fathers is important due to the negative consequences PPD can have on the parent-child relationship, couple relationship, family dynamics, and overall wellbeing of the mother and father [16–18]. Mothers' and fathers' PPD has been associated with increases in behavior problems and delays in cognitive and socio-emotional development among school-aged children as well as increased risk of developing an insecure attachment style [19,20]. There also seems to be a bidirectional relationship between PPD symptoms in parents and parental relationship satisfaction [21]. Lastly, PPD can impact mothers' and fathers' long-term wellbeing, as parents may be prone to poor sleep, alcohol and drug abuse, unhealthy eating habits, decreased physical activity, and mental health problems [17,22]. Some studies have even reported that paternal PPD is associated with increased stress, feelings of failure, and violence in fathers [13,80]. Finding family policies and interventions that can prevent mothers' and fathers' PPD is essential to the health of the family, child, and parent.

1.8 Childcare services in Europe

Another important dimension of family policy today is ECEC. ECEC can be defined as any care received outside of the parent and is often divided into two categories: formal childcare, which consists of centre-based childcare, nurseries, preschools, and registered child minders, and informal childcare, which consists of grandparents, relatives, unregistered nannies and/ child minders [23]. Childcare, similar to paternity leave, originated from the idea of enabling women's participation in the workforce as well as furthering children's education, helping children with special needs, and protecting children who come from more disadvantaged backgrounds [23,24]. After World War II, countries in Europe started viewing childcare as a public responsibility and not a private charity [23]. Between 1960 until present day, most countries in Europe offer universal provision of pre-school for children ages three to five years old, with very few countries offering universal provision of childcare before the age of three years old [23,24].

For the second article of this thesis, we focused on ECEC services prior to primary school in Britain, the Netherlands, Denmark, France, and Spain. There are big differences between early childcare (before the age of three or four years, depending on the country) and childcare (from age four years until primary school) in terms of funding, governance, access, staff and educational requirements, educational guidelines, evaluation, and monitoring [2]. **Table 4** provides a detailed outline of the ECEC structure for each of these countries.

Table 4: Funding, governance, access, staff and educational requirements, educational guidelines, and evaluation and monitoring in Britain, The Netherlands,

Denmark, France and Spain from the Early Childhood Education and Care in Europe, as outlined by the 2019 Eurydice Report [2]*

Britain

Funding: For children under four years old, there are no regulations on fees and providers have autonomy in setting the price. Some public subsidies to offset the costs are available only for the most disadvantaged children. After the age of 4, pre-school is free of charge.

Governance: Childcare is regulated across all age groups, and The Childcare Act of 2006 establishes that Her Majesty's Chief Inspector of Education, Children's Services and Skills (HMCI) oversees childcare provision, regulation, and inspection in England.

Access: Children are guaranteed a spot starting from the age of three years old, and they are legally entitled to 15 hours per week of care, with 30 hours per week of childcare for households with two working parents. No childcare guarantee is granted for children below three years of age, but childcare reform will take place in September 2024 which will allow eligible working families who have a child between the ages of 9 to 23 months weekly allotment of 15 hours of subsidized childcare.

Staff and educational requirements: The core practitioners are required to have an ISCED** 7 level of education. There are no minimum qualifications levels to

become an assistant. The maximum number of children per group and per staff member in centre-based childcare settings at age 2 is four and at age four is 30. The maximum number of children under age three years per childminder in a regulated home-based childcare setting is four.

Educational guidelines: Educational guidelines are set by top-level authorities for centre-based childcare settings across the whole childcare phase which are binding. These guidelines are provided for home-based settings as well but are not binding.

Evaluation and monitoring: the Office for Standards in Education, Children's Services, and Skills (OFSTED) oversees childcare inspections that take place across all childcare years.

The Netherlands

Funding: The Dutch government reimburses a substantial portion of the cost of childcare (ages zero until four years of age). The childcare benefit is called "kinderopvangtoeslag". The amount that parents are entitled to receive is dependent on several factors such as family income, the number of children and the working hours of parents. Children begin primary school at four years of age, which is free of charge.

Governance: The Municipal Health Services (GGD) and the Dutch Inspectorate of Education are responsible for monitoring the quality of early childhood education.

Access: There is no legal place guarantee for early childcare services. There is no legal obligation for children and parents to participate in early childcare services. Municipalities do, however, have an obligation to provide childcare services and sufficient of early childhood education spots for children who are at risk due to certain social disadvantages.

Staff and educational requirements: For children under the age of three, core practitioners are required to have an ISCED** 3-5 education level. No educational requirements are set for assistants. For children aged 3 or above, an ISCED** 6 education level is mandatory and an ISCED** education level 3 is required for assistants. The maximum number of children per group and per staff member in centre-based childcare settings at age two is eight and at age four there are no top-level regulations. The maximum number of children under age three years per childminder in a regulated home-based childcare setting is four.

Educational guidelines: Educational guidelines are set by top-level authorities only for centre-based childcare settings (which are binding) when the child is age 3 years and over. For under 3 years, educational guidelines only apply to children from a disadvantaged background who are age two until age four years). There are no educational guidelines for a home-based childcare setting.

Evaluation and monitoring: The municipal health services are primary responsible for carrying out the external evaluation of centre-based childcare settings. However, when they report shortcomings concerning the targeted programs within a centre-based childcare setting for children coming from a disadvantaged background, the Inspectorate for Education must do a follow-up inspection.

Denmark

Funding: Until the child enters primary school (age six), fees are charged for a place in an early childcare setting. Parental monthly fees cannot exceed 25 % of the gross operational expenses including lunch. The public funding therefore comprises at least 75 % of the expenses and is covered by the municipalities.

Governance: The Ministry of Social Affairs, through the 1999 Social Services Act, has the main responsibility for early daycare facilities for children ages zero to six years old. The Ministry issues guidelines for daycare facilities in accordance with the Act. Local authorities have the responsibility of providing daycare facilities for children, deciding how many slots are available for children, how much parents pay, the structure of the daycare, and the age-groupings.

Access: Every child has a guaranteed legal right to a place in a childcare setting from the age of 26 weeks.

Staff and educational requirements: No educational requirements are set out for core practitioners nor assistants for both children aged three years and up or children under the age of three years. The maximum number of children per group and per staff member in centre-based childcare settings at age two and at age four has no top-level regulations. The maximum number of children under age three years per childminder in a regulated home-based childcare setting is five.

Educational guidelines: Educational guidelines are set by top-level authorities for centre-based childcare settings which are binding. They also apply to home-based childcare settings.

Evaluation and monitoring: The municipalities are responsible for carrying out evaluations in early childcare settings. The municipal council sets the objectives and guidelines for evaluation. The pedagogical curriculum is evaluated at least every two years.

France

Funding: For children below three years of age, access to childcare structures has a cost for families, which generally depends on the parents' income (centre-based childcare) or is negotiated with the childminders (home-based childcare).

Governance: Childcare is regulated by the Ministry of Solidarity and Health for children less than three years of age. Then, the Ministry of National Education is responsible for pre-primary school from the ages of three until six years of age.

Access: There is no legal guarantee of a place in early childcare for children under the age of 3. From the age of 3 years, families are required to send their children to pre-primary school.

Staff and educational requirements: For children starting at age three, core practitioners are required to have an ISCED** 7 education level. Assistants are required to have an ISCED** 3 education level. For children under the age of 3, core practitioners must have an ISCED** 6 education level. The minimum qualification to work as an assistant with younger children (below age three) is an ISCED** 3 education level. The maximum number of children per group and per staff member in centre-based childcare settings at age two is seven and at age four there are no top-level regulations (the child is already in school). The maximum number of children under age three years per childminder in a regulated home-based childcare setting is four.

Educational guidelines: Educational guidelines are set by top-level authorities for centre-based childcare settings across all age groups but differ for each age group. The guidelines are only binding for children aged three years and over. These guidelines also apply to home-based childcare settings.

Evaluation and monitoring: Pre-primary schools can be externally reviewed, and are dictated by local authorities, which are not conducted on a routine basis. The Ministry of Social Affairs and Health developed a monitoring system for childcare settings at the national level. At the local level, the PMI services (Child and Maternal Protection Agency) and the Family Allowances Fund (Caisse des allocations familiales) are involved in developing the local monitoring system. The Ministry of Education developed the system for pre-primary schools.

Spain

Funding: Parents must pay for early childcare (birth until three years of age). The fees that families must pay differ by region and often are based on the household income as well as age of the child. Public childcare settings are subsidized by the government. From ages three to five years, children are guaranteed 25 hours of free weekly childcare.

Governance: The local education department oversees early childcare (birth to three years old) for each Autonomous Community in Spain, Galicia being the exception as the responsibility is shared with the social affairs department. The Ministry of Education and Vocational Training (MEVT) oversees childcare for children ages 3 years and older in terms of core curricula, objectives, and evaluation criteria.

Access: All children over three years of age have the legal right to a place in a childcare setting.

Staff and educational requirements: Core practitioners are required to have an ISCED** education level between 3-5 to teach children under the age of three years and an ISCED** 6 education level to teach children three years and older. No regulations are set out to become an assistant in either scenario. The maximum number of children per group in centre-based childcare settings at age two is 18 and at age four is 25. The maximum number of children under age three years per childminder in a regulated home-based childcare setting is four.

Educational guidelines: Educational guidelines are set by top-level authorities for centre-based childcare across all age groups but differ by age group. These guidelines are binding. There are no educational guidelines for home-based settings from top-level authorities.

Evaluation and monitoring:

Childcare is monitored and evaluated by local inspection services in each Autonomous Community across the whole childcare period (birth until six years old).

****International Standard Classification of Education (ISCED) [86]:**

ISCED 0: Early childhood education (less than primary school for educational attainment)

ISCED 1: Primary education

ISCED 2: Lower secondary education

ISCED 3: Upper secondary education

ISCED 4: Post-secondary non-tertiary education

ISCED 5: Short-cycle tertiary education

ISCED 6: Bachelor's or equivalent level

ISCED 7: Master's or equivalent level

ISCED 8: Doctoral or equivalent level

*Additional information on childcare was found for Britain [87], the Netherlands, Denmark [88,89], France [90,91], and Spain [90]

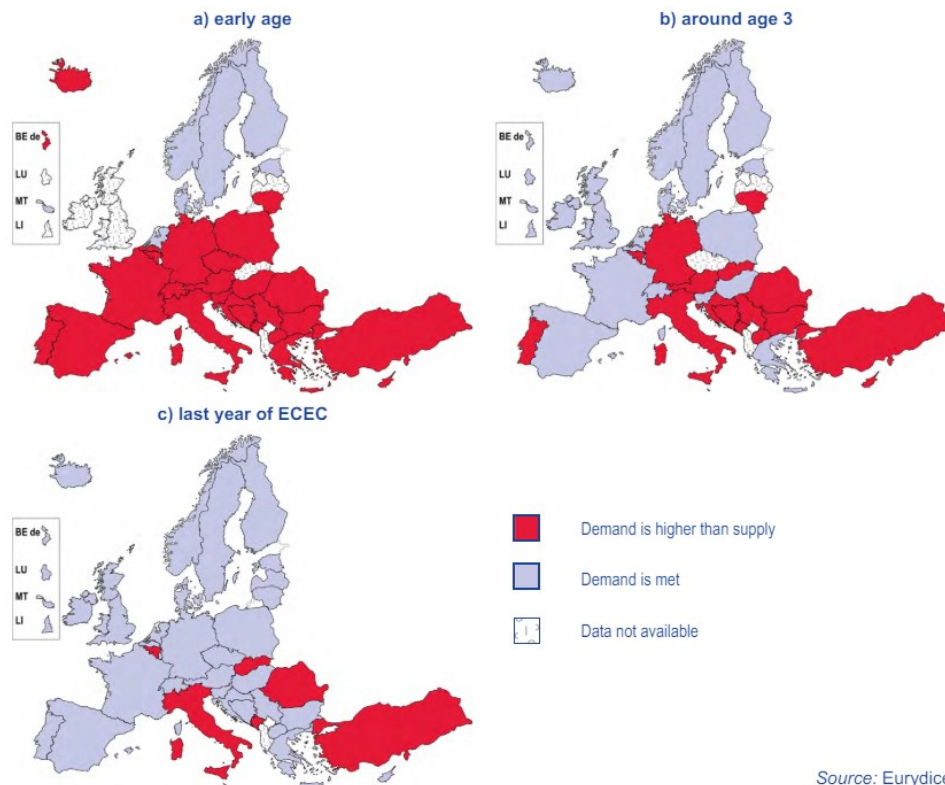
In **Table 4**, we see that none of the mentioned countries offer early childcare (birth to three or four years of age) free of charge, but the countries base the cost of childcare on a sliding scale determined by the parents' income and offer either heavily subsidized or free childcare for children coming from a disadvantaged background. For childcare between three or four years until primary school, only Denmark does not offer childcare free of charge until the beginning of primary school. For governance, some

countries divide who is in charge based on early childcare vs childcare (France and Spain) whereas other countries keep the same governance across the whole phase of childcare (Britain, Denmark, The Netherlands). Access for children is highly variable across the five countries. Britain, The Netherlands, France, and Spain offer no guarantee to a place in early childcare (though these countries guarantee a place in childcare after the age of three or four years old).

At the Barcelona Summit in 2022, two objectives were set for European countries: that at least 90% of children between ages three years until primary school and at least 33% of children under the age of three years should have access to formal childcare provision [23]. Only 12 European union member states have met this objective.

In **Figure 4**, we can see that the demand and supply of childcare is highly variable depending on the age of childcare, and not all countries are able to satisfy the demand [2]. For example, for children labelled 'early age' category, Britain, France, and Spain do not provide sufficient daycare options compared to the demand. The demand is met after the age of 3 years, where the law guaranteeing a spot in daycare applies (**Figure 4**) [2].

Figure 4: The Demand and supply of Early Childhood Education and Care (ECEC), as published in the Eurydice 2019 report [2]

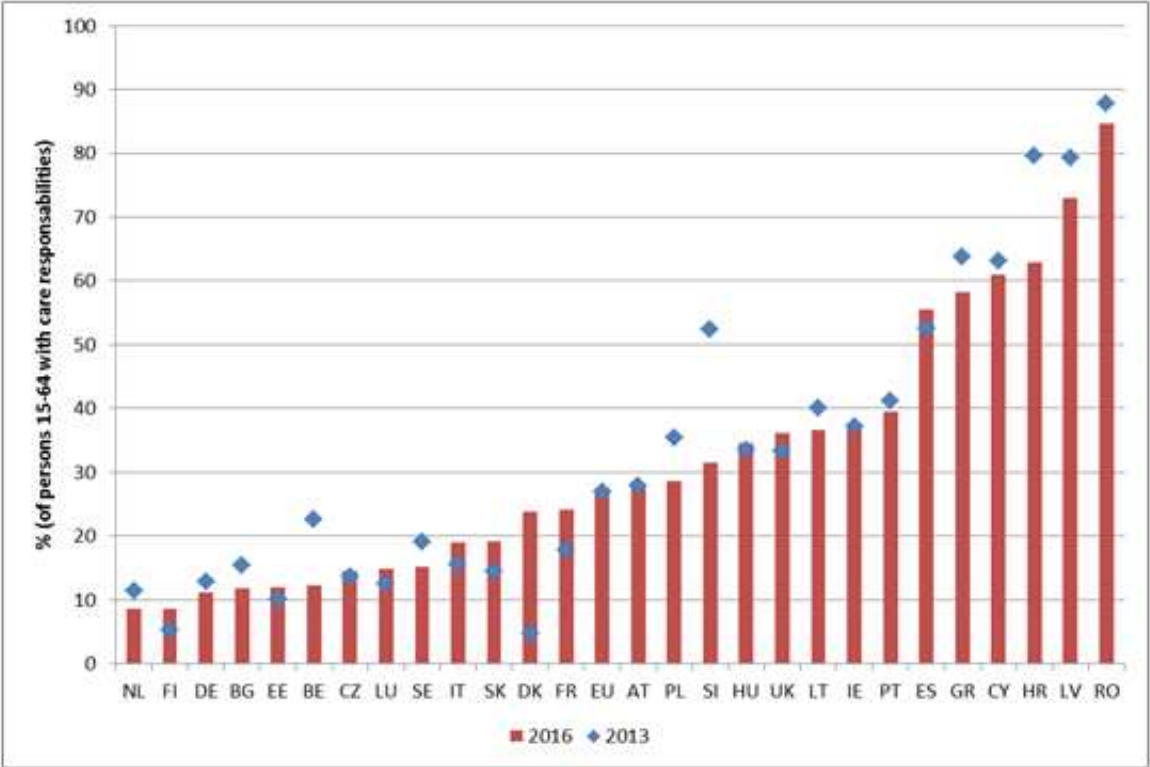


Explanatory note

This figure provides a generalised overview based on reports, surveys and expert estimates. The indicator mainly concerns public and publicly subsidised ECEC, but some countries provided an overall assessment. Both centre-based and home-based provision are included. The ECEC system is evaluated as a whole, e.g. if demand is higher than supply only in one region for the age group considered, the country is marked in the category 'demand is higher than supply'.

Furthermore, a survey in Europe in 2016 found that many women are subject to work part-time or take off full-time to take care of children due to a lack of suitable childcare service availability to them (around 28% in the whole of the EU) (**Figure 5**) [92].

Figure 5: European women who are inactive or work part-time due to care responsibilities who report a lack of suitable care services, %, as published by the European Commission, 2018 [92]



Source Eurostat, Labour Force Survey 2016

when looking at the educational guidelines created by top-level authorities, some countries have differing guidelines depending on the age of childcare (France, Spain) or do not have any educational guidelines for children below the age of three years but only for children coming from a disadvantaged background (The Netherlands) (**Table 4**). For staff, there is a wide range of educational requirements as well as staff ratios across countries for early and pre-primary childcare (**Table 4**). For example, Denmark does not require any educational requirements for staff across all age groups whereas Britain requires a master’s level education across all age groups. Staff-child ratios also vary greatly by country (**Table 4**). In Spain, the maximum number of children per staff member for two-year-olds is 18, and in France, it is seven (**Table 4**). Lastly, the governing body in charge of evaluating and monitoring childcares to ensure standards

are being upheld differ based on early and pre-primary childcare (**Table 4**). Most countries have the local authorities inspect childcares that are for children under the age of three or four years (The Netherlands, Denmark, Spain, France) whereas national governing bodies oversee inspection for pre-primary childcare (at three or four years until primary school) (**Table 4**).

1.9 Childcare quality standards

It is debatable what makes childcare prior to primary school ‘high-quality’ among policy makers, academics, researchers, and practitioners. There are three broad domains that can be used to evaluate the quality of childcare: structural quality, process quality, and system quality [93]. Structural quality examines the learning environment within a childcare and also includes the educator qualifications and staff-child ratios. Process quality focuses on the teacher strategies, caretaker-child interactions, curriculum, and socio-emotional support provided to children. System quality focuses on the governance and regulatory standards (age of entry, type of childcare provided, etc.) of childcare as well as how much these authorities invest in their childcare programs. One scoping review of meta-analyses and systematic reviews focusing on these three domains found mixed results regarding the impact of group size on children’s learning outcomes in terms of structural quality [93]. Some studies found that lower staff to child ratios improved process quality (such as a 1 to 7 ratio) whereas one study found no relationship. Other studies found that the physical environment such as the size of the play area and the ability to go outside influenced children’s behaviors, cognition, and emotions. One study also found that children coming from disadvantaged backgrounds benefited the most from having larger play spaces and going outside. When examining whether the staff’s education qualifications

were related to higher childcare quality, the results were mixed. Most studies found that the staff's qualifications or specialist training in early childhood care was not related to child developmental outcomes. Twelve meta-analyses focusing on professional development and support found that staff who received professional development which included modelling and performance feedback were associated with improved learning and developmental outcomes for children [93]. When looking at process quality, nine studies concluded that positive educator-child interactions and quality programs and practice improved children's outcomes. Lastly, observing system quality, one meta-analysis found that full-time participation rather than part-time participation in childcare may lead to positive child outcomes and that the age of enrollment did not seem to be an important factor. Childcare services having sufficient funds to purchase certain equipment and resources may be important but return on investment to the larger society seemed to be ambivalent [93].

1.10 Early childcare and children's development

Understanding the effects early childcare prior to primary school entry can have on children's development is crucial to determining which form of childcare can benefit both the family unit and the child's development. Research exploring the benefits of childcare on various child cognitive outcomes seems to be quite harmonious. One systematic review exploring the relationship between childcare prior to primary school entry and cognitive and learning outcomes found that early learning opportunities may prime children for their capacity to learn, which may explain why their later academic performance is higher than children who were exclusively cared for by their parents [25]. The effects seem to be short-term and moderate-term for children's positive cognitive development [25].

However, conclusions drawn from research on early childcare arrangements and children's socio-emotional development are quite mixed. Some of the limitations of these studies include: most being conducted in North America, not exploring mid-term and long-term impacts of early childcare arrangements, and having different definitions and age ranges of early childcare and socio-emotional outcomes [25,26].

Two common outcomes to explore socio-emotional development among children are internalizing and externalizing behaviors. Internalizing symptoms relate to behaviors and disorders displayed inwardly, which can include depression, anxiety, somatic grievances, suicidal ideation, and other inward negative emotional states [94]. Externalizing symptoms include outward behaviors such as aggression, conduct disorder, and violence [95]. Reducing the risk of internalizing and externalizing behavior onset is important due to the negative repercussions these behaviors can have on a person's quality of life. Children with internalizing symptoms are at an increased risk of poor academic achievement, development of behavioral issues, susceptibility to mental disorders, and increased risk of suicide [94]. Children with externalizing symptoms have been linked with poorer academic achievement and later externalizing behaviors in adulthood [95]. Finding solutions to prevent the onset of internalizing and externalizing behaviors in children is important to prevent the continuation of these symptoms into adulthood.

Aims of the thesis

The aim of the first article of my thesis is to explore how the uptake of a two-week paid paternity leave can impact mothers' and fathers' PPD measured at two months. Given the positive benefits that father involvement can have on children's development, father-child bonding, and greater relationship satisfaction, we believe studying the

relationship between paid paternity leave and parental PPD relevant to understand if it can be a protective factor against paternal and maternal PPD.

The aim of the second article of my thesis is to explore how the use of different types of early childcare (centre-based childcare, informal childcare, and exclusive parental care) prior to primary school entry impact children's internalizing and externalizing symptoms across their childhood (**article two**: 5-6 years, 7-9 years, 10-13 years). Given the positive benefits that have been recorded on use of high-quality centre-based childcare on children's learning and cognitive outcomes, we believe studying the relationship between different types of childcare and children's socio-emotional development relevant to understand if it can be a protective factor against internalizing and externalizing symptoms [25].

We hypothesized that:

- Fathers who take paid paternity leave would have decreased odds of postpartum depression at two months compared to fathers who did not take paid paternity leave (**article 1**).
- Mothers whose partners take paid paternity leave would have decreased odds of postpartum depression at two months compared to mothers whose partners do not take paid paternity leave (**article 1**).
- Children who attended centre-based childcare prior to primary school entry would have decreased internalizing and externalizing symptoms across all age groups (**article 2**).

2. General Methods

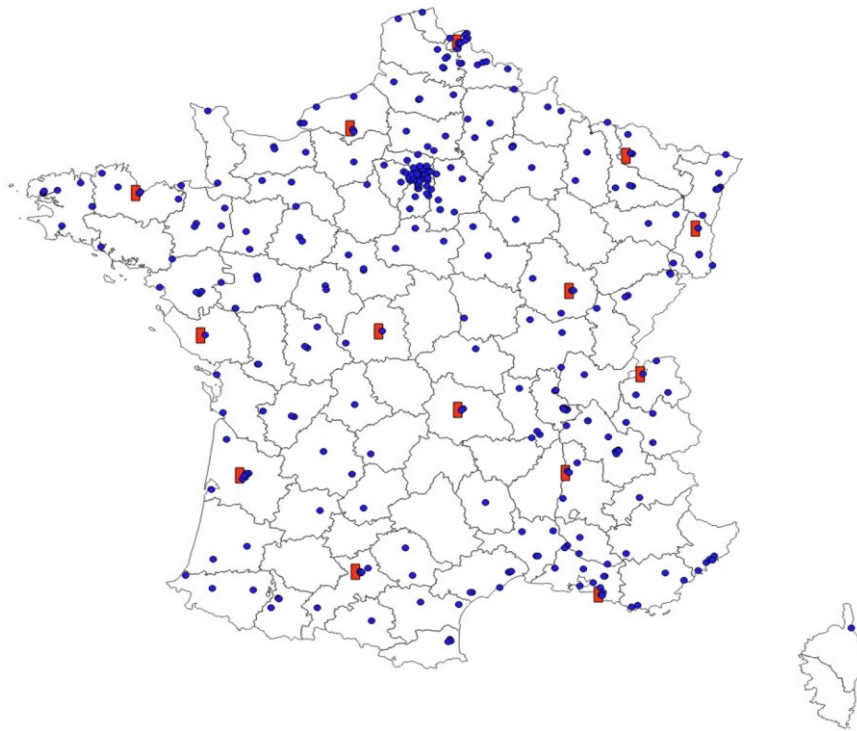
In this section, the cohort data, exposures, outcomes, and covariates used in each article as well as the statistical methods used to address missingness and to complete the main analyses will be presented. Lastly, the statistical tools used will be described as well as links provided to access all coding scripts for the two articles will be provided.

2.1 Data presentation

2.1.1 ELFE cohort

For the first and second article of my thesis, data originated from the French Longitudinal Study since Childhood (Etude Longitudinale Française depuis l'Enfance in French) (ELFE) cohort [27]. The purpose of the ELFE cohort was to study environmental, biological, behavioral, and social factors that could impact children's cognitive, language and social affective skills, educational outcomes, social integration and common childhood diseases. The ELFE cohort was formed in 2011, and 320 maternity units across France agreed to participate (**Figure 6**).

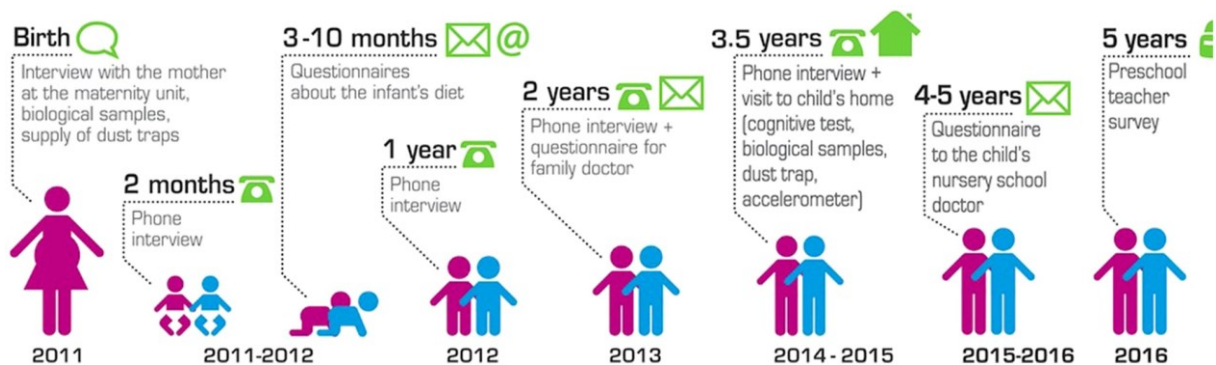
Figure 6: Randomly selected maternity leave units for the recruitment in the ELFE cohort (dots) and biological treatment and storage units (square), as published in the ELFE cohort profile [27]



Mothers and/or fathers were included in the study if they 1. had single or twin live births ≥ 33 weeks of gestation 2. were at least 18 years old 3. had no plan to leave metropolitan France within the following three years 4. provided signed, informed consent to participate. A total of 18 329 babies, including 289 twin pairs, were included in the study. Survey weights were calculated to correct for non-representativeness, making the study nationally representative.

Mothers and/or fathers were interviewed after the birth of their child, at 2 months post-birth, between three to ten months, two years, 3.5 years, between four to five years, and at five years (**Figure 7**). For the purposes of this first article, questionnaires at birth and at two months were used.

Figure 7: Follow-up schedule. ELFE cohort: birth to five years, as published in the ELFE cohort profile [27]



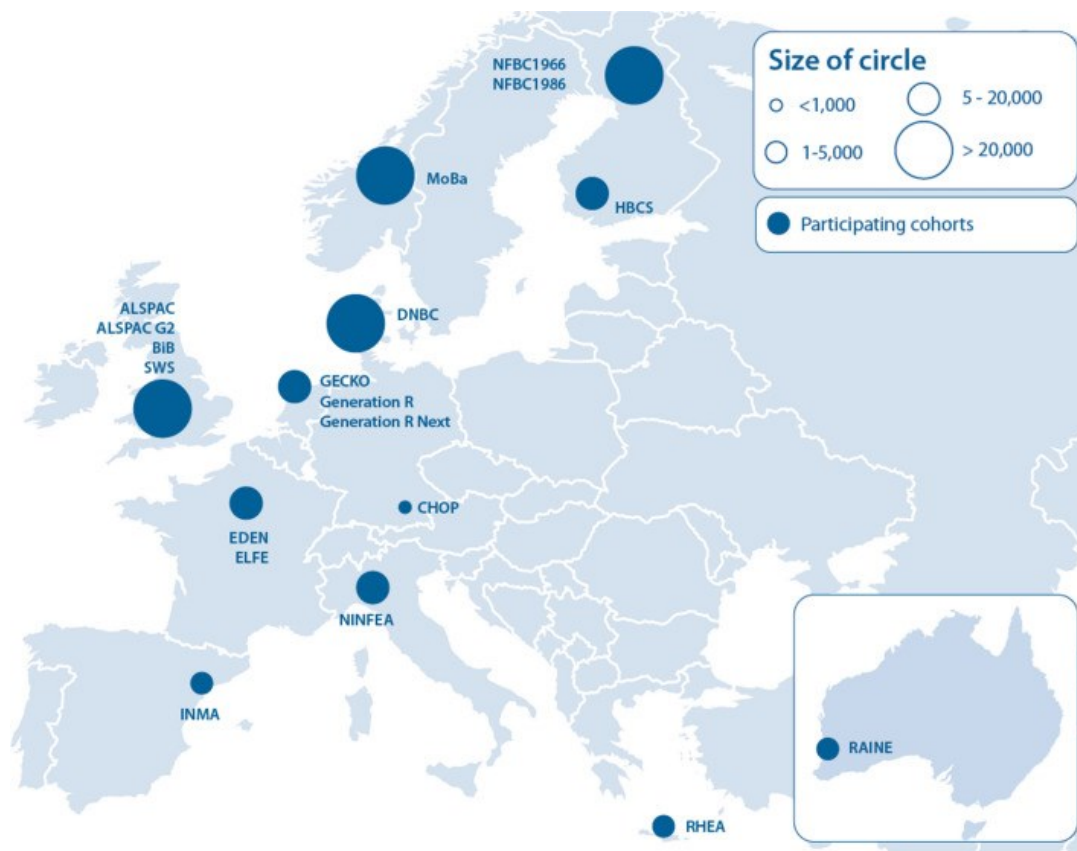
Participation rates remained relatively high, with around 4% of participants not completing information in each wave. For our study, in the two-month questionnaire, around 92% of participants who completed the birth questionnaire responded.

The ELFE cohort is funded and supported by the National Research Agency Investment for the Future programme (ANR-11-EQPX-0038); French National Institute for Research in Public Health (IRESF TGIR 2009–01 programme); Ministry of Higher Education and Research; Ministry of Environment; Ministry of Health; French Agency for Public Health; Ministry of Culture; and National Family Allowance Fund.

2.1.2 EU Child Cohort Network

For the second article of my thesis, data originated from five birth cohorts who are a part of the EU Child Cohort Network (EUCCN) [28]. The EUCCN was established by the Horizon 2020 Lifecycle project, which includes 19 pregnancy and childhood cohorts with over 250 000 children and their parents (**Figure 8**).

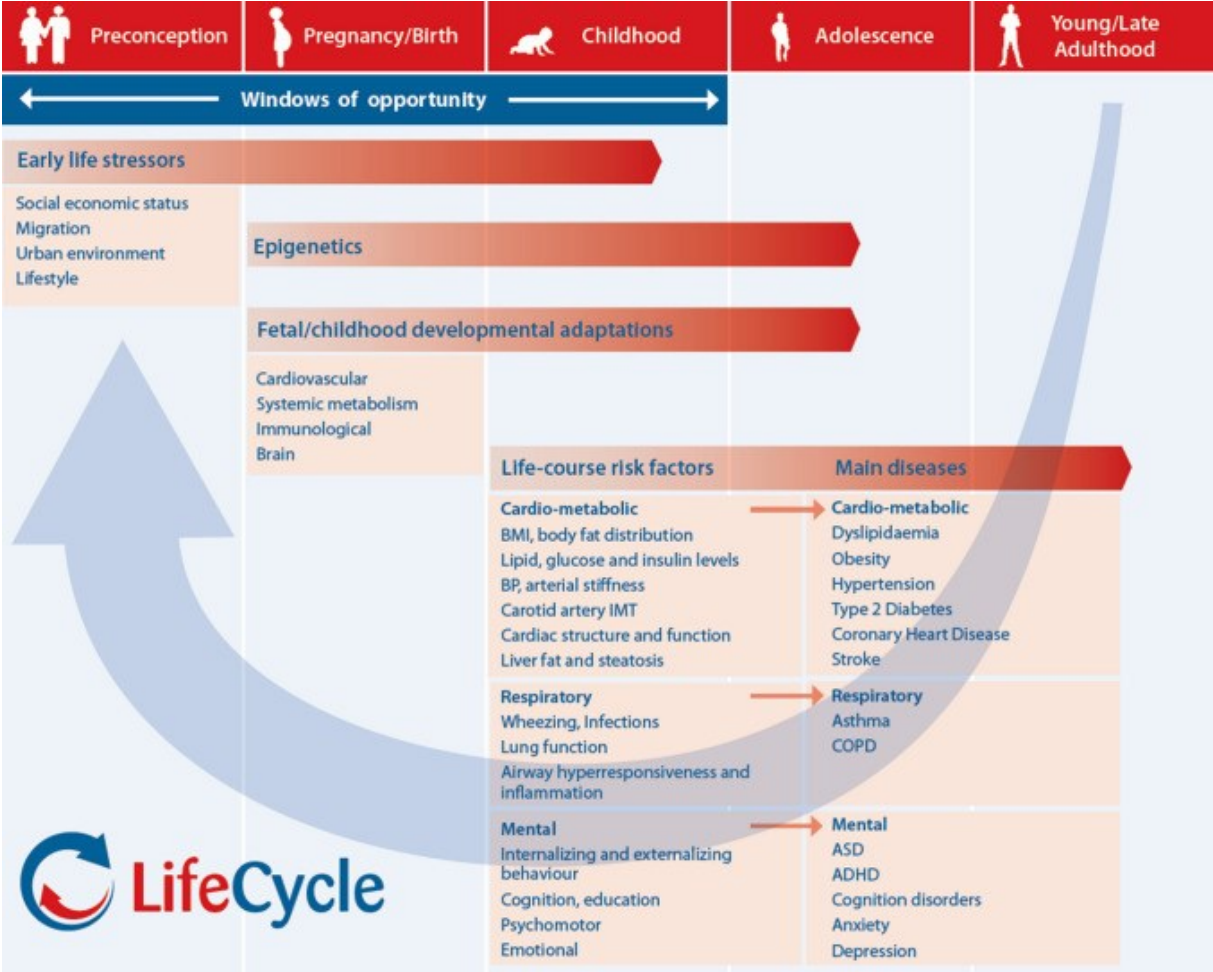
Figure 8: LifeCycle Project core cohorts that established the EU Child Cohort Network*, as published in the EU Child Cohort Network profile [28]



*ALSPAC: Avon Longitudinal Study of Parents and Children; ALSPAC G2: Second Generation of the Avon Longitudinal Study of Parents and Children; BIB: Born in Bradford; SWS: Southampton Women's Survey; EDEN: Étude des Déterminants pré- et postnatals du développement et de la santé de l'Enfant; ELFE: Étude Longitudinale Française depuis l'Enfance; INMA: Infancia y Medio Ambiente (Environment and Childhood); MoBa: Norwegian Mother, Father and Child Cohort Study; NFBC1966: Northern Finland Birth Cohort 1966; NFBC1986: Northern Finland Birth Cohort 1986; HBCS: Helsinki Birth Cohort Study; DNBC: Danish National Birth Cohort; GECKO: Groningen Expert Center for Kids with Obesity; Generation R: Generation R Study; Generation R Next: Next Generation of the Generation R Study; CHOP: Childhood Obesity Project; NINFEA: Nascita e Infanzia: gli Effetti dell'Ambiente (Birth and Childhood: Environmental Effects); RHEA: Mother-Child Cohort in Crete; RAINE: Western Australian Pregnancy Cohort (Raine) Study

Data across these cohorts have been harmonized and standardized. Data were harmonized by selecting a set of variables in each cohort necessary to perform multi-cohort analyses on different research questions. The variables were selected in order to study early life stressors, epigenetics, fetal/child development adaptations, life-course risk factors, and main diseases (both physical and mental) (**Figure 9**).

Figure 9: Main concepts of the LifeCycle Project and related data in the EU Child Cohort Network, as published in the EU Child Cohort Network cohort profile [28]



The harmonization work was performed by a data-harmonization group with representatives from each partner or cohort. Detailed information on how each variable was harmonized can be found on their website [96]. The purpose of the EUCCN is to allow researchers to explore early-life stressors that can impact children's cardio-metabolic, respiratory and mental health trajectories throughout their life course and find early life interventions that can prevent poor health outcomes, reduce human suffering, and reduce health expenditures across Europe [97].

The LifeCycle project received funding from the European Union's Horizon 2020 research and innovation programme (Grant Agreement No. 733206 LifeCycle).

For our study, five cohorts were selected from the EU Child Cohort Network to participate: ELFE, ALSPAC, GenR, DNBC, INMA, and EDEN

2.1.3 The Avon Longitudinal Study of Parents and Children (ALSPAC)

The Avon Longitudinal Study of Parents and Children (ALSPAC), also known as the "Children of the 90s", was formed to study the modifiable influences that exist on children's health and development [29,98]. Mothers from three health districts in south England whose estimated delivery took place between April 1st 1991 to December 31st 1992 were recruited for the study. ALSPAC used media information as well as antenatal and maternity health services to promote the study and distribute "expression of interest" forms to mothers. Furthermore, a follow-up assessment to recruit more mothers seven and eight to 18 years after the study formation who fit the original eligibility criteria also took place. The total eligible sample consists of 20 248 eligible pregnancies, with 14 541 mothers being enrolled during the first wave. During the seven year and eight-to-18-year recruitment phase, a further 456 and 257 children were recruited, respectively. A total of 14 062 live-born children of whom 13 988 were

alive at one year of age. Assessments were administered frequently, with 68 data collection time points from child's birth up to 18 years of age. A total of 34 child-completed questionnaires (CCQs, 25 including multiple domains and nine focusing on pubertal development), nine 'focus' clinical assessments and 25 questionnaires completed by the mother or other main caregiver about the child were performed.

Loss to follow-up due to permanent attrition reduced the sample size for each follow-up wave, resulting in 11 875 eligible participants after the 18-year follow-up [29].

The UK Medical Research Council (MRC), the Wellcome Trust and the University of Bristol currently provide core funding support for ALSPAC (WT092731).

2.1.4 The Generation R study

The Generation R Study (GenR) is a prospective population-based birth cohort study based in Rotterdam, The Netherlands that aims to understand the growth, development and health of children from early fetal life until young adulthood [30–34]. Mothers with an expected delivery date between April 2002 and January 2006 living in Rotterdam were eligible for participation and contacted through their midwife or obstetrician. Inclusion criteria included: Mothers who were legal residents of the Netherlands, with less than 24 weeks gestational age, expected to be a resident of Rotterdam at the date of delivery, gave birth between June 2002 and July 2004, provided informed consent (mother or father), and had the fetal growth measured at least twice by ultrasounds [34].

A total of 9778 mothers who gave birth to 9749 children were enrolled into the study, and a total of 6347 fathers were also included in the study. Questionnaires were provided to mothers during early pregnancy (gestational age < 18 weeks), mid

pregnancy (gestational age 18-25 weeks), late pregnancy (gestational age > 25 weeks), and fathers received one questionnaire during mother's pregnancy. Post-birth, maternal questionnaires were distributed at two months, three months, six months, 12 months, 18 months, 24 months, 30 months, 36 months, 48 months, six years, 10 years, and 13 years, with one being specifically for the father. Children are currently being followed up for the 16–17-year age range. Currently, less than 10% of data has been due to loss to follow-up.

The GenR study is funded by Erasmus Medical Centre, Rotterdam, Erasmus University Rotterdam, Dutch Diabetic Research Foundation, Dutch National Epilepsy Fund, Netherlands Asthma Foundation, Netherlands Organization for Health Research and Development (Zon Mw), Sint Laurensinstituut, Sophia Foundation for Medical Research, Stichting Bevordering Volkskracht, Stichting K.F. Heinfonds, Stichting Physico, Unilever Health institute, Vereniging Trustfonds Erasmus Universiteit.

2.1.5 The Danish National Birth Cohort (DNBC)

The Danish National Birth Cohort (DNBC) is a prospective, national birth cohort formed in Denmark with the purpose of investigating the causal relationships between exposures in early life, disease later in life, and possibilities of disease prevention [35,99]. A total of 3500 general practitioners in Denmark were contacted between 1996 and 2003 to invite women attending their first pregnancy visit (between 6-12 gestational weeks) to the DNBC cohort study. Inclusion criteria included 1. The mother being pregnant and planning to carry the pregnancy to full term 2. Speaking Danish. Mothers responded to telephone interviews at 12 and 30 gestational weeks as well as when the child was six and 18 months old. Further questionnaires were sent out when

the child was seven, 11, and 18 years old. A total of 101 042 women were enrolled to the DNBC cohort, with response rates ranging from 92% to 47% across data waves [100].

The DNBC cohort is funded by the Danish National Research Foundation. Additional support was obtained from the Danish Regional Committees, the Pharmacy Foundation, the Egmont Foundation, the March of Dimes Birth Defects Foundation, the Health Foundation and other minor grants. The DNBC Biobank has been supported by the Novo Nordisk Foundation and the Lundbeck Foundation. Follow-up of mothers and children have been supported by the Danish Medical Research Council (SSVF 0646, 271-08-0839/06-066023, O602-01042B, 0602-02738B), the Lundbeck Foundation (195/04, R100-A9193), The Innovation Fund Denmark (0603-00294B (09-067124)), the Nordea Foundation (02-2013-2014), Aarhus Ideas (AU R9-A959-13-S804), University of Copenhagen Strategic Grant (IFSV 2012) and the Danish Council for Independent Research (DFF – 4183-00594).

2.1.6 INMA cohort

The Environment and Childhood project (INfancia y Medio Ambiente in Spanish) (INMA) is a network of birth cohorts across Spain with the aim to study how different environmental pollutants during pregnancy and early childhood impact children's growth and development [36]. A total of four birth cohorts across Spain make up the INMA project: Valencia (n=855), Sabadell (n=657), Asturias (n=494) and Gipuzkoa (n=638) cohorts. Inclusion criteria included: 1. Pregnant women residing in each of the study areas featured in **Figure 11** 2. Being at least 16 years old 3. Having singleton pregnancy 4. Not using any assisted reproduction program 5. Delivering in the reference hospital listed 6. Having no communication problems.

Figure 10: Geographical location of INMA cohorts in Spain, as published in the INMA cohort profile [36]



The recruitment period differed by region: in the Ribera d'Ebre cohort, pregnant mothers were recruited between March 1997 and December 1999; in the Granada cohort between October 2000 and July 2002, in the Menorca cohort, from mid-1997 to mid-1998; in the Sabadell cohort, between July 2004 to July 2006; in the Asturias cohort, between May 2004 to July 2007; in the Valencia cohort, from November 2003

to June 2005; and for the Gipuzkoa cohort, between April 2006 to January 2008. For follow-up, each cohort had different assessment points. In Ribera d’Ebre, the follow-up examinations took place at birth and at eight weeks, eight months and one and four years. In Granada, the surveys were performed at birth and at four years. In Menorca, the follow-up started during pregnancy, and surveys were carried out at birth, at 3 months and at the ages of one, two, three, four, six, 9.5 and 10.5 years. Follow-up surveys of 9.5-year-olds in Granada and of 12- to 13-year-olds in Ribera d’Ebre and Menorca also took place. For Sabadell and Asturias, the recruitment survey in the first trimester of pregnancy was followed by surveys during the third trimester, at birth, at six months, at 1–1.5 years, at 2–2.5 years (except for Asturias) and at 4–5 years.

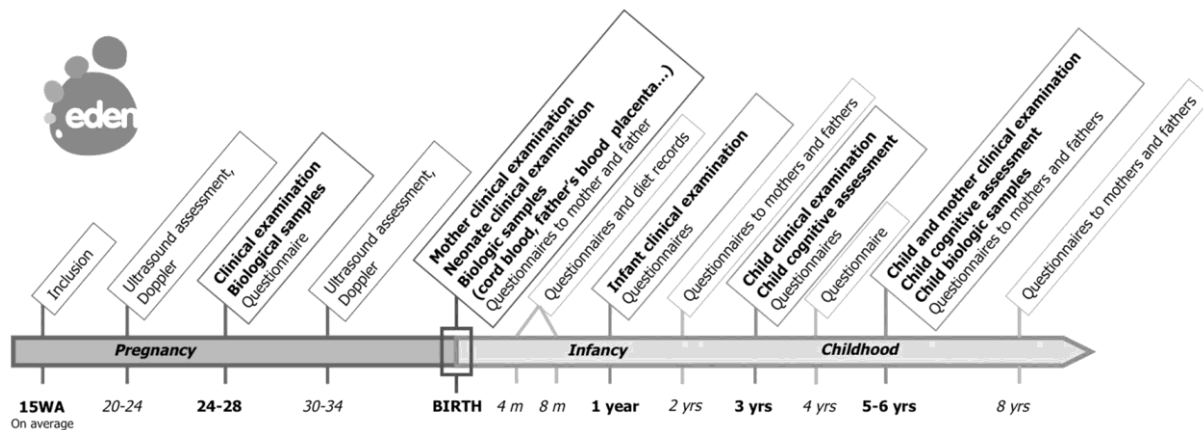
A total of 3768 newborns at birth were included in the study. A total of 331 children were lost to follow up at the 1-1.5-year mark.

The INMA project has been supported by the Instituto de Salud Carlos III, Red de Centros de investigación en Epidemiología y Salud Pública (RCESP) and CIBER Epidemiología y Salud Pública (CIBERESP), and in part by the Fondo de Investigación Sanitaria, the European Union’s sixth and seventh Framework Programmes (Hiwate, Escape, Hitea and Contamed projects), the Ministerio de Educación y Ciencia, the Generalitat de Catalunya, the Centre for Research in Environmental Epidemiology (CREAL) of Barcelona, the Fundació La Caixa, the Fundació Roger Torné, the Consejería de Salud de Andalucía, the Junta de Andalucía, the Conselleria de Sanitat de la Generalitat Valenciana, the CAJASTUR—Caja Asturias, the Spanish Association against the Cancer (AECC) (Delegación Provincial Asturias), the Departamento de Sanidad-Gobierno Vasco, the Diputación Floral de Gipuzkoa, the University of Oviedo, the KUTXA – Caja Gipuzkoa San Sebastián and the city councils of Zumarraga, Urretxu, Legazpi, Azpeitia, Beasain and Azkoitia in Gipuzkoa

2.1.7 EDEN cohort

The French general cohort study of early pre- and post-natal determinants of psychomotor development and child health (Étude de cohorte généraliste menée en France sur les Déterminants pré- et postnatals précoces du développement psychomoteur et de la santé de l'Enfant in French) (EDEN) recruited mothers from 2003 to 2006 in two maternity clinics located in Nancy and Poitiers, France [37]. As the name of the cohort suggests, the EDEN cohort was formed to better understand prenatal and postnatal factors that can impact later health in children. Women who visited the maternity clinic before their 24th week of amenorrhea were solicited. Women were not included if they had multiple pregnancies, had diabetes prior to pregnancy, French illiterate or planning to leave the region in the next three years. A total of 2002 women were enrolled in the study (1034 from Nancy and 968 from Poitiers). Follow up took place over the course of eight years with questionnaires delivered to the mother and/or father at birth, between four to eight months post-birth, one year, two years, three years, four years, between five to six years, and eight years (**Figure 12**).

Figure 11: Assessments and data collection -from mothers included during pregnancy to children eight years after birth. The EDEN Study, as published in the EDEN cohort profile [37]



As for attrition, only 95 women withdrew from the study during pregnancy and 1899 (66%) children were included from birth until five to six years.

Funding for the EDEN study includes: Foundation for Medical Research (FRM), National Agency for Research (ANR), National Institute for Research in Public Health (IRESP: TGIR cohorte santé 2008 program), French Ministry of Health (DGS), French Ministry of Research, Inserm Bone and Joint Diseases National Research (PRO-A) and Human Nutrition National Research Programs, Paris–Sud University, Nestlé, French National Institute for Population Health Surveillance (InVS), French National Institute for Health Education (INPES), the European Union FP7 programmes (FP7/2007-2013, HELIX, ESCAPE, ENRIECO, Medall projects), Diabetes National Research Program (through a collaboration with the French Association of Diabetic Patients (AFD)), French Agency for Environmental Health Safety (now ANSES), Mutuelle Générale de l'Education Nationale (MGEN), French National Agency for Food Security, and the French-speaking association for the study of diabetes and metabolism (ALFEDIAM). Funders had no influence of any kind on analyses or result interpretation.

2.2 Measures

2.2.1 Exposures

Paid paternity leave

In the first article of the thesis, mothers were asked if the father had taken the paid, two-week paternity leave allotted during the two-month ELFE questionnaire. The variable was then categorized: “yes, took paternity leave”, “yes, intention to take paternity leave”, “no”.

Early childcare attendance type

In the second article of the thesis, parents were asked about the type of early childcare arrangement the child received prior to primary school entry. In the second article, each cohort asked parents at different time points from age zero up to age four years if they attended some form of childcare, and if yes, what kind. The types of childcare were divided into three categories: exclusive parental care (the reference group), centre-based childcare, and informal childcare (a childcare professional, relatives/friends/nanny/babysitter/au pair and/or someone other than the parents). If the parent answered that the child attended centre-based childcare, this response was taken as priority. If the parent answered that the child attended informal childcare and no other form of childcare, they were placed in this group.

2.2.2 Outcomes

Maternal and paternal postpartum depression at 2 months

For the first article of the thesis, postpartum depression at two months was assessed using the widely-used Edinburgh Postnatal Depression Scale (EPDS) for mothers and

fathers [38,39]. The EPDS scale is a 10 item self-report scale that measures participants feelings over the past seven days. The answers to each question are rated using a Likert scale: 0= not true, 1= somewhat or sometimes true, 2= very true or often true, and the total sum score is out of 30 [38]. The EPDS scale has been validated for the French population [101]. Though there is no official standard cut-off for identifying postpartum depression in mothers and fathers, validity studies have found that mothers who score above 11 and fathers who score above a 10 is a good sign of having postpartum depression [39,102]. The variable was therefore dichotomized as follows:

- Mothers have signs of postpartum depression [yes/no] (yes meaning an EPDS scale above 11 out of 30)
- Fathers have signs of postpartum depression [yes/no] (yes meaning an EPDS scale above 10 out of 30)

Children's internalizing and externalizing symptoms

For the second article of the thesis, children's internalizing and externalizing symptoms were measured at different time points across childhood. Mothers self-reported children's internalizing and externalizing symptoms using either the Child Behaviour Checklist (CBCL) or the Strengths and Difficulties Questionnaire (SDQ) [40,41]. In the ALSPAC and GENR cohorts, the CBCL was used to measure internalizing and externalizing symptoms between ages 5-6 years, 7-9 years, and 10-13 years. In the DNBC, EDEN, and ELFE cohort the SDQ was used to measure internalizing and externalizing symptoms. The INMA cohort used the CBCL to measure internalizing and externalizing symptoms between 7-9 years and the SDQ between 10-13 years. The DNBC and INMA cohort measured internalizing and

externalizing symptoms between 7-9 and 10-13 years, the EDEN cohort between 5-6 and 7-9 years, and the ELFE cohort between 5-6 years.

The CBCL consists of 113 questions and contains three primary scales (total problems, externalizing symptoms, internalizing symptoms) and eight syndrome subscales (anxious/depressed, withdrawn/depressed, somatic complaints, social problems, thought problems, attention problems, rule-breaking behavior, and aggressive behavior) which measure children's behavioral and emotional problems [103,104]. A three-point Likert scale (0=absent, 1= occurs sometimes, 2=occurs often) is used to score responses.

The SDQ consists of 24 items and five scales (emotional symptoms, conduct problems, hyperactivity-inattention, peer problems, prosocial behavior) to measure children's behavioral and emotional problems [105]. Internalizing symptoms are measured by combining the emotional and peer problems subscales, and externalizing symptoms are measured by combining the conduct problems and hyperactivity-inattention subscales [41]. The SDQ also uses a three-point Likert scale (0=absent, 1= occurs sometimes, 2=occurs often) to score responses [106].

The internalizing and externalizing symptoms were formed as a harmonized percentile score from 0 to 100 in order to take into account the different scales used across cohorts. The internalizing and externalizing percentiles represent "the percentile where each individual is in relation to his/her group (cohort and age specific) using [the CBCL or SDQ] instrument" [42]. To address missingness in the internalizing and externalizing scales, if 25% of the questions addressing internalizing or externalizing symptoms were not answered, they were labelled as missing [42]. If less than 25% of the questions were missing, the pro-rated score was calculated:

$$T_P = \frac{T_R}{N_R} * N_T \quad \text{if } \frac{N_R}{N_T} \geq 0.75$$

Where:

T_P = prorated total scale score

T_R = total raw score based on completed items

N_R = number of items which have been responded to

N_T = the total number of items in the scale

Note that $\frac{T_R}{N_R}$ is the average score.

2.2.3 Covariates

For the first article of the thesis, propensity scores were calculated in order to balance out the exposure groups of interest. In the propensity score model, many maternal, paternal, child, and family and household characteristics were included in the model:

2.2.3.1 Maternal characteristics in the ELFE cohort

In the two month ELFE questionnaire [107], mothers and fathers self-reported:

- Maternal age (in years) at the time of the child's birth
- Maternal citizenship status (French or other)
- Maternal relationship status (married or civil union [yes/no])
- Maternal highest education level obtained (no diploma, below bachelor's degree, associate's degree, bachelor's degree, master's degree or higher)
- Maternal occupational grade (low, medium, high): categories are created by the national institute of statistics and economic studies (National Institute of statistics and economic studies/Institut national de la statistique et des études économiques in French (INSEE)) based on a person's socio-professional status [108]

- Maternal type of work contract (student, permanent contract, temporary contract, independent worker, other salaried worker, not working)
- Maternal employment sector (not working [student or retired], independent worker, private sector, public sector)
- Mother employed during pregnancy (yes/no)
- Mother's first pregnancy (yes/no)
- Mother desired to have a child (yes, no, hesitated or did not know)
- Psychological difficulties during pregnancy (yes/no)
- Depression during a previous pregnancy (yes/no)
- Has a chronic illness other than diabetes or hypertension (yes/no)

2.2.3.2 Paternal characteristics in the ELFE cohort

- Paternal age (in years) at the time of the child's birth
- Paternal citizenship status (French or other)
- Paternal highest education level obtained (no diploma, below bachelor's degree, associate's degree, bachelor's degree, master's degree or higher)
- Paternal occupational grade (low, medium, high): categories are created by the national institute of statistics and economic studies (INSEE) based on a person's socio-professional status [108]
- Paternal type of work contract (student, permanent contract, temporary contract, independent worker, other salaried worker, not working)
- Paternal employment sector (not working [student or retired], independent worker, private sector, public sector)
- Attended child's birth (yes/no)
- Father desired to have a child (yes, no, hesitated or did not know)

2.2.3.3 Child characteristics in the ELFE cohort

- Child's sex (male/female)
- Child's birth season (spring, summer, autumn, winter)
- Child's number of siblings (only child, 1-2 siblings, 2 or more siblings)
- Child's feeding practices at two months (breastfed exclusively, breastfed and baby formula fed, baby formula fed exclusively)
- Gestational week of birth
- Activity Pulse Grimace Appearance Respiration (APGAR) score at five minutes: a scoring system created by Dr. Virginia Apgar in 1952 to score newborns first moments of life and help understand their condition immediately after birth [109]. Each element is scored either 0,1 or 2 and a score between 7 to 10 is often a good sign of children's response
- Hospitalized for health complications (yes/no)

2.2.3.4 Family and household characteristics in the ELFE cohort

- Region of residence (Paris and suburban region, central France, northern France, eastern France, western France, southwestern France, central east France, south France)
- Number of individuals in the household
- Monthly household income
- Parent conflict before, during, and after pregnancy (never or rarely, sometimes, frequently)

For the second article of the thesis, maternal and child characteristics that confounded the relationship between type of early childcare and internalizing and externalizing symptoms were included in the adjusted models:

2.2.3.5 Maternal characteristics from the EU Child Cohort Network

Maternal characteristics were assessed at the child's birth or in the first 12 months postpartum:

- Maternal age in years at child's birth
- Mother's highest education level: divided into *high (short cycle tertiary, bachelor, masters, doctoral or equivalent)*, *intermediate (upper secondary, post-secondary non-tertiary)* or *low (no education, early childhood, pre-primary, primary, lower secondary or second stage of basic education)*, based on the International Standard Classification of Education 97/2011 (ISCED-97/2011)[110]
- Mother's employment status (employed, unemployed, other (student, apprentice, domestic tasks, inactive/receiving benefits, etc.))
- Parental separation: did the parents split up during the first-year post-birth (yes/no)
- Maternal postpartum depression within the first-year post-birth (yes/no)
- Mother's first child (yes/no)

2.2.3.6 Child Characteristics from the EU Child Cohort Network

Children's characteristics were collected at birth:

- Child's sex (male/female)
- Child's birth weight (in grams)
- Child's gestational age (in weeks)

2.3 Statistical Analyses

2.3.1 Missing data

For the first and second article of the thesis, missing data were handled using multiple imputation with fully conditional specification (FCS), also known as the multivariate imputation by chained equations (MICE) [43,44]. FCS works by addressing each variable with missing data one at a time and creates a multivariate imputation model for that variable based on the set of observed and imputed values from the other variables in the data. In our three articles, a total of five iterations were produced for each imputed data set. In the first article of the thesis, a total of 4.2% and 2.3% of data were missing for the mother's postpartum depression and father's postpartum depression sample, respectively. A total of 14 imputed datasets were generated after using Von Hippel's two stage procedure to determine the optimal number of imputed datasets to calculate for this study [111]. For the second article of the thesis, around 3.7% of total information was missing on covariates, and a total of 10 imputed datasets were generated, based on previous recommendations.

2.3.2 Propensity scores

For the first article of the thesis, propensity scores were generated using generalized boosting models (GBM) [45,46]. A propensity score can be defined as a participant's probability (ranging from 0 to 1) of being placed in the exposure group they are in given various "pre-exposure" characteristics (the confounding factors) [112]. In the first article of the thesis, we have multiple confounding factors that can contribute to why a participant is in the exposure group that they are in, so a propensity score is simply the sum of all the probabilities of being in a certain exposure group based on these

confounding factors. Each participant is assigned one propensity score based on their specific confounding factors. There are many advantages to using propensity scores over alternative methods for adjusting confounding in research. First, because the propensity score consolidates all the confounding factors into a single metric, it reduces risk of saturation that can occur from including too many confounding factors in your model [45]. Propensity score models also do not run the risk of extrapolating beyond the observed data which can occur in parametric regression models whenever the exposure and control groups have significant differences on the confounding factors [45].

In the first article of the thesis, a GBM, which is a type of machine learning technique, was used to generate propensity scores [45]. The GBM approach uses multiple regression trees to capture the complex and nonlinear relationships that can exist between the exposure and confounding factors without over-fitting the data [45,113]. To do this, the GBM uses a “forward stagewise additive algorithm” (which means the model is built step by step) which first fits a simple regression tree to the data to predict the exposure group assignment from the covariates [45,113]. Then, with each additional step of the algorithm, a new simple regression tree is added to the model from the previous iterations without changing any of the previous regression tree fits [45,113]. The new tree is considered to be the best fit to the residuals (the errors) of the model from the previous iteration and also provides the greatest increase in the log likelihood for the data [45,113]. An optimal number of iterations (based on the optimal amount to achieve the best balance between exposure groups) are selected, and with each iteration, the GBM model becomes more complex and fits more features of the data [113]. The GBM approach has also been shown to outperform traditional methods

of propensity score generation such as logistic regression models for generating propensity scores [114].

2.3.3 Inverse probability weighted logistic regression models

In the first article of the thesis, the propensity scores were then inverted ($1/\text{propensity score}$ (probability of being in a certain exposure group)) to generate the inverse probability weights (IPW), and this value was multiplied by the survey weights generated in the ELFE cohort study to make the cohort representative of the French population in 2011 [115–117]. This allowed the study to be representative of all eligible fathers of paid paternity leave in 2011. Then, IPW logistic regression models were executed, and the Odds Ratios (ORs) with their accompanying 95% Confidence Intervals (CI) were provided.

2.3.4 Two stage individual participant (IPD) meta-analysis

For the second article of the thesis, a two-stage individual participant data (IPD) meta-analysis was performed. In the two stage IPD meta-analysis, you first run the model on each cohort separately, collect the estimates and standard errors, and then, in the second stage, combine the results to have an overall measure [118]. Each cohort included in the meta-analysis is assigned a “weight (%)” which represents how much the study contributes to the overall estimate based on the cohort’s sample size, standard error of the mean, and observed variance [119]. In our study, we performed adjusted linear regressions on each cohort separately, collected the beta coefficients and standard errors, and then combined the results using random-effects meta-analysis with a restricted estimate maximum likelihood (REML) to obtain overall results [120]. A random effects meta-analysis differs from a fixed-effect meta-analysis

in that it assumes that the observed estimates can vary across cohorts due to the real differences in how the exposure impacts that outcome as well as due to chance (sampling variability) [121]. A random effects meta-analysis takes into account the variability that can occur both within cohorts and across cohorts and is particularly useful when there is suspected heterogeneity due to different study contexts or conditions [121].

2.3.5 Statistical tools used

In the first article of the thesis, R software 4.0.5 and SAS software 9.4 were used for data management and data analysis [122,123]. The MICE package was used to generate imputed datasets, and The Toolkit for Weighting and Analysis of Nonequivalent Groups (TWANG) package was used to generate propensity scores [43,113]. The MIANALYSE function in SAS was then used to combine the IPW logistic regression results [124]. Coding scripts on propensity score generation for the first article can be found through this link: <https://github.com/katybarry/Paternity-leave-use-and-postpartum-depression>

In the second article of this thesis, All statistical analyses were performed using DataSHIELD (packages: dsBase version 6.3.0; dsHelper version 1.4), which is a tool for federated analyses of individual-level data [125,126]. Coding scripts for the second article can be found through this link: <https://github.com/katybarry/nonparental-care-attendance-and-childrens-behaviors>

3. Articles

3.1 Article 1: Paternity leave uptake and parental postpartum depression: findings from the ELFE cohort study

I will now present the results of the relationship between a two-week paid paternity leave uptake and mother's and father's postpartum depression at two months. The results stem from the following publication:

Barry, K. M., Gomajee, R., Benarous, X., Dufourg, M. N., Courtin, E., & Melchior, M. (2023). Paternity leave uptake and parental postpartum depression: findings from the ELFE cohort study. *The Lancet. Public health*, 8(1), e15–e27. [https://doi.org/10.1016/S2468-2667\(22\)00288-2](https://doi.org/10.1016/S2468-2667(22)00288-2)

3.1.1 Summary of article 1

In Europe, the average length of paid paternity leave is two weeks. Paternity leave uptake has been associated with more father involvement in child rearing, household tasks, and relationship satisfaction between the mother and father. Prior to this study, little to no evidence explored the relationship between paternity leave uptake and parental postpartum depression. Parental postpartum depression can have negative consequences for children's development as well as the long-term psychical and mental well-being of the mother and father. In order to address this gap in research, the present study explores the relationship between paternity leave, divided into three groups: no paternity leave uptake, intended paternity leave uptake, and used paternity leave, and mothers' and fathers' postpartum depression (dichotomized (yes/no) using the EPDS at two months). Data originate from the ELFE cohort study, a French,

nationally-representative birth cohort study formed in 2011. A total of 18 040 mothers were included in the ELFE cohort study. Children of parents who received longer paternity leave due to having twins (n=366) were excluded as well as fathers not living with the mother (n=2854) or not eligible for paternity leave (n=1583). A total of 13 075 mothers provided information on maternal postpartum depression and a total of 10 975 father's provided information on paternal postpartum depression. Multiple imputation was used to address missing data on covariates (4.2% missing for mothers and 2.3% missing for fathers). Propensity scores of paternity leave uptake, which included various parental, child and household characteristics) were generated using generalized boosted models. The propensity scores were then multiplied by the study survey weights to generalize the results for families in which the father was eligible for paternity leave. Weighted logistic regression models, providing Odds Ratios (OR) and 95% Confidence Intervals (CI), were performed to understand the association between paternity leave and father's and mother's postpartum depression.

For fathers, both those who intended to take paternity leave and those who took paternity leave had decreased odds of postpartum depression at two months, respectively: (OR 0.74 [95% CI: 0.70, 0.78]); (OR 0.76 [95% CI: 0.70, 0.82]). For mothers, if their partner took paternity leave, they had higher odds of postpartum depression at two months: OR 1.13 [95 CI%: 1.05, 1.20].

The results of this study highlight that the type of fathers who plan or take paternity leave may have certain characteristics which protect them from developing postpartum depression. Also, fathers who take paternity leave may be more involved in the family, may be able to establish a work-life balance, and may encourage them to take up healthier behaviors. For mothers, a two-week paternity leave may not be sufficient

enough for her to feel supported or that the timing of the paternity leave is not optimal for her to be protected against postpartum depression.

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

Katharine M Barry, Ramchandrar Gomajee, Xavier Benarous, Marie-Noëlle Dufourg, Emilie Courtin, Maria Melchior



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 2010⁶ 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

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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 be 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%.¹² 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’Enfance (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.^{22,16} 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).^{22,16} 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, fathers¹⁹ who scored above 10 and mothers²⁰ 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 grade²¹ (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 Statistics²³), number of individuals living in the household, household income, and parental conflict (assessed before, during, and after pregnancy [never or rarely, sometimes, or frequently]).

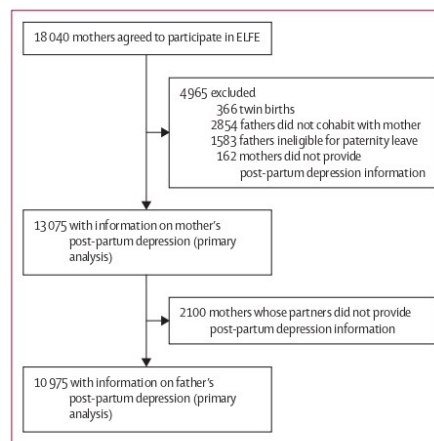


Figure 2: Study profile

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%)	8553 (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%)	3825 (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^{13,24} 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%)	5 185 (19.9%)	6 071 (23.2%)	<0.0001
Permanent contract	239 783 (67.4%)	62 265 (17.5%)	53 612 (15.1%)	..
Temporary contract	16 031 (66.3%)	3 249 (13.4%)	4 882 (20.2%)	..
Independent worker	2 934 (54.4%)	1 334 (24.8%)	1 121 (20.8%)	..
Other salaried work	13 205 (57.5%)	4 310 (18.8%)	5 432 (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%)	4 310 (18.8%)	5 432 (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	25 871 (63.4%)	68 222 (16.7%)	80 895 (19.8%)	<0.0001
Desire to have a child				
No	20 338 (58.2%)	5 861 (16.8%)	8 670 (24.9%)	<0.0001
Yes	359 741 (64.6%)	94 946 (17.1%)	101 803 (18.3%)	..
Hesitated or did not know	2 486 (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%)	8 490 (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%)	5 642 (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%)	4 117 (15.6%)	4 975 (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%)	5 863 (14.9%)	7 556 (19.2%)	..
Eastern France	32 656 (66.3%)	7 699 (15.6%)	8 926 (18.1%)	..
Western France	58 392 (68.7%)	14 230 (16.7%)	12 316 (14.5%)	..
Southwestern France	31 616 (64.2%)	9 375 (19.0%)	8 283 (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%)	2 497 (14.9%)	4 172 (25.6%)	..

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

See Online for appendix

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.

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 complete 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),³⁶ 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%)	3 790 (14.6%)	7 247 (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	4 751 (51.0%)	1 818 (19.4%)	2 784 (29.8%)	<0.0001
Permanent contract	269 748 (74.1%)	65 804 (18.1%)	28 601 (7.8%)	..
Temporary contract	13 764 (56.2%)	3 903 (15.9%)	6 818 (27.8%)	..
Independent worker	8 185 (51.1%)	2 722 (17.0%)	5 099 (31.9%)	..
Other salaried work	15 447 (35.5%)	5 099 (15.7%)	21 181 (48.7%)	..
Not working	7 834 (31.1%)	3 222 (12.8%)	14 154 (56.1%)	..
Employment sector				
Not working (eg, student or retired)	12 585 (36.2%)	5 040 (14.6%)	16 939 (49.0%)	<0.0001
Independent worker	15 447 (35.5%)	6 829 (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%)	8 154 (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%)	3 190 (15.2%)	4 502 (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%)	4 631 (18.6%)	4 421 (17.7%)	..
Post-partum depression at 2 months	14 114 (56.6%)	4 127 (16.6%)	6 683 (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%)	2 573 (12.3%)	5 531 (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%)	54132 (17.9%)	39997 (13.2%)	..
Temporary contract	12437 (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	72616 (62.1%)	18500 (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%)	15679 (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%)	4 810 (15.1%)	5 906 (18.6%)	..
Eastern France	27 445 (67.4%)	6 737 (16.5%)	6 537 (16.1%)	..
Western France	50 034 (69.6%)	12 402 (17.3%)	9 400 (13.1%)	..
Southwestern France	27 385 (65.9%)	7 716 (18.6%)	6 436 (15.5%)	..
Central East France	38 560 (69.0%)	9 558 (17.1%)	7 796 (13.9%)	..
South France	37 241 (63.8%)	8 171 (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	8 380 (62.4%)	1 936 (14.4%)	3 118 (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

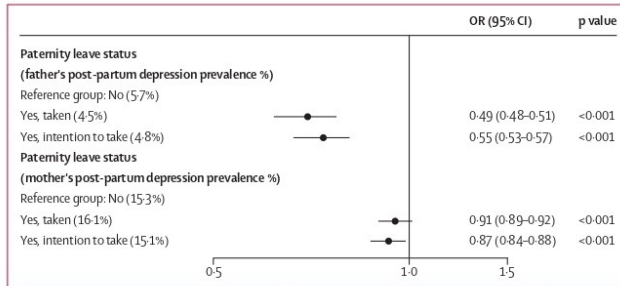


Figure 2: Association between paternity leave uptake and father's (n=10975) and mother's (n=13 075) post-partum depression at 2 months
 Figure shows inverse probability weighted-logistic regression models. Adjusted by father's age, father's nationality, father's educational level, father's occupational 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.

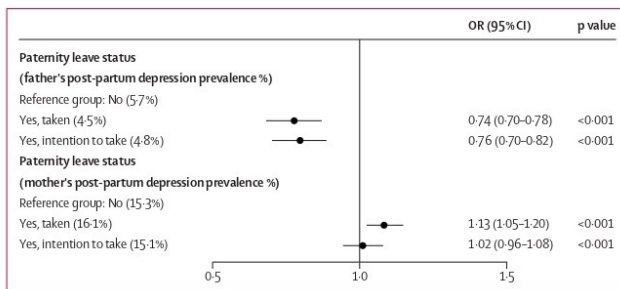


Figure 3: Association between paternity leave uptake and father's (n=10975) and mother's (n=13 075) post-partum depression at 2 months
 Figure shows crude logistic regression models.

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 dynamics² 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 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 fathers³⁰ but also reduce the odds of the child having conduct and emotional disorders, hyperactivity, anxiety and depression, or language delays

Please note, the titles for Figure 2 and Figure 3 have been incorrectly switched.

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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References

- EUR-Lex. Directive (EU) 2019/1158 of the European Parliament and of the Council of 20 June 2019 on work-life balance for parents and carers and repealing Council Directive 2010/18/EU. June, 2019. <http://data.europa.eu/eli/dir/2019/1158/oj/eng> (accessed Jan 28, 2022).
- Palih A, Solaz A, Tô M. Can daddies learn how to change nappies? Evidence from a short paternity leave policy. <https://www.ined.fr/en/publications/editions/document-travail/can-daddies-learn-how-to-change-nappies/> (accessed Feb 2, 2022).
- World Bank. Parenthood: Examining laws affecting women's work after having children. 2021. https://wbl.worldbank.org/en/data/explortopics/wbl_hc?msckid=623cfc16aed11caefc4f4871b56765 (accessed Jan 15, 2022).
- Galovan AM, Holmes EK, Schramm DG, Lee TR. Father involvement, father-child relationship quality, and satisfaction with family work: actor and partner influences on marital quality. *J Fam Issues* 2014; **35**: 1846–67.
- Séjourné N, Vaslot V, Beaumé M, Goutaudier N, Chabrol H. The impact of paternity leave and paternal involvement in child care on maternal postpartum depression. *J Reprod Infant Psychol* 2012; **30**: 135–44.
- Don BP, Mickelson KD. Paternal postpartum depression: the role of maternal postpartum depression, spousal support, and relationship satisfaction. *Couple Family Psychol* 2012; **1**: 323–34.
- Shorey S, Chee CYI, Ng ED, Chan YH, Tam WWS, Chong YS. Prevalence and incidence of postpartum depression among healthy mothers: a systematic review and meta-analysis. *J Psychiatr Res* 2018; **104**: 235–48.
- Paulson JF, Bazemore SD. Prenatal and postpartum depression in fathers and its association with maternal depression: a meta-analysis. *JAMA* 2010; **303**: 1961–69.
- Abdollahi F, Rezaei Abhari F, Zarghami M. Post-Partum depression effect on child health and development. *Acta Med Iran* 2017; **55**: 109–14.
- Gagliardi L, Petrozzi A, Rusconi F. Symptoms of maternal depression immediately after delivery predict unsuccessful breast feeding. *Arch Dis Child* 2012; **97**: 355–57.
- Bipartisan Policy Center. Paid family leave across OECD countries. <https://bipartisanpolicy.org/explainer/paid-family-leave-across-oecd-countries/> (accessed July 19, 2022).
- Charles MA, Thierry X, Lanoe J-L, et al. Cohort profile: the French national cohort of children (ELFE): birth to 5 years. *Int J Epidemiol* 2020; **49**: 368–69.
- France Ministry of Labour. Employment and integration, paternity and childcare leave. December, 2021. <https://travail-emploi.gouv.fr/droit-du-travail/les-absences-pour-maladie-et-conges-pour-evenements-familiaux/article/le-conge-de-paternite-et-d-accueil-de-lenfant> (accessed Dec 21, 2021).
- ELFE. Weighting: ELFE surveys general document. 2019. <https://www.elfe-france.fr/en/the-research/access-to-data-and-questionnaires/> (accessed Oct 6, 2022).
- ELFE. Weighting: Weighting inclusion. 2015. <https://www.elfe-france.fr/en/the-research/access-to-data-and-questionnaires/> (accessed Oct 6, 2022).
- Cox JL, Holden JM, Sagovsky R. Detection of postnatal depression. Development of the 10-item Edinburgh Postnatal Depression Scale. *Br J Psychiatry* 1987; **150**: 782–86.
- Edmondson OJ, Psychogiou L, Vlachos H, Netsi E, Ramchandani PG. Depression in fathers in the postnatal period: assessment of the Edinburgh Postnatal Depression Scale as a screening measure. *J Affect Disord* 2010; **125**: 365–68.
- Romano M, Cacciatore A, Giordano R, La Rosa B. Postpartum period: three distinct but continuous phases. *J Prenat Med* 2010; **4**: 22–25.
- Edmondson OJH, Psychogiou L, Vlachos H, Netsi E, Ramchandani PG. Depression in fathers in the postnatal period: assessment of the Edinburgh Postnatal Depression Scale as a screening measure. *J Affect Disord* 2010; **125**: 365–68.
- Levis B, Negeri Z, Sun Y, Benedetti A, Thombs BD, DEPRESSION Screening Data (DEPRESSD) EPDS group. Accuracy of the Edinburgh Postnatal Depression Scale (EPDS) for screening to detect major depression among pregnant and postpartum women: systematic review and meta-analysis of individual participant data. *BMJ* 2020; **371**: m4022.
- Insee. Professions and socio-professional categories PCS 2003. <https://www.insee.fr/fr/information/2400059> (accessed Feb 2, 2022).
- Simon LV, Hashmi MF, Bragg BN. Apgar score. In: StatPearls. Treasure Island, FL: StatPearls Publishing, 2021.
- Insee. Definition—region. <https://www.insee.fr/fr/metadonnees/definition/c1502> (accessed Nov 14, 2021).
- Von Hippel, P. T. How many imputations do you need? A two-stage calculation using a quadratic rule. *Sociol Methods Res* 2020; **49**: 699–718.
- McCaffrey DF, Griffin BA, Almirall D, Slaughter ME, Ramchand R, Burgette LF. A tutorial on propensity score estimation for multiple treatments using generalized boosted models. *Stat Med* 2013; **32**: 3388–414.
- Dong N, Stuart EA, Lenis D, Quynh Nguyen T. Using propensity score analysis of survey data to estimate population average treatment effects: a case study comparing different methods. *Eval Rev* 2020; **44**: 84–108.
- Dugoff EH, Schuler M, Stuart EA. Generalizing observational study results: applying propensity score methods to complex surveys. *Health Serv Res* 2014; **49**: 284–303.
- Nakamura A, Sutter-Dallay A-L, El-Khoury Lesueur F, et al. Informal and formal social support during pregnancy and joint maternal and paternal postnatal depression: data from the French representative ELFE cohort study. *Int J Soc Psychiatry* 2020; **66**: 431–41.
- Allport BS, Johnson S, Aqil A, et al. Promoting father involvement for child and family health. *Acad Pediatr* 2018; **18**: 746–53.
- Musser AK, Ahmed AH, Foli KJ, Coddington JA. Paternal postpartum depression: what health care providers should know. *J Pediatr Health Care* 2013; **27**: 479–85.
- Sarkadi A, Kristiansson R, Oberklaid F, Bremberg S. Fathers' involvement and children's developmental outcomes: a systematic review of longitudinal studies. *Acta Paediatr* 2008; **97**: 153–58.
- Rehel EM. When dad stays home too: paternity leave, gender, and parenting. *Gen Soc* 2014; **28**: 110–32.
- Bünning M. What Happens after the 'daddy months'? Fathers' involvement in paid work, childcare, and housework after taking parental leave in Germany. *Eur Sociol Rev* 2015; **31**: 738–48.
- Kim P, Swain JE. Sad dads: paternal postpartum depression. *Psychiatry* 2007; **4**: 35–47.
- Persson P, Rossin-Slater M. When dad can stay home: fathers' workplace flexibility and maternal health. Cambridge, MA: National Bureau of Economic Research, 2019.

-
- 36 Månsdotter A, Fredlund P, Hallqvist J, Magnusson C. Who takes paternity leave? A cohort study on prior social and health characteristics among fathers in Stockholm. *J Public Health Policy* 2010; **31**: 324–41.
- 37 Bullinger LR. The effect of paid family leave on infant and parental health in the United States. *J Health Econ* 2019; **66**: 101–16.
- 38 Moss P, Duvander A-Z, Koslowski A, eds. Parental leave and beyond: recent international developments, current issues and future directions, 1st edn. Bristol: Bristol University Press, 2019.
- 39 UUS Department of Labor. DOL policy brief: paternity leave: why parental leave for fathers is so important for working families. <https://digital.library.unt.edu/ark:/67531/metadc955354/> (accessed July 25, 2022).

3.2 Article 2: Early childcare arrangements and children's internalizing and externalizing symptoms: an individual participant data meta-analysis of six prospective birth cohorts in Europe

Now, I will present the results of the relationship between early childcare arrangements and children's internalizing and externalizing symptoms across early childhood and adolescence in six birth cohorts across five European countries. This article has been accepted and is currently being revised in *The Lancet Regional Health- Europe*

3.2.1 Summary of article 2

Early non-parental childcare, often defined as any care received outside of the parents and prior to primary school entry, can have many positive impacts on children's cognitive development depending on the quality provided. Children who attended centre-based childcare are often associated with greater school achievement and language acquisition compared to children exclusively cared for by their parents. For children's socio-emotional development, the research is quite mixed and often performed in North America. To address this limitation, our study aimed to explore the relationship between different types of childcare arrangements (centre-based childcare, informal childcare (nanny, relatives, day groups), exclusive parental care) on children's internalizing and externalizing behaviors from 5-6 years, 7-9 years, and 10-13 years in harmonized data which is part of the European Child Cohort Network: Britain (ALSPAC cohort), France (ELFE and EDEN cohorts), Denmark (DNBC cohort), The Netherlands (The GenerationR study), and Spain (INMA cohort). Mothers' postpartum depression one year following their child's birth, mothers' low education status, and child's sex were also tested for interactions. A total of 144 405 participants

were included in the cohorts. Participants who did not have measures between ages 4-13 years (n=39 064), did not have information on the exposure (n=14 088) nor information on the outcome (n=4 045) were excluded from the study. A total of 87 208 participants were included in the study. To address missingness on covariates, 10 multiply imputed datasets were generated. Adjusted linear regression models, adjusted by various maternal, child, and household characteristics, were performed separately for each cohort, and then, the coefficients and accompanying 95% confidence intervals (CI) were combined using random effects meta-analysis with a restricted estimate maximum likelihood.

Compared to children exclusively cared for by their parents, children who attended centre-based childcare prior to primary school had lower internalizing symptoms across all age groups: [5-6 years: β : -1.78 (95%CI: -3.39, -0.16) ;7-9 years: β : -0.55 (95%CI: -0.88, -0.73); 10-13 years: β : -0.76 (95%CI: -1.15, -0.37)]. For children who attended informal childcare, they were associated with higher internalizing symptoms between 7-9 years and 10-13 years, respectively: β :1.65 (95%CI: 1.25, 2.06); β :1.25 (95%CI: 0.96, 1.54). Children in informal childcare were also associated with higher externalizing symptoms between 7-9 and 10-13 years, respectively: [β :2.84 (95%CI: 1.41, 4.26); β : 2.19 (95%CI: 0.54, 3.84)]. For internalizing symptoms, mothers' low education status was found to be a positive interaction with centre-based childcare for children with internalizing symptoms between 5-6 years ($p<0.01$) and informal childcare for children with internalizing symptoms across all age groups ($p<0.001$). For externalizing symptoms at all age groups, we found significant positive interactions between mother's low education status (yes) and informal childcare ($p<0.001$). Lastly, informal childcare and child's sex (girls) showed a negative interaction with externalizing symptoms (10-13 years: $p=0.03$).

Children in high quality centre-based childcare may be protected from developing internalizing symptoms due to the professional-child interactions as well as the peer interactions with children their own age. By contrast, spending time in informal childcare may increase children's risk to externalizing symptoms as there may not be enough caretakers per child as well as differing ages of children within the same childcare setting that may lead to younger children trying to imitate bigger children and act in a more aggressive manner. Lastly, low maternal education modifies the effect of centre-based and informal childcare on children's internalizing and externalizing symptoms. Past research has found that children that come from a more favorable socioeconomic background are able to benefit more from early childcare whereas children from a disadvantaged background may be so far behind that they don't see much benefit from childcare.

The main takeaway from this study is that children attending a centre-based childcare prior to primary school are associated with lower internalizing symptoms, whereas children attending informal childcare were associated with higher levels of internalizing symptoms compared to exclusive parental care. Centre-based childcare may promote children's psychological development from 5-13 years of age.

Early childcare arrangements and children's internalizing and externalizing symptoms: an individual participant data meta-analysis of six prospective birth cohorts in Europe



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Summary

Background Early childcare attendance may be related to children's internalizing and externalizing symptoms throughout childhood and young adolescence, however evidence from Europe is limited. We aimed to assess this association across multiple population-based birth cohorts of children recruited in different European countries.

Methods Data come from six parent-offspring prospective birth cohort studies across five European countries within the EU Child Cohort Network. A total of 87,208 parent-child dyads were included in the study. To test associations between childcare attendance (centre-based or informal) anytime between ages 0 and 4 years and children's internalizing and externalizing symptoms in middle childhood and young adolescence (measured at: 5–6 years, 7–9 years, and 10–13 years) a two-stage individual participant data meta-analysis was implemented. Linear regression models were performed in each cohort separately; combined random-effects meta-analysis was then used to obtain overall association estimates. In secondary analyses, we tested interactions between childcare attendance and mother's post-partum depression, low education status, and the child's sex.

Findings Compared to children who were exclusively cared for by their parents prior to school entry, those who attended centre-based childcare had lower levels of internalizing symptoms in all age groups [5–6 years: β : -1.78 (95% CI: -3.39, -0.16); 7–9 years: β : -0.55 (95% CI: -0.88, -0.73); 10–13 years: β : -0.76 (95% CI: -1.15, -0.37)]. Children who attended informal childcare appeared to have elevated levels of internalizing symptoms between 7–9 and 10–13 years, respectively [β : 1.65 (95% CI: 1.25, 2.06); β : 1.25 (95% CI: 0.96, 1.54)]. Informal childcare attendance was also

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associated with increased levels of children's externalizing symptoms between 7–9 and 10–13 years, respectively [β : 2.84 (95% CI: 1.41, 4.26); β : 2.19 (95% CI: 0.54, 3.84)].

Interpretation Early centre-based childcare is associated with decreased levels of children's internalizing symptoms compared to exclusive parental care. For informal childcare, opposite associations were observed. Overall, our results suggest that centre-based childcare attendance may be associated with slight positive impacts on children's emotional development and should be encouraged by public policies. In addition, children from socioeconomically disadvantaged families require special attention, as they may not sufficiently benefit from universal early childhood education and care (ECEC).

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Keywords: Centre-based childcare; Informal childcare; Internalizing symptoms; Externalizing symptoms; Epidemiology; Child cohorts

Research in context

Evidence before this study

High quality, early non-parental childcare has been associated with children's improved cognitive and language abilities as well as positive peer interactions. However, most of the evidence comes from the United States and Canada and may not be broadly generalizable. Past studies vary in terms of definitions and timing of follow-up of children's psychological development. We searched PUBMED and Google scholar on April 28th, 2024 for articles related to early childcare and children's internalizing and externalizing behaviors across childhood using the following search terms: (((((((early childcare) OR (nonparental childcare)) OR (early childcare arrangement)) AND (internalizing)) OR (externalizing)) OR (internalising)) OR (externalising)) OR (behavior)) OR (emotional development). We found limited evidence from Australia, North America, Norway, and Switzerland, with only one longitudinal study from the United States. Some studies showed that high quality early childcare is linked to positive prosocial skills and lower levels of internalizing symptoms, while others found no relationship. Additionally, most studies did not differentiate between centre-based and other types of childcare, making it difficult to determine the impact of structured, professional settings on children's socio-emotional development.

Added value of this study

Using longitudinal data from six birth cohorts implemented in Britain, the Netherlands, Denmark, France, and Spain, we

examined the impact of attendance of centre-based or informal childcare on children's internalizing and externalizing symptoms from middle childhood to early adolescence (5–6 years, 7–9 years, 10–13 years). Children who attended early centre-based childcare between ages 0 and 4 years had lower levels of internalizing symptoms later on compared to those in exclusive parental care. Conversely, informal childcare attendance was associated with higher levels of internalizing and externalizing symptoms between ages 7–9 and 10–13 years. Internalizing and externalizing symptoms levels were higher among children whose mother had low educational levels and lower among girls. This study adds valuable information for Europe, as most research on early childcare and children's development. The six countries included in this study have national standards for center-based childcare, ensuring more homogenous definitions and quality of care than in previous investigations conducted in North America.

Implications of all the available evidence

To our knowledge, ours is the first individual participant meta-analysis to test the prospective relationship between early childcare arrangements and children's internalizing and externalizing symptoms in five European countries. Our results suggest that early centre-based childcare attendance may protect children from later internalizing difficulties. However, childcare attendance does not appear to compensate socioeconomic inequalities with regard to psychological development which appear early in life.

Introduction

In the European Union (EU) in 2020, approximately 53.4% of children under the age of three years were exclusively taken care of by their parents, 32.3% were in formal childcare for at least 1 h per week and 20.9% were cared for by grandparents, other relatives, or professional childminders.¹ Childcare, defined as any care a

child receives outside of his/her parents, is often divided into institutionalized childcare (that is centre-based) or informal childcare (a childcare professional, relatives/friends/nanny/babysitter/au pair and/or someone other than the parents). Understanding how non-parental childcare impacts a child's development may provide families and policymakers with valuable information on

whether increasing availability of non-parental childcare can benefit not only parents' work-life balance but also children's socio-emotional and cognitive development.

High quality childcare attendance—particularly centre-based—has been associated with children's improved cognitive and language acquisition skills and later school achievement,²⁻⁹ as well as fewer peer problems and lower levels of emotional difficulties.^{6,7} Centre-based childcare can provide children with an array of learning opportunities that they may not have at home or with a nanny^{5,8} and especially benefit those who come from disadvantaged backgrounds and experience family adversity.

The long-term impact of early childcare arrangements on children's emotional development is of interest due to the possible negative repercussions of early onset internalizing and externalizing symptoms. Internalizing symptoms can include signs of anxiety/depression, withdrawn behavior and/or somatic complaints.⁹ Externalizing symptoms can include attention difficulties and delinquent and/or aggressive behaviors.⁹ One study found a prevalence of 18.4% of internalizing and 7.8% of externalizing symptoms among children aged 6–12 years in eight EU countries.¹⁰ Children who experience internalizing symptoms in early adolescence are at higher risk of alcohol dependence, lower intimate partnership, higher welfare benefits and psychopathology later in life.^{11,12} Children who display externalizing symptoms from early on are at risk of decreased opportunities for social growth, lower school achievement, worse psychosocial outcomes, and less financial stability in their 20s and early 30s.¹¹ Considering the high prevalence of internalizing and externalizing symptoms in children and the possible detrimental health and social consequences they can have, there is need to identify propitious population-based protective factors, possibly childcare attendance prior to school entry, that could protect against internalizing and externalizing symptoms. Additionally, it is important to explore whether maternal postpartum depression, maternal educational level, and child's sex modify the relationship between early childcare arrangements and children's internalizing and externalizing symptoms. Children with depressed mothers are at higher risk for poor cognitive development, internalizing symptoms, difficult temperaments, and poorer language development, and some studies have suggested that early childcare arrangements may be able to buffer these effects.¹³⁻¹⁵ Similarly, maternal education level can also be explored as a moderator because disadvantaged backgrounds often lead to worse socio-emotional and cognitive outcomes and studies have yielded mixed results on whether children benefit more or less from childcare depending on their family's socio-economic background.^{4,5,8} Lastly, differences between boys and girls in internalizing and externalizing symptoms call for examining if the child's sex modifies these relationships.^{16,17}

Our aim was to examine the relationship between early childcare attendance prior to school entry and children's internalizing and externalizing symptoms in middle childhood and early adolescence, testing the hypothesis of a protective effect of centre-based childcare in a European context. We used data from five EU countries to test: (i) whether centre-based childcare and informal childcare are associated with lower levels of internalizing and externalizing symptoms compared to exclusive parental childcare, and (ii) whether mother's post-partum depression, educational level, or the child's sex modify the association between early childcare attendance and children's internalizing and externalizing symptoms.

Methods

Study design and oversight

This study includes six parent-offspring prospective birth cohort studies across five European countries participating in the EU Child Cohort Network (EUCCN).¹⁸ The EUCCN is part of the EU Horizon 2020 LifeCycle project, funded in 2017 with the overarching aim of understanding relationships between early-life stressors and child development, health and disease throughout the life course. Parent-offspring cohort studies were included in the study if they (i) collected information about non-parental childcare before school entry and recorded children's internalizing and externalizing symptoms at least once during follow-up, (ii) were approved by their institutional review boards, and (iii) had harmonized data available for analysis via the federated data analysis platform DataSHIELD¹⁹ (Fig. 1). Participating cohorts include: the Avon Longitudinal Study of Parents and Children²⁰ (ALSPAC; recruitment from 1 April 1991 to 31 December 1992) in the United Kingdom, The Generation R study²¹ (GENR; recruitment from 1 April 2002 to 31 January 2006) in the Netherlands, the Danish National Birth Cohort²² (DNBC; recruitment from 1995 to 2002) in Denmark, the Infancia y Medio Ambiente Project²³ (INMA; recruitment from 1997 to 2008) in Spain, the Étude des Déterminants pré Et postnatals du Développement de la santé de l'enfant²⁴ (EDEN; recruitment from 27 January 2003 to 6 March 2006) in France, and the Étude Longitudinale Française depuis l'Enfance²⁵ (ELFE; recruitment on 25 selected days of 2011 spread over the year) in France. All participating cohorts received approval from their local institutional review boards, written informed consent from all participants and parents was obtained, and written informed consent for use of data in this project was obtained from all principal investigators. Information regarding the ethical approval and consent from all participants has been outlined in the [Supplementary Information](#) (pages 1–3). The study design and characteristics of participants taking part in each cohort have been described in detail elsewhere.²⁰⁻²⁵

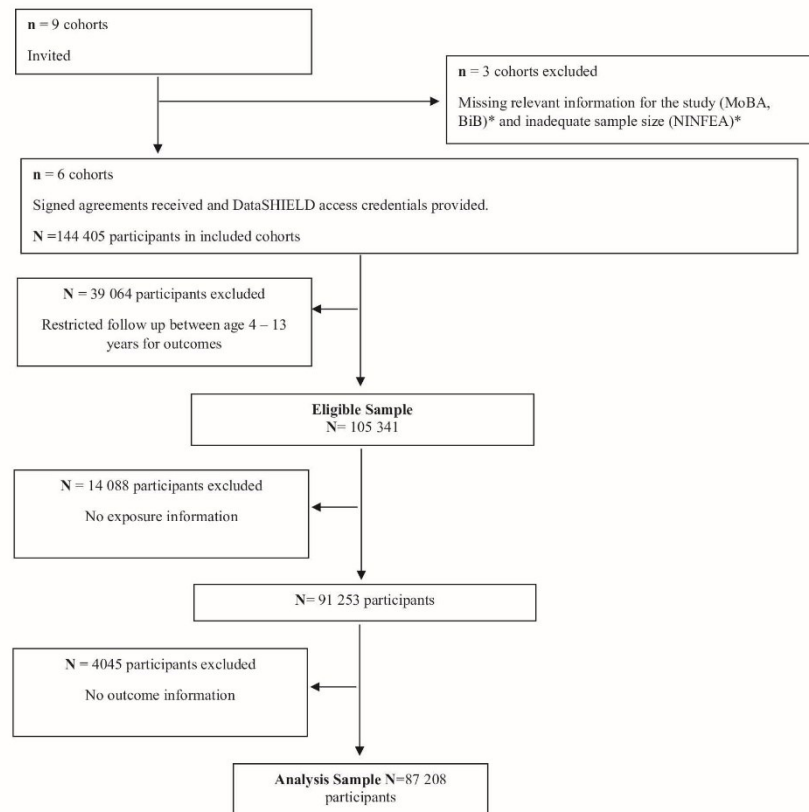


Fig. 1: Flow chart of cohorts and participants from the EU Child Cohort Network included in the study of the relationship between access to childcare and children’s internalizing and externalizing symptoms. *MoBA, Norwegian Mother, Father, and Child Cohort Study; BiB, Born in Bradford Family Cohort; NINFEA, Nascita e Infanzia: gli Effetti dell’Ambiente” (Birth and Childhood: the Effects of the Environment) Cohort Study.

Participants

After multiple imputation of missing data on study covariates (Supplementary Table S1), a total of 87,208 participants from six-participating parent-offspring cohorts were used to study internalizing and externalizing symptoms (Fig. 1).

Measures

Exposures of interest

Non-parental childcare care attendance. Parents reported on their children’s childcare arrangements at least one time between the ages of 0–4 years (Supplementary Table S2). If the parent reported that their child was in centre-based childcare, he/she was included in the

“centre-based childcare” group [yes/no]. If the parent reported that their child was in informal rather than in centre-based childcare, including, a childcare professional, relatives/friends/nanny/babysitter/au pair and/or someone other than the parents, they were considered to be in “informal childcare” [yes/no]. Supplementary Table S3 provides some contextual information on each cohort’s country’s early childcare policies at the time of data collection.

Outcomes of interest

Children’s internalizing and externalizing symptoms. Children’s internalizing and externalizing symptoms were reported by parents using either the Strengths and

Difficulties Questionnaire (SDQ)³⁶ or the Child Behavioral Checklist (CBCL).²⁷ Information regarding the use of different measures, ages of assessment and the standardization process for the scores is shown in Supplementary Table S2.

Covariates. Covariates were selected a priori based on previous research findings: maternal age in years was collected at the child's birth. Other maternal measurements were assessed in the first 12 months of the child's life: educational level: *high (associate, bachelor, masters, doctoral or equivalent), intermediate (upper secondary, post-secondary non-tertiary) or low (no education, early childhood, pre-primary, primary, lower secondary or second stage of basic education)*, based on the International Standard Classification of Education 97/2011 (ISCED-97/2011),^{28,29} employment status: *[employed, unemployed, other (student, apprentice, domestic tasks, inactive/receiving benefits, etc.)]*, parental separation: *did the parents split up during the first year of the child's life [yes/no]*, maternal post-partum depression (PPD) within the first year after child's birth [yes/no], and whether the participating child was an only child [yes/no].

The child's sex [male/female], birth weight (in grams), and gestational age (in weeks) were recorded at the child's birth.

Statistical analyses

To study the relationship between early childcare arrangements and children's internalizing and externalizing symptoms, we implemented a two-stage individual participant data (IPD) meta-analysis in order to reduce the risk of trial-level confounding being introduced into the analysis.³⁰

To address missing information on covariates (Supplementary Table S1), ten imputed datasets using fully conditional specification to impute missing data on covariates were performed for each sample. The imputation model incorporated all covariates and outcomes included in the analytical models. Second, linear regression models were implemented in each cohort separately. Third, cohort-specific coefficients and standard errors were combined using random-effects meta-analysis with a restricted estimate maximum likelihood (REML) approach to attain overall effect estimates. Based on the timing of measurement of children's internalizing and externalizing symptoms in each cohort, we distinguished three age-groups (5–6 years, 7–9 years, 10–13 years). In the ALSPAC, GENR, EDEN, DNBC and ELFE cohorts, regression models were adjusted for maternal age, educational level, employment status, parental separation, maternal PPD, only child status, child's birthweight, gestational age, and sex. In the INMA cohort, regression models were adjusted for previous variables except parental separation status, which was not measured.

The combined estimates testing associations between early childcare arrangements and children's internalizing and externalizing symptoms are presented with their accompanying 95% confidence intervals (95% CI), the estimated p-value and their heterogeneity statistics (Q, degrees of freedom (df), p-value, I², H²). An I² statistic >75% or I² ~ 75% with effect estimates in different directions represents moderate to substantial heterogeneity.^{31,32}

In sensitivity analyses, we tested association between childcare type from 0 to 3 years and children's internalizing and externalizing symptoms between 5–6 years, 7–9 years, and 10–13 years, as some countries, such as France, Spain, and the Netherlands, have different standards, structures, and regulations for childcare from 0 to the age of 3 years.³³ Additionally, we examined whether associations between childcare attendance and children's internalizing and externalizing symptoms were modified by maternal PPD, low education status (classified as any education at or below upper secondary, post-secondary or non-tertiary school) (yes/no) or the child's sex by including an interaction term (early childcare type*interaction of interest) in separate models for each interaction.^{34,35} Lastly, a sensitivity analysis was carried out in which cohorts were stratified based on the type of assessment tool was used to measure internalizing and externalizing symptoms to see if there were significant differences from our main results. The DNBC, ELFE, and EDEN cohorts used the SDQ assessment tool, while the ALSPAC and GENR cohorts used the CBCL assessment tool for all age groups. The INMA cohort used the SDQ assessment tool for ages 7–9 years and the CBCL assessment tool for ages 10–12 years.

All statistical analyses were performed using DataSHIELD (packages: dsBase version 6.3.0; dsHelper version 1.4), a tool for federated analyses of individual-level data.^{19,36} All statistical codes used to analyze data for this project have been made publicly available: <https://github.com/katybarry/nonparental-care-attendance-and-childrens-behaviors.git>.

Role of the funding source

The funders had no role in the design and conduct of the study; the analysis and interpretation of the data; preparation; the review, or approval of the manuscript.

Results

Participants' characteristics

We analyzed a total of 87,208 mother-child dyads, with 24,651 reporting information on children's internalizing and externalizing symptoms between 5 and 6 years, 65,081 between 7 and 9 years, and 50,896 between 10 and 13 years. Table 1 shows combined sample characteristics of participants by age group.

Children’s internalizing symptoms

Compared to children who were cared for by their parents prior to age 4 years, those who attended centre-based childcare had lower levels of internalizing symptoms in all age groups: [5–6 years: β : -1.78 (95% CI: -3.39, -0.16); 7–9 years: β : -0.55 (95% CI: -0.88, -0.73); 10–13 years: β : -0.76 (95% CI: -1.15, -0.37)] (Fig. 2).

To the contrary, informal childcare attendance was associated with higher levels of internalizing symptoms between 7–9 years and 10–13 years, respectively: β : 1.65 (95% CI: 1.25, 2.06); β : 1.25 (95% CI: 0.96, 1.54) (Fig. 2).

Children’s externalizing symptoms

No associations were found between centre-based childcare and externalizing symptoms across all age groups (Fig. 3). Informal childcare attendance was associated with higher externalizing symptoms between 7–9 and 10–13 years, respectively; [β : 2.84 (95% CI: 1.41, 4.26); β : 2.19 (95% CI: 0.54, 3.84)] (Fig. 3). We observed potential heterogeneity in the unadjusted statistical models for the 5–6 ($I^2 = 90.2\%$) and 7–9 ($I^2 = 83.8\%$) years age groups which decreased after controlling for covariates [5–6 years ($I^2 = 72.1\%$) and 7–9 years ($I^2 = 67.7\%$)] (Fig. 3).

All cohort-specific associations are shown in the Supplementary Information (Supplementary Figures S1–S4).

Early childcare from 0 to 3 years old

Studying specifically childcare attendance between the ages of 0 and 3 years, we found results similar to our main analysis. Children who attended centre-based childcare had lower levels of internalizing symptoms in all age groups: [5–6 years: β : -0.78 (95% CI: -1.15, -0.37); 7–9 years: β : -0.55 (95% CI: -0.87, -0.23); 10–13 years: β : -1.86 (95% CI: -3.42, -0.31)] (Supplementary Figure S5). To the contrary, informal childcare attendance was associated with higher levels of internalizing symptoms between 7–9 years and 10–13 years, respectively: β : 1.69 (95% CI: 1.45, 1.94); β : 1.25 (95% CI: 0.95, 1.54) as well as higher levels of externalizing symptoms at 7–9 and 10–13 years, respectively: [β : 2.77 (95% CI: 1.43, 4.11); β : 2.21 (95% CI: 0.52, 3.90)] (Supplementary Figure S5).

Effect modification

We tested interactions between childcare attendance and mother’s PPD, low education status (defined as having an intermediate education or below), and the

Age group	Combined study sample, N = 87,208		
	5–6 years (n = 24,651)	7–9 years (n = 65,081)	10–13 years (n = 50,896)
Included cohorts	4	5	4
Mother’s age, median, (IQR)	30.63 (33.77, 26.57)	30.04 (33.04, 27.11)	29.90 (32.89, 26.91)
Mother’s educational level			
High, n (%)	12,317 (50.00)	29,476 (45.30)	23,624 (46.40)
Medium, n (%)	10,044 (40.70)	26,676 (41.00)	20,729 (40.70)
Low, n (%)	2290 (9.29)	8929 (13.70)	6543 (12.90)
Mother’s employment status			
Employed, n (%)	18,816 (76.32)	49,412 (75.92)	38471 (75.59)
Unemployed, n (%)	795 (3.22)	2972 (4.57)	2139 (4.20)
Other, n (%)	5040 (20.44)	12,697 (19.51)	10,286 (20.21)
Mother post-partum depression (yes)	2022 (8.20)	9017 (13.90)	7159 (14.10)
Parental separation (yes), n (%)	472 (1.91)	839 (1.31)	604 (1.20)
Child’s sex (female), n (%)	12,073 (49.00)	31,814 (48.90)	25,556 (50.20)
Only child (yes), n (%)	11,971 (48.60)	31,447 (48.30)	24,421 (48.00)
child’s gestational week of birth (in weeks)	40 (41.39)	40 (41.39)	40 (41.39)
Child’s birthweight in grams, median (IQR)	3392 (3713,3076)	3563 (3905, 3240)	3571 (3915, 3251)
Types of childcare			
Centre-based childcare, n (%)	7194 (29.20)	17,137 (26.30)	12,594 (24.70)
Informal childcare, n (%)	13,008 (52.80)	33,006 (50.70)	26,360 (51.80)
Exclusive parental childcare, n (%)	4449 (18.00)	14,938 (23.00)	11,942 (23.50)
Internalizing symptoms percentile score, median (IQR)	46.82 (73.74, 19.30)	46.06 (66.19, 5.56)	43.55 (71.51, 23.87)
Externalizing symptoms percentile score, median (IQR)	48.51 (71.68, 20.75)	43.42 (70.75, 15.55)	39.84 (74.93, 20.59)

ALSPPAC, Avon Longitudinal Study of Parents and Children; GENR, The Generation R study; DNBC, Danish National Birth Cohort; INMA, Infancia y Medio Ambiente Project; EDEN, Étude des Déterminants pré Et postnatals du Développement de la santé de l’enfant; ELFE, Étude Longitudinale Française depuis l’Enfance. *Cohorts included in the combined sample.

Table 1: Covariate, exposure and outcome information in the EU Child Cohort Network (ALSPPAC, GENR, DNBC, INMA, EDEN, ELFE)* in the study of the association between childcare attendance and children’s emotional and behavioural difficulties (n, %).

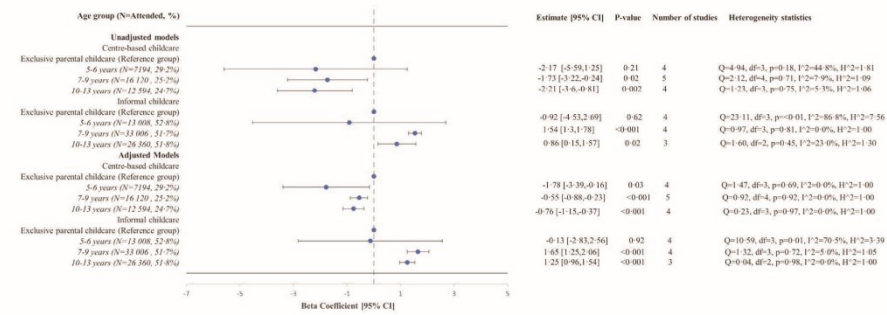


Fig. 2: Crude and adjusted associations between childcare attendance between ages 0 up and age 4 and children's internalizing symptoms by age group (5-6 years, 7-9 years, 10-13 years), in child cohort studies included in the EU Child Cohort Network (ALSPAC, GENR, DNBC, INMA, EDEN, ELFE)*. *ALSPAC, Avon Longitudinal Study of Parents and Children; GENR, The Generation R study; DNBC, Danish National Birth Cohort; INMA, Infancia y Medio Ambiente Project; EDEN, Étude des Déterminants pré Et postnatals du Développement de la santé de l'enfant; ELFE, Étude Longitudinale Française depuis l'Enfance. A two-stage individual participant data (IPD) meta-analysis was performed on each age group presented. The reference group was children who were exclusively cared for by their parents. Linear regression models were performed separately on each cohort for each given age group and then cohort-specific coefficients and standard errors were combined using random-effects meta-analysis with a restricted estimate maximum likelihood (REML) approach to attain overall effect estimates. The beta coefficient is provided with the accompanying 95% Confidence Interval (CI) and p-value. The number of studies for each age bracket is provided as well as the heterogeneity statistics. For the adjusted models, the ALSPAC, GENR, EDEN, DNBC, and ELFE cohorts' linear regression models were adjusted for maternal age at child's birth, maternal education at child's birth, maternal employment status at child's birth, parental separation status, mother's first child, child's sex and child's weight at birth when available. For INMA, models were adjusted for all the previous variables except for parental separation due to unavailability.

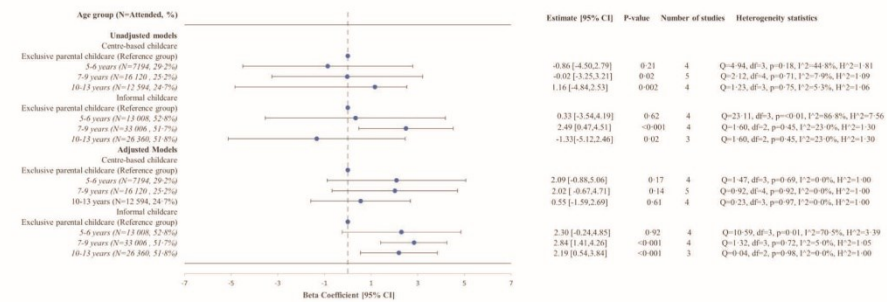


Fig. 3: Crude and adjusted associations between anytime centre-based childcare and Informal childcare attendance between ages 0 up and age 4 and externalizing symptoms by age group (5-6 years, 7-9 years, 10-13 years), in child cohort studies included in the EU Child Cohort Network (ALSPAC, GENR, DNBC, INMA, EDEN, ELFE)*. *ALSPAC, Avon Longitudinal Study of Parents and Children; GENR, The Generation R study; DNBC, Danish National Birth Cohort; INMA, Infancia y Medio Ambiente Project; EDEN, Étude des Déterminants pré Et postnatals du Développement de la santé de l'enfant; ELFE, Étude Longitudinale Française depuis l'Enfance. A two-stage individual participant data (IPD) meta-analysis was performed on each age bracket presented. The reference group was children who were exclusively cared for by their parents. Linear regression models were performed separately on each cohort for each given age bracket and then cohort-specific coefficients and standard errors were combined using random-effects meta-analysis with a restricted estimate maximum likelihood (REML) approach to attain overall effect estimates. The beta coefficient is provided with the accompanying 95% Confidence Interval (CI) and p-value. The number of studies for each age group is provided as well as the heterogeneity statistics. For the adjusted models, the ALSPAC, GENR, EDEN, DNBC, and ELFE cohorts' linear regression models were adjusted for maternal age at child's birth, maternal education at child's birth, maternal employment status at child's birth, parental separation status, mother's first child, child's sex and child's weight at birth when available. For INMA, models were adjusted for all the previous variables except for parental separation status due to unavailability.

child's sex (Supplementary Table S4). Regarding centre-based childcare attendance, we found a significant interaction between mother's low education status (yes) and centre-based childcare ($p \leq 0.01$) with a positive beta coefficient ($\beta = 1.27$), indicating that children whose mother had a low educational level may have elevated levels of internalizing symptoms between 5 and 6 years. Regarding informal childcare attendance, we found statistically significant interactions with mother's low education status (yes) such that children whose mother had a low educational level were most likely to experience elevated levels of internalizing symptoms (5–6 years; 7–9 years; 10–13 years: $p \leq 0.001$) with positive beta coefficients (5–6 years: $\beta = 49.74$, 7–9 years: $\beta = 44.22$, 10–13 years: $\beta = 44.86$). For externalizing symptoms at all age groups, we found significant interactions between mother's low education status (yes) and centre-based childcare (5–6: $p = 0.03$, 10–13: $p = 0.01$) with positive beta coefficients (5–6 years: $\beta = 2.28$, 10–13 years: $\beta = 2.22$). For externalizing symptoms at all age groups, we found statistically significant interactions between mother's low education status (yes) and informal childcare (5–6 years; 7–9 years; 10–13 years: $p \leq 0.001$) with positive beta coefficients (5–6 years: $\beta = 49.73$, 7–9: $\beta = 47.34$, 10–13 years: $\beta = 46.62$). Lastly, the association between informal care attendance and children's externalizing symptoms was modified by child sex (10–13 years: $p = 0.03$, $\beta = -1.21$), such that girls were associated with lower externalizing symptoms if they attended informal childcare than boys.

Stratification by outcome measurement tool

After stratifying the results based on the assessment tool used to measure children's internalizing and externalizing symptoms, we did not see substantial differences between the stratified groups and the main analysis as confidence intervals overlapped (Supplementary Table S5). We did, however, find that certain estimates became statistically significant after stratification. For example, cohorts which used the SDQ between ages 5 and 6 years (ELFE, EDEN) found that children who attended informal childcare had slightly decreased levels of internalizing symptoms [β : -2.12 (95% CI: $-3.85, -0.38$)]. Also, when cohorts were stratified by SDQ or CBCL, children who attended centre-based childcare had slightly higher externalizing symptoms between ages 7 and 9 years [β : 1.04 (95% CI: $0.75, 1.33$); β : 4.09 (95% CI: $0.53, 7.66$)], respectively.

Discussion

Studying six European mother-child cohorts which included 87,208 participants, we found that centre-based childcare attendance was associated with small decreases of internalizing symptoms; however, we observed the contrary regarding informal childcare attendance. Moreover, attendance at informal childcare

was also associated with a small elevation of children's externalizing symptoms. It is important to note that in our study informal childcare, which is likely to vary across European countries, included occasional or regular care provided by relatives or friends, as well as care provided by nannies and childminders, implying that this group is characterized by heterogeneity. Unfortunately, we were not able to distinguish different subtypes of informal childcare as not all of the studies provided had this information. However, in the future it would be relevant to distinguish professional from non-professional types of informal childcare. Lastly, these results reflect childcare arrangements from the late 1990s and early 2000s. Therefore, it's crucial to consider the childcare context described in Supplementary Table S3 before generalizing these findings to the current childcare systems in each country.

The effects of centre-based and informal childcare appeared slightly stronger among children whose mothers had a low education level. Moreover, boys had slightly elevated externalizing symptoms between ages 10 and 13 years if they attended informal childcare compared to girls. Overall, these results suggest that centre-based childcare attendance is associated with small positive effects on children's later psychological well-being, but other unmeasured factors such as parenting styles and children's early temperament may also play a role in children's internalizing and externalizing symptoms.

Past scientific literature on relationships between attendance at early childcare arrangements and children's development has shown somewhat inconsistent findings depending on the type of childcare, the childcare setting and children's age.

Studies examining associations between centre-based childcare and children's internalizing symptoms in Europe reported protective effects and higher levels of prosocial skills.^{6,34,35,37,38} Children attending centre-based childcare may be more likely to learn emotional regulation, cooperation and conflict resolution skills compared to children attending informal childcare.³⁹ Children in centre-based childcare may have access to better resources and facilities designed for children compared to informal child care which may home-based, and children in centre-based childcare may receive higher quality care due to the educational requirements and child-specific training that professional staff are required to have in centre-based childcare.³³ The staff-to-child ratio in centre-based childcare may be higher than in other informal childcare settings meaning that children may receive more focused attention that could impact their socio-emotional development than in informal childcare.³³ When considering socio-economic status, one study found that children who came from a more disadvantaged background experienced higher internalizing symptoms and substance use in childhood if they attended early centre-

based childcare.³⁵ The study explains that children from disadvantaged backgrounds may not experience the same benefits from childcare as their middle-class peers because childcare settings may mirror more middle-class behavioral norms, and as a result, these children may feel a sense of alienation as well as inner conflict as the behaviors and practices they are confronted with in childcare do not reflect the behaviors and practices they find in their home.³⁵

Studying children's externalizing symptoms, a meta-analysis reported no association between the number of hours spent in centre-based childcare and children's externalizing symptoms below five years of age.³⁵ In contrast, time spent in centre-based childcare has been reported to be related to higher levels of self-reported aggression between ages 7 and 8 years as well as self-reported Attention-Deficit/Hyperactivity Disorder (ADHD) symptoms between ages 15 and 17 years in Switzerland³⁵ and higher levels of teacher-reported externalizing symptoms from 52 months to grade five in the United States.³⁸

Some of the variation across studies may reflect differences in the quality, governance, accessibility and affordability of centre-based childcare provided for children before they start school in each country. Yet, only one-third of countries part of the Organization for Economic Co-operation and Development (OECD) have strict guidelines regarding the educational curriculum implemented in centre-based childcare centres as well as the developmental and learning goals that the childcare has set out to meet which are age-appropriate.³³ Some countries, such as Denmark, France, and Spain, have curriculum themes that are implemented in childcare which include personal development, social development, communication and language, body, senses, and movement, nature, outdoor life and science, and culture, aesthetics and community.⁴⁰⁻⁴² Other countries, such as the Netherlands, may not have any prescribed national curriculum, but may require childcare professionals to establish a curriculum plan that incorporates at least one child development goal.⁴³ These curriculum themes and childcare activities may influence children's internalizing and externalizing symptoms later on through social development and emotional regulation skills acquired early on in life.⁴⁴

Quality childcare as well as the number of children per centre-based childcare professional have been associated with fewer behavioral difficulties and better social skills in children, particularly among those who come from vulnerable backgrounds.^{6,35,37,38} The quality of centre-based childcare provided in each country may therefore play a role with regard to children's behavioral outcomes.

We found a positive association between children's informal childcare attendance and elevated levels of internalizing symptoms between 7-9 and 10-13 years. This aligns with a study conducted in Britain which

found that high use of non-institutionalized care during early childhood was linked to increased levels of teacher-rated anti-social behavior up to the age of seven years.^{39,45} In Switzerland, it was reported that children who visited a playgroup were more aggressive at ages seven and eight and had more self-reported symptoms of delinquency and substances use at age 13 if they were cared for by acquaintances rather than their parents.³⁵ This is consistent with our study, which showed that children who attended informal childcare were more likely to experience externalizing symptoms between the ages of 7-9 and 10-13 years. It may be that informal childcare, provided by persons who are neither properly trained nor supervised to care and stimulate young children, is a poor substitute for parental care and on average does not meet the quality standards of centre-based childcare. Also, children who are cared for by relatives or family friends may not have the same opportunities to interact with children their own age and may therefore have less prosocial skills compared to children attending centre-based childcare.

Our study found no evidence that maternal postpartum depression modifies the relationship between early childcare arrangements and children's internalizing and externalizing symptoms. This result differs from a study conducted in Canada which found that access to high quality childcare buffered the consequences of maternal depression on children's emotional and behavioral problems. One of the differences with our study is that maternal depression was ascertained when the child was in the pre-school age range, whereas we controlled for depression earlier in the child's life.^{14,46} Another study found that maternal depressive symptoms were most strongly associated with children's increased internalizing and externalizing problems as children grew older.⁴⁸

We also found that low maternal education status appears to positively modify the effect of centre-based and informal childcare on children's internalizing and externalizing symptoms. This aligns with a study which found that children who came from a more favorable socioeconomic background reaped more benefits of childcare compared to children who came from a more disadvantaged background.⁷ This may be because centre-based childcare may not be enough to reverse the negative consequences of coming from a disadvantaged background.⁷ Children coming from more adverse situations are already at a greater disadvantage in terms of their future academic achievement, educational attainment, and cognitive and social development.⁴⁷ This may be because they have a more unstable home environment with fewer stimulating and educational activities, experience less positive parenting practices, and experience more early life stressors compared to children coming from families with a higher socio-economic status.⁴⁷ All of these factors may, therefore, play a stronger role on children's socio-emotional development and may prevent early childcare from having any

real impacts on children's development as universal programs may not address the needs of children coming from very diverse backgrounds.⁴⁸ For child's sex, boys had a small increase in externalizing symptoms between 10 and 13 years compared to girls if they attended informal childcare. This interaction may reflect increased externalizing symptoms that boys tend to exhibit compared to girls, who may show more internalizing symptoms, due to various societal expectations and different parenting and caretaking styles given boys and girls are.^{49,50} Lastly, the stratified results based on the assessment tool used to measure internalizing and externalizing symptoms did not substantially differ from the main results. There was, however, a substantial decrease in heterogeneity in the stratified results which may indicate that the ALSPAC and GENR studies are more similar to each other and the DNBC, ELFE, EDEN, and INMA cohorts, which in turn may be more similar to one another. This could be due to similar study designs or potential country level factors.

Our study has some limitations which need to be acknowledged. First, an important issue in testing the association between childcare attendance and children's later outcomes is the role of confounding characteristics which influence both early education and mental health. Our analyses control for key confounding variables (family socioeconomic characteristics, parental mental health), however we cannot entirely rule out residual confounding, as we limited covariates to variables available in all child cohorts included. Nevertheless, all the covariates we included in this study were derived from a Directed Acyclic Graph (DAG) and no major confounding variable was missing. Second, some children attended different types of childcare over time. Yet we chose to focus on centre-based childcare, as in some participating cohorts, information on childcare attendance was only collected once. This may have introduced some misclassification bias, as studies have shown that children who attend multiple childcare arrangements may display more behavioral problems, possibly in part due to insecure attachment with adults that care for them.⁵¹ However, this is likely to represent only a minority of children included in our statistical analyses as trends in Europe have found that families who enroll their child into centre-based childcare use centre-based childcare as their primary source of childcare.⁵² Third, parent-reported children's internalizing and externalizing symptoms may underestimate their offspring's psychological difficulties.⁵³ However, the use of standardized measures of mental health which have previously been validated is likely to reduce this type of bias.⁹ Fourth, neither the age at which children started early childcare nor if they attend part-time or full-time childcare was measured in our study. These two factors may contribute to children's internalizing and externalizing symptoms, and further research should incorporate these variables. Fifth, the time period of data

collection of each cohort may have seen different ECEC policies which may have impacted early childcare attendance. We were unable to adjust for different policy changes within each country, and this limitation must be considered when analyzing the results.

Despite these limitations, our study also has strengths which should be highlighted. First, this is a federated analysis of individual level data from six different parent-child cohort studies across five European countries. The geographic diversity of our study sample provides enhanced location coverage across Europe, improves the generalizability of our results and facilitates intra- and inter-population comparisons. Second, the consistent harmonization of variables across cohort studies reduced between-study heterogeneity and strengthened the generalizability, external validity and reproducibility of findings. Third, we were able to account for key confounding variables and test whether the reported associations varied across family socioeconomic position and child sex, providing additional insight.

Conclusion

Our study, based on data from six epidemiological cohorts of parents and children recruited across five European settings, highlights complex associations between different types of early childcare arrangements and children's emotional and behavioral outcomes in mid-childhood and early adolescence. Our results indicate that children attending centre-based childcare have lower levels of internalizing symptoms as they grow up, whereas those who attend informal care have higher levels. In children whose mothers have low educational level and in boys these associations appear to be enhanced and the beneficial effects of centre-based childcare are not observed. Nevertheless, overall access to quality centre-based childcare could be a propitious way of promoting child well-being and psychological development in the mid and long-term. In addition, children from socioeconomically disadvantaged families require special attention, as they may not sufficiently benefit from universal ECEC.

Contributors

KMB, DA and MM conceptualized and designed the present study. Interpretation of the results. KMB, DA, and TC planned and performed the statistical and data analysis. KMB drafted the article. DA, TM, AE, HEM, PWJ, MW, AMNA, KSL, LGS, RSB, FBZ, JJ, MV, BH, MAC, ARG, and MM provided insights on the interpretation of the data and additional analyses to perform. All authors read and revised this manuscript critically for important intellectual content and finally approved this version of the manuscript for submission.

Data sharing statement

The datasets generated and analyzed during the current study are not publicly available due to data regulations and for ethical reasons, considering that this information might compromise research participants' consent because our participants only gave their consent for the use of their data by the original team of investigators. However, all the code for the data management and analysis are open sourced and publicly available: <https://github.com/katybarry/nonparental-care-attendance-and-childrens-behaviors.git>.

Declaration of interests

The authors have no conflicts of interest to declare that are relevant to the content of this article.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.lanepe.2024.101036>.

References

- 1 Eurostat. Childcare arrangements in the EU. <https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20220504-2>; 2020. Accessed August 7, 2023.
- 2 Felle C, Nollenberger N, Rodriguez-Planas N. Can't buy mommy's love? Universal childcare and children's long-term cognitive development. *J Popul Econ*. 2015;28:393–422.
- 3 Drange N, Havnes T. Early childcare and cognitive development: evidence from an assignment lottery. *J Labor Econ*. 2019;37:581–620. <https://doi.org/10.1086/700193>.
- 4 Kulic N, Skopek J, Triventi M, Blossfeld H-P. Social background and children's cognitive skills: the role of early childhood education and care in a cross-national perspective. *Annu Rev Sociol*. 2019;45:557–579. <https://doi.org/10.1146/annurev-soc-073018-022401>.
- 5 Berger LM, Panico L, Solaz A. The impact of center-based childcare attendance on early child development: evidence from the French elite cohort. *Demography*. 2021;58:419–450. <https://doi.org/10.1215/00703370-8977274>.
- 6 Linberg A, Burghardt L, Freund J-D, Weinert S. Differential effect of duration of early childcare under the age of three on socio-emotional outcomes. *Early Child Dev Care*. 2019;190:2505–2519. <https://doi.org/10.1080/03004430.2019.1588891>.
- 7 Gomajee R, El-Khouiry F, Côté S, van der Waerden J, Pryor L, Melchior M, EDEN mother-child Cohort Study Group. Early childcare type predicts children's emotional and behavioural trajectories into middle childhood. Data from the EDEN mother-child cohort study. *J Epidemiol Community Health*. 2018;72(11):1033–1043.
- 8 Garon-Carrier G, Bégin V. The (limited) contribution of early childcare arrangements to social and academic development among Canadian children. *Dev Psychol*. 2021;57(11):1855–1865. <https://doi.org/10.1037/dev0001257>.
- 9 Nader JL, Harris JR, Cadman T. Report on the life course trajectories leading from early internalizing and externalizing indicators to subsequent psychopathology outcomes in childhood: lifecycle report D6.1. <https://lifecycle-project.eu/our-findings/public-deliverables/>; 2021. Accessed August 3, 2023.
- 10 Husky MM, Boyd A, Bitfoi A, et al. Self-reported mental health in children ages 6-12 years across eight European countries. *Eur Child Adolesc Psychiatry*. 2018;27:785–795. <https://doi.org/10.1007/s00787-017-1073-0>.
- 11 Gornik AE, Clark DA, Durbin CE, Zucker RA. Individual differences in the development of youth externalizing problems predict a broad range of adult psychosocial outcomes. *Dev Psychopathol*. 2023;35:630–651. <https://doi.org/10.1017/S0954579421001772>.
- 12 Belsky J. Quantity of nonmaternal care and boys' problem behavior/adjustment at ages 3 and 5: exploring the mediating role of parenting. *Psychiatry*. 1999;62:1–20. <https://doi.org/10.1080/00332747.1999.11024848>.
- 13 Letourneau N, Duffett-Leger L, Dennis C-L, et al. Identifying the support needs of fathers affected by post-partum depression: a pilot study. *J Psychiatr Ment Health Nurs*. 2011;18:41–47. <https://doi.org/10.1111/j.1365-2850.2010.01627.x>.
- 14 Giles LC, Davies MJ, Whitrow MJ, et al. Maternal depressive symptoms and child care during toddlerhood relate to child behavior at age 5 years. *Pediatrics*. 2011;128:e78–e84. <https://doi.org/10.1542/peds.2010-3119>.

- 15 Charrois J, Côté SM, Paquin S, et al. Maternal depression in early childhood and child emotional and behavioral outcomes at school age: examining the roles of preschool childcare quality and current maternal depression symptomatology. *Eur Child Adolesc Psychiatry*. 2020;29:637–648. <https://doi.org/10.1007/s00787-019-01385-7>.
- 16 Miner JL, Clarke-Stewart KA. Trajectories of externalizing behavior from age 2 to age 9: relations with gender, temperament, ethnicity, parenting, and rater. *Dev Psychol*. 2008;44:771–786. <https://doi.org/10.1037/0012-1649.44.3.771>.
- 17 Chen C. How do behavior problems change over time in childhood? Evidence from the early childhood longitudinal study. *Humanit Soc Sci Commun*. 2024;11:355. <https://doi.org/10.1057/s41599-024-02867-z>.
- 18 Jaddoe VWV, Felix JF, Andersen A-MN, et al. The LifeCycle Project-EU Child cohort network: a federated analysis infrastructure and harmonized data of more than 250,000 children and parents. *Eur J Epidemiol*. 2020;35:709–724. <https://doi.org/10.1007/s10654-020-00662-z>.
- 19 Gaye A, Marcon Y, Isaeva J, et al. DataSHIELD: taking the analysis to the data, not the data to the analysis. *Int J Epidemiol*. 2014;43:1929–1944. <https://doi.org/10.1093/ije/dyu188>.
- 20 Fraser A, Macdonald-Wallis C, Tilling K, et al. Cohort profile: the Avon longitudinal study of parents and children: ALSPAC mothers cohort. *Int J Epidemiol*. 2013;42:97–110. <https://doi.org/10.1093/ije/dys066>.
- 21 Jaddoe VWV, Mackenbach JP, Moll HA, et al. The generation R study: design and cohort profile. *Eur J Epidemiol*. 2006;21:475–484. <https://doi.org/10.1007/s10654-006-9022-0>.
- 22 Olsen J, Melbye M, Olsen SF, et al. The Danish National Birth Cohort—its background, structure and aim. *Scand J Public Health*. 2001;29:300–307. <https://doi.org/10.1177/14034948010290040201>.
- 23 Guxens M, Ballester F, Espada M, et al. Cohort profile: the INMA-INfancia y Medio ambiente—(Environment and Childhood) project. *Int J Epidemiol*. 2012;41:930–940. <https://doi.org/10.1093/ije/dyr054>.
- 24 Heude B, Forhan A, Slama R, et al. Cohort Profile: the EDEN mother-child cohort on the prenatal and early postnatal determinants of child health and development. *Int J Epidemiol*. 2016;45:353–363. <https://doi.org/10.1093/ije/dyv151>.
- 25 Charles MA, Thierry X, Lanoe J-L, et al. Cohort Profile: the French national cohort of children (ELFE): birth to 5 years. *Int J Epidemiol*. 2020;49:368–369. <https://doi.org/10.1093/ije/dyz227>.
- 26 Goodman R. The strengths and difficulties questionnaire: a research note. *J Child Psychol Psychiatry*. 1997;38:581–586.
- 27 Bilenberg N. The Child Behavior Checklist (CBCL) and related material: standardization and validation in Danish population based and clinically based samples. *Acta Psychiatr Scand Suppl*. 1999;398:2–52. <https://doi.org/10.1111/j.1600-0447.1999.tb10703.x>.
- 28 UNESCO. International standard classification of education (ISCED). <http://uis.unesco.org/en/topic/international-standard-classification-education-isced>; 2017. Accessed January 10, 2022.
- 29 European Commission ISCED-Classification. Correspondence between ISCED 2011 and ISCED 1997 levels. https://ec.europa.eu/eurostat/documents/1978984/6037342/Comparability_ISCED_2011_ISCED_1997.pdf. Accessed May 5, 2024.
- 30 Riley RD, Burke DL, Morris T. One-stage versus two-stage approach to IPD meta-analysis. In: *Individual participant data meta-analysis*. John Wiley & Sons, Ltd; 2021:199–217.
- 31 Higgins JPT, Thompson SG. Quantifying heterogeneity in a meta-analysis. *Stat Med*. 2002;21:1539–1558. <https://doi.org/10.1002/sim.1186>.
- 32 Cumpston M, Li T, Page MJ, et al. Updated guidance for trusted systematic reviews: a new edition of the Cochrane Handbook for Systematic Reviews of Interventions. *Cochrane Database Syst Rev*. 2019;10:ED000142. <https://doi.org/10.1002/14651858.ED000142>.
- 33 European Commission. *Key data on early childhood education and care in Europe*. 2019 edition; 2019. https://eacea.ec.europa.eu/national-policies/eurydice/sites/default/files/ec319375enn_0.pdf. Accessed August 3, 2023.
- 34 Broekhuizen M. *Differential effects of early child care quality on children's socio-emotional development*. Dissertation: Utrecht University; 2015.
- 35 Averdijk M, Ribeaud D, Eisner M. External childcare and socio-behavioral development in Switzerland: long-term relations from childhood into young adulthood. *PLoS One*. 2022;17:e0263571. <https://doi.org/10.1371/journal.pone.0263571>.
- 36 Wilson RC, Butters OW, Avraam D, et al. DataSHIELD – new directions and Dimensions. *Data Sci J*. 2017;16:21. <https://doi.org/10.5334/dsj-2017-021>.
- 37 Gialamas A, Mitty MN, Sawyer MG, et al. Time spent in different types of childcare and children's development at school entry: an Australian longitudinal study. *Arch Dis Child*. 2015;100:226–232. <https://doi.org/10.1136/archdischild-2014-306626>.
- 38 Network NECCR. Early child care and children's development in the primary grades: follow-up results from the NICHD study of early child care. *Am Educ Res J*. 2005;42:537–570.
- 39 Zachrisson HD, Dearing E, Lekhal R, Toppelberg CO. Little evidence that time in child care causes externalizing problems during early childhood in Norway. *Child Dev*. 2013;84:1152–1170. <https://doi.org/10.1111/cdev.12040>.
- 40 Den styrkede pædagogiske læreplan. <https://www.uvm.dk/dagtilbud/paedagogiske-redskaber-og-rammer/den-styrkede-paedagogiske-laereplan>. Accessed July 4, 2024.
- 41 Educational guidelines. <https://eurydice.eacea.ec.europa.eu/national-education-systems/spain/educational-guidelines>. Accessed July 4, 2024.
- 42 Educational guidelines. <https://eurydice.eacea.ec.europa.eu/national-education-systems/france/educational-guidelines>. Accessed July 4, 2024.
- 43 Educational guidelines. <https://eurydice.eacea.ec.europa.eu/national-education-systems/netherlands/educational-guidelines>. Accessed July 4, 2024.
- 44 Mondì CF, Giovanelli A, Reynolds AJ. Fostering socio-emotional learning through early childhood intervention. *Int J Child Care Educ Policy*. 2021;15:6. <https://doi.org/10.1186/s40723-021-00084-8>.
- 45 MELHUISE E. Why children, parents and home learning are important. In: *Early childhood Matters*. Routledge; 2010.
- 46 Gjerde LC, Eilertsen EM, Reichborn-Kjennerud T, et al. Maternal perinatal and concurrent depressive symptoms and child behavior problems: a sibling comparison study. *J Child Psychol Psychiatry*. 2017;58:779–786. <https://doi.org/10.1111/jcpp.12704>.
- 47 Reardon SF. *The widening academic achievement gap between the rich and the poor: new evidence and possible explanations. Whither Oppor rising unequal uncertain life chances low-income child*. 2012.
- 48 Leseman PPM, Slot PL. Universal versus targeted approaches to prevent early education gaps. The Netherlands as case in point. *Z Für Erzieh*. 2020;23:485–507. <https://doi.org/10.1007/s11618-020-00948-8>.
- 49 Matos A, Salvador M, Costa J, et al. *The relationship between internalizing and externalizing problems in adolescence: does gender make a difference?*. 2017.
- 50 Fernandez Castelao C, Kröner-Herwig B. Developmental trajectories and predictors of externalizing behavior: a comparison of girls and boys. *J Youth Adolesc*. 2014;43:775–789. <https://doi.org/10.1007/s10964-013-0011-9>.
- 51 Chen J-H. Multiple childcare arrangements and health outcomes in early childhood. *Matern Child Health J*. 2013;17:448–455. <https://doi.org/10.1007/s10995-012-1016-9>.
- 52 Janta B. *Caring for children in Europe: how childcare, parental leave and flexible working arrangements interact in Europe*. RAND Corporation; 2014.
- 53 Cleridou K, Patalay P, Martin P. Does parent-child agreement vary based on presenting problems? Results from a UK clinical sample. *Child Adolesc Psychiatry Ment Health*. 2017;11:22. <https://doi.org/10.1186/s13034-017-0159-2>.

4. General discussion

4.1 Summary of main findings

In this thesis, we explored the impact of two types of family policy – paid paternity leave and early childcare arrangements – on fathers’ and mothers’ mental health and children’s socio-emotional development, respectively.

In the first article of this thesis, we found that fathers who took a paid, two-week paternity leave as well as fathers who intended to take paternity leave had decreased odds of postpartum depression at two months. If their partner took paternity leave, mothers had higher odds of PPD at two months. In the second article of this thesis, we explored different types of early childcare arrangements – centre-based childcare, informal childcare, and exclusive parental care – on children’s internalizing and externalizing symptoms at different moments throughout early and mid-childhood (**article 1**). In the second article, we found that centre-based childcare was associated with decreased internalizing symptoms between 5-6, 7-9, and 10-13 years of age. Informal childcare was associated with increased internalizing and externalizing symptoms between 7-9 and 10-13 years of age (**article 2**).

In this section of the thesis, we will explore the mechanisms behind these results and compare them with previous literature exploring the relationships between paternity leave and parental mental health, early childcare, and children’s development. Then, we will discuss the limitations present in these studies. Lastly, we will provide implications of these results as well as future research ideas.

4.2 What kind of father takes paid paternity leave?

In the first article of the thesis, we did not find differences between fathers who took paid paternity leave and fathers who intended to take paid paternity leave; both groups had decreased odds of PPD at two months compared to fathers who did not take paid paternity leave (**article 1**). The results consider multiple parental, household, and child characteristics that could influence the relationship between paternity leave uptake and paternal PPD. This then raises the following questions “what kinds of fathers decide to take paternity leave?” and “what kind of fathers decide not to take paternity leave?”.

Some qualitative studies have explored these questions [47,127]. If fathers consider parenthood an exciting endeavor and show commitment and involvement starting in the prenatal phase (going to doctor visits with the mother, attending parenting classes, preparing the home for the arrival of the baby, etc.), they are more likely to take paternity leave and even parental leave [47]. On the other hand, fathers who follow more traditional gender roles may believe that their role in the family is to be the breadwinner, and therefore, it is not necessary for them to take time off work [47]. Fathers who did not take paternity leave reported fears of missing out on employment promotions or appearing as though they are “slacking off” at work if they took time off to be home with their child [47]. On the same note, some fathers mentioned that there were no other examples in the office of fathers taking time off, and they were afraid to go against the “norm” of the office [47].

Research has further compared fathers who decided to take extended parental leave (defined as more than three weeks) versus fathers who took less than three weeks [47]. Fathers who took less than three weeks reported a lack of self-efficacy and felt as

though they were a burden to the mother [47]. Some fathers reported that the monotonous daily routine of a new-born child (eat, poop, sleep) meant that they were not really needed, and it would be more interesting for them to take time off when their child was a bit older and more “fun” [47]. Other fathers stated that the mother deserved to have more parental leave time, and they did not want to take away from her time off (in the case when parental leave time can be divided between the mother and father) [47]. This shows that gender roles, work environment, and family policy play a huge role in fathers’ decision-making process for taking paternity leave and/or parental leave (**article 1**).

4.3 What is father’s involvement and what determines father’s involvement?

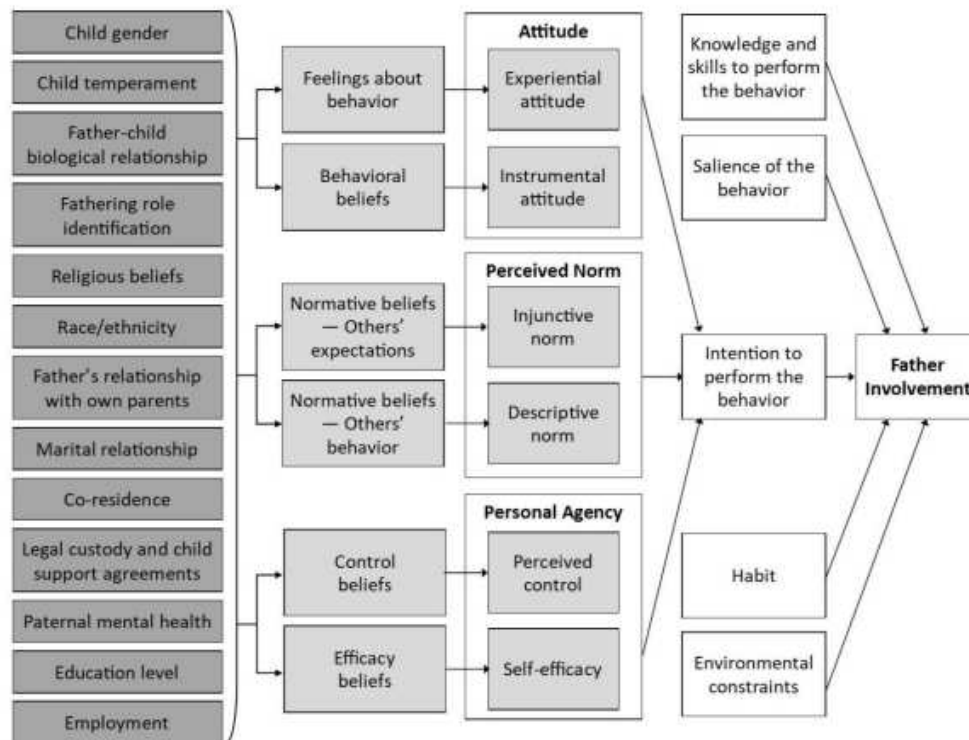
When we speak about father involvement, it is first important to understand what it looks like, how to measure it, and how it is multidimensional. To define father’s involvement, Pleck expanded on Lamb’s theory of paternal involvement, stating that paternal involvement includes five domains: 1. Positive engagement (direct interactions with the child such as playing, educational stimulation, and caregiving); 2. Control (such as monitoring the child’s activities, participating in decision-making for the child, setting rules and limits); 3. Warmth and responsiveness (the emotional quality of the father-child relationship); 4. Indirect care (can include buying necessities for the child, taking the child to extracurricular activities, doctor visits, etc); 5. Process responsibility (‘mental childcare’: thinking about the child’s needs, overseeing the child’s daily life and future needs) (**Table 5**) [48,49].

Table 5: Domains of Father Involvement as Described by Pleck [48] , with examples sourced from inventory of father involvement [128], as published in Allport et al. [49]

Domain	Examples
Positive engagement activities	<ul style="list-style-type: none"> • Playing with, reading to, or singing to an infant child. • Talking together. • Homework support.
Warmth and responsiveness	<ul style="list-style-type: none"> • Developing talents/skills (eg, sports, instruments). • Attentiveness and caregiving activities (eg, feeding, changing diapers). • Feelings and expressions of affection.
Control	<ul style="list-style-type: none"> • Monitoring of child, and knowledge of the child's whereabouts and activities. • Participation in decision making about the child. • Discipline.
Social and material indirect care	<ul style="list-style-type: none"> • Providing basic needs (eg, food, shelter, health care). • Accepting responsibility for financial support.
Process responsibility	<ul style="list-style-type: none"> • Planning, organizing, and overseeing the care of the child. • Supporting, encouraging, and cooperating with mother.

Fathers’ involvement and the type of engagement they have with their children are based on a host of determinants. Allport et al created an integrated behavioral model that explores what factors can influence father’s involvement (**Figure 13**) [49].

Figure 12: Adapted integrated behavioral model [51] incorporating the factors affecting father involvement, as published in Allport et al [49]



Factors include the child’s characteristics (gender, temperament), the biological bond between the father and the child, the father’s beliefs about his role in fatherhood, his religious beliefs, race, ethnicity, his relationship with his parents, his relationship with his spouse (relationship satisfaction, co-habitation), if he has legal custody of his child or not, his mental health status, educational level, and employment status. These factors then influence the father’s beliefs, then then influence the father’s attitudes, perceived norms, and personal agency, and lastly, influence the father’s intention to be involved as a father and co-parent (**Figure 13**).

To illustrate, past research has provided many examples of how these factors shape father’s involvement. Studies have found that fathers tend to engage more with boys than with girls, and fathers are less likely to interact with their son if he has

temperamental problems or with their daughter if she is more socially withdrawn [49,50]. Fathers are also more likely to bond with biological versus nonbiological children [49]. Fathers from higher socio-economic backgrounds often engage more in indirect care of the child (financial support) but not as much in positive engagement (children's play), whereas fathers from lower socioeconomic backgrounds engage more in positive engagement [132]. Additionally, fathers who have a higher educational background than the mother are associated with less positive engagement (children's play), whereas parents who have equal educational backgrounds are associated with more father-child play and more co-parenting behaviors [132].

A father's beliefs about his role in the family, influenced by culture, religion, and his relationship with the mother, may influence how he is involved with the child; he may take on a breadwinner role, disciplinarian role, or a caretaker role depending on his beliefs (**Figure 13**) [49]. Perceived norms, which are also influenced by culture, society, race, ethnicity, and religion, can also influence fathers' beliefs about what is expected of him as a father (**Figure 13**). One study found that highly religious fathers were more involved in indirect care of their child, such as buying necessities for the child, but less involved in the caretaking aspects, such as changing diapers or putting the child to sleep [132]. Another study found that fathers who attended the birth and participated in cutting the umbilical cord during birth were associated with more overall father involvement, which may reflect their attitudes of wanting to be engaged as a father [128]. Additionally, the father's relationship with his own parents and the type of parenting he received can also influence the kind of father he is to his own children. Fathers who report having positive childhood experiences show more involvement with their children [49,50].

The father's personal agency, meaning the confidence the father has in his abilities to be a parent (self-efficacy), can be influenced by the relationship dynamic between the mother and the father and the parenting dynamic between the mother and the father (**Figure 13**). For example, relationship conflict has been associated with less father involvement, and positive co-parenting arrangements have been associated with more father involvement. The father's mental health is also an important factor of father involvement, and as we have seen previously; depressed and anxious fathers are less likely to interact with their child [16,17].

Other factors mentioned in **Figure 13** that could influence father's involvement include "paternal knowledge and skills, salience of the behavior, habits, and environmental constraints" [49]. A father's knowledge and skills in parenting may be linked to his self-efficacy in parenting [49,50]. For example, mothers may have more experience with children because societal norms often expose them to more babysitting roles prior to motherhood. As a result, their self-efficacy in parenting may be stronger than fathers who may not have had similar experiences [49]. Other research on father involvement has found that fathers who attended prenatal classes or pregnancy check-ups were more involved, specifically in caregiving and play, during the first two years post-birth versus fathers who did not [132]. Additionally, fathers who have a higher educational status have been associated with more "verbal stimulation" and increased language development in children [132].

"Salience of the behavior" refers to how relevant the father finds paternal involvement to be, and this involvement may be put on the back burner if other factors such as their career, financial stability, or their personal time are deemed more important (**Figure 13**). Habits can be related to a father's prior parenting or childcare experiences that could influence his involvement. Also, first-time fathers have been found to be more

involved with their children than fathers with multiple children. Environmental constraints can include maternal gatekeeping, where the mother assumes herself to be the primary caregiver and does not allow the father to perform childrearing tasks if he is unsure how to do so (**Figure 13**) [49]. Gatekeeping can also extend to relatives such as grandparents who prevent the father from taking responsibility in child-rearing and interacting with their child if he seems not confident in his abilities to do certain tasks. Other environmental constraints may include being a co-habiting father or not, as nonresident fathers tend to be less involved in their child's lives compared to co-habiting fathers. Fathers who had lower work stress, less work hours, and more job stability were also associated with more father involvement, specifically in positive engagement [49,50]. Additionally, if the mother suffers from depression, the father usually compensates for this and is more involved with the child. Lastly, an important factor not mentioned in this model that can impact fathers' involvement is family policy (**article 1**). Specifically, the amount and timing of paternity leave offered to fathers as well as the incentives put forth to encourage paternity leave uptake can influence father's involvement with their child [132].

4.4 Paternal involvement and children's outcomes

Fathers who take paternity leave and/or parental leave may have more quality father-child time, which, in turn, can have positive impacts on their child's cognitive, physiological, and socio-emotional development (**article 1**) [52]. Studies have found that fathers who take paternity leave and/or longer parental leave are more involved with their children than fathers who do not [53,55]. In France, fathers who took a paid paternity leave even as short as two weeks engaged in more household tasks two years following childbirth versus fathers who did not take paternity leave [53]. On average,

fathers play with their child for 29 minutes on work days and around 38 minutes on non-work days [8]. The amount of time the fathers spends with the child seems to increase in early infancy (from zero to around eight years old) and then tapers off around the age of eight years [8]. When looking at the type of play that fathers engage in with their child, it varies differently from the type of play that mothers engage in. One systematic review comparing the different types of father-child play and its impact on child development, found that fathers engaged in more physical types of play, such as wrestling and tumble play, which involves forms of touch and movement [8]. The systematic review found positive associations between fathers' physical play and children's ability to self-regulate between ages zero to three years old [8]. Children also exhibited fewer emotional and behavioral problems, hyperactivity, conduct problems and peer problems [8]. Additionally, the systematic review found that fathers tended to play more with their male child versus their female child. This systematic review highlights the importance of father involvement, as they bring a different type of play than mothers and contribute significantly to their child's socio-emotional development. Another systematic review found similar results in which less father involvement was associated with more child-peer aggression, regardless of the quality of the mother-child relationship [50]. This is an important finding because though the mother-child relationship is valuable, the father-child is equally crucial and offers unique benefits and protective factors for children's development.

4.5 Paternal mental health illness and children's socio-emotional development

Fathers that suffer from mental health illnesses, such as PPD and anxiety, can often have a negative impact on their children's development. One umbrella review exploring the relationship between paternal mental health illness and children's development

found that children who are exposed to fathers with mental health illnesses, mainly PPD and anxiety, are more at risk for increased internalizing and externalizing behaviors, lower language development, and overall emotional and behavioral problems [16]. Some studies have found that children can show signs of poor emotional and behavioral development as early as two months of age [16]. As **article 1** of this thesis found, paternity leave may be a protective factor against the onset of paternal PPD at two months. Though a two-week leave may be a short amount of time, it can provide fathers with valuable father-child bonding time as well as help the father ease into parenthood (**article 1**). As mentioned earlier, fathers in France who took paid paternity leave were more involved with their children compared to fathers who did not take paternity leave [53]. Fathers may develop more self-efficacy in their parenting abilities during their paternity leave, which can lead to increased involvement across their child's early years. Paternity leaves as well as parental leave for fathers therefore can encourage fathers to be more involved with their children and their family as well as protect them against the onset of PPD (**article 1**).

4.6 Two week paid paternity leave uptake and development of maternal postpartum depression: why is there more risk?

Article one of this thesis found that mothers were more at risk of postpartum depression at two months if the father took paid paternity leave. We controlled for many maternal, paternal, household, and child characteristics when exploring this association. Understanding the underlying mechanisms—such as the paternal and maternal personality traits, relationship dynamics, parenting dynamics, gender roles, and what activities are taking place both during and after paternity leave—may provide valuable insights into our results.

One hypothesis may be that the duration of paternity leave is not a sufficient time for fathers to adopt a more active co-parenting role. Co-parenting can be defined as the roles and interactions between parental figures in childrearing [54]. There are often four domains of co-parenting: 1. Parental agreement on childrearing; 2. Distribution of child-related labor; 3. Supporting (or undermining) one another in parenting capabilities; 4. Jointly managing conflict in regard to child-rearing [54]. Research has found that positive co-parenting is associated not only with improved children's development in infancy and adolescence but also with reduced parental stress, increased parenting confidence (self-efficacy), and more satisfying couple relationships [54]. Fathers who take on longer paternity leaves and/or parental leaves are found to exhibit more co-parenting behaviors [54,55]. A two-week paternity leave may not allow enough time for the father to pick up on the cues, needs, and patterns of the baby that the mother may pick up on due to the extended amount of time she spends with the child (**article 1**). This can create a dynamic in which the father feels inadequate to respond to the needs of the child, and therefore turns to the mother to either tell him what to do (taking on a manager-helper role) or simply allowing the mother to take over responsibility for the child [54]. Mothers therefore may feel overwhelmed the first few months raising the child, as they bear most of the child-rearing responsibility and may not feel adequately supported, leading to a higher risk of postpartum depression (**article 1**). One study in France found that though fathers who took paternity leave performed more household and childrearing tasks than fathers who did not take paternity leave, there was still a huge divide between mothers and fathers [53]. The study also found that there was no significant impact of paternity leave uptake on the division of household tasks such as shopping, cooking, laundry, or repairs [53]. Only dishwashing and cleaning activities displayed a more egalitarian

division between the mother and father [53]. The main change in this study came from fathers who traditionally did not participate at all in domestic activities, in which they increased (by 2%) in assistance [53]. Since paternity leave is so short (two weeks), fathers may feel like their time is better suited for childcare versus household chores, and therefore, they expect the mother to do the “less fun” domestic activities [53]. One study in Germany looking at the impact of taking more than 2 months or less than 2 months of paid parental leave specifically for fathers (remunerated at 67%) found that fathers were more involved with their child no matter the length of parental leave taken; but that fathers who took longer parental leaves increased in their housework as well as fathers who took solo leaves (taking parental leave while the mother returns to work) [55]. As the first article of this thesis emphasized, a two-week paid paternity leave may not be adequate for the father to participate more in household tasks. If the father is taking paternity leave at the same time as the mother the majority of the time (which is the case in **article 1**), he may not be as involved in domestic activities and supporting his partner as much as he could be.

Studies have also found an association between partner support and maternal depressive symptoms, showing that mothers are more at risk of PPD if they report lower partner support [56]. Mothers are already at an increased risk of mental health illness during pregnancy and after the birth of their child, so if the mother also feels little or no social support from the father both during and after paternity leave, this can further contribute to their risk of postpartum depression. In France, couples in which the father took paternity leave had fewer couple disputes [53] (**article 1**). The study also found that mothers were more satisfied with the contribution in household and childrearing tasks by fathers who took paternity leave versus fathers who did not take leave [53]. The relationship with the father is not the only social support mechanism

for mothers, and studies have found that mothers are more likely to experience postpartum depression if they lack social support from their parents or other relatives in the family [56].

4.7 Maternal postpartum depression, maternal health, and children's socio-emotional development

If a two-week paid paternity leave is unable to protect mothers against postpartum depression, then finding other family policies that can protect mothers in this regard is important due to the grave consequences on the mothers' physical and mental health outcomes, as well as children's development (**article 1**). One systematic review found that mothers with PPD had an increased risk of weight problems, alcohol and illicit drug use, poorer social relationships, difficulties breastfeeding, and persistent depression beyond the postpartum period [56]. The review also found that these mothers responded neutrally to negative stimuli (going into a "numbing state" if they saw their child in distress), and were at a higher risk of homelessness, smoking, and had self-harming thoughts. Children whose mothers suffered from postpartum depression had a greater incidence of childhood illnesses, a twofold risk of mortality up to 12 months of age, poorer cognitive development, poorer language development, more difficult temperament and more internalizing behaviors. The review also found that mothers with severe postpartum depression consulted a general practitioner more often than mothers with mild postpartum depression, so mothers with less severe cases fail to get needed support during the postpartum period [56]. Considering all the negative impacts that maternal postpartum depression can have on the mother, the child, and the overall family unit, solutions are needed for mothers to feel more

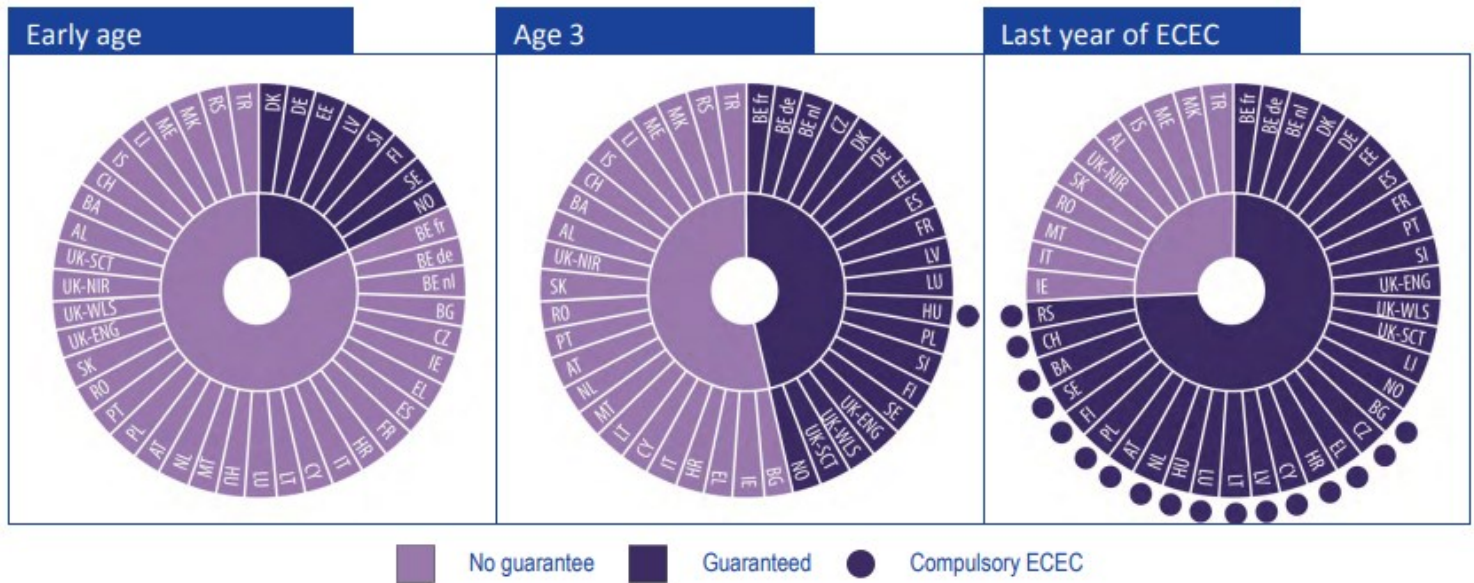
supported during the postpartum period. Short-term paternity leave may not be a sufficient solution to help mothers (**article 1**).

4.8 What influences families' decision to use certain childcares?

In the second article of this thesis, we found that informal childcare was one of the most frequently used early childcare options by parents before their child entered primary school (50.9%), followed by centre-based childcare (27.1%), and exclusive parental care (22%). Aligning with our study, previous research found that various maternal, parental, socio-economic, and child characteristics influence the type of childcare arrangements parents use [57]. For example, previous studies have found that children coming from disadvantaged backgrounds, such as low-income families or families in which parents have a high school degree or less, often opt for home-based childcare compared to children from more affluent backgrounds [57]. Studies also found that single-parent households are more likely to use informal types of childcare compared to two-parent households. Parents also have reported feeling more comfortable using either home-based childcare or relatives because they know the caregiver providing childcare, especially for families with infants [57].

Another factor that was not measured in our studies but significantly influences parents' decision on the type of childcare they use is accessibility. As mentioned in the introduction, countries in Europe vary significantly in providing children with the right to a place in childcare depending on the child's age. In most countries, children do not have a right to a place in childcare until after the age of three years (**Figure 14**). These barriers to childcare services often force parents to look at more informal types of care for their child, which may partially explain the higher rates of children found in informal childcare compared to centre-based childcare in our studies (**article 2**).

Figure 13: Children guaranteed a spot in Early Childhood Education and Care (ECEC) by European country, as published by the European Commission [2]



Source: Eurydice.

AT: Austria; BE fr: Belgium (French-speaking); BE de: Belgium (German-speaking); BE nl: Belgium (Dutch-speaking); BG: Bulgaria; BA: Bosnia and Herzegovina; CH: Switzerland; CZ: Czech Republic; DK: Denmark; DE: Germany; EE: Estonia; IE: Ireland; EL: Greece; ES: Spain; FR: France; HR: Croatia; IT: Italy; CY: Cyprus; LV: Latvia; LT: Lithuania; LU: Luxembourg; HU: Hungary; MT: Malta; NL: Netherlands; PL: Poland; PT: Portugal; RO: Romania; SI: Slovenia; SK: Slovakia; FI: Finland; SE: Sweden; AL: Albania; ME: Montenegro; MK: North Macedonia; NO: Norway; RS: Serbia; TR: Turkey; UK-ENG: United Kingdom (England); UK-SCT: United Kingdom (Scotland); UK-WLS: United Kingdom (Wales); UK-NIR: United Kingdom (Northern Ireland).

Another factor in accessibility is affordability. In Europe, most countries offer some subsidy or public childcare service for children above the age of three years. However, most families must pay to send their child to childcare when the child is under the age of three years [2]. There are a wide range of costs depending on the type of childcare used, and often, informal childcare can be the low-cost option for families. Additionally, parents who have relatives that are willing and able to help with childcare have a more affordable option.

4.9 Centre-based childcare and children's socio-emotional development

In the second article of this thesis, children who attended centre-based childcare at some point between birth to four years of age were associated with slightly decreased internalizing symptoms from 7-13 years of age. One explanation for these results may be the positive impact that early friendships can have on children's internalizing symptoms [58]. In centre-based childcare, where infants and toddlers are around children their own age, they can learn to interact and develop social skills in a safe environment [129]. Children that have more positive play behaviors are often more accepted by their peers and can develop reciprocal friendships [129]. Strong early friendships have been associated with less internalizing and externalizing symptoms, though these associations may also be bidirectional, with children who have less internalizing and externalizing symptoms having more quality friendships and peer interactions compared to children with higher internalizing and externalizing symptoms [58].

Professional staff could also be a factor in the reduced internalizing symptoms found among children attending centre-based childcare (**article 2**). Previous studies have found that a positive staff-child relationship may greatly influence children's ability to learn social skills, have positive peer interactions, and improve children's socio-emotional development [59–62]. Professional staff can teach children how to feel and talk about their emotions, provide safe, physical contact (hugs) and teach children about consent, foster learning through various educational and developmental activities, teach proper ways of interacting and playing with their peers (how to share, how to ask for something, etc), and many other skills that could act as protective factors against future socio-developmental problems [60].

Another benefit that centre-based childcare may provide compared to other types of childcare is the high staff-to-child ratios required in centre-based childcare. One meta-analysis found that children who were in centre-based childcare with more staff members per child had fewer problem behaviors (and more pro-social behaviors) compared to children who were in settings with more children per staff member [63]. When more professional staff are available for children, they may be able to give personalized attention that can enhance children's development and the quality of care provided compared to other forms of childcare [63]. These interactions can make the child feel secure in their attachment with the professional caretaker and reduce their risk of socio-emotional developmental problems [63].

4.10 Informal childcare and children's socio-emotional development

In the second article of this thesis, informal childcare prior to primary school was associated with more internalizing and externalizing symptoms in childhood. Informal childcare may lack the quality and standards required in centre-based childcare, which can in turn impact children's risk of internalizing and externalizing symptoms later in childhood [2,64]. For example, caretakers in informal daycares who have not received training similar to professional caretakers in centre-based childcare may dictate how they discipline and teach children based on their beliefs rather than specific training [2,64]. Also, children in informal care, such as in home-based care, may be among children of various ages, which could influence their behaviors and provide a challenge for caretakers to adapt their teaching styles to accommodate the wide array of ages in the home-care setting [2,64].

Caretakers in a home-based setting also may experience certain work-stress factors such as long hours, low pay, limited resources, lack of appreciation by society, too many

children per caretaker, and caring for children from a wide range of ages, which could influence the quality of childcare they provide [65]. Additionally, caretakers who provide care in their own home can experience the added stress of having to adapt their home into a care facility (buying supplies with their own funds) and not having a clear separation between their work and home life [65]. Caretakers in a home-based setting are also more likely to reach burn-out and quit compared to professional caretakers in a centre-based care setting, which can also influence the quality of care provided to children [65]. This turnover could provide too much change for children, and studies have found that children who experience more change in childcare arrangements have more language and emotional development problems [65,130].

4.11 Limitations

Though this thesis has many strengths, the limitations of each study must be addressed before any conclusions and implications can be drawn from the results. First, **Articles 1** and **2** relied on parent-reported outcomes, which can always introduce a risk of reporter bias. In **article 1**, parents self-reported their postpartum depression symptoms, if any, and in **article 2**, parents reported on their child's internalizing and externalizing symptoms. Since we did not have clinical records of postpartum depression in parents for **article 1** nor teacher-reported or clinician-reported records of internalizing and externalizing symptoms for children in **article 2**, we are unable to verify if the parent-reported information is accurate. Nevertheless, measures of depression which we used are valid [101].

Second, though **article 1** and **article 2** aimed to include the most relevant and identified confounding factors between our exposures and outcomes of interest, we cannot make any causal claims to our studies as there is still a risk of unmeasured

confounders influencing the associations. For example, in **article 1** of the thesis, variables such as the father's history of mental health was not measured in study questionnaires, and studies have found that fathers who have experienced depression prior to fatherhood are more at risk of postpartum depression compared to fathers who have no history of depression [83]. Therefore, we cannot know if we have a population with more or fewer fathers having a mental health history, but the percentage of fathers who had postpartum depression in our study was similar to the prevalence found in other countries (**article 1**). Other variables that were not measured in **article 1** that could impact the relationship between paternity leave uptake and paternal and maternal postpartum depression include sleep quality of parents (though self-reported health was measured), paternal and maternal attitudes and beliefs, intimate partner violence (though parental conflict was measured), co-parenting behaviors, work environment (if the work environment encouraged or not taking paternity leave, if the work environment was stressful or not), information on the mothers' and fathers' childhood experiences, parents' political views, religious beliefs, culture background, and if the mother had a difficult pregnancy and/or birth. Therefore, causal conclusions cannot be drawn from **article 1**, but we did generate propensity scores which included many parental, household, and child characteristics that could influence the relationship between paternity leave uptake and parental postpartum depression. In **article 2**, we adjusted for various maternal, household, and child characteristics in our models, but we did not have information on the fathers. As we have seen from this thesis, father involvement is an important factor in children's socio-emotional development, so the type of childcare that a child received, and their internalizing and externalizing symptoms could be greatly influenced by the relationship the child has with their father. Other factors that were not measured in **article 2** that could bias the

relationship between early childcare type and internalizing and externalizing symptoms in children include whether the father took paternity and/or parental leave, if the mother took maternity and/or parental leave, how long the parental leave was for each parent, if the mother and/or father have a good social network, if they received financial support or not, if the mother had a difficult pregnancy, if she breastfed the child, if the pregnancy was planned or not, mother's self-reported health, father's self-reported health, parental childhood history, history of intimate partner violence and parental conflict, if the infant has a difficult temperament (prior to childcare), and parental work-related stress. Also, the beliefs and attitudes of each parent, just as in **Article 1**, can influence their decision to place the child in childcare as well as influence if the child has internalizing and externalizing symptoms depending on how the parent interacts with the child. **Article 2** did adjust for relevant variables identified in past literature that could bias the relationship between type of early childcare received and children's internalizing and externalizing symptoms, but no causal inferences can be made to these results due to these limitations.

Another limitation in **article 2** is related to our exposure of interest: type of early childcare. The variable was divided into three categories —centre-based childcare, informal childcare, and exclusive parental care —and parents were asked what type of childcare their child received prior to primary school. This exposure variable has some loss of information as we do not know how long the child was in childcare, only that they were in a certain type of childcare prior to primary school. Also, informal childcare includes various types of care: a childcare professional, relatives/friends/nanny/babysitter/au pair and/or someone other than the parents. We did not have the possibility to explore how each type of informal childcare impacts children's internalizing and externalizing symptoms nor if children were in multiple

types of childcare arrangements prior to primary school. Further research which can determine exactly how long a child was in childcare, at what age they started childcare, if the child was in multiple childcare arrangements, and how different types of informal childcare influence children's internalizing and externalizing symptoms. This information is important to fully understand why we see elevated levels of internalizing and externalizing symptoms in children who attend informal childcare.

Article 1 of the thesis contained nationally representative data on eligible fathers of paternity leave in France in 2011, but **article 2** of the thesis, though including large birth cohorts from various countries, did not contain fully representative data on each country, with most of the data originating from western middle-class families. Therefore, the results of **article 2** cannot be generalized to other populations who do not fit this demographic.

4.12 Implications and future research

In this portion of the thesis, I will present the implications of our findings with a focus on co-parenting, paternal mental health, paternity leave, early childcare accessibility, and early childcare strategies that include children from disadvantaged backgrounds. Then, I will provide some ideas for future research and conclude with some final remarks.

4.12.1 From "Mommy's helper" to co-parenting

Mothers and fathers enter parenthood very differently. When family policies such as maternity leave and paternity leave have drastically different lengths, it communicates to society that the mother is considered the primary caregiver and the father is the "helper" with child rearing. Studies looking at single-father households or stay-at-

home-father households found that in the first months of the child's life, fathers exhibit the same behaviors and responses to their child that mothers do [47]. This finding challenges the idea that only mothers are "innately nurturing" and should be the primary caregivers of the child [47]. When interventions and prenatal classes include fathers to encourage more co-parenting and father involvement, the success rate is often minimal. This lack of success stems from interventions that do not require the father presence or from interventions that do not successfully include and make the father feel a part of the process. Also, interventions that do not consider all the determinants mentioned earlier, which impact father involvement, such as culture, identity, mental health status, educational level, and more, will not be as successful in meeting fathers where they are in their lives. Fathers may feel marginalized when it comes to childcare, so shifting policies, clinical practices, and interventions to engage fathers is important to increase father involvement and prevent depression in both mothers and fathers.

One systematic review exploring various father interventions on father outcomes and child development found that interventions focusing on strengthening the co-parenting relationship led to higher academic achievement, less depressive symptoms, and less conductive behaviors in children [10]. Co-parenting can also reduce anxiety in both parents and therefore improve the quality of the parental relationship as well as the parent-child relationship [131]. The review also found that successful co-parenting interventions were not necessarily limited to those that engaged the couple together, but also those in which fathers had access to father-only support groups [10]. Father-only support groups have been shown to be an effective method to keep fathers engaged in the intervention because they provide a safe space where fathers can process the challenges they face as fathers and partners, and prevent the discussion or intervention

from being directed only towards mothers [66,67]. For example, the Minnesota Early Learning Design for Young Dads program included co-parenting curriculum and incorporated positive role models by having dads who had previously gone through the program to be facilitators of the intervention and of the father-only support groups [67].

Another intervention for first-time fathers to encourage more co-parenting behaviors as well as screening for father's mental health is the SMS4Dads program established in Australia [68]. The SMS4Dads intervention created 180 brief SMS messages that were delivered to participating fathers on a four-week cycle, with a range of two to five text messages per week. The text messages focused on three themes: 1. father-infant interaction; 2. father's support for the mother; 3. father's self-care. Examples of the questions can be found in **Table 6**. Some of the questions also provided helpful website links or video links for fathers to learn more about a specific topic (**Table 6**).

Table 6: SMS4Dads message examples, as published in Fletcher et al. [68]

Week	Example Text	Content Category
1	Talk to your partner about staying home in the early months. Are there ways you can get more leave?[Txt STOP to OptOut] http://www.fairwork.gov.au/leave/maternity-and-parental-leave/paid-parental-leave ^a	Father-partner
2	Babies come with personality dad. Getting to know my personality can make being my dad much more rewarding for you.[Txt STOP to OptOut]	Father-baby
3	Good food, good sleep and lots of exercise can really help a lot at this time. [Txt STOP to OptOut] http://raisingchildren.net.au/looking_after_yourself/looking_after_yourself.html ^a	Father self-care
4	How are you going with picking names? Trying to imagine your baby’s personality is one way to start the bonding process.[Txt STOP to OptOut]	Father-baby
5	Doing it alone? This is the time to ask for support. Let family and friends know how they can help. http://raisingchildren.net.au/articles/grownups_services_and_support_nutshell.html ^a	Father self-care

^aA brief version of the URL is included in the message which keeps the SMS within 160 characters and allows the tracking of the clicked links (although what a father does once he lands on the web page is not recorded)

Alongside the SMS messages, fathers received an interactive mood tracker by receiving four questions on a three-week cycle: 1. “How are you feeling?”; 2. “How are you coping with things today?”; 3. “Is fatherhood working out as you thought it would?”; 4. “How is your stress level?”. If the father reported negatively to any of these questions, a perinatal mental health support helpline was provided for him to use. This intervention is an example of targeting fathers and encouraging father-child interactions, co-parenting, and self-care while also screening fathers for potential mental health conditions.

4.12.2 Paternal mental health screening and a family centered approach

Prenatal and pediatric visits are places where fathers can be directly targeted to assess their mental health as well as the health of the couple [49]. Currently, prenatal and pediatric visits are targeted at mothers, but creating a “mother-father-child triad” in

which both parents are encouraged to attend medical visits provides the doctor with opportunities to directly speak with the father. The clinician can provide fathers with useful information on co-parenting, paternal involvement, challenges that arise in parenthood and how to address them, and taking care of their child, as well as create a sense of belonging for the father. The doctor can also take the opportunity to screen the father for depression and substance abuse, as well as verify if his vaccines are up to date [49].

4.12.3 Paternity leave policies

As **Article 1** of this thesis has demonstrated, a two-week paid paternity leave reduces the risk of depression in fathers at two months postpartum among fathers who take or intend to take paternity leave but increases the risk of PPD at two months in mothers whose partners take paternity leave (**article 1**). This could indicate that the duration and/or timing of paternity leave is not optimal for preventing maternal PPD. Increasing paternity leave duration is one policy that could promote more father involvement as well as allocating more parental leave only to fathers (meaning the mother cannot reclaim the parental leave days if the father opts out of taking parental leave). One study in Germany found that when fathers took more than two months of parental leave, they exhibited more co-parenting behavior and more equality in child-related and house-related tasks relative to the mother [55]. The study also found that fathers who took less parental leave (one month) still showed increases in house-related tasks if they took the leave while the mother returned to work [55]. Fathers who took a month of parental leave during the time that the mother also took maternity leave did not see differences in house-related and child-related equality between parents [55]. This study highlights the importance of allowing fathers to have time

parenting away from the mother to build their self-efficacy in parenting as well as increase their participation in house-related tasks when they cannot pass on responsibility to the mother [55].

It is also important for paternity leave and parental leave for fathers to offer flexible options, allowing fathers to take different periods of leave across time (for example, some paternity leave after the birth of their child and some leave after the mother has finished maternity leave) [69]. Allowing fathers to choose when they take paternity and/or parental leave may increase uptake, as they can pick the optimal time or times that work for their family and work life.

Some of the barriers mentioned earlier that prevent fathers from taking paternity leave and/or parental leave also need to be addressed to encourage more father participation. For example, fathers have cited financial or career opportunities as barriers to taking paternity leave [47]. Paternity leave policies that guarantee the father receives 100% remuneration of his salary (at a capped rate if needed) and policies that prevent fathers from losing their work positions could increase father participation [47,69,70]. In the work environment, creating policies that require employers to provide employees with all the relevant information on how to take paternity leave and fostering a work culture that encourages paternity leave are important to prevent any discrimination against fathers. Fathers with multiple children often take less or no paternity leave, so creating incentives for fathers with multiple children to take paternity leave and parental leave can be an effective policy to keep fathers engaged in their role as a father [69]. Other barriers include administrative requirements, in which fathers do not understand if they are eligible for paternity and/or parental leave. Policies can be put in place requiring employers to provide information and assist in setting up paternity leave and/or parental leave for fathers. Lastly, some fathers may

not be able to access paternity and/or parental leave due to their legal entitlement situation [69]. For example, in some European countries, fathers are eligible for leave through the mother's entitlement, so if the mother is not eligible for maternity and/or parental leave, the father is not eligible either [69]. Creating eligibility requirements exclusively for the father is therefore important so that fathers can receive their benefits independent of the mother [69].

4.12.4 Childcare accessibility and quality for under threes

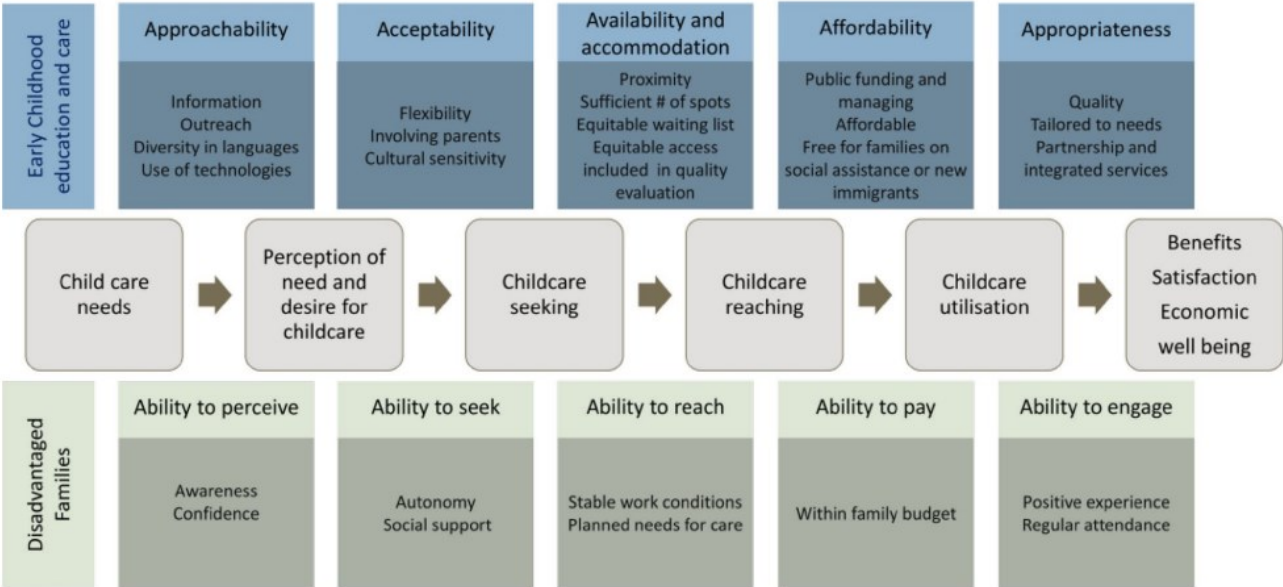
Almost no countries guarantee families a spot for their child in ECEC under the age of 3 years [2]. Additionally, most childcare services for children the age of three years can be expensive, with limited subsidies for families in disadvantaged situations [2]. Offering families a guaranteed spot in centre-based childcare (or home-base childcare that meets the same standards and regulations as centre-based childcare) that is accessible both in location and cost can provide parents with the best work-life balance options. Furthermore, many ECEC services offered to children ages three years and older are highly regulated and have strict guidelines on child-to-staff ratio and the staff qualifications as well as receive regular evaluations to guarantee the childcare service is following protocol [2]. These requirements can also be applied to childcare services offered to children under the age of three years to guarantee children receive the best care that enhances their socio-emotional development.

4.12.5 Framework for targeting children from more disadvantaged backgrounds

Children from more disadvantaged backgrounds are often underrepresented in ECEC, so creating interventions that can increase access for these children as well as making ECECs culturally inclusive is important in order to provide all children, regardless of

their background, with quality ECEC if desired [71]. Archambault et al created a conceptual framework that highlights how children from disadvantaged backgrounds can be included in ECEC by understanding the factors that hinder their inclusion as well as strategies that policy makers can use to achieve greater equity in ECEC access and care for all children (Figure 15) [71].

Figure 14: A conceptual framework of access to quality Early Childhood Education and Care (ECEC) for children from disadvantaged backgrounds, as published by Archambault et al [71]



The first factor to consider when developing ECEC programs that include children from disadvantaged backgrounds is its approachability, including information about the ECEC program existence as well as what benefits the child can receive from such a program. For some families that live in poverty or have recently immigrated to a country, the practices carried out in an ECEC may not align with the families’ personal values or beliefs about what a mother’s role is in the household [71]. Therefore, generating awareness about the programs, such as the benefits these programs can have for their children, as well as information about the costs and how to register can be one method to boost a family’s confidence in the services provided [71]. Awareness

campaigns that target community organizations or local libraries operating in their neighborhoods are important ways to get the message out about ECEC to families from more disadvantaged backgrounds [71]. It is also important to disperse the information in multiple languages [71]. In the ECEC, a system should also be in place to share information in the family's language of choice about their child daily so that families can develop more trust around what takes place in ECEC [71]. Staff working at an ECEC should also have specific training and guidance on how to welcome families from all types of backgrounds and how to have quality interactions with families from various cultures [71]. Another intervention strategy that has been proven to be effective is to have more flexibility in the ECEC to allow parents who wish to sit and watch what takes place in ECEC to do so, helping them become more comfortable with ECEC before they start leaving their child on a regular basis [71]. Hiring childcare workers from minority groups as well as childcare workers that speak other languages is also an important factor in creating ECEC that is diverse and representative of all the different cultures within the area [71].

Another barrier for families from disadvantaged backgrounds can be the demanding administrative processes required to enroll their child into ECEC. More flexibility in what legal documents must be provided can limit some of the barriers families face in enrolling their child into childcare [71]. In terms of availability of spots in ECEC, changing the systems to not be based on a first-come-first-serve basis —which discriminates families from more disadvantaged backgrounds, as they tend to register to services later than more privileged families — but to be based on factors which include low-income, ethnicity, and family situation can provide more access to disadvantaged families [71]. This system can also be evaluated by governing bodies to verify that these services are accessible to more socially diverse families [71]. Lastly, for

families with low-income status, it is important to provide free ECEC, as even reduced rates of ECEC can be too costly for these families [71]. These are all strategies which can be integrated into all ECEC structures to increase access for children coming from disadvantaged backgrounds and to create ECEC programs that adapt to all different types of backgrounds.

5. Conclusion

5.1 Future research directions

The first article of this thesis explored the impact of a two-week paid paternity leave on mother's and father's mental health, but there is currently no research exploring how longer paternity leaves impact the mental health of parents. Countries where fathers have longer paternity leave as well as countries where fathers take long parental leaves can explore how these are associated with parental postpartum depression as well as explore outcomes such as father involvement and co-parenting. Additionally, research can explore any differences that may occur when fathers take paternity leave concurrent with when the mother takes maternity leave versus the father taking paternity leave while the mother returns to work. Answering these research questions will help policy makers understand what types of paternity leave and parental leave for fathers have positive impacts on parents' mental health.

The second article of the thesis explored the relationship between different types of childcare attendance before primary school and children's internalizing and externalizing symptoms across young to mid-childhood. Further research can adjust for childcare quality using standardized measures that assess the quality of childcare based on teaching methods, professional-to-child ratio, and available resources. Research can also measure the length of time children spent in childcare prior to primary school, the age at which the child began childcare, and whether the child used multiple types of childcare services versus one childcare. Lastly, research can further investigate different types of informal care children may receive to understand which

types of informal care may be related to higher internalizing and externalizing symptoms in children.

5.2 Concluding remarks

Research has focused extensively on how different family policies impact the economy, but more attention needs to be given to how family policies affect the mental health of parents and children's development. In France, paternity leave was extended from two weeks to one month in July 2021 [132]. Although this policy is still far from providing the same length of leave allotted to mothers, it is a step in the right direction to more gender equality in the home and in the workforce. Creating policies that encourage more father involvement and make fathers feel included and valued in the home can also protect mothers from PPD and improve children's socio-emotional and cognitive development. Regarding ECEC services, our research finds that centre-based childcare may have positive impacts on children's socio-emotional development. Providing parents with more access to professional childcare services can help mothers and fathers achieve a family dynamic that does not rely solely on the mother as the primary caregiver. Children are raised by communities, not just parents. To ensure that children have positive outcomes, structures need to be in place that support children's development.

Families are multi-dimensional, and family policies need to address families' needs from all different angles. This thesis aimed to show two dimensions of how family policy impacts families: parental mental health and children's development. The hope of this work is to encourage policy makers to consider factors other than economic impacts when creating family policies. Additionally, this thesis advocates for future family policies that encourage gender equality in parenting by promoting fathers as co-

equal caregivers. Furthermore, this thesis supports the need for accessible professional childcare services before children enter primary school, ensuring families from all backgrounds know that their children are in good hands.

References

- [1] Ortiz-Ospina E, Tzvetkova S, Roser M. Women's Employment. Our World Data 2024. <https://ourworldindata.org/female-labor-supply> (accessed April 8, 2024).
- [2] European Commission. Key Data on Early Childhood Education and Care in Europe: 2019 Edition 2019. https://eacea.ec.europa.eu/national-policies/eurydice/sites/default/files/ec0319375enn_o.pdf (accessed August 3, 2023).
- [3] Internationale Arbeitsorganisation, editor. Women at work: trends 2016. Geneva: International Labour Office; 2016.
- [4] Ferrant G, Pesando LM, Nowacka K. Unpaid Care Work: The Missing Link in the Analysis of Gender Gaps in Labour Outcomes. 2014.
- [5] Redistribute Unpaid Work. UN Women – Hqrs n.d. <https://www.unwomen.org/en/news/in-focus/csw61/redistribute-unpaid-work> (accessed April 8, 2024).
- [6] Collombet C. French History of Parental Leave Policies: A Slow Coming out of the Stay-at-home Mother Compensation Model. *Rev Polit Soc Fam* 2021;n°141:195–209. <https://doi.org/10.3917/rpsf.141.0195>.
- [7] Kern V, Lecerf M. Maternity and Paternity Leave in the EU 2023. [https://www.europarl.europa.eu/RegData/etudes/ATAG/2023/739346/EPRS_ATA\(2023\)739346_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/ATAG/2023/739346/EPRS_ATA(2023)739346_EN.pdf) (accessed July 7, 2024).
- [8] Amodia-Bidakowska A, Laverty C, Ramchandani PG. Father-Child Play: A Systematic Review of its Frequency, Characteristics and Potential Impact on Children's Development. *Dev Rev* 2020;57:100924. <https://doi.org/10.1016/j.dr.2020.100924>.
- [9] Baker CE. When Daddy Comes to School: Father–School Involvement and Children's Academic and Social–Emotional Skills, Father Involvement, Father–Child Relationship Quality, and Satisfaction with Family Work. *Early Child Dev Care* 2018;188:208–19. <https://doi.org/10.1080/03004430.2016.1211118>.
- [10] Henry JB, Julion WA, Bounds DT, Sumo J. Fatherhood Matters: An Integrative Review of Fatherhood Intervention Research. *J Sch Nurs* 2020;36:19–32. <https://doi.org/10.1177/1059840519873380>.
- [11] Atkinson J. Shared Parental Leave in the UK: Can It Advance Gender Equality by Changing Fathers into Co-Parents? *Int J Law Context* 2017;13:356.
- [12] Risi A, Pickard JA, Bird AL. The Implications of Parent Mental Health and Wellbeing for Parent-Child Attachment: A Systematic Review. *PLOS ONE* 2021;16:e0260891. <https://doi.org/10.1371/journal.pone.0260891>.
- [13] Musser AK, Ahmed AH, Foli KJ, Coddington JA. Paternal Postpartum Depression: What Health Care Providers Should Know. *J Pediatr Health Care* 2013;27:479–85. <https://doi.org/10.1016/j.pedhc.2012.10.001>.
- [14] Rao W-W, Zhu X-M, Zong Q-Q, Zhang Q, Hall BJ, Ungvari GS, et al. Prevalence of Prenatal and Postpartum Depression in Fathers: A Comprehensive Meta-Analysis of Observational Surveys. *J Affect Disord* 2020;263:491–9. <https://doi.org/10.1016/j.jad.2019.10.030>.

- [15] Wang Z, Liu J, Shuai H, Cai Z, Fu X, Liu Y, et al. Mapping Global Prevalence of Depression among Postpartum Women. *Transl Psychiatry* 2021;11:1–13. <https://doi.org/10.1038/s41398-021-01663-6>.
- [16] Scarlett H, Moirangthem S, van der Waerden J. The Impact of Paternal Mental Illness on Child Development: An Umbrella Review of Systematic Reviews and Meta-Analyses. *Eur Child Adolesc Psychiatry* 2023. <https://doi.org/10.1007/s00787-023-02261-1>.
- [17] Slomian J, Honvo G, Emonts P, Reginster J-Y, Bruyère O. Consequences of Maternal Postpartum Depression: A Systematic Review of Maternal and Infant Outcomes. *Womens Health* 2019;15:1745506519844044. <https://doi.org/10.1177/1745506519844044>.
- [18] Cowan PA, Cowan CP, Pruett MK, Pruett K. Fathers' and Mothers' Attachment Styles, Couple Conflict, Parenting Quality, and Children's Behavior Problems: An Intervention Test of Mediation. *Attach Hum Dev* 2019;21:532–50. <https://doi.org/10.1080/14616734.2019.1582600>.
- [19] Kingston D, Tough S. Prenatal and Postnatal Maternal Mental Health and School-Age Child Development: A Systematic Review. *Matern Child Health J* 2014;18:1728–41. <https://doi.org/10.1007/s10995-013-1418-3>.
- [20] Pérez C F, Brahm M P. Paternal Postpartum Depression: Why is it also Important? *Rev Chil Pediatría* 2017;88:582–5. <https://doi.org/10.4067/S0370-41062017000500002>.
- [21] Garthus-Niegel S, Horsch A, Handtke E, Von Soest T, Ayers S, Weidner K, et al. The Impact of Postpartum Posttraumatic Stress and Depression Symptoms on Couples' Relationship Satisfaction: A Population-Based Prospective Study. *Front Psychol* 2018;9:1728. <https://doi.org/10.3389/fpsyg.2018.01728>.
- [22] Macdonald JA, Graeme LG, Wynter K, Cooke D, Hutchinson D, Kendall G, et al. How are you Sleeping? Starting the Conversation with Fathers about Their Mental Health in the Early Parenting Years. *J Affect Disord* 2021;281:727–37. <https://doi.org/10.1016/j.jad.2020.11.081>.
- [23] Janta B. Caring for Children in Europe: How Childcare, Parental Leave and Flexible Working Arrangements Interact in Europe. RAND Corporation; 2014.
- [24] A Global History of Early Childhood Education and Care - UNESCO Digital Library n.d. <https://unesdoc.unesco.org/ark:/48223/pf0000147470> (accessed May 17, 2024).
- [25] Burger K. How Does Early Childhood Care and Education Affect Cognitive Development? An International Review of the Effects of Early Interventions for Children from Different Social Backgrounds. *Early Child Res Q* 2010;25:140–65. <https://doi.org/10.1016/j.ecresq.2009.11.001>.
- [26] Blewitt C, Fuller-Tyszkiewicz M, Nolan A, Bergmeier H, Vicary D, Huang T, et al. Social and Emotional Learning Associated With Universal Curriculum-Based Interventions in Early Childhood Education and Care Centers: A Systematic Review and Meta-analysis. *JAMA Netw Open* 2018;1:e185727. <https://doi.org/10.1001/jamanetworkopen.2018.5727>.
- [27] Charles MA, Thierry X, Lanoe J-L, Bois C, Dufourg M-N, Popa R, et al. Cohort Profile: The French National Cohort of Children (ELFE): Birth to 5 Years. *Int J Epidemiol* 2020;49:368–369j. <https://doi.org/10.1093/ije/dyz227>.
- [28] Jaddoe VWV, Felix JF, Andersen A-MN, Charles M-A, Chatzi L, Corpeleijn E, et al. The LifeCycle Project-EU Child Cohort Network: A Federated Analysis Infrastructure and Harmonized Data of More than 250,000 Children and

- Parents. *Eur J Epidemiol* 2020;35:709–24. <https://doi.org/10.1007/s10654-020-00662-z>.
- [29] Fraser A, Macdonald-Wallis C, Tilling K, Boyd A, Golding J, Davey Smith G, et al. Cohort Profile: The Avon Longitudinal Study of Parents and Children: ALSPAC Mothers Cohort. *Int J Epidemiol* 2013;42:97–110. <https://doi.org/10.1093/ije/dys066>.
- [30] Jaddoe VVW, Mackenbach JP, Moll HA, Steegers EAP, Tiemeier H, Verhulst FC, et al. The Generation R Study: Design and cohort profile. *Eur J Epidemiol* 2006;21:475–84. <https://doi.org/10.1007/s10654-006-9022-0>.
- [31] Jaddoe VVW, van Duijn CM, van der Heijden AJ, Mackenbach JP, Moll HA, Steegers EAP, et al. The Generation R Study: Design and Cohort Update until the Age of 4 Years. *Eur J Epidemiol* 2008;23:801–11. <https://doi.org/10.1007/s10654-008-9309-4>.
- [32] Jaddoe VVW, van Duijn CM, Franco OH, van der Heijden AJ, van IJendoorn MH, de Jongste JC, et al. The Generation R Study: Design and Cohort Update 2012. *Eur J Epidemiol* 2012;27:739–56. <https://doi.org/10.1007/s10654-012-9735-1>.
- [33] Mn K, Cj K, Cm van D, L D, Oh F, Mh van Ij, et al. The Generation R Study: Design and Cohort Update 2017. *Eur J Epidemiol* 2016;31:1243–64.
- [34] Hofman A, Jaddoe VVW, Mackenbach JP, Moll HA, Snijders RFM, Steegers EAP, et al. Growth, Development and Health from Early Fetal Life until Young Adulthood: the Generation R Study. *Paediatr Perinat Epidemiol* 2004;18:61–72. <https://doi.org/10.1111/j.1365-3016.2003.00521.x>.
- [35] Olsen J, Melbye M, Olsen SF, Sørensen TI, Aaby P, Andersen AM, et al. The Danish National Birth Cohort--its background, structure and aim. *Scand J Public Health* 2001;29:300–7. <https://doi.org/10.1177/14034948010290040201>.
- [36] Guxens M, Ballester F, Espada M, Fernández MF, Grimalt JO, Ibarluzea J, et al. Cohort Profile: the INMA--Infancia y Medio Ambiente--(Environment and Childhood) Project. *Int J Epidemiol* 2012;41:930–40. <https://doi.org/10.1093/ije/dyr054>.
- [37] Heude B, Forhan A, Slama R, Douhaud L, Bedel S, Saurel-Cubizolles M-J, et al. Cohort Profile: The EDEN Mother-Child Cohort on the Prenatal and Early Postnatal Determinants of Child Health and Development. *Int J Epidemiol* 2016;45:353–63. <https://doi.org/10.1093/ije/dyv151>.
- [38] Cox JL, Holden JM, Sagovsky R. Detection of Postnatal Depression. Development of the 10-item Edinburgh Postnatal Depression Scale. *Br J Psychiatry J Ment Sci* 1987;150:782–6. <https://doi.org/10.1192/bjp.150.6.782>.
- [39] Levis B, Negeri Z, Sun Y, Benedetti A, Thombs BD. Accuracy of the Edinburgh Postnatal Depression Scale (EPDS) for Screening to Detect Major Depression among Pregnant and Postpartum Women: Systematic Review and Meta-Analysis of Individual Participant Data. *BMJ* 2020;371:m4022. <https://doi.org/10.1136/bmj.m4022>.
- [40] Bilenberg N. The Child Behavior Checklist (CBCL) and Related Material: Standardization and Validation in Danish Population Based and Clinically Based Samples. *Acta Psychiatr Scand Suppl* 1999;398:2–52. <https://doi.org/10.1111/j.1600-0447.1999.tb10703.x>.
- [41] Goodman A, Lamping DL, Ploubidis GB. When to Use Broader Internalising and Externalising Subscales Instead of the Hypothesised Five Subscales on the Strengths and Difficulties Questionnaire (SDQ): Data from British Parents,

- Teachers and Children. *J Abnorm Child Psychol* 2010;38:1179–91. <https://doi.org/10.1007/s10802-010-9434-x>.
- [42] Vincente Lopez M, Julvez J, Garcia R, Fernandez S, Sunyer J. Lifecycle Work Package 6 Harmonization Manual. 2019.
- [43] Buuren S van, Groothuis-Oudshoorn K. mice: Multivariate Imputation by Chained Equations in R. *J Stat Softw* 2011;45:1–67. <https://doi.org/10.18637/jss.v045.i03>.
- [44] van Buuren S. Multiple Imputation of Discrete and Continuous Data by Fully Conditional Specification. *Stat Methods Med Res* 2007;16:219–42. <https://doi.org/10.1177/0962280206074463>.
- [45] McCaffrey DF, Griffin BA, Almirall D, Slaughter ME, Ramchand R, Burgette LF. A tutorial on propensity score estimation for multiple treatments using generalized boosted models. *Stat Med* 2013;32:3388–414. <https://doi.org/10.1002/sim.5753>.
- [46] Wang M. Generalized Estimating Equations in Longitudinal Data Analysis: A Review and Recent Developments. *Adv Stat* 2014;2014:e303728. <https://doi.org/10.1155/2014/303728>.
- [47] Rehel EM. When Dad Stays Home Too: Paternity Leave, Gender, and Parenting. *Gend Soc* 2014;28:110–32. <https://doi.org/10.1177/0891243213503900>.
- [48] Pleck JH. *Paternal Involvement: Revised Conceptualization and Theoretical Linkages with Child Outcomes*. 5th Ed, Hoboken, NJ, US: John Wiley & Sons, Inc.; 2010, p. 58–93.
- [49] Allport BS, Johnson S, Aqil A, Labrique AB, Nelson T, Kc A, et al. Promoting Father Involvement for Child and Family Health. *Acad Pediatr* 2018;18:746–53. <https://doi.org/10.1016/j.acap.2018.03.011>.
- [50] Diniz E, Brandão T, Monteiro L, Veríssimo M. Father Involvement During Early Childhood: A Systematic Review of the Literature. *J Fam Theory Rev* 2021;13:77–99. <https://doi.org/10.1111/jftr.12410>.
- [51] Montañó DE, Kasprzyk D. Theory of Reasoned Action, Theory of Planned Behavior, and the Integrated Behavioral Model. *Health Behav. Theory Res. Pract.* 5th Ed, Hoboken, NJ, US: Jossey-Bass/Wiley; 2015, p. 95–124.
- [52] Sarkadi A, Kristiansson R, Oberklaid F, Bremberg S. Fathers' involvement and Children's Developmental Outcomes: A Systematic Review of Longitudinal Studies. *Acta Paediatr* 2008;97:153–8. <https://doi.org/10.1111/j.1651-2227.2007.00572.x>.
- [53] Pailhé A, Solaz A, Tô M. Can Daddies Learn How to Change Nappies? Evidence from a Short Paternity Leave Policy. Hal-02079059f 2018.
- [54] Pilkington P, Rominov H, Brown HK, Dennis C-L. Systematic review of the Impact of Coparenting Interventions on Paternal Coparenting Behaviour. *J Adv Nurs* 2019;75:17–29. <https://doi.org/10.1111/jan.13815>.
- [55] Bünning M. What Happens after the 'Daddy Months'? Fathers' Involvement in Paid Work, Childcare, and Housework after Taking Parental Leave in Germany. *Eur Sociol Rev* 2015;31:738–48. <https://doi.org/10.1093/esr/jcv072>.
- [56] Biaggi A, Conroy S, Pawlby S, Pariante CM. Identifying the Women at Risk of Antenatal Anxiety and Depression: A Systematic Review - ScienceDirect. *J Affect Disord* 2016;191:62–77. <https://doi.org/10.1016/j.jad.2015.11.014>.
- [57] Porter T, Paulsell D, Grosso PD, Avellar SA, Hass R, Vuong L. A Review of the Literature on Home-Based Child Care: Implications for Future Directions. Princeton, NJ: Mathematica Policy Research, 2010.

- [58] Laghi F, Baiocco R, Cannoni E, Di Norcia A, Baumgartner E, Bombi AS. Friendship in Children with Internalizing and Externalizing Problems: A Preliminary Investigation with the Pictorial Assessment of Interpersonal Relationships. *Child Youth Serv Rev* 2013;35:1095–100. <https://doi.org/10.1016/j.chilyouth.2013.05.007>.
- [59] Wustmann Seiler C, Sticca F, Gasser-Haas O, Simoni H. Long-Term Promotive and Protective Effects of Early Childcare Quality on the Social-Emotional Development in Children. *Front Psychol* 2022;13:854756. <https://doi.org/10.3389/fpsyg.2022.854756>.
- [60] OECD. Interactions between Children, Staff and Parents/Guardians in Early Childhood Education and Care Centres. 2018.
- [61] Burchinal MR, Peisner-Feinberg E, Bryant DM, Clifford R. Children’s Social and Cognitive Development and Child-Care Quality: Testing for Differential Associations Related to Poverty, Gender, or Ethnicity. *Appl Dev Sci* 2000;4:149–65. https://doi.org/10.1207/S1532480XADS0403_4.
- [62] Broekhuizen ML, van Aken MAG, Dubas JS, Leseman PPM. Child care Quality and Dutch 2- and 3-Year-Olds’ Socio-Emotional Outcomes: Does the Amount of Care Matter? *Infant Child Dev* 2018;27:e2043. <https://doi.org/10.1002/icd.2043>.
- [63] Perlman M, Fletcher B, Falenchuk O, Brunsek A, McMullen E, Shah PS. Child-Staff Ratios in Early Childhood Education and Care Settings and Child Outcomes: A Systematic Review and Meta-Analysis. *PloS One* 2017;12:e0170256. <https://doi.org/10.1371/journal.pone.0170256>.
- [64] OECD. Literature Review on Early Childhood Education and Care for Children Under the Age of 3. 2020.
- [65] Rusby JC, Jones LB, Crowley R, Smolkowski K. Associations of Caregiver Stress with Working Conditions, Caregiving Practices, and Child Behaviour in Home-Based Child Care. *Early Child Dev Care* 2013;183:1589–604. <https://doi.org/10.1080/03004430.2012.742992>.
- [66] Pfitzner N, Humphreys C, Hegarty K. Bringing men in from the margins: Father-inclusive practices for the delivery of parenting interventions. *Child Fam Soc Work* 2020;25:198–206. <https://doi.org/10.1111/cfs.12760>.
- [67] Lee JY, Knauer HA, Lee SJ, MacEachern MP, Garfield CF. Father-Inclusive Perinatal Parent Education Programs: A Systematic Review. *Pediatrics* 2018;142:e20180437. <https://doi.org/10.1542/peds.2018-0437>.
- [68] Fletcher R, Kay-Lambkin F, May C, Oldmeadow C, Attia J, Leigh L. Supporting Men through their Transition to Fatherhood with Messages Delivered to their Smartphones: A Feasibility Study of SMS4dads. *BMC Public Health* 2017;17:953. <https://doi.org/10.1186/s12889-017-4978-0>.
- [69] European Commission. Parental and Paternity Leave - Uptake by Fathers - Working Conditions - Clclavoro n.d. <https://www.readkong.com/page/parental-and-paternity-leave-uptake-by-fathers-working-5634849> (accessed June 27, 2024).
- [70] OECD. Parental Leave: Where are the Fathers? 2016.
- [71] Archambault J, Côté D, Raynault M-F. Early Childhood Education and Care Access for Children from Disadvantaged Backgrounds: Using a Framework to Guide Intervention. *Early Child Educ J* 2020;48:345–52. <https://doi.org/10.1007/s10643-019-01002-x>.
- [72] Daly M. Conceptualizing and Analyzing Family Policy and How It Is Changing. In: Nieuwenhuis R, Van Lancker W, editors. *Palgrave Handb. Fam. Policy*,

- Cham: Springer International Publishing; 2020, p. 25–41.
https://doi.org/10.1007/978-3-030-54618-2_2.
- [73] Women UN. Women in the Changing World of Work - Facts You Should Know n.d.
<https://interactive.unwomen.org/multimedia/infographic/changingworldofwork/en/index.html> (accessed April 8, 2024).
- [74] Daly M. Family Policy. In: Wright JD, editor. *Int. Encycl. Soc. Behav. Sci.* Second Ed., Oxford: Elsevier; 2015, p. 799–804. <https://doi.org/10.1016/B978-0-08-097086-8.75015-X>.
- [75] Kaufmann F-X. Politics and Policies Towards the Family in Europe: A Framework and an Inquiry into their Differences and Convergences. In: Kaufmann F-X, Kuijsten A, Schulze H-J, Strohmeier KP, editors. *Fam. Life Fam. Policies Eur.*, Oxford University Press; 2002, p. o.
<https://doi.org/10.1093/oso/9780198233282.003.0012>.
- [76] Gold S, Edin KJ, Nelson TJ. Does Time with Dad in Childhood Pay Off in Adolescence? *J Marriage Fam* 2020;82:1587–605.
<https://doi.org/10.1111/jomf.12676>.
- [77] Galovan AM, Kramer Holmes E, Schramm DG. Father Involvement, Father–Child Relationship Quality, and Satisfaction with Family Work: Actor and Partner Influences on Marital Quality 2013.
- [78] Goldacker K, Wilhelm J, Wirag S, Dahl P, Riotte T, Schober PS. Shared Leave, Happier Parent Couples? Parental Leave and Relationship Satisfaction in Germany. *J Eur Soc Policy* 2022;32:197–211.
<https://doi.org/10.1177/09589287211056187>.
- [79] Mughal S, Azhar Y, Siddiqui W. Postpartum Depression. StatPearls, Treasure Island (FL): StatPearls Publishing; 2024.
- [80] Kim P, Swain JE. Sad Dads. *Psychiatry Edgmont* 2007;4:35–47.
- [81] Areias ME, Kumar R, Barros H, Figueiredo E. Correlates of Postnatal Depression in Mothers and Fathers. *Br J Psychiatry J Ment Sci* 1996;169:36–41. <https://doi.org/10.1192/bjp.169.1.36>.
- [82] Zhao X-H, Zhang Z-H. Risk factors for Postpartum Depression: An Evidence-Based Systematic Review of Systematic Reviews and Meta-Analyses. *Asian J Psychiatry* 2020;53:102353. <https://doi.org/10.1016/j.ajp.2020.102353>.
- [83] Wang D, Li Y-L, Qiu D, Xiao S-Y. Factors Influencing Paternal Postpartum Depression: A Systematic Review and Meta-Analysis. *J Affect Disord* 2021;293:51–63. <https://doi.org/10.1016/j.jad.2021.05.088>.
- [84] Bruno A, Celebre L, Mento C, Rizzo A, Silvestri MC, De Stefano R, et al. When Fathers Begin to Falter: A Comprehensive Review on Paternal Perinatal Depression. *Int J Environ Res Public Health* 2020;17:1139.
<https://doi.org/10.3390/ijerph17041139>.
- [85] Da Costa D, Zelkowitz P, Dasgupta K, Sewitch M, Lowensteyn I, Cruz R, et al. Dads Get Sad Too: Depressive Symptoms and Associated Factors in Expectant First-Time Fathers. *Am J Mens Health* 2017;11:1376–84.
<https://doi.org/10.1177/1557988315606963>.
- [86] Eurostat. International Standard Classification of Education (ISCED) n.d.
[https://ec.europa.eu/eurostat/statistics-explained/index.php?title=International_Standard_Classification_of_Education_\(ISCED\)](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=International_Standard_Classification_of_Education_(ISCED)) (accessed January 29, 2024).
- [87] UK Government. Early Years and Childcare Enforcement Policy. GOVUK n.d.
<https://www.gov.uk/government/publications/early-years-and-childcare->

- ofsteds-enforcement-policy/early-years-and-childcare-enforcement-policy (accessed May 17, 2024).
- [88] OECD. OECD Country Note: Early Childhood Education and Care Policy in Denmark. 2001.
- [89] Nordic Approaches to Evaluation and Assessment in Early Childhood Education and Care n.d. <https://pub.norden.org/temanord2022-512/#97151> (accessed May 17, 2024).
- [90] Eurydice. Early Childhood Education and Care: France 2024. <https://eurydice.eacea.ec.europa.eu/national-education-systems/france/early-childhood-education-and-care> (accessed May 17, 2024).
- [91] OECD. Starting Strong IV: Monitoring Quality in Early Childhood Education and Care Country Note: France. 2016.
- [92] European Commission. 1 in 3 Children in the EU Now has Access to High-Quality and Affordable Childcare, Commission Report Shows 2008. <https://ec.europa.eu/newsroom/just/items/625317/en> (accessed May 17, 2024).
- [93] Eadie P, Page J, Levickis P, Elek C, Murray L, Wang L, et al. Domains of Quality in Early Childhood Education and Care: A scoping Review of the Extent and Consistency of the Literature. *Educ Rev* 2024;76:1057–86. <https://doi.org/10.1080/00131911.2022.2077704>.
- [94] LIU J, CHEN X, LEWIS G. Childhood Internalizing Behaviour: Analysis and Implications. *J Psychiatr Ment Health Nurs* 2011;18:884–94. <https://doi.org/10.1111/j.1365-2850.2011.01743.x>.
- [95] Liu J. Childhood Externalizing Behavior: Theory and Implications. *J Child Adolesc Psychiatr Nurs Off Publ Assoc Child Adolesc Psychiatr Nurses Inc* 2004;17:93–103.
- [96] Guides & Manuals. LifeCycle 2020. <https://lifecycle-project.eu/for-scientists/guides-manuals/> (accessed January 10, 2022).
- [97] Why it Matters. LifeCycle n.d. <https://lifecycle-project.eu/about-lifecycle/why-it-matters/> (accessed May 17, 2024).
- [98] Boyd A, Golding J, Macleod J, Lawlor DA, Fraser A, Henderson J, et al. Cohort Profile: The ‘Children of the 90s’—the Index Offspring of the Avon Longitudinal Study of Parents and Children. *Int J Epidemiol* 2013;42:111–27. <https://doi.org/10.1093/ije/dys064>.
- [99] Statens Serum Institut. Danish National Birth Cohort n.d. <https://en.ssi.dk/research/epidemiology/danish-national-birth-cohort> (accessed May 17, 2024).
- [100] Statens Serum Institut. Data Available n.d. <https://www.dnbc.dk/data-available> (accessed May 17, 2024).
- [101] Guedeney N, Fermanian J. Validation Study of the French Version of the Edinburgh Postnatal Depression Scale (EPDS): New Results about Use and Psychometric Properties. *Eur Psychiatry J Assoc Eur Psychiatr* 1998;13:83–9. [https://doi.org/10.1016/S0924-9338\(98\)80023-0](https://doi.org/10.1016/S0924-9338(98)80023-0).
- [102] Edmondson OJH, Psychogiou L, Vlachos H, Netsi E, Ramchandani PG. Depression in Fathers in the Postnatal Period: Assessment of the Edinburgh Postnatal Depression Scale as a Screening Measure. *J Affect Disord* 2010;125:365–8. <https://doi.org/10.1016/j.jad.2010.01.069>.
- [103] Achenbach TM. Child Behavior Checklist and Related Instruments. Use Psychol. Test. Treat. Plan. Outcome Assess., Hillsdale, NJ, US: Lawrence Erlbaum Associates, Inc; 1994, p. 517–49.

- [104] ASEBA/ Research Center for Children, Youth, and Families. Child Behavior Checklist (CBCL). n.d.
- [105] Goodman R. Psychometric Properties of the Strengths and Difficulties Questionnaire. *J Am Acad Child Adolesc Psychiatry* 2001;40:1337–45. <https://doi.org/10.1097/00004583-200111000-00015>.
- [106] University of Kansas. Scoring the Strengths & Difficulties Questionnaire for Ages 4-17 2015.
- [107] Plateforme d'Accès aux Données Elfe - 2 Mois. Ined - Inst Natl D'études Démographiques n.d. <https://plateforme-acces-donnees-elfe-france.site.ined.fr/fr/enquetes/2-mois> (accessed May 23, 2024).
- [108] INSEE. Professions et Catégories Socioprofessionnelles PCS 2003. 2003.
- [109] Apgar V. A Proposal for a New Method of Evaluation of the Newborn Infant. Originally published in July 1953, volume 32, pages 250-259. *Anesth Analg* 2015;120:1056–9. <https://doi.org/10.1213/ANE.ob013e31829bdc5c>.
- [110] European Commission. ISCED-Classification: Correspondence between ISCED 2011 and ISCED 1997 Levels 2011. https://ec.europa.eu/eurostat/documents/1978984/6037342/Comparability_ISCED_2011_ISCED_1997.pdf (accessed August 3, 2023).
- [111] Hippel Von T. P. How Many Imputations Do You Need? A Two-Stage Calculation using a Quadratic Rule. *Sociol Methods Res* 2018.
- [112] Austin PC. An Introduction to Propensity Score Methods for Reducing the Effects of Confounding in Observational Studies. *Multivar Behav Res* 2011;46:399–424. <https://doi.org/10.1080/00273171.2011.568786>.
- [113] Ridgeway G, McCarey D, Morral A. The TWANG package: Toolkit for Weighting and Analysis of Nonequivalent Groups 2006.
- [114] Griffin BA, McCaffrey DF, Almirall D, Burgette LF, Setodji CM. Chasing Balance and Other Recommendations for Improving Nonparametric Propensity Score Models. *J Causal Inference* 2017;5:20150026. <https://doi.org/10.1515/jci-2015-0026>.
- [115] Dugoff EH, Schuler M, Stuart EA. Generalizing Observational Study Results: Applying Propensity Score Methods to Complex Surveys. *Health Serv Res* 2014;49:284–303. <https://doi.org/10.1111/1475-6773.12090>.
- [116] Thierry Siméon. Weighting: ELFE Surveys General Document. 2019.
- [117] Siméon T. ELFE survey: Weighting National Survey Data. 2019.
- [118] Riley RD, Burke DL, Morris T. One-Stage versus Two-Stage Approach to IPD Meta-Analysis. *Individ. Particip. Data Meta-Anal.*, John Wiley & Sons, Ltd; 2021, p. 199–217. <https://doi.org/10.1002/9781119333784.ch8>.
- [119] Patole S, editor. Principles and Practice of Systematic Reviews and Meta-Analysis. Cham: Springer International Publishing; 2021. <https://doi.org/10.1007/978-3-030-71921-0>.
- [120] Vevea JL, Coburn KM. Maximum-Likelihood Methods for Meta-Analysis: A Tutorial using R. *Group Process Intergroup Relat* 2015;18:329–47. <https://doi.org/10.1177/1368430214558311>.
- [121] Riley RD, Higgins JPT, Deeks JJ. Interpretation of Random Effects Meta-Analyses. *BMJ* 2011;342:d549. <https://doi.org/10.1136/bmj.d549>.
- [122] R Core Team. R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing 2020.
- [123] SAS Institute Inc. Base SAS® 9.4 Utilities: Reference. 2013.

- [124] SAS Help Center: Overview: MIANALYZE Procedure n.d. https://documentation.sas.com/doc/en/statug/15.2/statug_mianalyze_overview.htm (accessed May 23, 2024).
- [125] Gaye A, Marcon Y, Isaeva J, LaFlamme P, Turner A, Jones EM, et al. DataSHIELD: Taking the Analysis to the Data, not the Data to the Analysis. *Int J Epidemiol* 2014;43:1929–44. <https://doi.org/10.1093/ije/dyu188>.
- [126] Wilson RC, Butters OW, Avraam D, Baker J, Tedds JA, Turner A, et al. DataSHIELD – New Directions and Dimensions. *Data Sci J* 2017;16:21–21. <https://doi.org/10.5334/dsj-2017-021>.
- [127] Périvier H, Verdugo G. Where Are the Fathers? Effects of Earmarking Parental Leave for Fathers in France. *ILR Rev* 2024;77:88–118.
- [128] Alan J. Hawkins, Bradford KP, Palkovitz R, Christiansen SL, Day RD, Call VR. The Inventory of Father Involvement: A Pilot Study of a New Measure of Father Involvement. *J Mens Stud* 2002;10:183–96. <https://doi.org/10.3149/jms.1002.183>.
- [129] Coelho L, Torres N, Fernandes C, Santos AJ. Quality of Play, Social Acceptance and Reciprocal Friendship in Preschool Children. *Eur Early Child Educ Res J* 2017;25:812–23. <https://doi.org/10.1080/1350293X.2017.1380879>.
- [130] Pilarz AR, Hill HD. Unstable and multiple child care arrangements and young children’s behavior. *Early Child Res Q* 2014;29:471–83. <https://doi.org/10.1016/j.ecresq.2014.05.007>.
- [131] Xiao X, Loke AY. The Effects of Co-Parenting/Intergenerational Co-Parenting Interventions during the Postpartum Period: A Systematic Review. *Int J Nurs Stud* 2021;119:103951. <https://doi.org/10.1016/j.ijnurstu.2021.103951>.
- [132] Ministère du travail, de l’emploi et de l’insertion. Le Congé de Paternité et d’Accueil de l’Enfant 2021. <https://travail-emploi.gouv.fr/droit-du-travail/les-absences-pour-maladie-et-conges-pour-evenements-familiaux/article/le-conge-de-paternite-et-d-accueil-de-l-enfant> (accessed July 17, 2024).