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AIM Children born very preterm require additional specialist care because of the health and developmental risks associated with preterm birth, but information on their health service use is sparse. We sought to describe the use of specialist services by children born very preterm in Europe.

METHOD We analysed data from the multi-regional, population-based Effective Perinatal Intensive Care in Europe (EPICE) cohort of births before 32 weeks' gestation in 11 European countries. Perinatal data were abstracted from medical records and parents completed a questionnaire at 2 years corrected age (4322 children; 2 026 females, 2 296 males; median gestational age 29wks, interquartile range [IQR] 27–31wks; median birthweight 1230g, IQR 970–1511g). We compared parent-reported use of specialist services by country, perinatal risk (based on gestational age, small for gestational age, and neonatal morbidities), maternal education, and birthplace.

RESULTS Seventy-six per cent of the children had consulted at least one specialist, ranging across countries from 53.7% to 100%. Ophthalmologists (53.4%) and physiotherapists (48.0%) were most frequently consulted, but individual specialists varied greatly by country. Perinatal risk was associated with specialist use, but the gradient differed across countries. Children with more educated mothers had higher proportions of specialist use in three countries.

INTERPRETATION Large variations in the use of specialist services across Europe were not explained by perinatal risk and raise questions about the strengths and limits of existing models of care.

What this paper adds

- Use of specialist services by children born very preterm varied across Europe.
- This variation was observed for types and number of specialists consulted.
- Perinatal risk was associated with specialist care, but did not explain country-level differences.
- In some countries, mothers' educational level affected use of specialist services.

Children born very preterm (<32wks' gestation) face higher risks of motor impairment, including cerebral palsy, vision and hearing loss, language and developmental delay, and behavioural and cognitive difficulties compared to children born at later gestational ages.[1–5] These risks rise with declining gestational age at birth.[1,2] Between 21% and 35% of children born extremely preterm (22–27wks) have been shown to have moderate to severe neurological disability in childhood.[2] Other perinatal factors also affect the probability of health difficulties later in life, most importantly, the presence of severe neonatal morbidities at discharge from the neonatal unit.[2] Up to 40% of infants born extremely preterm and 7% to 12% of infants born between 28 weeks and 31 weeks' gestation have a severe morbidity at discharge.[6,7] However, many children without severe morbidities also experience developmental problems.[8] Social factors may affect long-term prognosis, and children from socially disadvantaged families have more adverse outcomes in, for example, language development,[9] cognition,[8] and cerebral palsy.[10]

Equitable and timely access to high-quality health services is needed to ensure appropriate care for emerging health problems in this population. Studies show that health service use is higher in infants born very preterm compared to children born at term[2] and in children with developmental disabilities compared to those without.[11] Use of occupational and physical therapies is higher in children born very preterm at 18 months corrected age[12] and up to the age of 10 years to 12 years.[13] The type and number of services used depends primarily on gestational age at birth[1,4] and the severity of disabilities.[1] In the French Epidemiological Study on Small Gestational Ages (EPIPAGE)[1] cohort, one third of children born very preterm used specialized care, including occupational, speech and physiotherapy, and psychologist or psychiatrist consultations at 5 years of age.[1] Other studies suggest that families' socio-economic characteristics affect children's use of health care services. Unfavourable social circumstances have been associated with increased outpatient service use in children born very preterm in

Canada.[14] In the USA, low maternal education, poverty, and ethnic group have been associated with less access to early intervention services for high-risk infants.[15] Socio-economic characteristics have also been associated with the type of service providers consulted.[16]

While existing recommendations specify that paediatric specialist consultations, as well as sensory, developmental, and behavioral screening are needed for infants born preterm,[17,18] clear evidence-based guidelines governing post-discharge care do not exist. The importance of establishing more solid evidence-based and common guidelines has been highlighted by parent organizations and professional societies[19,20] but first, more information is needed about current practices. Existing studies provide an overview of the services used, but they are limited in their geographical coverage. Health service use may reflect both prevention and follow-up policies as well as how the health care system is organized, and are, therefore, highly context specific. In this study, the objective was to compare the use of specialist services by children born very preterm (<32wks' gestation) across Europe. The focus was on care received after discharge from hospital up to 2 years' corrected age and on investigating the differences by children's perinatal risk and mothers' social characteristics, across regions from 11 countries.

METHOD

Data source

Data were collected as part of the Effective Perinatal Intensive Care in Europe (EPICE) project, a population-based cohort of very preterm births in 19 regions in 11 European countries: Belgium (Flanders); Denmark (Eastern region); Estonia (entire country); France (Burgundy, Ile-de-France, and Northern region); Germany (Hesse and Saarland); Italy (Emilia-Romagna, Lazio, and Marche); the Netherlands (Central and Eastern region), Poland (Wielkopolska); Portugal (Lisbon and Northern region); Sweden (greater Stockholm) and the United Kingdom (East Midlands, Northern, and Yorkshire and the Humber regions). Regions were selected

based on geographic location, organizational diversity, on-site infrastructure, and expertise for implementing the protocol. Still and live births between 22 weeks' and 31 weeks and 6 days' gestation were included from all maternity hospitals over 12 months between April 2011 and September 2012. In France, the inclusions were performed over 6 months.

Perinatal data were abstracted from obstetric and neonatal records until the initial discharge from hospital, by medical staff or trained investigators. At 2 years' corrected age, parents were sent a questionnaire on the development and health of their child. Consistency and reliability were addressed in the design phase of the study; questionnaires included previously validated questions when possible and common definitions that were translated and pretested in each country.

Consent to participate in the EPICE cohort was obtained from all mothers included in the follow-up study, including for the collection of perinatal and follow-up data. Each region obtained approval from their local ethics board and/or hospital committee according to national legislations before the start of data collection. The study was also approved by the French Advisory Committee on Use of Health Data in Medical Research and the French National Commission for Data Protection and Liberties.

Study population

The EPICE cohort included 10 329 stillbirths, terminations of pregnancies, and live births before 32 weeks' gestation (Fig. S1, online supporting information). Out of 7 900 live births, 6 792 infants (86.0%) survived to discharge from the neonatal unit. Families whose child died before 2 years' corrected age (n=31) were not contacted for follow-up. Of the 6 761 children alive at 2 years, 2 336 (34.6%) did not participate in the study. The Northern region in the UK (380 children alive at 2 years) was excluded from the analyses because of concern about bias

linked to a low response rate (27.1%). After excluding the UK Northern region, the loss to follow-up varied between 0.7% and 53.0% across the countries (p<0.001). The final study sample included 4 322 children (67.7% of those eligible).

Data on use of specialist health services

Data on the use of health services were collected through the parent-report questionnaire at 2 years' corrected age. Parents were asked whether their child had seen any of the health care providers included on a prespecified list, or whether their child had seen any other health care professionals which could be answered by a free-text response. The prespecified list of providers was developed in English, then translated and adapted to local health care systems; the providers thus differed slightly across countries (Table SI, online supporting information). This analysis focused on the most commonly used services provided by specialist physicians and other health care professionals that are not routinely provided by a general practitioner or paediatrician. Free-text responses were abstracted and the most common specialist services were described. Services for similar health problems, such as psychologist and psychiatrist, were analysed together. A variable 'any specialist' was defined as having consulted, at least once since first discharge from the neonatal unit, any of the prespecified specialists for all countries. Information on paediatricians was included to assess if these consultations were more frequent where specialist use was lower.

Data on perinatal risk factors and socio-economic status

Perinatal and child characteristics included gestational age in weeks, sex, small for gestational age (birthweight <10th centile for gestational age and sex, using references developed for the cohort),[21] any congenital anomaly, bronchopulmonary dysplasia (based on need for supplemental oxygen or ventilation at 36 weeks' postmenstrual age), retinopathy of prematurity

(stages III–V, diagnosed before discharge), intraventricular haemorrhage (grades III and IV) or cystic periventricular leukomalacia, and necrotising enterocolitis needing surgery.

The mothers' highest achieved educational level was collected in the 2-year questionnaire using the International Standard Classification of Education 2011 definition and categorized as (1) high school (upper secondary) or below and (2) more than high school (post-secondary or more). Whether the mother was foreign-born was also self-reported. The mother's age at delivery was obtained from medical records.

Statistical analysis

First, responders were compared with non-responders regarding child characteristics, perinatal risk, and mother's sociodemographic factors. The use of specialist services was then described across the countries and by perinatal risk. Three risk groups were defined, based on perinatal characteristics associated with the risk of developing developmental or health problems in childhood:[2,8] (1) a high-risk group born before 28 weeks and/or with a severe neonatal morbidity (bronchopulmonary dysplasia, retinopathy of prematurity, intraventricular haemorrhage/cystic periventricular leukomalacia, or necrotising enterocolitis needing surgery) and/or a severe congenital anomaly; (2) a low-risk group born at 30 weeks or 31 weeks, not small for gestational age, without congenital anomalies, and without severe neonatal morbidity, and (3) a moderate-risk group including all other children, not classified as high or low risk. Proportions were compared using X^2 test for trend of odds and the mean number of different specialists seen across these risk groups was compared using the Kruskal–Wallis test.

To assess the effect of social factors, specialist use was compared by maternal education (high school or less vs more than high school) and birthplace (foreign vs native-born). Direct standardization was used to account for the distribution of perinatal risk within each country.

Binomial regression models were used to obtain *p*-values for the risk differences in any specialist service use across the educational groups and between foreign and native-born mothers, adjusting for perinatal risk. Adjusted mean numbers of specialists were predicted holding risk constant at the mean across social groups. *p*-values were obtained by negative binomial regressions, a method appropriate for Poisson-distributed data where the variance is greater than the mean,[22] and the Wald test, adjusted for perinatal risk. For both adjusted models, a clustered sandwich estimator was used to take into consideration intrafamily correlation for multiples.

Sensitivity analyses were performed to assess the impact of non-response on the estimates of service use using inverse probability weighting. The weights were derived using sociodemographic and medical characteristics to estimate the probability of responding to the 2-year questionnaire, following methods previously used for this cohort.[23] All analysis was performed using STATA 14.0 (Stata Corp., College Station, TX, USA).

RESULTS

The population at 2 years' corrected age consisted of 2 026 females and 2 296 males, with a median gestational age of 29 weeks (interquartile range, [IQR] 27–31; Table I) and a median birthweight of 1230g (IQR 970–1511g). Bronchopulmonary dysplasia was present in 12.6% of the children, severe and non-severe congenital anomaly in 1.1% and 7.3% respectively, retinopathy of prematurity in 3.8%, intraventricular haemorrhage/cystic periventricular leukomalacia in 6.1%, and necrotising enterocolitis needing surgery in 1.6%. Based on gestational age and perinatal factors, 26.9% were classified into the low-risk group, 38.8% into the moderate-risk group, and 34.3% into the high-risk group. Mothers had a median age of 31 years (IQR 27–35y) and a majority had more than high school education (53.6%). Among non-responders at 2 years, mothers were younger (≤24y) and more often foreign-born with singleton

pregnancies (Table SII, online supporting information). The questionnaires were completed by the mother (85.9%), father (6.0%), both (2.9%), or other responders (e.g. grandparents, 5.2%).

Overall, the highest reported specialist service use was for ophthalmologists and physiotherapists or motor development therapists (Table II). However, there was wide variation across countries: the use of ophthalmologists ranged from 23.9% in the Danish region to 99.3% in Estonia (overall 53.4%), and physiotherapists ranged from 29.5% in the UK regions to 96.4% in Estonia (overall 48.0%). Respiratory and asthma specialists were the third most used service (23.6% overall) but with a higher use of respiratory physiotherapy in French regions (63.5%). Psychologist/psychiatrist visits were more frequent in Estonia (42.0%) and in the Polish region (42.1%). Consultations with dieticians were reported more often in the UK (25.8%) and Swedish (27.9%) regions. Hearing specialists (including ear-nose-throat, audiology, and hearing screening) were reported as free-text answers in all countries except Estonia, where hearing examinations were prespecified and frequently reported (83.3%). However, the item in Estonia referred to the examination (not the specialist) and may have been provided in other settings. Use of any of the prespecified specialists varied from 53.7% (Italian regions) to 100% (Estonia). Consultations with paediatricians showed variability by country, but were not systematically higher when specialist service use was low.

Perinatal risk was associated with increased specialist use (Table III). In the lowest risk group, 64.3% had seen at least one specialist compared to 85.7% of the high-risk children ($p<0.001$). On average 1.1 specialists were reported for low-risk, 1.4 for moderate-risk, and 1.9 for high-risk children ($p<0.001$). This increase was seen in all countries except the Netherlands and Denmark.

Overall, the proportion of children having consulted at least one specialist was slightly higher for mothers with more than high school education (77.6% vs 74.2%; $p=0.009$), after

standardizing for risk group (Table IV). Significant differences by maternal educational level were found in Belgium, Germany, and Portugal. Differences were found between foreign and native-born mothers in France (any specialist use) and Germany (number of different specialists), after adjusting for risk.

The sensitivity analysis using inverse probability weights revealed slightly lower use of all services when loss to follow-up was taken into consideration (Table SIII, online supporting information). However, service use and differences between countries were otherwise very similar. The analysis by risk and educational groups yielded similar associations (data not shown).

DISCUSSION

This study provides a previously unavailable overview of specialist service use among children born very preterm in their first 2 years of life in 11 European countries. A large variability existed in the reported use of services across the countries, with use of any specialist varying from 54% to 100%. Higher perinatal risk was associated with increased specialist consultations and number of specialists. Maternal education was associated with specialist use in regions from three countries. These results reveal highly diverse approaches to the use of specialists in care of children born very preterm across Europe and the challenges of benchmarking care across countries, even when they share similar standards of living and universal health care coverage.

Our findings corroborate previous studies showing a high use of specialist services by children born preterm, much higher than the 16% in children born at 39 weeks or 40 weeks in a previous study.[1] It also confirms the documented association with perinatal risk factors.[1,14,24] However, perinatal risk did not explain differences between countries, as these persisted after

risk adjustment. This variation may be explained by differences in policies for the follow-up of infants born very preterm. For instance, Estonia, where almost all children had seen a specialist, has established national follow-up policies and a comprehensive programme including specialist care for all children born before 32 weeks. In the UK, Denmark, and Italy, where national protocols have not yet been established for follow-up of children born very preterm, specialist service use was lower, even when perinatal risk was high, possibly reflecting a focus on treatment more than prevention. Studying the content of established follow-up programmes and their ability to refer children to specialists could give a better picture of the role of specialists in screening, prevention, and treatment. Variation across countries may also reflect differences in how paediatric primary care is organized more generally, and the accessibility of paediatric services. Systems with varying provision of paediatric services exist across Europe.[25] However, there was no clear pattern across the countries with respect to using paediatric versus specialist services.

The two most commonly used services were ophthalmologist and physiotherapist, as reported previously.[12] Some services were more country specific, such as respiratory physiotherapy in France, speech therapy in Estonia, dietician in Sweden and the UK, and neurologist and psychologist/psychiatrist in Estonia and Poland. In France, respiratory physiotherapy is commonly used in the general paediatric population.[26] Speech/language therapy, which is used for feeding difficulties in this age group, were also mentioned by parents, although they were not prespecified in the questionnaire and should be included in future studies.

Children of more educated mothers were more likely to see a specialist in three of the 11 countries, which has similarly been reported for out-patient services in children born very preterm.[14] The absence of these differences in the remaining countries might be explained by

the organisation of care, such as having systematic follow-up in place, or referral or targeting practices focussing on socially disadvantaged families, and constitute areas for further investigation. Ensuring access to specialized health services for socially disadvantaged families is essential as these families are more likely to have a child born very preterm[27] and there is evidence that they may benefit more from some services.[28] Conversely, being foreign-born or not speaking the language may act as a barrier to contact with service providers.[29] Reassuringly, few differences were found between foreign and native-born women in this study.

The strengths of this study include its population-based design, geographic spread, and standardized protocol across 11 European countries. However, with limited detail collected about the frequency of consultations and whether they were for prevention or treatment, we could not consider the appropriateness of the care, nor whether specialist care was provided as part of other health services, such as motor development tests that are sometimes performed at maternal and child health centres. Neither could we distinguish private from public providers, nor assess if services had out-of-pocket costs. Another limitation was loss to follow-up, which varied across regions. Comparison of non-responders with responders showed that younger and foreign-born mothers were underrepresented, but proportions of medical risk factors were very similar in both groups. Consideration of non-response using inverse probability weighting lowered estimates of specialist use, suggesting that non-responders were less likely to use health services, but associations with risk and educational level did not change. Finally, recall bias might have affected the accuracy of the answers, but there is no reason to believe that recall bias was differential across regions as the protocol and questionnaires were standardized.

In conclusion, these data show high heterogeneity in specialist health service use among children born very preterm across European regions using a standardized parent-report instrument in 10 languages. This heterogeneity cautions about generalizing research results on

health care use from one country to others, and calls attention to the diverse models of care within Europe. Further studies on specialist service use in relation to health outcomes, use of emergency and in-patient services, parental experiences of care, and health care costs should investigate the advantages and drawbacks of these models in order to inform guidelines that are applicable across diverse health systems.

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SUPPORTING INFORMATION

Figure S1: Flow-chart illustrating the participation in the study.

Table SI: Specialist services as defined in each country specific questionnaire

Table SII: Responder and non-responder characteristics

Table SIII: Use of specialist services by country using inversed probability weighting, sorted by total use of services

REFERENCES

1. Larroque B, Ancel PY, Marret S, et al. Neurodevelopmental disabilities and special care of 5-year-old children born before 33 weeks of gestation (the EPIPAGE study): a longitudinal cohort study. *Lancet* 2008; **371:** 813–20.

2. Saigal S, Doyle LW. An overview of mortality and sequelae of preterm birth from infancy to adulthood. *Lancet* 2008; **371:** 261–9.

3. Vohr BR. Language and hearing outcomes of preterm infants. *Semin Perinatol* 2016; **40:** 510–9.

4. Johnson S. Cognitive and behavioural outcomes following very preterm birth. *Semin Fetal Neonatal Med* 2007; **12:** 363–73.

5. Pierrat V, Marchand-Martin L, Arnaud C, et al. Neurodevelopmental outcome at 2 years for preterm children born at 22 to 34 weeks' gestation in France in 2011: EPIPAGE-2 cohort study. *BMJ* 2017; **358:** j3448.

6. Edstedt Bonamy AK, Zeitlin J, Piedvache A, et al. Wide variation in severe neonatal morbidity among very preterm infants in European regions. *Arch Dis Child Fetal Neonatal Ed* 2018; doi: 10.1136/archdischild-2017-313697. [Epub ahead of print].

7. Ancel PY, Goffinet F; EPIPAGE-2 Writing Group, et al. Survival and morbidity of preterm children born at 22 through 34 weeks' gestation in France in 2011: results of the EPIPAGE-2 cohort study. *JAMA Pediatr* 2015; **169**: 230–8.

8. Beaino G, Khoshnood B, Kaminski M, et al. Predictors of the risk of cognitive deficiency in very preterm infants: the EPIPAGE prospective cohort. *Acta Paediatr* 2011; **100:** 370–8.

9. Wild KT, Betancourt LM, Brodsky NL, Hurt H. The effect of socioeconomic status on the language outcome of preterm infants at toddler age. *Early Hum Dev* 2013; **89:** 743–6.

10. Dolk H, Pattenden S, Bonellie S, et al. Socio-economic inequalities in cerebral palsy prevalence in the United Kingdom: a register-based study. *Paediatr Perinat Epidemiol* 2010; **24:** 149–55.

11. Arim RG, Miller AR, Guèvremont A, Lach LM, Brehaut JC, Kohen DE. Children with neurodevelopmental disorders and disabilities: a population-based study of healthcare service utilization using administrative data. *Dev Med Child Neurol* 2017; **59:** 1284–90.

12. Brok J, Greisen G, Madsen LP, et al. Agreement between Cochrane Neonatal reviews and clinical practice guidelines for newborns in Denmark: a cross-sectional study. *Arch Dis Child Fetal Neonatal Ed* 2008; **93:** F225–9.

13. Farooqi A, Hägglöf B, Sedin G, Gothefors L, Serenius F. Chronic conditions, functional limitations, and special health care needs in 10- to 12-year-old children born at 23 to 25 weeks' gestation in the 1990s: a Swedish national prospective follow-up study. *Pediatrics* 2006; **118:** e1466–77.

14. Luu TM, Lefebvre F, Riley P, Infante-Rivard C. Continuing utilisation of specialised health services in extremely preterm infants. *Arch Dis Child Fetal Neonatal Ed* 2010; **95:** F320–5.

15. Barfield WD, Clements KM, Lee KG, Kotelchuck M, Wilber N, Wise PH. Using linked data to assess patterns of early intervention (EI) referral among very low birth weight infants. *Matern Child Health J* 2008; **12:** 24–33.

16. Raspa M, Hebbeler K, Bailey DB Jr, Scarborough AA. Service provider combinations and the delivery of early intervention services to children and families. *Infants & Young Children* 2010; **23:** 132–44.

17. Phillips RM, Goldstein M, Hougland K, et al. Multidisciplinary guidelines for the care of late preterm infants. *J Perinatol* 2013; **33** (Suppl 2): S5–22.

18. American Academy of Pediatrics, Committee on Fetus and Newborn. Hospital discharge of the high-risk neonate. *Pediatrics* 2008; **122**: 1119–26.

19. EFCNI. Caring for Tomorrow: EFCNI white paper on maternal and newborn health and aftercare services. Karlsfeld: EFCNI; 2012. Available from: https://www.efcni.org/wp-content/uploads/2018/03/EFCNI_WP_01-26-12FIN.pdf (accessed 20 October 2018).

20. The Lancet. The unfinished agenda of preterm births. *Lancet* 2016; **388:** 2323.

21. Mikolajczyk RT, Zhang J, Betran AP, et al. A global reference for fetal-weight and birthweight percentiles. *Lancet* 2011; 3**77:** 1855–61.

22. Hilbe JM. Negative Binomial Regression. 2nd edition. Cambridge: Cambridge University Press, 2011.

23. Bonnet C, Blondel B, Piedvache A, et al. Low breastfeeding continuation to 6 months for very preterm infants: a European multiregional cohort study. *Matern Child Nutr* 2018: e12657. doi: 10.1111/mcn.12657. [Epub ahead of print]

24. Forrest CB, Riley AW, Vivier PM, Gordon NP, Starfield B. Predictors of children's healthcare use: the value of child versus parental perspectives on healthcare needs. *Med Care* 2004; **42:** 232–8.

25. van Esso D, del Torso S, Hadjipanayis A, Biver A, Jaeger-Roman E, Wettergren B, et al. Paediatric primary care in Europe: variation between countries. *Arch Dis Child* 2010; **95:** 791–5.

26. Arnoux V, Carsin A, Bosdure E, et al. [Chest X-ray and acute bronchiolitis: Are these indications decreasing?]. *Arch Pediatr* 2017; **24:** 10–6.

27. Bonet M, Smith LK, Pilkington H, Draper ES, Zeitlin J. Neighbourhood deprivation and very preterm birth in an English and French cohort. *BMC Pregnancy Childbirth* 2013; **13:** 97.

28. Spittle AJ, Treyvaud K, Lee KJ, Anderson PJ, Doyle LW. The role of social risk in an early preventative care programme for infants born very preterm: a randomized controlled trial. *Dev Med Child Neurol* 2018; **60:** 54–62.

29. Clements KM, Barfield WD, Kotelchuck M, Wilber N. Maternal socio-economic and race/ethnic characteristics associated with early intervention participation. *Matern Child Health* 2008; **12:** 708–17.

Table I: Sample characteristics

	n[a]	*n* (%) or **median [IQR]**
Gestational age in completed weeks	4322	**29 [27–31]**
<26		324 (7.5)
26–27		759 (17.6)
28–29		1152 (26.7)
30–31		2087 (48.3)
Birthweight, g	4322	**1230 [970–1511]**
Multiple birth		
Singleton	4322	2890 (66.9)
Twins		1259 (29.1)
Triplets or more		173 (4.0)
Sex: female	4322	2026 (46.9)
Small for gestational age	4322	
Yes (<10th centile)		1413 (32.8)
No (≥10th centile)		2909 (67.3)
Congenital anomaly	4321	
Severe		49 (1.1)
Non-severe		317 (7.3)
None		3955 (91.5)
Bronchopulmonary dysplasia at 36 weeks' postmenstrual age	4225	533 (12.6)
Retinopathy of prematurity stages III–V	4272	161 (3.8)
Intraventricular haemorrhage grade III or IV	4278	260 (6.1)
Necrotising enterocolitis needing surgery	4322	67 (1.6)
Perinatal risk[b]	4215	
Lower		1132 (26.9)
Moderate		1636 (38.8)
Higher		1447 (34.3)
Mother's age at delivery (y)	4322	**31 [27–35]**
≤24		537 (12.4)
25–34		2515 (58.2)
≥35		1260 (29.4)
Foreign-born mother	4308	956 (22.2)
Mother's educational level	4168	
High school or less		1936 (46.5)
More than high school		2232 (53.6)

Data reported as n (proportion) or in bold type for median [IQR]. [a]Percentages are calculated on all cases excluding missing values, as indicated. [b]Lower: over 29 weeks' gestation, without small for gestational age, severe neonatal morbidities, and congenital anomaly; Moderate: not classified as higher or lower risk; Higher: below 28 weeks' gestation or at least one neonatal morbidity or severe congenital anomaly. IQR, interquartile range.

Table II: Use of specialist services by country (sorted by total use of services)

Regions from	Total	Paedia-trician, %	Any of the prespecified services, %	Prespecified services[a]					Free text responses			
				Ophthal-mologist, %	Physiotherapist or motor development therapist, %	Respiratory, lung or asthma specialist or pulmonologist, %	Develop-mental psychologist or psychiatrist, %	Dietician or nutritio-nist, %	Hearing examination ear-nose-throat/ audiology/ hearing specialist, %	Neurologist, %	Osteo-path, %	Speech therapist, %
Belgium	308	90.0	62.8	33.1	**41.0**	13.7	8.5	1.7	2.3	0.3	2.3	1.6
Denmark	180	34.3	62.6	23.9	**45.8**	7.5	7.5	10.3	0.6	3.5[a]	2.2	0.0
Estonia	138	38.4[b]	100.0	**99.3**	96.4	16.1	42.0	3.6	83.3[a]	70.3[a]	2.2	29.7[a]
France	986	96.1	92.9	61.9	46.3	**63.5**	17.6	0.2	32.0	2.2[a]	26.9[a]	6.3
Germany	435	87.4	88.7	**78.5**	63.8	2.9	6.0	7.9	3.9	8.5[a]	4.6	1.6
Italy	731	86.4	53.7	**36.8**	30.2	7.8	10.0	3.1	5.9	26.1[a]	2.2	1.2
Netherlands	229	88.9	84.2	37.2	**79.0**	6.7	6.6	10.6	3.1	0.9	1.3	10.0
Poland	199	90.9	94.9	**90.8**	82.2	28.4	42.1	3.6	6.5	69.0[a]	0.0	10.6
Portugal	408	84.2	79.7	**67.7**	44.4	17.6	18.9	9.6	12.5	14.5[a]	0.0	1.2
Sweden	165	74.5	74.1	47.8	**54.0**	39.7	4.5	27.9	7.3	3.6[c]	0.0	1.8
UK	543	56.2	58.7	**33.6**	29.5	11.4	3.3	25.8	4.1	5.6[a]	0.0	6.5
Total	4322	81	75.9	53.4	48.0	23.6	13.3	7.9	14	13.7	7.4	4.9
n missing values		160	144	99	166	244	174	134	-	-	-	-

Most commonly used service in each country in bold type. [a]Prespecified services, i.e. services reported by the parent using a list of suggested services. [b]Paediatrician outside follow-up clinic. In Estonia, all children have a paediatrician consultation at a follow-up centre as part of follow-up. [c]Question asked in 35 of 165 cases (18.4%) in Sweden. Regions are: Belgium (Flanders); Denmark (Eastern region); Estonia (entire country); France (Burgundy, Ile-de-France, and Northern region); Germany (Hesse and Saarland); Italy (Emilia-Romagna, Lazio, and Marche); the Netherlands (Central and Eastern region), Poland (Wielkopolska); Portugal (Lisbon and Northern region); Sweden (greater Stockholm); and the UK (East Midlands and Yorkshire and the Humber regions).

Table III: Use of specialist services (proportion of any specialist and mean number of different services used) by country and level of medical risk

Regions from	Total	Lower			Moderate			Higher				
		Number of children	Any service, %	Mean number of services	Number of children	Any service, %	Mean number of services	Number of children	Any service, %	Mean number of services	p^a	p^b
Belgium	308	98	48.9	0.7	101	60.8	0.9	85	81.5	1.5	<0.001	<0.001
Denmark	180	33	50.0	0.7	64	59.4	0.9	69	72.5	1.1	0.022	0.053
Estonia	138	36	100.0	2.2	52	100.0	2.8	50	100.0	2.6	-	0.003
France	986	234	87.3	1.5	400	92.7	1.8	306	97.3	2.3	<0.001	<0.001
Germany	435	104	81.7	1.3	182	89.8	1.5	149	92.4	1.8	0.012	<0.001
Italy	731	215	42.3	0.6	284	51.9	0.8	225	66.1	1.3	<0.001	<0.001
Netherlands	229	53	81.1	1.4	86	82.6	1.3	89	88.6	1.5	0.200	0.194
Poland	199	53	96.1	2.1	62	91.8	2.3	83	96.4	2.9	0.798	<0.001
Portugal	408	98	64.8	1.1	173	80.4	1.4	137	89.2	2.0	<0.001	<0.001
Sweden	165	44	37.2	0.7	63	75.4	1.4	54	100.0	2.9	<0.001	<0.001
UK	543	164	44.9	0.6	169	51.2	0.8	200	76.8	1.6	<0.001	<0.001
Total	4322	1132	64.3	1.1	1636	75.1	1.4	1447	85.7	1.9	<0.001	<0.001

Data reported as number of children in each category, proportion of children having seen any of the prespecified services and mean number of different prespecified services seen.

[a]X^2 test for trend of odds. [b]Kruskal–Wallis test for *p*-value for mean number of services. Regions are: Belgium (Flanders); Denmark (Eastern region); Estonia (entire country); France (Burgundy, Ile-de-France, and Northern region); Germany (Hesse and Saarland); Italy (Emilia-Romagna, Lazio, and Marche); the Netherlands (Central and Eastern region), Poland (Wielkopolska); Portugal (Lisbon and Northern region); Sweden (greater Stockholm); and the UK (East Midlands and Yorkshire and the Humber regions).

Table IV: Use of specialist services (proportion of any specialist and mean number of different specialists seen) by country, maternal education level and birthplace, adjusted by medical risk

		Use of specialist services by educational level and birthplace, adjusted for risk														
Regions from		High school or less			More than high school					Foreign-born			Native				
	Total	Number of children	Any service (%)[a]	Mean number of services[b]	Number of children	Any service (%)[a]	Mean number of services[b]	p^c	p^d	Number of children	Any service (%)[a]	Mean number of services[b]	Number of children	Any service (%)[a]	Mean number of services[b]	p^c	p^d
Belgium	308	128	57.1	0.8	174	67.8	1.0	0.036	0.197	58	67.2	0.9	250	62.2	0.9	0.836	0.615
Denmark	180	27	65.2	1.1	150	63.4	0.9	0.968	0.467	18	43.1	1.0	162	63.9	0.9	0.485	0.767
Estonia	138	46	100.0	2.7	89	100.0	2.5	-	0.104	9	100.0	2.6	129	100.0	2.6	-	0.757
France	986	428	91.9	1.9	481	94.0	1.9	0.295	0.434	335	90.3	1.8	646	94.1	1.9	0.045	0.439
Germany	435	221	88.1	1.5	200	93.0	1.7	0.008	0.186	122	82.1	1.3	311	91.0	1.7	0.145	0.006
Italy	731	459	54.6	0.8	266	51.0	0.8	0.406	0.512	188	53.2	0.8	543	53.5	0.8	0.994	0.935
Netherlands	229	39	87.5	1.6	187	84.0	1.4	0.873	0.173	27	76.2	1.2	202	85.4	1.4	0.377	0.269
Poland	199	114	93.8	2.4	83	97.6	2.6	0.081	0.069	1	-	2.2	198	-	2.5	-	0.062
Portugal	408	228	74.7	1.4	175	86.2	1.7	0.011	0.013	76	84.1	1.6	332	78.8	1.5	0.828	0.408
Sweden	165	71	70.6	1.4	93	75.3	1.5	0.396	0.537	48	66.4	1.3	117	75.5	1.5	0.280	0.535
UK	543	175	56.7	0.9	334	59.9	1.0	0.519	0.693	74	51.0	0.9	462	59.8	1.0	0.229	0.378
Total	4322	1936	74.2	1.4	2232	77.6	1.5	0.009	0.170	956	75.1	1.4	3352	76.2	1.4	0.456	0.227

Data reported as number of children in each category, proportion of children having seen any of the prespecified services and mean number of different prespecified services seen. [a]Proportions adjusted by level of medical risk by direct standardization. [b]Adjusted predictions of mean number of services holding risk constant at mean across social groups. [c]*p*-value for risk difference adjusted for perinatal risk and clustering for multiples, using binomial regression. [d]*p*-value for difference in mean number of specialists seen adjusted by risk and clustering for multiples, using Wald test after negative binomial regression. Regions are: Belgium (Flanders); Denmark (Eastern region); Estonia (entire country); France (Burgundy, Ile-de-France, and Northern region); Germany (Hesse and Saarland); Italy (Emilia-Romagna, Lazio, and Marche); the Netherlands (Central and Eastern region), Poland (Wielkopolska); Portugal (Lisbon and Northern region); Sweden (greater Stockholm); and the UK (East Midlands and Yorkshire and the Humber regions).

SUPPORTING INFORMATION

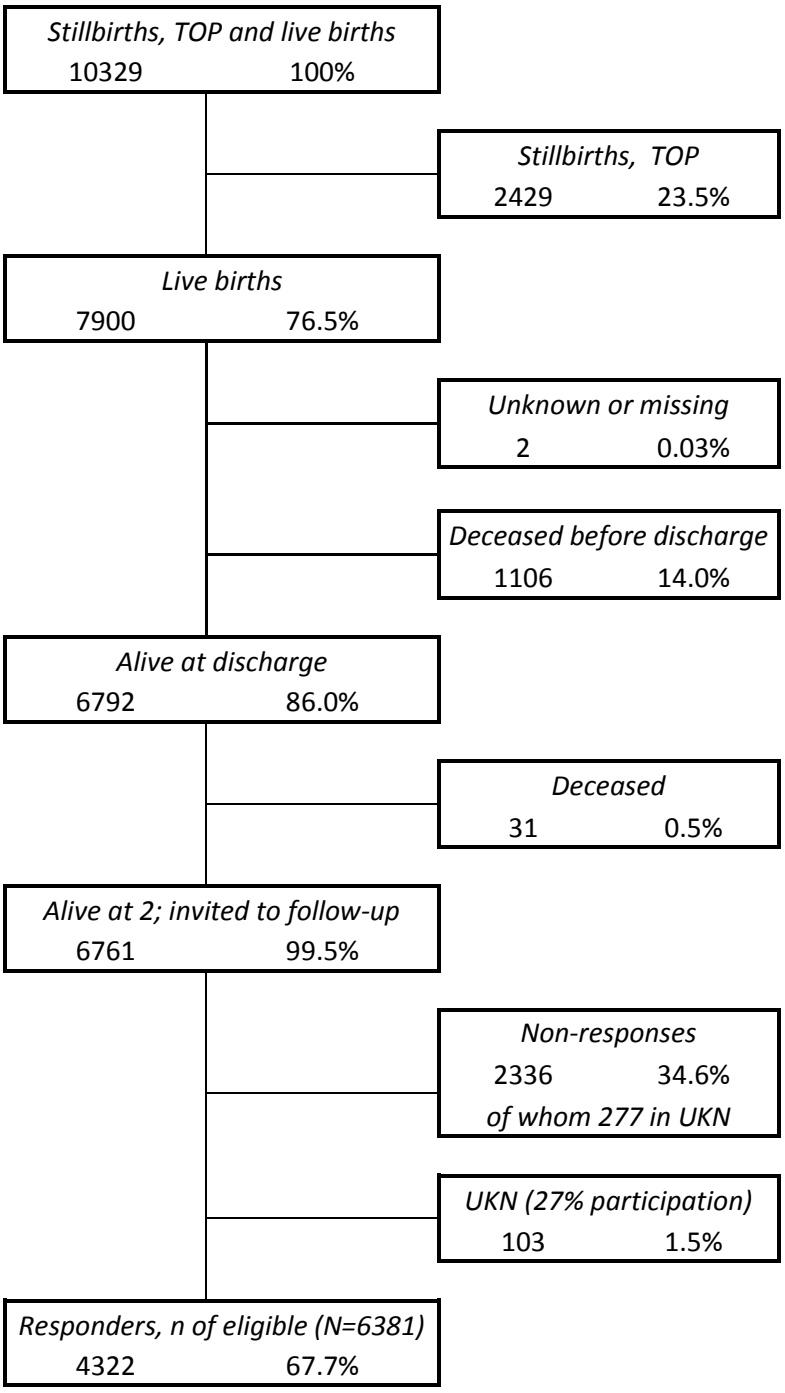

Figure SI: *Flow-chart illustrating the participation in the study. TOP: Terminations of pregnancy; UKN: UK Northern Region*

Table SI: Specialist services as defined in each country specific questionnaire. Only freetext answers obtained where crossed out cells.

Pre-specified services and/or free-text answers	UK	FRANCE	SWEDEN	DENMARK	GERMANY	BELGIUM & THE NETHERLANDS	PORTUGAL	ITALY	POLAND	ESTONIA
Paediatrician	Paediatrician	Un(e) pédiatre ***Paediatrician***	Barnläkare ***Paediatrician***	Børnelæge ***Paediatrician***	Kinderärztin/ Kinderarzt ***Paediatrician***	Kinderarts ***Paediatrician***	Pediatra ***Paediatrician***	Pediatra *(oltre le visite di controllo presso la neonatologia)* ***Paediatrician (outside check-up visit at neonatal unit)***	Pediatra ***Paediatrician***	Lastearst väljaspool eelnevaid asutusi ***Pediatrician outside the follow-up clinic***
Physiotherapist or motor development therapist	Physiotherapist/ Motor development therapist	Des séances de kinésithérapie motrice ***Physiotherapy sessios***	Sjukgymnast ***Physiotherapist***	Fysioterapeut ***Physiotherapist***	Physiotherapeut(in)/ Krankengymnast(in) ***Physiotherapist***	Fysiotherapeut ***Physiotherapist***	Fisioterapeuta/ Terapeuta de desenvolvimento motor ***Physiotherapist/ Motor development therapist***	Fisioterapista/ Terapista della motricità (oltre le visite di controllo presso la neo-natologia) ***Physiotherapist/Motor development therapist (outside check-up visit at neonatal unit)***	Fizjoterapeuta/ Rehabilitant ***Physiotherapist/ Rehabilitation***	Füsioterapeut ***Physiotherapist***
	Motor development therapist	Un(e) psycho-motricien(ne) ***Psychomotor therapist***				Therapeut voor motorische ontwikkeling ***Motor development therapist***				
Resporatory, lung or asthma specialist, allergologist, pulmonologist	Respiratory/ Asthma specialist	Des séances de kinési-thérapie respiratoire ***Respiratory physiotherapy***	Andningsmottagning eller lungmottagning ***Respiratory or lung specialist***	Lungespecialist / astmaspecialist ***Lung specialist/ asthma specialist***	Lungenspezialist(in)/ Asthmaspezialist(in) ***Lung specialist/ asthma specialist***	Ademhalings-/astmaspecialist ***Respiratory/ asthma specialist***	Imuno-alergologista/ pneumologista ***Immuno-allergist / pulmonologist***	Specialista in malattie respiratorie (oltre le visite di controllo presso la neo-natologia) ***Specialist in respiratory diseases (outside check-up visit at neonatal unit)***	Pulmonolog ***Pulmonologist***	Kopsuarst ***Allergologist/ pulmonolmogist***
Psychologist or developmental psychologist	Developmental or behavioural psychologist	Un(e) psychologue ***Psychologist***	Psykolog ***Psychologist***	Udviklings- eller adfærdspsykolog **Developmental or behavioural psychologist**	Entwicklungspsycholo gin ***Develomental psychologist***	Ontwikkelings- of gedragspsycholoog **Developmental or behavioural psychologist**	Psicólogo (do comportamento ou do desenvolvimento) **Psychologist (behavior or development)**	Psicologo dello sviluppo in età evolutiva (oltre le visite di controllo presso la neonatologia) ***Developmental psychologist*** **(outside check-up visit at neonatal unit)**	Psycholog ***Psychologist***	Lastepsühholoog ***Child psychologist***
Psychiatrist	Psychiatrist	Un(e) psychiatre ***Psychiatrist***	Psykiater ***Psychiatrist***	Børnepsykiater ***Child psychiatrist***	Psychiater(in) ***Psychiatrist***	Psychiater ***Psychiatrist***	Psiquiatra ***Psychiatrist***		Psychiatra ***Psychiatrist***	Lastepsühhiaater ***Child psychiatrist***
Dietician or nutritionist	Dietician	Un(e) diététicien(ne) ***Dietician***	Dietist ***Dietician***	Diætist ***Dietician***	Ernährungsberater(in) ***Dietician***	Diëtist(e) ***Dietician***	Nutricionista/Dietista ***Nutritionist/Dietist***	Dietista *(oltre le visite di controllo presso la neonatologia)* ***Dietician (outside check-up visit at neonatal unit)***	Dietetyk ***Dietician***	Dieetõde ***Dietician***
Ophthalmologist or eye specialist	Ophthalmologist	Un(e) orthoptiste/ ophtalmologiste (spécialiste des yeux) ***Optometrist/ ophthalmologist (eye specialist)***	Ögonläkare /Ortoptist ***Ophthalmologist/ orthoptist***	Øjenspecialist ***Ophthalmologist***	Augenärztin/ Augenarzt ***Ophthalmologist / eye doctor***	Oogspecialist ***Ophthalmologist***	Oftalmologista ***Ophthalmologist***	Oculista *(oltre le visite di controllo presso la neonatologia)* ***Oculist (outside check-up visit at neonatal unit)***	Okulista ***Oculist***	Silmaarst ***Ophthalmologist***
Neurologist	Neurologist	Un(e) neurologue ***Neurologist***	*« Neurologist » asked in some questionnaires*	Neurolog ***Neurologist***	Neuropädiater(in) ***Child neurologist***		Neurologista ***Neurologist***	Neuropsichiatra infantile / Neurologo (oltre le visite di controllo presso la neonatologia) ***Child neuro-psychologist / Neurologist (outside check-up visit at neonatal unit)***	Neurolog ***Neurologist***	Lasteneuroloog ***Child neurologist***
Speech therapist										Logopeed ***Speech therapist***
Hearing examination/ ear specialist/ ENT/audiology										Kuulmisuuringud ***Hearing examinations***
Osteopath		Ostéopathe ***Osteopath***								

Table SII: Responder and non-responder characteristics

	Responders at 2 years (N=4322)	**Non-responders at 2 years** (N=2059)
	n(%) or median [IQR]	**n(%) or median [IQR]**
Gestational age, weeks	29 [27-31]	30 [28-31]
<26	324 (7.5)	175 (8.5)
26-27	759 (17.6)	297 (14.4)
28-29	1152 (26.7)	554 (26.9)
30-31	2087 (48.3)	1033 (50.2)
Total	4322 (100.0)	2059 (100.0)
Birth weight, grams	1230 [970-1511]	1250 [985-1525]
Multiple birth		
Singleton	2890 (66.9)	1456 (70.8)
Twins or triplets	1432 (33.1)	602 (29.3)
Total	4322 (100.0)	2058 (100.0)
Sex of child		
Male	2296 (53.1)	1115 (54.2)
Female	2026 (46.9)	943 (45.8)
Undetermined	0 (0.0)	1 (0.1)
Total	4322 (100.0)	2059 (100.0)
Small for gestational age		
No (>10^{th} percentile)	2909 (67.3)	1401 (68.1)
Yes (≤10^{th} percentile)	1413 (32.7)	657 (31.9)
Total	4322 (100.0)	2058 (100.0)
Congenital anomaly		
None	3957 (91.6)	1898 (92.2)
Non-severe	315 (7.3)	138 (6.7)
Severe	49 (1.1)	23 (1.1)
Total	4321 (100.0)	2059 (100.0)
Bronchopulmonary dysplasia at 36 weeks postmenstrual age		
No	3692 (87.4)	1740 (86.3)
Yes	533 (12.6)	276 (13.7)
Total	4225 (100.0)	2016 (100.0)
Retinopathy of prematurity stages III-V		
No	4111 (96.2)	1952 (96.6)
Yes	161 (3.8)	68 (3.4)
Total	4272 (100.0)	2020 (100.0)
Intraventricular haemorrhage grades III-IV or cystic periventricular leukomalacia		
No	4018 (93.9)	1882 (92.8)
Yes	260 (6.1)	146 (7.2)
Total	4278 (100.0)	2028 (100.0)
Necrotising enterocolitis with surgery		
No	4255 (98.5)	2020 (98.1)
Yes	67 (1.6)	39 (1.9)
Total	4322 (100.0)	2059 (100.0)
Overall perinatal risk		
Low	1132 (26.9)	575 (28.7)
Moderate	1636 (38.8)	764 (38.2)
High	1447 (34.3)	662 (33.1)
Total	4215 (100.0)	2001 (100.0)

Data reported as median [IQR: interquartile range] or n(proportion)

Table SII, continued: Responder and non-responder characteristics

	Responders at 2 years (N=4322)	**Non-responders at 2 years** (N=2059)
	n(%) or median [IQR]	**n(%) or median [IQR]**
Mother's age in years at delivery	31 [27-35]	29 [25-34]
≤24	537 (12.4)	488 (23.7)
25-34	2515 (58.2)	1098 (53.3)
≥35	1270 (29.4)	473 (23.0)
Total	4322 (100.0)	2059 (100.0)
Mother's country of birth		
Foreign-born	956 (22.2)	500 (38.4)
Native	3352 (77.8)	802 (61.6)
Total	4308 (100.0)	1302 (100.0)
Mother's educational level[a]		
High school or less[b]	1936 (46.5)	
More than high school[c]	2232 (53.6)	
Total	4168 (100.0)	
Country		
Belgium	308 (7.1)	345 (16.8)
Denmark	180 (4.2)	106 (5.2)
Estonia	138 (3.2)	1 (0.1)
France	986 (22.8)	117 (5.7)
Germany	435 (10.1)	222 (10.8)
Italy	731 (16.9)	237 (11.5)
The Netherlands	229 (5.3)	101 (4.9)
Poland	199 (4.6)	50 (2.4)
Portugal	408 (9.4)	197 (9.6)
Sweden	165 (3.8)	75 (3.6)
UK	543 (12.6)	608 (29.5)
Total	4322 (100.0)	2059 (100.0)

Data reported as median [IQR: interquartile range] or n(proportion)
[a]*Not available for non-responders at 2 years*
[b]*ISCED levels 0-3 (early childhood education to upper secondary)*
[c]*ISCED levels 4-8 (post-secondary to doctoral)*

Table SIII: Use of specialist services by country using inversed probability weighting, sorted by total use of services

			Specialised services								
			Pre-specified services*					Free text responses			
Regions from:	Paediatrician	Any of the pre-specified services	Ophthalmologist	Physiotherapist or motor development therapist	Respiratory, lung or asthma specialist or pulmonologist	Developmental psychologist or psychiatrist	Dietician or nutritionist	Hearing examination/ ENT/audiology/ hearing specialist	Neurologist	Osteopath	Speech therapist
	%	%	%	%	%	%	%	%	%	%	%
Belgium	89.3	61.2	33.0	***38.4***	13.5	7.5	1.4	2.1	0.3	2.2	1.4
Denmark	34.7	60.5	22.6	***44.5***	6.9	6.8	10.1	0.5	3.5*	2.2	0.0
Estonia	38.5[a]	100.0	***99.3***	96.4	16.1	42.1	3.6	83.3*	70.3*	2.2	29.7*
France	96.0	92.8	61.6	46.5	***63.7***	17.5	0.2	32.1	2.2*	26.3*	6.3
Germany	87.0	87.9	***77.8***	63.8	2.9	6.0	8.7	3.8	8.9*	4.3	1.6
Italy	86.0	53.9	***36.5***	30.4	8.0	9.8	3.2	5.4	26.1*	2.1	1.0
Netherlands	88.7	84.7	37.7	***78.7***	7.1	7.1	11.2	3.2	0.9	1.3	9.6
Poland	90.7	95.0	***90.8***	82.4	28.9	41.9	3.7	6.3	69.5*	0.0	10.6
Portugal	84.4	79.9	***66.8***	45.5	19.3	20.5	10.6	12.1	15.7*	0.0	1.0
Sweden	75.2	71.3	46.9	***51.7***	37.9	4.9	27.8	6.4	3.4[b]	0.0	2.0
UK	54.4	57.7	***33.4***	27.9	12.3	3.4	26.2	3.5	5.8*	0.0	6.5
Total	78.8	73.0	50.3	45.8	21.0	11.9	9.5	11.2	12.4	5.7	4.4

Most commonly used service in each country in bold. Weighted proportions derived using sociodemographic and medical characteristics to estimate the probability of responding to the two-year questionnaire. Variables used to construct weights include maternal age, foreign origin, parity, breastfeeding at discharge, previous caesarean, region of birth, gestational age, multiple pregnancy, pregnancy complications (premature rupture of membranes, antepartum haemorrhage), mode of delivery, small for gestational age, Apgar score, congenital anomalies, neonatal morbidities (bronchopulmonary dysplasia, any severe morbidity), neonatal transport, level of unit of discharge, neonatal care (respiratory support, surgery) as described in reference 23.

[a] *Paediatrician outside follow-up clinic. In Estonia, all children have a paediatrician consultation at a follow-up centre as part of follow-up.*

[b] *Question asked in 35 of 165 cases (18,4%) in Sweden.*

**Pre-specified services, i.e. services reported by the parent using a list of suggested services*

Regions are: Belgium (Flanders); Denmark (Eastern Region); Estonia (entire country); France (Burgundy, Ile-de-France and the Northern region); Germany (Hesse and Saarland); Italy (Emilia-Romagna, Lazio and Marche); the Netherlands (Central and Eastern region), Poland (Wielkopolska); Portugal (Lisbon and Northern region); Sweden (greater Stockholm) and the United Kingdom (East Midlands and Yorkshire & Humber regions)