



Parental practices that influence children's development: how often are they implemented and by whom—results from the NASCITA birth cohort study

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Abstract

This study aims to assess how commonly 15 parental practices, known to have positive effects on child and adult health, are carried out by families in Italy, if they are related, and which characteristics are associated with implementation. Children participating in the NASCITA Cohort, a prospective study in which family pediatricians in Italy collect data on children and their families, were included if they had sufficient data. Data on practice implementation, socio-demographic characteristics, and interrelatedness between practices were analyzed. In all, 3337 children were included. Their mothers had an average age at birth of 33 years (range 17–52) and medium-high levels of education (86% of mothers) and employment (72%). No smoking or alcohol in pregnancy, supine infant sleeping position, and tummy time were the most commonly implemented practices (by over 85% of mothers, each), while the least common was exclusive breastfeeding at 6 months (28%). Parental practices are related and several socio-demographic characteristics influence their implementation, with mother's educational level and geographic area of residence influencing most of the practices (each influencing 12 of 15 practices). Low educational level (OR 0.34; 95% CI 0.26–0.44), being born abroad (OR 0.43; 95% CI 0.34–0.56), and residing in the South (OR 0.49; 95% CI 0.41–0.58) most reduce the probability of implementing numerous supportive practices (all three $P < 0.001$).

Conclusion: Socio-demographic factors contribute significantly to carrying out supportive practices. Future interventions should address the identified inequalities, prioritizing families most in need. Direct involvement of pediatricians is warranted given their favorable position for promoting positive behaviors.

What is Known:

- Several parental actions in the early life of a child are known to have positive effects on later child health and development.
- While folic acid supplementation and exclusive breastfeeding have been promoted for years, other supporting actions are less well-known.

What is New:

- Rates of parental adherence to the different supportive actions varied greatly and actions were often scantily adopted.
- Socio-demographic characteristics influenced adherence, with young, unemployed mothers with low educational levels, living in the South, or who were born abroad adhering significantly less.

Keywords Child development · Cohort studies · Italy · Lifestyle · Pediatrics

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Abbreviations

NASCITA NAscere e creSCere in ITAlia
OR Odds ratio
Tdap Tetanus-diphtheria-pertussis

Introduction

Investing in children's health, education, and development is beneficial for children, their future offspring, and society as a whole [1]. The perinatal period and the first few years of life are crucial moments for the later health and development of a child. Different factors and exposures

in what are also called the first 1000 days can enhance development and prevent health issues into adulthood, from obesity to chronic diseases [2]. Nurturing care is a concept that encompasses many parental and caregiver behaviors that make it possible for a child to thrive.

In this context, parenting interventions to improve caregivers' practices have been set up worldwide and are effective [3, 4]. The benefits of some preventive interventions during pregnancy and in the first few months of life are well well-known and documented, for example, folic acid supplementation, avoidance of smoke and alcohol in pregnancy, infant immunization, and exclusive breastfeeding for at least 6 months. Other interventions are implemented with the aim to promote child development and improve parent-child interactions, such as the US' Reach Out and Read and Italy's Nati per Leggere, for example, which support reading aloud [5, 6]. Primary care has been identified as a potentially powerful, low-cost setting to implement preventive interventions [6, 7].

Beyond the effectiveness of the interventions, it is crucial to monitor their adoption by parents and the factors that promote or reduce adherence to these practices. Few studies are available, in particular in the Italian context, and most of those available did not have a longitudinal design [8] and were focused only on specific interventions (e.g., folic acid supplementation, breastfeeding) [9, 10]. A comprehensive evaluation of parents' overall attitude towards adopting these practices is lacking. In this context, we wished to assess the extent to which 15 parental practices, embedded in the nurturing care concept and known to have positive effects on childhood health and development, were followed by parents in pregnancy and in the first year of life, which parental characteristics were associated with taking, or not taking, these practices and how these practices relate to each other.

Methods

We used the NASCITA Cohort [11, 12], a population-based, prospective study that collects information on a cohort of 5054 newborns and their families from birth through the preschool age throughout Italy, to assess adherence to the parental practices. Enrollment has been described elsewhere [11]. Briefly, pediatric primary care in Italy is free and guaranteed by family pediatricians. Pediatricians belonging to a national association of pediatricians (Associazione Culturale Pediatri) were asked to participate and to invite other pediatricians. Between April 2019 and July 2020, participating pediatricians enrolled, for a 1-year period, all newborns presenting for their first visit, and asked parents for information on demographics and family characteristics. The pediatricians are located throughout Italy and collect data mostly during well-child visits.

In order to have a comparable population of children, only healthy-born children were included: children with a birthweight ≥ 2500 g; born at ≥ 37 weeks gestational age; and who did not need neonatal resuscitation, had no malformations, and had not been admitted to the intensive care unit. Of the children meeting these criteria, 904 were not assessable for the specific aims of this study due to the following reasons: 791 were missing one or more of the four programmed visits with the pediatrician in the first year (mostly due to the COVID-19 pandemic), and 113 attended all the visits, but had insufficient data on the parental practices. The remaining 3337 were included in the analyses (Fig. 1).

Variables

The 15 supportive practices considered were as follows: (1) proper folic acid intake; (2) maternal pertussis vaccination in pregnancy; (3) no alcohol in pregnancy; (4) no smoking in pregnancy; (5) reading aloud in pregnancy; (6)

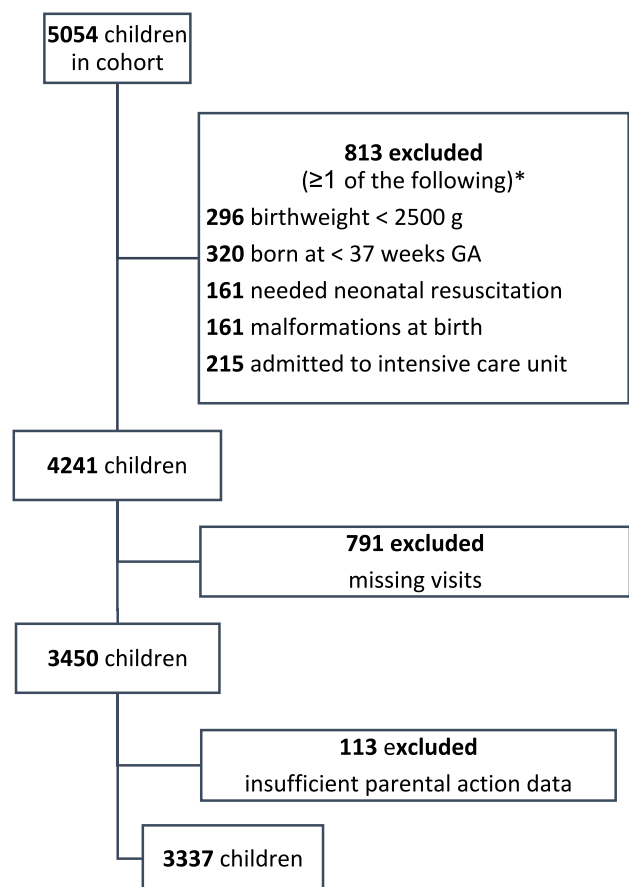


Fig. 1 Flow chart of population selection. *The sum of the exclusion criteria is more than 813 because some categories overlap (e.g., low birth weight/preterm/admitted to intensive care unit)

infant supine sleeping position; (7) child pneumococcal vaccine; (8) exclusive breastfeeding; (9) tummy time; (10) reading aloud to child; (11) listening to music together; (12) outdoors time; (13) minimizing screen exposure; (14) TV-on time ≤ 4 h; (15) bedtime routine. The practices chosen concern children's physical, psychological, and behavioral development and their general well-being. Eight (numbers 1–4; 6–8; 10) were chosen because they have been promoted in Italy since 2007 through a national surveillance program that includes medical education for health personnel and local promotion tools for families and communities [13]. The other seven practices (numbers 5; 9; 11–15) were selected based on consolidated information from promotion initiatives in Italy or on their increasingly well-known effects [14]. The pneumococcal vaccine in children was selected as a proxy for the parents' intention to vaccinate their children since it is not obligatory in Italy, but is strongly recommended (details in Supplementary Methods 1).

These practices were assessed individually and grouped into three general intervention areas, based loosely on the time period in which they are carried out by parents: (1) prevention in pregnancy—folic acid, vaccination in pregnancy, no alcohol, no smoking, reading aloud; (2) prevention after birth—supine sleeping position, childhood vaccination, exclusive breastfeeding at 6 months; (3) direct accompaniment actions (lifestyle practices)—tummy time, reading aloud, listening to music aloud, bedtime routine, outdoors time, screen exposure, TV-on time in the home.

Statistical analysis

A network analysis was performed to evaluate the interactions between the 15 practices, and after the estimation of partial correlations, a weighted network structure showing the individual practices was produced (Supplementary Methods 2 for details).

Univariate analyses were carried out to verify if there were significant differences in socio-demographic characteristics between the assessable and non-assessable populations. Univariate and multivariable analyses were also performed to test the socio-demographic characteristics of the mothers in relation to implementing the single practices, correcting the odds ratios (ORs) for the multiple covariates considered in order to assess the influence of each family characteristic independently. Log-binomial regression models were used for all multivariable analyses. Confidence intervals with a *P* value of 0.05 were considered. Analyses were carried out using frequency distributions for categorical variables; summarized using proportions, mean, and range for continuous variables; and tested using chi-square and Fisher's exact tests, where applicable.

Furthermore, considering all the practices on the same importance level, we evaluated the characteristics of families

who were highly adherent to good practices (implementing ≥ 10 practices, i.e., more than the median number). We then performed multivariable analyses to assess which characteristics influence the greater likelihood of implementing numerous practices, calculating odds ratios and confidence intervals. Log-binomial regression models were used. All variables were entered into two models, the first considering and the second not considering, missing values, to assess whether any significant differences in the two populations were present, and a stepwise regression analysis was conducted. The Hosmer-Lemeshow test and calibration belt test designed by Nattino et al. [15] were used to determine the goodness of fit of the logistic regression models. To measure multicollinearity, we calculated the variance inflation factor (VIF) in our model [16].

All data management and analyses were performed using STATA and SAS software.

Results

A total of 3337 children were included in the analysis. The socio-demographic characteristics of the families involved, and the comparison of assessable versus not assessable families, are reported in Table 1. Slight differences were observed between the two samples concerning maternal educational level, occupational status, geographic and residential areas, place of birth, and birth type. The average and median number (range 2–15) of supportive practices "received" by children was 9, with 8 covering the 25th and 11 covering the 75th percentiles.

Figure 2 shows the frequency distributions of the three broad "intervention" areas into which the practices were grouped. Compliance within each area varied greatly (e.g., in the first area, prevention in pregnancy, only 33% of mothers had gotten vaccinated for pertussis, while 94% had avoided smoke). Considering all three areas, the most common practices ($> 75\%$ coverage) were no alcohol or smoking in pregnancy, supine sleeping position, tummy time, listening to music together, and TV-on time ≤ 4 h. The least common was exclusive breastfeeding at 6 months (930 mothers, 28%).

Univariate and multivariable analyses

The univariate analyses showing the relationship between socio-demographic characteristics and the implementation of the single practices are reported in Supplementary Table 2. In general, maternal educational level and employment influenced most of the practices (13 out of 15, each), with low educational level negatively influencing all 13 practices and being unemployed negatively influencing 12 of the 13. Area of residence had an impact

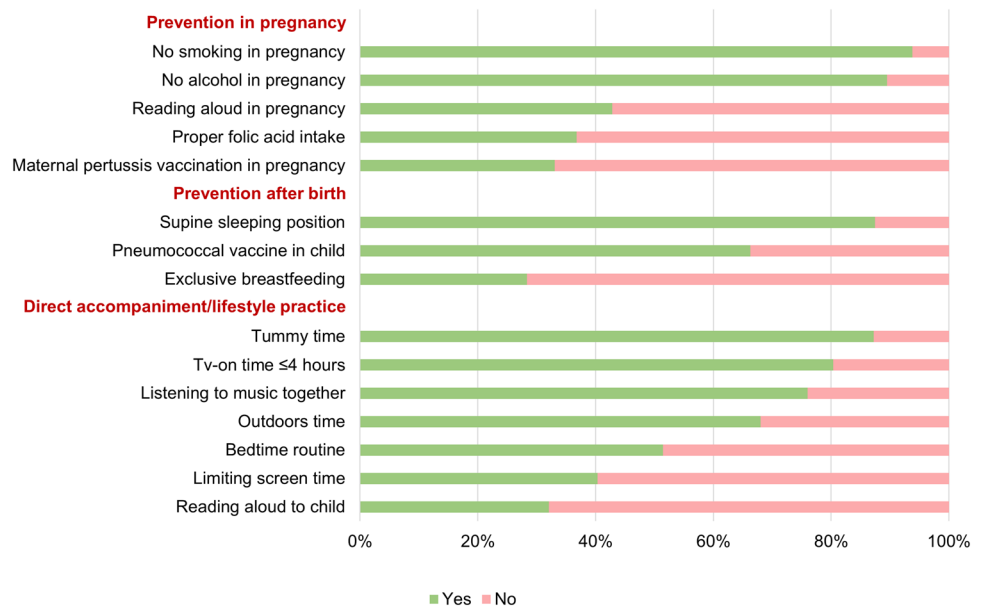
Table 1 Socio-demographic characteristics of the families involved, comparing the population of children included in the analyses (n. 3337) with the population not assessable for missing visits and/or insufficient data for parental actions (n. 904)

	No. 3337 (%)	N. 904 (%)	χ^2 or <i>t</i> (<i>P</i> value)
Mother's age, years (mean; min–max):	33.02; 17–52	32.62; 16–49	1.00 (0.94)
Mother's age category (years)			
< 30	797 (24.3)	238 (27.4)	4.22 (0.12)
30–34	1181 (36.0)	314 (36.1)	
≥ 35	1299 (39.6)	318 (36.6)	
Total	3277 (100.0)	870 (100.0)	
Mother's educational level^a			
Low	470 (14.2)	175 (19.8)	3425.93 (<0.001)
Medium-high	2840 (85.8)	708 (80.2)	
Total	3310 (100.0)	883 (100.0)	
Mother's occupational status			
Employed	2386 (71.9)	570 (63.8)	25.31 (<0.001)
Unemployed	932 (28.1)	324 (36.2)	
Total	3318 (100.0)	894 (100.0)	
Geographic area			
North	1603 (48.0)	371 (41.0)	14.30 (<0.001)
Center	635 (19.0)	202 (22.3)	
South	1099 (32.9)	331 (36.6)	
Total	3337 (100.0)	904 (100.0)	
Type of residential area^b			
Urban	1303 (39.1)	358 (39.7)	4235.04 (<0.001)
Rural/suburban	2033 (60.9)	544 (60.3)	
Total	3336 (100.0)	902 (100.0)	
Mother born in Italy			
Yes	2916 (87.6)	740 (82.5)	15.55 (<0.001)
No	414 (12.4)	157 (17.5)	
Total	3330 (100.0)	897 (100.0)	
Mother's co-living status			
Living with spouse/partner	3179 (96.3)	840 (94.9)	3.35 (0.07)
Single	123 (3.7)	45 (5.1)	
Total	3302 (100.0)	885 (100.0)	
Mother's first child			
Yes	1809 (54.4)	484 (53.7)	0.74 (0.69)
No	1515 (45.6)	418 (46.3)	
Total	3324 (100.0)	902 (100.0)	
Pre-pregnancy BMI			
Underweight	239 (7.3)	55 (6.8)	0.91 (0.82)
Normal weight	2207 (67.5)	540 (67.2)	
Overweight	574 (17.5)	139 (17.3)	
Obese	251 (7.7)	69 (8.6)	
Total	3271 (100.0)	803 (100.0)	
Birth type			
Spontaneous	2260 (67.7)	577 (63.8)	4.93 (0.03)
Cesarean/assisted	1076 (32.3)	327 (36.2)	
Total	3336 (100.0)	904 (100.0)	

^aEducational level: low, no schooling or primary versus high, secondary school or university

^burban vs rural/suburban areas were defined according to the Eurostat classification

Fig. 2 Frequency distributions of the three areas



on 12 practices, with living in the South reducing the implementation of 8 practices.

The multivariable analyses (Table 2) confirmed the mother’s educational level and geographic area of residence as the variables that influenced the implementation of most of the practices. In particular, the mother’s educational level influenced the implementation of 12, while living in the South influenced, positively or negatively, the implementation of 11 practices. Tummy time and child pneumococcal vaccination were the practices less influenced by socio-demographic characteristics.

The strongest associations in the multivariable analysis were found between living in the South and decreased likelihood of getting vaccinated in pregnancy (aOR 0.15, 95% CI 0.12–0.18) and between living in the South and increased likelihood of avoiding alcohol in pregnancy (aOR 3.13, 95% CI 2.32–4.21). Supplementary Table 3 reports the full details for each practice, divided into the three general intervention areas.

The multivariable analysis performed to evaluate the association between socio-demographic characteristics and extent of implementation of good practices (Table 3) revealed that several characteristics significantly reduced the probability of

Table 2 Multivariable analyses showing relationship (adjusted odds ratios) between socio-demographic characteristics and implementation of the single practices. Significant associations (*P* value 0.05) are colored

Variable	Value	1 ^a	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sex	F vs M											0.82		0.84		
Geographic area	C vs N		0.37	2.79				0.58				1.72	1.56			1.98
	S vs N	0.57	0.15	3.13			0.65		0.52		0.60	1.51	0.29	0.53	0.46	1.88
Mother's age	<30 vs 30-34	0.53	0.75			0.70					0.80				0.74	
	>=35 vs 30-34	1.43														
Mother's educational level	Low vs High	0.69	0.60		0.37	0.40	0.51		0.69	0.57	0.45	0.62	0.72	0.62	0.46	
Maternal employment	No vs Yes	0.73	0.73	1.56	0.66	0.77			0.74		0.72	0.80	0.78	0.69		
Type of residential area	Rural vs Urban		0.79	1.45				0.68				0.82			0.63	
Mother born in Italy	No vs Yes	0.55				0.60					0.51	0.61	0.69	0.59	0.51	0.65
Mother's co-living status	Single vs Living with spouse/partner				0.41								0.67		0.74	
Primiparous	Yes vs No	1.61	1.55			0.27					0.61	1.51	1.21	0.72	1.65	
Birth type	Cesarean/assist. vs Spontaneous							0.67								

^aPractices: 1) Proper folic acid intake; 2) Maternal pertussis vaccination in pregnancy; 3) No alcohol in pregnancy; 4) No smoking in pregnancy; 5) Reading aloud in pregnancy; 6) Supine sleeping position; 7) Child pneumococcal vaccine; 8) Exclusive breastfeeding; 9) Tummy time; 10) Reading aloud to child; 11) Listening to music together; 12) Outdoors time; 13) Minimizing screen exposure; 14) Tv-on time ≤4 hours; 15) Bedtime routine
N=North; C=Centre; S=South. Educational level: low: no schooling or primary versus high: secondary school or university.

	Much more likely to follow practice (OR ≥2)
	More likely to follow practice (OR >1 and <2)
	Less likely to follow practice (OR ≥.5 and <1)
	Much less likely to follow practice (OR <.5)

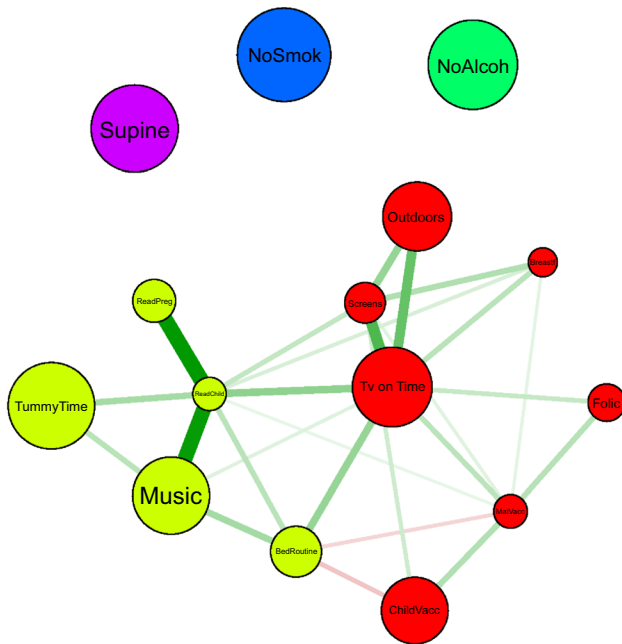


Fig. 3 Network analysis showing the relationship between the parental practices. Nodes represent the 15 parental actions and edges represent connections between them, with the edge width and color density corresponding to the strength of the connections. Green edges represent positive connections, while red ones represent negative connections. The area of the nodes is proportional to the level of parental adherence, and the colors correspond to detected communities in the network

being highly compliant (≥ 10 practices): having a low educational level (OR 0.34), being born abroad (OR 0.43), residing in the South (OR 0.49), being unemployed (OR 0.60), and being a young mother (OR 0.65) (all $P < 0.001$).

Table 3 Multivariable analysis of the socio-demographic characteristics of families that carried out ≥ 10 supportive practices (compared to those that carried out < 10)

Variable	OR	$N = 3337$ (95% CI)	P value
Area of residence: Center vs North	1.14	0.94–1.38	0.18
Area of residence: South vs North	0.49	0.41–0.58	< 0.001
Mother's age: < 30 vs > 30 –34	0.65	0.53–0.80	< 0.001
Mother's age: ≥ 35 vs 30 –34	1.10	0.93–1.30	0.28
Mother's educational level: low vs medium–high	0.34	0.26–0.44	< 0.001
Mother's occupational status: unemployed vs employed	0.60	0.50–0.72	< 0.001
Mother born in Italy: no vs yes	0.43	0.34–0.56	< 0.001

Educational level: low, no schooling or primary versus high, secondary school or university

Hosmer and Lemeshow goodness of fit test: Model 1, $\chi^2 = 4.59$; $df = 7$; P value = 0.71. A second model with missing data was created and did not reveal significant differences in OR estimates

The results of the variance inflation factor test do not exceed the threshold value of 2.5 and indicate the absence of multicollinearity among the variables of our model

Network analysis

The network analysis shows the most consistent associations and presents a simple network model (Fig. 3) comprising positive (green lines) and negative (red) correlations between the variables. Supplementary Table 1 shows the partial correlation matrix between the 15 practices. The coefficients close to one, in particular, indicate a positive association between reading aloud in pregnancy and reading to the child, between listening to music together and reading to the child, and between limited TV-on and screen times.

Regularized associations between variables change the network, showing that no alcohol and no smoking in pregnancy and supine sleeping position have no edge drawn between nodes, indicating that these variables are independent after controlling for all other variables. Some variables are more central and have more connections than others: TV-on time and reading aloud postnatally are more related to the variables in the network, whereas folic acid supplementation, reading aloud in pregnancy, and tummy time only relate to one or two other variables (and are therefore more isolated). It is important to note that strong, positive connections are present between reading aloud to the child and reading aloud in pregnancy and listening to music with the child, as well as between limited TV-on time, staying outdoors, and limited screen time. Negative associations are observed, on the other hand, between bedtime routine and maternal and child vaccination.

The centrality measures (Supplementary Fig. 1) confirm that the most central isolation variables in the network are no alcohol, no smoking, and supine sleeping position. The results concerning strength, the most straightforward of the

three centrality measures, show that reading to the child and limited TV-on time have a high node strength, and proper folic acid intake, tummy time, exclusive breastfeeding, and child vaccination have a lower node strength. This means that the first two have a direct influence on the network, while the latter four have a low level of involvement.

Figure 3 also shows the results of the community detection analysis, in which the nodes were colored according to their community membership. Five different communities were identified. The light green nodes, which include practices that concern a pro-active involvement of parents, seem to generally represent the area concerning cognitive development and the red nodes seem to generally represent the area concerning physical and motor development, although many of the practices have positive effects in multiple dimensions. The three remaining communities, in purple, blue, and green, are represented by the single nodes (no alcohol and no smoking in pregnancy, and supine sleeping position).

The analysis of the distinct centrality measures for the two areas identified by the community detection analysis confirms that the most central nodes are TV-on time and reading aloud to the child (Supplementary Fig. 2).

Discussion

This study found large differences in implementation rates of the practices, and that, as expected, socio-demographic factors contribute significantly. It also found that the practices are related; that those most commonly carried out span different areas, from prevention in pregnancy to direct accompaniment actions; and that living in the South is a determinant of health inequalities.

The network analysis attempted to provide a visual display of how parental practices influence each other. This influence can be direct, as between minimizing screen exposure and taking children outdoors, or indirect, such as when socio-demographic characteristics influence practices. The latter seems to be the case for one-child families, for example, as they were significantly less likely to read aloud in pregnancy and, afterwards, directly to the child, while families with multiple children are more likely to read to the older child and, in doing so, also to read aloud in pregnancy and/or to the younger sibling.

The strong, positive associations found between reading aloud in pregnancy and to the child, and listening to music together, seem to be a matter of attitudes, with parents who do one being more likely to do the other. The strong associations between limited TV-on time, limited screen exposure, and greater time outdoors also make sense in that increasing time outdoors would decrease time in front of a screen. The negative associations found between bedtime routine and maternal and child vaccination may be due to the fact

that bedtime routine was very common in the South, while the latter two were uncommon, also suggesting the need for initiatives to improve best practices geared towards a set target population [17].

In general, families with young, unemployed mothers with low levels of education, residing in the South, or who were born abroad were less likely to implement the individual practices. These differences may be due to the extent of the mothers' health literacy levels, and consequent ability to access, understand, and apply health information [18], and to the more limited efficiency of southern Italy's healthcare system [19]. The results of the multivariable analysis, in any case, identify these mothers as those most in need of interventions to reduce health inequalities.

The mass campaigns led in the past likely contributed to the fact that avoiding smoking and alcohol in pregnancy and using the supine infant sleeping position were the most common preventive behaviors and that they were independent variables in the network analysis. Concerning the other practices, it is presumable that parents have been influenced to different degrees based on the timing and extent of implementation of related campaigns and on the pediatrician's involvement. Tummy time is a form of exercise promoted in the USA from 2005 with several benefits, including improved motor development [20]. The rate of parents meeting tummy time recommendations was surprisingly high compared to the rate of less than one-third from recent UK research [21]. Active promotion of tummy time in Italy began only recently, for example through specialist information on the internet [22], so the high implementation rate may be a result of one or more of the following: promotion by pediatricians, information from pregnancy classes, and, possibly, the more lenient definition for adherence to the practice used in this study.

The results of this study show that exclusive breastfeeding and proper folic acid intake, also abundantly promoted in Europe and the USA [23, 24], are, instead, probably not suitably recommended by pediatricians and gynecologists in Italy, confirming the low rates, and geographic differences, found in other Italian studies [9, 10].

Another worrying result was how many 1-year-olds were allowed to use electronic devices, with less than half of parents limiting such exposures despite mounting knowledge of their negative effects. Limiting TV-on time in the home had a better implementation rate, although its definition was less stringent. Limiting exposure to any kind of screen [25] should be actively promoted.

Maternal pertussis vaccination in pregnancy, effective in reducing infant disease, is a more recent recommendation in Italy [26], which may partly explain why only one in three mothers chose to adhere compared to 54.9% for the Tdap vaccine in the USA in 2019 to 79.4% in Spain in 2018 [27, 28].

Evidence about the positive effects of reading aloud to children from early on, a practice followed by only a third of mothers, has been building for years [5, 6] and has been promoted since 2000 in Italy through a national initiative endorsed by family pediatricians [29]. The participation of family pediatricians in promoting reading aloud is very effective and should be strongly promoted [29, 30].

Some of the practices assessed in this study are among those included in other prevention-related initiatives and campaigns to promote early child development implemented in Italy [31]. The eight practices promoted by this campaign have been studied by the 0–2 Surveillance Project [8], and the results are generally comparable.

Strengths and limitations

The strengths of this study are that it collects data through the family pediatrician, who is directly involved with families, instead of, for example, through online questionnaires. Efforts were also made by pediatricians to collect certain data retrospectively from parents from before the child's birth. Furthermore, the cohort population of newborns is representative of the national newborn population in terms of geographical distribution and characteristics [12].

There are a few limitations of this study. Firstly, the COVID-19 pandemic interfered with data collection. Several children missed one or more well-child visits because either the pediatrician or the parents avoided visits for fear of contagion. When comparing the characteristics of children evaluated with those not assessable due to insufficient data, some differences were present, but, with the exception of the mother's occupational status, the differences in terms of percentage distribution were not so relevant. It should be noted, however, that we may have overestimated implementation rates given these slight differences. Secondly, pediatricians who participated represent a research-active group and were therefore more likely to be updated on research results and to promote supportive practices, possibly influencing implementation rates.

Thirdly, we expanded the number of practices evaluated beyond those for which there is long-established evidence on child health and development, and for some of them, the evidence of effectiveness is not as strong. Also, in some cases, there is no consensus on how to define the parental behavior as appropriate (e.g., TV-on time), and arbitrary criteria were chosen. In any case, since the least compliance was observed for the more established interventions (exclusive breastfeeding, folic acid supplementation), we believe that overall adherence is not underestimated.

Finally, the fact that adherence to practices is reported by parents to the pediatrician could represent a bias, but the same bias may affect almost all of the studies evaluating compliance to parental practices. In conclusion, the findings show that the most common practices, such as avoiding smoke during pregnancy,

have been largely incorporated into parental attitudes and do not need large investments, while other behaviors are in greater need of effective interventions. Along the same lines, the three broad intervention areas that group the practices include, both, well-established practices and practices that need more effective promotion interventions. This indicates that, to be most effective, interventions should be multifaceted, address multiple issues, and take into consideration interactions between practices. The findings enforce those of other studies, highlighting the need to address multiple social and cultural factors to achieve health equity [32]. Based on these findings, future interventions should specifically prioritize families with young, unemployed mothers with low levels of education, who were born abroad, or who reside in the South. The clinical practice implications of these findings entail the direct involvement of pediatricians (or family doctors or gynecologists, where appropriate) as providers of reliable information, given their extended involvement with families. Their vantage point in promoting preventive measures early in life would help achieve greater benefits spanning from the children, to the family relationships, to future health costs [32]. Furthermore, their involvement could take advantage of Italy's public health system and programmed visits to limit costs related to information campaigns.

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Authors' contributions All authors contributed to the study conception and design. Study supervision and coordination were performed by Maurizio Bonati, Antonio Clavenna, and Chiara Pandolfini. Material preparation, data collection, and analysis were performed by Rita Campi, Massimo Cartabia, and Stefano Finazzi. The first draft of the manuscript was written by Chiara Pandolfini and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Data availability The data that support the findings of this study are available from the corresponding author, CP, upon reasonable request, and based on national regulations on privacy.

Declarations

Ethics approval NASCITA was approved by the Fondazione IRCCS Istituto Neurologico Carlo Besta ethics committee. This study was conducted in full conformance with the principles of the “Declaration of Helsinki,” Good Clinical Practice (GCP), and within the Italian laws and regulations.

Consent to participate Written informed consent was obtained from the parents.

Competing interests The authors declare no competing interests.

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