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ORIGINAL RESEARCH

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Short-term and long-term positive outcomes of the multidisciplinary care implemented by the French health networks for the prevention and care of paediatric overweight and obesity

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Summary

Background: The nine French regional health networks for the prevention and care of paediatric obesity offer a 2-year program of multidisciplinary primary care (medical, dietetical, psychological, adapted physical activity) based on multicomponent lifestyle interventions.

Objectives: To assess the short-term and long-term impact of care management.

Methods: The impact of the multidisciplinary care was assessed by changes in the body mass index (BMI) Z score during the period of the care, and at least 2 years after the end. Anthropometric data were collected at baseline and at the end of the care either through a digital medical file or through direct phone contacts with the referring. Long-term outcomes were assessed through studies relative to post follow-up evaluation.

Results: At the end of the period of the care in a network, 72.9% of 6947 children had decreased their BMI Z score from 3.6 ± 1.0 DS at baseline to 3.3 ± 1.1 DS at the end. The four studies relative to long-term evaluation showed a pursuit of the decrease of BMI Z score during the 5.1 years after the beginning of the care.

Conclusions: The care provided by regional French networks for prevention and care of paediatric obesity induce a reduction of BMI that continues afterwards.

KEYWORDS

Health care network, multidisciplinary care, paediatric obesity, short-term and long-term outcomes

1 | INTRODUCTION

Even though recent studies have shown a stabilisation of prevalence in various countries including France since the 2000s,[1] the prevalence of childhood obesity remains high (16%-20% of overweight including obesity and 3%-4% of obesity, according to the IOTF definition) and is still a major challenge for public health policies in France[2] owing to the short-term, mid-term, and long-term consequences for

health.[3-7] Within the framework of The French National Nutrition and Health Program and the recommendations of the French National Authority for Health, health recommendations promoting healthy behaviours and the optimisation of the screening and treatment of paediatric obesity have been established.[8,9]

To locally coordinate the actions and the stakeholders involved in prevention and treatment, the regional health networks for the prevention and care of paediatric obesity were set up in 2003. Nowadays, the nine networks for paediatric obesity which are financially supported by the regional health authorities and each managed by a coordination team with expertise on paediatric obesity, coordinate actions contributing to the prevention and the care of childhood obesity. To achieve these objectives, the coordination team (1) conducts training sessions for health professionals (doctors, dieticians, psychologists, educators in adapted physical activity, and scholar nurses) to help them to apply the latest recommendations for the prevention, diagnosis, and treatment of obesity and (2) coordinates individualised multidisciplinary health care for children with overweight or obesity based on regular medical follow-ups with the attending physician who refers them to dieticians, psychologists, or educators for adapted physical activity lasting a maximum of 2 years. Based on therapeutic education strategies, the objective of multidisciplinary care is to support and assist the child and his family to modify their feeding habits and physical activities in a sustainable way.

In the current literature, there is growing evidence of the short-term efficiency of health care programs based on multicomponent lifestyle interventions in reducing children's corpulence at the end of the care. However, investigations until now have focused mainly on primary ambulatory care.[10-14] A first study published by one of the nine French networks showed that the body mass index (BMI) of more than 75% of the children had decreased by the end of the 2-year program.[15] However, to our knowledge, few investigations have focused on the long-term evolution of children's corpulence after the end of the program. The main focus has been in-patients[16] or ambulatory programs that are shorter than those offered by the French network.[17,18]

The objective of this first study common to the nine regional French health networks was therefore to globally assess the outcome of care for paediatric obesity provided by the networks regarding the impact of the programme on the children's BMI after the 2-year period of multidisciplinary care and after.

2 | METHODS

2.1 | Multidisciplinary care offered by the French networks

The underlying principles of the care are similar in each network: to offer local multidisciplinary care including medical, dietetic, psychological, and physical activity interventions. Initiated by the attending physician, generally the family's general practitioner or paediatrician, care is based on the severity of the initial weight excess and the overall situation of the child and his family. It begins with a baseline consultation by the attending physician to assess the child's overweight or obesity, environment, lifestyle, and comorbidities. This baseline consultation allows the physician to set specific, personalised, and agreed objectives for the child and his family (both parents or one parent or guardian according to the family situation of the child). After the baseline consultation, the child receives regular medical follow-up for a maximum duration of 2 years with the attending physician who refers the child, if necessary, to dieticians, psychologists, or educators in adapted physical activity. According to the availability of ambulatory health staff in each territory and the financial support granted by local health authorities to pay for dietetic and psychological consultations, the nature of the intervention may vary between networks. In areas where there are few health professionals or where funding for dietary and psychological consultations are more limited, care may be based on phone calls from the experts of the coordination team, on group workshops, on specific or complete examinations in hospital, or on short stays in a specific inpatient unit. However, the frequency and duration of the intervention are similar across the networks (Table 1).

The network coordinates all the professionals involved in the program either by phone or through a digital medical file that they fill in after each consultation.

2.2 | Evolution of children's BMI during multidisciplinary care

2.2.1 | Study population

This study was conducted among children with overweight or obesity up to the age of under 18 included in the French health networks for the prevention and care of paediatric obesity.

2.2.2 | Data collected

The data from the baseline consultation and from the last available medical follow-up in the network were collected either in the digital medical file filled in by the referring physician or by direct phone contact between the network coordinator and the referring physician otherwise. For each child, data extracted from the baseline consultation were gender, date of birth, date of baseline consultation, height, and weight at baseline. Data extracted from the last available medical follow-up consultation were date of the last consultation in the network, height, and weight at the last consultation. Height and weight were measured by the referring physician using a standardised procedure: weight was measured in lightly dressed children without shoes, and height was measured with the child standing up, weight being equally distributed on the feet, head back, and buttock on the vertical part of the height gauge. Data at baseline and at the last consultation were combined in a database per network and then pooled in a global Excel database.

TABLE 1 Specificities of the networks: Characteristics of localisation, activity, health professionals included, and modalities of care

	Network 1	Network 2	Network 3	Network 4	Network 5	Network 6	Network 7	Network 8	Network 9
Characteristics of localisation									
Demography (inhabitants)	3 400 000	1 900 000	325 383	1 179 000	12 190 000	1 261 000	1 841 000	499 406	3 027 000
% of population living in municipalities with 10 000 or more inhabitants	(39.8)	(42.4)	(30.2)	(26.8)	(83.9)	(42.8)	(42.8)	(23.5)	(37.3)
Network Activity									
Inception since	2006	2011	2007	2005	2003	2010	2004	2004	2003
Mean number of inclusions per year	540	115	110	237	740	190	370	180	250
Mean number of training sessions for health professionals per year	7	3	3	2	6	4	4	0	2
Health professionals included in network (2015)									
Medical doctors	732	88	100	163	204	111	200	121	270
Dieticians	217	16	40	21	148	71	45	19	138
Psychologists	199	6	30	34	104	67	45	24	116
Modalities of care (2015)									
Duration of intervention (years)	2	2	2	2	2	2	2	2	2
Funding granted by local health authorities for period of care (per patient):									
- number max of consultations with a dietician	7	8	8	9	5	5	5	6	8
- number max of consultations with a psychologist	14	8	8	14	5	5	5	10	8
Phone support by expert in coordinating team	No	No	Yes	No	No	Yes	Yes	No	No
Group of adapted physical activity	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Group workshop/therapeutic education	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Complete examinations in hospital	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes
Short stays in a specific inpatient unit	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes

2.2.3 | Explanatory calculated data

Based on anthropometric data, BMI at baseline and at the last available medical follow-up was calculated as weight (kg) divided by height squared (m^2). In childhood, BMI varies substantially with age and gender. A cut-off point related to age and gender is therefore needed to classify a child's corpulence. In this study, as recommended in French clinical practice guidelines,[13] weight status was attributed using the French age-specific and gender-specific BMI cut-off points for overweight (BMI > 97th percentile),[19] and the International Obesity Task Force (IOTF) cut-offs were used for obesity (BMI > centile 30).[20] The centile curve of the 97th percentile of the French BMI cut-off points is very close to the centile curve of the IOTF definition that matches the value of 25 at 18 years,[21] thereby enabling comparisons with the literature. To take variations of BMI with age and sex into account, BMI at baseline and at the last consultation were converted into BMI Z score using the LMS method (L for lambda: skewness in the distribution of BMI, M for mu: median of BMI at each age, and S for sigma: coefficient of variation). LMS values tabulated for a series of ages according to the French BMI reference were used.[19] Changes in corpulence from baseline to the end of care management were assessed using the ΔBMI absolute Z score and ΔBMI relative Z score, calculated as follows:

- ΔBMI absolute Z score = BMI Z score at the last consultation − BMI Z score at baseline
- ΔBMI relative Z score = ΔBMI absolute Z score/BMI Z score at baseline

The ΔBMI relative Z score takes the initial BMI at baseline into account and provides an assessment of the evolution of corpulence by neutralising the effect of initial BMI.

Duration of care management in the network was defined as the time that had elapsed, in months, between the baseline and the last available medical follow-up reported by the referring physician.

2.2.4 | Data analysis

The description of the study population and the evolution of the BMI Z score between baseline and the end of the period of care were carried out globally by the network. Differences between data at baseline and at the end of the period of care in each network were assessed using the chi test or Student t-test. The objective was to globally evaluate the outcome of multidisciplinary care. Children who dropped out before the end of the period of 2 years were not excluded from the study.

2.3 | Long-term evolution of children's BMI after period of multidisciplinary care

2.3.1 | Data sources

To assess long-term outcome of care, an analysis was performed on the post-programme evaluation conducted by the coordination teams of the networks. The aim was to assess the evolution of BMI at least 2 years after inclusion in the regional health network.

2.3.2 | Data extraction

For each available long-term study, extraction of information included sample size, mean age, sex ratio, method used to collect long-term anthropometric data and to calculate the BMI Z score, in addition to ΔBMI absolute Z score between baseline and the end of care in the network, between the end of care and the long-term consultation, and/or, between baseline and the long-term.

2.3.3 | Data analysis

Main data relative to methodology and outcomes of each available study were pooled in order to describe the evolution of the corpulence of children at least 2 years after the end of the period of care in the network. No comparison between studies was statically assessed.

3 | RESULTS

- Evolution of children's BMI during period of multidisciplinary care

In total, 6947 children who received multidisciplinary care for their overweight or obesity in one of the nine French regional networks between 2003 and 2015 were included in the study. At baseline, the mean age was 10.5 (±3.1) years and 59.2% of the cohort were girls. The mean BMI Z score at baseline was 3.55 (±1.0) SD. The average length of care was 13.5 (± 8.1) months, and 59.2% of the children had more than 10 months of follow-up in a network. The mean BMI Z score at the end of the period of care was 3.26 (±1.1) SD. Comparison of data at baseline and at the end of the period of care between network is shown in Table 2. During the period of care, an overall decrease in BMI Z score was observed with a ΔBMI absolute Z score = −0.30 (±0.57) SD and ΔBMI relative Z score = −8 (±18)% from baseline to the end of the period of care. Furthermore, BMI Z score decreased in 72.9% of children.

Whatever the network, a decrease in BMI Z score was observed at the end of the period of care management, with a significant decrease in BMI Z score between inclusion and the end of the care in eight of the nine networks (Table 2).

- Long-term evolution of children's corpulence after period of multidisciplinary care

Four studies performed in the framework of a doctoral thesis assessing the long-term evolution of the corpulence of children after the end of the period of care were available in four of the nine networks. Long-term changes in corpulence were assessed at least 2 years after the end of the period of care, with an average of 5.1 years after the beginning of care. Anthropometric data at baseline and at the end

TABLE 2 Characteristics and anthropometric data of children at baseline and at the end of the period of care, and impact of the care management in the French regional networks for prevention and treatment of paediatric obesity

	Network 1	Network 2	Network 3	Network 4	Network 5	Network 6	Network 7	Network 8	Network 9	*P*-Values	Global
	N = 982	N = 258	N = 445	N = 161	N = 2210	N = 610	N = 2093	N = 35	N = 153		N = 6947
Characteristics of children	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)		n (%)
Girls	588 (59.9)	141 (54.7)	259 (58.2)	94 (58.4)	1305 (59.0)	354 (58.0)	1250 (59.7)	24 (68.6)	99 (64.7)	0.60	4114 (59.2)
Data at baseline	m (ET) or n (%)	m (ET) or n (%)	m (ET) or n (%)	m (ET) or n (%)	m (ET) or n (%)	m (ET) or n (%)	m (ET) or n (%)	m (ET) or n (%)	m (ET) or n (%)		m (ET) or n (%)
Inclusion in network	2006/2010	2011/2015	2006/2015	2004/2006	2003/2011	2010/2015	2005/2015	2013/2015	2011/2015		2003–2015
Age	10.6 (3.2)	11.2 (2.7)	10.4 (3.2)	10.4 (3.1)	10.3 (2.8)	10.3 (3.0)	10.6 (3.1)	10.9 (3.4)	10.3 (2.6)	< 0.001	10.5 (3.1)
BMI Z score (DS)	3.36 (1.0)	4.06 (1.0)	3.46 (1.0)	3.46 (1.1)	3.49 (1.0)	3.79 (1.0)	3.57 (1.0)	3.80 (1.4)	3.52 (1.0)	< 0.001	3.55 (1.0)
% of children with obesity (IOTF)	550 (56.0)	205 (79.4)	250 (56.2)	92 (57.2)	1292 (58.5)	439 (72.0)	1266 (60.5)	21 (60,0)	95 (62.0)	< 0.001	4211 (60.6)
Data at end of period of care in network	m (ET) or n (%)	m (ET) or n (%)	m (ET) or n (%)	m (ET) or n (%)	m (ET) or n (%)	m (ET) or n (%)	m (ET) or n (%)	m (ET) or n (%)	m (ET) or n (%)		m (ET) or n (%)
Age	12.0 (3.2)	13.3 (2.7)	11.5 (3.1)	12.0 (3.1)	11.4 (2.8)	11.3 (3.0)	11.6 (3.1)	12.4 (3.3)	11.4 (2.7)	< 0.001	11.7 (3.1)
BMI Z score (DS)	2.99 (1.1)	3.66 (1.1)	3.26 (1.1)	3.08 (1.1)	3.19 (1.1)	3.54 (1.1)	3.29 (1.1)	3.50 (1.3)	3.23 (1.1)	< 0.001	3.26 (1.1)
% of children with obesity (IOTF)	417 (42.5)	178 (68.8)	201 (47.2)	67 (41.6)	1031 (46.7)	377 (61.8)	1072 (51.2)	19 (54.3)	69 (45.1)	< 0.001	3441 (49.5)
Impact of care management	m (ET) or n (%)	m (ET) or n (%)	m (ET) or n (%)	m (ET) or n (%)	m (ET) or n (%)	m (ET) or n (%)	m (ET) or n (%)	m (ET) or n (%)	m (ET) or n (%)		m (ET) or n (%)
Length of care (month)	14.1 (8.3)	24.7 (1.6)	13.5 (8.5)	18.0 (7.4)	12.4 (7.3)	12.4 (7.75)	12.6 (8.1)	18.4 (6.2)	13.4 (7.9)	<0.001	13.5 (8.1)
ΔBMI absolute Z score (DS)	−0.36 (0.6)	−0.40 (0.7)	−0.21 (0.6)	−0.38 (0.7)	−0.30 (0.5)	−0.24 (0.5)	−0.28 (0.5)	−0.29 (0.6)	−0.29 (0.7)	<0.001	−0.30 (0.6)
ΔBMI relative Z score (%)	−11 (18)	−9 (20)	−5 (24)	−9 (22)	−8 (17)	−7 (16)	−8 (17)	−7 (23)	−7 (27)	<0.001	−8 (18)
P-value*	< 0.001	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001	0.38	0.02		< 0.001
% of children whose BMI Z score decreased during care	742 (75.6)	199 (77.1)	298 (67.0)	111 (68.9)	1640 (74.2)	426 (69.8)	1507 (72.0)	25 (71.4)	113 (73.9)	<0.001	5061 (72.9)

**P*-value (BMI Z score inclusion vs BMI Z score end).

of care were collected through the digital medical file or by direct phone contact with the referring physician. Long-term anthropometric data were collected either through the digital medical file still filled in by the referring physician or by a phone call with the family (who transmitted the last weight and height mentioned by the physician in the family health notebook) or by a questionnaire filled in by the referring physician. Long-term BMI Z scores were calculated using the LMS method for three of the four studies and using the classic Z score formula for one study:

$$\text{BMI Z score} = \frac{(\text{BMI observed value} - \text{BMI median value of the reference population})}{\text{BMI standard deviation value of reference population}}.$$

Changes in corpulence from baseline to the end of the period of care and from the end of the period of care and the long-term consultation were assessed using the absolute ΔBMI Z score. The results of the four studies showed a long-term decrease in BMI Z score, 5.1 years after the beginning of care and up to 2 years after the end of the period of care in the network. The methodology and the results of these four studies are summarised in Table 3.

4 | DISCUSSION

The main finding of this study is that the multidisciplinary care provided by the nine regional health networks for the prevention and care of paediatric obesity had a positive impact on BMI of children with overweight or obesity during the period of care and after. BMI Z score decreased in more than 72% of the children during the period of care in the nine networks, and the four studies analysing long-term evolution showed that BMI Z score continued to decrease, at least until 2 years after care. Despite some regional differences between the networks concerning organisational procedures and some of the characteristics of the children and modalities of care, the positive effect of care management was similar across the networks. The non-significant decrease observed in one of the nine networks may be explained by the relatively small number of data analysed for this network (N=35).

Our results concerning the reduction in BMI Z score during the period of care are consistent with those already published in one of the nine French networks[14] and are similar to, or better than, those in other studies in the literature. Previous investigations into the outcomes of educational programmes involving children with obesity (N = 42, 8-17 years) and their families[13] or of randomised controlled trials (*N* = 8461, 6-11 years)[11] showed that multicomponent behaviour-changing interventions incorporating diet and physical activity may be beneficial in achieving small, short-term reductions in BMI, BMI Z score, and weight. Of note, the regional networks aimed to durably modify the diet and physical activities of the children and their families but focused on health care organisation, so these results are to be compared cautiously with those of other studies. To date, a few studies dealing with care organisation and treatment of paediatric obesity have confirmed our results, but they were conducted on a smaller number of children and adolescents. For example, one performed in American children (N = 60, 4-8 years) suggested that a primary care-based, parent-focused obesity treatment program had positive effects on anthropometric data and improved the children's overall health trajectory.[10] Another one in Caucasian children (N = 43, 5-12 years) and adolescents (N = 31, 13-17 years) demonstrated that a clinical lifestyle intervention with a family-based approach achieved positive results in body composition and positive changes in lifestyle habits in children and adolescents.[12]

Regarding the long-term evolution of the corpulence of children after the period of care, our findings concerning the reduction in BMI Z score are also consistent with those in the literature. Two studies assessing long-term outcomes of health care programmes for children with overweight or obesity focusing on ambulatory follow-up (N = 663, 4-16 years and N = 90, 7-13 years) confirmed the long-term positive outcome of individualised and multidisciplinary health care.[17,18] As suggested by Oude et al,[13] the short-term and long-term evolution of corpulence depends on maintaining the changes in lifestyle habits and behaviours of children and their families (diet, sedentary and physical activities) during and after the period of care.

Therefore, our findings show that the ambulatory multidisciplinary care for paediatric obesity dispensed by the French health networks and based on multicomponent lifestyle interventions, combined with family-based approaches, is durably efficient. Paediatric obesity is a complex issue with behavioural and environmental influences.[22,23] Prevention and treatment in children is a critical challenge requiring consideration not only of nutrition education, physical activity, and lifestyle modifications but also of psychological, social, cultural, and socio-economic factors. The modalities of the ambulatory multidisciplinary care provided by the French networks aim to make children and families autonomous in managing their health, as they become the primary actors for changing and promoting self-efficacy by establishing personal goals. Our findings also confirm the importance of involving the family in achieving success for two reasons. First, interventions that focus on both parents and children have been found to have positive short-term and long-term effects.[24] Second, families aware of obesity issues might be significantly more likely to get their children screened early and to improve their diet and physical activity. Moreover, the networks also ensure the training of professionals so that the national recommendations for the prevention and care of paediatric obesity are disseminated and that knowledge among all relevant stakeholders is shared. The synergy of all these actions makes it possible to achieve a consensual approach to childhood obesity among a broad range of stakeholders and enables professionals to deal with individual behaviours in the context of societal and environmental influences.

This study has limitations. First, the absence of a control group did not allow us to determine what changes in BMI might have occurred without the care. Second, information was lacking about families who refused the care or dropped out before the end of the period of care. Nevertheless, the outcomes of this multidisciplinary care program were assessed in a large population of 6947 children with

TABLE 3 Methodology and main outcomes of studies assessing long-term evolution of children's corpulence after care in French regional networks for prevention and treatment of paediatric obesity

	Study Available in Network 1	Study Available in Network 4	Study Available in Network 7	Study Available in Network 9		
Methodology						
Method of long-term data collection	Families transmitted last weight and height mentioned by referring physician in the family medical notebook	Weight and height extracted from digital medical file of network still filled in by referring physician	Families transmitted last weight and height mentioned by referring physician in family medical notebook	(1) Weight and height were transmitted through a questionnaire filled in by referring physician	(2) Families transmitted last weight and height mentioned by referring physician in family medical notebook	(3) = (1)+ (2)
Method of BMI Z score calculation	LMS method	LMS method	Basic z score formula $\frac{(x-\mu)}{\sigma}$	LMS method	LMS method	LMS method
Characteristics of children	**n (%)**	**n (%)**	**n (%)**		**n (%)**	
N	106	88	102	44	151	16
Girls	64 (60.4)	57 (64.7)	66 (64.7)	28 (63.6)	84 (55.6)	NA
Data during period of care	**m (SD) or n**	**m (SD) or n**	**m (SD) or n**	**m (SD) or n**	**m (SD) or n**	**m (SD) or n**
Beginning of care management between	2007 and 2008	2004 and 2006	2005 and 2009	2006 and 2008	2006 and 2008	2006 and 2008
BMI Z score at baseline (DS)	3.26 (0.9)	3.40 (1.2)	3.39 (1.4)	3.32 (0.7)	3.38 (1.0)	3.21 (0.8)
BMI Z score at end of period of care (DS)	2.83 (1.0)	3.06 (1.2)	3.07 (1.6)	NA	NA	2.66 (0.8)
ΔBMI absolute Z score (baseline − end)[a]	−0.43 (0.6)	−0.34 (0.7)	−0.32 (0.8)	NA	NA	−0.55 (0.7)
Long-term data	**m (SD) or n**	**m (SD) or n**	**m (SD) or n**	**m (SD) or n**	**m (SD) or n**	**m (SD) or n**
Period between beginning and long-term consultation (year)	4.5	5.6	4.2	5.0	6.9	4.8
Long-term BMI Z score (DS)	2.41 (1.3)	2.75 (1.4)	2.44 (1.4)	2.74 (0.9)	2.26 (1.3)	2.10 (1.)
ΔBMI absolute Z score (end − long term consultation)[b] (DS)	−0.42 (0.8)	−0.31 (0.9)	−0.63 (0.8)	NA	NA	−0.49 (0.9)
ΔBMI absolute Z score (baseline − long term consultation)[c] (DS)	−0.85 (1.3)	−0.65 (1.3)	−0.95 (1.4)	−0.57 (0.8)	−1.12 (1.4)	−1.11 (1.4)

NA, not available.

[a]Between baseline and end of period of care.

[b]Between end of period of care and long-term consultation.

[c]Between baseline and long-term consultation.

homogenous characteristics in real-life conditions. Another issue is that the relative weight of some demographics (rural/urban) and individual characteristics of the population (age, other pathology, or health complications of overweight or obesity) or some modalities of care (networks, number of visits, duration of follow-up) were not evaluated. Nevertheless, this work should be regarded as being a first study common to the nine French networks that evaluates the overall outcome of multidisciplinary care for children and adolescents in France and does not compare outcomes between network or assess factors associated with better outcomes. Further research is required to confirm these positive findings in all children regardless of their age, the modalities of the care, family support, their localisation, or their health status.

Regarding the long-term impact, few methodological differences were observed between our data (method used to collect the long-term anthropometric data or reference used to calculate BMI Z score), information was lacking about families whose long-term data was not transmitted, the samples were relatively small, and the data of the four networks were not pooled. Despite these weaknesses, these results highlight the positive impact of the programme after the period of care. Further research is required with a larger number of children, a prospective design, and with a regular follow-up after the care in order to better assess the long-term evolution of children BMI.

The present findings confirm that this ambulatory multidisciplinary care based on lifestyle intervention and performed in primary care as provided by the French networks is efficient in the short and long term and should remain the recommended treatment for paediatric obesity.[9,13,25] The reduction in BMI—even moderate—observed during and after the period of care may significantly improve the short-term, mid-term, and long-term health of children and limit the consequences of obesity.[4,5,26] Indeed, recent investigations have shown that a reduction in BMI in children significantly improved hypertension, hypertriglyceridemia, and low HDL-cholesterol during adulthood,[26] was associated with greater improvements in their psychosocial well-being,[27] and seemed to be effective in improving the quality of life in the physical, emotional, social, and psychosocial domains.[28] Moreover, the homogeneous outcomes observed confirm the sustainability, transferability, and reproducibility of the multidisciplinary care offered by the French networks and may be considered as a proof of concept of such organisation of care for paediatric obesity. Finally, our findings underline the importance of organising care within the family and the professional community, demonstrating that a consensual coordinated approach ensures the connection between medical and paramedical staff and all the stakeholders involved in screening, care, and prevention.

ETHICS STATEMENT

At the initiation of the care, patients and their family signed a written consent form stating that their personal and medical data could be used anonymously for scientific studies. Data were obtained from a secure computerised file and were analysed anonymously.

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CONFLICTS OF INTEREST

No conflict of interest was declared.

AUTHOR CONTRIBUTIONS

Caroline CARRIERE collected the regional data, performed data management and analysis, structured and discussed the results, and drafted and revised the manuscript.

Hélène THIBAULT, Véronique NEGRE, Maïthé TAUBER: designed the study, transmitted regional data, drafted the manuscript, discussed the results, and revised the manuscript.

Pascal BARAT, Fatiha GUEMAZI-KHEFFI, Blandine MELLOUET-FORT, Laurent ANCILLON, Anne-Marie BERTRAND, Sylvain QUINART, Sophie GUILMIN-CRÉPON, Armine ARSAN, Anne LESTROUNELLE, Régine BRUMENT, Camille SAISON-CANAPLE, Lise RENEL, Adeline DAUSSAC, Béatrice JOURET: transmitted regional data, discussed the results, and revised the manuscript.

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