Economic evaluation of a school-based strategy to prevent overweight and obesity in French adolescents: Insights from the PRALIMAP randomised trial

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Abstract

Objectives: This study aimed to provide cost-effectiveness and budget-impact analyses of a school-based overweight/obesity screening and care prevention strategy among adolescents.

Study design: Cost-effectiveness and budget-impact analyses.

Methods: Data from 3538 adolescents who participated in a school-based randomised controlled trial in the Northeast of France were used. Costs (from a public payer's perspective) included screening for overweight and obesity and subsequent care. Effectiveness was measured as the change in body mass index (BMI) (kg/m²), prevalence of overweight/obesity, moderate physical activity energy expenditure, duration and frequency, and total sitting time (ST). The incremental cost-effectiveness ratio (ICER) was calculated and a budget-impact analysis was conducted.

Results: The screening and care strategy resulted in an ICER of €1634.48 per averted case of overweight/obesity and €255.43 per BMI-unit decrease. The costs for increasing moderate physical activity by 1000 metabolic equivalent of task (MET)-min/week, duration by 60 min/week and frequency 1 day/week were €165.28, €39.21 and €93.66 per adolescent, respectively. Decreasing total ST by 60 min/week had a cost of €8.49 per adolescent. The cost of implementing the strategy nationally was estimated to be €50.1 million with a payback period from 3.6 to 7.3 years.

Conclusions: The screening and care strategy could be an efficient way to prevent overweight and obesity among adolescents. Future studies should investigate how the current results could be achieved in schools with different settings, and thus justify its relevance for overweight and obesity prevention to policy-makers.

Keywords: adolescents; obesity; prevention; economic analysis

Introduction

The prevalence overweight and obesity has rapidly increased over recent decades and it has become a major public health issue because of the health consequences of these conditions[1,2]. The impact of

overweight and obesity is not limited to population health; it also imposes a heavy economic burden on nations, resulting, in part, from the health expenditure generated by the treatment of overweight and obesity and related chronic conditions[3]. In support of this, the economic consequences of overweight and obesity in 52 countries from the Organisation for Economic Cooperation and Development (OECD), the European Union (EU) and the G20 were estimated to cost US$ 425 billion per year, accounting for 0.45–1.62% of the countries' gross domestic products[4]. In France, the economic burden of overweight of obesity represents approximately 0.8% of the gross domestic product and accounts for nearly US$ 25 billion (i.e. 6%) of total health expenditure[5].

Among existing measures to address public health obesity concerns, preventing obesity in adolescents is among the most important, given that overweight adolescents often remain overweight in adulthood[6]. A systematic review showed that 70–80% of adolescents with obesity are concerned about the persistence of obesity in adulthood;[6] therefore, effective early intervention could reduce future morbidity. Accordingly, many studies have analysed the effectiveness and economic incentives for obesity interventions. In their recent systematic review, Zanganeh et al. included 39 studies with an economic evaluation of interventions for childhood and adolescent obesity[7,8]. These studies produced different results since the programmes evaluated were different in design; many studies demonstrated an economic benefit of such interventions[9–14], but others concluded that the related costs would not be socially sustainable[15–17]. On this basis, it may be difficult to assess the cost effectiveness and economic sustainability of adolescent obesity prevention programmes without conducting a specific economic evaluation. In addition, only five studies included in Zanganeh et al.'s systematic review concerned adolescents, suggesting a need for an economic study in this age group[8]. All existing overweight and obesity prevention programmes that have demonstrated to be effective among adolescents should be economically evaluated. Such evaluations will help and guide policy-makers and programme planners in their decisions to efficiently prevent overweight and obesity.

In France, The PRomotion de l'ALIMentation et de l'Activité Physique (PRALIMAP) trial was conducted to evaluate the effectiveness of a school-based overweight and obesity prevention strategy among adolescents[18]. Although, the analysis showed a positive effect of the prevention strategy (i.e. a decrease in the prevalence of overweight and obesity, an increase in physical activity [PA] and a decrease in total sitting time [ST]), no economic evaluation was conducted after the trial[19]. The current study aimed to provide cost-effectiveness and budget-impact analyses of an adolescent overweight and obesity prevention strategy (the PRALIMAP trial) compared to no strategy in the French context.

Methods

The PRALIMAP trial

This study used data from the PRALIMAP trial, a randomised controlled study assessing the effectiveness of three intervention strategies for overweight and obesity prevention among adolescents in 24 state-run high schools (i.e. the only eligibility criteria) in northeastern France over 2 academic years between 2006 and 2009.

The three health promotion strategies were 'educational' (i.e. lectures and group work on EB and PA), 'environmental' (i.e. increasing the availability of fruits, vegetables, water and PA) and 'screening and care' (see next section). These strategies were in line with the Ottawa charter, which provides a framework for health promotion actions using five means, of which three are particularly relevant for the prevention of overweight and obesity among adolescents in a school setting: develop personal skills (educational strategy), create a supportive environment (environmental strategy) and reorient health services (screening and care strategy)[20].

Outcomes were assessed at baseline (T0) and 2 years (T2). Each high school was assigned to receive none, one, two or all three strategies according to a 2×2×2 factorial cluster randomisation design (for each intervention strategy, 12 high schools received the intervention and 12 did not). High schools gave parents an information letter to obtain parental consent. If parents did not want their children to participate, they could inform high schools by a letter indicating their refusal. Adolescents were also given written and oral information and had the right to not participate.

The trial was approved by the French ethics committee Commission Nationale de l'Informatique et des Libertés (no.906312) and the French data protection authority (no.906312), and was registered at ClinicalTrials.gov (no.NCT00814554).

The study design, methods and rationale are described in detail elsewhere[18]. A total of 3538 adolescents (14–18 years old, 57.6% girls, 20.2% with overweight or obesity [see Table 1]) completed the PRALIMAP trial and their data were analysed. Reporting of this study followed the 2022 Consolidated Health Economic Evaluation Reporting Standards (CHEERS)[21] (see Supplementary Table S1).

Of all strategies, only the screening and care strategy was shown to be effective in reducing the prevalence of overweight and obesity[19], increasing PA and decreasing ST[22]. Therefore, an economic evaluation of the screening and care strategy compared to no strategy (i.e. usual practice in schools) was conducted from a public payer's perspective (this is the most likely funding source to implement such an intervention). The time periods assessed were the duration of the intervention (cost-effectiveness analysis) and lifetime (budget-impact analysis). No health economic analysis was

originally planned for the PRALIMAP trial, but this should be conducted in the future to contribute to scientific evidence.

Screening and care strategy

The screening and care strategy consisted of school nurses screening adolescents for overweight or obesity (i.e. measuring their weight, height and waist circumference) and proposing, if necessary, group care management. The eligibility criterion to receive care was weight excess corresponding to a body mass index (BMI) greater than the International Obesity Task Force[23] age- and sex-specific overweight thresholds. When eligible, adolescents were registered with a care programme that comprised of seven scheduled collective 1.5-hr sessions (i.e. group educational sessions) provided at or outside of each school. These sessions were centred around the themes of healthy eating and PA, and were led by a multidisciplinary team (i.e. a physician, dietician, psychologist and sports educator) belonging to an health network specialising in overweight and obesity prevention. Twelve of the 24 high schools were randomly assigned to the screening and care strategy, with a total of 1687 adolescents (all were screened by school nurses). The other high schools did not receive the screening and care strategy, with a total of 1851 adolescents.

Effectiveness outcomes

Two anthropometric and four behavioural outcomes were considered in this study. Anthropometric outcomes comprised differences in changes in the prevalence of overweight and obesity and BMI between the screening and care and no screening and care groups from T0 to T2. Behavioural outcomes included differences in changes in moderate PA energy expenditure (Metabolic Equivalent of Task [MET].min/week), duration (min/week) and frequency (day/week), and total ST (min/week) from T0 to T2 between the screening and care and no screening and care groups. PA and total ST were measured using the International Physical Activity Questionnaire[24]. The effectiveness outcomes of the screening and care strategy were adjusted for the other two strategies (i.e educational and environmental)[19,22].

Measurement of costs

The costs of implementing the screening and care strategy were measured. There were no costs related to the no screening and care strategy because it consisted of the usual practice. All costs were obtained from structures of the PRALIMAP coordination committee (expense monitoring during the trial) and are presented in euros (€).

Costs of screening: Costs related to screening activity were estimated by multiplying the average time of a screening by the 2021 average hourly wage of school nurses in France. The average duration of screening time was estimated to be 10 minutes per adolescent and the average wage was estimated to be €35 per hour (including staff and travel costs). These costs included all participants in the screening and care group and were calculated by taking the two measurement times (T0 and T2) into account.

Costs of care: Overweight and obesity management costs included all 2006 costs related to professional member coordination, training before conducting collective sessions and working time. A full-time project manager was recruited for an equivalent of 3 months to coordinate the setting of the intervention (i.e. organisation of professionals' training sessions, planning and coordination of collective sessions). All professionals received a half-day training session before the organisation of collective sessions. The overall costs of collective sessions were calculated by taking the amount each professional (i.e. physicians, dieticians, psychologists and sports educators) was paid, based on 2021 costs, by the programme into account (see Table 2).

Statistical analyses

All analyses were carried out using Microsoft Excel software 2016 and conducted according to an intention-to-treat principle.

Incremental cost and effectiveness: Cost effectiveness was analysed by the incremental cost-effectiveness ratio (ICER) for each effectiveness outcome (i.e. the difference in cost between the screening and care and no screening and care strategies, divided by their difference in the effectiveness outcome from T0 to T2) as follows:

$$ICER = \frac{screening\ and\ care\ strategy\ costs - no\ screening\ and\ care\ strategy\ costs}{screening\ and\ care\ strategy\ effectiveness\ - no\ screening\ and\ care\ strategy\ effectiveness}$$

The ICER represented the average incremental cost associated with one averted overweight and obesity case, a decrease in BMI of 1 kg/m², an increase in energy expenditure of 1000 MET-min/week energy expenditure (representing approximately 60 minutes of moderate PA [3 METs], 5 days a week), an increase in PA duration of 60 min/week, an increase in moderate PA frequency of a 1 day/week and a decrease in total ST of 60 min/week.

Budget-impact analysis: In addition to the cost-effectiveness evaluation, a budget-impact analysis (BIA) was conducted (for overweight and obesity outcomes only) to compare costs that would result from fully implementing the screening and care strategy nationally to cost savings generated during adulthood by the same strategy (see Supplementary methods for more details). Given there is insufficient evidence of the long-term effect (i.e. into adulthood) of interventions to prevent overweight and obesity among

adolescents[25–27], two scenarios were modelled under two hypotheses (1: the effect of the strategy would be maintained into adulthood; 2: the effect of the strategy would decrease by 25% into adulthood). BIA was conducted by discounting the annual adult overweight and obesity care cost at 0% and 1.5% over 60 years (which represents the mean life expectancy in France at 20 years), as recommended in France[28].

Results

Screening and care costs

The total intervention cost for all participants was estimated at €47,400 and the average cost per adolescent was estimated to be €28.1 (see Table 3). Screening represented the highest cost component (41.6%), followed by project management (29.5%) and collective sessions (28.9%).

Intervention effectiveness

The screening and care strategy resulted in a 1.71% greater reduction (-2.27% and -0.56% in the screening and care and no screening and care high schools, respectively) in the prevalence of overweight and obesity (p = 0.04), corresponding to 61 averted cases[19] (see Table 4). BMI values changed more favourably in the 12 high schools that received screening and care (+0.64 ± 1.44) than BMI values in the high schools that did not receive screening and care (+0.72 ± 1.49), with a 0.11 kg/m² greater reduction (95% confidence interval [CI] [-0.21; -0.01], p = 0.03)[19]. In the 12 high schools that received screening and care, increases in moderate PA energy expenditure, duration and frequency were 170.0 MET-min/week (95% CI [50.0; 291.0], p = 0.005), 43.0 min/week (95% CI [12.0; 73.0], p = 0.005) and 0.3 day/week (95% CI [0.1; 0.6], p = 0.04) greater, respectively, than those in the 12 high schools that did not receive screening and care[22]. The schools that received screening and care had a greater reduction in total ST that was 198.6 min/week lower (95% CI [-313.2; -83.9], p = 0.0006) than in schools that did not receive screening and care[22].

Cost-effectiveness analysis

The results showed that the cost of averting one case of overweight or obesity was estimated to be €1634.48 (see Table 4). The mean cost of decreasing BMI by 1 kg/m² was estimated at €255.43 per adolescent. The estimated costs of increasing moderate PA energy expenditure by 1000 MET-

min/week, the duration by 60 min/week and the frequency by 1 day/week were €165.28, €39.21 and €93.66 per adolescent, respectively. Decreasing total ST by 60 min/week was estimated to cost €8.49 per adolescent.

Budget-impact analysis

Nationally, the total number of eligible adolescents was estimated to be 1,782,172 (Table 5). Considering a cost of €28.1 per adolescent, the implementation cost of the screening and care strategy was estimated at €50.1 million at the national level. Furthermore, if the screening and care strategy was implemented, a 1.71% decrease in the prevalence of overweight and obesity would be obtained and would correspond to a total of 30,476 eligible adolescents. Considering the persistence rate of overweight and obesity from adolescence to adulthood to be 70%, a total of 21,334 cases of overweight or obesity in adulthood would be averted in scenario 1. These cases would result in an annual care cost savings for the public payer of €13.8 million. Scenario 2 would lead to a total of 16,000 averted cases of overweight and obesity in adulthood, and would result in an annual care cost savings of €10.4 million. The payback periods were 3.6 and 4.8 years under scenarios 1 and 2, respectively. With a discount of 1.5%, the mean additional care cost was €430 per individual per year, which translated into payback periods of 5.5 and 7.3 years for scenarios 1 and 2, respectively.

Discussion

This study presented cost-effectiveness and budget-impact analyses of an overweight and obesity screening and care strategy among French school-aged adolescents from the public payer's perspective. The cost of an averted case of overweight or obesity, a one-unit decrease in BMI, a 1000 MET-min/week increase in moderate PA and a 60-minute decrease in total ST were €1634.48, €255.43, €165.28 and €8.49, respectively. In the case of a national implementation of the screening and care strategy, the payback period was estimated to range from 3.6 to 7.3 years. In light of these findings, school-based interventions of this type are likely to be cost-effective (i.e. in reference to the annual overweight or obesity care cost of an adult) uses of public funds and warrant consideration by policy-makers and programme planners.

The literature suggests that implementation of the screening and care intervention in high schools has the potential to make a cost-effective contribution to the reduction in the prevalence of overweight and obesity, increase in PA and decrease in total ST during adolescence. A study based on the screening and management of obesity among 6- to 12-year-old children showed an intervention cost of $237

(2014 US dollars [€200]) per BMI unit reduced, which is in line with the current findings[29]. Furthermore, in their 2-year school-based PA intervention targeting adolescents, Sutherland et al. estimated the costs per adolescent to avert a one-unit BMI gain and to increase the duration of moderate-to-vigorous PA by 1 minute at $1408 (2014 Australian dollars [€870]) and $56 (€35), respectively[30]. These costs are substantially greater than those estimated in the current study, potentially due to differences in the year of the considered costs, and may suggest a better cost-effective ratio in school-based interventions that include PA and eating behaviour components, such as the PRALIMAP trial.

In France, in 2019, the mean life expectancy at 20 years of age was estimated at 60.3 and 66.1 years for men and women, respectively[31]. Compared to these estimations, the durations for the payback period shown in this study are relatively small (from 3.6 to 7.3 years), even when considering a lower life expectancy (approximately 4 to 10 years less according to Lung et al.[32]) among individuals with overweight or obesity than those with healthy weight status.

Transferability

The PRALIMAP trial was conducted in four northeastern French departments. From the perspective of its implementation at the national level, the question of its transferability warrants discussion. Transferability refers to the extent to which the measured effectiveness of an applicable intervention could be achieved in another setting[33] and depends on the target population, implementation conditions, professionals and environment[34]. Northeastern France is characterised by a higher prevalence of overweight and obesity than some other regions[35]. If implemented in such regions, and given that screening cost did not depend on the prevalence of overweight and obesity, the cost-effectiveness ratio could increase. Previous work evidenced three important aspects to consider in the transferability of the PRALIMAP intervention: (i) a multidisciplinary approach (interdisciplinary teamwork and support by managers); (ii) a participatory process (involvement of stakeholders in setting goals and allowing them to adapt the intervention if necessary); and (iii) support for knowledge transfer (mutual learning between stakeholders and researchers)[36]. Taking the new context and environment in which the intervention is implemented into account is also crucial. For example, there could be a low participation rate due to the intervention location[37], or existing alternative programmes/local public health policies that could interact with the effectiveness of the strategy. It should be stated that the high schools that participated in the PRALIMAP trial were state run (as are a large majority of French high schools), whose organisations and programmes are similar. Thus, the fact that the structures are not fundamentally different could favour the transferability of the intervention. Notably, the results of the PRALIMAP trial led to the implementation of the PRALIMAP-INES (INEgalités de Santé) trial, which includes the screening and

care strategy[38,39]. It was first implemented in northeastern France and was then transferred to Guadeloupe, a French island with a high prevalence of overweight and obesity (intervention in progress)[40]. These elements could provide confidence in the transferability of the PRALIMAP trial. Within the framework of the international transferability of the intervention, it would be interesting to investigate how the screening and care strategy could be implemented or adapted in other countries and what its economic impact would be.

Strengths and limitations

The results of this study should be interpreted with consideration of its strengths and limitations.

The main strengths of this study include the BIA that was used to complete the cost-effectiveness analysis and provide important data for decision-making [42]. While the cost-effectiveness analysis provides a direct interpretation of the health and economic impact of the screening and care strategy, the BIA provides additional information to decision-makers on the financial consequences of nationally implementing the strategy. Second, outcomes on the effectiveness of the screening and care strategy are based on results from a 2-year randomised controlled trial with a large sample size[19,22]. Third, the use of two anthropometric and four behavioural outcomes allowed this study to report the ICER from a number of perspectives (obesity, PA and ST) and will facilitate comparisons across studies.

In terms of limitations, first, the estimated annual costs of overweight and obesity are from a study published in 2007 and costs of medical care have increased since that time[41]. In addition, these costs were estimated from individuals who consumed fewer medical goods and services than excluded ones (selection bias), and data were obtained by self-reporting (measure bias). These could have led to underestimated costs of overweight and obesity, but results of the BIA are therefore conservative. However, there are no more recent estimations of the costs of overweight and obesity in the French context. Second, two hypothetical scenarios on the effect maintenance of the strategy were tested in the BIA and could lead to the overestimation or underestimation of the current results. However, there is no clear evidence of the long-term effectiveness of interventions from adolescence to adulthood on which these scenarios could be based[27]. Third, no modern technologies, such as social media or online portals, were included in the screening and care strategy; however, these tools may be inappropriate for screening adolescents (i.e. measurements by nurses must be done in person). If the strategy was implemented in the present day, modern technologies could be used to care for adolescents after screening (e.g. remote educational sessions), which would reduce the costs. Fourth, the use of a self-reporting questionnaire to measure PA could have led to an overreporting of PA by adolescents.

However, the use of an objective measure, such as an accelerometer for several thousand adolescents, would have been difficult to implement (more expensive, less convenient). In addition, the questionnaire used is reliable and validated, which can provide confidence in its use[24].

Conclusions

In conclusion, this study highlighted that the screening and care school-based strategy was effective in reducing the prevalence of overweight and obesity, the total ST and increasing moderate PA, with a relatively low cost of €28.1 per adolescent over 2 academic years. The costs, per adolescent, for avoiding one case of overweight or obesity, increasing moderate PA by 1000 MET-min/week and decreasing total ST by 60-minute were €1634.48, €165.28 and €8.49, respectively. The national implementation of the strategy would cost €50.1 million and, each year, would avoid approximately €6.9–13.8 million of cost increase caused by the morbidity for people with overweight or obesity. The strategy would be profitable after 3.6–7.3 years. The screening and care strategy could be an efficient way to prevent overweight and obesity among adolescents. Future studies should investigate how the current results could be achieved in schools with different settings, and thus justify its relevance for overweight and obesity prevention to policy-makers.

Author statements

Ethical approval

The trial was approved by the French ethics committee Commission Nationale de l'Informatique et des Libertés (no.906312) and the French data protection authority (no.906312), and was registered at ClinicalTrials.gov (no.NCT00814554).

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Competing interests

The authors have no competing interests to declare.

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Table 1. Characteristics of adolescents who completed the PRALIMAP trial (n = 3538)

Characteristic	n	%
Age [years ± SD]	[15.6]	[± 0.7]
Sex		
Boys	1499	42.4
Girls	2039	57.6
High school type		
Vocational	546	15.4

General/technical	2992	84.6
Home area		
Rural	1432	40.5
Urban	2106	59.5
Overweight or obesity		
No	2825	79.8
Yes	713	20.2
Screening and care strategy		
No	1851	52.3
Yes	1687	47.7

Data are numbers, unless indicated otherwise.

Table 2. Direct costs of collective sessions

Cost	SESSION 1	SESSION 2	SESSION 3	SESSION 4	SESSION 5	SESSION 6	SESSION 7
Implicated professionals (amount paid/session)[a]	Physician (200 €) and dietician (78 €)	Dietician (78 €)	Dietician (78 €) and psychologist (90 €)	Sport educator (60 €)	Sports educator (60 €) and psychologist (90 €)	Psychologist (90 €)	Physician (200 €), dietician (78 €), psychologist (90 €) and Sports educator (60 €)
Amount paid session	278 €	78 €	168 €	60 €	150 €	90 €	428 €
Travel allowance (45 €/professional)	90 €	45 €	90 €	45 €	90 €	45 €	180 €
Cost per session organised[b]	368 €	123 €	258 €	105 €	240 €	135 €	608 €
Number of times the session was conducted	9	8	7	7	7	7	7
Total cost	3312 €	984 €	1806 €	735 €	1680 €	945 €	4256 €

[a] based on 2021 costs.

[b] cost per session organised was the sum of the amount paid to professionals and the travel allowance.

Table 3. Direct costs of the screening and care strategy

Costs items	Details	Costs (€)	
		Group (% of total cost)	Per participant
COSTS OF SCREENING		19,682 (41.6)[a]	11.67[c]
Number of participants to receive screening at baseline and the end of the intervention (n= 1,687)			
	Total duration[b] (hours)	281.2	
	Average wage rate of school nurses (€/hour)	35	
COSTS OF CARE			419.97[d]
Number of participants to receive care (n= 66)			
Project coordination costs		14,000 (29.5)	212.12
	Coordination (3 months of Equivalent Full Time: 3 * 3000 €)	9000	
	Training of professionals	4000	
	Others	1000	
Costs of collective sessions		13,718 (28.9)	207.85
TOTAL COST		47,400	28.1[e]

[a] The cost of screening was obtained by multiplying the total number of screening measurements (i.e. 3374 [1687 at baseline and 1687 at the end of the intervention]) by the total screening duration (i.e. 281.2 hours) by the average wage rate of a school nurse (i.e. 35€/hour).

[b] The total duration was obtained by multiplying the total number of adolescents (i.e. 1687) by the average duration of the screening per adolescent (i.e. 10 minutes) and converted in hours (i.e. divided by 60).

[c] Cost of screening per screened adolescent.

[d] Cost of care per cared for adolescent.

[e] Cost of screening and care strategy per screened adolescent.

Table 4. Incremental effectiveness, cost and the incremental cost effectiveness ratio of the screening and care strategy (n = 3 538)

	T0 %/Mean±SD	T2-T0 %/Mean±SD	Incremental Effectiveness %/β [95% CI]	p-value	Averted cases	Incremental cost (€)	ICER
Overweight and obesity prevalence (%)							
Screening and care group (n = 1687)	17.09%	-2.27%	**-1.71%**	**0.04**	**29[a]**	**47,400**	**€1634.48 per averted case of overweight and obesity**
No screening and care group (n = 1851)	19.90%	-0.56%	_			-	
Body mass index (kg/m²)							
Screening and care group (n = 1687)	21.37±3.20	0.64±1.44	**-0.11 [-0.21; -0.01]**	**0.03**	-	**47,400**	**€255.43 per kg/m² decrease per screened adolescent**
No screening and care group (n = 1851)	21.69±3.77	0.72±1.49	-			-	
Moderate physical activity							
Energy expenditure (MET-min/week)							
Screening and care group (n = 1687)	587.8±27.7	223.1±37.9	**170.0 [50.0; 291.0]**	**0.005**	-	**47,400**	**€165.28 per 1000 MET.min/week increase per screened adolescent**
No screening and care group (n = 1851)	665.8±28.8	74.3±37.7	-			-	
Duration (min/week)							
Screening and care group (n = 1687)	147.0±6.9	55.8±9.5	**43.0 [12.0; 73.0]**	**0.005**	-	**47,400**	**€39.21 per 60 min/week increase per screened adolescent**

	T0 %/Mean±SD	T2-T0 %/Mean±SD	Incremental Effectiveness %/β [95% CI]	p-value	Averted cases	Incremental cost (€)	ICER
No screening and care group (n = 1851)	166.5±7.2	18.6±9.4	-			-	
Frequency (days/week)							
Screening and care group (n =1687)	2.4±0.1	0.5±0.1	**0.3 [0.1; 0.6]**	**0.04**	-	**47,400**	**€93.66 per 1 day/week increase per screened adolescent**
No screening and care group (n = 1851)	2.5±0.1	0.2±0.1	-			-	
Total sitting time (min/week)							
Screening and care group (n = 1687)	2766.3±26.1	15.4±40.4	**-198.6 [-313.2; -83.9]**	**0.0006**	-	**47,400**	**€8.49 per 60 min/week decrease per screened adolescent**
No screening and care group (n = 1851)	2729.6±23.6	209.3±38.8	-			-	

SD, standard deviation; β, regression coefficient; CI, confidence interval; ICER, incremental cost effectiveness ratio; Met, metabolic equivalent of task.

[a] The number of averted cases was calculated by multiplying the number of adolescents in the screening and care group by the incremental effectiveness (i.e. 1.71%).

Table 5. Budget impact analysis of the screening and care strategy on overweight and obesity by scenario

Input	Scenario 1: Constant effect of the intervention in adulthood	Scenario 2: 25% decrease of effect of the intervention in adulthood
Target population [a]	1,782,172	1,782,172
Cost of the intervention per adolescent (€)	28.1	28.1
Estimated total cost of the intervention (€) [b]	50,079,034	50,079,034
Potential averted cases in adults[c]	21,334	16,000
DISCOUNT RATE: 0%		
Estimated additional care cost per individual per year for overweight and obesity (€) [d]	648	648
Total estimated additional care cost per year (€) [e]	13,824,432	10,368,000
Payback period (years) [f]	3.6	4.8
DISCOUNT RATE: 1.5%		
Estimated additional care cost per individual per year for overweight and obesity (€) [g]	430	430
Total estimated additional care cost per year (€) [e]	9,173,620	6,880,000
Payback period (years) [f]	5.5	7.3

[a] Estimated from the « Direction de l'évaluation, de la prospective et de la performance » (French Ministry of National Education, Youth and Sports).

[b] Obtained by multiplying the total target population by the cost per adolescent.

[c] Obtained by multiplying the total target population by the screening and care strategy effectiveness (i.e. 1.71%) and by the persistence proportion of overweight and obesity from adolescence to adulthood (i.e. 70%).

[d] These costs were estimated from Emery C et al.[34] and referred to the direct medical costs of adults with overweight or obesity (consumption of care and medical goods presented for reimbursement).

[e] Obtained by multiplying the estimated additional care cost per individual per year by the total number of potential averted cases.

[f] Obtained by dividing the estimated total cost of the intervention by the total estimated additional care cost per year.

[g] This cost was obtained by applying a discount rate of 1.5% each year over 60 years to the estimation from Emery C et al.[34]. It represented the mean discounted additional care cost (per individual per year for overweight and obesity).