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PERCEPÇÕES PARENTAIS SOBRE OS NÍVEIS DE ATIVIDADE FÍSICA E OS COMPORTAMENTOS SEDENTÁRIOS DAS CRIANÇAS E ADOLESCENTES DE FAMÍLIAS RURAIS DO NORDESTE PORTUGUÊS: UMA INVESTIGAÇÃO EPIDEMIOLÓGICA

PARENTAL PERCEPTIONS OF CHILDREN AND ADOLECENTS 'S PHYSICAL ACTIVITY AND SEDENTARY BEHAVIORS LEVELS IN RURAL NORTHEAST PORTUGUESE FAMILIES: AN EPIDEMIOLOGICAL RESEARCH

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Resumo
A diminuição da atividade física (AF) e do comportamento sedentário (CS) entre os jovens são preocupações prementes de saúde pública. No entanto, a investigação sobre AF e CS é limitada, particularmente em regiões rurais como o Nordeste de Portugal. Este estudo teve como objetivo conhecer as perceções parentais sobre a atividade física e os comportamentos sedentários de crianças dos 9 aos 11 anos e de adolescentes dos 12 aos 15 anos de uma zona rural do nordeste de Portugal. Este estudo observacional, prospetivo e de coorte avaliou os níveis de AF, CS e as perceções parentais através de inquéritos específicos. Este estudo sublinha a importância de compreender os padrões de AF e CS, juntamente com as perceções dos pais, nas populações jovens rurais. Entre os sexos, foram encontradas diferenças significativas para a quantidade de atividade física moderada que a sua criança/adolescente faz habitualmente por dia ($F = 5,89$; $p = 0,019$; $\eta^2 = 0,09$).Foram encontradas diferenças entre os efeitos de interação do sexo e dos grupos etários (crianças vs adolescentes) para a quantidade de atividade física moderada que a sua criança/adolescente costuma fazer por dia ($F = 1,26$; $p = 0,020$; $\eta^2 = 0,27$). Foram encontradas diferenças entre os efeitos de interação de sobre os dias por semana que o seu filho costuma praticar atividade física vigorosa ($F = 5,87$; $p = 0,019$; $\eta^2 = 0,01$). Os resultados fornecem informações valiosas para o desenvolvimento de intervenções direcionadas, que promovam comportamentos mais saudáveis e melhorem o bem-estar geral nas comunidades rurais do nordeste de Portugal.

Palavras-chave
Envolvimento parental, infância, adolescência, deslocação de 24 horas, comunidade, epidemiologia.

Abstract
Diminishing physical activity (PA) and PA (SB) among young people are pressing public health concerns. However, there is limited research focusing on PA and SB, particularly in rural regions such as northeastern Portugal. This study aimed to parental perceptions of PA and SB among children aged 9 to 11 and adolescents aged 12 to 15 in a rural area of northeastern Portugal. Utilizing an observational, prospective cohort design, the research evaluated PA levels, SB, and parental perceptions through specific surveys. Between sexes, significant difference were found for the amount of moderate PA from child/adolescent usually does each day ($F = 5.89$; $p = 0.019$; $\eta^2 = 0.09$). Differences between interaction effects of sex and age groups (children vs adolescents) were found for the amount of moderate PA from child/adolescent usually does each day ($F = 1.26$; $p = 0.020$; $\eta^2 = 0.27$). Differences between interaction effects of were found about days a week does your child usually engage in moderate-to-vigorous physical activity (MVPA) ($F = 5.87$; $p = 0.019$; $\eta^2 = 0.01$). This study highlights the critical need to understand PA and SB trends and parental viewpoints in rural youth populations. The findings offer crucial information for creating targeted interventions aimed at fostering healthier behaviors and enhancing the overall well-being of rural communities in northeastern Portugal.

Keywords
Parental involvement, childhood, adolescence, 24-hour move, community, epidemiology.

INTRODUCTION

Physical activity (PA) and sedentary behavior (SB) play pivotal roles in the health and well-being of children and adolescents [1,2]. There is growing concern globally over the decline in PA levels and the concurrent rise in sedentary lifestyles among youth, which pose significant health risks including obesity, cardiovascular diseases, and mental health disorders [3,4]. Understanding the patterns of PA and SB, as well as parental perceptions, is crucial for developing effective interventions aimed at promoting healthier behaviors within this demographic [5,6]. In rural areas, where lifestyle factors and resource accessibility may differ markedly from urban settings, exploring PA and SB assumes heightened importance [7,8]. However, research focusing on these aspects in rural regions, particularly within Portugal, remains relatively sparse despite the potential influence of environmental factors on activity levels [9,10].

Evidence-based interventions tailored to local contexts, we aim to foster sustainable improvements in PA behaviors and overall well-being within rural communities in Northeastern Portugal [10]. Despite these efforts, the majority of PA research has been concentrated in urban settings, leaving gaps in understanding the activity levels of children and adolescents in less-studied rural areas. Also, parents often have limited accuracy in estimating their children's PA levels and tend to overestimate moderate-to-vigorous physical activity (MVPA) while underestimating sedentary time. This discrepancy suggests a potential gap between perceived and actual activity levels [11]. Parental perceptions can significantly influence children's PA and SB. Positive parental attitudes towards PA, such as encouragement and role modelling, are associated with higher levels of PA in children [12]. Conversely, parents who perceive their children as less active may inadvertently contribute to lower activity levels through reduced encouragement or opportunities for active play [13]. Cultural and socioeconomic factors influence parental perceptions of PA and SB. For instance, in some cultures, academic success may be prioritized over PA, affecting parental attitudes and behaviors towards encouraging active lifestyles [14,15]. Socioeconomic status can also impact access to resources and opportunities for PA, thereby shaping parental perceptions and behaviors related to PA [16].

Parents also express concerns about their children's SBs, particularly screen time and its potential negative impacts on health. This concern may lead to efforts to restrict screen time and encourage more active pursuits [17]. Understanding parental perceptions is crucial for designing effective interventions aimed at promoting healthier behaviors in children. Interventions that educate parents about the benefits of PA and provide strategies for incorporating more activity into daily routines can help align parental perceptions with recommended activity guidelines [18–20]. Overall, the literature underscores the importance of considering parental perceptions as a significant factor in shaping children's PA and SB. Addressing parental attitudes and knowledge gaps can contribute to more successful efforts to promote active lifestyles among children and adolescents. Therefore, this study aimed to parental perceptions of PA and SBs among children aged 9 to 11 and adolescents aged 12 to 15 in a rural area of Northeastern Portugal.

Methodology

Sample

The study sample was conducted in Alfândega da Fé, a town and municipality in the Bragança province of northeastern Portugal, with 5,000 residents and significant agricultural industry. The sample included students from the local high school, the Escola EB2.3/s de Alfândega da Fé. Ethical approval was obtained from the Polytechnic Institute of Bragança. Participants' age and body composition according to children and young girls and boys are represented on Table 1.

Table 3. Participants' age and body composition according to children and young girls and boys.

Variables	Girls		Boys	
	Children (9-11 years)	Adolescents (12-15 years)	Children (9-11 years)	Adolescents (12-15 years)
Age (y)	10.54 ± 0.59	13.20 ± 0.94	10.31 ± 0.60	12.93 ± 0.80
Height (m)	1.32 ± 0.52	1.47 ± 0.41	1.30 ± 0.51	1.29 ± 0.68
Weight (kg)	63.0 ± 38.34	48.20 ± 20.00	38.16 ± 17.88	47.56 ± 28.34
BMI (kg/m²)	19.06 ± 3.63	21.34 ± 6.10	19.51 ± 3.90	22.36 ± 4.28

BMI – Body Mass Index.

Data collection

A cross-sectional design will be used to collect data between September 2022 and January 2023. In addition to informational materials, students will get a study pack that includes an agreement form for student completion, a consent form for parental completion, and a sociodemographic questionnaire. It is optional to fill out the questionnaire online. It will be made clear to participants that participation is entirely voluntary, and they are free to end it at any moment. To gather general information about the target population and the guardians' perception of the PA levels of the students, the project considers using a sociodemographic questionnaires [21,22].

Sociodemographic variables

Using a portable scale (Seca model 770, Hanover, MD, USA) and a portable stadiometer (Harpenden model 98.603, Holtain Ltd, Crosswell, UK), the participants' height and weight were measured in the morning at the school, respectively, to the nearest 0.1 cm and 0.1 kg. The body mass index (BMI, kg/m2) was computed [23]. The questionnaire gathered information on parents' perceptions of PA as well as sociodemographic factors. Family relationship, education level, employment, nationality, and place of residence are the factors that were gathered. The independent analyses included in the analysis were gender (boys and girls) and age groups (children 9-11 years; adolescents 12-15 years). Additionally, the parental perception of PA was collected by the questionnaire. The questionnaire assessed the frequency and duration of vigorous and moderate physical activities, as well as daily walking habits and sedentary behaviour. It also solicits an overall description of the child's PA level, excluding school time. The questionnaire was validated for the assessment of PA levels in Portuguese children and young people, and applied beforehand [24].

Statistical analysis

Descriptive statistics involved assessing normality and homogeneity using the Kolmogorov-Smirnov and Levene's tests. Results were presented as mean ± one standard deviation (SD), percentage (%), and 95% confidence intervals (CI). Mean differences were analyzed using a two-way analysis of variance (ANOVA). The effect size index for each test was described by the eta square – η^2: (i) without effect if $0 < \eta^2 \leq 0.04$; (ii) minimum if $0.04 < \eta^2 \leq 0.25$; (iii) moderate if $0.25 < \eta^2 \leq 0.64$; and (iv) strong if $\eta^2 > 0.64$. Statistical significance was considered at $p < 0.05$. All analyses were performed by IBM SPSS Statistics for Windows, Version 27.0 [25].

RESULTS

Table 2 showed shows the average differences between sexes and age groups in the level of PA and sedentary behaviour, according to the questionnaire items. Between sexes, significant difference were found for the amount of moderate PA your child/adolescent usually does each day ($F = 5.89$; $p = 0.019$; $\eta^2 = 0.09$). Differences between interaction effects of sex and age groups (children vs adolescents) were found for the amount of moderate PA your child/adolescent usually does each day ($F = 1.26$; $p = 0.020$; $\eta^2 = 0.27$). Differences between interaction effects of were found about days a week does your child usually engage in vigorous PA, such as lifting and/or carrying heavy objects, digging, aerobics or cycling at high speed ($F = 5.87$; $p = 0.019$; $\eta^2 = 0.01$).

Table 2. Mean differences between sex and age groups in physical activity level and sedentary behaviour bouts, according to questionnaire items.

	Girls		Boys		Sex			Age Groups			Sex x Age Groups		
	Children (9-11 y)	Adolescents (12-15 y)	Children (9-11 y)	Adolescents (12-15 y)	*F*	*p*	η^2	*F*	*P*	η^2	*F*	*p*	η^2
1a	3.09 ± 1.58	2.00 ± 0.71	2.00 ± 1.41	3.2 ± 1.66	0.87	0.355	0.02	0.19	0.665	0.003	5.87	0.019	0.10
1b	126.36 ± 80.28	90.00 ± 67.08	90.00 ± 67.08	107.00 ± 77.92	0.313	0.578	0.006	0.345	0.560	0.007	1.277	0.264	0.024
2a	2.91 ± 1.51	3.20 ± 2.28	2.80 ± 2.68	2.93 ± 1.75	0.093	0.762	0.002	0.016	0.899	-	0.270	0.605	0.005
2b	175.45 ± 132.92	93.00 ± 56.52	52.00 ± 27.75	84.67 ± 55.01	5.880	0.019	0.094	1.258	0.267	0.020	0.067	0.769	0.001
3a	4.64 ± 2.06	5.60 ± 1.34	5.20 ± 2.68	4.40 ± 1.96	2.030	0.159	0.030	0.508	0.478	0.008	0.014	0.907	-
3b	126.82 ± 128.19	119.00 ± 202.74	58.00 ± 53.57	82.33 ± 113.14	3.054	0.085	0.045	1.295	0.259	0.019	0.030	0.863	-
4a	4.91 ± 2.17	7.00 ± 3.08	8.20 ± 1.30	7.20 ± 2.93	0.497	0.483	0.006	1.278	0.262	0.017	0.756	0.387	0.010
4b	4.27 ± 1.68	7.20 ± 9.45	6.20 ± 2.78	5.67 ± 2.82	0.490	0.486	0.007	1.051	0.309	0.014	1.742	0.191	0.023

Note: ES – Effect size; η^2: eta squared for ANOVA.

DISCUSSION

This study aimed to parental perceptions of PA and SBs among children aged 9 to 11 and adolescents aged 12 to 15 in a rural area of Northeastern Portugal. Utilizing an observational, prospective cohort design, the research evaluated PA levels, SB, and parental perceptions through specific surveys. Between sexes, significant difference were found for the amount of moderate PA your child/adolescent usually does each day. Also, differences between interaction effects of sex and age groups were found for moderate PA your child/adolescent usually does each day, as well as between interaction effects of were found about days a week does your child usually engage in vigorous PA.

The findings of this study provide valuable insights into parental perceptions and actual PA levels among children and adolescents in a rural area of Northeastern Portugal. The use of an observational, prospective cohort design allowed for a detailed assessment of PA levels, SB, and parental attitudes through specific surveys [26,27]. The study revealed significant differences between sexes in the amount of moderate PA performed daily by children and adolescents [11]. This highlights a potential disparity that could influence health outcomes, as moderate PA plays a crucial role in maintaining physical fitness and overall well-being during developmental years. Moreover, the interaction effects of sex and age groups further underscored nuanced differences in PA behaviors [11,12]. Specifically, significant interactions were noted concerning the amount of moderate PA undertaken daily, emphasizing that these behaviors vary not only between sexes but also across different developmental stages within each gender group [15]. Such insights are crucial for tailoring interventions that target specific demographic profiles to enhance PA engagement effectively [13]. Understanding these variations can guide healthcare professionals and policymakers in developing targeted strategies that cater to the diverse needs and preferences of children and adolescents in rural areas [17,28].

Furthermore, the study identified differences in the frequency of engaging in vigorous PA based on interaction effects, suggesting that these behaviors are influenced by a combination of individual factors such as sex and age. These findings underscore the complexity of promoting vigorous PA in rural settings, where access to facilities and opportunities for structured physical activities may differ from urban environments. Addressing these disparities is essential for promoting active lifestyles among young populations, thereby mitigating the risks associated with sedentary behaviors and fostering long-term health benefits [10,21]. Future research could explore additional socio-environmental factors that may influence PA and SB among rural youth, providing a more comprehensive understanding of the determinants of PA in diverse geographical contexts. The major limitation of this study is the lack of a comparison with an objective variable for measuring PA and SB levels. Thus, the future application of accelerometers could provide a gold standard reference for

the assessment of PA due to their ability to offer an unbiased assessment of MVPA based on body movements [4,23].

CONCLUSION

About parental perceptions of the PA and SB levels, between sexes, significant difference were found for the amount of moderate PA your child/adolescent usually does each day. Also, differences between interaction effects of sex and age groups were found for the amount of moderate PA your child/adolescent usually does each day, as well as between interaction effects of were found about days a week does your child usually engage in MVPA. This study highlights the critical need to understand PA and SB trends and parental viewpoints in rural youth populations. The findings offer crucial information for creating targeted interventions aimed at fostering healthier behaviours and enhancing the overall well-being of rural communities in Northeastern Portugal.

REFERENCES

1. Farooq MA, Parkinson KN, Adamson AJ, Pearce MS, Reilly JK, Hughes AR, et al. Timing of the decline in physical activity in childhood and adolescence: Gateshead Millennium Cohort Study. Br J Sports Med [Internet]. 2018 Aug 1 [cited 2024 Feb 8];52(15):1002–6. Available from: https://bjsm.bmj.com/content/52/15/1002
2. Rodriguez-Ayllon M, Cadenas-Sánchez C, Estévez-López F, Muñoz NE, Mora-Gonzalez J, Migueles JH, et al. Role of Physical Activity and Sedentary Behavior in the Mental Health of Preschoolers, Children and Adolescents: A Systematic Review and Meta-Analysis. Sports Med [Internet]. 2019 Sep 1 [cited 2024 Feb 12];49(9):1383–410. Available from: https://doi.org/10.1007/s40279-019-01099-5
3. Riddoch CJ, Mattocks C, Deere K, Saunders J, Kirkby J, Tilling K, et al. Objective measurement of levels and patterns of physical activity. Archives of Disease in Childhood [Internet]. 2007 Nov 1 [cited 2024 Feb 24];92(11):963–9. Available from: https://adc.bmj.com/content/92/11/963
4. Troiano RP, Berrigan D, Dodd KW, Mâsse LC, Tilert T, Mcdowell M. Physical Activity in the United States Measured by Accelerometer. Medicine & Science in Sports & Exercise [Internet]. 2008 Jan [cited 2024 Feb 24];40(1):181–8. Available from: https://journals.lww.com/00005768-200801000-00025
5. Fairclough SJ, Boddy LM, Mackintosh KA, Valencia-Peris A, Ramirez-Rico E. Weekday and weekend sedentary time and physical activity in differentially active children. Journal of Science and Medicine in Sport [Internet]. 2015 Jul 1 [cited 2024 May 20];18(4):444–9. Available from: https://www.sciencedirect.com/science/article/pii/S1440244014001169
6. Harrell JS, Pearce PF, Markland ET, Wilson K, Bradley CB, McMurray RG. Assessing Physical Activity in Adolescents: Common Activities of Children in 6th–8th Grades. Journal of the American Academy of Nurse Practitioners [Internet]. 2003 [cited 2024 May 20];15(4):170–8. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1745-7599.2003.tb00259.x
7. Carbone PS, Smith PJ, Lewis C, LeBlanc C, COUNCIL ON CHILDREN WITH DISABILITIES COSMAF. Promoting the Participation of Children and Adolescents With Disabilities in Sports, Recreation, and Physical Activity. Pediatrics [Internet]. 2021 Dec 1 [cited 2023 Jan 11];148(6):e2021054664. Available from: https://doi.org/10.1542/peds.2021-054664
8. Santana P, Santos R, Nogueira H. The link between local environment and obesity: A multilevel analysis in the Lisbon Metropolitan Area, Portugal. Social Science & Medicine [Internet]. 2009 Feb 1 [cited 2023 Jan 12];68(4):601–9. Available from: https://www.sciencedirect.com/science/article/pii/S0277953608006084
9. Kerr J, Cox T, Griffiths AJ. Workplace Health: Employee Fitness And Exercise. CRC Press; 2020. 212 p.
10. Machado-Rodrigues AM, Coelho-E-Silva MJ, Mota J, Padez C, Martins RA, Cumming SP, et al. Urban–rural contrasts in fitness, physical activity, and sedentary behaviour in adolescents. Health Promotion International [Internet]. 2014 Mar 1 [cited 2023 Jan 12];29(1):118–29. Available from: https://doi.org/10.1093/heapro/das054
11. Edwardson CL, Gorely T. Parental influences on different types and intensities of physical activity in youth: A systematic review. Psychology of Sport and Exercise [Internet]. 2010 Nov 1 [cited 2024 Jun 17];11(6):522–35. Available from: https://www.sciencedirect.com/science/article/pii/S1469029210000580

12. Davison KK, Birch LL. Childhood overweight: a contextual model and recommendations for future research. Obesity Reviews [Internet]. 2001 [cited 2024 Jun 17];2(3):159–71. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1046/j.1467-789x.2001.00036.x
13. Fuemmeler BF, Anderson CB, Mâsse LC. Parent-child relationship of directly measured physical activity. Int J Behav Nutr Phys Act [Internet]. 2011 Mar 8 [cited 2024 Jun 17];8(1):17. Available from: https://doi.org/10.1186/1479-5868-8-17
14. Griffiths LJ, Sera F, Cortina-Borja M, Law C, Ness A, Dezateux C. Objectively measured physical activity and sedentary time: cross-sectional and prospective associations with adiposity in the Millennium Cohort Study. BMJ Open [Internet]. 2016 Apr 1 [cited 2024 Jun 17];6(4):e010366. Available from: https://bmjopen.bmj.com/content/6/4/e010366
15. Houwen S, van der Veer G, Visser J, Cantell M. The relationship between motor performance and parent-rated executive functioning in 3- to 5-year-old children: What is the role of confounding variables? Human Movement Science [Internet]. 2017 Jun 1 [cited 2024 Jun 17];53:24–36. Available from: https://www.sciencedirect.com/science/article/pii/S0167945716303268
16. Trost SG, Pate RR, Sallis JF, Freedson PS, Taylor WC, Dowda M, et al. Age and gender differences in objectively measured physical activity in youth. Med Sci Sports Exerc. 2002 Feb;34(2):350–5.
17. Vasques C, Magalhães P, Cortinhas A, Mota P, Leitão J, Lopes VP. Effects of Intervention Programs on Child and Adolescent BMI: A Meta-Analysis Study. Journal of Physical Activity and Health [Internet]. 2014 Feb 1 [cited 2023 Jul 3];11(2):426–44. Available from: https://journals.humankinetics.com/view/journals/jpah/11/2/article-p426.xml
18. Boreham CA, Twisk J, Savage MJ, Cran GW, Strain JJ. Physical activity, sports participation, and risk factors in adolescents. Med Sci Sports Exerc [Internet]. 1997 Jun 1 [cited 2024 May 20];29(6):788–93. Available from: https://doi.org/10.1097/00005768-199706000-00009
19. Sá C, Vilar J, Magalhães P, Vasques C. Sleep time, tv/video games and snack consumption in preschool children: a cross-sectional study. Retos: nuevas tendencias en educación física, deporte y recreación [Internet]. 2022 [cited 2023 Jan 12];(46):581–5. Available from: https://dialnet.unirioja.es/servlet/articulo?codigo=8555096
20. Vasques C, Magalhães P, Carvalhal I, Coelho E. Relação entre as horas de sono e o IMC em crianças do pré-escolar: programa pé-ativo. Estudos de Desenvolvimento Motor da Criança XV [Internet]. 2020 [cited 2023 Jan 12];103–5. Available from: https://bibliotecadigital.ipb.pt/handle/10198/23301
21. Kakinami L, Wissa R, Khan R, Paradis G, Barnett TA, Gauvin L. The association between income and leisure-time physical activity is moderated by utilitarian lifestyles: A nationally representative US population (NHANES 1999–2014). Preventive Medicine [Internet]. 2018 Aug 1 [cited 2023 Jan 12];113:147–52. Available from: https://www.sciencedirect.com/science/article/pii/S0091743518301634
22. Vanhelst J, Mikulovic J, Bui-Xuan G, Dieu O, Blondeau T, Fardy P, et al. Comparison of two ActiGraph accelerometer generations in the assessment of physical activity in free living conditions. BMC Res Notes [Internet]. 2012 Apr 25 [cited 2023 Jan 12];5(1):187. Available from: https://doi.org/10.1186/1756-0500-5-187
23. Kêkê LM, Samouda H, Jacobs J, di Pompeo C, Lemdani M, Hubert H, et al. Body mass index and childhood obesity classification systems: A comparison of the French, International Obesity Task Force (IOTF) and World Health Organization (WHO) references. Revue d'Épidémiologie et de Santé Publique [Internet]. 2015 Jun 1 [cited 2024 Feb 12];63(3):173–82. Available from: https://www.sciencedirect.com/science/article/pii/S0398762015003089
24. Vasques C, Magalhães P, Cortinhas A, Mota P, Leitão J, Lopes VP. Effects of Intervention Programs on Child and Adolescent BMI: A Meta-Analysis Study. Journal of Physical Activity and Health [Internet]. 2014 Feb 1 [cited 2023 Jan 12];11(2):426–44. Available from: https://journals.humankinetics.com/view/journals/jpah/11/2/article-p426.xml
25. Hopkins WG, Marshall SW, Batterham AM, Hanin J. Progressive statistics for studies in sports medicine and exercise science. Med Sci Sports Exerc. 2009 Jan;41(1):3–13.
26. Dumuid D, Simm P, Wake M, Burgner D, Juonala M, Wu F, et al. The "Goldilocks Day" for Children's Skeletal Health: Compositional Data Analysis of 24-Hour Activity Behaviors. Journal of Bone and Mineral Research [Internet]. 2020 [cited 2024 May 20];35(12):2393–403. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1002/jbmr.4143

27. Kohl HW, Craig CL, Lambert EV, Inoue S, Alkandari JR, Leetongin G, et al. The pandemic of physical inactivity: global action for public health. The Lancet [Internet]. 2012 Jul 21 [cited 2023 Jan 11];380(9838):294–305. Available from: https://www.sciencedirect.com/science/article/pii/S0140673612608988
28. Ginja S, Arnott B, Araujo-Soares V, Namdeo A, McColl E. Feasibility of an incentive scheme to promote active travel to school: a pilot cluster randomised trial. Pilot Feasibility Stud [Internet]. 2017 Nov 14 [cited 2022 Dec 20];3(1):57. Available from: https://doi.org/10.1186/s40814-017-0197-9