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Editorial

The Epidemic of Obesity and Poor Physical Activity Participation: Will We Ever See a Change?

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Obesity is a global epidemic, and researchers have been examining its prevalence and impact for decades [1]. In 2016, The World Health Organization (WHO) estimated that more than 1.9 billion adults over the age of 18 were overweight, and 650 million of these adults were obese [2]. Worldwide obesity in adults has greatly increased in the last ~40 years [2]; a systematic review of over 1700 research studies found that the global proportion of overweight/obese adults increased from 28.8% to 36.9% in males, and 29.8% to 38% in females between 1980 and 2013 [1]. Furthermore, global obesity rates are projected to continue to steadily increase [3].

Unfortunately, the epidemic of obesity is not limited to adults; children and adolescents are overweight and obese at alarming levels worldwide, with many countries reporting prevalence rates of ~20–35% [4–11]. As seen in adults, the proportion of overweight/obese youth continues to rise [1,12]. Even more concerning is that obesity is becoming a prevalent issue in very young children; the WHO estimates that as of 2016, 41 million children under the age of five are overweight or obese [2]. In one a study of over 2000 four-year-old children from Spain, the prevalence of obesity increased from 5.4% to 10.1% over a two-year follow-up [4]. Obesity during childhood/adolescence drastically increases the probability of obesity in adulthood [13,14]. Early-onset obesity is setting children up for a lifelong risk of obesity-associated complications, as it is now understood that early markers of adult cardiovascular disease begin in childhood [15].

Obesity is associated with disorders of almost every system in the body [16]. For example, adults with obesity have increased incidence of cardiovascular disease, diabetes, high cholesterol, and hypertension [17–19]. Childhood obesity is also associated with hypertension, insulin resistance, and liver disease, among others [16]. In a large cohort study of over 8500 nine-year-old Irish children, a staggering 11.1% of the population reported having a chronic illness that impaired daily living [20]. Children who reported living with chronic diseases were more often overweight or obese (32% prevalence) [20]. The negative health effects associated with obesity are not limited to physical outcomes; cognitive function is also decreased in obese children [21,22]. For example, a recent study examined the association of adiposity with achievement and cognitive function in obese children aged 7–9 years old vs. normal-weight children [23]. Compared to normal-weight children, children who were obese had lower performance on tests of reading and math. In the obese children, higher visceral adipose tissue was associated with poorer intellectual abilities and cognitive performance [23]. Published data indicate that an increasing number of children are at risk of

obesity-associated physical and cognitive dysfunction, as well as poor psychosocial health (i.e., anxiety, depression) [24], underscoring the need to address this epidemic.

Physical activity is an important, modifiable lifestyle factor that can help improve health outcomes in adults and children, including reducing obesity [25–27], cardiovascular disease [28,29], and diabetes [27,30]. Current WHO global recommendations for physical activity suggest that adults aged 18–64 years of age should engage in at least 150 min of moderate–vigorous physical activity per week, in bouts of at least 10 min of duration [31], and that children aged 5–17 years old should be accumulating 60 min of daily moderate–vigorous intensity physical activity. The WHO report indicates a dose-response relationship with greater physical activity levels associated with additional health benefits in adults and children [31].

Unfortunately, and perhaps not surprisingly, both adults and children are not meeting these physical activity guidelines globally [32–36]. Canadian Health Measures Survey data (2007–2009) indicate that only 15% of Canadian adults are accumulating the recommended 150 min of moderate–vigorous physical activity per week [32], and of them, only 5% accumulate 150 min per week in at least 30-min bouts five or more days per week [32]. According to the Centers for Disease Control and Prevention (CDC) in the United States, only 20.5% of adults in 2015 were meeting the WHO-recommended physical activity guidelines [33]. In an international study of 20 countries, the percentage of adults who reported being physically inactive (sedentary) was between 6.9% (China) and 42.3% (Taiwan) [36].

Children are also not achieving physical activity guidelines; the WHO estimates that globally, 81% of school-aged children are not meeting guidelines of 60 min of physical activity per day [37]. The new Canadian 24-h Movement Guidelines for the Early Years (0–4 years) suggest that preschoolers should engage in at least 180 min per day of physical activities, 60 min of which should be moderate to vigorous daily physical activity [38]. Chaput et al. reported that 38.2% of Canadian preschool children (mean age 3.5 years) were not meeting these physical activity recommendations [39]. When the Canadian 24-h Movement Guidelines were examined in an international sample of over 6000 children, the global prevalence of meeting the recommendations was only 7% [40]. Therefore, the problem of physical inactivity is evident at a very early age.

The information regarding poor physical activity participation, combined with the high prevalence of obesity, is more than just disappointing; it is concerning. There have been no major, successful population intervention strategies to reduce obesity, and there have been no national successes in reducing the burden of obesity in the past 33 years [1]. We know that physical activity is a potent 'medicine' against obesity, yet despite the prominent health benefits of physical activity, participation rates in both adults and children remain low. We are observing a disconnect between the known benefits of physical activity and the number of individuals who actively engage in the recommended amounts. We wonder then, "What kind of data will it take for the general population to decide that physical activity is a necessity to include in their daily lives?" One emerging area of research is examining the association between physical activity and mortality. Perhaps identifying a link between physical inactivity and increased mortality will be the convincing data needed to encourage adherence to physical activity guidelines.

A recent study titled "Impact of healthy lifestyle factors on life expectancies in the U.S. population" by Li and colleagues was published in the prominent American Heart Association journal, *Circulation* [41]. This was a comprehensive, large-scale analysis of how lifestyle factors impact life expectancy in the U.S. population [41]. The authors examined the association of lifestyle-related low-risk factors (specifically: diet, smoking, physical activity, alcohol consumption, and body mass index) using well-collected cohort data including the Nurses' Health Study (NHS), and the Health Professionals Follow-up Study (HPFS). They also used data from the National Health and Nutrition and Examination Surveys (NHANES) to determine the distribution of the lifestyle related factors in the U.S. population, and they derived death rates from the Centers for Disease Control and Prevention

Wide-Ranging Online Data for Epidemiological Research database. At baseline, the authors included 78,865 females and 44,354 males for analysis [41].

Li et al. defined five low-risk factors (diet, smoking, physical activity, alcohol consumption, and body mass index) and examined their impact together and independently on mortality [41]. We will focus on discussing the physical activity findings. Physical activity was measured using a validated questionnaire (updated every two years), and was considered to be a low-risk lifestyle factor if individuals engaged in >30 min per day of moderate or vigorous activity (including brisk walking). To determine how lifestyle factors affected mortality risk, Li et al. calculated the average physical activity level using the last two repeated measurements relative to a mortality event. For example, if a mortality case occurred in 1982–1984, the average of the 1980 and 1982 physical activity questionnaire for that individual was used [41].

Women had a median study follow-up of 33.9 years, and men had a follow-up of 27.2 years. During this time 42,167 deaths were recorded [41]. The authors found that each of the five healthy lifestyle components was significantly associated with the risk of all-cause mortality. A higher dose of physical activity was associated with a decrease in all-cause mortality, death due to cancer, and death due to cardiovascular disease. Specifically, completing 0.1–0.9 h/week of physical activity was associated with a hazard radio (HR) of 0.65 (95% confidence intervals (CI): 0.63–0.66); 1.0–3.4 h/week was associated with a HR of 0.56 (95% CI: 0.54–0.58); 3.5–5.9 h/week was associated with a HR of 5.0 (95% CI: 0.48–0.52); and $\geq$6 h/week was associated with a HR of 0.44 (95% CI: 0.43–0.46) for all-cause mortality [41]. In other words, engaging in physical activity for as little as 0.1 hour/week up to $\geq$6 h/week was associated with a 35–56% reduced risk of death over the follow-up period [41]. The authors estimated gained life expectancy, and found that increased participation in physical activity compared to the most sedentary group was associated with a longer life expectancy [41]. The conclusions from this large and well-designed analysis are clear; modifiable lifestyle factors such as physical activity can improve life expectancy in U.S. adults [41].

Therefore, we return to our previous question, "what kind of data will it take for the general population to decide that physical activity is a necessity to include in their daily lives?" It is evident from Li et al.'s comprehensive study that life expectancy is directly linked with physical activity participation in adults [41]. Will this be the convincing piece of evidence required to convince adults that physical activity participation is necessary? It is unlikely that the results from Li and colleagues' study will lead to large-scale physical activity participation change, because there have been previous studies that also report an inverse, independent association between volume of physical activity and mortality in adults [42–45].

However, let us say, optimistically, that Li et al.'s study does result in knowledge translation and encourages adults to become more physically active to prolong life; do the results also encourage physical activity participation in children? As previously mentioned, Li et al. quantified cumulative average levels of physical activity using the last two repeated measures (i.e., four years) prior to mortality; and therefore they reported that relatively short-term physical activity participation is associated with prolonged life [41]. This may suggest that a long-term sedentary lifestyle during childhood and early adulthood is not problematic. However, we know that this is untrue based on studies that show childhood/lifetime physical activity participation is predictive of physical activity habits, fitness, and cardiovascular health later in life [46,47]. Healthy, active kids often equate to healthy, active adults. Furthermore, the body mass index of children is significantly and positively associated with a family history of obesity [48]; encouraging healthy-weight children leads to healthy-weight adults, which in turn results in the next generation of healthy-weight children.

While the conclusions by Li et al. are important and should not be diminished [41], we are still in need of research that longitudinally assesses how lifelong physical activity, beginning in childhood, contributes to life expectancy and mortality. We acknowledge that this would be a large, expensive, and difficult endeavour given the extensive follow-up it would require, and is likely why this type of study does not yet exist. However, consider the large economic burden of obesity, which has been

estimated at $2.0 trillion dollars globally [49]; if we funnelled even a small portion of this money into research, a long-term physical activity and life-expectancy study beginning in childhood is suddenly realistic. We desperately need to change our future obesity outlook; it is our duty as researchers and academics to prioritize future studies that may, in turn, result in the information necessary to trigger large-scale changes in physical activity participation and obesity.

References

1. Ng, M.; Fleming, T.; Robinson, M.; Thomson, B.; Graetz, N.; Margono, C.; Mullany, E.C.; Biryukov, S.; Abbafati, C.; Abera, S.F.; et al. Global, regional and national prevalence of overweight and obesity in children and adults 1980–2013: A systematic analysis. *Lancet* **2014**, *384*, 766–781. [CrossRef]
2. World Health Organization. Obesity and Overweight. 2017. Available online: http://www.who.int/en/news-room/fact-sheets/detail/obesity-and-overweight (accessed on 10 May 2018).
3. The Organisation for Economic Co-operation and Development. Obesity Update 2017. Available online: https://www.oecd.org/els/health-systems/Obesity-Update-2017.pdf (accessed on 10 May 2018).
4. Ortiz-Marron, H.; Ortiz-Pinto, M.A.; Cuadrado-Gamarra, J.I.; Esteban-Vasallo, M.; Cortes-Rico, O.; Rey-Gayo, L.; Ordobas, M.; Galan, I. Persistence and variation in overweight and obesity among the pre-school population of the Community of Madrid after 2 years of follow-up. The eloin cohort. *Rev. Esp. Cardiol.* **2018**. [CrossRef] [PubMed]
5. Sjoberg, A.; Moraeus, L.; Yngve, A.; Poortvliet, E.; Al-Ansari, U.; Lissner, L. Overweight and obesity in a representative sample of schoolchildren—Exploring the urban-rural gradient in Sweden. *Obes. Rev.* **2011**, *12*, 305–314. [CrossRef] [PubMed]
6. Liu, J.M.; Ye, R.; Li, S.; Ren, A.; Li, Z.; Liu, Y.; Li, Z. Prevalence of overweight/obesity in Chinese children. *Arch. Med. Res.* **2007**, *38*, 882–886. [CrossRef] [PubMed]
7. Bertoncello, C.; Cazzaro, R.; Ferraresso, A.; Mazzer, R.; Moretti, G. Prevalence of overweight and obesity among school-aged children in urban, rural and mountain areas of the Veneto Region, Italy. *Public Health Nutr.* **2008**, *11*, 887–890. [CrossRef] [PubMed]
8. Malik, M.; Bakir, A. Prevalence of overweight and obesity among children in the United Arab Emirates. *Obes. Rev.* **2007**, *8*, 15–20. [CrossRef] [PubMed]
9. Hassapidou, M.; Daskalou, E.; Tsofliou, F.; Tziomalos, K.; Paschaleri, A.; Pagkalos, I.; Tzotzas, T. Prevalence of overweight and obesity in preschool children in Thessaloniki, Greece. *Hormones* **2015**, *14*, 615–622. [CrossRef] [PubMed]
10. Kulaga, Z.; Gurzkowska, B.; Grajda, A.; Wojtylo, M.; Gozdz, M.; Litwin, M. The prevalence of overweight and obesity among Polish pre-school-aged children. *Dev. Period Med.* **2016**, *20*, 143–149. [PubMed]
11. Statistics Canada. Body Mass Index of Children and Youth, 2012–2013. 2013. Available online: https://www.statcan.gc.ca/pub/82-625-x/2014001/article/14105-eng.htm (accessed on 10 May 2018).
12. Statistics Canada. Overweight and Obese Youth (Self-Reported). 2014. Available online: https://www.statcan.gc.ca/pub/82-625-x/2015001/article/14186-eng.htm (accessed on 10 May 2018).
13. Whitaker, R.C.; Wright, J.A.; Pepe, M.S.; Seidel, K.D.; Dietz, W.H. Predicting obesity in young adulthood from childhood and parental obesity. *N. Engl. J. Med.* **1997**, *337*, 869–873. [CrossRef] [PubMed]
14. Guo, S.S.; Wu, W.; Chumlea, W.C.; Roche, A.F. Predicting overweight and obesity in adulthood from body mass index values in childhood and adolescence. *Am. J. Clin. Nutr.* **2002**, *76*, 653–658. [CrossRef] [PubMed]
15. Li, S.; Chen, W.; Srinivasan, S.R.; Bond, M.G.; Tang, R.; Urbina, E.M.; Berenson, G.S. Childhood cardiovascular risk factors and carotid vascular changes in adulthood: The Bogalusa Heart Study. *JAMA* **2003**, *290*, 2271–2276. [CrossRef] [PubMed]
16. Gungor, N.K. Overweight and obesity in children and adolescents. *J. Clin. Res. Pediatr. Endocrinol.* **2014**, *6*, 129–143. [CrossRef] [PubMed]
17. Ghandehari, H.; Le, V.; Kamal-Bahl, S.; Bassin, S.L.; Wong, N.D. Abdominal obesity and the spectrum of global cardiometabolic risks in US adults. *Int. J. Obes.* **2009**, *33*, 239–248. [CrossRef] [PubMed]
18. Hu, F.B. Globalization of diabetes: The role of diet, lifestyle, and genes. *Diabetes Care* **2011**, *34*, 1249–1257. [CrossRef] [PubMed]

19. Schulze, M.B.; Hu, F.B. Primary prevention of diabetes: What can be done and how much can be prevented? *Annu. Rev. Public Health* **2005**, *26*, 445–467. [CrossRef] [PubMed]
20. Fitzgerald, M.P.; Hennigan, K.; O'Gorman, C.S.; McCarron, L. Obesity, diet and lifestyle in 9-year-old children with parentally reported chronic diseases: Findings from the growing up in Ireland longitudinal child cohort study. *Ir. J. Med. Sci.* **2018**. [CrossRef] [PubMed]
21. Kamijo, K.; Khan, N.A.; Pontifex, M.B.; Scudder, M.R.; Drollette, E.S.; Raine, L.B.; Evans, E.M.; Castelli, D.M.; Hillman, C.H. The relation of adiposity to cognitive control and scholastic achievement in preadolescent children. *Obesity* **2012**, *20*, 2406–2411. [CrossRef] [PubMed]
22. Chojnacki, M.R.; Raine, L.B.; Drollette, E.S.; Scudder, M.R.; Kramer, A.F.; Hillman, C.H.; Khan, N.A. The negative influence of adiposity extends to intraindividual variability in cognitive control among preadolescent children. *Obesity* **2018**, *26*, 405–411. [CrossRef] [PubMed]
23. Raine, L.; Drollette, E.; Kao, S.C.; Westfall, D.; Chaddock-Heyman, L.; Kramer, A.F.; Khan, N.; Hillman, C. The associations between adiposity, cognitive function, and achievement in children. *Med. Sci. Sports Exerc.* **2018**. [CrossRef] [PubMed]
24. Sagar, R.; Gupta, T. Psychological aspects of obesity in children and adolescents. *Indian J. Pediatr.* **2017**. [CrossRef] [PubMed]
25. Katzmarzyk, P.T.; Barreira, T.V.; Broyles, S.T.; Champagne, C.M.; Chaput, J.P.; Fogelholm, M.; Hu, G.; Johnson, W.D.; Kuriyan, R.; Kurpad, A.; et al. Physical activity, sedentary time, and obesity in an international sample of children. *Med. Sci. Sports Exerc.* **2015**, *47*, 2062–2069. [CrossRef] [PubMed]
26. Ohkawara, K.; Tanaka, S.; Miyachi, M.; Ishikawa-Takata, K.; Tabata, I. A dose-response relation between aerobic exercise and visceral fat reduction: Systematic review of clinical trials. *Int. J. Obes.* **2007**, *31*, 1786–1797. [CrossRef] [PubMed]
27. Fedewa, M.V.; Gist, N.H.; Evans, E.M.; Dishman, R.K. Exercise and insulin resistance in youth: A meta-analysis. *Pediatrics* **2014**, *133*, e163–e174. [CrossRef] [PubMed]
28. Kohl, H.W., 3rd. Physical activity and cardiovascular disease: Evidence for a dose response. *Med. Sci. Sports Exerc.* **2001**, *33*, S472–S483. [CrossRef] [PubMed]
29. Ingul, C.B.; Tjonna, A.E.; Stolen, T.O.; Stoylen, A.; Wisloff, U. Impaired cardiac function among obese adolescents: Effect of aerobic interval training. *Arch. Pediatr. Adolesc. Med.* **2010**, *164*, 852–859. [CrossRef] [PubMed]
30. Eriksson, J.G. Exercise and the treatment of type 2 diabetes mellitus. An update. *Sports Med.* **1999**, *27*, 381–391. [CrossRef] [PubMed]
31. World Health Organization. Global Recomendations on Physical Activity for Health. 2010. Available online: http://apps.who.int/iris/bitstream/handle/10665/44399/9789241599979_eng.pdf;jsessionid=8967C56AE594AB4936F7DD184F2C52A6?sequence=1 (accessed on 10 May 2018).
32. Colley, R.C.; Garriguet, D.; Janssen, I.; Craig, C.L.; Clarke, J.; Tremblay, M.S. Physical activity of Canadian adults: Accelerometer results from the 2007 to 2009 Canadian health measures survey. *Health Rep.* **2011**, *22*, 7–14. [PubMed]
33. Centre for Disease Control and Prevention. Nutrition, Physical Activity, and Obesity: Data, Trends and Maps. Available online: https://nccd.cdc.gov/dnpao_dtm/rdPage.aspx?rdReport=DNPAO_DTM.ExploreByLocation&rdRequestForwarding=Form (accessed on 10 May 2018).
34. Ranasinghe, C.D.; Ranasinghe, P.; Jayawardena, R.; Misra, A. Physical activity patterns among South-Asian adults: A systematic review. *Int. J. Behav. Nutr. Phys. Act.* **2013**, *10*, 116. [CrossRef] [PubMed]
35. Marsaux, C.F.; Celis-Morales, C.; Hoonhout, J.; Claassen, A.; Goris, A.; Forster, H.; Fallaize, R.; Macready, A.L.; Navas-Carretero, S.; Kolossa, S.; et al. Objectively measured physical activity in European adults: Cross-sectional findings from the Food4Me Study. *PLoS ONE* **2016**, *11*, e0150902. [CrossRef] [PubMed]
36. Bauman, A.; Bull, F.; Chey, T.; Craig, C.L.; Ainsworth, B.E.; Sallis, J.F.; Bowles, H.R.; Hagstromer, M.; Sjostrom, M.; Pratt, M. The international prevalence study on physical activity: Results from 20 countries. *Int. J. Behav. Nutr. Phys. Act.* **2009**, *6*, 21. [CrossRef] [PubMed]
37. World Health Organization. 10 Facts on Physical Activity. 2017. Available online: http://www.who.int/features/factfiles/physical_activity/en/ (accessed on 10 May 2018).

38. Tremblay, M.S.; Chaput, J.P.; Adamo, K.B.; Aubert, S.; Barnes, J.D.; Choquette, L.; Duggan, M.; Faulkner, G.; Goldfield, G.S.; Gray, C.E.; et al. Canadian 24-hour movement guidelines for the early years (0–4 years): An integration of physical activity, sedentary behaviour, and sleep. *BMC Public Health* **2017**, *17*, 874. [CrossRef] [PubMed]
39. Chaput, J.P.; Colley, R.C.; Aubert, S.; Carson, V.; Janssen, I.; Roberts, K.C.; Tremblay, M.S. Proportion of preschool-aged children meeting the Canadian 24-hour movement guidelines and associations with adiposity: Results from the Canadian health measures survey. *BMC Public Health* **2017**, *17*, 829. [CrossRef] [PubMed]
40. Roman-Vinas, B.; Chaput, J.P.; Katzmarzyk, P.T.; Fogelholm, M.; Lambert, E.V.; Maher, C.; Maia, J.; Olds, T.; Onywera, V.; Sarmiento, O.L.; et al. Proportion of children meeting recommendations for 24-hour movement guidelines and associations with adiposity in a 12-country study. *Int. J. Behav. Nutr. Phys. Act.* **2016**, *13*, 123. [CrossRef] [PubMed]
41. Li, Y.; Pan, A.; Wang, D.D.; Liu, X.; Dhana, K.; Franco, O.H.; Kaptoge, S.; Di Angelantonio, E.; Stampfer, M.; Willett, W.C.; et al. Impact of healthy lifestyle factors on life expectancies in the US population. *Circulation* **2018**. [CrossRef] [PubMed]
42. Kokkinos, P. Physical activity, health benefits, and mortality risk. *ISRN Cardiol.* **2012**, *2012*, 718789. [CrossRef] [PubMed]
43. Lee, I.M.; Skerrett, P.J. Physical activity and all-cause mortality: What is the dose-response relation? *Med. Sci. Sports Exerc.* **2001**, *33*, S459–S471. [CrossRef] [PubMed]
44. Stewart, R.A.H.; Held, C.; Hadziosmanovic, N.; Armstrong, P.W.; Cannon, C.P.; Granger, C.B.; Hagstrom, E.; Hochman, J.S.; Koenig, W.; Lonn, E.; et al. Physical activity and mortality in patients with stable coronary heart disease. *J. Am. Coll. Cardiol.* **2017**, *70*, 1689–1700. [CrossRef] [PubMed]
45. Leitzmann, M.F.; Park, Y.; Blair, A.; Ballard-Barbash, R.; Mouw, T.; Hollenbeck, A.R.; Schatzkin, A. Physical activity recommendations and decreased risk of mortality. *Arch. Intern. Med.* **2007**, *167*, 2453–2460. [CrossRef] [PubMed]
46. Barnekow-Bergkvist, M.; Hedberg, G.; Janlert, U.; Jansson, E. Prediction of physical fitness and physical activity level in adulthood by physical performance and physical activity in adolescence—An 18-year follow-up study. *Scand. J. Med. Sci. Sports* **1998**, *8*, 299–308. [CrossRef] [PubMed]
47. Twisk, J.W.; Van Mechelen, W.; Kemper, H.C.; Post, G.B. The relation between "long-term exposure" to lifestyle during youth and young adulthood and risk factors for cardiovascular disease at adult age. *J. Adolesc. Health* **1997**, *20*, 309–319. [CrossRef]
48. Corica, D.; Aversa, T.; Valenzise, M.; Messina, M.F.; Alibrandi, A.; De Luca, F.; Wasniewska, M. Does family history of obesity, cardiovascular, and metabolic diseases influence onset and severity of childhood obesity? *Front. Endocrinol.* **2018**, *9*, 187. [CrossRef] [PubMed]
49. Dobbs, R.; Sawers, C.; Thompson, F.; Manyika, J.; Woetzel, J.; Child, P.; McKenna, S.; Spatharou, A. *Overcoming Obesity: An Initial Economic Analysis*; McKinsey Global Institute, 2014.