

Opinion

# Population physical activity legacy from major sports events: The contribution of behavior change science

Stuart J.H. Biddle<sup>a,b,\*</sup>, Martin S. Hagger<sup>a,c</sup>, Sami Kokko<sup>a</sup>, Montse C. Ruiz<sup>a</sup>,  
Taru Lintunen<sup>a</sup>, Keegan Knittle<sup>a</sup>

<sup>a</sup> Faculty of Sport & Health Sciences, University of Jyväskylä, Jyväskylä FI-40014, Finland

<sup>b</sup> Centre for Health Research, University of Southern Queensland, Springfield Central, QLD 4300, Australia

<sup>c</sup> Department of Psychological Sciences, University of California, Merced, CA 95343, USA

Received 5 October 2022; revised 23 November 2022; accepted 29 November 2022

Available online 14 December 2022

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In a commentary paper in the *Journal of Sport and Health Science*, world-renowned physical activity researchers, Barbara Ainsworth and James Sallis, discussed the opportunities arising from the Beijing 2022 Olympic Winter Games for increasing physical activity in youth.<sup>1</sup> Moreover, a clarion call from the Asia-Pacific Society for Physical Activity has been made concerning the physical activity legacy that could arise from the 2032 Olympic and Paralympic Games in Brisbane, Australia (see: ASPA vision for Olympic legacy—ASPA (aspactivity.org)).

Analyses of physical activity trends pre- and post-Olympic Games have been made, although rather few Games in the past have had an explicit physical activity legacy policy. The Melbourne Games of 1956 were an early example of intended legacy,<sup>2,3</sup> but, according to Bauman et al.,<sup>4</sup> only 4 of 15 pre-Olympic policy statements made reference to physical activity related legacies between 1992 and 2020, although all Olympic Summer Games since Beijing, 2008, have had some form of physical activity legacy policy or intention. Moreover, the physical activity trends assessed either side of such Games essentially have shown no change,<sup>4,5</sup> and evidence for health and socio-economic effects of multi-sport games is limited.<sup>6</sup> Any lay person reading this might be surprised by these findings as it seems logical to link a major event, such as the Olympics, to positive “spin-offs”, such as participation in sport and physical activity or health. That said, the main purpose of major sporting events, including the Olympic and Paralympic Games, is to provide competition for elite performers, and the associated “entertainment” value that provides for in-person

spectators and broadcast viewers. However, a secondary aim might involve the seeking of additional effects, such as improved physical infrastructure and population health, and the International Olympic Committee now require some legacy planning within bid documents.<sup>2</sup>

“Legacy” refers to any changes created through a sports event and that remain after the finish of the event, although such effects could be intended or non-intended, and positive or negative.<sup>2–7</sup> Legacy effects could be seen in population behaviors, such as physical activity and sports participation, environmental changes, infrastructure and transport improvements, and creation of new sports facilities (e.g., Lillehammer 1994 Olympic Winter Games<sup>7</sup>). We will focus our discussion only on the legacy of population physical activity levels.

In this short opinion piece, we argue that any potential for changing population levels of physical activity resulting from using Olympic or other major sporting events as a catalyst, requires much greater understanding and use of contemporary behavior change science.<sup>8</sup> In addition to highlighting some key behavior change frameworks, we also address the important issues of how physical activity should consider individuals’ affective experiences associated with physical activity, but also to recognize the inherent complexity of physical activity behavior.

## 1. Toward better enactment of behavior change science

Any attempts at physical activity legacies from Olympic or other major sporting events will involve not one but many context- and setting-specific interventions. These might involve targeting different age groups (e.g., children, youth, adults), settings (e.g., the workplace, schools), or contexts (e.g., certain actions and activities undertaken before, during, or after the

Peer review under responsibility of Shanghai University of Sport.

\* Corresponding author.

E-mail address: [stuart.j.h.biddle@jyu.fi](mailto:stuart.j.h.biddle@jyu.fi) (S.J.H. Biddle).

Games). Hence any attempt to leverage the Games for increasing population levels of physical activity will involve many such initiatives. A starting point for policy makers and planners, therefore, could be the 8 investment areas “that work” and identified by the International Society for Physical Activity and Health. These include whole-of-school programs, active transport, active urban design, health care, public education, sport and recreation, workplaces, and community-wide programs.<sup>9</sup> Within each of these settings, planning around contemporary behavior change science is essential.

The development of a behavior change intervention takes time, and careful consideration of a number of factors is required. Those planning interventions must consider the points below, and these could be addressed in any Olympic legacy document:

- Work to understand the target behavior;
- Give consideration to the context in which they wish to change the behavior and/or deliver the intervention;
- Be aware of what is already known and what knowledge gaps exist;
- Choose a theory or theories to underpin the intervention;
- Develop the intervention strategies and resources;
- Implement and evaluate the intervention.<sup>10</sup>

Several frameworks have been developed to guide this process and encourage a systematic approach to intervention development. One example for the development of complex interventions (i.e., an intervention with many parts to it such as one aimed at increasing physical activity in a community by a variety of means) has been provided by the Medical Research Council in the United Kingdom.<sup>11,12</sup> The framework has 4 phases: development, feasibility/piloting, evaluation, and implementation. It is debatable whether such a process has been followed when planning Olympic Game legacy effects.

There are also behavior change frameworks that should be used. There are several to choose from, including the Behavior Change Wheel<sup>13,14</sup> and Intervention Mapping.<sup>15,16</sup> Each proposes a series of steps and stages to follow in planning and designing an intervention. Using the Behavior Change Wheel as an example, planning a physical activity legacy from a major sports event should consider key sources of behavior, including capability, opportunity, and motivation to perform the “new” behavior (physical activity), as well as intervention functions and policy categories (see later). Importantly, motivation is identified to have both conscious/reflective and automatic/less conscious forms, the latter being associated with more rapid processing of cues and environments, and hence less cognitive effort required for behavior change attempts.

Intervention functions might include education, environmental restructuring, modelling, training, persuasion, and other methods, and will need to be tailored to the needs of the people and places being targeted, as well as the key sources of behavior (capability, opportunity, motivation) identified above. For example, the successful “football fans in training” initiative in Scotland targeted gender-sensitized social support and education to recruit and retain overweight and obese men

in a healthy living program.<sup>17</sup> One key aspect of success of such a program has been in the recruitment of men, typically a hard-to-reach group for health programs. Similar initiatives have been implemented in other sports and settings and these could also be rolled out in association with specific Olympic sports.

Practical strategies for behavior change, often called “behavior change techniques”, can and should be planned. These are active ingredients of behavior change, such as goal-setting, self-monitoring, or changing the environment. Some techniques could be “self-enactable”.<sup>18</sup> “Gamification” (“game design elements to motivate and engage people”) is 1 novel method to engage fans, with evidence suggesting positive physical activity effects.<sup>19</sup>

The Behavior Change Wheel also identifies seven policy categories that could enable or support the interventions. These are: communication/marketing, guidelines, fiscal, regulation, legislation, environmental/social planning, and service provision. The intervention functions suggest which of the policy categories are likely to be appropriate. Hence, this approach, if applied to creating legacy effects from the Olympics or other events, would suggest that careful consideration be given to sources of behavior, intervention functions, and policy categories. These may differ according to the type of intervention being targeted.

Using the Behavior Change Wheel has several advantages, including consideration of all potential intervention functions and policy categories; providing the basis for systematic analysis of how to choose what to do; emphasizing context; and looking beyond conscious processing models to include automatic processing, such as habit.<sup>14</sup>

## 2. Complexity

There is increasing recognition that physical activity is a complex behavior that takes place embedded in multiple settings and systems.<sup>20</sup> This must be recognized in attempts to leverage legacy effects from major sporting events. For example, rarely are education-based interventions effective on their own; behavior change will require multiple other processes to be engaged, possibly including environment restructuring and incentives. “Systems mapping” is increasingly being undertaken to better understand the multiple influences on physical activity, and this will be required for successful behavior change after major sporting events. Examples can be seen in Rutter et al.<sup>21</sup> and Cavill et al.<sup>22</sup>

## 3. Affective experiences and behavioral maintenance

The justification for attempting to create a physical activity legacy from Olympic and other major events is nearly always centered on population health benefits. This is reflected in national and international physical activity guidelines that recommend certain types and amount of physical activity that “should” be undertaken for reasons of health.<sup>23</sup> However, while a rationale based on health is justified, and is likely to capture the interest and engagement of policy makers and politicians, it will be insufficient to motivate large sectors of the

population, at least in the longer term. Young people are certainly less motivated by health reasons, and while adults might find health an initial driver for participation, enjoyment and well-being are much more likely to influence behavioral maintenance, and this has been known for some time.<sup>24</sup> Experiences of pleasure associated with physical activity are linked with the initiation and maintenance of physical activity, as noted by Ekkekakis and Brand<sup>25</sup> It could be argued that this should be prioritized over an emphasis on health when promoting or marketing physical activity.

To create optimal affective experiences in physical activity, 2 key factors need to be considered. First, the promotion of feelings of autonomy (choice), competence, and social relatedness, as suggested in Self-Determination Theory.<sup>26</sup> This will enable stronger intrinsic motivation. Second, activities need to fulfil a positive function for the individual, such as a social function (e.g., playing active games with friends or family), a psychological function (e.g., need to develop skills and competence), or a physical function (e.g., to improve fitness). If the right “function” can be met, alongside satisfying the three needs from self-determination theory, including the promotion of environments that provide opportunities to satisfy these needs, progress toward more optimal psychological and affective states will be made. Behavioral maintenance is then more likely.

### 3.1. What could be moderators of any legacy effect?

Although we have focused our discussion mainly around Olympic events, the same arguments can be made for other major events. There has been little study of potential moderators of any legacy effects, such as single- versus multi-sport events, event size, media coverage, etc. However, it seems logical that sport or physical activity participation effects may show some sport-specific effects. This is known as the “Wimbledon effect” in the UK where, after the tennis tournament, local tennis courts seem to be more populated. However, it is thought that such an effect is short-lived.

Moreover, some sports may be more appealing to certain population groups over others (e.g., rugby world cup; a tennis “slam”), and thus could affect participation in, for example, an age-related way. One good application of behavior change science is to plan for post-event legacy assessment, including any moderator variables.

## 4. Conclusion

In this commentary, we have attempted to show how behavior change science can be applied to the creation of physical activity legacy effects from Olympic Games or other major sports events. With evidence showing limited legacy effects,<sup>27</sup> even when Olympic/Paralympic Games have an explicit policy for legacy, more work is required drawing on behavior change frameworks and underpinning theory. Psychological and other behavioral scientists need to be involved in the planning for Olympic legacy effects.

## Authors' contributions

SJHB conceived of the idea for the paper and wrote an initial draft; MSH, SK, MCR, TL, and KK participated in content decisions and helped to draft the manuscript. All authors have read and approved the final version of the manuscript, and agree with the order of presentation of the authors.

## Competing interests

The authors declare that they have no competing interests.

## References

1. Ainsworth BE, Sallis JF. The Beijing 2022 Olympic Winter Games: An opportunity to promote physical activity and winter sports in Chinese youth. *J Sport Health Sci* 2022;**11**:3–5.
2. Preuss H. Event legacy framework and measurement. *Int J Sport Policy Polit* 2019;**11**:103–18.
3. Delany W. Prepare for the Games NOW!. *Australas Phys Educ J* 1949;**1**:3–6.
4. Bauman AE, Kamada M, Reis RS, et al. An evidence-based assessment of the impact of the Olympic Games on population levels of physical activity. *The Lancet* 2021;**398**:456–64.
5. Mahtani KR, Protheroe J, Slight SP, et al. Can the London 2012 Olympics “inspire a generation” to do more physical or sporting activities? An overview of systematic reviews. *BMJ Open* 2013;**3**:e002058. doi:10.1136/bmjopen-2012-002058.
6. McCartney G, Thomas S, Thomson H, et al. The health and socioeconomic impacts of major multi-sport events: Systematic review (1978–2008). *BMJ* 2010;**340**:c2369. doi:10.1136/bmj.c2369.
7. Hanstad DV, Lesjø JH. A positive legacy—Against all odds Olympic facilities at the 1994 Olympic Winter Games. *Current Issues in Sport Science* 2020;**5**:008. doi:10.36950/2020ciiss008.
8. Hagger MS, Cameron LD, Hamilton K, Hankonen N, Lintunen T. *The handbook of behavior change*. Cambridge: Cambridge University Press; 2020.
9. Milton K, Cavill N, Chalkley A, et al. Eight investments that work for physical activity. *J Phys Act Health* 2021;**18**:625–30.
10. Biddle SJH, Mutrie N, Gorely T, Faulkner G. *Psychology of physical activity: Determinants, well-being and interventions*. 4th ed. London: Routledge; 2021.
11. Campbell M, Fitzpatrick R, Haines A, et al. Framework for the design and evaluation of complex interventions to improve health. *BMJ* 2000;**321**:694–6.
12. Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, Petticrew M. Developing and evaluating complex interventions: The new Medical Research Council guidance. *BMJ* 2008;**337**:979–83.
13. Michie S, Atkins L, West R. *The behaviour change wheel: A guide to designing interventions*. London: Silverback Publishing; 2014.
14. Michie S, van Stralen M, West R. The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implement Sci* 2011;**6**:42. doi:10.1186/1748-5908-6-42.
15. Bartholomew Eldredge LK, Markham CM, Ruiter RAC, Fernández ME, Kok G, Parcel GS. *Planning health promotion programs: An intervention mapping approach*. 4th ed. San Francisco, CA: Wiley; 2016.
16. Bartholomew LK, Parcel GS, Kok G, Gottlieb NH. *Intervention mapping: Designing theory- and evidence-based health promotion programs*. Mountain View, CA: Mayfield; 2001.
17. Hunt K, Wyke S, Gray CM, et al. A gender-sensitised weight loss and healthy living programme for overweight and obese men delivered by Scottish Premier League football clubs (FFIT): A pragmatic randomised controlled trial. *The Lancet* 2014;**383**:1211–21.
18. Knittle K, Heino M, Marques MM, et al. The compendium of self-enactable techniques to change and self-manage motivation and behaviour v.1.0. *Nat Hum Behav* 2020;**4**:215–23.

19. Kamada M, Hayashi H, Shiba K, et al. Large-scale fandom-based gamification intervention to increase physical activity: A quasi-experimental study. *Med Sci Sports Exerc* 2022;**54**:181–8.
20. Kokko S, Baybutt M, editors. *Handbook of settings-based health promotion*. Cham: Springer; 2022.
21. Rutter H, Cavill N, Bauman A, Bull F. Systems approaches to global and national physical activity plans. *Bull World Health Organ* 2019;**97**:162–5.
22. Cavill N, Richardson D, Faghy M, Bussell C, Rutter H. Using system mapping to help plan and implement city-wide action to promote physical activity. *J Public Health Res* 2020;**9**:1759. doi:10.4081/jphr.2020.1759.
23. Bull FC, Al-Ansari SS, Biddle S, et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *Br J Sports Med* 2020;**54**:1451–62.
24. Dishman RK, Sallis JF, Orenstein DR. The determinants of physical activity and exercise. *Public Health Rep* 1985;**100**:158–71.
25. Ekkekakis P, Brand R. Affective responses to and automatic affective valuations of physical activity: Fifty years of progress on the seminal question in exercise psychology. *Psychol Sport Exerc* 2019;**42**:130–7.
26. Ryan RM, Deci EL. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *Am Psychol* 2000;**55**:68–78.
27. Weed M, Coren E, Fiore J, et al. The Olympic Games and raising sport participation: A systematic review of evidence and an interrogation of policy for a demonstration effect. *Eur Sport Manag Q* 2015;**15**:195–226.