



This is a repository copy of *A whole systems approach to integrating physical activity to aid mental health recovery – Translating theory into practice.*

White Rose Research Online URL for this paper:

<https://eprints.whiterose.ac.uk/192131/>

Version: Published Version

Article:

Machaczek, K.K., Quirk, H., Firth, J. et al. (8 more authors) (2022) A whole systems approach to integrating physical activity to aid mental health recovery – Translating theory into practice. *Mental Health and Physical Activity*, 23. 100480. ISSN 1755-2966

<https://doi.org/10.1016/j.mhpa.2022.100480>

Reuse

This article is distributed under the terms of the Creative Commons Attribution (CC BY) licence. This licence allows you to distribute, remix, tweak, and build upon the work, even commercially, as long as you credit the authors for the original work. More information and the full terms of the licence here:

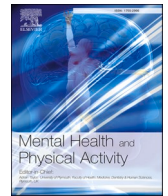
<https://creativecommons.org/licenses/>

Takedown

If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing eprints@whiterose.ac.uk including the URL of the record and the reason for the withdrawal request.



eprints@whiterose.ac.uk
<https://eprints.whiterose.ac.uk/>



A whole systems approach to integrating physical activity to aid mental health recovery – Translating theory into practice

Katarzyna Karolina Machaczek^{a,*}, Helen Quirk^b, Joseph Firth^c, Rebekah Carney^d, Robert James Copeland^a, Nick Pollard^e, Emily Peckham^f, Susan Hampshaw^b, Stephanie De-la Haye^g, Hannah Burton^h, Elizabeth Goyder^b

^a Advanced Wellbeing Research Centre (AWRC), Sheffield Hallam University, UK

^b School of Health and Related Research (ScHARR), University of Sheffield, Sheffield, UK

^c Division of Psychology & Mental Health, University of Manchester, Manchester, UK

^d Youth Mental Health Research Unit, Greater Manchester Mental Health NHS Foundation Trust, Manchester, UK

^e Health Research Institute (HRI), Sheffield Hallam University, Sheffield, UK

^f Department of Health Sciences, University of York, Heslington, UK

^g Survivors of Depression in Transition (SODIT), Sheffield, UK

^h Barnsley Recovery College, South West Yorkshire Partnership NHS Foundation Trust, Wakefield, UK

ARTICLE INFO

Keywords:

Severe mental illness (SMI)
Mental health
Physical activity
Exercise
Recovery
Disease management
Complex systems
Systems thinking
Whole-systems approach

ABSTRACT

Improving health outcomes for people with severe mental illness (SMI) through increased physical activity (PA) on a large scale remains an elusive goal. There is promising evidence that increasing levels of PA in people with SMI can improve psychological and physical health outcomes. However, SMI is associated with reduced levels of physical activity and more sedentary behaviour than is usual in people without SMI.

Increasing PA and reducing sedentary behaviour among people with SMI is a complex process, as there are drivers of these behaviours at the individual, household, community and policy levels. Examples of these include the symptoms associated with SMI, poverty, unemployment, social isolation and stigma. Such drivers affect opportunities to take part in PA and individuals' abilities to do so, creating negative reinforcing loops of behaviours and health outcomes.

Most previous approaches to PA for this population have focused largely on individual behaviour change, with limited success. To increase levels of PA effectively for people with SMI at scale also requires consideration of the wider determinants and complex dynamic drivers of PA behaviour in this population.

This position paper sets out a rationale and recommendations for the utilisation of whole systems approaches to PA in people with SMI and the improvement of physical and psychological outcomes. Such approaches should be delivered in conjunction with bespoke, individual-level interventions which address the unique needs of those with SMI.

1. Background

Mental ill-health affects almost one billion people worldwide, and the economic and societal costs equate to around US\$1trillion per year (The Lancet Global Health, 2020). Severe Mental Ill health (SMI) is diagnosed by the presence of a range of severe and debilitating psychological problems that impair an individual's ability to engage in functional (occupational and social) activities (Heller et al., 1997). As no standard definition of SMI has been agreed, for the purpose of this

position paper we adopted a pragmatic definition based on those diagnoses that would be included in the UK primary care SMI register (schizophrenia or other psychotic disorders, bipolar disorder or depression with psychotic features) (British Medical Association, 2008).

People with SMI are significantly more likely to experience poor physical health than the general population and have a reduction in life expectancy of 10–20 years (Chesney et al., 2014). Heart, liver and respiratory diseases, diabetes and obesity are three to five times more common amongst people with SMI than in people without SMI (Correll

* Corresponding author.

E-mail address: k.machaczek@shu.ac.uk (K.K. Machaczek).

<https://doi.org/10.1016/j.mhpa.2022.100480>

Received 24 February 2022; Received in revised form 14 June 2022; Accepted 3 October 2022

Available online 7 October 2022

1755-2966/Crown Copyright © 2022 Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

et al., 2017; Liu et al., 2017; Reilly et al., 2015). This is partly attributable to smoking, poor diet (Reilly et al., 2015; The World Health Organization, 2014) and sedentary lifestyles (Vancampfort et al., 2016), many individuals with SMI have lower levels of physical activity (PA) (Liu et al., 2017; Reilly et al., 2015; The World Health Organization, 2014; Vancampfort et al., 2016) and increased levels of sedentary behaviour than the general population (Schuch et al., 2017; Stubbs et al., 2016a, 2016b; Vancampfort et al., 2017b). Increasing PA and reducing sedentary behaviour, along with other changes to health risk behaviour (e.g., improved diet, cessation of smoking), could reduce the mortality gap people with SMI experience by approximately 28% (Dregan et al., 2020).

PA is recommended in the Lancet Psychiatry Commission (Firth et al., 2019), in European Psychiatric Association guidance and by the International Organisation of Physical Therapists in Mental Health (Firth et al., 2019; Stubbs et al., 2018) for the treatment of SMI. The Lancet Psychiatry Commission recommends that healthy lifestyle programmes be integrated into routine mental health care and made accessible for all people living with mental illness.

PA interventions, encompassing the domains of exercise and sport, are increasingly popular among people with SMI (Fenton et al., 2017; Soundy et al., 2015). PA is a recommended evidence based treatment for adults with major depressive disorders (Ravindran et al., 2016) and adults with schizophrenia-related disorders. Evidence suggests that PA can enhance personal recovery (e.g., reducing psychological distress and improving cardiovascular function (Liu et al., 2017; Reilly et al., 2015)), social inclusion (Soundy et al., 2012, pp. 3–20) and cognitive functioning (Firth et al., 2017) in people with SMI which may, in turn, contribute to better real-world functioning. However, it is important to recognise the methodological challenges in complex interventions in mental health, such as contamination effect (Magill et al., 2019).

A previous meta-analysis found that motivational interventions were effective for adults with SMI (Romain et al., 2020), however, it failed to explore the effects of contexts in which these interventions were delivered. Furthermore, most of these studies were small in scale; and many current interventions designed to engage those with SMI have been unsuccessful due to significant documented barriers to uptake even when opportunities to be more active are available (Johnstone et al., 2009). It is here that systems thinking may have something to offer.

Systems thinking can help to maximise the effectiveness of programmes (Adam, 2014; Voehl, 2016). It is concerned with understanding how change can occur within complex systems. A complex system is defined as a number of heterogeneous interdependent parts that interact dynamically (i.e. the rules of interaction may change over time); while change in the system occurs in a non-linear fashion (the outputs produced by a fixed input are not constant but dynamic) (Cilliers, 2002; Grant and Hood, 2017). Interactions take place between components of the system as well as between the system and its environment (Rivkin & Siggelkow, 2007). The system's environment is a set of components and their properties, changes in any of which can either cause or produce changes in the system (Ackoff & Emery, 2017). Using a systems approach helps to better understand what helps or hinders the success of interventions through, amongst other things, identifying aspects in the system's environment that affect impact.

This paper represents a first step in a comprehensive programme of work to examine how the effectiveness of PA interventions for those who live with SMI can be maximised through the use of a whole systems approach. We argue that this can advance knowledge about, among other things:

- a) context-dependent circumstances associated with how PA interventions for those with SMI operate, e.g., the cultural and social characteristics of local communities.
- b) drivers of behaviour in the system, e.g., commissioning policies which lead to inadequate and unequal access to PA opportunities for those with SMI; and,

- c) the key leverage points with which to intervene to increase engagement in regular PA among people who live with SMI, e.g., policies and processes that inhibit integration of PA into the routine treatment of SMI.

Our discussion focuses on the UK contexts, but the issues identified may also be relevant to other health systems.

2. Definition of a whole systems approach

A whole systems approach involves the application of systems thinking, tools and practices to identify collective action to address complex problems (Vancampfort et al., 2013). For the purpose of this paper, we have developed a working definition of a whole systems approach, using definitions previously used by Clarkson (Clarkson et al., 2017) and Komashie (Komashie et al., 2021):

An approach to addressing challenges associated with utilising PA to improve physical and psychological health outcomes and personal recovery that acknowledges and addresses the multiplicity of interrelated and interacting factors which affect PA levels in people who have SMI. Such an approach necessitates collaboration between stakeholders from different sectors, including healthcare, non for profit and voluntary organisations to maximise impact.

3. A whole-systems approach could improve efforts to integrate PA into the routine treatment of SMI to improve their physical and psychological health outcomes

Below we look at efforts to integrate PA into the routine treatment of SMI through the prism of selected, interconnected (Mingers, 2015) principles of systems thinking: 1) multiple factors that exert influence over behaviour; 2) PA practices are context-driven; 3) emergence; and 4) shared purpose. In the selection of these principles, we adopted an inductive approach. We started with the exploration of barriers that prevent the increase of PA levels among people with SMI at scale. Then, with the use of a systems-thinking lens, we worked towards identifying principles that could be used as examples to introduce the reader to the applicability and potential usefulness of systems thinking/complex systems in consideration of the PA practices of people with SMI. This method was informed by previous work, which emphasised the importance of contexts and complexity in PA practice among people with SMI (Machaczek et al., 2018, 2022; Quirk et al., 2020). The discussion below demonstrates how the use of systems thinking can embrace this complexity to guide efforts to place PA into the mainstream, day-to-day practice of those with SMI. The selected principles are not by any means exclusive, and they do not cover all concepts of systems thinking.

1) Multiple factors that exert influence over behaviour

Low levels of PA among people with SMI are the product of a complex system, involving individual-, organisational-, community- and policy-level factors.

Individual-level influences are *biological/physiological, psychological and social-economic* factors. Examples of the biological and physiological factors are: severity of symptoms (Firth et al., 2016), feeling too unwell (Fraser et al., 2015), lack of energy (Fraser et al., 2015), co-morbid physical-health problems (Firth et al., 2016). Examples of psychological factors are: motivational deficiencies, lack of self-confidence, self-consciousness (Deighton & Addington, 2014), fear/perceptions of embarrassment (Fraser et al., 2015), lack of interest, fear of making the current condition worse (Deighton & Addington, 2014) and of going outdoors (Carpiniello et al., 2013), and uncertainty about what to do (Carpiniello et al., 2013). Examples of *social-economic* factors are: educational status and financial constraints (Klingaman et al., 2014). The resource-heavy implications of PA maintenance (financial and time costs) are more prohibitive for people with low incomes (Farrell et al.,

2013).

Organisational contextual features include, for example, obesogenic factors in mental-health hospitals such as limited PA facilities, the lack of stair access or “culture of sitting” (Gorczyński et al., 2013), or not being permitted to leave hospital units (Gorczyński et al., 2013). The experiences of health care providers in terms of PA and mental health both observed in the people they provide care for and their own personal experiences of PA may also influence whether they provide PA promotion for adults with SMI (Gorczyński et al., 2013).

Beyond individual-level influences, community-level factors also affect the PA behaviour of people with SMI. These include *cultural, ecological, environmental and social factors*. Examples of these are: stigma (Komashie et al., 2021), social isolation (Linz & Sturm, 2013) and lack of social support (Deighton & Addington, 2014). Many people with SMI live in socio-economically deprived areas and have limited access to local community recreation centres or sports facilities (Firth et al., 2016; Crone et al., 2008). In addition, living in densely populated areas and perceptions of lack of neighbourhood safety in terms of crime and traffic may affect PA participation among those with SMI (Vancampfort et al., 2013).

Strong evidence shows the importance of context in shaping health-related behaviour (Althoff et al., 2017; Marmot, 2010; Marmot et al., 2020; Wilkinson & Pickett, 2019). Furthermore, individual and contextual barriers co-vary. For example, there is a high prevalence of SMI in deprived areas which often contain relatively few resources (Public Health England, 2018a, 2018b). A measure that targets an individual’s PA choice is unlikely to be effective in an economic environment in which the individual has little time or resources for recreational PA. Such contextual factors must be addressed in order to help those with SMI to increase their PA levels.

Policy-level influences also affect the ability of people with SMI to initiate and maintain regular PA. In the UK, for example, the changes to the welfare system that introduced personal independence payments and the mandatory re-assessment of people with chronic health conditions and disabilities may have encouraged people who live with conditions such as SMI to withdraw from organised PA. This is due to the fear of being assessed as fit for work and therefore the loss of qualification to receive disability benefits (Johnson & Spring 2018).

Interactions between the multitude of factors that affect uptake of PA among these people mean that the low levels of PA that result are a product of a *complex system*. According to systems thinking, a change in one or more of these components (i.e. individual, community- or policy-level factors) leads to a need to balance or reinforce change in other areas of the system (Stroh and Joni, 2015), which implies circular rather than linear causality (‘feedback’). This way of thinking about change in complex behaviours such as the undertaking of PA has been largely absent from PA research to date. Instead, experimental research on PA to aid recovery of mental health and improve physical health has focused almost exclusively on linear cause-and-effect solutions, the individuals, and their risk behaviour.

This failure to embrace the complexity inherent in the PA practice¹ of those with SMI has led to limited impact at scale.

Implications for practice: Researchers and policy-makers must become comfortable with the complexity that is associated with addressing low levels of PA among people with SMI. This means that they must gain a better understanding of context and the drivers of behaviour within this context for those with SMI.

2) PA practices are context-driven.

In line with the *openness* principle of systems thinking, a system, such as the PA interventions for people with SMI, cannot be understood in

isolation from the context or environment in which it is situated (Haynes et al., 2020). A system’s environment is conceptualised as a set of elements and their relevant properties; these elements are not part of the system but a change in any of them can produce a change in the state of the system (Ackoff, 1971). It is important to demarcate the system’s boundaries or environment, which involves describing a system’s components and relations (Stroh, 2015). The first step towards demarcating the system’s boundaries is the creation of a model of interacting determinants of actions that can be employed across the system (interventions), which are based on a deep understanding of context. This requires the utilisation of techniques such as system mapping to ensure the provision of effective solutions that involve key stakeholders. One aim of system mapping is to answer a ‘focusing question’, e.g., ‘why, often despite our best efforts, have we been unable to achieve a certain goal or solve a particular problem?’ (Stroh, 2015, p.84).

The importance of context in efforts to increase PA levels among people with SMI has been previously described (Carney et al., 2016; Machaczek et al., 2022; McKeon et al., 2022; Romain & Bernard, 2018). However, current interventional approaches to PA to improve mental and physical health have largely decontextualised the PA practices of those with SMI. Furthermore, insufficient attempts are made to delineate how aspects outside the programmes’ boundaries might enhance or hinder the success of the programmes.

A further weakness of current approaches to PA that are aimed to improve mental and physical health outcomes is the lack of attention paid to biosocial interactions (Clarke and Adamson, 2021a). These interactions are those that occur between biological and social factors (Marmot et al., 2020), and their influence may contribute to efforts to increase levels of PA in this clinical population and affect the effectiveness of PA programmes.

Physical activity norms, including preferences for attitudes, body shapes and identities also remain largely unaddressed in PA interventions that are aimed to aid mental health recovery (Clarke and Adamson, 2021b). Such norms may create stigmatising social environments that are not conducive to exercising and that trigger feelings of shame, inadequacy, and helplessness among those with mental ill health. Also, discourses within exercise promotion that use discriminatory language such as able-ist or mentalist phrases, put participants at risk of discrimination (Clarke and Adamson, 2021a).

The recognition that PA practices are context-driven has pragmatic consequences and underscores the importance of gaining an insight into how contexts can worsen or enhance PA practice among people living with SMI.

Adoption of a systems-thinking approach to ‘wicked problems’ such as the promotion of PA (Finegood et al., 2010) could improve understanding of how to create the conditions within which people with SMI might find engagement in and maintenance of PA easier.

‘Zooming out’ or looking at the big picture is part of a whole-systems approach, one that facilitates the gaining of insight into how aspects outside of a programme’s boundaries may affect its effectiveness. Ripple effect mapping technique (REM), (Nobles et al., 2021, pp. 1–23), for example, allows the identification of other interventions, policies, norms, structures and patterns in the broader system, in order to consider values, perspectives and interrelationships that may impact, in this case, programmes to increase PA levels among people with SMI. This enables the identification of leverage points (Stroh and Joni, 2015), which represents places to ‘intervene’ in the system to enable greater impact and which provide insights into why the impact of intervention varies and whether it can be sustained and successfully translated to other contexts and locations. For a highly relevant example of the use of REM to facilitate systems approaches in the context of public health interventions please see Nobles et al. (Nobles et al., 2022).

Furthermore, efforts should be made to ensure programmes that utilise whole-systems approaches to increase PA levels at population levels, (e.g. legal strategies (Nau et al., 2021)), are inclusive of people with SMI.

¹ Practice is defined as a person’s routine activity, which is a combination of components such as skills, locations and timing (81).

Implications for practice: PA programmes need to be examined as a component of the wider system or context within which they operate, to identify and change – or find ways to overcome – aspects of the programme’s context which may affect its potential to effect change in PA practices.

3) Emergence

A central theme of systems thinking is that the behaviour of objects and people cannot be reduced to the characteristics of its parts (Mingers, 2015). The utilisation of systems theory includes examination of how all the components (systems) come together to produce the whole (complex system) and of how this eventually results in an outcome that none of these components could have produced on their own with no change to their environment (emergent properties). In other words, the activity of the whole is more than the sum of the activities of the individual components within the system. In addition, the properties of the whole, named *emergent properties*, cannot be reduced to the sum of the properties of individual components because, while they are possessed by the whole, they are not possessed by its components (‘anti-reductionism’) (Mingers, 2015). In a social context, a crowd develops emergent properties of behaviour that cannot be understood in terms of the behaviour of individuals – the crowd itself creates behaviours such as, for example, surging forward.

Comprehension of systems and the principles of emergence involves interconnected thinking that draws in perceptions of the world, problems and interventions as a dynamic, complex and interrelated agglomeration of relationships and feedback loops (interconnectivity) (Ackoff & Emery, 2017; Stroh, 2015). It requires a shift in mindset, from linear cause and effect to the concept of emergence, in which the connectivity and multiplicity of relatively simple interactions among individual components results in complex systems (Pentecost et al., 2015), to understand the problems and to address them. For example, that some people with SMI do not follow a healthy regime that is recommended by a healthcare professional may not be explained by their lack of knowledge of the importance of the regime.

A shift of perception from entities to relationships is required; hence, this approach highlights the importance of connections as it rejects disciplinary boundaries (Stroh, 2015). It also highlights the importance of finding context-specific, local solutions, as opposed to searching for global rules that govern the system. This is particularly pertinent to the unmet needs of people with SMI.

Finally, this approach underscores the importance of adopting philosophical traditions that are compatible with systems thinking, such as critical realism.

Implications for practice: interventions that are designed to increase PA levels among people with SMI require building multidisciplinary partnerships and local solutions. Research into ways to increase PA levels among people with SMI at scale requires philosophical approaches that are compatible with systems thinking.

4) Shared purpose

Systems thinking begins with “a particular phenomenon to be explained or purpose to be achieved” (Mingers, 2015) p. 120. A clear, shared purpose (Ackoff & Emery, 2017) would be necessary to unite stakeholders from different backgrounds and sectors, including healthcare, non for profit and voluntary organisations, to enable everyone from different parts of the system to move in the same direction to maximise impact. Shared understanding and appreciation of challenges and opportunities faced by partner organisations will strengthen the collaborative working that is essential to enact change. The shared purpose would require continual renegotiation as, for example, in local authorities or in health care trusts organisational boundaries shift, staff are reallocated, and services respond to changes in their environments.

This way of thinking allows to overcome fragmentation inherent in

care provision, including mental and physical care or preventative and curative services. It can therefore offer solutions for local partners to work together to develop programmes that span public health and clinical models. These organisations may provide relevant infrastructure (e.g., facilities) (Pentecost et al., 2015) and appropriately trained staff (Crone et al., 2008) to support the initiation of and sustained participation in PA among people with SMI.

An element of such work would involve understanding how economic and political agendas may affect choices and decisions that key stakeholders make. It would also necessitate the establishment of ways in which partners can work together to support collaborative working, including a model of information flow between partner organisations.

Collaborative working needs to be facilitated in such a way that each partner can clearly see:

- the connections between what they do, and other parts of the system;
- how what they do affects the ability of people with SMI to start and sustain greater levels of PA, in the short- and long-term;
- and the benefits of working together – i.e., how working collaboratively as opposed to in silos (KlepacPogrmilovic et al., 2021; Martín-Borrás et al., 2018) can benefit them, organisations they work for, those with SMI, communities, and the health of the population.

Most importantly, this collaborative would have to be carried out with people affected by SMI (including those with lived experience, their families and those providing support to people with SMI) and other key stakeholders (Rütten et al., 2019). Understanding context is only possible if we ensure that the unique needs of individuals with SMI are central to intervention development. Many people with SMI understand how their challenges could be addressed but do not have the authority, permission or resources to enact change. This means that co-production is an essential part of ‘how’ systems approaches should be delivered.

Co-production, known as “a relationship where professionals and citizens share power to plan and deliver support together, recognising that both partners have vital contributions to make in order to improve quality of life for people and communities.” p. 3 (Slay & Stephens, 2013), presents an opportunity for those with SMI to produce initiatives with others as equal contributors. It offers methods and mindsets which reduce power imbalance between people with lived experience and others. These methods and mindsets facilitate a shift of power towards people with lived experience and help them to feel supported to co-produce solutions that address their needs and reduce inequalities regarding access to, and utilisation of, PA interventions.

Implications for practice: The whole systems approach requires a cross-sector approach and action at both individual and organisational levels to create a model of interacting determinants of PA behaviours. This approach is most likely to be effective if it takes into account contextual factors such as culture. It is also more likely to work if it is co-produced with people affected by SMI. Working together with these clinical populations would require accounting for the nature of SMI (typically, recurrent and relapsing), and SMI-specific barriers to participation.

3.1. Ambition: creating sustainable, long-term solutions

The use of systems thinking implies an ambition to create sustainable, long-term solutions to chronic problems has particular pertinence to PA practice among those with SMI. Commitment to bringing about long-term change requires understanding the short- and long-term consequences of actions. In the context of PA practice such commitment requires distinguishing between factors and mechanisms linked to initiation and those linked to maintenance of physical activity among people with SMI. This is important, since initiation of PA is necessary but not sufficient for long-term health improvement.

Research on PA and mental health has not paid enough attention to maintenance; to effect long-term health improvement, PA needs to be

undertaken regularly, over an extended period. The maintenance of regular PA may depend on factors different to those affecting initiation; these will include the experience of physical activities themselves, values/ethos and the perceived benefits and contextual factors such as the social context, the continuity of policy and local geography (Kas-savou et al., 2014; Norman et al., 1996). Consistent engagement in PA of those with SMI can be challenging. For example, people may disappear and resurface as their situation allows.

Flexible and less structured interventions (Every-Palmer et al., 2018) are likely to: i) be more appealing to this group, and ii) facilitate PA maintenance. For example, individuals might be allowed to drop in and out of PA interventions should their SMI symptoms fluctuate and those dropping out could be offered encouragement to drop back in. This would account for the cyclical nature of the condition and hence, improve PA adherence.

Implications for practice: A whole systems approach is required to address the key issue of long-term maintenance of PA. The support for PA uptake and maintenance should be tailored to meet the unique needs of individuals with SMI.

4. Future research

Research studies are warranted to develop and integrate systems approach into current efforts to increase PA levels among people with SMI. Such efforts could start with stakeholder mapping exercises and demarcation of the system's boundaries or environment at local levels.

5. Conclusion

This paper sets out a rationale and some specific recommendations for utilising whole systems approaches to PA in SMI to improve mental and physical health outcomes. We believe that such approaches need to be delivered in conjunction with bespoke, individual-level interventions which address the unique needs of those with SMI. The next steps are to find effective ways to integrate systems thinking into the management of SMI and to apply these principles in the development and implementation of future interventions to support people with SMI improve their health and wellbeing through physical activity.

Ethics approval and consent to participate

Ethics approval was not required for this paper.

Funding statement

This project has been funded by the Closing the Gap network. Closing the Gap is funded by UK Research and Innovation and their support is gratefully acknowledged (Grant reference: ES/S004459/1). Any views expressed here are those of the project investigators and do not necessarily represent the views of the Closing the Gap network or UKRI. For the preparation of the manuscript, Dr Helen Quirk was funded by the National Institute for Health Research (NIHR) School for Public Health (SPHR) post-doctoral launching fellowship, and Dr Joseph Firth by the UKRI Future Leaders Fellowship.

Declaration of competing interest

Given their roles as Editorial Board Members, Dr J. Firth and Dr R. Carney had no involvement in the peer-review of this article and had no access to information regarding its peer-review. All other authors have no conflict of interest to declare.

Data availability

Data is openly available from the published papers reviewed in this paper. No new research data was collected for the purpose of this study.

References

- Ackoff, R. L. (1971). *Towards a system of systems concepts* (Vol. 17, pp. 661–671). Management Science.
- Ackoff, R. L., & Emery, F. E. (2017). *On purposeful systems. An interdisciplinary analysis of individual and social behaviour as a system of purposeful events*. London and New York: Routledge.
- Adam, T. (2014). Advancing the application of systems thinking in health. *Health Research Policy and Systems*, 12, 50.
- Althoff, T., Sosić, R., Hicks, J. L., et al. (2017 Jul 20). Large-scale physical activity data reveal worldwide activity inequality. *Nature*, 547(7663), 336–339, 2017/07/10. *British medical association (BMA) and national health service (NHS) employers. Revisions to the GMS contract, 2008/9. Delivering investment in general practice.* (2008). London, UK: BMA.
- Carney, R., Bradshaw, T., & Yung, A. R. (2016). Physical health promotion for young people at ultra-high risk for psychosis: An application of the COM-B model and behaviour-change wheel. *International Journal of Mental Health Nursing*, 25(6), 536–545.
- Carpiniello, B., Primavera, D., Pilu, A., et al. (2013 Dec). Physical activity and mental disorders: A case-control study on attitudes, preferences and perceived barriers in Italy. *Journal of Mental Health*, 22(6), 492–500. <https://doi.org/10.3109/09638237.2013.815330>. Available from:
- Chesney, E., Goodwin, G. M., & Fazel, S. (2014). Risks of all-cause and suicide mortality in mental disorders: A meta-review. *World Psychiatry*, 13(2), 153–160.
- Cilliers, P. (2002). *Complexity and postmodernism: Understanding complex systems*. Routledge.
- Clarke, C. V., & Adamson, B. C. (2021a). *A syndemics approach to exercise is medicine*. *Health*. <https://doi.org/10.1177/13634593211021481>. United Kingdom, Available from.
- Clarke, C. V., & Adamson, B. C. (2021b). *A syndemics approach to exercise is medicine*. *Health (Irvine Calif) [Internet]*. <https://doi.org/10.1177/13634593211021481>. 13634593211021480. Available from.
- Clarkson, P. J., Bogle, D., Dean, J., et al. (2017). *Engineering better care: A systems approach to health and care design and continuous improvement*. London: Royal Academy of Engineering.
- Correll, C. U., Solmi, M., Veronese, N., et al. (2017 Jun 1). Prevalence, incidence and mortality from cardiovascular disease in patients with pooled and specific severe mental illness: A large-scale meta-analysis of 3,211,768 patients and 113,383,368 controls. *World Psychiatry*, 16(2), 163–180.
- Crone, D., Johnston, L. H., Gidlow, C., et al. (2008). Uptake and participation in physical activity referral schemes in the UK: An investigation of patients referred with mental health problems. *Issues in Mental Health Nursing*, 29(10), 1088–1097.
- Deighton, S., & Addington, J. (2014). Exercise practices of young people at their first episode of psychosis. *Schizophrenia Research*, 152(1), 311–312.
- Dregan, A., McNeill, A., Gaughran, F., et al. (2020 Mar 27). Potential gains in life expectancy from reducing amenable mortality among people diagnosed with serious mental illness in the United Kingdom. *PLoS One*, 15(3), Article e0230674.
- Every-Palmer, S., Huthwaite, M. A., Elmslie, J. L., et al. (2018). Long-term psychiatric inpatients' perspectives on weight gain, body satisfaction, diet and physical activity: A mixed methods study. *BMC Psychiatry*, 18(1), 300.
- Farrell, L., Hollingsworth, B., Propper, C., & Shields, M. A. (2013). The socioeconomic gradient in physical inactivity in England. *Work Pap Ser*, 13(311), 1–33. Available from: <https://www.bristol.ac.uk/media-library/sites/cmpo/migrated/documents/wp311.pdf>.
- Fenton, L., White, C., Gallant, K. A., et al. (2017 Jan 2). The benefits of recreation for the recovery and social inclusion of individuals with mental illness: An integrative review. *Leisure Sciences*, 39(1), 1–19.
- Finegood, D. T., Merth, T. D. N., & Rutter, H. (2010 Feb 1). Implications of the foresight obesity system map for solutions to childhood obesity. *Obesity*, 18(S1), S13–S16.
- Firth, J., Rosenbaum, S., Stubbs, B., et al. (2016). Motivating factors and barriers towards exercise in severe mental illness: A systematic review and meta-analysis. *Psychological Medicine*, 46(14), 2869–2881.
- Firth, J., Siddiqi, N., & Koyanagi, A. S. D. (2019). The Lancet Psychiatry commission: A blueprint for protecting physical health in people with mental illness. *The Lancet Psychiatry*, 6(8), 675–712.
- Firth, J., Stubbs, B., Rosenbaum, S., et al. (2017). Aerobic exercise improves cognitive functioning in people with schizophrenia: A systematic review and meta-analysis. *Schizophrenia Bulletin*, 43(3), 546–556.
- Fraser, S. J., Chapman, J. J., Brown, W. J., et al. (2015 Oct 1). Physical activity attitudes and preferences among inpatient adults with mental illness. *International Journal of Mental Health Nursing*, 24(5), 413–420.
- Gorczyński, P., Faulkner, G., & Cohn, T. (2013 Sep 1). Dissecting the obesogenic environment of a psychiatric setting: Client perspectives. *Canadian Journal of Community Mental Health*, 32(3), 51–68.
- Grant, R. L., & Hood, R. (2017 Oct 20). Complex systems, explanation and policy: Implications of the crisis of replication for public health research. *Critical Public Health*, 27(5), 525–532.
- Haynes, A., Rychetnik, L., Finegood, D., et al. (2020). Applying systems thinking to knowledge mobilisation in public health. *Health Research Policy and Systems*, 18, 134.
- Heller, T., Roccoforte, J. A., Hsieh, K., et al. (1997). Benefits of support groups for families of adults with severe mental illness. *American Journal of Orthopsychiatry*, 67(2), 187–198, 2.
- Johnson, E., & Spring, E. (2018). The Activity Trap: Disabled people's fear of being active. *Activity Alliance*, 1–42. Available from https://www.activityalliance.org.uk/assets/000/002/433/Activity_Alliance_-_The_Activity_Trap_full_report_Accessible_PDF_FINAL_original.pdf?1538668349.

- Johnstone, R., Nicol, K., Donaghy, M., & Lawrie, S. (2009 Dec 1). Barriers to uptake of physical activity in community-based patients with schizophrenia. *Journal of Mental Health, 18*(6), 523–532.
- Kassavou, A., Turner, A., Hamborg, T., & French, D. P. (2014 Jul). Predicting maintenance of attendance at walking groups: Testing constructs from three leading maintenance theories. *Health Psychology, 33*(7), 752–756.
- Klepac Pogrmilovic, B., Linke, S., & Craike, M. (2021). Blending an implementation science framework with principles of proportionate universalism to support physical activity promotion in primary healthcare while addressing health inequities. *Health Research Policy and Systems, 19*(1), 6.
- Klingaman, E. A., Viverito, K. M., Medoff, D. R., Hoffmann, R. M., & Goldberg, R. W. (2014). Strategies, barriers, and motivation for weight loss among veterans living with schizophrenia. *Psychiatric Rehabilitation Journal, 37*(4), 270–276.
- Komashie, A., Ward, J., Bashford, T., et al. (2021 Jan 1). Systems approach to health service design, delivery and improvement: A systematic review and meta-analysis. *BMJ Open, 11*(1), Article e037667.
- Linz, S. J., & Sturm, B. A. (2013 Oct 1). The phenomenon of social isolation in the severely mentally ill. *Perspectives in Psychiatric Care, 49*(4), 243–254.
- Liu, N. H., Daumit, G. L., Dua, T., et al. (2017 Feb 1). Excess mortality in persons with severe mental disorders: A multilevel intervention framework and priorities for clinical practice, policy and research agendas. *World Psychiatry, 16*(1), 30–40. <https://doi.org/10.1002/wps.20384>. Available from:
- Machaczek, K. K., Allmark, P., Goyder, E., et al. (2018). A scoping study of interventions to increase the uptake of physical activity (PA) amongst individuals with mild-to-moderate depression (MMD). *BMC Public Health, 18*(1).
- Machaczek, K. K., Allmark, P., Pollard, N., et al. (2022). Integrating physical activity into the treatment of depression in adults: A qualitative enquiry. *Health and Social Care in the Community, 30*, 1006–1017.
- Magill, N., Knight, R., McCrone, P., et al. (2019 Jan 7). A scoping review of the problems and solutions associated with contamination in trials of complex interventions in mental health. *BMC Medical Research Methodology, 19*(1), 4.
- Marmot, M. (2010). *The Marmot review. Strategic review of health inequalities in England post-2010*. Fair Society, Healthy Lives.
- Marmot, M., Allen, J., Boyce, T., et al. (2020). *Health equity in England: The Marmot review 10 years on* (Vols. 1–172).
- Martín-Borrás, C., Giné-Garriga, M., Puig-Ribera, A., et al. (2018). A new model of exercise referral scheme in primary care: Is the effect on adherence to physical activity sustainable in the long term? A 15-month randomised controlled trial. *BMJ Open, 8*(3), 1–9.
- McKeon, G., Curtis, J., & Rosenbaum, S. (2022 Jun 9). Promoting physical activity for mental health: An updated evidence review and practical guide. *Current Opinion in Psychiatry*. <https://doi.org/10.1097/YCO.0000000000000796>. Epub ahead of print.
- Mingers, J. (2015). *Systems thinking, critical realism and philosophy (ontological explorations)* (1 edition). London: Routledge.
- Nau, T., Smith, B. J., Bauman, A., & Bellew, B. (2021 Aug 1). Legal strategies to improve physical activity in populations. *Bulletin of the World Health Organization, 99*(8), 593–602, 2021/05/04.
- Nobles, J., Wheeler, J., Dunleavy-Harris Active Gloucestershire Richard Holmes, K., Inman-Ward Active Gloucestershire Alexandra Potts, A., Hall, J., Royal Inrmary Sabi Redwood, B., et al. (2021). *Ripple effects mapping: Capturing the wider impacts of systems change efforts in public health*.
- Nobles, J., Wheeler, J., Dunleavy-Harris, K., et al. (2022). Ripple effects mapping: Capturing the wider impacts of systems change efforts in public health. *BMC Med Res Methodol [Internet]*, 22(1), 72.
- Norman, P., & Conner, M. (1996). The role of social cognition models in predicting health behaviours: Future directions. In M. Conner, & P. Norman (Eds.), *Predicting health behaviours: Research and practice with social cognition models* (pp. 197–225). Buckingham: Open University Press.
- Pentecost, C., Farrand, P., Greaves, C. J., et al. (2015). Combining behavioural activation with physical activity promotion for adults with depression: Findings of a parallel-group pilot randomised controlled trial (BACPaC). *Trials, 16*.
- Public Health England. (2018a). *Severe mental illness (SMI) and physical health inequalities: Briefing*. Available from <https://www.gov.uk/government/publications/severe-mental-illness-smi-physical-health-inequalities/severe-mental-illness-and-physical-health-inequalities-briefing>.
- Public Health England. (2018b). *Severe mental illness (SMI) and physical health inequalities: Briefing*. Available from <https://www.gov.uk/government/publications/severe-mental-illness-smi-physical-health-inequalities/severe-mental-illness-and-physical-health-inequalities-briefing>.
- Quirk, H., Hock, E., Harrop, D., et al. (2020 Oct 22). Understanding the experience of initiating community-based group physical activity by people with serious mental illness: A systematic review using a meta-ethnographic approach. *European Psychiatry, 63*(1), e95.
- Ravindran, A. V., Balneaves, L. G., Faulkner, G., et al. (2016). Canadian network for mood and anxiety treatments (CANMAT) 2016 clinical guidelines for the management of adults with major depressive disorder: Section 5. Complementary and alternative medicine treatments. *Canadian Journal of Psychiatry, 61*(9), 576–587.
- Reilly, S., Olier, I., Planner, C., et al. (2015). Inequalities in physical comorbidity: A longitudinal comparative cohort study of people with severe mental illness in the UK. *BMJ Open, 5*(12).
- Rivkin, J. W., & Siggelkow, N. (2007). Patterned interactions in complex systems: Implications for exploration. *Management Science, 53*(7), 1068–1085.
- Romain, A. J., & Bernard, P. (2018). Chapter 10 - behavioral and psychological approaches in exercise-based interventions in severe mental illness. In *Stubbs B, rosenbaum SBT-E-BI for MI* (pp. 187–207). Academic Press. Available from: <https://www.sciencedirect.com/science/article/pii/B9780128126059000101>.
- Romain, A. J., Bernard, P., Akkrass, Z., et al. (2020). Motivational theory-based interventions on health of people with severe mental illness: A systematic review and meta-analysis. *Schizophrenia Research, 222*, 31–41.
- Rütten, A., Frahsa, A., Abel, T., et al. (2019 Feb 1). Co-Producing active lifestyles as whole-system-approach: Theory, intervention and knowledge-to-action implications. *Health Promotion International, 34*(1), 47–59.
- Schuch, F., Vancampfort, D., Firth, J., et al. (2017). Physical activity and sedentary behavior in people with major depressive disorder: A systematic review and meta-analysis. *Journal of Affective Disorders, 210*(August 2016), 139–150.
- Slay, J., & Stephens, L. (2013). *Co-Production in mental health: A literature review*. London: new economics foundation.
- Soundy, A., Kingstone, T., & Coffee, P. (2012). *Understanding the psychosocial processes of physical activity for individuals with severe mental illness: A meta-ethnography*. Ment Illnesses - Eval Treat Implic.
- Soundy, A., Roskell, C., Stubbs, B., et al. (2015). Investigating the benefits of sport participation for individuals with schizophrenia: A systematic review. *Psychiatry Danubina, 27*(1), 2–13.
- Stroh, D. P. (2015). In P. Joni (Ed.), *Systems thinking for social change*. Chelsea Green Publishing.
- Stubbs, B., Firth, J., Berry, A., et al. (2016a). How much physical activity do people with schizophrenia engage in? A systematic review, comparative meta-analysis and meta-regression. *Schizophrenia Research, 176*, 431–440.
- Stubbs, B., Vancampfort, D., Hallgren, M., et al. (2018). EPA guidance on physical activity as a treatment for severe mental illness: A meta-review of the evidence and position statement from the European psychiatric association (EPA), supported by the international organization of physical Therapists in mental health (IOPTMH). *European Psychiatry, 54*, 124–144.
- Stubbs, B., Williams, J., Gaughran, F., & Craig, T. (2016 Mar). How sedentary are people with psychosis? A systematic review and meta-analysis. *Schizophrenia Research, 171* (1–3), 103–109.
- The Lancet Global Health. (2020). Mental health matters. *Lancet Global Health, 8*(11), Article e1352. Available from: [http://doi.org/10.1016/S2214-109X\(20\)30432-0](http://doi.org/10.1016/S2214-109X(20)30432-0).
- The World Health Organization. (2014). *Premature death among people with severe mental disorders*. Available from http://www.who.int/mental_health/management/info_sheet.pdf?ua=1.
- Vancampfort, D., De Hert, M., De Herdt, A., et al. (2013). Associations between physical activity and the built environment in patients with schizophrenia: A multi-centre study. *General Hospital Psychiatry, 35*(6), 653–658.
- Vancampfort, D., Firth, J., & Schuch, F. (2016). Physical activity and sedentary behaviour in people with bipolar disorder: A systematic review and meta-analysis. *Journal of Affective Disorders, 201*, 145–152.
- Vancampfort, D., Firth, J., Schuch, F. B., et al. (2017b). Sedentary behavior and physical activity levels in people with schizophrenia, bipolar disorder and major depressive disorder: A global systematic review and meta-analysis. *World Psychiatry, 16*(3), 308–315.
- Voehl, F. (2016). Systems thinking. Innov tools handb organ oper tools, methods. *Tech that Every Innov Must Know, 1*, 373–383.
- Wilkinson, R., & Pickett, K. (2019). *The inner level: How more equal societies reduce stress, restore sanity and improve everyone's wellbeing*. London: Penguin Press.