EDITORIAL: Why complexity matters in physiotherapy research

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Main Text

We talk of complexity throughout physiotherapy and rehabilitation - complex interventions, complex patients and complex conditions are all too familiar phrases in both research and practice [1]. But what does complexity mean? It may be helpful to start with a distinction – a complicated system (such as a space rocket) comprises many intricate, multi-faceted elements which behave linearly and as we would predict. Each of these constituent parts have a clearly defined and constant relationship with each other and the external context and so can be reliably replicated *ad infinitum* [2]. In contrast, the behaviour of a complex system is often unpredictable, non-linear and is difficult to replicate. It has many interacting elements; these elements directly influence and are influenced by each other and the wider context. Complex systems are emergent and adaptive, that is, their overall effect is greater than the sum of their parts and they change over time. This means that in a complex system it is impossible to reliably identify or predict the contribution of a single element on the overall outcome [2].

Why does this matter for physiotherapy? In clinical practice, a holistic approach has long recognised complexity –we understand that the context, belief and behaviours of both therapists and patients affect the response to any intervention we provide [3]. Yet many of our research trials do not reflect, measure or acknowledge these factors, despite them having a pivotal influence on both the effectiveness and implementation of interventions in the real-world. Research designs that search for a single effective ingredient in a restrictive context and control as many variables as possible may appear attractive [4], but they risk stifling the emergent interactions that influence the effectiveness of a complex intervention [5]. Put simply, constraining complex interventions in research means that beneficial interventions could be incorrectly judged as ineffective and *vice versa*. Findings of this reductive research is also likely to be difficult to implement as the controlled context in which it was conducted

bears little resemblance to realistic practice [6]. Ultimately, attempting to reduce or control the complexity that is inherent to many physiotherapy interventions reduces the power of research to improve practice and results in patients being offered suboptimal care. However, trials with little definition or control of potentially confounding variables will not generate data that can be confidently applied to an individual patient. Clearly, embracing complexity in our research is important but it does not mean that we should abandon controlled designs; randomised controlled trials (RCTs) are our most powerful tool to test effectiveness and it is entirely appropriate to control extraneous variables when assessing efficacy. However, understanding complexity should prompt us to contemplate different trial designs that enable us to recognise rather than constrain complexity in our research [6].

The recent revision of the NIHR/MRC framework for the development and evaluation of complex interventions [6] builds on an established recognition of the importance of complexity in public health, basic science and more latterly, health research [4,7]. It is particularly pertinent for physiotherapy researchers because, as we know, most of our interventions can be defined as complex. The framework explicitly highlights the need to consider the behaviour of complex systems in research, stresses the importance of context and prioritises designs that generate clinically valuable data over those that simply seek to minimise bias [6]. It recommends that researchers and stakeholders work together to identify the most pressing questions that the research should address, rigorously develop the intervention to be tested and articulate a (programme) theory that describes how an intervention will produce an outcome. This should not only detail the effect of the intervention on the individual but also consider complexity – that is, the wider dynamic context that will influence, and be influenced by, an intervention. A comprehensive programme theory also supports implementation, economic evaluation and enables changes

to be made to the intervention even during a trial [6] so that recent developments in knowledge, practice or context can be incorporated into the interventions once a trial has begun. This is particularly advantageous in light of how quickly practice can change in response to internal and external influences and how slowly large clinical trials progress. Developing this theory is vital *prior* to considering or conducting an evaluative trial as it guides the decision whether to proceed to a trial and ensures that many potential problems that would undermine evaluation are identified and proactively managed. Once it has been decided to move to a trial, process evaluations within a RCT and novel pragmatic and critical realist RCT designs present established methods to determine both the effects of an intervention but also explain how these effects were created [8,9]. Novel efficient RCT designs (e.g. master protocol trials) enable multiple treatments and people with different clinical presentations to be evaluated simultaneously, but are not yet used widely in rehabilitation [10]. These trials enable clinicians to understand what works, for whom and should a trial not show significant benefit, still provides useful knowledge to inform other research studies which reduces research waste.

In conclusion, physiotherapy practice is complex and this complexity should be reflected in how we design and conduct research into our interventions. Now more than ever, physiotherapy researchers have a clear mandate to undertake ambitious studies of complex interventions that go beyond traditional reductionist designs and have the opportunity to become recognised leaders in complexity-informed health research. This approach not only supports high-quality research that addresses many of the key uncertainties in physiotherapy practice but also provides a mechanism for implementation, so that effective interventions bring benefit to patients more quickly. However, the developmental studies which are necessary to prioritise, develop and refine complex interventions can be overlooked in favour

of evaluative trials, perhaps because complex designs are more unpredictable and are unlikely to be easy or cheap to conduct [7]. Yet if the complex studies that are vital to advance our practice are rejected in favour of simplistic, 'neat' research designs that answer easily definable yet irrelevant questions [6] our profession and our patients will pay a significant price. To make progress in developing effective, implementable physiotherapeutic interventions we must conduct research using new tools designed to deal with the complexities that are inherent to healthcare. This will enable us to answer clinically important questions, advance our evidence-base, benefit our profession and, most importantly, transform outcomes for our patients.

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References

[1] Fritz J, Söderbäck M, Söderlund A, Sandborgh M. The complexity of integrating a behavioral medicine approach into physiotherapy clinical practice. Physiotherapy Theory and Practice 2019;35:1182–93. https://doi.org/10.1080/09593985.2018.1476996.

[2] Sturmberg JP, Martin CM. Complexity and health - yesterday's traditions, tomorrow's future. Journal of Evaluation in Clinical Practice 2009;15:543–8. https://doi.org/10.1111/j.1365-2753.2009.01163.x.

[3] Doring LA. An elaboration on holistic physiotherapy. Australian Journal of Physiotherapy 1975;22:83–9.

[4] Greenhalgh T, Papoutsi C. Studying complexity in health services research: desperately seeking an overdue paradigm shift. BMC Medicine 2018;16:95. https://doi.org/10.1186/s12916-018-1089-4.

[5] Reed JE, Howe C, Doyle C, Bell D. Successful Healthcare Improvements From Translating Evidence in complex systems (SHIFT-Evidence): simple rules to guide practice and research. International Journal for Quality in Health Care 2019;31:238–44. https://doi.org/10.1093/intqhc/mzy160.

[6] Skivington K, Matthews L, Simpson SA, Craig P, Baird J, Blazeby JM, et al. Framework for the development and evaluation of complex interventions: gap analysis,

workshop and consultation-informed update. Health Technol Assess 2021;25:1–132. https://doi.org/10.3310/hta25570.
[7] Plsek PE, Greenhalgh T. The challenge of complexity in health care. BMJ 2001;323:625–8. https://doi.org/10.1136/bmj.323.7313.625.
[8] Long KM, McDermott F, Meadows GN. Being pragmatic about healthcare complexity: our experiences applying complexity theory and pragmatism to health services research. BMC Med 2018;16:94. https://doi.org/10.1186/s12916-018-1087-6.
[9] Porter S, McConnell T, Reid J. The possibility of critical realist randomised controlled trials. Trials 2017;18:133. https://doi.org/10.1186/s13063-017-1855-1.
[10] Park JJH, Siden E, Zoratti MJ, Dron L, Harari O, Singer J, et al. Systematic review of basket trials, umbrella trials, and platform trials: a landscape analysis of master protocols. Trials 2019;20:572. https://doi.org/10.1186/s13063-019-3664-1.