**Supplementary File 2**

**Detailed Description of Ten Key Themes of Implementation**

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| **S/N** | **Domain** | **Themes** | **Definition** |
| 1 | Implementation Strategy Design | Having a clear implementation strategy prior to execution | A prevalent assumption of an implementation strategy was that of "clinical serendipity"— a natural and smooth adoption of new innovations or interventions by clinician (1). In contrast, successful implementation required various, if not all parts of the implementation strategy (e.g. dissemination, training, support) to be carefully designed. This included outlining specific tasks and timelines (2,3) and ensuring that the implementation strategy was adaptable to address unique requirements in any particular context(4). |
| 2 | Ensuring interventions are adaptable | Adaptability refers to the propensity of an intervention/innovation to be adapted to or customized to a particular context (2). As each context is unique and distinct, (4) , it will invariably have a large bearing on the success of implementation. Allowing for the intervention to be adapted to the local setting is reported to increase success of implementation (1,5,6). Allowing adaptation of the intervention to the local environment, instils a sense of ownership in the implementation process (7), to which successful implementation may be attributed to. Adaptability, was addressed in the literature in mainly two ways i.e. as in the RE-AIM framework (8,9) that called for flexibility of the intervention design as compared to a more structured approach by identifying vs CRIR 2009, diffusion of innovations that give a more structured approach to identifying “core component” i.e. the indispensable elements of the intervention that define its uniqueness and an "adaptable periphery" that maybe modified to suit local context (2,10). |
| 3 | Organizational Support | Conducting an organizational needs assessment. | Organizational readiness assessments were referred to explicitly, with specific tools created to assess readiness (11) based on organizational factors such as communication channels (2), leadership (10), culture and morale (5), and resource allocations (10); and implicitly by inferring the need to develop an understanding of the local operating environment or context (2,12,13). It is expected that different medical technologies will require differing aspects of organizational readiness to be surveyed, taking context into account. |
| 4 | Aligning innovation to organizations' strategic objectives and work routines | Aligning the innovation to the organizations' strategic objectives and work routines has been described as fitting in with the organizations' goals (13) and compatibility with existing work routine (13,14). Apart from aligning with tangible elements of work routines, compatibility has been described as being accordant with intangibles elements such as values, and experiences of adopters (15). The general consensus in the literature was that compatible interventions were more likely to be adopted (6). |
| 5 | Context analysis of various domains | In addition to understanding organizational context, the literature guides to study the interaction between the intervention and the context, to assess and manage barriers upfront. Various methods have been proposed to assess context e.g. the CICI framework(12) defines context through 7 domains i.e. Geographical, Epidemiological, Socio-cultural, Socio-economic, Ethical, Legal, Political domain), CADTH defines context via SLEEPERS (16) i.e. social, legal, ethical, environmental, political, entrepreneurial, research and innovation issues. Regardless of the method employed, there is consensus in the literature that HTA is a multidisciplinary process and hence is likely to have interactions with the context outside of healthcare. Not all domains may be applicable, end users should assess their HTA interventions based on the relevant domains for upstream identification of barriers. |
| 6 | Ensuring the organization has appropriate resources to implement | Resources were referred to in the literature as infrastructure, skills and motivation (17) and, financial resources in the form of funding (18), educational resources in the form of training and, physical space and time (2). This theme was usually accompanied by the recognition that implementation requires changes in various aspects of the organization, i.e. workflow, manpower, infrastructure, for which resources were a rate limiting step (1,19). |
| 7 | Stakeholder Engagement | Engaging all stakeholders, including clinical champions and key opinion leaders, involved in the service provision of the innovation. | The theme of stakeholder engagement was widely reported. In essence, implementation efforts should be consultative, allowing for ample stakeholder participation. Early engagement of stakeholders helped address and manage any concerns upstream (20) and by doing so, ensured support for the implementation strategy (3,13) . Stakeholders representative of a range of different backgrounds catered for adaptability in the implementation strategy (18,21).  “Champions” were broadly defined as individuals who were dedicated to bringing the intervention to fruition and overcoming any resistance within the organization(22). They were often thought to have a sphere of influence that could be tapped on to facilitate implementation of the intervention, especially with regard to softer elements of implementation such as culture and social acceptability. Champions should be chosen and incorporated into the implementation strategy upstream of implementation efforts. Most commonly, champions were clinical champions. However, champions from other relevant domains e.g. financial, operational should be considered. (23).  Opinion leaders need not be subject matter experts but were described in the literature as influential as a result of their position or their credibility in the community (24) or status (10). They were described to be instrumental to success of implementation by spreading positive influence of the innovation. One source noted that opinion leaders should not become obstacles by promoting negative influence about the innovation (22) |
| 8 | Information Dissemination | Employing diverse and intelligent strategies to disseminate information e.g. Knowledge translation tools | Dissemination was defined as an active process of knowledge transfer, one that was vertical, planned, formal and centralised (25) . The more extensive and multi-pronged the mode of information dissemination was, the greater the implementation success (7,15). Specific to HTA, INAHTA’s guidance document highlighted that mail-outs and journal presentations might be ineffective as standalone modes of communication and instead, recommended a mixed approach. This involved face-to-face consultations, in tandem with distribution of written materials (26). It was also important for information dissemination methods to be tailored to the target audience, suggest forms for HTA included research and summary reports, consultations, online distributions and project specific knowledge translation tools (23). |
| 9 | Having a dedicated unit within the organization responsible for implementation | Having a localised unit (2,13) within the organization to orchestrate implementation efforts was shown to improve implementation success. Such a unit introduced structure and clarity of roles, key deliverables, and timelines for seamless information flow (3). It was suggested these units possess the necessary technical, communication, financial and project management skills required to carry out the implementation effort (1). In Singapore, institutions self-form working groups to aid and coordinate ACE’s implementation efforts. |
| 10 | Programme Evaluation | Evaluating implementation outcomes | Evaluation of implementation outcomes was explicitly described as evaluating fidelity, adoption, appropriateness, costs, feasibility, penetration, and sustainability (27); and implicitly described as incorporating a component for audit (28) or feedback (10) in any implementation strategy. Regardless of the method chosen, ensuring some form of feedback mechanism was hardwired into the evaluation enhanced the robustness of an implementation strategy. Evaluation outcomes created in partnership (8) with stakeholders ensured the outcomes were relevant and specific to their context, instilling greater ownership among stakeholders. |

References

1. Parston G, McQueen J, Patel H, Keown OP, Fontana G, Al Kuwari H, et al. The Science And Art Of Delivery: Accelerating The Diffusion Of Health Care Innovation. Health Aff Proj Hope. 2015 Dec;34(12):2160–6.

2. Damschroder LJ, Aron DC, Keith RE, Kirsh SR, Alexander JA, Lowery JC. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. Implement Sci. 2009 Aug 7;4(1):50.

3. Meyers DC, Durlak JA, Wandersman A. The quality implementation framework: a synthesis of critical steps in the implementation process. Am J Community Psychol. 2012 Dec;50(3–4):462–80.

4. Pfadenhauer LM, Mozygemba K, Gerhardus A, Hofmann B, Booth A, Lysdahl KB, et al. Context and implementation: A concept analysis towards conceptual maturity. Z Evidenz Fortbild Qual Im Gesundheitswesen. 2015;109(2):103–14.

5. Feldstein AC, Glasgow RE. A practical, robust implementation and sustainability model (PRISM) for integrating research findings into practice. Jt Comm J Qual Patient Saf. 2008 Apr;34(4):228–43.

6. Greenhalgh T, Wherton J, Papoutsi C, Lynch J, Hughes G, A’Court C, et al. Beyond Adoption: A New Framework for Theorizing and Evaluating Nonadoption, Abandonment, and Challenges to the Scale-Up, Spread, and Sustainability of Health and Care Technologies. J Med Internet Res. 2017 01;19(11):e367.

7. Dearing JW. Applying Diffusion of Innovation Theory to Intervention Development. Res Soc Work Pract. 2009 Sep 1;19(5):503–18.

8. Glasgow RE, Vogt TM, Boles SM. Evaluating the public health impact of health promotion interventions: the RE-AIM framework. Am J Public Health. 1999 Sep;89(9):1322–7.

9. RE-AIM – Reach Effectiveness Adoption Implementation Maintenance [Internet]. [cited 2019 Dec 4]. Available from: http://www.re-aim.org/

10. Greenhalgh T, Robert G, Macfarlane F, Bate P, Kyriakidou O. Diffusion of Innovations in Service Organizations: Systematic Review and Recommendations. Milbank Q. 2004 Dec;82(4):581–629.

11. Scaccia JP, Cook BS, Lamont A, Wandersman A, Castellow J, Katz J, et al. A practical implementation science heuristic for organizational readiness: R = MC2. J Community Psychol. 2015 Apr;43(4):484–501.

12. Pfadenhauer LM, Gerhardus A, Mozygemba K, Lysdahl KB, Booth A, Hofmann B, et al. Making sense of complexity in context and implementation: the Context and Implementation of Complex Interventions (CICI) framework. Implement Sci. 2017 Feb 15;12(1):21.

13. Murray E, Treweek S, Pope C, MacFarlane A, Ballini L, Dowrick C, et al. Normalisation process theory: a framework for developing, evaluating and implementing complex interventions. BMC Med. 2010 Oct 20;8(1):63.

14. Kristensen FB, Sigmund H. Health Technology Assessment Handbook Danish Centre for Health Technology Assessment, National Board of Health. 2007.

15. Dobbins M, Ciliska D, Cockerill R, Barnsley J, DiCenso A. A Framework for the Dissemination and Utilization of Research for Health-Care Policy and Practice. Worldviews Evid-Based Nurs Presents Arch Online J Knowl Synth Nurs. 2002;E9(1):149–60.

16. Martin J, Polisena J, Dendukuri N, Rhainds M, Sampietro-Colom L. LOCAL HEALTH TECHNOLOGY ASSESSMENT IN CANADA: CURRENT STATE AND NEXT STEPS. Int J Technol Assess Health Care. 2016;32(3):175–80.

17. Wandersman A, Duffy J, Flaspohler P, Noonan R, Lubell K, Stillman L, et al. Bridging the gap between prevention research and practice: the interactive systems framework for dissemination and implementation. Am J Community Psychol. 2008 Jun;41(3–4):171–81.

18. Anton MT, Jones DJ. Adoption of Technology-Enhanced Treatments: Conceptual and Practical Considerations. Clin Psychol Sci Pract. 2017;24(3):223–40.

19. Braithwaite J, Marks D, Taylor N. Harnessing implementation science to improve care quality and patient safety: a systematic review of targeted literature. Int J Qual Health Care J Int Soc Qual Health Care. 2014 Jun;26(3):321–9.

20. Drummond MF, Schwartz JS, Jönsson B, Luce BR, Neumann PJ, Siebert U, et al. Key principles for the improved conduct of health technology assessments for resource allocation decisions. Int J Technol Assess Health Care. 2008;24(3):244–58; discussion 362-368.

21. Llewellyn S, Procter R, Harvey G, Maniatopoulos G, Boyd A. Facilitating technology adoption in the NHS: negotiating the organisational and policy context – a qualitative study [Internet]. Southampton (UK): NIHR Journals Library; 2014 [cited 2019 Dec 4]. (Health Services and Delivery Research). Available from: http://www.ncbi.nlm.nih.gov/books/NBK259891/

22. Powell BJ, Waltz TJ, Chinman MJ, Damschroder LJ, Smith JL, Matthieu MM, et al. A refined compilation of implementation strategies: results from the Expert Recommendations for Implementing Change (ERIC) project. Implement Sci. 2015 Feb 12;10(1):21.

23. Department of Health, Innovation and Stakeholder Relations Division, Research and Innovation Branch. Maximizing the Impact of Health Technology Assessment: The Alberta Framework. 2017 Jun;10.

24. Eljiz K, Hayes K, Dadich A, Fitzgerald JA, Sloan T, Kobilski S. Can that work for us?: Analysing organisational, group and individual factors for successful health services innovation. In 2010.

25. Glasgow RE, Vinson C, Chambers D, Khoury MJ, Kaplan RM, Hunter C. National Institutes of Health approaches to dissemination and implementation science: current and future directions. Am J Public Health. 2012 Jul;102(7):1274–81.

26. Hailey D, Babidge W, Cameron A. An INAHTA guidance document. 2010.

27. Proctor E, Silmere H, Raghavan R, Hovmand P, Aarons G, Bunger A, et al. Outcomes for implementation research: conceptual distinctions, measurement challenges, and research agenda. Adm Policy Ment Health. 2011 Mar;38(2):65–76.

28. Kitson A, Harvey G, McCormack B. Enabling the implementation of evidence based practice: a conceptual framework. Qual Health Care QHC. 1998 Sep;7(3):149–58.