Supplementary File 1: Study Design Table

Table 1: Strengths and limitations of selected randomised designs for assessing the effects of implementation interventions

Description	Strengths	Limitations
RCT[1-3]	• An efficient trial design. • Protects against most threats to internal validity: ambiguous temporal precedence, selection, history, maturation, testing, instrumentation, regression to the mean.	• May not be appropriate for strategies targeting system or organisational level changes.' • Risk of intervention or implementation strategy contamination between experimental trial arms.
Cluster RCT[4]	• Can reduce the risk of implementation strategy contamination. • With large number of clusters provides a robust assessment of intervention effects.	• With small numbers of clusters there is an increased probability of non-equivalence of groups which may confound effect estimates. • Sample sizes for cluster RCTs need to be inflated to adjust for clustering." • As individuals are often consented after randomization in cluster RCTs, there is the potential for selection bias.
Stepped wedge RCT[5-8]	• Can reduce the risk of implementation strategy contamination. • Each cluster serves as its own control (within-cluster) and can be compared with the performance of other sites (between-cluster). • Is consistent with processes of rolling out new innovations in health service which may improve feasibility and acceptability of the design to stakeholders as long as willing to be assigned a start date. • Improved statistical power and may require less clusters than parallel group cluster randomized trials.	• Require substantially longer trial duration than RCT or Cluster RCT designs as implementation strategy is delivered sequentially. • Repeated measurement of outcomes at each interval can be prohibitive unless routinely collected data is available. • May not be suitable for testing implementation strategies where effects are not expected for some time (until more than one time interval after the intervention is introduced) or if effects may vary over time. • As individuals are consented after allocation of clusters to phase is known there is the potential for selection bias.
Factorial design[3,4,9]	• Allow testing combinations of implementation strategies more easily.	• Requires large sample sizes to ensure sufficient sample per group to assess interactions where effects may be small. • Can be difficult to operationalize and analyse - power is diminished if interactions between interventions are identified.

Description	Strengths	Limitations
	• Require much smaller sample sizes than comparable single-factor experiments to maintain the same level of statistical power. • Provide information about not only the main effects of each factor, but also their combined or interaction effects.	
Fractional Factorial design[3,4,10]	• Useful when resources are too limited to implement all possible combinations of factors in a full factorial design or because some combinations cannot or should not be implemented. • Enables multiple comparisons of implementation strategies (main effects and interactions).	• Requires large sample sizes to ensure sufficient sample per group to assess main effects and interactions where effects may be small. • Difficult to operationalize and analyse - power is diminished if interactions between interventions are identified. • When conditions are removed, certain effects become confounded with each other and cannot be estimated separately.
Sequential Multiple Assignment Randomized Trial (SMART) [11,12]	• Allows valid causal inferences concerning the relative effectiveness of the implementation strategy options. • More efficient than the use of multiple, one-stage-at-a-time, randomized trials. • Relative to one-stage-at-a-time, the approach provides increased validity of analyses aimed at discovering when the effect of one implementation strategy (or intervention) is enhanced by subsequent or prior strategies and enhanced ability to reduce the impact of cohort effects.	• Because SMARTs are used to develop adaptive implementation strategies (interventions) as opposed to confirming that a particular adaptive strategy is better than control, SMARTs should be followed by a randomized confirmatory trial. • Analyses can be complex. • Depending on the primary comparison may require greater sample size than a two arm randomized trial.

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