**Title: Evaluating the use of text-message reminders and personalised text-message reminders on the return of participant questionnaires in trials, a systematic review and meta-analysis**

Short title: SMS for Trial Retention

Word count: 2,889

Authors: 1Laura Doherty, 1Catherine Arundel, 1Elizabeth Coleman, 2Ailish Byrne, 3Katherine Jones

Affiliation:

1 York Trials Unit, Department of Health Sciences, University of York, UK

2 Keele Medical School, Keele University, UK

3 Warwick Clinical Trials Unit, Warwick Medical School, University of Warwick, UK

Corresponding author: Laura Doherty. [Laura.doherty@york.ac.uk](mailto:Laura.doherty@york.ac.uk) 01904 326406

**Key words**: SMS, personalised, text-message, retention, SWAT, study within a trial, randomised controlled trials

**Abstract**

**Introduction**

Randomised Controlled Trials (RCTs) are widely accepted as the gold standard research methodology for the evaluation of interventions. However, they often display poor participant retention. To prevent this, various participant interventions have been identified and evaluated through the use of Studies Within A Trial (SWATs). Two such interventions are participant Short Message Service (SMS) reminders (also known as text-messages) and personalised participant SMS reminders, designed to encourage a participant to return a study questionnaire. Whilst previous SWATs have evaluated the effectiveness of these two retention strategies, trialists continue to spend both time and money on these strategies whilst the evidence remains inconclusive.

**Methods**

This systematic review and meta-analysis compared the use of SMS reminders with no SMS reminder and personalised SMS reminders with non-personalised SMS reminders, on participant retention. Eligible studies were identified through advanced searches of electronic databases (MEDLINE, EMBASE and Cochrane Library) and hand-searching of alternative information sources. The review primary outcome was the proportion of study questionnaires returned for the individual SWAT primary analysis time points.

**Results**

Nine eligible SWATs were identified, of which four compared SMS vs no SMS and five compared personalised SMS vs non-personalised SMS. For those which compared personalised SMS vs non-personalised SMS, only three were deemed appropriate for meta-analysis. The primary outcome results for SMS vs no SMS concluded that SMS led to a statistically non-significant increase in the odds of study questionnaire return by 9% (OR 1.09, 95% CI 0.92 to 1.30). Similarly, comparison of personalised SMS vs non-personalised SMS, concluded that personalised SMS caused a statistically non-significant increase in odds by 22% (OR 1.22, 95% CI 0.95 to 1.59).

**Conclusion**

The effectiveness of both SMS and personalised SMS as retention tools remains inconclusive and further SWAT evaluations are required. However, as SMS are low in cost, easy to use and generally well accepted by participants, it is suggested that trialists adopt a pragmatic approach and utilise these reminders until further research is conducted. Given both the minimal addition in cost for studies already utilising SMS reminders and some evidence of effect, personalisation should also be considered.

**Background**

Randomised controlled trials (RCTs) are considered the gold standard research methodology to evaluate the effectiveness of both health and social care interventions 1 however, they often display poor participant retention 2,3. When designed for use within research and clinical practice, the response rate for Patient Reported Outcome Measures (PROMs) often falls below 50% 4. This is true for remote questionnaires, by which PROMs are commonly administered 5. The non-return of questionnaires may introduce bias, reduce statistical power, or jeopardise a study’s internal and external validity 6-9. Consequently, trials may be prematurely terminated, or require additional funding and resource to counteract the impact of poor retention; thus, contributing to research waste 10-12.

One strategy often employed within RCTs to increase the return of participant questionnaires is the use of Short Message Service (SMS) reminders 13, 14. As a retention tool, SMS reminders (also known as text-message reminders) are relatively low in cost, easy to implement, rapid to send and can be both automated and personalised 15,16. They are also widely accessible and inclusive, with a report published in the year 2020 evidencing that 95% of all UK adults use a mobile telephone 17. However, the evidence for their effectiveness as a retention tool remains both inconclusive and inconsistent.

Previous systematic reviews of retention methods concluded the use of electronic prompts and reminders to have either a small, positive impact or no impact on participant retention, with no statistical significance 12, 18, 19. Further to this, authors of the most recently published Cochrane review 12, considered the evidence to be either low or very low GRADE. Whilst four Studies Within A Trial (SWATs) were found to compare the impact of SMS reminders vs no reminder (independent of other retention strategies), a meta-analysis of theses SWATs does not appear to have been performed 20 -22. For the use of personalised SMS reminders specifically, the evidence is far less abundant. Two previous studies reported conflicting findings, with personalised SMS reminders increasing and decreasing participant retention; neither of which showed statistical significance 23, 24.

In addition to this, working as a member of the research team for the PROMoting THE Use of Studies Within A Trial (PROMETHEUS) programme25 highlighted additional SWATs which had both evaluated the use of SMS reminders and were not included in previous reviews. This programme was led by York Trials Unit and was designed to pump prime host trial teams with the funding and support to conduct a recruitment or retention SWAT25. Therefore, to update the limited evidence with that of additional SWAT evaluations, we undertook a systematic review and meta-analysis to evaluate the effectiveness of SMS reminders vs no reminders and personalised SMS reminders vs non-personalised SMS reminders on participant retention.

**Methods**

The protocol was prospectively pre-registered on PROSPERO, registration ID: CRD42020227342

***Inclusion and exclusion criteria***

Eligible studies were randomised Studies Within A Trial (SWAT) design, which were embedded within a host RCT, with an adult population (aged ≥18 years) and which collected PROMs data using study questionnaires, for which the proportion returned was evaluated as the study’s primary outcome. Due to the nature of the review, two different interventions and their corresponding comparators were eligible for inclusion (Table 1).

***Information sources***

An advanced online search of the Cochrane Library, MEDLINE and EMBASE databases was performed from inception to June 2023 (Appendix 1). The following information sources were hand-searched by one reviewer: Trial Forge website, F1000 Research – Open Research Platform, The Northern Ireland Network for Trials Methodology Research SWAT Repository and the reference lists of both review-included studies and relevant systematic reviews identified through searching (Appendix 2). Members of the PROMoting THE Use of Studies Within A Trial (PROMETHEUS) programme were also contacted to identify any relevant SWATs. This programme was led by York Trials Unit and was designed to pump prime host trial teams with the funding and support to conduct a recruitment or retention SWAT; therefore, being deemed as a relevant information source 25.

Screening and data extraction was performed by two independent reviewers, for which a third independent reviewer resolved any discrepancies. Data was collected using a pre-piloted data extraction tool (Appendix 3) to capture the key information of individual studies (including the population type, intervention, comparator, study design) and their measured outcomes.

***Review outcomes***

The primary outcome was the proportion of participant study questionnaires returned at the SWAT primary analysis time point, reported as the number of questionnaires returned, of the total to be returned (provided as an Odds Ratio (OR) and 95% Confidence Interval (CI)). Where a corresponding OR and 95% CI were not reported, they were calculated by the review primary author.

Secondary outcomes were the proportion of participants who returned a study questionnaire at other study time points and the cost-effectiveness of the intervention, defined as the cost of retaining one additional participant.

***Data synthesis***

Narrative synthesis and meta-analysis compared the use of SMS reminders vs no reminder and personalised vs non-personalised reminders. As aspects of text messaging dependency have been shown to decline with increasing age 26, subgroup analysis for age was also performed (both < and ≥ 65 years). The age of 65 years was chosen as adults of this age and older are often considered ‘older adults’ 27. With previous research also evidencing participant response to both postal and electronic questionnaires to be significantly greater for shorter, rather than longer, questionnaires, a sub-group analysis of questionnaire page length was deemed important to explore 14. Aligned with the review by 18Partha Sarathy et al., short and long questionnaires were categorised as both < and ≥ 10 pages respectively. Additionally, as the impact of participant attrition is greatest for trials with long-term follow-up 28, sub-group analysis of the duration of time between enrolment of SWAT participants to the host trial and the SWAT primary analysis time-point (both ≤ and > 6 months) was undertaken. These sub-groups were chosen as trial participation of > 6 months has been observed as a strong barrier to participation 29.

A post-hoc sub-group analysis compared the intent for a reminder to be received either before, or after, a retention time point, defined as both a prompt and reminder respectively by Gillies et al12.

All analyses used a fixed effects model. Funnel plots were generated to assess for publication bias and the Cochrane Risk of Bias 2 tool was completed by two independent reviewers to evaluate the quality of included studies.

Factorial SWATs with at least one eligible intervention and comparator arm were included. The data from ineligible SWAT arms was not extracted or included within the analysis. For factorial SWATs with more than one eligible intervention or comparator arm, the data from the arms were combined; assuming that no evidence of interaction between the review eligible intervention and additional intervention had been reported by the authors.

The cost-effectiveness analysis, as detailed in Appendix 4, derived the cost of retaining one additional participant through use of the intervention.

**Results**

Eight studies, which reported a total of nine SWATs, were deemed eligible for inclusion (Figure 1) 20-24,30-32. Keding et al. (2016) sequentially embedded two independent SWATs within the same host trial21. Four SWATs compared the use of SMS vs no SMS 20-22 and five compared personalised vs non-personalised SMS 23,24,30-32 (Table 2).

***Narrative synthesis***

**SMS vs no SMS**

Of the four SWATs, either a two-armed parallel RCT (n =2), 2x2 factorial (n=1), or partial factorial (n =1) design was used (Table 2). In addition to SMS reminders, Bradshaw et al. evaluated the impact of a participant monetary incentive but reported no interaction between interventions meaning the SWAT data could be appropriately combined to compare SMS vs no SMS exclusively20. Starr et al. also evaluated the use of a postal/email reminder, which was ineligible for review, therefore only the data from the two SWAT arms comparing SMS and no SMS was extracted22. In light of this, the SWAT authors reported no evidence of interaction between the use of SMS reminders and postal/email reminders.

Collectively the SWATs studied a mixed gender population of similar age (mean ages 31.3 to 41.0 years old) and recruited from UK based hospitals (Appendix 5). However, the SWAT population size varied considerably (range of 418 to 1,394 participants) (Table 2). The SMS intervention for all four SWATs were non-personalised and sent only once per follow-up time point used. Each included the host trial acronym, reference to the arrival of the study questionnaire and it’s return or completion. All SMS were sent prior to the study questionnaire, except for Keding et al. Trial 3 (Table 2)21. Each SWAT sent questionnaires primarily via post (Appendix 5), excluding Bradshaw et al. which utilised both electronic and postal questionnaires dependent on participant preference20. Where reported, questionnaire page length varied considerably (ranging from 4 to 12 pages) (Appendix 5).

Two of the four SWATs provided a measure of the participants socioeconomic status. Bradshaw et al.20 reported similar median values for the English Index of Multiple Deprivation (IMD) across the four SWAT arms (reported as 6 for those who received an SMS and monetary incentive, 5 for an SMS and no monetary incentive and 6 for no SMS, either with or without a monetary incentive). Therefore, across the arms, the overall median decile for the English IMD was 5, suggesting that for this SWAT, the participants were generally from areas of average depravity. For the SWAT by Keding et al.21 the mean age of participant’s leaving education was 18.1 years (SD 3.89). The participant employment status was also reported as: 214 (41%) working full time, 100 (19%) working part time, 65 (12%) looking after home, 61 (12%) unable to work, 21 (4%) in full-time education, 18 (3%) retired, 30 (6%) ‘other’ and 14 (3%) provided no information. None of the four SWATs reported on race or ethnicity.

The two SWATs by Bradshaw et al. and Starr et al. were the only two to evaluate the return of questionnaires at subsequent time points to the SWAT primary end point20, 22. Across the SWATs the primary end point varied considerably (ranging from 4-weeks post-randomisation to 9 months) (Appendix 5). Data from the return of questionnaires at 24 months studied by Bradshaw et al. 20 was deemed irrelevant as it was collected via a face-to-face visit and not a remote data collection method – and as such was not extracted.

For the two SWATs by Keding et al., the primary OR and corresponding 95% CI was calculated by the review primary author 21. This showed the return to be greater for the control group, than the intervention group (OR 0.87 and 0.92 respectively). Whereas Bradshaw et al. and Starr et al. found the proportion of returned questionnaires at the SWAT primary analysis time-point was greater for the intervention group (OR 1.17 and 1.24)20, 22. All results were not considered statistically significant. At subsequent time points these findings showed the opposite for Starr et al. (OR 0.97) and fluctuated for Bradshaw et al. (ORs 1.02, 0.87 and 1.03).

**Personalised SMS vs non-personalised SMS**

Across the SWATs, either a two-armed parallel RCT (n =4) or 2x2 factorial design (n =1) was used (Table 2). Coleman et al. evaluated the timing and personalisation of SMS factorially 30; however, as there was no evidence of interaction between interventions, the SWAT data was combined to evaluate personalisation exclusively. For all five SWATs the number of recruited participants (range of 100 to 1,470 participants), the mean participant age (range of 27.1 – 77.8 years) and research area varied considerably (Table 2 and Appendix 5). However, most recruited a mixed gender population from either a hospital or clinic within the UK.

SMS interventions across all five SWATs were sent only once per follow-up time point used, however the timing in which they were sent varied (Table 2). The intervention and comparator SMS included the host trial acronym, reference to the arrival or phone-call receival of the questionnaire and the return or completion of it. They were issued at the same time and frequency; however personalised SMS included the participant’s name. The method of questionnaire delivery and page length (range of 4.5 to 15 pages) varied considerably (Appendix 5).

Of the five SWATs, only Coleman et al. provided a measure of the participant’s ethnicity30. In this SWAT, 168 participants (88.9%) self-reported their ethnicity as Caucasian. This finding was similar for each of the SWAT arms (92.4% for those who received the personalised SMS and 85.6% for those who received a non-personalised SMS). None of the five SWATs reported on the participant’s socio-economic status.

Each SWAT evaluated the primary outcome at one time point only (Appendix 5). For Coleman et al. 30 and Herbert et al. 32, the duration of time between host trial enrolment and the SWAT primary analysis time-point differed for each participant due to the nature of the studies (Appendix 5). Coleman et al. was also the only SWAT to place a time restriction on questionnaire completion (14 days). For Cureton et al. 31, Herbert et al. 32 and Mitchell et al. 24, the proportion of returned questionnaires was greater for the intervention group (OR 1.63, 1.49 and 1.09 respectively, Table 2). The opposite was true for Cochrane et al.23 and Coleman et al. 30 (OR 0.64 and 0.61 respectively). The OR and corresponding 95% CI for Cureton et al. was calculated by the review primary author and had a CI which could be considered statistically significant (95% CI 1.01 – 2.63).

***Meta-analysis***

Studies by Coleman et al. and Herbert et al. were not included in the meta-analysis as their questionnaires were completed via phone-call 30,32. It is possible that the introduction of human-to-human interaction may stimulate a different response to that of either postal or electronic remote data collection.

**SMS vs no SMS**

The primary analysis, which included all four SWATs that compared SMS vs no SMS, favoured the use of SMS for the return of participant study questionnaires (OR 1.09, 95% CI 0.92 to 1.30, *I2*= 0%, Figure 2). Sub-group analysis of the two SWATs with a questionnaire length of 10 pages or greater (Keding et al. 21), favoured the use of no SMS (OR 0.90, 95% CI 0.66 to 1.23, *I2*= 0%). In contrast, the three studies with a duration of 6 months or less between participant enrolment to the host trial and the SWAT primary analysis time point (Bradshaw et al., Keding et al. Trial 1 and Starr et al. 20-22), favoured the use of SMS (OR 1.13, 95% CI 0.93 to 1.37, I*2*= 0%). The results of this analysis were identical to that for the use of an SMS ‘prompt’ rather than ‘reminder’. The influence of mean participant age could not be evaluated as this was below 65 years for all four SWATs.

**Personalised SMS vs non-personalised SMS**

Primary analysis of the three SWATs that compared personalised vs non-personalised SMS favoured the use of personalised SMS on participant questionnaire return (OR 1.22, 95% CI 0.94 to 1.59, Figure 3), however there was heterogeneity (*I2*= 16%). Sub-group analysis of the two SWATs with a mean participant age of 65 years or older (Cochrane et al. and Mitchell et al. 23,24) favoured the use of personalised SMS (OR 1.07, 95% CI 0.78 to 1.47, *I2*= 0%). The results of this analysis were identical to that for the use of an SMS ‘prompt’ rather than ‘reminder’. Similarly, sub-group analysis of Mitchell et al.24 and Cureton et al.31 which used questionnaires of 10 pages or more, favoured personalised SMS (OR 1.24, 95% CI 0.95 to 1.62) however with moderate heterogeneity (I2=46%). Again, for SWATs with 6 months or less between participant enrolment to the host trial and the SWAT primary analysis time point (Cochrane et al. and Cureton et al. 23,31), personalised SMS were favoured (OR 1.53, 95% CI 0.96 to 2.63, *I2*= 0%).

***Publication bias and Risk of Bias***

Funnel plots for SWATs comparing SMS vs no SMS and personalised vs non-personalised SMS suggested the review primary analyses suffered very little and some publication bias respectively. The Cochrane Risk of Bias 2 tool (Appendix 6) concluded that all eight of the nine SWATs showed ‘some concern’, however no SWAT had a rating of ‘high risk’ for any domain.

***Cost-effectiveness analysis***

The only SWAT to report the cost of both a personalised and non-personalised SMS was Cochrane et al. 23 (£0.096 and £0.048 respectively). Therefore, these values informed the cost-effectiveness analysis. Analysis showed the cost to retain an additional participant when using an SMS compared with no SMS is £4.80. The cost to retain an additional participant when using a personalised compared with a non-personalised SMS is £1.60, in addition to the cost of sending a non-personalised SMS, resulting in a total of £1.65.

**Discussion**

When comparing the use of SMS vs no SMS, SMS favoured a non-significant increase in the return of participant questionnaires (Table 3), as aligned with the findings of previous reviews. Similarly, when compared with non-personalised SMS, personalised SMS favoured a non-significant increase in participant questionnaire return (Table 3). As the increase in odds was much greater for the latter comparison, it should be considered that personalisation, rather than the medium of personalisation, has a greater impact on retention. Therefore, it could be useful to incorporate personalisation for other retention tools.

Whilst the review findings provide an important contribution to the existing research, they are not conclusive. Aligned with Trial Forge Guidance 2, the inconsistency in the direction of the intervention’s effect for the individual studies, suggests that further SWAT evaluations are required33. Therefore, as informed by this same guidance33, we suggest that trialists adopt a pragmatic approach of utilising personalised SMS as a low cost, easy to use intervention, until further research suggests otherwise. This is superior to using interventions (of potentially higher cost) which have no evidence of a positive effect on retention.

As the impact of retaining one additional study participant can vary between studies, there is no uniform measure for the clinical significance and impact of a retention tool. Therefore, trialists should consider the use of an intervention such as SMS reminders on a study specific basis.

***Strengths and limitations***

In contrast to previous research, this review evaluated the use of SMS (both personalised and non-personalised), independent of other electronic retention tools; therefore, answering a more specific research question. Additionally, the review included three newly published SWATS, which were not included in the review by Gillies et al. (2021). No study presented a ‘high’ risk of bias and the review’s primary analyses displayed either none or minimal heterogeneity. Whilst the review is susceptible to language bias, due to including only English reported studies, the advanced electronic database search, which was not restricted by language, returned no further relevant studies.

For this review a wide range of both published and unpublished information sources were searched, mostly by two independent reviewers. The host trials within which the SWATs were embedded mostly studied mixed gender populations and spanned a diverse collection of research areas, increasing the results generalisability. The minimally reported socio-economic information appears to align with that for the UK population, with UK residents leaving education aged 19.3 years on average (as reported in 2018)34 and 52.7% of residents in England and Wales recorded as either employed or self-employed in 202135. Similarly, a Median Decile of English IMD value of 5 suggests an average deprivation status for England36. However, as seven SWATs did not report socio-economic information, this cannot be confidently determined for the review findings overall.

The review findings are only applicable to studies within the UK, which utilise questionnaires completed via remote data collection methods and for comparison of SMS vs no SMS specifically, a narrow participant age range. Of the nine SWATs, only one reported on participant ethnicity, jeopardising the generalisability of the review findings to the wider UK population. For the one SWAT which did report on ethnicity, the 2021 Census data, which reports 81.7% of residents in England and Wales to be White37, suggests that a greater percentage of Caucasians were included in the SWAT compared to the UK population. However, this should be improved for most research as ethnic minorities are commonly under-represented in trials38.

It was also not considered that the individual host trials measured the return of study questionnaires by their own definition, which may have differed in completeness and time of receival. It is also possible the host trials implemented additional SWATs, or retention strategies, which were not accounted for. The review may have suffered some publication bias and some sub-group analyses presented heterogeneity. Additionally, the odds ratios calculated by the review primary author may be less accurate than those reported by SWAT authors, as the latter have access to raw data and may adjust for covariates.

**Conclusion**

Although not statistically significantly, the use of an SMS increases participant retention and retention can be further increased when SMS are personalised. Therefore, as SMS are low in cost, easy to implement and generally well accepted by participants, it is suggested that future trials adopt a pragmatic approach and use personalised SMS to potentially increase participant retention. Future evaluations of both personalised and non-personalised SMS in populations outside of the UK or evaluations of SMS compared with no SMS within populations aged either below 30 or above 40 years of age, remain useful.

**Declaration of conflicting interests:**LD, CA and EC declare that they have previously received funding from the PROMETHEUS programme (MR/R013748/1) and an NIHR CTU infrastructure grant (NIHR132547). All other authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**Funding:**The author(s) received no financial support for the research, authorship, and/or publication of this article.

**References**

1. Torgerson DJ, Torgerson C. *Designing Randomised Trials in Health, Education and the Social Sciences: An Introduction*. 1st ed. Basingstoke England: Palgrave Macmillan, 2008.
2. Treweek S, Gillies K. Trial retention: it’s time for Cinderella to go to the ball. *On Medicine,* https://blogs.biomedcentral.com/on-medicine/2017/09/01/trial-retention-its-time-for-cinderella-to-go-to-the-ball/ (2017, accessed April 11, 2024).
3. Frampton GK, Shepherd J, Pickett K, et al. Digital tools for the recruitment and retention of participants in Randomised Controlled Trials: A Systematic Map. *Trials* 2020; 21. Epub ahead of print 5 June 2020. DOI: 10.1186/s13063-020-04358-3
4. Warwick H, Hutrya C, Politzer C, et al. Small Social Incentives Did Not Improve the Survey Response Rate of Patients Who Underwent Orthopaedic Surgery: A Randomized Trial. *Clinical Orthopaedics & Related Research* 2019; 477: 1648 – 1656.
5. Neve OM, van Benthem PP, Stigglebout AM, et al. Response rate of patient reported outcomes: The Delivery Method Matters. *BMC Medical Research Methodology* 2021; 21. Epub ahead of print 22 October 2021. DOI: 10.1186/s12874-021-01419-2.
6. Nunan D, Aronson J, Bankhead C. Catalogue of bias: Attrition bias. *BMJ Evidence-Based Medicine* 2018; 23: 21-22.
7. Page SJ, Persch AC. Recruitment, Retention, and Blinding in Clinical Trials. *The American Journal of Occupational Therapy* 2013; 67: 154-161.
8. Fogel DB. Factors associated with clinical trials that fail and opportunities for improving the likelihood of success: A review. *Contemporary Clinical Trials Communications* 2018; 11: 156 – 164.
9. Patino CM, Ferreira JC. Internal and external validity: Can you apply research study results to your patients? *Journal Brasileiro de Pneumologia* 2018; 44: 183.
10. Williams RJ, Tse T, DiPiazza K, et al. Terminated Trials in the Clinical Trials.gov Results Database: Evaluation of Availability of Primary Outcome Data and Reasons for Termination. *PLOS ONE* 2015; 10. Epub ahead of print 26 May 2015. DOI: 10.1371/journal.pone.0127242.
11. Salman RA-S, Beller E, Kagan J, et al. Increasing value and reducing waste in biomedical research regulation and management. *The Lancet* 2014; 383: 176-185.
12. Serdar CC, Cihan M, Yucel D, et al. Sample size, power and effect site revisited: simplified and practical approaches in pre-clinical, clinical and laboratory studies. *Biochemia medica* 2021; 31: 27-53.
13. Gillies K, Kearney A, Keenan C, et al. Strategies to improve retention in randomised trials. *Cochrane Database of Systematic Reviews* 2021. Epub ahead of print 6 March 2021. DOI: 10.1002/14651858.MR000032.pub3.
14. Edwards PJ, Roberts I, Clarke MJ, et al. Methods to increase response to postal and electronic questionnaires. *Cochrane Database of Systematic Reviews* 2009. Epub ahead of print 8 July 2009. DOI: 10.1002/14651858.MR000008.pub4
15. Schwebel FJ, Larimer ME. Using text message reminders in health care services: A narrative literature review. *Internet Interventions* 2018; 13: 82-104.
16. Hughes-Morley A, Torgerson D. SWAT 35: Personalised text messages versus standard text message prompts for increasing response to postal questionnaires. *SWAT store – The Northern Ireland Network for Trials Methodology,* https://www.qub.ac.uk/sites/TheNorthernIrelandNetworkforTrialsMethodologyResearch/SWATSWARInformation/Repositories/SWATStore/ (2015, accessed April 11 2024).
17. Ofcom. Adults’ Media Use & Attitudes report 2020, Adults' Media Use & Attitudes report 2020. https://www.ofcom.org.uk/\_\_data/assets/pdf\_file/0031/196375/adults-media-use-and-attitudes-2020-report.pdf (2020, accessed April 11 2024).
18. Partha Sarathy P, Kottam L, Parker A, et al. Timing of electronic reminders did not improve trial participant questionnaire response: A randomized trial and Meta-analyses. *Journal of Clinical Epidemiology* 2019; 122: 70-77.
19. Clark L, Gillies K, Torgerson D et al. Evidence pack - retention: Electronic prompts (ID Ret2). *Trial Forge,* (2020, accessed April 12 2024).
20. Bradshaw LE, Montgomery AA, Williams HC, et al. Two-by-two factorial randomised study within a trial (SWAT) to evaluate strategies for follow-up in a randomised prevention trial. *Trials* 2020; 21. Epub ahead of print 8 June 2020. DOI: 10.1186/s13063-020-04373-4
21. Keding A, Brabyn S, MacPherson H, et al. Text message reminders to improve questionnaire response rates. *Journal of Clinical Epidemiology* 2011; 79: 90-95.
22. Starr K, McPherson G, Forrest M, et al. SMS text pre-notification and delivery of reminder e-mails to increase response rates to postal questionnaires in the SUSPEND trial: a factorial design, randomised controlled trial. *Trials* 2015; 16. Epub ahead of print 8 July 2015. DOI: 10.1186/s13063-015-0808-9
23. Cochrane A, Welch C, Fairhurst C, et al. An evaluation of a personalised text message reminder compared to a standard text message on postal questionnaire response rates: An embedded randomised controlled trial. *F1000 Research* 2020; 9: 154.
24. Mitchell AS, Cook L, Dean A, et al. An embedded randomised controlled retention trial of personalised text messages in an orthopaedic setting. *F1000 Research* 2020; 9: 591.
25. Doherty L, Parker A, Arundel C, et al. PROMoting the use of studies within a trial (PROMETHEUS): Results and experiences from a large programme to evaluate the routine embedding of recruitment and retention strategies within randomised controlled trials routinely. *Research Methods in Medicine & Health Sciences* 2022; 4: 113-122.
26. Ferraro FR. Does Age Impact Text-Message Dependence? *The Journal of General Psychology* 2018; 145, 199-207.
27. Age UK. Later life in the United Kingdom 2019, https://www.ageuk.org.uk/globalassets/age-uk/documents/reports-and-publications/later\_life\_uk\_factsheet.pdf (2019, accessed 25th April 2024).
28. Herbert RD, Kasza J, Bo K. Analysis of randomised controlled trials with long-term follow-up. *BMC Medical Research Methodology* 2018; 18. Epub ahead of print 29 May 2018. DOI: 10.1186/s12874-018-0499-5
29. Desai M. Recruitment and retention of participants in clinical studies: Critical issues and challenges. *Perspectives in Clinical Research* 2020; 11: 51.
30. Coleman E, Whitemore R, Clark L, et al. Pre-notification and personalisation of text messages to increase questionnaire completion in a smoking cessation pregnancy RCT: an embedded randomised factorial trial. *F1000 Research* 2021; 10: 637.
31. Cureton L, Marian IR, Barber VS, et al. Randomised study within a trial (SWAT) to evaluate personalised versus standard text message prompts for increasing trial participant response to postal questionnaires (PROMPTS). *Trials* 2021; 22. Epub ahead of print 28 July 2021. DOI: 10.1186/s13063-021-05452-w.
32. Herbert E, Papaioannou D, Loban A, et al. Personalised versus standard text message prompts for increasing trial participant response to telephone follow-up: An embedded randomised controlled retention trial. *Trials* 2024; 25. Epub ahead of print 7 February 2024. DOI: 10.1186/s13063-024-07916-1
33. Treweek S, Bevan S, Bower P, et al. Trial Forge Guidance 2: how to decide if a further Study Within A Trial (SWAT) is needed. *Trials* 2020; 21(1):33. DOI: <https://doi.org/10.1186/s13063-019-3980-5>
34. Office for National Statistics. Milestones: journeying into adulthood. *Office for National statistics*. <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/articles/milestonesjourneyingintoadulthood/2019-02-18#:~:text=Between%201998%20and%202018%2C%20the,17.8%20years%20to%2019.3%20years> (2019, accessed 12 November 2024).
35. Office for National Statistics. Economic activity status, England and Wales: Census 2021. *Office for National Statistics.* [https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/economicactivitystatusenglandandwales/census2021(2022](https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/economicactivitystatusenglandandwales/census2021%20(2022), accessed 12 November 2024).
36. Ministry of Housing Communities and Local Government. The English Indices of Deprivation 2015. *Gov.UK*. <https://assets.publishing.service.gov.uk/media/5a7f42a940f0b6230268e6b3/English_Indices_of_Deprivation_2015_-_Statistical_Release.pdf>. (2019, accessed 22 November 2024).
37. Gov.UK. Population of England and Wales. *Gov.UK.* <https://www.ethnicity-facts-figures.service.gov.uk/uk-population-by-ethnicity/national-and-regional-populations/population-of-england-and-wales/latest/#:~:text=The%202021%20Census%20data%20shows,other'%20ethnic%20group%20(6.2%25)> (2022, accessed 12 November 2024).
38. Dawson S, Banister K, Biggs K, et al. Trial Forge Guidance 3: randomised trials and how to recruit and retain individuals from ethnic minority groups – practical guidance to support better practice. *Trials* 2022; 23: 672. https://doi.org/10.1186/s13063-022-06553-w

**Table 1:** Summary of the review eligibility and ineligibility study criteria

|  |  |  |
| --- | --- | --- |
| **PICOS Framework** | **Eligibility criteria** | **Ineligibility Criteria** |
| **Population** | Participants aged ≥ 18 years. | Participants aged <18 years. |
| **Intervention** | An SMS reminder (either personalised or non-personalised) sent to the participant to encourage their return of a study questionnaire. | Any electronic reminder alternative to an SMS, e.g., e-mail reminder, application notification or phone call. |
| **Comparator** | No SMS reminder or a non-personalised SMS reminder | Any electronic reminder alternative to an SMS, e.g., e-mail reminder, application notification or phone call. |
| **Outcome** | Primary outcome  The proportion of participants who returned either a postal or electronic study questionnaire at the primary analysis time point defined by the specific retention trial. |  |
| **Study design** | SWATs designed as an RCT embedded within a host RCT. SWATs of a factorial RCT design. | Host trials designed as cluster design RCTs and all non-randomised study types. SWATs designed as non-randomised study types. |

**Table 2:** The PICOS summary table for all studies included within the review

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Host trial information** | | | | **SWAT information** | | | | |
| **Lead author (year of publication)** | **Trial acronym** | **Study design** | **Research area** | **Location** | **Population**  n = total number of participants randomized *(n= total number of participants analysed)* | **Intervention(s)** | **Comparator(s)** | **Primary outcome(s)** | **Study design** |
| **SMS vs. no SMS** | | | | | | | | | |
| **Bradshaw (2020)** | BEEP | 2-armed parallel RCT | Dermatology | UK hospitals | Parents, the majority of which were mothers.  n = 1,394  *(n = 1,394)* | *SWAT arm 1:*  Non-personalised SMS sent to the participant 1 day before their study questionnaire was sent (either electronically or via post). SMS were sent prior to the 3-, 6-, 12- and 18-month questionnaires. Participants also sent a letter at 22 months informing them that they will receive a £10 shopping voucher at their 24-month visit.  *SWAT arm 2:*  Non-personalised SMS sent to the participant 1 day before their study questionnaire was sent (either electronically or via post). SMS were sent prior to the 3-, 6-, 12- and 18-month questionnaires. Participants also received a letter at 22 months, which enclosed a £10 shopping voucher. | *SWAT arm 3:*  No SMS sent to the participant. Participants sent a letter at 22 months informing them that they will receive a £10 shopping voucher at their 24-month visit.  *SWAT arm 4:*  No SMS sent to the participant.  Participants also received a letter at 22 months, which enclosed a £10 shopping voucher. | 1. Collection of data via the chosen method of questionnaire (postal or electronic) at 3, 6, 12 and 18 months.  2. Collection of the BEEP host-trial primary outcome at 24-months, during a home or clinic visit. | 2x2 Factorial design |
| **Keding (2016)**  ***Trial 1*** | ACUDep | 3-armed pragmatic RCT | Acupuncture and depression | Primary care practices in Yorkshire and the North of England | Mixed gender population.  n = 523  *(n = 523)* | Participants were sent a non-personalised SMS on the same day as there 3-month postal study questionnaire. | No SMS was sent to the participant. | The proportion of participants who returned a valid 3-month study questionnaire to the trial team. | 2-armed parallel RCT |
| **Keding (2016)**  ***Trial 3*** | ACUDep | 3-armed pragmatic RCT | Acupuncture and depression | Primary care practices in Yorkshire and the North of England | Mixed gender population.  n = 523  *(n = 523)* | Participants were sent a non-personalised SMS 4 days after the 9-month study questionnaire was posted. | No SMS was sent to the participant. | The proportion of participants who returned a valid 9-month study questionnaire to the trial team. | 2-armed parallel RCT |
| **Starr (2015)** | SUSPEND | 3-armed parallel RCT | Ureteric colic | Urology departments of UK hospitals | Mixed gender population.  n = 418**a**  *(n = 418****a****)* | Participants were sent a non-personalised, pre-notification SMS prior to both the 4- and 12-week questionnaires.  ***b****Two SWAT arms ineligible for review:*  Participants who did not return their 4- or 12-week study questionnaire were also randomised to receive either an e-mail or postal reminder. **The data from these two SWAT arms were not eligible for or included within this review.** | No SMS was sent to the participant. | The questionnaire response rate at 4- and 12- week study time points. | 2x2 partial factorial design |
| **Personalised SMS vs. non-personalised SMS** | | | | | | | | | |
| **Cochrane (2020)** | OTIS | Cohort RCT | Fall prevention in the elderly | Participant homes in the UK | Mixed gender population.  n = 403  *(n = 283)* | Participants were sent a personalised SMS four days after their 4-month questionnaire was posted. The SMS was personalised with the participants title and surname. | Participants were sent a non-personalised SMS four days after their 4-month questionnaire was posted. | The proportion of participants who returned their 4-month postal questionnaire. | 2-armed parallel RCT |
| **Coleman (2021)** | MiQuit-3 | 2-armed parallel RCT | Smoking cessation in pregnancy | UK hospital antenatal clinics | Female population.  n = 194  *(n = 189)* | *SWAT arm 1:*  Participants were sent a personalised SMS 1 week prior to their 36-week gestational follow-up study phone call. The SMS was personalised with the participant’s name.  *SWAT arm 2:*  Participants were sent a personalised SMS 1 day before their 36-week gestational follow-up study phone call. | *SWAT arm 3:*  Participants were sent a non-personalised SMS 1 week prior to their 36-week gestational follow-up study phone-call.  *SWAT arm 4:*  Participants were sent a non-personalised SMS 1 day before their 36-week gestational follow-up study phone call. | The completion rate, defined as the proportion of the questionnaires completed via phone-call within the 14-day follow-up window.  The secondary outcome of the SWAT was the proportion of questionnaires completed via any method of follow-up (including phone-call, postal, e-mail/web or SMS). | 2x2 Factorial design |
| **Cureton (2021)** | GRASP | 2 x 2 Factorial design | Shoulder pain | UK muscoskeletal clinics | Mixed gender population.  n = 618  *(n = 618)* | Participants were sent a personalised SMS at the same time as their 6-month follow-up study questionnaire was posted. The SMS was personalised with the participant’s title and preferred name. | Participants were sent a non-personalised SMS at the same time as their 6-month follow-up study questionnaire was posted. | The questionnaire response rate, defined as the proportion of 6-month GRASP follow-up questionnaires returned by participants. | 2-armed parallel RCT |
| **Herbert**  **(2024)** | MAGIC | 2-armed parallel RCT | Paediatric surgery | UK hospitals | Mixed gender population.  n = 100  *(n = 100)* | Participants were sent a personalised SMS 24-48 hours prior to their telephone call follow-up, which was scheduled 14 days post-surgery. The SMS was personalised the participant’s first name. | Participants were sent a non-personalised SMS 24-48 hours prior to their telephone call follow-up, which was scheduled 14 days post-surgery. | The proportion of participants who were successfully contacted and completed any of the questionnaires, over the telephone within the follow-up window (day 14 + 7 days). | 2-armed parallel RCT |
| **Mitchell (2020)** | KReBS | 2-armed parallel RCT | Knee replacement bandage | UK hospitals | Mixed gender population.  n = 1,470  *(n = 1,465)* | Participants were sent a personalised SMS 4 days after the 12-month study questionnaire was posted. The SMS was personalised with the participants title and surname. | Participants were sent a non-personalised SMS, 4 days after the 12-month study questionnaire was posted. | The primary outcome was the proportion of participants who returned a 12-month study questionnaire. | 2-armed parallel RCT |

*aTotal number of participants for the two review eligible SWAT arms only (Starr et al., 2015).*

***b****SWAT arm data not extracted by reviewers or included within the review.*

**Table 3. The pooled OR (95% CI) for the primary, sub-group and post-hoc analyses for both the comparison of SMS vs no SMS and personalised vs non-personalised SMS**

|  |  |  |
| --- | --- | --- |
|  | **Pooled OR (95% CI)** | |
| **Analysis** | **SMS vs no SMS** | **Personalised vs non-personalised SMS** |
| **Primary analysis:** |  | |
| *The return of study questionnaires for the SWAT primary analysis time point.* | 1.09 (0.92 to 1.30) | 1.22 (0.95 to 1.59) |
| **Sub-group analysis:** |  | |
| *Mean participant age (< 65 years)* | No meta-analysis performed. | No meta-analysis performed. |
| *Mean participant age (≥ 65 years)* | No meta-analysis performed. | 1.07 (0.87 to 1.47) |
| *Study questionnaire page length (< 10 pages)* | No meta-analysis performed. | No meta-analysis performed. |
| *Study questionnaire page length (≥ 10 pages)* | 0.90 (0.66 to 1.23) | 1.24 (0.95 to 1.65) |
| *Duration of time between participant host trial enrolment and the SWAT primary analysis time point (≤ 6 months)* | 1.13 (0.93 to 1.37) | 1.53 (0.96 to 2.43) |
| *Duration of time between participant host trial enrolment and the SWAT primary analysis time point (> 6 months)* | No meta-analysis performed. | No meta-analysis performed. |
| **Post-hoc analysis:** |  | |
| *The use of an SMS sent prior to the study questionnaires arrival/date to be completed (SMS prompt)* | 1.13 (0.93 to 1.37) | No meta-analysis performed. |
| *The use of an SMS sent following the study questionnaires arrival/date to be completed (SMS prompt)* | No meta-analysis performed. | 1.07 (0.78 to 1.47) |