A meta-analysis of 16 randomized controlled trials to evaluate computer-based clinical reminder systems for preventive care in the ambulatory setting
Shea S, DuMouchel W, Bahamonde L

Authors' objectives
To perform a meta-analysis of published randomised controlled trials (RCTs) to assess the overall effectiveness of computer-based reminder systems in ambulatory settings directed at preventative care.

Searching
MEDLINE was searched from 1966 to December 1995, CINAHL from 1982 to October 1995, and the Health Planning and Administration database from 1975 to November 1995, using the keywords 'reminder systems'. Additional material was located by examining reference lists from retrieved articles, and by searching other databases (keywords are provided).

Study selection
Study designs of evaluations included in the review
RCTs of computer-based reminder systems for preventative services in ambulatory settings were included. The following types of study were excluded: studies of non-computer reminder systems, and those using only historical controls or before-and-after designs.

Specific interventions included in the review
The following four intervention conditions were studied: computer-based reminders, manual reminders, both computer-based and manual reminders, and no intervention control. The following categories of preventative measures were studied: vaccinations, breast cancer screening, cervical cancer screening, colorectal cancer screening, cardiovascular risk reduction and other preventative services.

Participants included in the review
The participants included physicians, their patient panels, and individual patients.

Outcomes assessed in the review
The outcome assessed was that of success, where success referred to completion of the preventative manoeuvre.

How were decisions on the relevance of primary studies made?
The authors do not state how the papers were selected for the review, or how many of the authors performed the selection.

Assessment of study quality
The validity of the primary studies was assessed on the basis of randomisation and the use of controls, with 'controlled' being defined as a study in which the intervention group was compared with a concurrent control group. The authors do not state how the papers were assessed for validity, or how many of the authors performed the validity assessment.

Data extraction
It is not stated how the following data were extracted: the number of patients in a group and the proportion reflecting the success rate for a preventative outcome within that group, which were combined to give a data point in the overall model; the median number of patients per data point; the unit of randomisation; the number of intervention conditions; the number of preventative practices; and the number of patient groups. The preventative practices were grouped into six categories.
Methods of synthesis

How were the studies combined?
A weighted mixed-effects model regression was used to analyse the observed success rates. The six categories of preventative practice and four intervention conditions were incorporated in the model as fixed-effect, whereas the following were entered as random effects: the interaction of preventative service category and intervention, the main effect of the study, the patients’ group within the study, interventions within the study, preventative service category within the study, and within-study time periods. The model was used to estimate odds ratios (ORs) for each combination of preventative service category and intervention, and to compare intervention strategies averaged over all preventative service categories.

How were differences between studies investigated?
Additional fixed terms identifying studies that randomised patients and providers, and studies using more than one time period, were included in the regression model to estimate the effect of study design. F-tests were computed to test whether these effects interacted with an intervention condition.

Results of the review
Sixteen RCTs were used to assess the effectiveness of computer-based reminders. The number of patients included for each outcome assessed is unclear.

Investigation of publication bias: the magnitude of the ORs was not significantly correlated with the standard errors of the natural logarithm of the ORs (Kendall’s R=0.16, N=26, P=0.24).

Comparisons of reminder systems versus control group: computer reminders increased preventative practices, compared with a control group, for 4 of the 6 groups of preventative practices (including vaccination, breast cancer screening, colorectal cancer screening and cardiovascular risk reduction) and for all 6 practices combined; OR 1.77 (95% confidence interval, CI: 1.38, 2.27).

Manual reminders increased preventative practices, compared with a control group, for the same 4 (of the 6) preventative practice groups and for all 6 practices combined; OR 1.57 (95% CI: 1.20, 2.06). Computer plus manual reminders increased preventative practice for all 6 groups of preventative practices and for all 6 combined; OR 2.23 (95% CI: 1.67, 2.98).

Computer versus manual reminders: OR 1.13 (95% CI: 0.85, 1.49, P=0.4) for all 6 preventative categories combined.

Computer plus manual reminders versus computer reminders: adjusted OR 1.26 (95% CI: 0.93, 1.70, P=0.13) for all 6 preventative categories combined.

Computer plus manual reminders versus manual reminders: adjusted OR 1.42 (95% CI: 1.02, 1.97, P=0.04) for all 6 preventative categories combined.

Effect of study design on intervention effect: there is a trend towards a larger effect size being described in studies using comparisons with historical control groups (F=2.00, d.f.=3,240, P=0.1).

Whether the study was randomised by patients or providers did not affect the size of the intervention effect (F=0.24, d.f.=3,240, P=0.9).

Authors’ conclusions
Evidence from RCTs supports the effectiveness of data-drive computer-based reminder systems to improve prevention services in the ambulatory care setting.

CRD commentary
The subject area is undoubtedly complicated by the multiplicity of preventative practices targeted, which makes reading of this review difficult; this would have been eased by less ambiguous selection criteria and clarification of the
data extracted. The search strategy included several databases and it is unlikely that a significant number of relevant articles were omitted.

Inclusion criteria are given, but as mentioned above, clarification is required for ease of comprehension. The authors refer to data-generated reminders in the introduction and the discussion, but it is unclear if this is an inclusion criteria for primary studies.

Minimal criteria are used to assess validity. Details of the methods used to select studies for inclusion, assess quality and extract data are lacking. Mention is made that a disproportionate share of the patients in the studies come from poor or racial minority populations but no other information is given about the participants. Hence, the generalisability of the results cannot be commented upon. The ORs from the individual studies are tabulated and the variability of the magnitude of effect among studies is commented on. However, the investigation of heterogeneity is limited to assessment of only two factors: study design, defined as randomisation of patients or providers, and the use of concurrent or historical controls. Had other criteria been used to assess the quality of the primary studies, the influence of these factors on the intervention effect could have been investigated.

More information is required on the populations studied and the implementation (including costs) of the interventions used before the cost-effectiveness of this intervention can be assessed.

**Implications of the review for practice and research**
The cost-effectiveness of data-generated computer-based reminder systems for preventative care in different populations, used to target different preventative practices, needs to be evaluated.

**Funding**
Commonwealth Fund.

**Bibliographic details**

**PubMedID**
8930856

**Other publications of related interest**
These additional published commentaries may also be of interest. Wyatt J. Computer-based reminder systems increase preventive practices in the ambulatory care setting. Evidence-Based Health Policy and Management 1997;1:95-7. Baker R. Review: computerized reminders increase the rate of use of most preventive services. ACP J Club 1997;126:80.

**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Ambulatory Care; Efficiency, Organizational; Humans; Immunization; Likelihood Functions; Mass Screening; Odds Ratio; Preventive Health Services; Regression Analysis; Reminder Systems

**AccessionNumber**
11996001872

**Date bibliographic record published**
Date abstract record published
31/05/1998

Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.