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SYSTEMATIC REVIEW OF ECONOMIC EVALUATIONS AND COST ANALYSES OF GUIDELINE IMPLEMENTATION STRATEGIES

Running title: Economics of guideline implementation

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ABSTRACT

Objectives

To appraise the quality of economic studies undertaken as part of evaluations of guideline implementation strategies; determine their resources use; and recommend methods to improve future studies.

Methods

Systematic review of economic studies undertaken alongside robust study designs of clinical guideline implementation strategies published (1966-1998). Studies assessed against the BMJ economic evaluations guidelines for each stage of the guideline process (guideline development, implementation and treatment).

Results

235 studies were identified, 63 reported some information on cost. Only 3 studies provided evidence that their guideline was effective and efficient. 38 reported the treatment costs only, 12 implementation and treatment costs, 11 implementation costs alone, and two guideline development, implementation and treatment costs. No study gave reasonably complete information on costs.

Conclusions

Very few satisfactory economic evaluations of guideline implementation strategies have been performed. Current evaluations have numerous methodological defects and rarely

consider all relevant costs and benefits. Future evaluations should focus on evaluating the implementation of evidence based guidelines.

Keywords: Cost-effectiveness analysis, physician (or health care professional) behaviour, practice guidelines, quality improvement, systematic review.

INTRODUCTION

Access to health care services is only one of a number of determinants of people's health and there are concerns that people cannot gain access to care that is appropriate to prevent, maintain and promote health. These concerns have led to increasing policy interest in quality improvement activities across a wide range of health care systems and settings. Clinical practice guidelines are an increasingly common element of such quality improvement activities throughout the world. Guidelines have been defined as "systematically developed statements to assist practitioner and patient decisions about appropriate health care".[1] They have the potential to improve the care received by patients by promoting interventions of proven benefit and discouraging ineffective interventions. However, the development and introduction of guidelines is not itself without cost. Even when they represent effective and cost-effective practice for the setting in which they are to be introduced (which is not always the case, particularly in relation to cost-effectiveness), their implementation may not be efficient. In some circumstances, the costs of guideline development and introduction are likely to outweigh their potential benefits. In other circumstances, it may be more efficient to adopt less costly but less effective implementation strategies. Local health care organisations have relatively few resources for clinical effectiveness activities and policy makers need to consider how best to use these to maximise benefits based upon consideration of the likely benefits and resources needed for different implementation strategies. Whilst there are a substantial number of systematic reviews of the *effectiveness* of different guideline implementation strategies, none have explicitly reported on the cost-effectiveness of different strategies.[2-8]

Economic evaluation is a way of providing information about whether the benefits of adopting a course of action compensate for the loss of benefits which would have been generated had the best alternative use been made of the limited resources. It does this by undertaking a comparative analysis of alternative courses of action in terms of both their costs (resource use) and benefits.[9] Bringing costs and benefits together in an economic evaluation provides information as to whether:

- one strategy should be preferred to another as it provides more benefits and uses less resources (i.e. is 'cost-saving'); or
- the extra benefits obtained by a more costly strategy are worth the extra resources (i.e. is 'cost-effective').

This paper reports a systematic review of economic evaluations and cost analyses undertaken alongside rigorous but non-economic evaluations of guideline implementation strategies. We identify the methods used in such economic studies and their frequency, and summarise existing evidence on the efficiency of guideline implementation strategies. Where possible we have described the resource use involved in guideline development and implementation, as such data may help inform decision-makers as to the likely cost of these activities. From this, we draw conclusions about the strengths and weaknesses of the existing economic evaluations of guideline implementation and make recommendations about how such studies can be improved.

ECONOMIC EVALUATION FRAMEWORK

In principle, economic evaluations of guideline implementation strategies should be based on the same basic principles as an evaluation of a standard health technology (a new drug or a new type of surgery).[9] A standard health technology assessment limits itself to the

consideration of the costs and benefits of providing a treatment (e.g. administering drug A or drug B) and the consequences of that treatment. The evaluation of guideline implementation strategies is different in that the breadth of costs and benefits that could be considered is wider. Determining whether the implementation of a guideline is worthwhile involves determining (a) whether the practice embodied in the guideline represents an efficient use of resources and (b) whether the guideline implementation process represents the most efficient way of bringing practice into line with that embodied in the guideline.

There are three distinct stages in the introduction of guidelines that could be considered in an economic evaluation of guideline implementation:[10]

1. Development of the guideline;
2. Implementation of the guideline; and
3. Treatment effects and costs as a consequence of behaviour change.

The first stage covers the costs and benefits of assembling the data and agreeing the guideline recommendations. From the economic perspective the development should only commence once consideration has been given to whether devoting resources to improve health care delivery is the best way to improve people's health. It should also consider whether the recommendations would represent effective and efficient practice for the health care provider and the client groups they serve. The second stage involves dissemination of the guideline (e.g. through workshops) or the adoption of active implementation strategies (e.g. the use of patient specific reminders). Activities such as the organisation of workshops or reminder systems would involve resource use and may also benefit the professional and patient groups involved in the behaviour change process.

From an economic perspective the choice of implementation strategies to be evaluated should also be influenced by the consideration of the setting in which they are to be introduced and an understanding of the relative importance of the different factors influencing the health care professionals behaviour (i.e. knowledge of their utility function). The final stage considers the costs and benefits consequent on the behaviour change. For instance, the change in cost, patient well-being and other benefits caused by changes in treatment.

Although the structure of an economic evaluation of guideline implementation strategies could include the costs and benefits from each of the three stages, it may sometimes be legitimate to design an economic evaluation of more limited scope. For example, it would be legitimate to evaluate only the costs and benefits of disseminating and implementing a guideline that had already been shown to represent efficient practice in the setting in which it is to be applied.[11,12] A further reason for legitimately limiting the scope of the economic evaluation relates to its perspective. If a non-societal perspective, for example that of the health care provider, is adopted then it may be legitimate to exclude costs falling on the patient as well as those benefits gained by health professionals in terms of improved knowledge, job satisfaction that may arise during development and implementation of the guideline. A final possible reason for not measuring some costs and benefits is when the assumption can be made that their inclusion will not change the policy decision. For example, if it is believed, a priori, that a guideline will substantially reduce the costs of treatment while maintaining or improving the outcomes of patients it may be felt legitimate to exclude the costs of development, and implementation as they could not possibly cancel out any savings in treatment costs. However, this makes it difficult to judge which implementation strategy

was the most efficient. Furthermore, this limits the transferability of results to situations where the same implementation strategies are compared for a guideline addressing the same issues in a similar setting. Whether such limitations are appropriate depends on the justification given for the limitation. Such justification should be explicit and supported by appropriate evidence.

The extent that the economic evaluations and cost analyses included in this review have considered all costs and benefits from each of the three stages is assessed as part of the review. Where relevant costs and benefits have been excluded, consideration will be given to whether their exclusions were justified on the basis of stated perspective, unimportance to final conclusions, or previous work showing adoption of the guideline recommendation would be efficient.

METHODS

This review of economic evaluations and cost analyses in evaluations of clinical guideline implementation strategies was undertaken as part of a broader review of the effectiveness of guideline implementation strategies.[13]

Summary of methods for the review of effectiveness of guideline implementation strategies

Studies were selected for inclusion if they met the following criteria: *study design* – randomised controlled trials (RCT), controlled clinical trials (CCT), controlled before and after studies (CBA), or interrupted time series analysis (ITS); *intervention* – guideline implementation strategies; *participants* – medically qualified health care providers; and *outcomes* – objective measures of provider behaviour and/or patient outcome. The

following databases were searched using an extensive search strategy that was 92% sensitive for studies meeting the inclusion criteria:[13] MEDLINE (1966-1998); EMBASE (1980-1998); HealthSTAR (1975-1998); SIGLE (1980-1998); the Cochrane Controlled Trials Register (4th edition 1998) and the register of the Cochrane Effective Practice Organisation of Care Group (EPOC). Studies were not excluded on the basis of language and attempts were made to identify unpublished studies e.g. final reports and dissertations. Approximately 150,000 hits were screened by two researchers. Hard copies of 863 potentially relevant studies were retrieved of which 235 met the inclusion criteria. Two reviewers independently undertook detailed data abstraction.

Inclusion criteria for the review of economic evaluations and cost analyses

For the review of economic evaluations and cost analyses, two reviewers independently assessed whether studies reported any economic data. Studies were included if they reported either an economic analysis or cost analysis. A study was considered to have undertaken an economic evaluation if it reported evidence on costs and at least surrogate endpoints for effectiveness/benefits. A study was considered to have undertaken a cost analysis if it failed to relate costs to effectiveness/benefits.

Review of methodological quality of economic evaluations and cost analyses

Included studies were assessed against the British Medical Journal guidelines for reviewers of economic evaluations.[14] These guidelines are designed to improve the quality of economic evaluations and cover three broad areas including study design, data collection, and analysis and interpretation of results. The criteria were not used as a scoring system but rather as a common means of summarising those aspects of an economic evaluation that are generally considered to be important. Even though these

guidelines were published in 1996 it is worth noting they represent refinements to criteria that had been developed over 20 year earlier. If studies only reported cost analyses, they were not assessed against the criteria relating to benefits.

Review of results of economic evaluations and cost analyses

Data were abstracted on resource use and cost of guideline development and implementation and any resulting changes in clinical treatment and summarised according to the type of implementation strategies adopted.

RESULTS

Studies reporting cost analyses or economic evaluations

Sixty three of 235 (27%) studies (involving 78 comparisons) reported economic evaluations and cost analyses (see appendix). Characteristics of the included studies are described in Table 1. The majority of the studies were conducted in the USA and aimed to improve management. Thirty-six studies tried to change 1 behaviour, the remainder targeted several behaviours (to a maximum of 6).[15]

Table 1 about here

Interventions evaluated

Comparisons were made between more than 2 strategies in several studies (Table 2) and a total of 53 different behaviour change strategies were considered (including 'no intervention' controls). Forty behaviour change strategies were multifaceted, involving more than 1 intervention. The maximum number of interventions employed was 7.[16]

Other than the 'no intervention' control only 1 strategy (use of reminders alone) was used in more than 10 studies.

Table 2 about here

Methodological quality of economic evaluations

The methodological quality of the included studies is summarised in Table 3. Of the 10 studies that stated the viewpoint of the study 4 took the perspective of the health service, [17-20] 5 that of the hospital or providers,[21-25] and only 1 a societal perspective.[26] Almost all the studies provided some simple rationale for the choice of implementation strategies considered. However, none of the studies reported studying the utility functions of the health care professionals in order to determine the design of the implementation strategies that were to be evaluated.

The form of economic evaluation was rarely stated. Even where it was stated it was sometimes misleading. For example, 3 studies reported that they had undertaken 'cost-benefit' analyses.[26-28] Two of these presented differences in cost set against differences in several measures of effectiveness, without any attempt at aggregation (a design defined in this paper as a cost-consequence analysis).[26,28] The third undertook a cost analysis.[27] Thirty five of the remaining studies were cost consequence analyses, 11 were cost-effectiveness analyses and 13 reported some aspect of cost (e.g. staff or material costs) but made no effort to relate costs to benefits (cost analyses).

Table 3 about here

Data collection criteria

Sources of effectiveness estimates

All the studies used experimental or quasi-experimental study designs. However, methodological weaknesses often undermined the effectiveness results. For example, the statistical significance of benefits was uncertain in 16 RCTs, CCTs and CBAs that had potential unit of analysis errors and 11 ITS studies were inappropriately analysed in the published reports.

Only 5 studies attempted to measure health outcomes.[18, 26,29-31] Only 1, using a balance sheet approach, attempted to consider any wider benefit either to patients, their families or practitioners.[26] The reliance on process measures by the majority of studies was of uncertain validity as few provided any details of how the evidence base supporting recommendations was constructed. Therefore, it is unclear whether any of the observed changes in behaviour improved or maintained patient outcomes or were efficient.

Methods for estimation of costs

Thirty eight studies only considered the costs consequent on behaviour change (treatment costs). Eleven reported costs of implementation and 12 implementation and treatment. Only 2 considered the costs of guideline development, implementation and treatment.[26,32] These 2 studies were amongst the few that attempted to provide descriptions of resource use but neither were comprehensive in terms of costs considered. One did attempt to bring uncosted resource use into the decision making process by using a balance sheet approach.[26] Overall, no study gave reasonably complete information on the estimation of cost for guideline development, implementation and treatment.

Analysis criteria

Discounting was not undertaken or mentioned in any of the economic evaluations in which it was required and few reported any form of sensitivity analysis. The sensitivity analysis that was conducted was very limited. For example, in 12 studies sensitivity analysis was limited to changes in a single variable (e.g. a cost of a procedure).

In 1 study, initially planned as a cost-effectiveness analysis, the implementation strategy was cost saving.[25] In all but 11 of the 38 cost-consequences analyses it was concluded that the implementation strategy was 'efficient'. In 3 studies the implementation strategy was reported to be more costly but no more effective.[28,31,33] These conclusions must clearly be treated with suspicion, as must the other conclusions about cost and efficiency, given the limitations in methodology, especially the lack of reports on the evidence base for the guideline and reporting of the methods used described above.

Summary of resource and cost estimates for guideline development, and implementation

Due to the generally poor quality of reporting of the economic evaluations, data on resource use and cost of guideline development and implementation were available for only 4 analyses.[26,32-34] In one of these studies conducted in the 1970's and which compared audit and feedback with a local consensus process, the estimates of resource use may no longer be generalisable.[33] Two studies used the preparation and dissemination of educational materials along with educational meetings[26,32] and one provision of reminders.[34] A summary of the resource use information reported in these studies is available from the authors.

DISCUSSION

By systematically identifying and critiquing the available economic evidence on guideline implementation strategies, we have sought to provide information to decision-makers and researchers to aid in their deliberation on how best to get guidelines into practice. A total of 63 studies were identified that reported an economic evaluation or cost analysis. The multifaceted nature of many of the implementation strategies adopted, the multitude of policy issues addressed and the weak methodology adopted by the majority of the studies precluded the presentation of results on the efficiency of alternative implementation strategies in any meaningful form.

Overall, the methodological quality of the 63 included studies was poor. This finding is similar to other reviews of economic evaluations[36] and in part should be expected given the loose interpretation of what defines an economic evaluation. In another recently completed review of economic evaluations, studies had to present costing methodology in the methods section and results of the economic evaluation in the results section in order to be included in the review.[37] Had this criteria been applied in this review it would undoubtedly have reduced the number of included studies, but it is unlikely that the overall conclusion of generally poor methodology would have changed.

One of the main weaknesses of the included studies is the very limited attempts to show that the guidelines that were to be implemented would represent effective or efficient practice. This combined with the use of process measures by many of the studies severely limits the validity of any conclusions drawn that development and implementation of the guideline represents an efficient use of resources.

The majority of identified studies considered only the costs of treatment and its consequences. In several cases this limitation in scope would not be expected to change the conclusions, as the magnitude of cost savings provided by adopting the recommended practice was so large.[38-42] Therefore in such cases, other methodological weaknesses aside, the evaluation would have been fit for the purpose for which it was designed. However, the results of such evaluations are context specific and have limited transferability as it is not possible to determine whether the resources used to provide the implementation strategies compared within these studies were efficiently used. Furthermore, none of the studies reported using any economic rationale to determine the design of the implementation strategies. This leads to further uncertainty about whether strategies that had the potential to change behaviour in the desired way were compared.

The results presented in this paper are based on a search strategy that was developed to be as comprehensive as possible and over 150,000 abstracts were assessed. Studies were only identified to the end of 1998 and it is possible that more recent studies are of higher quality, as guidelines such as those published by the BMJ have become more readily available. Nevertheless, the majority of included studies were published in the 1990s and similar guidance had been published years earlier.refs Williams, Drummond On the whole the studies included in this paper are of a generally low methodological quality regardless of when or where the study was conducted and published.

The search strategy was also devised with the intention of identifying those studies based on robust study designs. The study designs chosen were those that, if analysed appropriately, could provide the most robust data on effectiveness. As such data often help determine total costs and are integral to estimates of efficiency it is implicit that such

studies should provide the best data on which to base, at least, some parts of an economic evaluation. It is possible that the search strategy may not have identified some studies that have reported economic data separately or have used data from robust study designs to model efficiency. However, given the limitations in the primary evidence base the inclusion of any such studies would not change the findings of this study.

CONCLUSIONS

Recently a number of agencies, such as the National Institute for Clinical Excellence in the UK and the Task Force for Preventive Services in the USA, have explicitly started to produce guidelines incorporating evidence on effectiveness and efficiency.[45,46] There are however still concerns that such national guidance may not represent efficient practice at a local level. Furthermore, it has been shown that the simple production of such evidence based guidelines does not appear to change practice,[47] which again highlights the need for the evaluation of guideline implementation strategies. However, the paucity of data on resource use, cost and efficiency of guideline implementation strategies has been shown in this review. Overall, studies were of poor methodological quality and did not appear to consider guidelines based on evidence of effectiveness or efficiency. Studies also did not report an economic rationale for the choice of implementation strategies considered and did not cover all stages of guideline implementation that may be relevant.

It is tempting to recommend further large scale studies that can give unbiased estimates of costs and effect for all three stage (guideline development, implementation and the treatment effects and costs as a consequence of behaviour change). However, it is unlikely that in many cases such studies will be practical due to statistical issues relating to sample size requirements. The approach outlined by Mason *et al* (1999) and Sculpher

(2000) seems more realistic.[11,48] They argue that primary studies should concentrate on evaluating behaviour change and estimating costs of development and implementation of the guideline, while modelling exercises should use these data to determine whether the guideline is efficient within the setting considered and at the level of behaviour achieved or desired.[11,48]

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Table 1 General characteristics of included studies

Study characteristic	Type	Number of studies
1. Study design	RCT	10
	Cluster RCT	24
	ITS	18
	Other	11[a]
2. Country of origin	USA	45
	UK	11
	Canada	3
	Other	4[b]
3. Rationale for study	Improve management	36
	Cost containment	19
	Both management and cost containment	8
4. Targeted behaviour	General management	24
	Patient education and advice	14
	Prescribing	28
	Preventive services	13
	Referrals	8
	Test ordering	24
	Other	18[c]
5. Number of groups compared[d]	Comparison of 2 groups	35
	Comparison of 3 groups	4
	Comparison of 4 groups	6
6. Study population	Physicians	49
	Physicians & nurses	3
	Physicians, nurses, pharmacists	1
	Physicians, nurses, pharmacists, other	1
	Physicians, nurses, other	2
	Physicians, unclear	1
	Physicians, other	6

RCT = randomised controlled trial; ITS = Interrupted Time Series

a Cluster Controlled before and after design 4; Controlled clinical trial 5; Cluster Controlled clinical trial 2

b Australia 2, New Zealand 1, Thailand 1

c Procedures 6, Diagnosis 5, Financial 5, Record keeping 1, Discharge planning 1

d Excluding the 18 ITS studies where a direct comparison was not made

Table 2 **Frequency of employment of behaviour change strategies used by abridged Cochrane Effective Practice and Organisation of Care Group[78] classification[a]**

Intervention Type	Number of times employed
Audit and Feedback	24
Consensus process	5
Educational materials	29
Educational meetings	25
Outreach visits	10
Patient-mediated	3
Reminders	20
Other behaviour change interventions	17
Financial	4
Organisational	10
Structural	11

a In the full EPOC list 56 different behaviour change interventions are defined; the 44 financial, structural and organisational interventions are amalgamated into three sub headings as they were rarely employed

Table 3 Criteria used to assess the quality of economic evaluations and cost analyses

Study design	Number[a]
1. Research question stated	63
2. Importance of question stated	60
3. Viewpoint of analysis: • Stated • Defined	 10 5
4. Rationale for choosing alternative programmes or interventions compared stated	61
5. Alternatives being compared clearly defined	63
6. Form of economic evaluation used stated	12
7. Choice of form of economic evaluation justified in relation to question addressed	1
Data collection	
8. Source(s) of effectiveness estimates stated	63
9. Details of design and results of effectiveness study given (if based on single study	63
10. Details of methods of synthesis or meta-analysis of data underpinning guideline recommendations	3
11. Primary outcome measure(s) for economic evaluation clearly stated	25
12. Methods to value health states and other benefits stated	5
13. Details of subjects from whom valuations were obtained given	5
14. Productivity changes (if included) reported separately	3
15. Relevance of productivity changes to study question discussed	3
16. Quantities of resources reported separately from their unit costs	20
17. Methods for estimation of quantities and units costs described	30
18. Currency and price data recorded	13

Table 3 cont

Data collection (cont)	
19. Details of currency and price adjustments for inflation or currency conversion given	5
20. Details of any model used	0
21. Choice of model used and key parameters on which it is based justified	0
Analysis	
22. Time horizon of costs and benefits stated	48
23. Discount rate(s) stated	0/38
24. Choice of rate(s) justified	0/38
25. Explanation given if costs and benefits are not discounted	0
26. Details of statistical tests and CI given for stochastic data	16
27. Approach to sensitivity analysis given	16
28. Choice of variable for sensitivity analysis justified	5
29. Ranges of which variables are varied stated	7
30. Relevant alternatives compared	6
31. Incremental analysis reported	37
32. Major outcomes presented in an aggregated as well as a disaggregated form	0
33. Answer to study question given	60
34. Conclusions follow from data reported	44
35. Conclusions accompanied by appropriate caveats	42

a Out of 63 studies except where otherwise noted

Additional Data available on request from the authors

Table A Details of studies reporting resource consequences of guideline development and implementation strategies

Study	Intervention	Behaviours targeted	Setting
Gurwitz 1992[38]	**Distribution of educational materials, educational meetings,**[a] Other professional behaviour change (list of patients receiving target therapy), financial interventions (changes to reimbursable products)	Prescription of H2 receptor antagonists (treatment of gastro-intestinal disorders) in nursing home patients	Boston, USA Long term care facility Time of study: 1988 to 1990 Costs in 1989 US dollars Cost of providing financial change not stated
Thomas 1998[77]	**Distribution of educational materials, educational meetings** organisational changes (open access clinic)	Guidelines for two urological problems: prostatism due to benign prostatic hyperplasia; and microscopic haematuria in the general population	Grampian, Scotland Family Practice Time of study 1995 to 1996 Cost in UK pounds cost Year not stated possibly 1995/6 Costs of providing organisational change intervention not stated
Rosser 1991[63]	**Reminders** about requirement for a procedure/test	Influenza vaccination Cervical screening Blood pressure screening Tetanus boosters	Ontario, Canada Family practice Time of study: 1984/5 Unclear if costs in US or Canadian dollars. Year that costs relate to not stated

Table A continued

Study	Intervention	Behaviours targeted	Setting
Winickoff 1985[75]	Reminders **Audit and Feedback** Local consensus process	Management of hypertension	Boston, USA Primary care Time of study unclear but the study took 18 months Costs in 1979 US dollars Only costs of proving audit and feedback were reported

a Data in **bold** identifies the intervention on which resource use data is provided

Table B Resources used in the guideline development stage

Study	Area of resource use	Quantity of resource use	Monetary cost of development
Gurwitz 1993[38]	Literature review by MD/Pharmacist	20 hours (also includes preparation of documentation which should be considered as part of implementation costs)	$650 (at 32.50 hour)
Thomas 1998[77]	GP/nurse/clinician researcher time spent at meetings (including travel time)	217 hours (163 leisure hours; 54 work hours)	£1944 (work hours only); £9029 including valuation of leisure time
	Research staff preparing for development meetings	182 hours	£2676
	Travel costs	Mileage or unit costs not reported but 1998 UK Automobile Association cost per mile	£462
	Consumables	Not detailed	£3329

Table C Resources used in the implementation stage

Study	Cost generating event	Quantity of resources used	Cost
Gurwitz 1992[38]	***Educational materials***		
	Documentation preparation by MD/Pharmacist	See Table 3	See Table 3
	Review of medical records for documents by MD/Pharmacist	25 hours	$812.50
	Printing costs	Resource use not recorded but materials required for 16 providers	$200
	Educational meetings		
	Preparation time for presentation by (MD/Pharmacist)	5 hours	$32.50
	Group discussions attended 16 members of staff and MD/Pharmacist	Time not stated	Not costed

Table C continued

Study	Cost generating event	Quantity of resources used	Cost
Thomas 1998[77]	***Educational materials***		
	Consumables (printing folders)	Resource use not detailed but guideline was disseminated to approximately 300 general practitioners and 74 practice managers	£2484
	Time spent assembling and mailing the guidelines	24 hours	£265
	Postage of guidelines and letters/reminders	Resource use not detailed but guideline was disseminated to approximately 300 general practitioners and 74 practice managers	£431
	Educational meetings		
	GP/nurse/clinician researcher time spent at meetings (including travel time and post graduate education allowance payment for general practitioners	111 hours of which all was out with regular working hours. This cost spread over 74 general practices and approximately 300 general practitioners	£0 as no work time forgone but £7024 if leisure time valued
	Research staff preparing for meetings	40 hours	£517
	Travel costs	Mileage or unit costs not reported but 1998 UK Automobile Association cost per mile	£304

Table C continued

Study	Cost generating event	Quantity of resources used	Cost
Rosser 1991[63a]	*Letter reminder to patients*		
	Clerical time to prepare letter	1.7 minutes to 5.77 minutes (depending on clinical area)	$0.28 to $0.96
	Physician time to sign letters	10 seconds	$0.16
	Stamps	Not specified	$0.32
	Stationary	Not specified	$0.06
	Repeated costs of above for 2nd reminder letter	84% patients required repeated mailing	
	Telephone reminder to patients		
	Clerical time to prepare patient documentation	0.33 to 2.8 minutes	$0.06 to $0.48
	Nurse time contacting patient	2.8 minutes	$0.70
	Cost of telephone calls	Not specified	Not specified
	Repeat calls to patients	1.7 - 2.4 calls per patient	Not specified

Table C continued

Study	Cost generating event	Quantity of resources used	Cost
	Physician time to explain need for test/procedure		
	Physician time to explain need for test/procedure	0.25 - 1.70 minutes	$0.25 - $1.70
Winickoff 1985[75]	Computer time used to create reports from routine data for 2216 patients for 16 physician/nurse provider teams	90 hours	$2300
	Staff time to produce reports	5 to 10 hours	$27.50 to $55

a Quantities of resource use and costs expressed are per patient.

Appendix List of included studies

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