Holter monitoring: are two days better than one
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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
The use of holder monitoring (HM) for the initial assessment of symptomatic and asymptomatic arrhythmias. A 48-hour monitoring period was compared with a 24-hour monitoring period.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised patients with primary indications for HM. More specifically, palpitations, presyncope, syncope, evaluation of atrial fibrillation, and cerebral ischaemic events.

Setting
The setting was tertiary care. The economic study was carried out in Boston, USA.

Dates to which data relate
The effectiveness and resource data were collected from July 1992 to October 1998. The price year was 1998.

Source of effectiveness data
The effectiveness data were derived from a single retrospective study.

Link between effectiveness and cost data
The authors did not clearly state that the costing was carried out retrospectively on the same sample of patients as that used in the effectiveness study.

Study sample
Power calculations were not reported. A total of 164 consecutive patients were included in the study. The patients had a mean age of 59 (+/- 19) years (range: 17 - 93) and 74 were men.

Study design
This was a retrospective study, carried out in a single centre, in which each patient referral generated two separate 24-hour HM readings, all symptoms being recorded in a diary. The patients were followed for 2 days. Fourteen patients (9%) did not return diaries. These patients were considered asymptomatic for purposes of the analysis, because their
frequency of arrhythmia did not significantly differ from the rest of the study population.

**Analysis of effectiveness**
It appears that all the study participants were included in the analysis. The patients who did not return diaries were assumed to be asymptomatic. The study outcome was the diagnostic yield of three positive diagnostic outcomes. These were relevant new symptoms in the presence or absence of arrhythmia, new serious or potentially serious arrhythmia, and other new arrhythmias. A combined outcome for each 24-hour period was defined by the sum of these positive diagnostic outcomes. No statistical analysis of the effectiveness results was reported.

**Effectiveness results**
During day 1, 74 (45%) patients were diagnosed with new symptoms, compared with 16 (10%) patients on the second day.

During day 1, 96 (59%) patients were diagnosed with a new arrhythmia, compared with 8 (5%) patients on the second day.

During day 1, 31 (19%) patients were diagnosed with a new serious or potentially serious arrhythmia, compared with 5 (3%) patients on the second day.

Using the combined outcome, 117 (71%) patients reported new symptoms and/or new arrhythmia on the first day, compared with 23 (14%) patients on the second day.

**Clinical conclusions**
The incremental diagnostic yield of HM decreased with a second day of monitoring.

**Measure of benefits used in the economic analysis**
No summary benefit measure was used in the economic evaluation. In effect, this was a cost-consequences analysis.

**Direct costs**
Discounting was not relevant since the costs were incurred during less than one year. The unit costs and the quantities of resources used were not presented separately. The costs included in the analysis were monitoring costs. These comprised monitoring equipment depreciation, laboratory technical staff, and the interpreting physician fee. The cost/resource boundary of the study was not reported. It is unclear whether the resource use data were estimated using actual data coming from the sample of patients involved in the effectiveness study, or whether the average resource use was assumed. The source of the unit costs was not reported. The price year was 1998. The authors made one major assumption. They assumed that the cost of a 48-hour monitoring period would be double that of a 24-hour monitoring period.

**Statistical analysis of costs**
A statistical analysis of the costs was not carried out.

**Indirect Costs**
The indirect costs were not considered.

**Currency**
US dollars ($).
Sensitivity analysis
Sensitivity analyses were not performed.

Estimated benefits used in the economic analysis
See the 'Effectiveness Results' section.

Cost results
The total costs were not reported.

The incremental cost of detecting a new symptom increased from $665 for 24 hours' HM to $3,075 for 48 hours' HM.

The incremental cost of diagnosing a new serious arrhythmia increased from $1,587 for 24 hours' HM to $9,840 for 48 hours' HM.

The incremental cost of observing a new symptom or diagnosing a new arrhythmia increased from $421 for 24 hours' HM to $2,139 for 48 hours' HM.

The incremental cost of diagnosing a new serious arrhythmia in patients being evaluated for possible atrial fibrillation increased from $450 for 24 hours' HM to $2,100 for 48 hours' HM.

The incremental cost of diagnosing a new serious arrhythmia in patients referred for evaluation of palpitations increased from $3,000 for 24 hours' HM to $9,000 for 48 hours' HM.

Synthesis of costs and benefits
A synthesis of the costs and benefits was not relevant as a cost-consequences analysis was carried out.

Authors' conclusions
In the population studied, 48 hours' holder monitoring (HM) was generally not cost-effective (both less effective and more costly) when compared with 24 hours' HM. One possible exception was when evaluating asymptomatic paroxysmal atrial fibrillation.

CRD COMMENTARY - Selection of comparators
The choice of 24 hours' HM as the comparator was explicitly justified since it represented the routine practice adopted by physicians for the initial assessment of symptomatic and asymptomatic arrhythmias. You should decide whether it represents a valid comparator in your own setting.

Validity of estimate of measure of effectiveness
The analysis of effectiveness was based on a retrospective study in which patients were screened over 2 days and the diagnostic yield specific to each day was identified. The authors acknowledged that a prospective randomised controlled trial would have been a more appropriate design for the study question. Also, the authors noted that, in the absence of random assignment, selection bias might have occurred. Power calculations were not carried out and this may represent a drawback of the analysis. However, the main drawback of the study was the lack of statistical tests of significance to compare the health outcomes between the two periods.

Validity of estimate of measure of benefit
No summary benefit measure was used in the analysis because, in effect, a cost-consequences analysis was carried out.
Validity of estimate of costs
The perspective of the study was not stated. Thus, it is not possible to assess whether all the relevant categories of costs were included in the analysis. Details of the unit costs and quantities of resources used were not reported, which limits the transferability of the economic analysis to other settings. It is likely that the cost estimates were derived from a single centre and were specific to the study setting. The date to which the prices related was reported, which will enhance possible reflation exercises. Discounting was not relevant and was not carried out. The main drawback of the cost analysis was that statistical and sensitivity analyses were not performed on the costs. Consequently, the external validity of the study may be low.

Other issues
The authors compared their results with one published study that evaluated the cost-effectiveness of continuous-loop event recorder monitoring, showing similar observations (Zimetbaum et al., see Other Publications of Related Interest). The authors did not address the issue of the generalisability of the study results to other settings, although they justified the applicability of the results to the general population of HM (similar frequency of arrhythmia detection in other published studies). Sensitivity analyses, to account for variability in the cost or effectiveness data, were not performed. Consequently, caution should be exercised when extrapolating the study results to different contexts. The results were not reported selectively and the effectiveness conclusions reflected the scope of the study. The authors reported a number of further limitations to their study, which have been highlighted already.

Implications of the study
The authors recommended that a prospective randomised assessment of HM duration should be performed.

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Other publications of related interest

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