Determining the cost-effectiveness of mass screening for cervical cancer using common analytic models
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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 study compared single mass screening, with Papanicolaou (Pap) smears, to no mass screening for cervical cancer. The authors did not define the model of mass screening used in the study or the method of organising and implementing the programme.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population consisted of women between the ages of 30 and 79, without symptoms of cervical cancer.

Setting
The authors did not specify the setting for the screening programme. The study used data specific to Japan.

Dates to which data relate
The authors did not report the sources for some of the data used in the evaluation. Estimates of the effectiveness parameters that were referenced were from data collected or published between 1989 and 1993. The bibliography includes studies published between 1983 and 1998. The sources of the data used to generate estimates of the costs of screening and diagnosis were not reported. The costs of treatment were based on data for the period 1989 to 1994.

Source of effectiveness data
Effectiveness data were derived from a review of the literature.

Modelling
A decision analytic model was used to synthesise data to estimate the expected costs of screening, diagnosis and treatment for cervical cancer, and the expected survival and life years gained by screening. The model was used to estimate the expected costs and outcomes for 10-year age bands, starting at age 30 and ending at age 79.

Outcomes assessed in the review
The evaluation reviewed completed studies for data to estimate the values of the input parameters used in the model. These were:
(1) incidence of cervical cancer;

(2) mortality rates for uterine cancer and other causes;

(3) stage distribution of cancers detected for the no screening situation;

(4) stage distribution of cancers detected with mass screening;

(5) five year survival with cervical cancer;

(6) sensitivity and specificity of Pap smears; and

(7) life expectancy.

**Study designs and other criteria for inclusion in the review**
The authors extracted data from cancer registries (parameters (1), (3), and (6)), national population statistics (parameters (1), (2), and (7)) and a case controlled study (parameter (4)). They did not report if other studies were included in the review, neither did they report the inclusion and exclusion criteria for the selection of studies.

**Sources searched to identify primary studies**
The authors did not state that a systematic review was carried out and did not report the sources searched to identify primary studies and data sources.

**Criteria used to ensure the validity of primary studies**
The authors did not report any criteria used to ensure the validity of the primary studies or data sources.

**Methods used to judge relevance and validity, and for extracting data**
The authors did not report the methods used to assess the validity of the primary studies or data sources.

**Number of primary studies included**
The authors did not provide references for all sources of effectiveness data. The authors identify 4 sources for 6 of the 7 input parameters. The bibliography included a total of 11 references related to screening for cervical cancer.

**Methods of combining primary studies**
The authors did not report the methods used to combine the results of the primary studies.

**Investigation of differences between primary studies**
The authors did not report whether there were differences between the primary studies and whether these were investigated if they existed.

**Results of the review**
The input parameters derived from the review were:

(1) incidence of cervical cancer, not reported;

(2) mortality rates for uterine cancer and other causes, not reported;

(3) stage distribution of cancers detected for the no screening situation, carcinoma in situ (CIS) = 30%, invasive cancer
(4) stage distribution of cancers detected with mass screening, CIS = 94%, invasive cancer = 6%;

(5) five year survival with cervical cancer, CIS = 100%, invasive cancer = 67%;

(6) sensitivity and specificity of Pap smears 90.8% and 99.5% respectively and

(7) life expectancy, not reported.

**Measure of benefits used in the economic analysis**
The economic analysis used lives saved and life years saved as the measures of benefit.

**Direct costs**
The evaluation included the direct costs to the payer of mass screening with Pap smears, diagnosis (pap smears for unscreened women, colposcopy and punch biopsy, physician fees) and medical treatment of cervical cancer. Both costs and outcomes were discounted at 5%. Resource use and costs were not reported separately. The cost estimates were derived from Japanese health service charge and cost data. The costs were based on data for the period 1989 to 1994. The authors did not report whether the cost data were adjusted for inflation. The study used average cost data as inputs to the model. The authors reported total and incremental expected costs as the outputs of the model.

**Statistical analysis of costs**
No statistical analysis was conducted.

**Indirect Costs**
Indirect costs were not included in the evaluation and were not relevant to the perspective of the study.

**Currency**
US dollars ($). The authors converted Japanese yen to US dollars at a rate of $1 = 120 Japanese yen.

**Sensitivity analysis**
The authors conducted a one way sensitivity analysis on three of the model parameters to assess whether variability in the values assigned influenced the cost per life year gained. These were reported by the authors to be the consultation rate for closer examination, the prevalence rate and the cost of medical treatment for those who survived and those who died. The authors did not report the reasons why these parameters were selected for sensitivity analysis or the ranges of values tested.

**Estimated benefits used in the economic analysis**
The incremental lives saved by mass cervical screening compared to no screening for each age band were:

- 30-39 years = 21.6;
- 40-49 years = 13.7;
- 50-59 years = 14.4;
- 60-69 years = 17.7;
- 70-79 years = 18.7.
The incremental life years saved by mass cervical screening compared to no screening for each age band were:

- 30-39 years = 0.010;
- 40-49 years = 0.005;
- 50-59 years = 0.004;
- 60-69 years = 0.003;
- 70-79 years = 0.002.

These were estimated from expected survival for mass screening and no screening and life expectancy for each age group.

Cost results
The total cost per person (screening, diagnosis and medical treatment for identified cervical cancer) of mass cervical screening for each age band were:

- 30-39 years = $51.1;
- 40-49 years = $40.0;
- 50-59 years = $36.8;
- 60-69 years = $36.9;
- 70-79 years = $57.3.

The total cost per person (diagnosis and treatment for identified cervical cancer) of no screening for each age band were:

- 30-39 years = $23.6;
- 40-49 years = $10.8;
- 50-59 years = $7.9;
- 60-69 years = $8.9;
- 70-79 years = $29.2.

The incremental cost per person of mass cervical screening compared to no screening for each age band were:

- 30-39 years = $27.5;
- 40-49 years = $29.2;
- 50-59 years = $28.9;
- 60-69 years = $28.0;
- 70-79 years = $28.1.

The costs were discounted at 5%. The authors did not report the timeframe used to calculate the costs of diagnosis and treatment, or when these costs were incurred.
Synthesis of costs and benefits

The authors calculated an incremental cost per life year gained for each age band (incremental cost divided by incremental life years). These were:

30-39 years = $2,782;
40-49 years = $5,908;
50-59 years = $7,451;
60-69 years = $8,726;
70-79 years = $14,867.

The authors also calculated an incremental cost per life saved for each age band (incremental cost divided by incremental lives saved). These were:

30-39 years = $127,412;
40-49 years = $213,992;
50-59 years = $200,433;
60-69 years = $157,323;
70-79 years = $149,559.

The costs and life years gained were discounted at 5%. The time frame for estimation of life years gained was 50 years.

The cost per life year saved increased for each age group of women screened. The highest cost per life saved was for the 40-49 age group. This group had the highest incremental cost and lowest number of lives saved by mass screening. The sensitivity analysis indicated that the results were sensitive to the assumed consultation rate and the prevalence of cervical cancer. If the consultation rate was decreased from 100% to 50%, the incremental cost per life year gained was increased by approximately twofold. If the prevalence of cervical cancer was decreased to less than 40% of the rate used in the analysis, then the cost per life year saved showed a steep increase for all age groups.

Authors’ conclusions

The authors compared the costs of cervical screening with those of screening for other diseases. They concluded that the cost per life year gained by mass screening for cervical cancer was within the range reported for screening for other cancers. The authors also concluded that the cost per life year gained by mass screening for cervical cancer was acceptable from the perspective of economic effectiveness. The authors noted a number of factors that would reduce the relative cost-effectiveness of mass screening for cervical cancer. These include decreases in the incidence of cervical cancer, increased frequency of screening within a cohort and reductions in the interval between screenings.

CRD COMMENTARY - Selection of comparators

The authors compared single mass screening for cervical cancer to no screening. The authors indicated that mass screening reflected current practice in Japan, the setting for the study. They did not report whether this is single mass screening for each age cohort, or whether the same cohort is invited for screening on a regular basis. The authors indicated that there is little economic evidence to support a mass screening programme for cervical cancer. They also noted that decreases in the incidence of cervical cancer may mean that it is not cost-effective. However, they did not provide a rationale for comparing mass screening to no screening. The authors did not describe alternatives, such as targeted or opportunistic screening, and did not provide a detailed description of what the mass screening programme and no screening entailed. This makes it difficult to assess whether the comparator of no screening is a relevant or
widely used alternative to mass screening.

Validity of estimate of measure of effectiveness
The authors used decision analysis to model the effectiveness and health benefit of the alternatives. The input parameters for the model were estimated from previously conducted studies and from available data. The authors did not report whether these sources of data were identified from a systematic search of the literature, the criteria used to select studies for inclusion in the evaluation, the methods used to assess the validity of the data sources or the methods used to extract and combine data from the individual studies. The authors did not report the sources used for all of the parameters or all of the values used for the base case and sensitivity analyses. This makes it difficult to assess the validity and relevance of the data to alternative settings and populations. The authors did not report whether they assumed that all women would comply with the mass screening programme, or whether a percentage would not attend. This would have implications for the costs of the programme (for example the costs of follow up letters and repeat invitations to attend) and the effectiveness of the programme (for example number of cases detected). The combination of these two factors may mean that the cost per life or life year gained was under estimated. The authors noted that the cost-effectiveness of mass screening declines as the frequency of screening increases and the interval between screening decreases, since there are fewer prevalent cases to detect at each screening. They did not include these factors in the evaluation, but did report the results of other studies to support this conclusion.

Validity of estimate of measure of benefit
The authors estimated lives saved and life years gained by mass screening compared to no mass screening. This implicitly assigns an equal value to the life years gained by women who have cervical cancer and medical treatment and those who do not. This may overestimate the value of survival gains from mass screening. The authors also implicitly assumed that for those who survive cervical cancer, the age specific life expectancy is equivalent to those who do not have cervical cancer. This assumption was not validated or tested. Lives and life years gained does not include information about the preferences and values of women for the process and outcomes of screening for cervical cancer, which might over estimate the value of mass screening programmes.

Validity of estimate of costs
The authors reported Japanese health service charges (converted into US dollars) for the costs of events included in the model but did not report how these charges were calculated. In particular it is not possible to assess the quantity and types of services used for each event. This means it is not possible to determine if (a) the services used for screening, diagnosis and treatment are similar or otherwise to those provided in other settings or (b) whether all relevant costs were included in the analysis. The authors tested the sensitivity of the results to variations in the rate of consultations and the costs of medical treatment but did not test the sensitivity of the results to variations in other cost items.

Other issues
The authors did not report whether the structure of the model had been validated. They did not describe the model or underlying assumptions in detail, or test the sensitivity of the results to changes in the structure or underlying assumptions of the model. This, combined with the issues outlined above, makes it difficult to assess the internal validity and robustness of the results and the generalisability of the evaluation to alternative settings or populations.

Implications of the study
The authors concluded that single mass screening for cervical cancer in Japan is currently cost-effective. However, changes in the incidence of the disease, frequency of screening, intervals between screens or adoption of new screening methods and types will require further evaluation to determine whether screening remains cost-effective.

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