Economic benefit of breast-feeding infants enrolled in WIC
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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
Breast-feeding versus formula feeding in infants.

Type of intervention
Breastfeeding; Primary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
Breast-fed and formula-fed infants. The average age of mothers was 25 for the breast-feeding and 22.2 for the formula-feeding group, (p<0.001). The two groups were comparable in terms of education background. 70% of the breast-feeding group were white women and 55.7% of the formula-feeding group, (p<0.001). The women in the breast feeding group had a higher rate of employment (43.1% versus 32.3%, p<0.001) and were less likely to smoke (13.7% versus 26.2%, p<0.001).

Setting
Community. The economic study was carried out in Colorado, USA.

Dates to which data relate
The resources were measured using data for the period 1 August 1993 - 31 December 1993. 1993-1994 prices were used.

Source of effectiveness data
Effectiveness data were derived from a single study.

Link between effectiveness and cost data
The costing was undertaken retrospectively on the same patient sample as that used in the effectiveness study.

Study sample
Using the Colorado WIC database, infants were identified as possible subjects if they were: (a) born between August 1, 1993, and December 31, 1993; (b) enrolled in WIC within 1 month of birth; (c) either formula-fed exclusively or breast-fed exclusively for at least the first 3 months of life; and (d) classified as a normal, singleton birth (born after 37 weeks of gestation with a birth weight above 2,500 g and born without any severe medical conditions).

Breast-fed infants were further identified as to duration of exclusive breast-feeding (3, 4, 5 or 6 months of exclusive
breast-feeding) based on redemption of WIC wouchers for infant formula. It is not evident that the initial study sample was appropriate for the clinical study question; it was not reported whether power calculations were used to determine the sample size.

The breast-feeding cohort and the formula-feeding cohort consisted of 406 and 470 infants respectively. Infants were excluded if (a) birth certificate or Medicaid records indicated congenital anomaly, or less than 37 weeks of gestation; (b) the Medicaid record indicated that medical services were provided by a health maintenance organization or a federally qualified health centre (where Medicaid payments for services were not related to intensity of service provided); or (c) Medicaid records indicated other third-party reimbursement for any medical service during the study period.

**Study design**
Single centre cohort study. The cohorts were identified and tracked prospectively for 6 months. No information about loss to follow up was reported.

**Analysis of effectiveness**
Not reported.

**Effectiveness results**
The effectiveness results were not explicitly reported.

**Clinical conclusions**
The study considers that breast feeding is at least as effective as formula feeding in terms of health benefits for infants.

**Measure of benefits used in the economic analysis**
Since the authors assumed that there was no difference in effectiveness or clinical benefit between the intervention and comparator, the economic analysis was based on the difference in costs only (cost-minimization) plus a benefit to cost ratio calculation.

**Direct costs**
Discounting was not applied due to the short period of the study (<1 year). Costs and quantities were not reported separately. The type of costs included in the study were as follows: the food costs for the women and infants in the two groups plus the administrative expenses for 6 months, minus manufacturers' rebates for formula, plus Medicaid expenditures for health care initiated in the first 6 months of each infant's life for: procedure, revenue, diagnosis-related-group, non-diagnosis-related-group and pharmacy. The quantity/cost boundary adopted was the health service. The estimation of quantities and costs was based on actual data. The source of quantity/cost data was the Colorado WIC database and the Medicaid records. The dates of the price data were 1993-1994.

**Statistical analysis of costs**
WIC costs and Medicaid expenditures were summed for each mother-infant pair and compared between the cohorts by means of t tests and analysis of covariance. Regression techniques were used to estimate total Medicaid expenditures for each feeding method when adjusted for other variables. The sex of the infant and number of prenatal visits were found to contribute significantly to total Medicaid expenditures. Analysis of covariance was used to estimate the total difference in Medicaid expenditures between the breast-fed and formula-fed cohorts, adjusted for sex of the infant and number of prenatal visits.

**Indirect Costs**
Not reported.

Currency
US dollars ($).

Sensitivity analysis
A simple sensitivity analysis was carried out on administrative costs.

Estimated benefits used in the economic analysis
Not applicable.

Cost results
The 6 months food cost was $299 lower for breast-feeding mother-infant pairs than for the formula-fed cohort ($269 versus $568, p<0.0001). With the addition of a 26% administrative cost adjustment, 6 months food cost remained less for the breast-fed cohort than for the formula-fed cohort, $339 versus $715. The 6 months, post-rebate (manufacturer's rebate) WIC food cost for the formula-feeding cohort, before adjusting for the programme's administrative cost, was $18.63 less than the food package cost for the breast-feeding cohort. When administrative costs were added to food package cost (calculated with 26% administrative cost of pre-rebate food package), the food cost of the formula-feeding cohort was higher by $59 than that of the breast-feeding cohort. Mean, unadjusted total Medicaid expenditures for infants in the breast feeding cohort were approximately $102 less than for infants in the formula-feeding cohort ($484.80 +/- 964.14 versus $586.67 +/- 1,222.36, not statistically significant). Mean pharmacy payments, a subcategory of total Medicaid expenditures, were significantly lower for the breast-fed cohort than for the formula fed cohort ($16.83 and $37.56 respectively, p<0.0001). Compared with the formula-feeding cohort, adjusted pharmacy payments for the breast-feeding cohort were $29.82 (95% CI: $21.14 - $38.50) lower for males and $12.16 (95% CI: $5.90 - $18.41) lower for females.

Synthesis of costs and benefits
A benefit-cost ratio was calculated. The benefits (Medicare expenditures) were divided by the (WIC) costs of the programmes to produce a ratio score which showed the monetary value of outcomes produced with each dollar of input. Post-rebate breast-fed cohort ratios ranged from 1.02 to 1.73 compared with ratios of 1.59 to 1.75 for the formula-fed cohort. These results do not, however, reflect the finding that both Medicaid and post-rebate WIC costs were higher for the formula-fed alternative. The average formula-fed infant required 21% more Medicaid expenditures and the infant-mother pair required 14% to 19% more WIC dollars than the average breast-fed infant-mother pair.

Authors' conclusions
The study results show that breast-feeding reduces WIC costs and Medicaid expenditures in the short term, so examination of a longer time period may reveal greater savings. In order to achieve valid conclusions, it is important to consider the problem of incomplete Medicaid expenditure data and breast-feeding infants receiving care from providers who use revenue billing codes (which tends to result in a higher level of payment). The lower pharmacy costs associated with breast-fed children could mean a substantial saving for the Medicaid programme if more low-income mothers chose to breast-feed their infants.

The authors argued that the breast-feeding method produced a net month saving of $9.83, which, applied to the 17.5% of Colorado WIC infants breast-fed for 6 months, can lead to a saving of $25,803 per month. In addition to producing monetary benefits, breast-feeding produces intangible benefits for the mother and infant, as well for society.
Validity of estimate of measure of benefit
The health benefits of the intervention and the comparator were not explicitly analysed. As such, the authors conducted an economic evaluation which had some characteristics of cost-benefit analysis (e.g. benefit/cost ratio, net benefit) and others which resembled cost-minimization analysis. However, in terms of cost-benefit analysis, health benefits were not explicitly analysed but, rather, the conversion from health outcomes to dollar values was represented in Medicaid expenditures alone. In terms of cost-minimization, the authors did not adequately demonstrate that the effectiveness of breast-feeding was identical to formula-feeding. However, the results suggest additional benefit for breast-fed infants.

Validity of estimate of costs
Resource quantities were not reported separately from the prices, but adequate details of methods of quantity/cost estimation were given. All the important cost items were included.

Other issues
The results of the study need to be validated, for example with a cohort study which employs a longer period of follow up using appropriate methods to assess differences in the health outcomes of the two populations.

Implications of the study
The study supports the view that the breast feeding of infants is associated with both health and economic benefits.

Source of funding
Supported in part by grants from The American Dietetic Association Research Foundation and the Colorado Breastfeeding Task Force.

Bibliographic details

PubMedID
9120189

DOI
10.1016/S0002-8223(97)00094-1

Other publications of related interest

Indexing Status
Subject indexing assigned by NLM

MeSH
Adult; Bottle Feeding /economics; Breast Feeding; Cohort Studies; Cost Control; Cost-Benefit Analysis; Female; Follow-Up Studies; Food Services /economics; Humans; Infant Food /economics; Infant, Newborn; Medicaid /economics /utilization; Prospective Studies; United States

AccessionNumber
21997000575

Date bibliographic record published
31/07/1999

Date abstract record published
31/07/1999