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# An economic analysis of midwifery training programmes in South Kalimantan, Indonesia

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**Abstract** In order to improve the knowledge and skills of midwives at health facilities and those based in villages in South Kalimantan, Indonesia, three in-service training programmes were carried out during 1995–98. A scheme used for both facility and village midwives included training at training centres, peer review and continuing education. One restricted to village midwives involved an internship programme in district hospitals. The incremental cost-effectiveness of these programmes was assessed from the standpoint of the health care provider. It was estimated that the first scheme could be expanded to increase the number of competent midwives based in facilities and villages in South Kalimantan by 1% at incremental costs of US\$ 764.6 and US\$ 1175.7 respectively, and that replication beyond South Kalimantan could increase the number of competent midwives based in facilities and villages by 1% at incremental costs of US\$ 1225.5 and US\$ 1786.4 per midwife respectively. It was also estimated that the number of competent village midwives could be increased by 1% at an incremental cost of US\$ 898.1 per intern if replicated elsewhere, and at a cost of US\$ 146.2 per intern for expanding the scheme in South Kalimantan. It was not clear whether the training programmes were more or less cost-effective than other safe motherhood interventions because the nature of the outcome measures hindered comparison.

**Keywords** Midwifery/education; Inservice training/economics; Costs and cost analysis; Indonesia (*source: MeSH, NLM*).

**Mots clés** Profession sage-femme/enseignement; Stage/économie; Coûts et analyse coût; Indonésie (*source: MeSH, INSERM*).

**Palabras clave** Tología/educación; Capacitación en servicio/economía; Costos y análisis de costo; Indonesia (*fuelle: DECS, BIREME*).

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*Voir page 54 le résumé en français. En la página 54 figura un resumen en español.*

## Introduction

In 1989 the Indonesian Safe Motherhood Initiative was launched with the aim of reducing maternal mortality in South Kalimantan from an estimated 543 per 100 000 live births to 225 per 100 000 by 2000 (1). In order to accommodate the strong preference among women for giving birth at home a strategy of placing a trained midwife in every village was adopted. Special consideration was given to the most remote villages (1).

Preservice training programmes based in nursing schools were developed in order to train a large number of village midwives (VMWs, known locally as *bidan di desa*) in a relatively short period. The first of 60 000 trained VMWs were deployed in 1994. However, the quality of training was compromised by the need to place VMWs in villages as quickly as possible, and the midwives had little practical experience in conducting deliveries (2). The need for further in-service training and

continuing education was recognized, and short courses were developed centrally and offered at district level. However, both participants and independent evaluators felt that there were too many participants and that too little hands-on care was given. Those responsible for the training of VMWs were, and still are, facility-based midwives (FMWs, known locally as *bidan*). The pressure of in-service training duties has made it impossible to update the training of the FMWs through refresher courses (2).

Three programmes intended to improve the knowledge and skills of FMWs and VMWs in the province of South Kalimantan were conducted during 1995–98. They were designed and implemented through a partnership that included the national and provincial levels of the Ministry of Health, the Indonesian Midwifery Association and the MotherCare/John Snow Inc. Project, funded by the United States Agency for International Development. Technical assistance was provided

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by the American College of Nurse Midwives through the MotherCare Project.

We have performed a cost-effectiveness analysis of these different training programmes. It is anticipated that the results will provide vital information for recommending training strategies for the Ministry of Health in Indonesia and for the region as a whole. In addition, we hope that they will lead to a methodology on which others can build.

## Training programmes

### In-service education and peer review activities

Activities began in 1995 in three districts of South Kalimantan, namely Banjar, Barito Kuala, and Hulu Sungai Selatan. Training in life-saving skills (LSS), developed by the American College of Nurse Midwives (3), was adapted to meet the needs of the midwives and the community, as determined by a training needs assessment conducted in November 1995 (4). It was necessary for the FMWs and VMWs to improve their capabilities in the handling of obstetric emergencies and in the normal aspects of antenatal, labour delivery and postpartum care. A manual (5) was developed to meet the needs of both groups. The training for FMWs became known as advanced LSS and that for VMWs as basic LSS (Table 1).

Two hospitals were established during 1996 as training centres on the basis of their capacity to support competence-based training, particularly the availability of adequate clinical experience for each participant (15 deliveries per participant per month). A third training centre was established at another hospital in March 1998. Each hospital underwent a one-week site preparation during which the programmes were introduced and all staff working in antenatal, delivery and postpartum wards received training to encourage the staff at the training centres to apply the skills and techniques taught in LSS.

Eighteen FMWs were selected as trainers, and attended: a two-week course on clinical skills in advanced LSS; a separate clinical training-of-trainers course for the basic LSS course; and a one-week course for teaching skills.

An integrated system was developed to support the initial in-service training through regular peer review visits by trained FMWs and incorporation of the aggregated information from these visits into continuing education sessions. All LSS-trained FMWs were trained as peer reviewers and were expected to make annual visits to each other and to VMWs who received in-service education. Furthermore, after a fund-raising workshop the districts were provided with seed money and began fund-raising activities (6) (Fig. 1).

### Internship programme

In mid-1997 the Ministry of Health at provincial level was interested in expanding the training programme for VMWs to the six other districts of South Kalimantan. Because none of the hospitals in these districts had sufficient obstetric patients to become training centres, an internship programme was designed as an alternative mechanism to implement LSS training for VMWs (see Table 1). This programme allowed VMWs to work in hospitals under the guidance of LSS-trained FMWs serving as clinical instructors for a recommended period of a month, although in reality the periods were determined by the hospitals. The preparation of the hospitals to be sites for LSS internships included the procurement of equipment and supplies and the orientation of hospital directors and staff during June, July and August 1998.

## Methods

### Costing

The health care provider's perspective was adopted and an incremental analysis was performed by estimating the extra costs of adding each programme. Both financial and economic costs were estimated on the basis of 1998 prices.

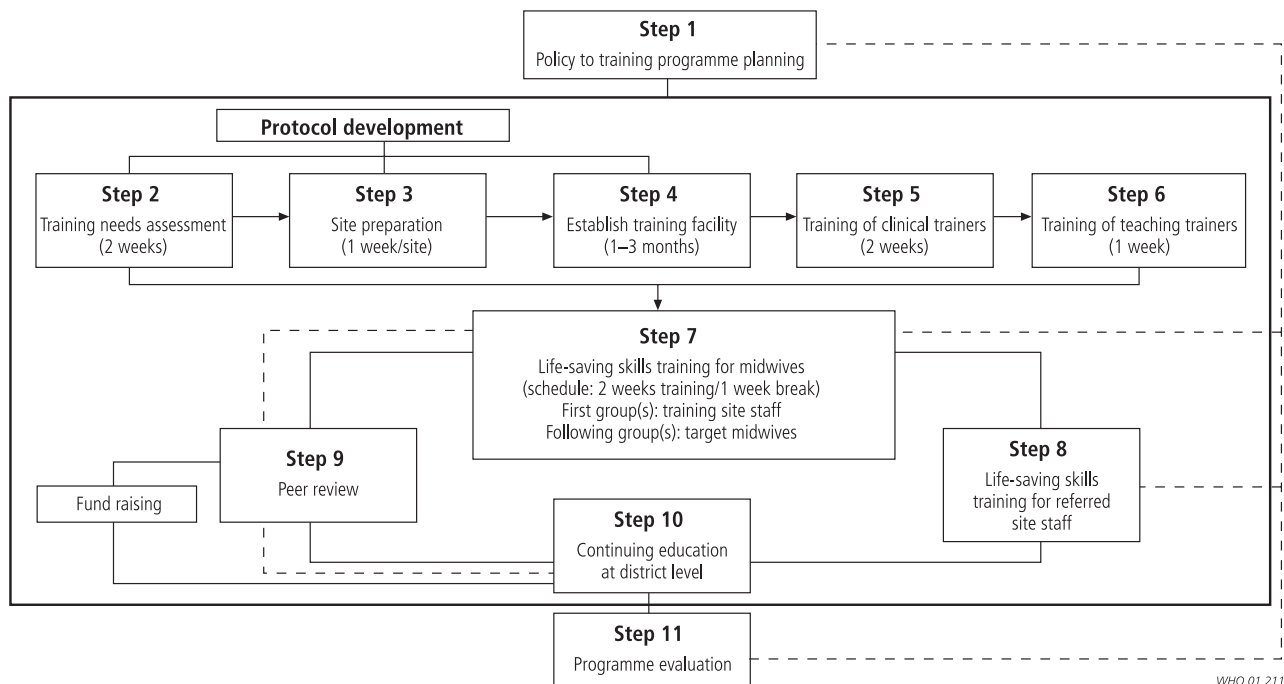
Information on costs incurred throughout the training programme was collected from records of resources and expenditure held in South Kalimantan, Jakarta and Washington DC. The following activities were costed: central administration, technical assistance, training needs assessment, site preparation, training of trainers, LSS training of FMWs and

Table 1. Content of midwifery training programmes in South Kalimantan, Indonesia

| Facility-based midwives (advanced life-saving skills) 2 weeks                    | Village midwives (basic life-saving skills) 11 days                              | Village midwives internship 2-4 weeks  |
|--|--|--|
| Problem-solving  | Problem-solving  | <i>Infection prevention</i>  |
| <i>Infection prevention</i>  | <i>Infection prevention</i>  | Normal labour and delivery care (Stage I, II, III and <i>use of partograph</i> ) |
| Normal antenatal care  | Normal antenatal care  | Infant resuscitation   |
| Normal labour and delivery care (stage I, II, III and <i>use of partograph</i> ) | Normal labour and delivery care (stage I, II, III and <i>use of partograph</i> ) | <i>Bimanual compression for management of haemorrhage</i>                        |
| Normal postpartum care for mother and baby                                       | Normal postpartum care for mother and baby                                       | Manual removal of placenta   |
| <i>Infant resuscitation</i>  | <i>Infant resuscitation</i>  |  |
| <i>Bimanual compression for management of haemorrhage</i>                        | <i>Bimanual compression for management of haemorrhage</i>                        |  |
| <i>Manual removal of placenta</i>  | <i>Manual removal of placenta</i>  |  |
| Episiotomy and repair of lacerations   | Working with community   |  |
| Hydration and rehydration  | Using information, education and communication materials                         |  |

Skills included in the training evaluation are in italics.

Fig. 1. Systems approach to training



VMWs, internship training, peer review, continuing education and fund-raising activities. The provincial Ministry of Health and the hospitals in the six districts with the internship programmes were visited in order to review expenditure records and identify the costs of the programmes.

Because of the way in which expenditure data were recorded it was not possible to adopt an "ingredients" approach to costing (7). Each cost was therefore classified in accordance with the activities indicated above and was categorized as "stand-alone" or "joint", i.e. fully incurred by one activity or shared by two or more. Where possible, costs associated with technical assistance were allocated to the appropriate activity. However, it was necessary to allocate the cost of some technical assistance and central administrative support among activities. In addition, the costs of the fund-raising, peer review and continuing education activities were allocated between the FMW and VMW programmes, in line with the ratio of numbers of FMWs and VMWs trained in each scheme.

The costs of expanding and replicating the training programmes were considered. For expansion to provide training to more midwives in South Kalimantan, the costs of technical assistance, central administrative support and all start-up activities were excluded, because only the running costs of the programmes needed to be considered. With regard to the replication, to establish similar training programmes in other provinces, start-up activities were included because they were essential for successful establishment, but technical assistance and administrative costs were excluded.

Economic cost data were collected during visits to the districts. Consultations with health staff revealed that there were no opportunity costs of using rooms for accommodation, storage and teaching, nor of various supplies and equipment, because these items would not otherwise have been used productively.

### Effectiveness measures

A training evaluation, conducted in August 1999, provided quantitative scores for overall performance of five key skills common to all three programmes (Table 1), and the percentages of competent providers, defined as having an overall score of at least 70%. FMWs and VMWs from the districts of Banjar, Barito Kuala, and Hulu Sungai Selatan, and interns from three other districts, were selected from lists of training participants. Because no baseline performance scores were available, FMWs and VMWs from other districts in South Kalimantan, who had not participated in any of the training programmes, were chosen to represent the level of knowledge and skills of the midwives before participation. They are identified as untrained in the present study.

The evaluation was conducted at a central site in South Kalimantan. Each participant was provided with a unique identifier to blind the evaluators to the participants' training status. Seven senior midwives, who were LSS trainers from the Indonesian Midwifery Association National Office and the Midwifery Academy based in Jakarta, were selected to serve as evaluators. Five stations were set up to deal with each skill assessed. Performance at each station was assessed by the same evaluator in order to achieve internal consistency.

Clinical skills were evaluated by using checklists adapted from training materials common to all three programmes. The aggregate scores of FMWs and VMWs from the various training schemes were compared among themselves and with those of untrained FMWs and VMWs in order to estimate the increase in skills acquired. Kruskal-Wallis tests were used to determine *P*-values.

### Sensitivity analysis

Univariate sensitivity analyses were performed to assess the robustness of the results to changes in selected input variables. Analysis was confined to the sampling variability of the cost of

LSS training cycles (with 95% confidence intervals), minimum and maximum ranges for mean skill scores and different passing scores to define a skill level that would be considered competent (e.g.  $\geq 75\%$ ,  $80\%$ ,  $85\%$ ). Because the distributions of the effectiveness measures were non-parametric, ranges were used as measures of variability.

## Results

Between 1996 and 1997, 128 FMWs received advanced LSS training and participated in the peer review and continuing education systems, 18 of whom were FMW trainers. In addition, 24 FMWs who served as clinical instructors in the internship programme received advanced LSS training but did not participate in the peer review and continuing education activities. Between 1996 and 1998, 284 VMWs received basic LSS training and participated in the peer review and continuing education activities. Interviews conducted in three districts providing the internship scheme revealed that in each district two cycles of four VMW interns each were held, giving a total of 24 interns. It was assumed that the same level of training was achieved in the other three districts and that altogether, therefore, there were 48 VMWs participating in the internship programme.

### Cost analysis

Table 2 shows that, in real terms, the three different training schemes cost about US\$ 570 000, the contributions of LSS for FMWs, LSS for VMWs and internships being 26%, 60% and 13% respectively of the total. Technical assistance and central administration costs represented 63% and 5% of total costs respectively. The next largest contributor was the operational cost of providing LSS training (11%). The cost per trainee was highest for VMW interns (US\$ 1694), followed by LSS for FMWs (US\$ 1343) and LSS for VMWs (US\$ 1214) (see Table 3).

In order to arrive at approximations of future costs of replication to other provinces, central administration and technical assistance costs were excluded. The highest unit cost was US\$ 512 for the LSS programme for FMWs (see Table 3). The unit costs for the LSS programme for VMWs and the VMW internship programme were US\$ 384 and US\$ 355 respectively. The costs of central administration, technical assistance and start-up were excluded in order to obtain approximations of the costs of expanding the programmes in South Kalimantan. In this case the unit costs were US\$ 320 for the LSS FMW, US\$ 253 for the LSS VMW and US\$ 58 for the VMW internship programmes respectively.

### Measures of effectiveness

Although the mean number of deliveries reported in the two months prior to the evaluation was lower for LSS FMWs (3.8) than for untrained FMWs (4.5), fewer LSS FMWs (6%) reported no deliveries in this period than untrained FMWs (25%). With regard to VMWs, the mean number of deliveries was highest for LSS VMWs (5.5); interns and untrained VMWs reported 3.3 and 3.6 respectively. Less than 10% of VMWs, regardless of training status, reported no deliveries in the two months preceding evaluation.

All programmes resulted in statistically significant improvements ( $P \leq 0.03$ ) in the skills of FMWs and VMWs (Table 4). Also, significantly more of both categories who

participated in the training programmes were competent ( $P \leq 0.03$ ) in their ability to perform key skills. These findings hold true even when the scores for the five skills are compared individually. The internship programme increased the skills of the VMWs but not to the same level as the other programmes. VMWs with training, peer review and continuing education scored significantly higher in manual removal of placenta, bimanual uterine compression, and neonatal resuscitation; no differences were detected for use of partograph and infection control. Table 4 also illustrates the effect of using a higher overall score than 70% to define a competent midwife. As expected, the higher the cut-off, the fewer midwives are defined as competent.

### Incremental cost-effectiveness

For those FMWs who received advanced LSS training and participated in the peer review and continuing education activities, it cost US\$ 1343 per trainee to increase mean scores by 27% (from 40% for non-participants to 67% for participants), equivalent to US\$ 49.7 per 1% increase in mean skill scores, and US\$ 147 705 to increase the number of competent FMWs by 46% (0% for non-participants to 46% for participants), equivalent to US\$ 3210.9 per 1% increase in the number of competent FMWs. On the assumption that the quality of the programme does not decrease with replication and expansion, it would cost US\$ 18.9 and US\$ 11.8 respectively per 1% increase in mean skill scores, and US\$ 1225.5 and US\$ 764.6 per 1% increase in the number of competent FMWs.

For VMWs who received basic LSS training and participated in the peer review and continuing education activities, it cost US\$ 1214 per trainee to increase mean scores by 20% (from 51% for non-participants to 71% for participants), equivalent to US\$ 60.7 per 1% increase in mean skill scores, and US\$ 344 775 to increase the number of competent VMWs by 61% (from 6% for non-participants to 67% for participants), equivalent to US\$ 5651.5 per 1% increase in the numbers of competent VMWs. On the same assumption as above about maintaining programme quality, it would cost US\$ 19.2 and US\$ 12.6 respectively per 1% increase in mean skill scores, and US\$ 1786.4 and US\$ 1175.7 per 1% increase in the number of competent FMWs if the programmes were replicated and/or expanded.

For those VMWs who participated in the internship programme it cost US\$ 1607 per trainee to increase mean scores by 11% (from 51% for non-participants to 62% for interns), equivalent to US\$ 154.0 per 1% increase in mean skill scores, and US\$ 81 325 to increase the number of competent VMWs by 19% (from 6% for non-participants to 25% for interns), equivalent to US\$ 4060.8 per 1% increase in the number of competent VMWs. The same results would cost US\$ 32.34 and US\$ 13.20 respectively per 1% increase in mean skill scores, and US\$ 678.6 and US\$ 146.2 per 1% increase in the number of competent FMWs if the programmes were replicated and/or expanded.

In Fig. 2 the slopes of the lines linking the origin to each of the individual points represent the incremental cost-effectiveness ratios of training in different scenarios, and the figures adjacent to these lines indicate the extra costs of increasing the number of competent VMWs by 1%. The cost-effectiveness of the intervention declines as the steepness of the slope increases.



Table 2. Cost of main activities by training programme, 1998 prices (US\$)

| Activity                            | Life-saving skills training, peer review, continuing education |              |                  |              | Internship       |              | Project        |              |
|-------------------------------------|--|--------------|------------------|--------------|------------------|--------------|----------------|--------------|
|                                     | Facility-based midwives  | (% of total) | Village midwives | (% of total) | Village midwives | (% of total) | Project        | (% of total) |
| Central administration <sup>a</sup> | 7 337  | (5)          | 18 944           | (5)          | 3 202            | (4)          | 29 483         | (5)          |
| Technical assistance                | 83 994   | (57)         | 216 857          | (63)         | 61 060           | (75)         | 361 911        | (63)         |
| <i>Subtotal</i>                     | 91 331   |              | 235 801          |              | 64 262           |              | 391 395        |              |
| <b>Start-up</b>                     |  |              |                  |              |                  |              |                |              |
| Training needs assessment           | 1 632  | (1)          | 4 213            | (1)          | 712              | (1)          | 6 557          | (1)          |
| Site preparation                    | 12 189   | (8)          | 31 469           | (9)          | 7 056            | (9)          | 50 714         | (9)          |
| Training of trainers                | 7 382  | (5)          | 1 570            | (0.5)        | 6 518            | (8)          | 15 470         | (2)          |
| <i>Sub-total</i>                    | 21 203   |              | 37 251           |              | 14 286           |              | 72 741         |              |
| <b>Operational</b>                  |  |              |                  |              |                  |              |                |              |
| Life-saving skills training         | 22 556   | (15)         | 39 153           | (11)         | 2 777            | (3)          | 64 486         | (11)         |
| Fund-raising                        | 2 052  | (2)          | 5 297            | (1.5)        | –                | –            | 7 349          | (1)          |
| Peer review                         | 9 273  | (6)          | 23 941           | (7)          | –                | –            | 33 214         | (6)          |
| Continuing education                | 1 290  | (1)          | 3 331            | (1)          | –                | –            | 4 621          | (1)          |
| <i>Subtotal</i>                     | 35 171   |              | 71 722           |              | 2 777            |              | 113 840        |              |
| <b>Total</b>                        | <b>147 705</b>   | <b>(100)</b> | <b>344 774</b>   | <b>(100)</b> | <b>81 325</b>    | <b>(100)</b> | <b>573 805</b> | <b>(100)</b> |

<sup>a</sup> 26% of costs were borne by MotherCare offices in Jakarta and Banjarmasin and were allocated across the training programmes.

Table 3. Unit costs of training programmes, 1998 prices (US\$)

|   | Life-saving skills training, peer review and continuing education activities |                  | Internship       |
|---|--|------------------|------------------|
|   | Facility-based midwives  | Village midwives | Village midwives |
| Number of trainees                          | 110  | 284              | 48               |
| Total cost                                  | 147 705  | 344 775          | 81 325           |
| Cost per trainee                            | 1 343  | 1 214            | 1 694            |
| Total cost of replication                   | 56 374   | 108 974          | 17 063           |
| Cost per trainee – replication <sup>a</sup> | 512  | 384              | 355              |
| Total cost of expansion                     | 35 171   | 71 722           | 2 777            |
| Cost per trainee – expansion <sup>b</sup>   | 320  | 253              | 58               |

<sup>a</sup> Excluding central administration and technical assistance activities.

<sup>b</sup> Excluding central administration, technical assistance and start-up activities.

### Sensitivity analysis

Table 5 and Table 6 illustrate the results of one-way sensitivity analyses undertaken to test the robustness of the cost-effectiveness estimates. Variations in factors influencing the cost of the training programmes had a small impact on cost-effectiveness. The effect was greater when the cost-effectiveness of expanding the programmes was projected, however, as the training programmes represented the bulk of the costs in this instance. The variation of effectiveness parameters had a greater impact on cost-effectiveness estimates. While the results for the FMW programme remained fairly robust, variation among the VMW programmes was larger, suggesting more uncertainty in these results.

### Discussion

Poor quality of care is an important contributor to excessive maternal morbidity and mortality in many countries (8–10). Safe motherhood programmes have followed the traditional response of family planning and child survival programmes, i.e. with in-service training programmes to improve the performance of health care providers. However, little attention has been paid to assessing the cost-effectiveness of this approach. Our data provide a model and information allowing a start to be made on the complex task of assessing the cost-effectiveness of different training schemes.

We estimate that it costs US\$ 1343 per FMW and US\$ 1214 per VMW for the scheme that includes competence-based LSS training and participation in peer review and continuing education activities, and US\$ 1694 per VMW for the internship scheme. Of course, the cost differences relate, in part, to the variations in the numbers of trainees for each scheme at the time of the study: an estimated 48 VMWs participated in the internship programme, whereas 110 FMWs and 284 VMWs participated in LSS training, peer review and continuing education schemes. If more midwives had been trained, or if the period had been longer, average costs would have been more likely to fall, given the high start-up costs and spare capacity for training. Separation of the one-off start-up costs from running costs provides more meaningful information for future decision-making in South Kalimantan. The exclusion of technical assistance, central administration and start-up costs suggests that the LSS training, peer review and continuing education programmes could train additional FMWs and VMWs at marginal costs of US\$ 320 per FMW and US\$ 253 per VMW; the marginal cost for the internship programme would be US\$ 58 per VMW. Replication of these programmes beyond South Kalimantan would require some of

Table 4. Skill scores and percentages of competent facility-based midwives and village midwives for different cut-offs

| Measures                          | Facility-based midwives    |                       | Village midwives           |                              |                       |
|-----------------------------------|----------------------------|-----------------------|----------------------------|------------------------------|-----------------------|
|                                   | LSS/PR/CE*<br>(n = 33)     | Untrained<br>(n = 24) | LSS/PR/CE*<br>(n = 33)     | Internship<br>(n = 28)       | Untrained<br>(n = 47) |
| Mean skill score<br>(% and range) | 67 <sup>a</sup><br>(46–82) | 40<br>(16–62)         | 71 <sup>b</sup><br>(53–85) | 62 <sup>b,c</sup><br>(53–81) | 51 (28–76)            |
| % with score ≥ 70%                | 46 <sup>a</sup>            | 0                     | 67 <sup>b</sup>            | 25 <sup>b,c</sup>            | 6                     |
| % with score ≥ 75%                | 27                         | 0                     | 33                         | 21                           | 2                     |
| % with score ≥ 80%                | 15                         | 0                     | 9                          | 4                            | 0                     |
| % with score ≥ 85%                | 0                          | 0                     | 6                          | 0                            | 0                     |

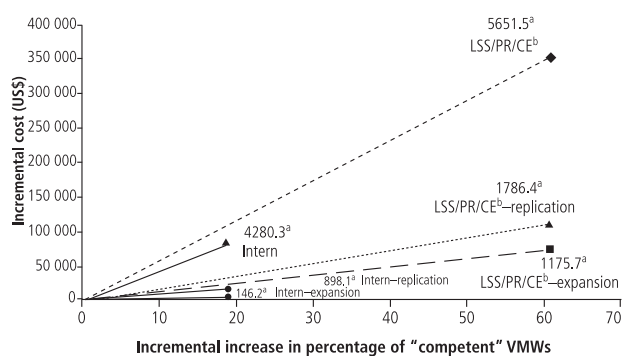
\* LSS/PR/CE: life-saving skills training, peer review and continuing education activities.

<sup>a</sup> P < 0.001 when compared with untrained FMWs.

<sup>b</sup> P < 0.03 when compared with untrained VMWs.

<sup>c</sup> P < 0.003 when compared with training, peer review and continuing education activities.

Fig. 2. Incremental cost per percentage increase in number of “competent” village midwives (VMWs)



<sup>a</sup> Extra cost of increasing the number of competent midwives by 1% (US\$).

<sup>b</sup> LSS/PR/CE: Life-saving skills training, peer review and continuing education activities.

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the start-up activities to establish training centres, train trainers, and set up peer review and continuing education systems and internship sites. Assuming a similar scale and costs of production, the estimated replication costs for LSS training, peer review and continuing education programmes per FMW and VMW would be US\$ 512 and US\$ 384 respectively; for VMW interns the corresponding cost would be US\$ 355.

Unfortunately, the continuing unstable economic situation in Indonesia, which began during the implementation of the programmes, limits the scope for drawing general conclusions from the findings both in this country and elsewhere, as does the inability to report costs using the “ingredients” approach, since it is unclear what quantities of resources were required to implement the programmes. However, the analysis of cost-effectiveness does allow us to generalize about the key factors affecting the costs and effects of these activities elsewhere.

Key intervention-related factors that can be expected to influence the level of costs include the nature of activities and integration with other services. Technical assistance for the development of training programmes is expensive. Clearly, therefore, the type of skills required initially for in-service education and peer review activities influences total costs.

However, once local capacity has been developed, less expensive local staff may be able to supervise and implement the programmes. Another factor that determines the success of a training programme is the baseline skill levels among providers, i.e. FMWs and VMWs in the present case. The relative costs of staff, in terms of both salaries and per diems for trainers, and existing skill levels, should therefore be borne in mind when international comparisons are being made or cost data are being extrapolated to other countries. The numbers of trainees per training cycle and the number of days per cycle are also important determinants of cost-effectiveness. However, it should be borne in mind that increases in the former and reductions in the latter may have detrimental effects on the acquisition of skills by trainees.

The measures of effectiveness used in this study were skill assessment scores for five essential skills relating to mothers and neonates. The data from this evaluation indicated that the training, peer review and continuing education schemes for FMWs and VMWs were able to improve their overall skills significantly. The internship programme for VMWs also significantly improved the ability to perform life-saving skills, although not, apparently, to the same level as the programme that included peer review and continuing education.

It is difficult to ascertain how much of the differences in the skill scores can be attributed to the training programmes. We tried to minimize selection bias in the design of the evaluation by using random sampling and to select appropriate comparison groups. It was difficult to maintain the random selection during implementation of the evaluation and still achieve the necessary sample size. Even with strict maintenance of random selection, however, this would not address selection bias associated with participation in the training schemes or with basic differences between the districts in the skill levels of their FMWs and VMWs. The only data collected for comparison were reported deliveries in the two months before the evaluation. These revealed that the LSS VMWs were more active than the untrained or intern VMWs. Their higher volume possibly reflected an increase in confidence in their ability attributable to the training, or was possibly the result of a higher overall volume of deliveries in the three districts of Banjar, Barito Kuala, and Hulu Sungai Selatan.

Table 5. Sensitivity of cost-effectiveness estimates to sampling variation of cost data, 1998 prices (US\$)<sup>a</sup>

| Parameter tested                              | Incremental cost per 1% increase in mean skill score |             |           | Incremental cost per 1% increase in number of competent midwives |             |           |
|---|--|-------------|-----------|--|-------------|-----------|
|   | Observed   | Replication | Expansion | Observed   | Replication | Expansion |
| <b>Cost per FMW LSS cycle</b>                 |  |             |           |  |             |           |
| Lower limit of 95% CI <sup>b</sup><br>1005.88 | 48.9   | 18.2        | 11.0      | 3157.9   | 1172.5      | 711.6     |
| 1127.78 <sup>c</sup>                          | 49.7   | 18.9        | 11.8      | 3210.9   | 1225.5      | 764.6     |
| Upper limit of 95% CI<br>1249.68              | 50.6   | 19.8        | 12.7      | 3263.9   | 1278.5      | 817.6     |
| <b>Cost per VMW LSS cycle</b>                 |  |             |           |  |             |           |
| Lower limit of 95% CI<br>740.99               | 59.9   | 18.4        | 11.9      | 5581.1   | 1715.5      | 1104.8    |
| 833.04 <sup>c</sup>                           | 60.7   | 19.2        | 12.6      | 5651.5   | 1786.4      | 1175.7    |
| Upper limit of 95% CI<br>925.09               | 61.5   | 19.9        | 13.4      | 5722.9   | 1857.4      | 1246.7    |

<sup>a</sup> We have focused on advanced and basic life-saving skills (LSS) training, peer review and continuing education programmes for facility-based midwives (FMWs) and village midwives (VMWs).

<sup>b</sup> Confidence interval.

<sup>c</sup> Baseline estimate.

Table 6. Sensitivity of cost-effectiveness estimates to variation in effectiveness data, 1998 prices (US\$)

| Parameter tested   | Incremental cost-effectiveness |             |           |
|--|--------------------------------|-------------|-----------|
|  | Observed                       | Replication | Expansion |
| Minimum score for FMWs                                     | 44.8                           | 17.0        | 10.7      |
| Mean score for FMWs <sup>a</sup>                           | 49.7                           | 18.9        | 11.8      |
| Maximum score for FMWs                                     | 67.1                           | 25.6        | 16.0      |
| Minimum score for LSS/PR/CE <sup>b</sup><br>VMWs           | 48.5                           | 15.7        | 10.3      |
| Mean score for LSS/PR/CE <sup>b</sup><br>VMWs <sup>a</sup> | 60.7                           | 19.2        | 12.6      |
| Maximum score for LSS/PR/CE <sup>b</sup><br>VMWs           | 134.8                          | 42.7        | 28.1      |
| Minimum score for intern<br>VMWs                           | 67.7                           | 14.2        | 5.8       |
| Mean score for intern VMWs <sup>a</sup>                    | 154.0                          | 32.3        | 13.2      |
| Maximum score for intern<br>VMWs                           | 338.8                          | 71.0        | 29.0      |
| <b>FMWs</b>  |                                |             |           |
| % with score $\geq$ 70% <sup>a</sup>                       | 3210.6                         | 1225.5      | 764.6     |
| % with score $\geq$ 75%                                    | 5470.5                         | 2087.9      | 1302.6    |
| % with score $\geq$ 80%                                    | 9846.9                         | 3758.2      | 2344.7    |
| % with score $\geq$ 85%                                    | –                              | –           | –         |
| <b>LSS/PR/CE VMWs</b>                                      |                                |             |           |
| % with score $\geq$ 70% <sup>a</sup>                       | 5651.5                         | 1786.4      | 1175.7    |
| % with score $\geq$ 75%                                    | 11 121.7                       | 3515.3      | 2313.6    |
| % with score $\geq$ 80%                                    | 38 308.2                       | 12 108.1    | 7969.0    |
| % with score $\geq$ 85%                                    | 57 462.3                       | 18 162.2    | 11 953.5  |
| <b>Intern VMWs</b>   |                                |             |           |
| % with score $\geq$ 70% <sup>a</sup>                       | 4280.3                         | 898.1       | 146.2     |
| % with score $\geq$ 75%                                    | 4280.3                         | 898.1       | 146.2     |
| % with score $\geq$ 80%                                    | 20 331.3                       | 4265.8      | 694.3     |
| % with score $\geq$ 85%                                    | –                              | –           | –         |

<sup>a</sup> Baseline estimate.

<sup>b</sup> LSS/PR/CE: life-saving skills training, peer review and continuing education activities.

It becomes even more complex to interpret these data when the cost estimates and the evaluation data are linked. Estimates of the incremental cost per 1% increase in the mean skill score assume a linear relationship between the effectiveness measure and the cost. This assumption probably does not hold for improvements in skill level, so the interpretation of these types of cost-effectiveness ratios should be made with caution. With a view to obtaining a more accurate measure we expressed the incremental cost per 1% increase in the number of competent midwives, although this was far from being an ideal solution. The decision to use 70% as the cut-off point for defining competence was made after completing the evaluation of those trained and was independent of those who assigned the scores. However, sensitivity analysis illustrated that the results were sensitive to the cut-off point chosen, suggesting that it is important to develop a more valid and reliable measure for defining what is competent.

The cost-effectiveness estimates also assumed that the quality of the programmes would be maintained over time. Furthermore, we were unable to evaluate the contribution of peer review and continuing education components to the maintenance of or improvement in skill levels. There is a need for future training evaluations that monitor skill levels at several points over a longer period and try to evaluate the contributions of these components of the programmes. This would shed light on the extent to which gains in the acquisition of new skills are short-lived and on the contributions of post-training activities to the maintenance of skills.

A comprehensive review of reproductive health costs failed to identify any evaluations of similar training programmes for midwives (11). Indeed, it only identified two studies referring to reproductive health in Indonesia, one concerned with a maternal tetanus immunization programme in Aceh province (12), the other with a family planning project (13). Our own additional literature search for cost or cost-effectiveness analyses of training programmes for health care staff identified two reports. One involved the evaluation of an immunization training programme in Maluku, Indonesia. It



matched highly performing immunizers with inexperienced, poorly performing immunizers for an on-the-job training session lasting between one and two weeks (14). The other involved a comparison in Peru of a new system of continuous individual retraining of family planning distributors by their supervisors in the field with a traditional system of initial group training followed by group retraining (15). Comparison with these training programmes is of limited value, however, as the final health impact of each is very different even though the intermediate outcome measures are similar.

It is difficult to say whether the training programmes described here are the most cost-effective interventions that could be used for improving the quality of care in Indonesia. The Ministry of Health has to decide whether the extra benefits are worth the extra costs, i.e. whether the programmes represent value for money. We hope that our experience will motivate and inform others. ■

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## Résumé

### Analyse économique des programmes de formation aux soins obstétricaux dans le Kalimantan du Sud (Indonésie)

Afin d'améliorer les connaissances et les compétences des sages-femmes de village et de celles qui travaillent dans les établissements de soins dans le Kalimantan du Sud (Indonésie), trois programmes de formation en cours d'emploi ont été réalisés en 1995-1998. Le programme commun aux deux catégories de sages-femmes comprenait un enseignement dispensé dans un centre de formation, une évaluation par des pairs et une formation continue. Le programme destiné aux sages-femmes de village comportait un stage dans un hôpital de district. Le rapport coût marginal-efficacité de ces programmes a été évalué du point de vue du dispensateur de soins. Il a été estimé que le premier programme pouvait être étendu dans le Kalimantan du Sud en augmentant le nombre de sages-femmes compétentes travaillant dans des établissements de soins et dans les villages de 1 % pour

un coût marginal de US \$764,6 et US \$1175,7 respectivement, et que si ce programme était repris en dehors du Kalimantan du Sud, il pourrait augmenter le nombre de sages-femmes compétentes travaillant dans des établissements de soins et dans les villages de 1 % pour un coût marginal de US \$1225,5 et US \$1786,4 par sage-femme. Il a également été estimé que le nombre de sages-femmes de village compétentes pouvait être augmenté de 1 % pour un coût marginal de US \$898,1 par stagiaire si le programme était repris dans une autre région et de US \$146,2 par stagiaire si le programme était étendu dans le Kalimantan du Sud. On n'a pas pu établir avec certitude si les programmes de formation avaient un meilleur rapport coût-efficacité que d'autres interventions en faveur de la maternité sans risque car la nature des critères d'évaluation ne facilitait pas les comparaisons.

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## Resumen

### Análisis económico de programas de formación de parteras en el sur de Kalimantan (Indonesia)

A fin de mejorar los conocimientos teóricos y prácticos de las parteras que trabajaban en servicios de salud y en aldeas del sur de Kalimantan, Indonesia, entre 1995 y 1998 se llevaron a cabo tres programas de formación en el servicio. Un plan aplicado tanto a las parteras de los servicios como a las de aldea incluía adiestramiento en centros de capacitación, revisión por homólogos y formación permanente. Otro plan limitado a las parteras de aldea comprendía un programa de residencia en hospitales de distrito. Se evaluó el incremento de costoeficacia conseguido mediante estos programas desde el punto de vista del proveedor

de atención. Se estimó que el primer plan permitía aumentar el número de parteras competentes en los servicios de salud y en las aldeas del sur de Kalimantan en un 1% a un costo marginal de US\$ 764,6 y US\$ 1175,7, respectivamente, y que la aplicación de dicho plan fuera del sur de Kalimantan podía aumentar el número de parteras competentes de servicios y de aldea en un 1% a un costo marginal de US\$ 1225,5 y US\$ 1786,4 por partera, respectivamente. Se estimó asimismo que el número de parteras de aldea competentes podría aumentarse en un 1% a un costo marginal de US\$ 898,1 por residente en caso de aplicar el plan en

otro lugar, y a un costo de US\$ 146,2 por residente si se ampliaba el plan al sur de Kalimantan. No pudo determinarse con claridad si los programas de formación eran más o menos costoeficaces que

otras intervenciones de fomento de la maternidad sin riesgo, debido a que el tipo de mediciones de los resultados dificultaba la comparación.

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