

Cost-Effectiveness Analysis of Training Nurses for Task-shifting in Angola

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**Abstract**

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**Introduction:**

The Angolan Ministry of Health is scaling-up HIV treatment and authorized training nurses to expand their role in delivery of care and treatment to HIV patients through task-shifting. A training program was implemented in one province from May to September of 2012, which included didactic training, rotations and mentoring sessions at the work sites of nurse participants. The cost-effectiveness of the program was estimated.

**Methods**

This analysis adopted a societal perspective to calculate the incremental cost-effectiveness ratio (ICER). Costing data were collected from I-TECH's accounting records and estimated from information provided by local government and program participants. Effectiveness was measured through changes in

knowledge and clinical competency of nurse participants. A random effects model was used to estimate the relationship between change in knowledge and the number of clinical mentoring sessions.

## **Results**

The total cost of the program was US\$ 242,393, of which US\$ 184,543 were financial and US\$ 57,850 economic costs. The average knowledge test score increased by 27.2%, ( $p < 0.000$ ), and the average clinical skills score increased from 1.9 to 2.3 ( $p = 0.0712$ ), raising competency level from “fair” to “good”. The ICER for each 1% increase in knowledge and clinical skills was US\$ 278 and US\$ 947, respectively. Individual knowledge increase was positively associated with the number of clinical mentoring sessions performed ( $r^2 = 0.52$ ,  $p < 0.001$ ).

## **Discussion**

The incremental analysis estimates that it would cost US\$ 12,343 per nurse to increase an average participant’s knowledge scores to 100% and US\$ 51,138 per nurse to increase an average participant’s clinical skills a to 100%, reaching the “excellent” category. Technical assistance corresponded to the largest portion of financial costs. Once local capacity to implement the program is developed, costs would drop from US\$ 7,574 to US\$ 3,214 per nurse if the program is replicated by Ministry of Health in Angola.

## **Conclusion**

Despite the significant costs associated with training nurses for task-shifting of HIV care and treatment in Angola, a successful training strategy can generate improvements over time, by achieving productive efficiency of health workforce.

## **1. Introduction**

### **1.1. Angola and HIV**

In 2011, there were approximately 34 million people living with HIV around the world, most of them in Sub-Saharan Africa [1]. As part of this region, Angola has kept its prevalence below 2% [2], in contrast to its neighboring countries which have long reached double digit rates [1]. Angola suffered a long civil war, ending in 2002, that kept the country's borders closed and severely restricted the mobility of people in the region, possibly slowing down the transmission of HIV in the country.

Ten years after the end of the war, Angola now has a fast growing economy [3] that is attracting jobs, stirring migration in the region and generating government investments in infra-structure and social services. Although much progress has been made, the country still faces challenges in providing social services, including health care. It is estimated that 50-60% of the population has access to health services, with even lower access in rural areas. These factors, in conjunction with the high HIV prevalence of neighboring countries, a relatively young population, local sexual practices that include polygamy, early sex initiation and low rates of safe sex, could set the stage for significant spread of HIV in the country. In fact, half of the high prevalence provinces share borders with Congo, Zambia, Botswana or Namibia, which are high prevalence countries [2].

HIV services in Angola are currently concentrated in urban areas and in larger health facilities. One of the limitations for the expansion of such services is the severe shortage of health care providers. The current health worker to population ratio is 1 physician and 2 nurses per 60.000 people [2], which is considerably below both the regional average, which is also considerably below the average in other regions. Nurses serve a key role; not only are they present in higher numbers, but they are also more likely to work in rural areas, where health services are scarcer.

The Angolan Ministry of Health (MOH) is currently intensifying its efforts to prevent the spread of HIV, working with partners and international donors to promote HIV prevention strategies and scale-up testing and treatment. In 2011, international donors provided US\$ 12.4 million to support the Ministry of Health (MOH) with its HIV/AIDS programs. As part of these efforts, the MOH authorized training of nurses to expand their role in the delivery of care and treatment to HIV patients through task-shifting. This strategy is defined by the World Health Organization (WHO) as "the rational redistribution of tasks among health workforce teams. Specific tasks are moved, where appropriate, from highly qualified health workers to health workers with shorter training and fewer qualifications in order to make more

efficient use of the available human resources for health”[4]. The goal of task-shifting is to increase productive efficiency, meaning to either increase the number of health care services provided at a given quality and cost, or, alternatively, to provide the same level of health care services at a given quality at a lower cost. Another sought benefit is the reduction of time needed to scale up the health workforce [5].

The International Training and Education Center for Health (I-TECH) is a university-based organization that supports the development of skilled health workers and well-organized national health delivery systems around the world. I-TECH was invited to provide technical assistance to the Provincial Health Department of Huambo, in Central Angola. Its capital, of the same name, is the country’s second-largest city. Huambo Province has a population of 2,075,713 people, almost half of the province’s population resides in the capital. The province was one of the hardest hit in the civil war, when a large part of its infrastructure was destroyed, including roads, communication lines and health facilities. A health facility mapping conducted in 2007 identified 135 health facilities under the Provincial Health Department, of which most were health posts and health centers, and only 6 were hospitals [6].

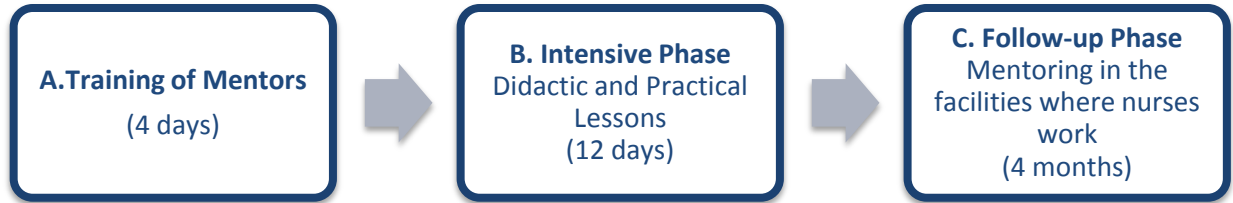
## **1.2. Training Program for Nurses in Huambo**

I-TECH worked in close partnership with the Huambo Provincial Health Department to implement a HIV training program for nurses. The overall goal of the training was to provide nurses with clinical competencies needed for the provision of clinical care and appropriate follow-up of patients with HIV and AIDS, and their interactions with TB, Malaria and Opportunistic Infections. The program was implemented from May to September of 2012.

The training program uses the clinical mentoring model, in which a more experienced clinician mentors less experienced professionals in their work-setting [7] [8] [9]. The content is based on pre-established clinical competencies, that nurses are expected to perform after the completion of the program. These competencies were developed by WHO [10], and extensively revised and updated by I-TECH. The material is based in a syndromic approach, following a model implemented by WHO through IMAI (Integrated Management of Adolescent and Adult Illness)[11].

The Angola clinical mentoring program included 3 components, as described in Figure 1.

**Figure 1. Components of the Angola Clinical Mentoring Training Program**



**A. Training of Mentors:** 14 local physicians, with previous HIV training and experience, were selected as mentors of the program. A four day workshop oriented them on the program goals and tools, and trained them in mentoring skills, including teaching methods in a clinical setting, communication skills and relationship building.

**B. Intensive Phase:** 32 nurses from across the province were selected by the Provincial Health Department to participate. Nurses came from 11 different cities in the province. This phase of the training was mostly didactic, and included a 2 week classroom component and 2 days of rotations across the different inpatient and outpatient services at the Provincial Hospital of Huambo (*Hospital Geral de Huambo*). I-TECH staff and clinicians from the Provincial Hospital with significant HIV experience facilitated the training. All nurses received a training package with reference materials, that included the national HIV guidelines and all content covered during the training, to be used in their practice.

**C. Follow-up phase:** Clinical mentoring sessions were conducted over 4 months. Mentors were oriented to schedule weekly sessions with nurse mentees. A low mentee/ mentor ratio of 2 or 3:1 was designed to minimize the burden on physicians, who already have many responsibilities. As much as possible, mentors were matched with nurses who worked in the same health facility, where mentoring sessions occurred. Clinical mentoring sessions included case observation, discussions, review of mentee's clinical competencies and recommendations for next steps.

## 2. Methods

### Overall Study Design

The primary objective of this study is to estimate the cost-effectiveness of the HIV Clinical Mentoring Training Program for nurses, implemented in the Huambo Province of Angola from May to September of 2012. The results of this analysis will inform the Angolan Ministry of Health and funders' plans to scale

up nurse training in the country. This analysis will contribute to the understanding of costs associated with international technical assistance and in-service training methodologies for health worker's training in developing countries.

### **Determination of Costs**

An ingredients approach was used to calculate costs [12], which were subsequently separated into three categories: training development, training implementation and technical assistance. All costs were in US dollars and were estimated using 2012 prices.

Financial costs were collected from I-TECH's accounting records and included headquarters and field related expenses. Each of the three categories included personnel and operational costs. Technical assistance also included staff benefits and expenses related to trips to Angola to assist with program design, implementation and training evaluation, and did not include costs associated with this analysis. Training evaluation is part of I-TECH's program standards and knowledge tests and clinical observations take place regardless of this study. Miscellaneous program costs were allocated to each of the three categories, and included general program expenses and indirect rates of the University of Washington, where I-TECH is based. Management costs were also included in each of the categories, which in training development and implementation consisted of payments for consultant's time to manage the program in country, while in technical assistance it included part of a staff's salary at headquarters.

Economic costs were estimated from information provided by nurse participants and mentors through program monitoring forms, and interviewer administered surveys, in addition to consultation with key health professionals and MOH staff. Interviews were conducted in Portuguese during monitoring visits to the health facilities where nurse participants work. Economic costs included time away from work and transportation to attend training and mentoring sessions. Frequency and length of mentoring sessions were calculated by averaging nurses and mentors responses. The total number of mentoring sessions performed was reported monthly through standardized forms submitted by mentors to the program manager. Other economic costs borne by the Ministry of Health included the estimated cost of the training facility and accommodation of I-TECH staff when staying at MOH housing.

Transportation costs were estimated for mentors and nurses who did not live or work in the city of Huambo, and thus required an additional commute to attend the intensive phase of the training. These costs were estimated by calculating the total distance traveled and multiplied by the local cost of fuel and did not include time traveled. The opportunity costs of facilitators, mentors and participants to

attend training was obtained by calculating the hourly wage for both physicians and nurses and multiplying this by the time spent in sessions. Salaries of physicians and nurses were self-reported, but benefits were not. The base case analysis assumes a benefit rate of 25% and sensitivity analyses were conducted with benefit rates of 15% and 35% to evaluate the impact of different levels of staff benefits on program costs.

### **Measures of Impact**

The effectiveness of the training program was measured through two outcomes: knowledge and clinical competency of nurse participants. Change in participant's knowledge was measured by pre and post knowledge tests. Tests consisted of 40 multiple choice questions developed by I-TECH's clinical team. All questions were based on the HIV clinical competencies that also informed the development of the content taught during the training. The pre-test was conducted before the start of the intensive phase in June, and post-test was conducted during I-TECH's technical assistance visits to the health facilities in September of 2012. Results of the pre-test were used as baseline data and were compared with the results of the post-test to indicate overall knowledge acquired during training. In the estimate of relationship between participant's knowledge increase and the number of clinical mentoring sessions performed, only the sessions performed until the end of August were included. This was chosen as most post tests were conducted in the first week of September.

Change in skill level and clinical performance of nurse participants was measured through a clinical observational checklist. The checklist consisted of 31 clinical competencies that included HIV specific tasks, as well as tasks related to general clinical care of patients, and a rating scale that varied from poor to excellent. To measure improvement in HIV clinical competencies of participants, nurses were observed providing care to an HIV+ patient and assessed in the applicable competencies, according to each case. The assessment of nurses' clinical competencies was performed twice, in June and September of 2012. Whenever possible, nurses were observed at their worksite, however, in some cases they were required to travel to the Huambo Provincial Hospital for the clinical observation. Data analysis of change in clinical skills was performed for the 13 nurses assessed by I-TECH's clinical advisor in both visits. Numerical values were assigned to each of the rating (1=poor; 5=excellent), in order to allow calculation of average scores and to measure changes in clinical competency level of the group. The final results were then categorized according to the rating scale described above.

### **Cost-Effective Analysis**

This analysis adopted a societal perspective to calculate the incremental cost-effectiveness ratio (ICER) of the nurse training program. The ICER was calculated by comparing knowledge and skill level of nurse participants before and after the intervention, for three different scenarios: observed, replication and replication “out-of-pocket”. The first scenario corresponds to all costs observed with the current training program. The second scenario only includes costs associated with the replication of the training. The replication “out-of-pocket” scenario is similar to the previous, but only includes financial costs related to replication. Although a societal perspective usually includes all costs [13], this analysis did not include cost of space and utilities during follow-up phase of the training, or travel time of participants to attend sessions, because these costs could not be estimated accurately and were expected to be small.

### **Statistical methods**

Paired t-tests were conducted to compare the results of the pre and post-tests scores, and the results of clinical competencies observed on the first and second visits. A random effects regression was performed to estimate the relationship between knowledge increase and number of mentoring sessions, controlling for unobserved differences across participants. Statistical analyses were performed using Stata MP12.

### **Ethical considerations**

Non-Research Determination for this protocol was issued by the University of Washington Human Subjects Division.

### **3. Results**

For this analysis, 13 of 14(93%) mentors and 27 of 32 (84%) participants were interviewed. Thirty two (100%) nurses completed the pretest and 27(84%) completed the post test. There was a loss to follow-up due to the absence of nurse participants in the health facility when the post-test was conducted. The five (16%) nurses lost to follow-up performed, on average, better on the pre-test than the retained group. The clinical assessment was conducted with 13 of 32 (40%) participants. Although it was not possible to assess clinical competency of all participating nurses, the sample of 13 nurses had the same average improvement in the knowledge tests as the nurses whose clinical skills were not assessed, suggesting that this is a representative sample.

Table 1 shows all measured costs of the program, which constitutes the observed costing scenario .The total cost of the program was US\$ 242,393, of which US\$ 184,543 corresponded to financial costs and US\$ 57,850 to economic costs. The largest part of financial costs was associated with technical

assistance, which focused on capacity building activities, including assistance with program design, implementation and training evaluation.

Economic costs were the highest during implementation, specifically during the intensive phase of the program, due to the opportunity costs of participants and facilitator's time away from work to attend all day didactic sessions. During follow-up, opportunity costs dropped considerably, despite the longer duration of this phase. Hourly wages used in these calculations were US\$ 4.40 for nurses and US\$ 11.25 for physicians. The proportion of salary associated with benefits is unknown; however it would have minimal impact on the total program costs. The base case assumed that benefits are 25% of physicians' and nurses' salaries and increased implementation costs by US\$ 6,799. In the sensitivity analysis with benefits rates of 15% and 25%, the cost of fringe benefits was US\$4,079 and US\$9,518 and the total cost of the program was 239,673 and US\$ 245,122, respectively.

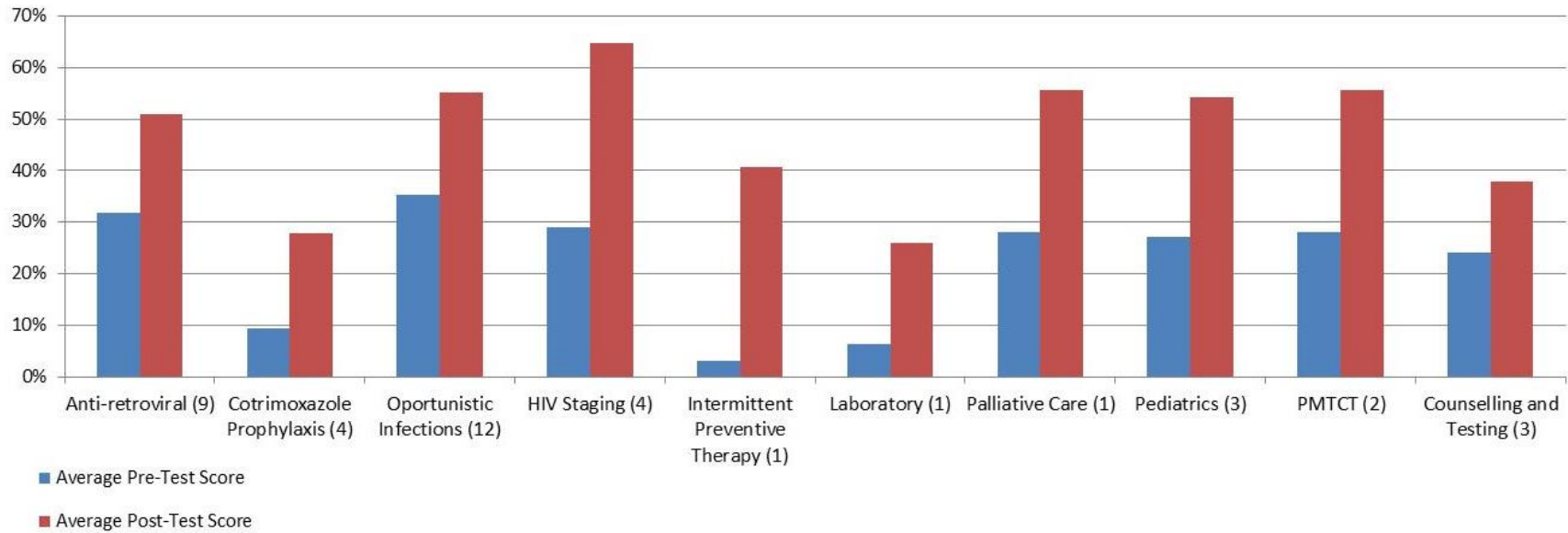
The other two costing scenarios were derived from the observed costs; the replication scenario includes only implementation costs and is US\$ 102,846, and the replication "out-of-pocket" scenario only includes financial costs associated with implementation of the program and is US\$ 51,049.

Table 1. Summary of All Observed Training Costs

Categories	Financial	Economic	Total	% of total
<b>Training Development</b>				
Technical Working Group	\$900	\$703	\$1,603	0.7%
Operational	\$510	\$1,500	\$2,010	0.8%
Management	\$4,366		\$4,366	1.8%
Allocation of Misc. Costs	\$272		\$272	0.1%
SubTotal	\$6,048	\$2,203	\$8,251	3.4%
<b>Implementation</b>				
Training of Mentors	\$1,201	\$7,074	\$8,275	3.4%
Nurse Training: Intensive phase	\$13,828	\$32,869	\$46,697	19.3%
Nurse Training: Follow-up phase	\$11,200	\$11,854	\$23,054	9.5%
Management	\$21,428		\$21,428	8.8%
Allocation of Misc. Costs	\$3,392		\$3,392	1.4%
SubTotal	\$51,049	\$51,797	\$102,846	42.4%
<b>Technical Assistance (TA)</b>				
Trips	\$30,021	\$3,850	\$33,871	14.0%
Training Development	\$40,034		\$40,034	16.5%
Training Implementation	\$36,591		\$36,591	15.1%
Management	\$16,464		\$16,464	6.8%
Allocation of Misc. Costs	\$4,336		\$4,336	1.8%
SubTotal	\$127,446	\$3,850	\$131,296	54.2%
<b>SubTotal all Categories</b>	<b>\$184,543</b>	<b>\$57,850</b>	<b>\$242,393</b>	100.0%

Nurses average knowledge test score was 28.4% (M=11, SD=4.7) in the pre-test and 55.6% (M=22, SD=5.1) in the post test, of a total of 40 questions. There was a significant difference in the scores of the both tests ( $t=10.8$ ,  $p < 0.000$ ), showing that knowledge of nurses increased with participation in the training program, with an absolute average improvement of 27.2%. Answers were combined into main topic areas, to measure knowledge increase in specific areas of HIV care, as shown on Figure 2

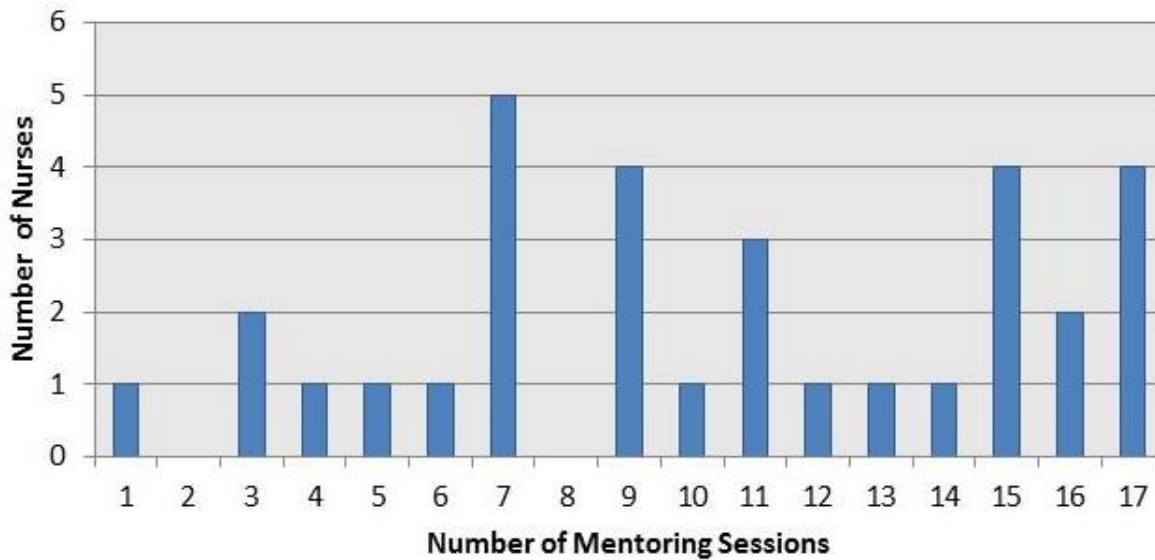
Figure 2. Average Percentage Scores on Pre and Post-Tests by Topic Area



\*Number of questions related to each topic shown in parenthesis

During the 4 months of follow-up phase, 303 mentoring sessions were performed, with an average duration of 2 hours per session and 9 sessions per participant. The average duration of sessions reported by mentors was slightly higher (2.1h) than and the one reported by nurses (1.9h). Each session cost US\$ 107 ( $\$8,275+23,054+1,032/303$ ), these costs include the training of mentors, the follow-up phase of the nurse training and allocation of miscellaneous costs. The distribution of number of clinical mentoring sessions by participants is shown in Figure 3.

Figure 3. **Distribution of the Number of Clinical Mentoring Sessions per Participant**



Individual knowledge increase was shown to be positively associated with the number of clinical mentoring sessions performed. A random effects regression model estimated an approximate absolute increase of 1.3 points of the knowledge test scores to be accounted for by each additional clinical mentoring session ( $r^2 = 0.52$ ,  $p < 0.001$ ), which is equivalent to a 10% increase in average knowledge scores every 8 sessions. Based on this model, it would cost US\$ 856 ( $\$107 \times 8$ ) per participant to perform the number of sessions needed to reach a 10% increase in average knowledge scores.

For nurses whose clinical skills were assessed in both technical visits ( $n=13$ ), average skill level increased from 1.9 (38%) to 2.3 (46%), representing a change in the clinical competency level from “fair” to “good”. There was also a 15% increase in the number of nurses performing at a clinical competency level “Very Good”, as shown below on Table 2. Despite this, these results were not statistically significant at a 95% confidence interval ( $t = -1.5169$ ,  $p = 0.0712$ ).

Table 2. Clinical Competency of Nurses Participants

Clinical Competency	1st Observation		2nd Observation	
	# of Nurses	%	# of Nurses	%
Poor	0		0	
Fair	8	61%	6	46%
Good	4	31%	4	31%
Very Good	1	8%	3	23%
Excelent	0		0	
<b>Total</b>	<b>13</b>	<b>100%</b>	<b>13</b>	<b>100%</b>

### Incremental Cost Effectiveness Ratio (ICER)

This training program cost US\$ 7,574 (US\$ 242,393/32) per participant to increase both the average clinical skills from 1.9 to 2.3, raising competency level from “fair” to “good”, and average knowledge test scores by 27.2%.

Tables 3a and 3b show the results of the cost-effective analysis in three different costing scenarios. The first scenario shows all costs observed during the training. The observed cost per one percent increase in knowledge was \$278, and per one percent increase in clinical skills score was \$947. The second scenario shows economic and financial costs associated with replication of the training by including only implementation costs, and the third scenario only includes financial costs associated with implementation.

Table 3a. Incremental Costs of Knowledge Increase under Different Costing Scenarios

	Pre	Post	Incremental	ICER (1% increase)	ICER (absolute increase)
Observed	\$0	\$7,574	\$7,574	\$278 (7,574/27.20)	\$689 (7,574/11)
<b>Costs</b> Replication	\$0	\$3,214	\$3,214	\$118 (3,214/27.20)	\$292 (3,214/11)
Replication "Out of Pocket"	\$0	\$1,595	\$1,595	\$59 (1,595/27.20)	\$145 (1595/11)
<b>Effectiveness (Percentage Test Scores)</b>	28.04%	55.60%	27.20%		
<b>Effectiveness (Absolute Test Scores)</b>	11	22	11		

Table 3b. Incremental Costs of Clinical Skills Increase under Different Costing Scenarios

	Pre	Post	Incremental	ICER (1% increase)	ICER (absolute increase)
Observed	\$0	\$7,574	\$7,574	\$947 (7,574/8)	\$1,894 (7,574/4)
<b>Costs</b> Replication	\$0	\$3,214	\$3,214	\$402 (3,213/8)	\$803 (3,213/4)
Replication "Out of Pocket"	\$0	\$1,595	\$1,595	\$199 (1,595/8)	\$399 (1,595/4)
<b>Effectiveness (Percentage Clinical Skills)</b>	38.00%	46.00%	8.00%		
<b>Effectiveness (Absolute Clinical Skills)</b>	1.9	2.3	0.4		

#### 4. Discussion

Task-shifting has been considered a cost-effective approach to address the shortage of health workers in resource-limited settings [14] [15]. Despite this, little is known about the cost-effectiveness associated with training the workforce for this transition.

This analysis estimates that economic and financial costs of training nurses for task-shifting of HIV care and treatment in Angola are US\$ 7,574 per participant, using a clinical mentoring methodology. This program could be replicated by Ministry of Health in Angola at considerably lower cost, once local capacity to implement the program has been developed. Financial costs accounted for 76% of the total cost of the program, and were provided through international assistance funds. Financial costs associated with replication would drop to US\$ 1,595 per participant, should the program be replicated by the Angolan Ministry of Health. Cost savings would come from removing technical assistance and training development costs. It is estimated that economic costs to the Angola health care system and the local population would remain constant during replication.

Economic costs were considerably lower during the follow-up phase, when compared to the intensive phase of the program. The low ratio of mentor per mentee and the prioritization to match local physicians and nurses working in the same health facility resulted in low costs. This was possible by keeping transportation costs low, in addition to minimizing health provider's time away from work, which may have an impact on patient flow. Attending a greater number of mentoring sessions was associated with an increase in knowledge, suggesting that the continuous support from a mentor could sustain or even increase knowledge acquired through didactic training. These results are aligned with evidence from nurse training in other countries [16] [17]. The mentor/mentee relationship can also be fundamental to the effective implementation of a task-shifting strategy, by validating the expanded role of the nurse [18] and establishing trust between physicians and nurses, in order to transition tasks. Future research should analyze the contribution of each phase of the training, didactic and mentoring, to the increase in participant's knowledge and skills in relation to its costs.

An incremental analysis estimates the costs associated with increasing nurses' knowledge and skills by one percent through this program. . Even though this training program was successful in increasing knowledge and skills of participants, showing comparable results to other trainings [19], due to participants' low baseline scores, a substantial increase in both outcomes is still required in order to increase their performance to 100%. Assuming a linear relationship between training outcomes and

cost, it would cost US\$12,343, \$5,239 and \$2,620 per nurse to increase an average participant's knowledge scores to 100% under observed, replication and replication "out-of-pocket" scenarios respectively. Likewise, costs were estimated to be US\$51,138, \$21,708 and \$10,746 per nurse to increase the average participant's clinical skills to 100%, reaching the "excellent" category, under the previously mentioned scenarios

MOH has recognized the need to improve the quality of health workers [19], based on the identified gaps in training and performance. "Many basic-level nursing schools in the provinces are overcrowded, use outdated curricula, and are staffed with teachers who lack continual education and are not updated on new norms" [19]. The performance of health workers has improved over time, but still needs a considerable increase to achieve a high level. In 1992, only 12% of 539 primary care consultations observed in a patient management study were considered adequately managed [20]. Another assessment of health workers' performance in 2011, amongst mostly mid and basic level nurses, identified that on average, 37% of the cases observed in Uíge province and 53% in Luanda were correctly diagnosed [21].

Health outcomes were not measured as part of the Angola training evaluation. Future research should investigate the relationship between levels of knowledge and skills of health care workers acquired through training and changes in health outcomes of patients and the cost per disability-adjusted life year (DALY) of such interventions. An example suggests an approximate value for the cost per DALY when knowledge and competency increases to 100%. If each nurse trained is able to save the life of 10 HIV patients per year for five years, adding 15 years to each patient's life for a total of 750 life years, the cost per DALY of knowledge increase would be US\$16 ( $\$12,343/750$ ), \$7 ( $\$5,239/750$ ) and \$4 ( $\$2,620/750$ ) under observed, replication and replication "out-of-pocket" scenarios; and US\$68 ( $\$51,138/750$ ), \$29 ( $\$21,708/750$ ) and \$14 ( $\$10,746/750$ ) for skill increase under the same scenarios.

Results from a similar training program targeting nurses in Huambo are encouraging. An in-service supervision program, that included a 1-day workshop and weekly supervision by an expatriate physician, increased the skills and motivation of nurses, resulting in increased successful treatment and decreased fatality rates of malnourished children [27].

This analysis also measured costs of international technical assistance for the development and implementation of this training program. Technical assistance corresponded to the largest portion of financial costs. All organizational expenses outside of Angola were included, as well as capacity building

activities, which focused on building human and institution capacity to allow transition of the program to local ownership. A comparison of costs with another training program implemented in Indonesia [22] offers valuable information on costs of international assistance for training programs. Technical assistance accounted for between 57 to 75% of the total costs of training programs in Indonesia, and 54% in Angola. Although technical assistance represented a large percentage of costs, both programs worked directly with Ministries of Health and aligned with national health priorities, which is suggested to greatly increase efficiency of international aid for health [23].

While costs would drop during replication, further technical assistance will be needed before the program fully transitions to local institutions. Evidence from other settings shows that institutionalizing new HIV interventions can be challenging. Once technical assistance is no longer provided, agencies can experience reduced capacity to address problems, as well as lower motivation for implementing the program [24]. For instance, physicians may be less motivated and proactive to schedule mentoring sessions should this activity be integrated into their job responsibilities, if they will no longer receive supplemental financial assistance to perform such activities. Although financial incentives were effective in motivating mentors and sustaining adherence to the program, such incentives can also have a negative impact on the sustainability of donor funded programs [25]. In order to continue to promote adherence to the program MOH should continue to provide financial incentives to mentors, when possible. The replication costing scenario in this analysis includes such incentives in the financial cost of the follow-up phase.

The low number of physicians in Angola presents challenges for replication and expansion of this training under the current model. The number of physicians with HIV experience to qualify as mentors is very small, and these physicians already have too many responsibilities in their normal duties in the health facilities. Although task-shifting to nurses would ultimately alleviate their burden, the training process requires additional short term responsibilities for both nurses and physicians. The low HIV prevalence and low utilization of health services in rural areas add additional challenges to extend this program beyond urban centers, where most HIV services are located, limiting the chances of nurses to practice and improve their skills.

The small sample size of nurses assessed in clinical competency and lack of statistical significant in the results does not provide confidence that results can be replicated. Furthermore, it would be difficult to replicate individual or health facility factors that impacted training outcomes, since those were not measured. Another limitation of this analysis is the possibility of information bias. Mentors received

payment upon submission of monthly program forms, and although payment was not contingent on performing a minimum number of sessions, some information bias by over-reporting may have occurred. However, the difference between the average duration of visits reported by mentors and participants was .2 hours (10%), which may indicate the magnitude of potential over-reporting of visits. Another limitation is that the percentage increase in knowledge depends on the difficulty of the tests; these results extend only to participants of the same training and tests.

## 5. Conclusion

Despite the significant costs associated with training nurses for task-shifting of HIV care and treatment in Angola, a successful training strategy can generate improvements over time, by achieving productive efficiency of health workforce. While international assistance can provide support for the implementation of such programs, technical assistance is expensive and not sustainable in the long term.

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