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A Cost Effect Analysis of Utilising Community Health Workers in the Management of Tuberculosis, Kenya

Jane Rahedi Ong'ang'o[1], Christina Mwachari[1], Simon Karanja[2]
[1] *(Centre for Respiratory Disease Research, Kenya Medical Research Institute, Kenya)*
[2] *(College of Health Sciences, Jomo Kenyatta University of Agriculture and Technology, Kenya)*

Abstract
Introduction: *Community Health Workers (CHWs) have been utilised for various primary health care activities in different settings especially in developing countries. Usually when utilised in well defined terms, they have a positive impact.*
Objectives: *The overall objective of this study was to undertake a cost effect analysis of utilising CHWs in tuberculosis (TB) management.*
Methods: *A retrospective cohort study was conducted in selected health facilities using standard clinical records for each TB patient registered for treatment between 2005 to 2011.*
Results: *The study assessed 2778 tuberculosis patients and among them 1499 (54%) utilized CHWs for their TB treatment. The cost effect analysis revealed that the average cost per Disability Adjusted Life Year (DALY) averted for treatment success was higher (184 US$) in the cohort that utilised CHWs compared to the non-utilising cohort (87 US$). Use of CHWs resulted in better treatment success rate (82.15%) compared to not using at 72.25% (p-value <0.001). Utilising CHWs resulted in less DALYs (5688) from death compared to not utilising CHWs (5725). Of the patients who died, a majority ( ) died within the first month of their treatment and they were in the cohort that did not utilise CHWs.*
Conclusion: *The use of CHWs may be considered as a health and economic benefit because more life was saved with a higher treatment success rate and there seemed to be death averted in the early months of TB treatment.*
Keywords *- CHWs, Cost Effect Analysis, DALY, TB*

I. Introduction

Community Health Workers (CHWs) have been utilised for various primary health care activities in different parts of the world [1,2,3]. It is generally felt that engagement of CHWs impacts positively on human health via encouraging increased utilization of health care services and supporting preventive health programmes [4,5]. In Kenya, the National TB Programme (NTP) provides free TB treatment that consists of a standard 6 month regimen (2 months intensive phase of combined rifampicin, isoniazid, pyrazinamide, and ethambutol (RHZE), followed by 4 months continuation phase of combined isoniazid and rifampicin (RH)) for the new TB cases diagnosed that are sensitive to first line treatment. Retreatment TB cases are treated with a standard 8-month regimen (2 months intensive phase of combined streptomycin, rifampicin, isoniazid, pyrazinamide, and ethambutol (SRHZE), a continuation phase of 1 month (RHZE) followed by 5 months of combined rifampicin, isoniazid and ethambutol (RHE).

A qualitative study has shown that TB patients on treatment, who receive the support and care of their families were more likely to adhere to therapy and achieve cure [6]. More studies [7,8,9,10] have reported good treatment outcomes when CHWs are involved in TB management. To measure the effectiveness of utilising the CHWs in TB management, this study did a cost effect analysis.

II. Methods

This was a retrospective cohort study that retrieved standard clinical records for each TB patient registered for treatment between the years 2005 to 2011. The study was carried out in an urban and rural setting. In each of these settings, two similar TB treatment health facilities were purposively selected: one engaged CHWs for TB management and the other did not. One informal settlement in Nairobi, namely, Kawangare of Dagoretti Division and Nyando District, Nyanza Province of Western Kenya represented the urban and rural set-up respectively. The study was approved by the scientific and ethical review committees of KEMRI before implementation. STATA version 12 was used for statistical analysis. The cost effectiveness of utilising the CHWs was measured in terms of cost per DALY averted using the number of tuberculosis cases that were successfully treated being considered as averted. To calculate the cost per DALY averted by successfully treating these patients, the following assumptions were made; that the professional health care provided to these

patients was equal in the 2 comparison groups, the only difference being the additional care provided by the CHWs in the intervention group so that this would be an additional cost to be included in the calculation. The additional cost of utilising the CHWs mainly considered the main expenditure that sustains the CHW work which includes; incentive that CHWs receive on a monthly basis (US$25 per month for each CHW), 3 day training received once per year at a cost of US$84 per training for each CHW and also the number of CHWs that were utilised in the facilities yearly which was always about 5 for each facility throughout the year. The cost of treating these patients with first line TB regimen for new and retreatment TB patients was also considered. Based on the price list of the Global Drug Facility (GDF) a six-month course of treatment for a newly diagnosed TB patient was approximately US$ 30, while an eight-month course of treatment for a retreatment patient was estimated to be US$ 50 [11]. Infrastructure factors and other logistics were not considered in the calculations. The calculation of DALY considered the disability weighting of TB (0.3) as provided by the Global burden disease study 2010 [12] and time duration(in years) of treatment of TB which was 6 months for the new TB patients and 8 months for the retreatment TB patients. The following formula was used with the assumption that disability was only at that the time of TB treatment;

Disability Weighting of TB (0.3) X Time in years on TB treatment (6/12 or 8/12)

Each new TB patient had a DALY 0.15, while a retreatment patient had a DALY of 0.2.

In addition a comparison of mortality of TB patients in the 2 groups was also compared using DALY. The total DALYs resulting from these deaths were calculated using the following recommended formula;

(Life expectancy years – Age of person at death) X the weighting of Death.

Kenya's 2012 life expectancy at Birth of 63 years [13]was used with the disability weighting of death at 1.

III. Results

The study enrolled 2778 TB patients and among them 1499 (54%) utilized CHWs for their TB treatment. The proportion of males and females was comparable in both the groups that utilized CHWs and that which did not (Table 1). Age group distribution was similar in the 2 groups with mean age and standard deviations falling within the same range. The urban setting in comparison with the rural setting contributed significantly to a higher proportion (70%) of patients utilising the CHWs (p<0.001).

Of the enrolled 2,778 patients in the study, 2,669 (96%) had treatment outcomes documented. There was a significant statistical difference in treatment success rate between the cohort that utilised CHWs and that which did not utilise (82.15% vs 72.25% p-value <0.001), (Table 2).

Among the patients that were successfully treated there were 2 types of patients; the new TB patients (n=1,749) who were having TB disease for the first time and retreatment TB patients (n=323) who previously had TB (Table 3). Table 4 illustrates the cost of treating TB patients who had a treatment success outcome, the total DALYs averted and the average cost per DALY averted in both the intervention and control group. The average cost per DALY averted was higher (184 US$) in the cohort that utilised CHWs compared to the cohort that did not utilise CHWs (87 US$). A total of 191 deaths were reported among the TB patients enrolled. Table 5 summarises the number of deaths and total DALYs resulting from them. Utilising CHWs resulted in less DALYs (5688) from death compared to not utilising CHWs (5725).

A majority of patients died in the first 3 months of treatment in both the study cohorts (Fig 1). However of concern was a majority (n=30) who died within the first month in the cohort that did not utilise CHWs.

		Table 1: Characteristics of study participants	
p- value	**CHWs not utilized n=1279***	**CHWs utilized n= 1499***	
<0.001	32.73 (mean) SD 14.24	29.88 (mean) SD 13.39	**Age**
			Gender
0.563	660 (51.60)	790 (52.70)	Male
	619 (48.40)	709 (47.30)	Female
			Disease Classification
<0.001	936 (73.18)	287 (19.15)	Pulmonary Smear Positive (PSP)
	40 (3.13)	839 (56.0)	Pulmonary Smear Negative (PSN)
	299 (23.38)	371 (24.75)	Extra Pulmonary TB (EPTB)
	4 (0.31)	2 (0.13)	Missing
			Patient Classification
<0.001	1106 (86.47)	1128 (75.25)	New
	110 (8.60)	329 (21.95)	Retreatment
	63 (4.93)	42 (2.80)	Missing
			Accepted HIV Screening
<0.001	287 (22.44)	87 (5.80)	No
	992 (77.56)	1412 (94.20)	Yes
			Location
<0.001	785 (61.38)	448 (29.89)	Rural
	494 (38.62)	1051 (70.11)	Urban
			Adherence to treatment

<0.001	343 (26.82)	215(14.34)	No
	875 (68.41)	1237 (82.52)	Yes
	61 (4.77)	47 (3.14)	Missing
			*All data are n(%)

Table 2: Tuberculosis treatment outcomes and utilisation of CHWs

p-value	CHWs not utilised n=1218*	CHWs utilised n=1451*	TB Treatment Outcomes
<0.001	880 (72.25)	1192 (82.15)	Treatment Success
	104 (8.54)	87 (6)	Died
	7 (0.57)	2 (0.14)	Failure
	156 (12.81)	86 (5.93)	Lost to Follow-up
	71 (5.83)	84 (5.79)	Transfer Out
			* All data are n(%)

Table 3: Tuberculosis Treatment Success by Type of Patient

Patients treated successfully		
CHWs not utilised n=880*	CHWs utilised n=1192*	Type of Patient
803 (91)	946 (79)	New
77 (9)	246 (21)	Retreatment
		* All data are n(%)

Table 4: Total number of patients treated successfully, total cost of treatment in US dollars, total DALYs averted, and average cost per DALY averted for utilising CHWs and not utilising CHWs for tuberculosis treatment

Average Cost per DALY averted(US$)	weighted Total DALYs averted	Total DALYs averted	Total cost of treatment (US$)	Number of Patients with a treatment Success	Intervention
184	332	191	61,211	1192	Utilised CHWs
87	320	135	27,940	880	CHWs not utilised

Table 5: Number of deaths, total DALYs, by utilisation of CHWs and not utilising CHWs for TB treatment

Weighted Total DALYs	Total DALYs	Number of Deaths	Intervention
5688	2588	86	Utilised CHWs
5725	3120	103	CHWs not utilised

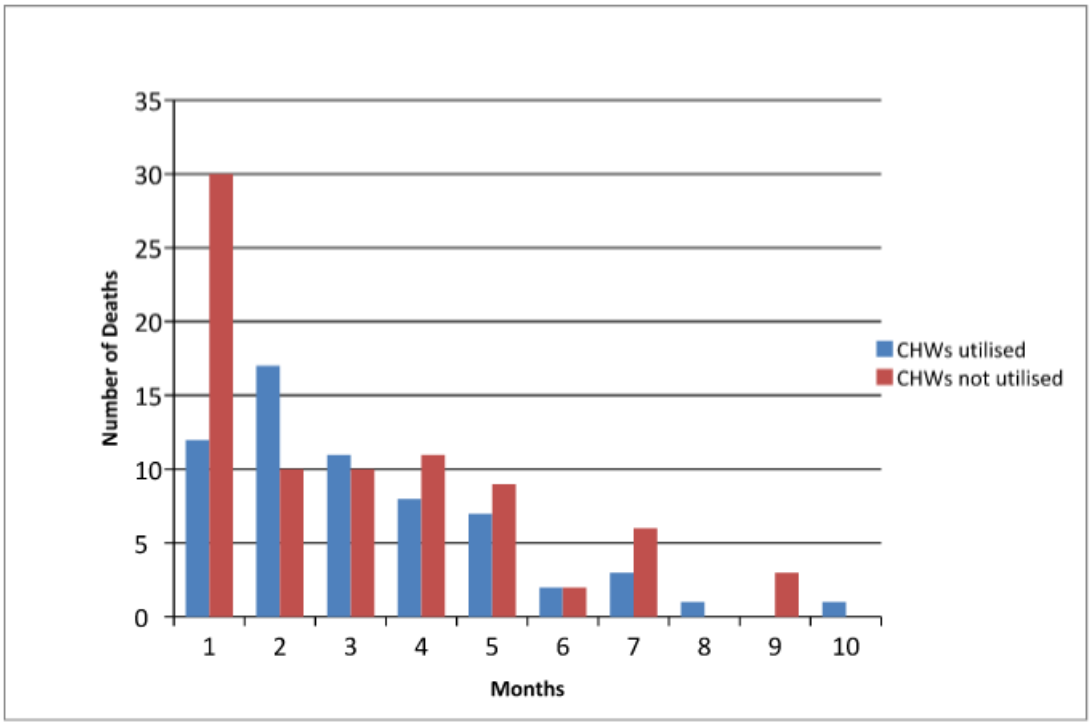

Figure 1: Time of Death in months, of TB patients after initiating treatment

IV. Discussion

The average cost per DALY averted for treatment success was higher (184 US$) in the cohort that utilised CHWs compared to the cohort that did not utilise CHWs (87 US$). Valuable resources were allocated for the use of CHWs and this resulted in a better treatment success rate of 82.15% compared to 72.25% (p-value <0.001). This may be considered as a health and economic benefit because life was saved by curing those who had TB and a majority of them were in the productive age group of 25-34 years making up 38% of the cohort that utilised CHWs. This finding is similar to other studies [14,15] that reported improved quality of life by curing or controlling chronic disease.

Utilising CHWs resulted in less DALYs (5688) from death compared to not utilising CHWs (5725). This finding re-emphasises the outcome of better treatment success rate that prevented the occurrence of death. A majority of patients who died within the first month were in the cohort that did not utilise CHWs. The use of CHWs seems to strongly avert death and this could greatly prevent death in the early months of TB treatment.

Using routine care data by this study strongly supports the intervention of utilising CHWs in the management of TB treatment. The positive effect of utilising CHWs in a programmatic setting as found in this study can be of value for areas outside the context of TB especially for chronic illnesses.

Cost effective analysis differs in various studies depending on the scope of cost put into the analysis and also pricing differs in different set-ups. The analysis done in this study may have limited application to only the local setting where the data was gathered from.

V. Conclusion

Investment in the use of CHWs resulted in higher treatment success rate and more deaths were averted an indication of health and economic gain.

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