Home-based treatment of children with HIV infection or tuberculous meningitis in South Africa

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Cost-effectiveness of home-based versus in-hospital treatment of paediatric tuberculous meningitis

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SUMMARY

Setting: Cape Town, South Africa, 2014

Objective: To assess societal costs and cost-effectiveness of home-based versus in-hospital treatment of paediatric tuberculous meningitis.

Design: An economic evaluation from a societal perspective using probabilistic analysis. Healthcare, informal care, lost-productivity costs and costs in other sectors, health-related quality of life and family impact were assessed during interviews with caregivers, children, medical staff and management.

Results: Societal costs for home-based treatment were USD3857 and USD28043 for in-hospital treatment. Home-based versus in-hospital treatment health-related quality of life-scores were 90.9% versus 84.5%, and family impact-scores were 94.8% versus 73.1%. The point estimate of the incremental cost-effectiveness ratio indicated that improving health-related quality of life and family impact with one percent was associated with USD3726 and USD1140 saved, respectively, for home-based versus in-hospital treatment. The probabilistic analyses show that the probability that home-based treatment was less costly and more effective than in-hospital treatment was 96.3% for health-related quality of life, and 100% for family impact.

Conclusion: Societal costs of home-based treatment are lower compared to in-hospital treatment. Children treated at home have a better health-related quality of life and family impact-scores. Home-based treatment is a cost-effective alternative for in-hospital treatment of drug-susceptible tuberculous meningitis.

INTRODUCTION

The global number of incident tuberculosis (TB) cases in 2016 was estimated at 10.4 million of whom 10% were children aged 0-14 years; 1.7 million of whom 14.7% children, died from TB [1]. With 438.000 TB cases, South Africa accounts for over 4% of the global TB burden [1]. Tuberculous meningitis (TBM), the most severe form of TB, frequently occurs in early childhood [2]. In the Western Cape Province of South Africa, 14.9% of all culture-confirmed TB cases in children (<13 years) from two major referral hospitals had TBM [3]. In-hospital treatment is widely considered the gold standard of treatment for children with TBM due to the complexity of care and serious consequences of non-adherence to anti-tuberculosis treatment [4]. However, long term hospitalization can negatively affect the child and its family [5]. Under certain conditions, home-based treatment is a viable alternative to six-month in-hospital treatment for TBM [6]. A prospective observational study at Tygerberg Hospital (TBH) showed that short intensified treatment both in-hospital and home-based is safe and effective in children with drug-susceptible TBM [7].

The cost-effectiveness of home-based treatment compared to in-hospital treatment has not yet been determined. Research priorities in the South African context are health policy and systems research activities to generate new knowledge on improving delivery of cost-effective existing healthcare interventions [8]. Long-term in-hospital TBM treatment is seldom feasible in resource-poor countries due to bed shortages and budgetary constraints [4, 7]. Therefore, home-based treatment can provide a cost-effective intervention to support easing the strain on the South African health system.

The aim of this study was to assess the costs and cost-effectiveness of home-based paediatric TBM treatment as compared to in-hospital treatment in Cape Town, South Africa. We included both health-related quality of life and family impact as effect measures and assessed costs from a societal perspective.

STUDY POPULATION AND METHODS

We performed a probabilistic analysis covering the duration of TBM treatment to assess the cost-effectiveness of home-based compared to in-hospital treatment from a societal perspective. Treatment consisted of two phases; first, in both groups, stabilisation was done at an academic tertiary hospital. In the home-based group this was followed by home-based care coordinated by TBH specialised outpatient clinic. In the in-hospital group, this was followed by treatment at Brooklyn Chest Hospital (BCH), a specialized primary care tuberculosis hospital.

Caregivers were eligible for participation in the study when the child (0-14 years) had received at least one month of treatment after stabilisation and up to six months after completion of treatment. Children receiving in-hospital treatment at BCH were eligible for

participation in the study if they were referred from hospitals other than TBH and fulfilled the TBH eligibility criteria for home-based treatment (exclusion criteria were an unreliable caregiver, insufficient income or support network, regular TB clinic visits not possible, directly observed therapy-supporter unavailable, multidrug-resistant TB, or untreated household TB cases) [6, 7].

Stellenbosch University's Health Research Ethics Committee approved this study. All caregivers provided written informed consent for their and their child's participation. In addition, all children (>7 years and with good cognitive function) provided written informed assent for their participation.

Costs measures

Interviews were held with 22 caregivers to estimate societal costs between October 2014 and January 2015 (10 home-based of whom 2 still on treatment, 12 in the in-hospital group of whom 10 on treatment at time of interview). In addition to estimate costs, medical staff, hospital management and non-governmental organisation (NGO) management were consulted between October 2014 and January 2015. Expert opinions guided the proportion, frequency and duration estimates of healthcare services used.

Societal costs included healthcare, informal care, lost-productivity costs and costs in other sectors. Within the home-based group, an estimated 5.6% of children are readmitted[7] for a duration of 2 months; corresponding costs are included in the analyses. All cost indicators were converted from South African Rand to US Dollars using 2014 purchasing power parity rates [9].

Healthcare costs

Healthcare costs during the stabilisation period (24 days) were fixed and included costs of hospital admission per ward and consultations. Admission costs per ward were calculated as the aggregated costs per patient-day equivalent [10]. Costs were based on 2.5 days in either a paediatric emergency (95%) or paediatric intensive-care unit (5%) setting, followed by 21 days in a general paediatric ward which offered the following interventions: social work (all children, four visits), dietician (all children, 1.5 visits), physiotherapy (all children, three visits), occupational therapy (all children, three visits) and ophthalmology (55% of children, 3 visits).

Healthcare costs in the second phase of treatment (177 days) were fixed. In the home-based group, healthcare costs included follow-up visits at TBH (all children, monthly), physiotherapy (20% of children, monthly), occupational therapy (all children, monthly), medication (all children, local short intensive regimen [6, 7] at median age 58 months [7] converted to weight using advanced paediatric life support ratio suitable for Western Cape,

South Africa [11]) and costs for readmission. In-hospital healthcare costs were based on aggregated costs per bed per day which included medication, transportation and referrals to other services (excluding social work).

Informal care costs

Informal care costs were variable and for both home-based and in-hospital groups these included general caregiving time (cleaning, washing, shopping, cooking, administration), condition-specific caregiving time (administering medication, personal care for child, moving child, playing, school support), travel time, travel costs and time spent at hospital (to attend follow-up for the home-based group, to visit the child for the in-hospital group). In the home-based group, additional costs for case-notification at a local clinic (once-off visit including travel time, costs and duration of visit), and costs associated with readmission were included. Time investment of caregivers was converted to monetary units with the proxy good method [12], using the minimum hourly wage for domestic workers in 2014 [13].

Lost-productivity costs

Lost-productivity costs were variable and estimated based on unpaid leave taken by caregivers (frequency and duration), their self-reported hourly wage, and the duration of readmission in the home-based group. Costs were calculated using the human capital approach [14].

Costs in other sectors

Costs in other sectors were fixed and included social work/counselling, day-care, primary school costs, and costs associated with readmission. In the home-based group, these costs were estimated based on salaries and educator-learner ratios for public day-care (ratio 1/25) [15], and public primary-school (ratio 1/28.9) [15]. Costs for social-work were provided through the TBH specialised out-patient clinic (all children, one visit). For the in-hospital group, day-care, schooling and social-work were provided by an NGO. Costs were estimated based on salaries and teacher-student ratio (1/8 for both day-care and primary-school). Both groups were assumed to have 35.3% of children in day-care and 64.7% of children in primary school.

Effect measures

To estimate effect measures, interviews were held with caregivers and their child (>5 years). Between October 2011 and December 2014, we included 17 home-based and 10 in-hospital children who were on treatment at the time of the interview.

Effect measures were health-related quality of life (HRQoL) and family impact. Health-related quality of life was measured using the Paediatric quality of life inventory™ (PedsQL™) 4.0 generic core scale. This scale consists of three age-dependent questionnaires: 36-item (1 to 12 months), 45-item (13-24 months) and 21-item (2-18 years). The parent-proxy report (all ages) is combined with the child's self-report (>5 years) and measures physical, emotional, social and school functioning. The infant scales (1-24 months) also included physical symptoms and cognitive functioning [16-18]. Family impact was defined as the impact of paediatric chronic health conditions on caregiver and family and measured with the PedsQL™ 2.0 family impact module. This 36-item module includes parent functioning (physical, emotional, social cognitive, communication and worry) and family functioning (daily activities and family relationships) [19]. A higher score (%) indicated better HRQoL and better overall family functioning [20].

Clinical background was described using medical records. TBM stage was classified as stage I (Glasgow coma scale (GCS) 15/15 with no focal neurological signs), stage II (GCS 11-14 with focal neurology) and stage III (GCS<11) [7].

Statistical analyses

Descriptive characteristics of the home-based and in-hospital groups were analysed using SPSS statistics version 25 (IBM® corporation, South Africa). Because costs and effects were not assessed in the same cohort of children with TBM and their caregivers, we developed a probabilistic analysis model assuming gamma distributions for both costs and effect outcomes. The gamma distributions were defined by the alpha ($(mean/SE)^2$) and beta (SE^2/ mean) of the outcome distributions. Uncertainty surrounding the costs and effects was estimated using Monte Carlo Simulation with 1000 simulations based on random draws from the gamma distributions. The 95% credibility intervals (CI) were estimated using 2.5 and 97.5 centiles from the empirical sampling distribution of these 1000 simulations.

The incremental cost-effectiveness ratio (ICER) was calculated for both effect measures (health-related quality of life and family impact) comparing home-based with in-hospital treatment.

$$\text{ICER} = \text{mean } \Delta C / \text{mean } \Delta E = \frac{\text{Costs}^{\text{home-based}} - \text{Costs}^{\text{in-hospital}}}{\text{Effect}^{\text{home-based}} - \text{Effect}^{\text{in-hospital}}}$$

The simulated cost-effect pairs reflect the joint uncertainty in incremental costs and effects around the point estimate of the ICER. This uncertainty, together with the ICER point estimate, were plotted on a cost-effectiveness (CE) plane. In a CE plane, differences in effects are plotted on the x-axis and differences in costs on the y-axis.

Cost-effectiveness acceptability (CEA) curves were estimated to show the probability of home-based treatment being cost-effective compared to in-hospital treatment given

different ceiling ratios. Ceiling ratios (λ) are defined as the amount of money a decision-maker is willing to pay in order to gain one unit effect. Incremental net monetary benefits (INMB) were calculated for every simulation using a wide range of ceiling rations ranging from 0 to positive infinity (INMB= Δ Effect * λ - Δ Costs). For every λ, the proportion of INMBs >0 was estimated indicating the probability that home-based treatment was cost-effective as compared to in-hospital treatment at that λ. These analyses and figures were created using Microsoft® Excel version 15.32 (Microsoft® for Mac, South Africa).

Sensitivity analyses

The main societal cost-effectiveness analyses from a societal perspective (including healthcare, informal care, lost productivity costs and costs in other sectors) were supplemented with two sensitivity analyses using different assumptions. The first sensitivity analysis adjusted societal costs under the assumption that costs for time taken off work to care for the child were included in costs for time spent informal care (including hospital visits). Absenteeism time costs were subtracted from informal care costs (if negative set to 0). The second sensitivity analysis adjusted societal costs by excluding schooling costs (day-care/pre-primary and primary school).

RESULTS

General, clinical and socio-economic characteristics of the children and their caregivers were similar in the home-based treatment groups compared to the in-hospital treatment groups (Table 1). The median age of children in the different groups ranged between 3.4 and 6.5 years. Five of 22 (23%) caregivers were employed; 5 (23%) caregivers experienced loss of work productivity (time taken of work due to the child's condition), but only 3 (14%) lost income. The total household income (combined household members' earnings, grants and community support) during the treatment period was USD179 in the home-based group and USD 170 in the in-hospital group per month.

Costs and effect measures

Healthcare costs during the initial in-hospital stabilisation period (24 days) were USD9754 in both groups (Table 2). Healthcare costs of the second phase (177 days) were USD1092 for home-based treatment and USD23407 for in-hospital treatment. Healthcare costs in the home-based treatment group were 95% lower than in the in-hospital group. Informal care costs of second phase treatment (177 days) were USD1868 for home-based and USD2093 for in-hospital treatment. Informal care costs in the home-based treatment group were 11% lower than in the in-hospital group. Costs for lost-productivity were USD345 in the home-based group and USD515 in the in-hospital group. Lost-productivity costs in the home-

Table 1. Child, caregiver, clinical and socio-economic characteristics of home-based and in- hospital groups for both cost and effect data populations

		Cost data (N=22)		Effect data (N=27)	
		Home-based (n=10) n (%)	**In-hospital (n=12) n (%)**	**Home-based (n=17) n (%)**	**In-hospital (n=10) n (%)**
Child characteristics					
Age, years, median [IQR]		6.5 [1.5-10.4]	5.3 [1.9-8.1]	3.4 [2.3-9.6]	4.8 [1.3-9.4]
Sex	Female	2 (20)	6 (50)	9 (53)	4 (40)
	Male	8 (80)	6 (50)	8 (47)	6 (60)
Caregiver characteristics					
Age, years, median [IQR]		35.4 [30.0-39.7]	32.7 [30.4-39.5]	33.6 [24.0-35.6]	35.2 [29.4-40.9]
Sex	Female	9 (90)	11 (92)	16 (94)	9 (90)
	Male	1 (10)	1 (8)	1 (6)	1 (10)
Relation	Parent	8 (80)	10 (83)	14 (82)	8 (80)
	Grandparent	2 (20)	1 (8)	1 (6)	1 (10)
	Uncle/Aunt	0 (0)	1 (8)	2 (12)	1 (10)
Marital status	Not married	6 (60)	10 (83)	12 (71)	8 (80)
	Married	4 (40)	2 (17)	5 (29)	2 (20)
High school complete	No	7 (70)	9 (75)	12 (71)	8 (80)
	Yes	3 (30)	3 (25)	5 (29)	2 (20)
Clinical characteristics					
TBM	Stage 1	3 (30)	2 (17)	2 (13)	1 (10)
	Stage 2	5 (50)	9 (75)	6 (40)	8 (80)
	Stage 3	2 (20)	1 (8)	7 (47)	1 (10)
HIV	Negative	9 (90)	11 (92)	15 (88)	9 (90)
	Positive	1 (10)	1 (8)	2 (12)	1 (10)
Socio-economic characteristics					
Household members, n, median [IQR]		5.0 [3.8-8.0]	7.0 [5.0-8.0]	5 [5.0-7.0]	7.0 [5.0-8.0]
Caregiver employed	No paid job	7 (70)	10 (83)	-	-
	Yes, paid job	3 (30)	2 (17)	-	-
Lost-productivity	No	7 (70)	10 (83)	-	-
	Yes	3 (30)	2 (17)	-	-
Government grant	No	1 (10)	1 (8)	-	-
	Yes	9 (90)	11 (92)	-	-
Community support	No	6 (60)	7 (58)	-	-
	Yes	4 (40)	5 (42)	-	-
Medical insurance	No	9 (90)	12 (100)	-	-
	Yes	1 (10)	0 (0)	-	-
Household income, USD, mean ± SD*		99.11 ± 123.37	143.17 ± 248.18	-	-
Grant income, USD, mean ± SD*		38.46 ± 43.02	26.67 ± 19.00	-	-
Support income, USD, mean ± SD*		45.85 ± 95.42	0.19 ± 0.41	-	-
TOTAL household income, USD, mean ± SD*		178.84 ± 152.74	170.01 ± 253.21	-	-

*per member living in household per month

IQR=interquartile range, TBM=tuberculous meningitis, HIV=human immunodeficiency virus, USD=United States Dollar (2014), SD=standard deviation

Table 2. Overview of mean healthcare, informal care, lost-productivity and costs in other sectors for home-based and in-hospital groups.

	Home-based (n=10)	In-hospital (n=12)	Difference Mean (95%CI)
Healthcare cost - stabilisation (24 days) in USD			
Paediatric emergency ward	886.69	886.69	0
Paediatric ICU ward	249.67	249.67	0
General paediatrics ward	8310.62	8310.62	0
Social work	93.34	93.34	0
Dietician	35.00	35.00	0
Physiotherapy	70.00	70.00	0
Occupational therapy	70.00	70.00	0
Ophthalmology	38.50	38.50	0
STABILISATION TOTAL	9753,82	9753,82	0
Healthcare costs - second phase (177 days) in USD			
In-patient (incl. consults and medication)	-	23406.49	-
Outpatient clinic visit	291.16	-	-
Physiotherapy	27.16	-	-
Occupational therapy	135.80	-	-
Medication	200.17	-	-
Readmission	437.88	0	437.88
HEALTHCARE COST TOTAL	1092.17	23406.49	-22314.32
Informal care costs - second phase (177 days) in USD			
Informal care general	1089.78	1088.07	1.70 (-507.76 to 511.17)
Informal care condition specific	622.81	495.68	127.13 (-264.88 to 519.13)
Travel time to hospital/clinic	28.60	111.59	-82.99 (-129.15 to -36.83)
Travel cost to hospital/clinic	73.88	238.18	-164.31(-299.17 to -29.44)
Duration follow-up/visit at hospital/clinic	43.42	159.54	-116.12 (-177.47 to -54.77)
Case notification at local clinic	4.84	0	4.84
Readmission	4.42	0	4.42
INFORMAL CARE COSTS TOTAL	1867.75	2093.06	-225.32(-866.46 to 415.82)
Informal care SENSITIVITY 1*	1564.45	1881.22	-316.77 (-1084.16 to 450.63)
Lost-productivity costs - second phase (177 days) in USD			
Lost-productivity costs	341.10	515.14	-174.04 (-1236.44 to 888.37)
Readmission	3.35	0	3.35
LOST PRODUCTIVITY COSTS TOTAL	344.45	515.14	-170.68 (-1233.09 to 891.72)
Costs other sectors - second phase (177 days) in USD			
Social work / counselling	23.33	257.61	-1234.28
Day-care / pre-school	74.59	233.11	-158.52
Primary school	425.58	1537.41	-1111.83
Readmission	28.96	0	28.96
COSTS OTHER SECTORS TOTAL	552.47	2028.13	-1475.66
Other sector SENSITIVITY 2†	27.85	257.61	-229.76

*Societal costs adjusted by informal care costs corrected for absenteeism, †Societal costs adjusted by other sector costs excluding day-care/pre-school and primary school cost
CI=credibility interval, USD=United States Dollar (2014)

based treatment group were 33% lower than in the in-hospital group. Costs in other sectors were USD553 in the home-based group and USD2028 in the in-hospital group. Costs in other sectors in the home-based treatment group were 73% lower than in the in-hospital group (Table 2).

Total societal costs (healthcare, informal care, lost-productivity and costs in other sectors) were USD3857 for home-based and USD28043 for in-hospital treatment. Thus, home-based treatment is less costly compared to in-hospital care. Both sensitivity analyses show similar results: in the first sensitivity analysis adjusted total societal costs were USD3554 for home-based and USD27831 for in-hospital treatment; in the second sensitivity analysis, adjusted total societal costs were USD3332 for home-based treatment, and USD26272 for in-hospital treatment. Children treated at home had higher health-related quality of life and family impact-scores compared to children treated in-hospital (respective 90.9 versus 84.5%; and 94.8 versus 73.1% (Table 3).

Table 3. Mean societal costs and effect measures for home-based and in-hospital groups including sensitivity analyses

Cost measures, USD	**Home-based (n=10) Mean ± SD (SE)**	**In-hospital (n=12) Mean ± SD (SE)**	**Difference Mean (95%CI)**
Costs Main societal	3856.84 ± 780.57 (246.84)	28042.82 ± 2267.95 (654.70)	-24185.98 (-25557.37 to -22814.60)
Costs Sensitivity 1 *	3553.54 ± 775.87 (245.35)	27830.97 ± 1572.22 (453.86)	-24277.43 (-25288.66 to -23266.20)
Costs Sensitivity 2 †	3332.22 ± 780.57 (246.84)	26272.30 ± 2267.95 (654.70)	-22940.08 (-24311.47 to -21568.70)
Effect measures, %	**(n=17)**	**(n=10)**	
Health-related quality of life	90.94 ± 9.74 (2.36)	84.45 ± 9.68 (3.06)	6.49 (-1.09 to 14.07)
Family impact	94.78 ± 4.91 (1.19)	73.08 ± 9.98 (3.16)	21.22 (14.60 to 27.84)

*Societal costs adjusted by informal care costs corrected for absenteeism, †Societal costs adjusted by other sector costs excluding day-care/pre-school and primary school cost
SD=standard deviation , SE=Standard Error of mean, CI=credibility interval, USD=United States Dollar (2014)

Cost-effectiveness analyses

Improving health-related quality of life of a child in home-based treatment with one percent was associated with USD3726 saved as compared to in-hospital treatment (USD3740 and USD3536, respectively, for sensitivity analyses one and two) (Table 4). Thus, home-based treatment is dominant compared to in-hospital treatment. The probabilistic analysis shows that there is a probability of 96.3% that home-based treatment was less costly and more effective than in-hospital treatment (SE quadrant), and 3.7% that home-based treatment was less costly and less effective than in-hospital treatment (SW quadrant)

(figure1). Sensitivity analyses one and two showed similar results (Table 4). The CEA curves show that the probability that home-based treatment is cost-effective compared to in-hospital treatment is 100% at a willingness-to-pay of 0 USD/additional percentage point improvement in health-related quality of life. This probability only slowly decreases with higher ceiling ratios, confirming dominance of home-based treatment over in-hospital treatment (data not shown).

Improving family impact for a child in home-based treatment with one percent was associated with USD1140 saved as compared to in-hospital treatment indicating dominance of home-based treatment (USD1144 and USD1081 for sensitivity analyses one and two respectively) (Table 4). The probabilistic analysis shows that there is a probability of 100% that home-based treatment is dominant over in-hospital treatment (SE quadrant) (Figure 1). Findings for sensitivity analyses one and two were similar (Table 4). CEA curves indicate that the probability that home-based treatment is dominant over in-hospital treatment for family impact is 100% for all willingness-to-pay values (data not shown).

Table 4. Probabilistic cost-effectiveness results for the main analysis and the sensitivity analyses

Simulation		Mean cost difference USD	Mean effect difference %	ICER USD	Distribution CE plane %			
					NE	SE	SW	NW
HRQoL	Main societal	-24185,98	6.49	-3725,76	0.0	96.3	3.7	0.0
	Sensitivity 1*	-24277,43	6.49	-3739.85	0.0	95.6	4.4	0.0
	Sensitivity 2†	-22940,08	6.49	-3535.46	0.0	95.8	4.2	0.0
Family Impact	Main societal	-24185,98	21.22	-1139.69	0.0	100.0	0.0	0.0
	Sensitivity 1*	-24277,43	21.22	-1144.08	0.0	100.0	0.0	0.0
	Sensitivity 2†	-22940,08	21.22	-1081.06	0.0	100.0	0.0	0.0

*Societal costs adjusted by informal care costs corrected for absenteeism, †Societal costs adjusted by other sector costs excluding day-care/pre-school and primary school cost

USD=United States Dollar (2014), ICER=Incremental Cost-Effectiveness Ratio, CE=Cost-effectiveness, NE=North-East quadrant, SE=South-East quadrant, SW=South-West quadrant, NW=North-West quadrant, HRQoL=Health-related Quality of life

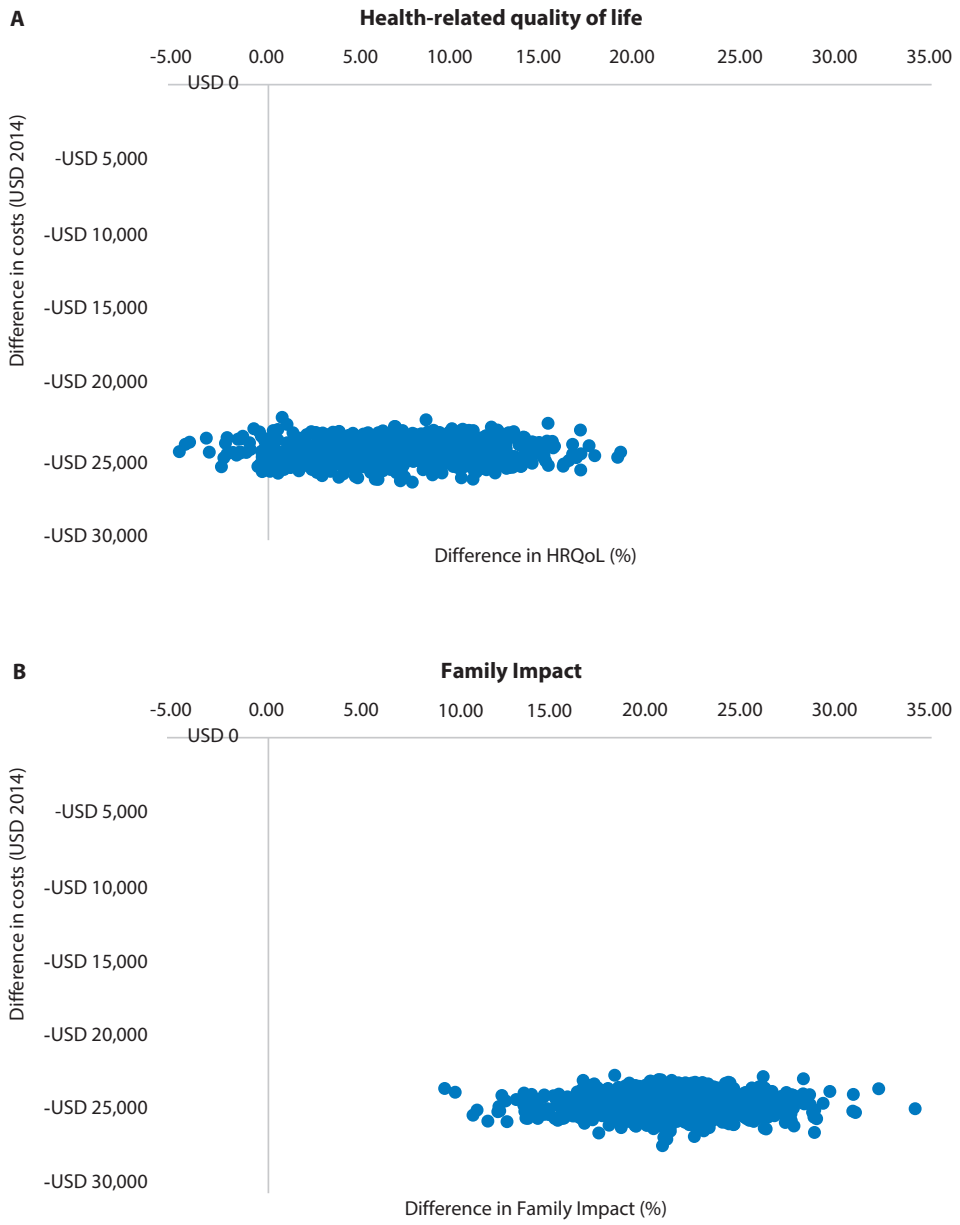

Figure 1. Cost-effectiveness planes of home-based treatment vs. in-hospital treatment for **A)** HRQoL and **B** family impact-scores.

HRQ=health-related quality of life, USD=United States Dollar (2014)

DISCUSSION

Home-based treatment of paediatric, drug-susceptible TBM was dominant compared to in-hospital treatment of patients that qualified for home-based treatment with regard to both health-related quality of life and family impact. The difference in costs between the treatments can mainly be attributed to the high healthcare costs of in-hospital treatment. Sensitivity analyses excluding costs of schooling/day-care, or accounting for possible double counting of lost-productivity costs confirmed these findings.

Cost-effectiveness of home-based versus in-hospital treatment in paediatric TBM for quality of life effect measures has not previously been assessed. Reports describe cost-effectiveness of community-based treatment versus in-hospital treatment for (pulmonary) TB in adult populations [21-26]. Similar to our research, these studies adopted a societal costs perspective within African populations. Despite methodological differences, our findings are similar: community-based approaches dominate the conventional hospital-based approach with the major costs saving component being healthcare costs.

A small sample size was a limitation of our study, although all eligible patients at the time were included. In addition, assessments of costs and effects were done in two different cohorts of patients. Therefore, probabilistic analysis was performed to compare the groups. Whereas informal care and lost-productivity costs were based on individual patient data, healthcare costs and costs in other sectors were based on average patient data ignoring variation between individual patients. Most variation in resource utilization and related costs occurs during in-hospital stabilization, which was not included in the simulation and cost-effectiveness analyses. Strict selection criteria including home-treatment eligibility requirements for the in-hospital group further diminishes variability within the study cohorts, and increases generalisability to other settings.

Some consideration is required regarding the use of both PedsQL™ questionnaires which are non-preference based health-related quality of life measures (societal health state utilities cannot be derived and results cannot be expressed in quality adjusted life years). On the other hand, interpretation of the 0-100 scale is straightforward, the instrument is designed specifically for children with chronic disease and both scales have good measurement properties (validity and reliability) [16-19]. The societal design was a strength, addressing healthcare, patient, caregiver, education and NGO perspectives.

Potential treatment interruption (loss to follow-up during home-based treatment) and corresponding societal costs are not addressed in this evaluation. TBM is the most lethal form of TB [27] and uninterrupted treatment is essential to improve clinical symptoms, limit disease progression, terminate transmission, and prevent the emergence of drug resistance [28]. Successful implementation of home-based treatment for paediatric TBM requires a structured follow-up systems to ensure children remain on treatment until completion.

CONCLUSION

This economic evaluation from a societal perspective shows that home-based treatment is dominant over in-hospital treatment in well-selected cases. This finding adds to other studies that treatment of drug-susceptible paediatric TBM can be successfully provided at home when adequate screening, counselling and support are in place [6, 7]. Both in-hospital (specialised primary level hospital) and home-based treatment (outpatient clinic at tertiary hospital) are provided at provincial level. We recommend policy makers to invest in home-based treatment infrastructure (e.g. dedicated programme nurse) to facilitate costs savings and increase quality of life and family impact for children with TBM.

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Author's contribution

SLvE and AMvF conceived the economic evaluation study and all authors contributed to the conception of design and methodology of the study and prepared the protocol. SLvE, SvD, and JEB contributed to acquisition of data, prepared the datasets and conducted the statistical analyses. All authors contributed substantially to the interpretation of the data. SLvE and SvD drafted the manuscript and all authors revised the manuscript critically for important intellectual content. All authors reviewed and approved the final manuscript.

Conflict of interest statement

The authors have no conflicts of interest to declare.

Ethics committee approval

Ethical approval was obtained from the Health Research Ethics Committee of the Stellenbosch University (reference number N11/03/061). Permission was obtained in accordance with the Provincial Research Policy and Tygerberg Hospital (Notice No. 40/2009).

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PART III

Treatment-support intervention