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Original Research Article

Psychological, socioeconomic burdens and coping mechanisms of caregivers of children with bronchoasthma in Kakamega County, Kenya

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ABSTRACT

Background: Childhood bronchoasthma consistently pose diverse caregiving burdens yet, magnitude of these and coping mechanisms adopted by caregivers are infrequently assessed during routine care only focused on index patients.
Methods: A partially mixed descriptive cross-sectional study was conducted for a minimum of 408 respondents. The results were presented in form of tables and text.
Results: A total of 408 caregivers were surveyed, with a mean age of 33 years (SD=9.86). Majority (78.7%) were actual parents of whom 73.5% were married. Primary-level education was the highest attained by 64% of caregivers while those earning <10,000 KES per month were 76% with about 3 out 4 being self-employed. Significant psychological concerns include sleep disturbance on the night previous to the interview, caregivers' concern about the child's asthma medication and side effects. Work absenteeism; reduced total annual income; lost job; discontinued child schooling and delayed family investment/cut budgets were significant social/economic burdens. Most caregivers used escape-avoidance coping mechanisms with a significant majority being involved in substance abuse (72.3%); feeling helpless or downplayed the severity of symptoms because of myths and stigma. Young age (p=0.002); being widowed (p=0.040), and being of low level of education (p<0.001) were associated with poor coping mechanisms.
Conclusions: There was considerable prevalence of psychological burden and socio-economic status among caregivers with significant majority using adversarial coping mechanisms, particularly among socio-economically disadvantaged.

Keywords: Childhood asthma, Caregivers, Social economic, Psychological, Coping, Demographic

INTRODUCTION

Bronchoasthma is multi-etiologic non-communicable disorder of the lower respiratory system, but linked to multiple burdens to the patients and their care givers.[1] The underlying etiology is often undetermined, but is clinically associated with chronic episodic airway obstruction.[2] It is ranked as the 14th most common disorder globally, affecting approximately 339 million people by 2018, with figures expected to rise to 400 million by 2025, 14% of these being children.[3] Developing countries account for more than 80% of the asthma-associated mortality, with about 50 million cases occurring in Africa. Kenya accounts for approximately 4 million of the known cases.[2,4] However, childhood bronchoasthma remains under-diagnosed and under-

treated in the Africa region. Whereas caregivers of children with bronchoasthma play a critical role in the long-term care of diagnosed cases, the attendant long-term caregiving burdens and coping mechanisms among caregivers are infrequently assessed with routine care only focused on index patients. The burden of caregiving includes frequent but uncertain acute episodes, high cost of management, stigma as well as physical and psychological stress.[5] The frequent hospitalizations, expenditures on ambulatory acute care, prescription medication and medical consultations can be overwhelming for caregivers and other stressful factors often lead to caregivers being unusually stressed and fatigued.[6,7] The stress, fatigue, and depression that caregivers face when taking care of the children with bronchoasthma influences in greater degrees and diverse ways their psycho-emotional status when compared to those without.[8] When combined with factors like child anxiety, smoking and a home environment that undermines wellbeing, caregiver stress may compound asthma comorbidity. Furthermore, caregiver stress could also erode the child's self-efficacy and capacity to self-manage the condition while eroding the problem-solving competencies of the child's family, resulting to poor medication adherence as well as quality of life.[9] The interplay of these intermediaries and relationships with care-giver psychological burden is still poorly understood. A study has shown that caregivers of children in Kenya, experienced major challenges that included lack of finances for treatment and other living expenses; inadequate, unaffordable, or interrupted medical care; emotional stress exacerbated by juggling many responsibilities, pressure to emotionally support the patient, and personal sacrifice as well as persisting stigma.[10] Understanding the factors of psychological burden is necessary to tailor essential social support to mitigate caregiver stress, thus enabling them to adopt effective coping solutions that allow them to confront the emotional and behavioral challenges that asthmatic children exhibit.[11,12] Coping mechanisms can be classified as: problem- focused, concerned with alleviating or at least minimizing the stressors that caregivers face; emotion-focused, involving helping caregivers to adopt healthier emotional responses to stressors, and; escape-avoidance- focused, involving flight from the stressors by relying on such strategies as humor and a refusal to acknowledge the difficult reality that the caregiver faces.[6] However, the individual strategies are not constant in time, and may be modified by other overlapping mechanisms in the care context. For example, a stressful environment influences coping response, controlled in part by personality and habitual tendencies as well as costs involved.[13] Usually there are no formal structures to routinely monitor these experiences nor are there necessary support measures to enhance adaptive coping strategies for caregivers. Whereas the African region shoulders a heavy burden of communicable diseases, non-communicable diseases such as bronchoasthma in children are becoming increasingly prevalent and compounding the public health challenges that the African nations face.[14] Collaboration between lay-caregivers and professionals for chronic diseases care is limited across the region, while caregiver well-being is not usually integrated within the chronic care process.[15,16] Caregivers provide essential long-term continuity of care for children with bronchoasthma through which to improve care outcomes, yet the impact of this on their well-being is unclear. Understanding the prevalence of typical stressors, how caregivers cope with them and what coping mechanisms are often adopted, is desirable to enable development of appropriate interventions to improve quality of the post-diagnosis long-term homecare-giving in an ideal chronic care model for children with bronchoasthma.[17] Given the critical role of caregivers in the post-diagnosis long-term care, there is need to further understand their lived experiences and ways of coping with stressful demands of care giving. There is still dearth of information in this regard in Kenya. The intent of this research therefore is to determine the psychological and socioeconomic burdens experienced by the caregivers and, establish the coping mechanisms that they adopt.

Aim

The study aimed at determining the psychological, socioeconomic burdens and coping mechanisms of caregivers of children with bronchoasthma attending Kakamega County General Hospital, Kenya.

METHODS

A descriptive cross-sectional study design was carried out at the paediatric outpatient clinic which caters for the children below 5 years of age; the medical outpatient clinic which treats the children from 5 years and above; and also, in the area surrounding the Kakamega County General Teaching and Referral Hospital (KCGTRH), between October 2019 and December 2019. Up to 3000 children were seen per month at the hospital. Currently, there is no specialized paediatric bronchoasthma clinic at the hospital. Diagnosis of bronchoasthma had been made clinically by attending clinicians. Caregivers of children with bronchoasthma aged below 14 years were enrolled if they consented, their children had confirmed diagnosis of asthma and were enrolled for follow up at the paediatric clinic and had cared for the child for the past three months as per the records. Caregivers of children who had an uncertain diagnosis, serious chronic comorbidities, were unavailable on the interview day and did not consent were excluded from the study. The attending clinicians prompted the eligible caregivers about the research at the clinic and those interested in participating were given a serialized research card to present to the research assistant in an adjacent room, where the interview was conducted. For those caregivers who were unable to attend the clinic, the researcher was referred to the community health volunteers (CHV) who were able to locate them at their homes using their contact details. The data for the caregivers was gathered with the aid of a semi structured

questionnaires. The study targeted 424 caregivers. However, only 408 caregivers' questionnaires were noted to be completely filled with the deficit accounting for those which were not completely filled. Psychological stress was assessed based on 2 dimensions namely; Paediatric Asthma Caregiver Quality of Life (PACQOL) and caregiver strain index (CSI).[18,19] PACQOL questionnaire comprised of 10 items which assessed caregiver's emotional concerns and impaired activities. The CSI tool had 13 items, used to assess strain placed on the caregiver by bronchoasthma. A score of 7 and above was considered adversarial with a high stress level to the caregiver. The socioeconomical questionnaire assessed financial strain and adjustments, social life deprivation and lifestyle changes associated with caregiving. The questionnaire on coping mechanisms contained 10 items, and was stratified into 3 categories namely; problem focused, emotion focused and escape avoidance. The population of children between 0-14 years old in Kakamega County was 786,681.[20] Clearance to carry out the research was granted from the Maseno University School of Graduate Studies (SGS), Maseno University Ethics and Review Committee (MUERC), National Commission for Science Technology and Innovation (NACOSTI) and Kakamega County General Teaching and Referral Hospital (KCGTRH) Ethics Committee. A pilot test and face validity from the experts were used to establish the validity of the questionnaire for the study. A pre-test comprising of 10% of the study population was conducted prior to the onset of the study to establish the reliability of the questionnaires (Chronbac's α reliability was 0.869). Data was entered into SPSS version 24 and analyzed. Data from the questionnaires was coded, tabulated, entered into a computer then analyzed and interpreted. The mean, standard deviation and percentages of the variables was calculated and used appropriately. Descriptive statistics were used to summarize bronchoasthma caregiver's burdens and copings strategies, in the form of means (caregivers age), standard deviation (caregiver age) and percentages (socioeconomic and demographic characteristics of the respondents and the burdens) as appropriate. Chi-square test (p=0.05 level of significance) was used to evaluate whether there is a significant goodness of fit of the caregiver burdens and coping mechanisms that caregivers adopt, psychological and socioeconomic burden goodness of fit test. Mean, standard deviation and percentages of variables was calculated and used appropriately.

Thus, sample size was determined by: $n=1.96\times0.5(100-95)/0.5^2/1+(1.96^2\times0.5(100-95)/1.96^2\times2.2$; n=385.

An additional 10% will be added. The final sample size was: (385×10)/100=38.5 (39) 39+385=424

RESULTS

Background information sought were gender, age, education housing, employment status, source of fuel (Table 1).

The psychological burden of bronchoasthma

The study focused on interference with daily activities, emotional concerns and the caregiver strain index.

Interference with daily activities and emotional concern

When asked about interference with daily activities, significantly more participants indicated 'never' for each dimension. Similarly, among those experiencing interference with daily activities, significantly more participants responded with 'quite often' (Table 2).

Participants who felt 'bothered because of the child's condition' (38.7%) and 'angry that the child has the condition' (33.1%) and; 'were concerned about the child's asthma medication and side effects' (48.5%) were significantly more frequent. Almost half (48.3% of the participants were never 'worried or concerned about the child being able to lead a normal life'.

Caregiver strain index

Majority of respondents (82.9%, n=345) had high level of stress and 15.9% moderate CSI with the remaining having low CSI. The mean care strain index was found to be 9.3 (SD=2.8) compared to a normal of 7. Majority of the caregivers (90.4%, n=369) were disturbed from sleep in the previous nights by the child's condition; experienced financial challenges (84.6%, n=345) and emotional changes (84.1%, n=343). Of the female caregivers 59.8% (n=244) and 10.8% (n=44) of males were differently inconvenienced by caregiving; felt physically and emotionally constrained; changed plans because of caregiving; experienced financial challenges; and had difficulty in decision making.

Socioeconomic burden of caregiving

Socioeconomic questionnaire addressed financial strain and adjustments, social life deprivation and lifestyle changes associated with the caregiving. Almost 3-quarter of caregivers (72.8%, n=297) had made several emergency departments visits in last 12 months preceding study and; (86.3%, n=352) agreed to have had hospitalization.

Significantly more participants experienced being absent from work (75.2%; p=0.015); reduced total annual income (59.3%; p=0.045); job loss (60.8%; p=0.037); poor quality of life (83.6%; p<0.001); child discontinued schooling (82.1%; p=0.011) and; delay investment/cut budgets (95%; p=0.015). Majority of participant disagreed with the statement that caregiving had 'impaired daily activities' (81.4%; p<0.001) (Table 4). A great majority (92.2%, n=376) of respondents had some form of income generating activities. At least three quarters (76.7%, n=313) were earning less than Ksh 10,000 per month (χ^2=110.1; df=1; p<0.001). Of these, 74.5% (n=304) were self-employed while only 17.6%

(n=72) were in formal employment (χ^2=11.7, df=3, p<0.008). Majority of the caregivers lived in mud houses (75%, n=306) compared to others who lived in stone houses (22.5%, n=92) and 2.5% (n=10) who lived in wooden houses (χ^2=343.5, df=2, p<0.001) (Table 3).

Caregivers coping strategies

The study focused on problem focused, emotion focused and escape avoidance as the caregiver's coping strategies.

Problem focused

The results show that caregivers who were using problem-focused coping mechanisms were unsure about attending trainings, (33.3%, n=136). Of these, some did not see the need to attend trainings (44.1%, n=180). Others sought health information (58.8%, n=240), evaluated pros and cons (43.6, n=178), while only the (47.1%, n=192) focused on intervention on improvement in the behavior of the child and effectively in the reducing anxiety and worry (χ^2=102.1; df=4; p≤0.001).

Emotion focused

For the caregivers who utilized emotion focused coping mechanism, majority sought spiritual help (61.3%,

n=250), while (37%, n=151) had withdrawn the child from school as a result of his/her condition (χ^2=119.97; df=4; p≤0.001). Isolation of the child from the public was rarely done by (59.5%, n=243) caregivers taking care of the children with bronchoasthma.

Escape avoidance

The commonly adopted coping mechanism was escape avoidance, utilized by 72.9% of the divorced people, followed closely by the widowed at 72.4%. Most of the participants, hoped and prayed for the betterment of their children (79.7%, n=325), while those who were involved in substance abuse were (72.3%, n=295) (χ^2=181.6; df=4; p<0.001). Some of the drugs of abuse used included the locally brewed illicit alcohol. More than a half of the caregivers who adopted escape avoidance, downplayed the severity of the symptoms because of the myths and stigma surrounding bronchoasthma, (68.6%, n=280) (χ^2=141.9; df=4; p<0.001).

Table 1: Socio-demographic characteristics of the respondents.

Characteristics		Frequency		X^2	Df	P value
		N	%			
Age bracket (In years)	19-25	101	24.8	156.25	4	<0.001
	26-35	169	41.4			
	36-45	87	21.3			
	46-55	33	8.1			
	56 and above	18	4.4			
Gender	Male	359	88	235.5	1	<0.001
	Female	49	12			
Relationship with the child	Parent	321	78.7	134.2	1	<0.001
	Guardian	87	21.3			
Level of education	No formal education	19	4.7	549.2	3	<0.001
	Primary	261	64			
	Secondary	92	22.5			
	Post-secondary (College; university)	36	8.8			
Employment status	Self-employed	317	77.9	554.06	3	<0.001
	Employed	72	17.6			
	Student	19	4.7			
Average monthly income (Ksh)	Below 10000	313	76.7	605.3	3	<0.001
	10000-19,999	69	16.9			
	20000-49,999	25	6.1			
	50,000 and above	1	0.2			
Age of the child (In years)	<1	36	8.8	46.6	4	<0.001
	1-3	88	21.6			
	4-7	117	28.7			
	8-11	98	24.0			
	12-14	69	16.9			

Table 2: Paediatric Asthma Caregiver Quality of Life, (n=408).

Dimensions	Always, N (%)	Quite often, N (%)	Once in a while, N (%)	Never, N (%)	X^2	Df	P value
Feel helpless, frightened of child condition	102 (25)	77 (18.9)	52 (12.7)	177 (43.4)	85.8	3	<0.01
Need to change plans because of child's condition	58 (14.2)	110 (27)	82 (20.1)	158 (38.7)	54.3	3	<0.01
Feel frustrated or impatient because of the child's condition	60 (14.7)	102 (25)	75 (18.4)	171 (41.9)	71.1	3	<0.01
Child's condition interferes with your job or work	58 (14.2)	118 (28.9)	86 (21.1)	146 (35.8)	43.0	3	<0.01
Feel upset because of the child's condition	99 (24.3)	99 (24.3)	80 (19.6)	130 (31.9)	12.6	3	<0.01
Have sleepless nights because of child's condition	52 (12.7)	126 (30.9)	86 (21.1)	144 (35.3)	50.0	3	<0.01
Feeling bothered because of child's condition	158 (38.7)	101 (24.8)	54 (13.2)	95 (23.3)	53.8	3	<0.01
Awakened during night because of child's condition	52 (12.7)	135 (33.1)	72 (17.6)	149 (36.5)	65.7	3	<0.01
Feel angry that child has condition	135 (33.1)	100 (24.5)	49 (12)	124 (30.4)	43.0	3	<0.01
Worried or concerned about child's performance of normal daily activities	105 (25.7)	179 (19.4)	68 (16.7)	156 (38.2)	45.2	3	<0.01
Worried/concerned about child's asthma medication and side effects	198 (48.5)	81 (19.9)	42 (10.3)	87 (21.3)	132.2	3	<0.01
Worried or concerned about being overprotective of your child	93 (22.8)	120 (29.4)	54 (13.2)	141 (34.6)	41.5	3	<0.01
Worried or concerned about your child being able to lead normal life	81 (19.9)	74 (18.1)	56 (13.7)	197 (48.3)	121.2	3	<0.01

Table 3: A chi square test of independence for categories of socioeconomic burden of caregivers.

Variables	Strongly disagree, N (%)	Disagree, N (%)	Neutral, N (%)	Agree, N (%)	Strongly agree, N (%)	χ^2	Df	P value
ED visits in last 12 months	2 (0.5)	83 (20.3)	26 (6.4)	96 (23.5)	201 (49.3)	292.8	4	<0.001
Absent from work	6 (1.5)	62 (15.2)	33 (8.1)	145 (35.5)	162 (39.7)	232.2	4	<0.001
Hospitalization	1 (0.2)	21 (5.1)	34 (8.3)	167 (40.9)	185 (45.3)	372.8	4	<0.001
Borrow finances for medication	2 (0.5)	29 (7.1)	38 (9.3)	217 (53.2)	122 (29.9)	379.5	4	<0.001
Negatively affect relationship	4 (1)	61 (15)	49 (12.0)	162 (39.7)	132 (32.4)	202.4	4	<0.001
Lack time for social activities	6 (1.5)	89 (21.8)	55 (13.5)	152 (37.3)	106 (26)	147.5	4	<0.001
Loss of opportunities for career advancement	8 (2)	85 (20.8)	54 (13.2)	176 (43.1)	85 (20.8)	185.2	4	<0.001
Reduced productivity at work	9 (2.2)	77 (18.9)	52 (12.7)	195 (47.8)	75 (18.4)	233.7	4	<0.001
Reduced total annual income	7 (1.7)	93 (22.8)	66 (16.2)	170 (41.7)	72 (17.6)	169.7	4	<0.001
Lost job	8 (2)	102 (25)	50 (12.3)	179 (43.9)	69 (16.9)	202	4	<0.001
Face neglect from family	7 (1.7)	68 (16.7)	84 (20.6)	155 (38)	94 (23)	138.4	4	<0.001
Poor quality of life	3 (0.7)	38 (9.3)	26 (6.4)	183 (44.9)	158 (36.5)	334.4	4	<0.001
Impaired daily activities	4 (1)	51 (12.5)	21 (5.1)	183 (44.9)	149 (36.5)	311.9	4	<0.001
Discontinued the schooling	2 (0.5)	31 (7.6)	40 (9.8)	144 (35.3)	191 (46.8)	324.6	4	<0.001
Delay investment/ cut budgets	2 (0.5)	12 (2.9)	6 (1.5)	170 (41.7)	218 (53.4)	530.8	4	<0.001

Table 4: Caregivers coping strategies.

Variables		Response	N	%	X^2	Df	P value
Problem focused	Attend training	Strongly disagree	72	17.6	102.1	4	<0.001
		Disagree	108	26.5			
		Neutral	136	33.3			
		Agree	78	19.1			
		Strongly agree	14	3.4			
	Seeking health information	Strongly disagree	29	7.1	151.8	4	<0.001
		Disagree	50	12.3			
		Neutral	89	21.8			
		Agree	173	42.4			
		Strongly agree	67	16.4			
	Evaluating the pros and cons of the situation	Strongly disagree	53	13	98.7	4	<0.001
		Disagree	108	26.5			
		Neutral	69	16.9			
		Agree	145	35.5			
		Strongly agree	33	8.1			
	Focus on intervention on improvement	Strongly disagree	28	6.9	110.4	4	<0.001
		Disagree	93	22.8			
		Neutral	95	23.3			
		Agree	148	36.3			
		Strongly agree	44	10.8			
Emotion focused	Seek consolation from a spiritual leader	Strongly disagree	32	7.8	88.6	4	<0.001
		Disagree	74	18.1			
		Neutral	52	12.7			
		Agree	131	32.1			
		Strongly agree	119	29.2			
	Withdraw the child from school	Strongly disagree	34	8.3	119.97	4	<0.001
		Disagree	117	28.7			
		Neutral	75	18.4			
		Agree	146	35.8			
		Strongly agree	36	8.8			
	Isolate the child from the public for fear of being stigmatized	Strongly disagree	103	25.2	84.4	4	<0.001
		Disagree	140	34.3			
		Neutral	63	15.4			
		Agree	71	17.4			
		Strongly agree	31	7.6			
Escape avoidance	Wish hope and pray that the child will get better	Strongly disagree	6	1.5	348.9	4	<0.001
		Disagree	41	10			
		Neutral	36	8.8			
		Agree	217	53.2			
		Strongly agree	108	26.5			
	Involved in substance abuse	Strongly disagree	37	9.1	181.6	4	<0.001
		Disagree	51	12.5			
		Neutral	25	6.1			
		Agree	148	36.3			
		Strongly agree	147	36			
	Downplaying the severity of symptoms	Strongly disagree	52	12.7	141.9	4	<0.0001
		Disagree	42	10.3			
		Neutral	34	8.3			
		Agree	145	35.5			
		Strongly agree	135	33.1			

DISCUSSION

In the current study, the observed narrow mean psychological index of between the 2.10 to 2.80 with the concurrent high stress index of 9.3 indicates a considerable level of individual level caregiver mental and physical health burden. Majority of the caregivers in the current study were simultaneously experiencing considerable financial, social and physical constraints and lacked strong social protection. Insurance companies traditionally do not cover chronic/ "pre-existing" conditions and caregivers rely on out-pocket financing. Recent studies have attributed the scope and distribution of caregiver stress as being shaped by factors like the disease severity, social structures, duration, and the extent of their involvement in caring.[21-24] Caregiving leaves individuals feeling overwhelmed and powerless and has also been linked to such secondary adverse outcomes as productivity challenges in the workplace as well as strained interpersonal relationships.[25] Studies in Kenya showed that caregiving of children with differing chronic illnesses not only cause considerable mental health challenges but also placed the children at higher risks of developing mental health conditions.[26-28] In addition, in Kenya outpatient and in-patient as well as emergency departments are inherently busy while care is skewed to dealing with acute cases. At the same time, front-line medical staff are poorly experienced in diagnosis and management of mental health while psychosocial support may be less established in the institutions. Interventions to improve case identification of caregivers during routine follow-up visits of children who are ailing from bronchoasthma and closer follow-up surveillance are imperative.[22] This calls for a more comprehensive chronic care approach and mechanisms which also integrate psychosocial and structural support for caregivers of pediatric patients with asthma.[29] Significant majority of caregivers were found to be poor and of low socioeconomic status and living in mud-thatched or -iron sheet roofed houses. These stressors were likely to further complicate the microenvironment of the child living with bronchoasthma and how it may impact on the clinical progression and management outcomes. Interventions to improve a child's microenvironment as well as of the caregivers' are part of the chronic care model. However, its implementation remains problematic in Kenya as in other resource-limited regions.[30] Use of digital technology to enhance case identification, management and remote follow up may be a necessary step to enhance health systems adaptability and responsiveness.[31,32] In addition, involvement and training of education staff and support groups for caregivers have been recommended to strengthen caregivers' support, create environments that safeguard the health of asthma patients and ensure swift emergency response.[33-35] There are a few limitations of the study. Beliefs and myths surrounding bronchoasthma, fear of stigmatization and stress observed may have clouded the caregivers' mindset from being more open about their child's bronchoasthma and personal experiences. This limitation was addressed by reassuring and empowering the caregivers with information about bronchoasthma, visiting the homes in the company of CHVs they are familiar with and providing psychosocial help and referral as need be during the interview. However, the impact of this limitation or remedies implemented would not be known. Also, given that seasons significantly influence the manifestation of childhood bronchoasthma, the rather short period during which the study was conducted could leave out patients whose bronchoasthma is in the stable stage. The study did not quantify the economic burden of the caregiver.

CONCLUSION

Majority of the participants not only experienced considerable mental and physical health strain directly as a result of caregiving to their children with bronchoasthma but also, were financially constrained. In addition there was no established comprehensive care system to enable psychosocial and financial support across their healthcare levels.

Recommendations

With most of the caregivers using escape avoidance coping mechanisms with predilection to drug and substance abuse, broad-based and multi-tiered improvement interventions to ensure health service delivery adaptation and responsiveness to long-term care needs of children with bronchoasthma and their caregivers, is imperative. This may include strategies to empower caregivers to mitigate social and financial burdens they face. County health teams may also to provide multi-disciplinary multi-level care using person centered strategies, for example, screening, interventions to enhance information seeking, promoting psychosocial motivation and emotion stability and mitigating drug abuse. There might be need to review the clinic organization to accommodate interventions for caregivers of children above 5 years of age, psychological counseling, frequent home visits or administer a screening tool to the caregiver as the child is receiving treatment, for referral to psychosocial support system.

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