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Measuring Economic Burden on Family of Patients with Chronic Kidney Disease on Haemo Dialysis

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ABSTRACT: ***Background:*** Chronic Kidney Disease (CKD) is growing public health challenge in Bangladesh, with significant economic burden. The financial strain is exacerbated by the high cost of hemodialysis, the primary treatment for End-Stage Renal Disease (ESRD). Despite the public sector funding 67.1% of hemodialysis treatments, the economic impact remains severe, with families often resorting to borrowing money or selling assets to afford treatment. ***Materials and Methods:*** A cross-sectional study was conducted at the Kumudini Hospital's dialysis unit in Mirzapur, involving 40 CKD patients undergoing hemodialysis. Data were collected using a structured questionnaire covering demographics, comorbid conditions, dialysis-related factors, and financial burden. Financial burden was assessed through semi-structured interviews. Descriptive statistics, Chi-Square tests, and Spearman's correlation were used to analyze the data. ***Results:*** The study found that a significant portion of the patients (80%) rely on family members or relatives to fund their dialysis treatment. Monthly expenditure on dialysis ranged from 5,800 BDT to 33,600 BDT, with a mean of 19,425 BDT. Study found significant associations between burden category and quality of life (Chi-Square = 14.3481, p = 0.0260) and a moderate strength correlation between burden and quality of life. ***Conclusion:*** Hemodialysis imposes a significant financial burden on CKD patients' families, leading to increased poverty risk and financial insecurities. The findings highlight the need for improved financial support systems and healthcare policies to alleviate the economic strain on affected households.

Keywords: Hemodialysis Cost, Economic Burden, Financial Insecurity, Healthcare Policy.

Article at a glance:

Study Purpose*: The purpose of this study was to measure economic burden on families of patients with chronic kidney disease on haemo dialysis.*

Key findings: *Expenses such as dialysis sessions, medications, and hospitalizations contribute substantially to the financial strain on families.*

Newer findings: *Rising healthcare costs have intensified the economic challenges faced by families.*

Abbreviations: *CKD: chronic kidney disease.*

INTRODUCTION

Globally, CKD afflicts over 800 million individuals (~10% prevalence), while Bangladesh exhibits an elevated burden (16-22%), translating to an estimated 26.4-36.3 million affected among its 165 million populace.[1] The economic burden of chronic kidney disease (CKD) on families is significant, with high healthcare costs, work disruptions, and out-of-pocket expenses severely affecting caregivers' financial stability and overall quality of life.[2] Hemodialysis, as the primary treatment for end-stage renal disease (ESRD), imposes a substantial financial burden on patients and their families due to ongoing medical expenses, including dialysis sessions, medications, hospitalizations and ancillary costs such as transportation and lost income.[3] With only 200 kidney transplants available annually for 10,000 new ESRD cases, dialysis remains the costly alternative, consuming up to 10-15% of healthcare budgets in many countries.[4] Therefore, the growing prevalence of

chronic kidney disease (CKD) in Bangladesh highlights significant public challenges, as the economic burden of treatment exacerbates existing healthcare disparities, disproportionately affecting vulnerable populations, and intensifying issues related to financial toxicity, limited access to dialysis therapies, and inequitable healthcare distribution.

Factors like rising healthcare costs, limited access to specialized care and scarce renal replacement therapies exacerbate CKD patients' financial, physical, and emotional burdens, severely impacting their quality of life before and after diagnosis.[4, 5] The quality of life for chronic kidney disease (CKD) patients deteriorates significantly, as 67.1% hemodialysis treatments are funded by the public sector, yet the financial burden on families continues to grow, with treatment costs soaring to approximately $3000 per year, nearly eight times the average per capita income.[5, 6] Furthermore, studies indicate that nearly 30% of families with CKD patients report having to borrow money or sell assets to fund treatment, thereby increasing the risk of long-term financial insecurity for these households.[7] The lack of sufficient social safety nets and financial support for families facing these burdens intensifies the strain on already marginalized communities.[8] The escalation in healthcare costs associated with CKD, particularly the need for ongoing dialysis, contributes significantly to the inequities in healthcare access and the rise in the number of households driven into poverty due to medical expenses.[9] In conclusion, the aim of this study is to measure the economic burden that hemodialysis imposes on the families of patients with chronic kidney disease (CKD) in Bangladesh, by evaluating both direct medical expenses and indirect costs such as lost income and caregiver time. Through this analysis, the study seeks to highlight the financial challenges faced by families and contribute to the development of targeted interventions that could reduce the economic strain on caregivers while improving access to necessary treatments.

METHODS

The methodology for this study was designed to comprehensively assess the demographic, medical, financial, and quality-of-life factors of chronic kidney disease (CKD) patients undergoing hemodialysis. The study was conducted at the dialysis unit of Kumudini Hospital, Mirzapur, from 10 September 2024 to 10 October 2024 to assess the pre- and post-dialysis economic burden. The study used cross-sectional method that included 40 CKD patients undergoing hemodialysis, selected using purposive sampling. The inclusion criteria consisted of patients aged 18 years or older, undergoing regular hemodialysis, and providing informed consent to participate. Data collection was carried out using a structured questionnaire, which was divided into four sections: demographic characteristics, comorbid conditions, dialysis-related factors, and financial burden. The financial burden was evaluated using a semi-structured interview schedule, adapted from the method described by Pai and Kapur. The interview schedule evaluates the financial burden of patients' families by assessing the impact of expenditure related to dialysis on family finances, disruption of normal family activities and stress experienced by family members used in psychiatric care framework Descriptive statistics were used to analyze the demographic and clinical characteristics of the participants, while the Chi-Square test was used to determine the connection between financial burden and the quality of life satisfaction. Spearman's correlation was used to assess the strength and direction of the relationship between economic burden and overall satisfaction with overall life. The level of significance was set at $p < 0.05$ for all statistical tests.

RESULTS

The table details the demographic characteristics of CKD patients undergoing hemodialysis. Among the 40 patients, the largest age group is 40-49 years (27.5%, n=11), followed by 50-59 years (25%, n=10), and 30-39 years (10%, n=4). A higher proportion of females (55%, n=22) compared to males (42.5%, n=17) are represented. Regarding marital status, 90% (n=36) are married, 7.5% (n=3) are unmarried, and 2.5% (n=1) are widows. In terms of education, 45% (n=18) have secondary education, 35%(n=14) have primary education, and 12.5%(n=5) have education beyond HSC, with 7.5%(n=3) being illiterate. Lastly, 95%(n=38) of the patients practice Islam, while 5%(n=2) follow Hinduism. [Table 1]

Table 1: Demographic Distribution of CKD Patients on Hemodialysis

Demographic Characteristics	(n, %)
Age Group	
20-29	2, 5.0%
30-39	4, 10.0%
40-49	11, 27.5%
50-59	10, 25.0%
60-69	9, 22.5%
70-80	4, 10.0%
Sex	
Male	17, 42.5%
Female	22, 55.0%
Marital Status	

Unmarried	3, 7.5%
Married	36, 90.0%
Widow	1, 2.5%
Education	
Primary	14, 35.0%
Secondary	18, 45.0%
Above HSC	5, 12.5%
Illiterate	3, 7.5%
Religion	
Islam	38, 95.0%
Hinduism	2, 5.0%

This table shows the distribution of comorbid conditions in CKD patients on hemodialysis. Hypertension (HTN) is the most common comorbidity, affecting 62.9% (n=34) of patients, followed by diabetes mellitus (DM) at 18.5% (n=10). Cardiovascular diseases (CVD) and hepatitis C (HCV) are present in 5.5% (n=3) and 7.4% (n=4) of patients, respectively. Other conditions like hearing loss and ischemic heart disease (IHD) are less prevalent, with 1.8% (n=1) and 3.7% (n=2) of patients affected. Housewives (55%) constitute the largest group among patients, followed by those in business (15%) and various labor-intensive jobs. Post-dialysis, unemployment rises to 32.5%, with a shift toward inactivity and retirement (7.5% and 5%, respectively). The mean initial income for patients with hemodialysis was 9,007.5 ± 13,025.3, ranging from 0 to 50,000. After dialysis, medium consumption dropped significantly to 2,050 ± 4,872.5, with the range from 0 to 20,000. This decreases by 77.2% to a decrease in middle income. This indicates severe financial difficulties likely due to job losses or poor work ability. [Table 2]

Table 2: Distribution of Study Population Based on Comorbid Conditions, Occupation, and Income Among CKD Patients on Hemodialysis

Comorbid Conditions, Occupation, and Income	**(n, %)**
Comorbid Conditions	
HTN	34, 62.9%
DM	10, 18.5%
CVD	3, 5.5%
HCV	4, 7.4%
Hearing Loss	1, 1.8%
IHD	2, 3.7%
Prior Occupation	
Housewife	22, 55.0%
Business	6, 15.0%
Auto Driver	2, 5.0%
Electric Mechanics	2, 5.0%
Expatriate	1, 2.5%
Farmer	1, 2.5%
Labor	1, 2.5%
Private Job	1, 2.5%
Teacher	1, 2.5%
Unemployed	1, 2.5%
	2, 5.0%
Post Occupation	
Housewife	22, 55.0%
Unemployed	13, 32.5%
Retirement	3, 7.5%
Inactive	2, 5.0%
Prior Income	
Mean ± SD	9007.5 ± 13025.3
Minimum	0

Maximum	50000
Post Income	
Mean ± SD	2050 ± 4872.5
Minimum	0
Maximum	20000

This table presents data on the dialysis access methods, frequency and tenure among CKD patients. A majority of patients (80%, n=32) use arteriovenous fistulas (AVF) for dialysis access, with fewer patients relying on jugular vein catheters (JVC) and permanent catheters (5%, n=2 each). Regarding dialysis frequency, 52.5% (n=21) undergo dialysis once a week, while 20% (n=8) and 17.5% (n=7) have twice and four times weekly sessions, respectively. The tenure of dialysis varies, with a minimum of 1 year, a maximum of 36 years, and a mean of 10.9 ± 10.4 years. These findings highlight a preference for AVF access and a higher incidence of less frequent dialysis sessions among the patient group. [Table 3]

Table 3: Distribution of Dialysis Access Methods, Frequency of Sessions, and Tenure in CKD Patients

Access of Dialysis (in years)	**(n, %)**
AVF	32, 80.0%
FVC	2, 5.0%
JVC	4, 10.0%
Permanent Catheter	2, 5.0%
Dialysis Frequency Distribution	
≤ 48 (Weekly Once)	21, 52.5%
> 48-96 (Weekly Twice)	8, 20.0%
> 96-144 (Weekly Thrice)	4, 10.0%
> 144 (weekly four times)	7, 17.5%
Tenure of Dialysis	
Minimum	1
Maximum	36
Mean	10.9 ± 10.4

This table provides insights into the financial sources and expenditure patterns of CKD patients undergoing dialysis. The majority of patients rely on relatives (50%, n=20) to fund their dialysis treatment, followed by family members (27.5%, n=11), savings (32.5%, n=13), and property sales (12.5%, n=5). Monthly expenditure on dialysis ranges from a minimum of 5,800 BDT to a maximum of 33,600 BDT, with a mean of 19,425±5,298 BDT. The expenditure per dialysis session ranges from 1,800 BDT to 5,000 BDT, with a mean of 2,588 ± 655 BDT. [Table 4]

Table 4: Distribution of Study Population Based on Sources and Monthly Expenditure for Dialysis Treatment

Sources and Monthly Expenditure for Dialysis Treatment	**(n, %)**
Source Expenditure	
Family Members	11, 27.5%
Relatives	20, 50.0%
Savings	13, 32.5%
Property Sales	5, 12.5%
House Rent	2, 5.0%
Others (e.g., Donor, Savings, Business)	3, 7.5%
Monthly Expenditure	
Minimum	5800 BDT
Maximum	33600 BDT
Mean	19425 ± 5298 BDT
Expenditure Per Dialysis	
Minimum	1800 BDT
Maximum	5000 BDT
Mean	2588 ± 655 BDT

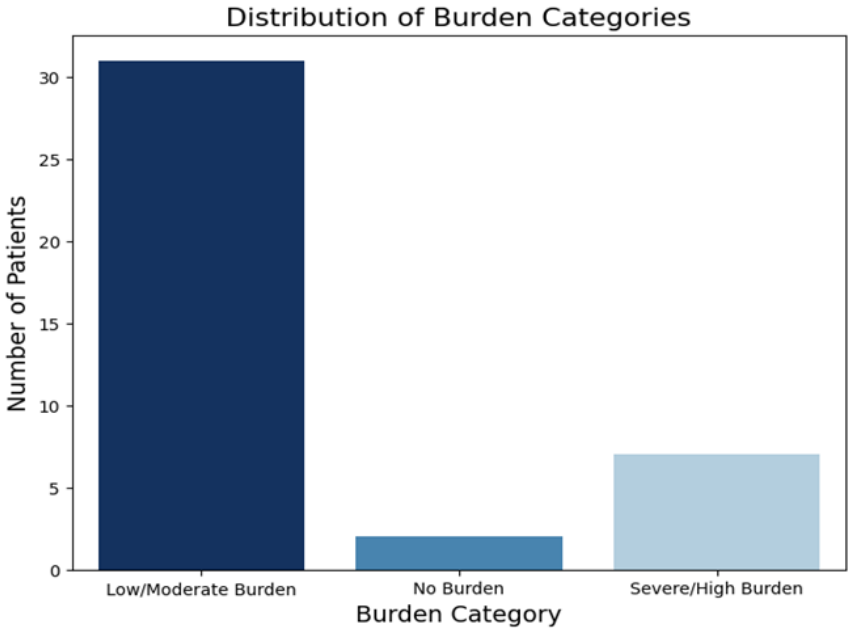

Figure 1: Distribution of Burden Categories Among CKD Patients Undergoing Dialysis Treatment

The bar plot presents the distribution of burden categories among patients undergoing dialysis and CKD treatment. "Low/Moderate Burden" (31) is the most prevalent category, suggesting that many patients adapt to treatment with manageable difficulties. In contrast, "Severe/High Burden" (7) represents patients who face significant financial distress, potentially use to treatment costs and the associated effects on their families. While "No Burden" (2) is the least reported, showing that very few patients experience no financial difficulties in pre and post-treatment. [Figure 1]

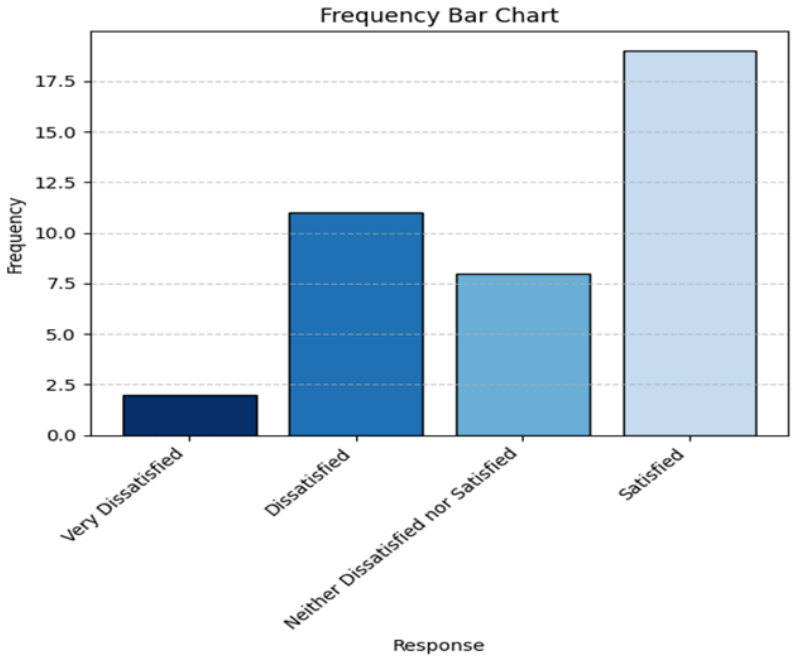

Figure 2: Frequency Distribution of Satisfaction with Current Quality of Life After Dialysis and CKD Treatment

The bar plot shows the frequency distribution of satisfaction responses with their current quality of life after dialysis and CKD treatment. "Satisfied" (18) is the most frequent response, indicating that a significant portion of patients perceive an improvement in their well-being. However, "Dissatisfied" (11) and "Neither dissatisfied nor Satisfied" (8) responses suggest that a considerable number still experience challenges. "Very Dissatisfied" (2) is the least common, highlighting that extreme dissatisfaction is rare. [Figure 2]

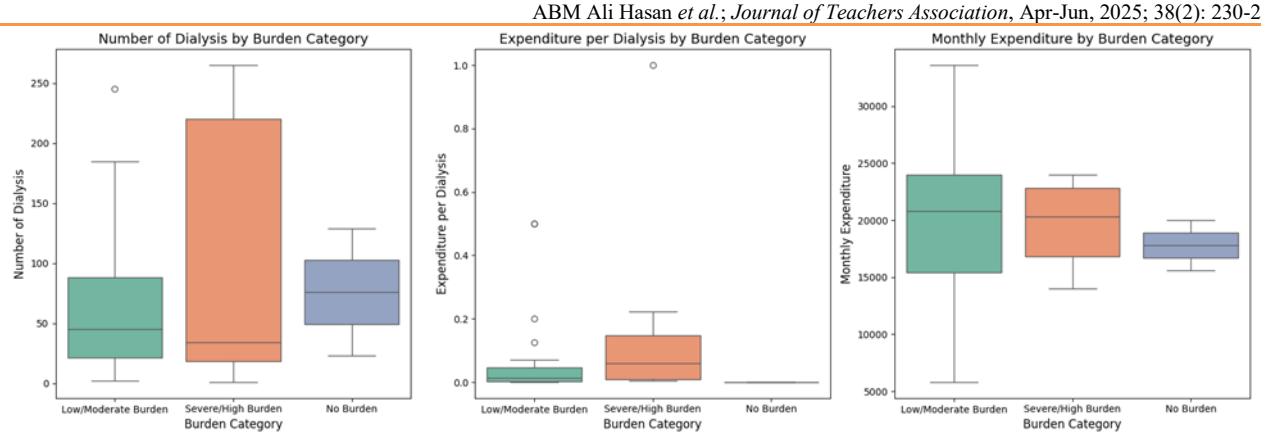

Figure 3: Boxplot Showing Economic Strain on Families of CKD Patients Undergoing Hemodialysis Across Different Burden Categories

The boxplot highlights the economic strain on families of chronic kidney disease (CKD) patients undergoing hemodialysis, showing significant variations in dialysis frequency, per-session expenditure, and overall monthly costs across different burden categories. Severe/High Buren patients undergo the most dialysis sessions, with a mean above 150, while Low/Moderate Burden and No Burden groups have lower medians, around 100 and 50, respectively. Variability is highest in Severe//High Burden (IQR ~ 100-200), and outliers in Low/Moderate Buren excess 200 sessions. Expenditure per dialysis is highest for Severe/High Buren (median ~0.6), while No Burden has the lowest (~0.4), with extreme values surpassing 0.8-1.0 in outliers. Monthly expenditure follows a similar trend, with Severe/High Burden and Low/Moderate Burden medians around 20,000, while No Buren is below 15,000; however, some outliers in Low/Moderate Burden exceed 30,000; indicating a few patients bear disproportionately high costs. [Figure 3]

The statistical analysis reveals a significant association between the economic burden on families of CKD patients undergoing hemodialysis and their quality of life. The Chi-Square test (14.35, p=0.026) confirms a significant link between burden category and quality of life, with Cramer's V (0.4235) indicating a moderate strength of this association. Additionally, the Spearman correlation (-0.3944, p=0.0118) highlights a significant negative correlation between total burden score and quality of life, suggesting that as the economic burden increases, the quality-of-life decreases. [Table 5]

Table 5: Statistical Analysis of the Association Between Burden Category and Current Quality of Life.

Statistical Test	Statistics	P-value	Degree of Freedom	Conclusion
Chi-Sqaure Statistics	14.3481	0.0260	6	Significant association between Burden Category and Current Quality of Life
Cramer's V	0.4235	N/A	N/A	Moderate strength of association between Burden Category and Current Quality of Life
Spearman Correlation	-0.3944	0.0118	N/A	Significant correlation between Total Burden Score and Current Quality of Life.

DISCUSSION

In the study of Biswas *et al*., out of 105 patients, 73 (69.5%) were male and 32(30.5%) were female, yielding a male-to-female ratio of 2.28:1, with the majority of patients aged between 41 and 60 years, and 42 (40.0%) belonging to the upper middle class, while 35 (33.3%) patients financed their treatment with external help, and 33(31.4%) sought treatment abroad, contributing to substantial financial burdens on these individuals.[10] In study of 111 patients undergoing maintenance hemodialysis, 70 males and 41 females (aged 25-77, mean 46.97±7.51 years) were analyzed, where hospital expenses were the highest in the employee medical insurance group ($p<0.005$).[3] In contrast, our findings from this study finds higher representation of females (55%, n=22) compared to males (42.5%, n=17) in this study contrasts with the predominance of male patients (69.5%) in the earlier cohort. Even with 45% (n=18) of patients having secondary education and 35% (n=14) possessing only primary education, this study reflects a similar trend in education levels seen in the previous cohort, where a significant proportion of patients belong to lower socioeconomic classes, affecting their access to healthcare. A significant relationship was found between caregiver burden and caregiver gender [$\chi^2(3) = 9.8$, $p = 0.02$], caregiver education [$\chi^2(12) = 44.28$, $p<0.01$], caregiver age [$\chi^2(3)=9.8$, $p=0.002$], and patient age [$H(3)=8.15$, $p=0.04$], with caregiver burden also correlated with depression severity in patients [$\chi^2(12) = 67.20$, $p<0.01$; $\rho(49) = 0.435$, $p < 0.01$].[6]

Even, patients with CKD face a 35% increase in healthcare costs, with 40% requiring dialysis and 18% undergoing kidney transplants, while 60% report a decreased quality of life and 45% experience mental health issues like anxiety and depression.[11] In our study, with 50% relying on relatives to fund dialysis and a mean monthly expenditure of 19,425 BDT. This economic burden negatively correlates with their quality of life (Spearman correlation = -0.3944, p=0.0118), highlighting that higher financial strain leads to poorer quality of life outcomes. Consequently, the study of showed that a 1% increase in healthcare expenditure relative to GDP corresponds to decrease of 0.023 in the HD/PD ratio, demonstrating a clear relationship between healthcare spending and dialysis modality costs, while other variables, such as local manufacturing and private healthcare spending, further influence these costs across countries.[12] In this study, Hypertension (62.9%) as the most common comorbidity among CKD patients on hemodialysis, with a 77.2% income decline post-dialysis, indicating severe financial distress due to job loss or reduced work capacity. Research of Barbosa *et al*. supports that the post-income burden on CKD patients undergoing hemodialysis is significant, as reduced work status (17.02%) and a low burden score (41.22%) highlights the economic and emotional challenges they face.[13] Similarly, patients who received hemodialysis showed significant changes in hospitalization rates, with decreases in admissions for conditions like type 2 diabetes, pneumonia, and bacteremia, while increases were observed for essential hypertension, anemia, and hyperkalemia.[14] Economic strains were evident, as individuals in the more advanced stages of CKD, particularly stage 3 with albuminuria (20%), and stage 4/5 CKD (66.7%), were more likely to be in lower income quintiles compared to those with normal/low normal kidney function (13.6%). This association highlights the compounded challenges faced by CKD patients in terms of health and economic wellbeing.[15-31]

Limitation of the Study

This study is limited by its small sample size, which may not fully represent the broader CKD population in Bangladesh. Additionally, the reliance on self-reported financial data may introduce bias. The study also lacks longitudinal data to assess the long-term economic impact of CKD treatment on families.
Recommendation.

CONCLUSION

The study highlights the substantial economic burden of hemodialysis on CKD patients and their families in Bangladesh, revealing high treatment costs and financial strain. The findings emphasize the need for targeted interventions to alleviate these financial challenges, particularly through improved access to affordable healthcare and financial support systems. The research calls for a comprehensive approach to address the rising costs of treatment and its impact on family livelihoods. Ultimately, reducing the financial burden can enhance the quality of life both patients and their caregivers.

Recommendation

It is recommended that policymakers implement financial support programs for CKD patients, focusing on reducing the economic burden of hemodialysis through subsidies and insurance schemes. Additionally, enhancing public awareness and improving access to affordable healthcare options could alleviate the financial strain on both patients and caregivers. Further studies with larger sample sizes and longitudinal data are also needed to better understand the long-term impact of CKD on financial well-being.

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Authors' contributions

ABMAH, SM, DH: Concept and design, data acquisition, interpretation and drafting. SB, MSHT, TB and MRH: Data acquisition, interpretation, drafting, final approval and agree to be accountable for all aspects of the work.

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