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Diabetic Foot Amputation at Colonial War Memorial Hospital from 2017- 2021, Suva, Fiji: A Mixed Method Study

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Abstract:

Introduction: Over 1 million lower limb amputations occur worldwide each year as a result of diabetes, making it a global public health crisis. High rates of diabetic foot amputations occur in the Pacific countries of Solomon Islands, Nauru, and Vanuatu. From 2017 to 2021, this study intends to comprehend the prevalence, clinical features, and demographics of diabetic foot amputation at CWM Hospital.

Method: A sequential mixed-method study was carried out in the Post Anesthesia Recovery Unit (PARU) at CWM Hospital in Suva, Fiji. A retrospective descriptive analysis was conducted in the quantitative phase to ascertain the five-year (2017–2021) prevalence of diabetic foot amputation. An extensive semi-structured interview guide was utilized to gather data on the 20 amputees in the four amputation kinds (toe, forefoot, below-knee, and above-knee) groups for the study's qualitative phase.

Results: According to the report, there are 10662 diabetic foot amputations for every 100,000 people in Fiji over a 5-year period. Male amputees with type 2 diabetes make up the majority. Amputation rates rise with age, and there is a high correlation between HbA1c, gender, and ethnicity. While knowledge, financial support, and helpful healthcare professionals promote drug adherence, coping techniques include social, behavioral, and physical support.

Conclusion: In Fiji, diabetic foot amputation is a serious health issue that calls for prompt, high-quality diabetes screening and the right kind of therapy. Given the rising occurrence of amputations in the 18–50 age range, it is critical to comprehend coping strategies and medication non-adherence to control diabetes and avoid complications such as foot amputations.

Keywords: *Diabetes mellitus, diabetic foot amputation, forefoot amputation, below knee amputation, above knee amputation, toe amputation, lower extremity amputation*

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1. INTRODUCTION

Diabetes is a major cause of death and disability in the Pacific area and Fiji, making it a global public health concern. According to a survey, 415 million people had diabetes mellitus in 2015, an 8.8% rise from the year before. Diabetic foot infections are the cause of up to 75% of lower extremity amputations. With 989 procedures performed in 2017, New Zealand saw a 13% increase in diabetic amputations in the Pacific area. Most of the 4,400 diabetes-related amputations performed in Australian hospitals are preventable. In Fiji, type 2 diabetes affects 44.8% of those 40 years of age and over. In Fiji, there were three DFA per day in 2017 compared to two per day in 1996 (6). The average age of initial amputation was 58.4 years, and the duration of type 2 diabetes was 9.5 ± 5.7 years, according to a study involving 649 participants. Males (55%) and Indigenous Fijians (71.8%) were more likely to have major amputations, and the causes included low hemoglobin, septicemia, midfoot lesions, poor RBS levels, and a history of hypertension.

2. OBJECTIVES

Over a five-year period (2017–2021), the study aims to determine the prevalence, demographics, and clinical characteristics of Diabetic Foot Amputation (DFA) at the Colonial War Memorial (CWM) Hospital in Suva, Central Division, Fiji. The coping mechanisms and medication compliance of DFA patients at CWM Hospital in Suva, Fiji, from 2017 to 2021 are also examined in this study. Furthermore, this study combines qualitative and quantitative data to provide a comprehensive understanding of the prevalence of diabetic foot amputation, patient coping mechanisms, and medication adherence at the CWM Hospital.

3. METHODOLOGY

A mixed-methods study was carried out at the Post Anaesthesia Recovery Unit (PARU) at CWM Hospital in Suva, Fiji, to explore the prevalence and impact of diabetes-related foot amputations (DFA). The study was conducted in three phases. First, the quantitative phase involved a retrospective analysis of data from PARU's records over a five-year period (2017–2021), examining the prevalence of the diabetic risk population among the 15,146 patients treated at the hospital. This data was collected using a data extraction sheet to track trends in patient demographics.

The second phase focused on the qualitative aspect, where in-depth interviews were conducted with 20 patients who had undergone amputations due to diabetes. The interviews explored their coping strategies and adherence to diabetes medication, using a semi-structured interview guide to gather detailed insights.

The final phase will bring together the findings from both the quantitative and qualitative phases through triangulation. This process will involve comparing and contrasting the data to draw comprehensive conclusions and provide recommendations based on the combined results.

I. Inclusion Criteria

All patients who underwent a diabetic foot amputation (DFA) at Colonial War Memorial (CWM) Hospital in Suva, Fiji, between 2017 and 2021 were aged 18 or older. For the qualitative part of the study, participants were selected based on their ability to actively participate in an interview.

II. Data Collection

The study involved extracting patient data from the Post Anaesthesia Recovery Unit (PARU) register at CWM Hospital, covering the period from 2017 to 2021. The quantitative data was then analyzed using Epi Info version 7.2 software. For the qualitative phase, participants gave their consent by signing a form, and interviews took place in a comfortable and private setting. A semi-structured interview guide was used to explore participants' experiences, coping strategies, and adherence to diabetes medication. Interviews were conducted in English, Hindi, or i-Taukei, and were recorded for quality assurance. Participants were assigned pseudonyms, and the recordings were transcribed into English or Hindi. After each interview, participants were thanked for their time before the recording was turned off.

III. Data Analysis

The study utilized EPI Info software to conduct quantitative analyses on diabetic foot amputation (DFA) patients at CWM Hospital from 2017 to 2021. Descriptive statistics were employed to summarize the demographic and clinical characteristics of the patients, and the data were presented through bar and line graphs for better visualization. The prevalence of DFA was determined by dividing the number of DFA cases by the total population during the study period.

The formula for calculating prevalence is:

$$\textbf{Prevalence} = \frac{\text{Total number of amputees per year}}{\text{Total number of diabetic patients attending CWM per year}} \times 100\%$$

In the qualitative analysis, the study followed the six steps of thematic analysis as outlined by Braun and Clarke (2006). Thematic analysis is a method used to identify, analyze, and interpret patterns or themes within qualitative data, and it is widely employed in qualitative research (Braun & Clarke, 2006). This approach is particularly useful when working with diverse data, as it is straightforward for researchers to apply and offers flexibility in how the analysis is conducted.

4. Results

I. Quantitative Results

Demographic Characteristics of DFA Patients

Between 2017 and 2021, a total of 15,146 diabetic patients at Colonial War Memorial Hospital underwent diabetic foot amputation (DFA). Of these, 1,615 (10.6%) required amputations. The majority of cases (54%-68%) were male, with i-Taukei and Indo-Fijian patients being the most common ethnic groups. The incidence

of amputations increased with age, and 99% of the cases were associated with type 2 diabetes. HbA1c testing was conducted for 49%-56% of the patients.

Table 4.1: Demographic Characteristics of Diabetic Patients with Foot Amputations (2017–2021) in the Central Division, Fiji

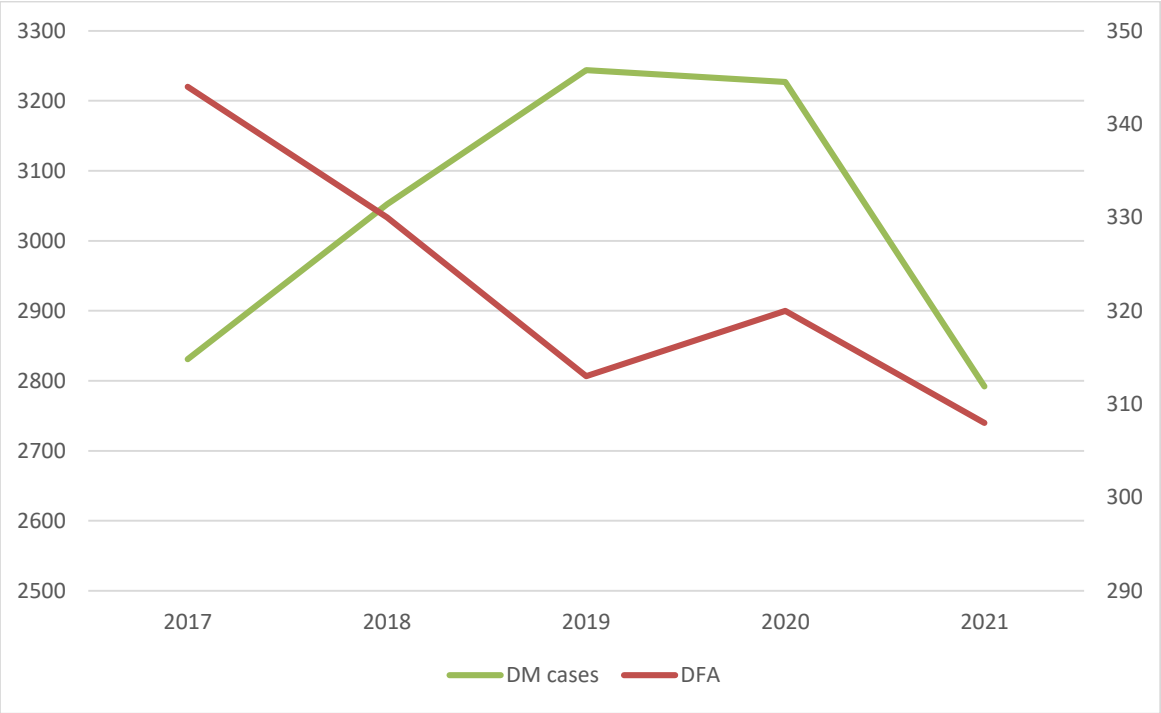
Year	2017 (n=344)	2018 (n=330)	2019 (n=313)	2020 (n=320)	2021 (n=308)	Total (n=1615)
Gender-Males	199 (57%)	181 (54%)	166 (53%)	197 (61%)	186 (60%)	929 **(57%)**
Females	145 (43%)	149 (46%)	147 (47%)	123 (39%)	122 (40%)	686 (43%)
Ethnicity						
i-Taukei	267 (78%)	245 (74%%)	217 (69%)	233 (73%)	229 (74%)	1191**(74%)**
Indo-Fijian	75 (22%)	77 (23%)	90 (29%)	76 (24%)	76 (25%)	394 (24%)
Others	2 (1%)	8 (3%)	6 (2%)	11 (3%)	3 (1%)	30 (2%)
Age-18-24	4(1%)	3(0.90%)	5(1.6%)	2(0.6%)	1(0.32%)	15(0.93%)
25-40	22(6%)	17(5%)	21(6.7%)	21(6.6%)	20(6.5%)	101(6.3%)
41-50	39(11%)	26(7.9%)	39(12.5%)	42(13%)	46(15%)	192(11.8%)
51-60	116(34%)	110(33%)	84(26.8%)	76(24%)	108(35%)	494(30%)
60+	163(47.4%)	174(52.8%)	164(52.4%)	179(56%)	133(43%)	813(50%)
Types of Diabetes						
Type 1	0 (0%)	1(0%)	1 (0%)	1 (1%)	0 (3.7%)	3(1%)
Type 2	353 (100%)	329 (100%)	312 (1%)	319 (99%)	308 (99%)	1612**(99%)**
HbA1c						
Test was done	170 (49%)	147(46%)	154(51%)	171(53.5%)	175(56%)	**822(51%)**
Test was not done	174 (51%)	183(54%)	154 (49%)	149 (46%)	133 (44%)	793 (49%)

Prevalence of Diabetic Foot Amputation

The overall prevalence of diabetic foot amputation during the 5 years was 106.6 per 1000 diabetic patients, or 10.6%. The prevalence for each year was as follows: 122 for 2017, 108 for 2018, 97 for 2019, 99 for 2020, and 110 for 2021. Figure 4.1 shows the number of amputations that decreased gradually from 2017 to 2019 but experienced a slight increase from 2019 to 2020 rather than a decrease from 2020 to 2021, which shows a downward trend in terms of diabetic foot amputations. In 2017, the prevalence rate was approximately 122 per 1000 population, indicating a relatively higher burden of DFA within the population. From 2018 to 2019, the prevalence rates relatively decreased, with rates of approximately 108 and 99 per 1000 population, respectively. In 2020, there was also a slight increase in the prevalence rate to approximately 99 per 1000 population. However, in 2021, there was a notable increase in the prevalence rate to approximately 110 per 1000 population, reflecting a higher burden of DFA over the past three years.

A continuous reduction in the prevalence of DFA from 122 cases per 1000 population in 2017 to 110 cases per 1000 population in 2021. The 5-year trend test in the prevalence of DFA (*tau* = -0.698, $P < 0.05$) indicated a significant downward trend for the three years in the prevalence of DFA, with an overall annual decreasing rate of 25 DFA cases per 1000 people.

Figure 4.1 Prevalence of DFA and projected at-risk of diabetic population from 2017 to 2021.



In 2017, the prevalence of diabetic foot amputations was high in comparison to the cases seen at CWM Hospital. In 2018, the number of diabetic cases presented increased, with the number of diabetic amputations decreasing. In 2019, the number of diabetic cases further increased while diabetic amputations decreased. The decreasing trend shows there was adequate health education on diabetic foot care. In 2020–2021, the number of diabetic cases with diabetic amputations is generally decreasing. The reason for the decreasing trend is the COVID-19 outbreak. At this time, people in the central division were mostly advised to stay at home to restrain their movements. Therefore, further study will be needed to show the trend for diabetic amputation in the post-COVID period.

Diabetic foot Amputation Trend and Type-Specific Prevalence

From 2017 to 2021, diabetic foot amputation (DFA) prevalence varied across different types, with below-knee amputation (BKA) having the highest prevalence rates at 45-66 per 1000 population. Toe amputations consistently had the highest prevalence rate, while partial foot amputations (FFA) showed lower rates. BKA showed a decreasing trend, suggesting potential positive impact of interventions. Above-knee amputations (AKA) had the lowest prevalence rates, with a lower incidence compared to other types of DFA. These findings suggest the need for interventions to reduce BKA need.

Table 42 Prevalence of DFA and type-specific prevalence by each year, Central Division, Fiji

Year	TA[1]	FFA[2]	BKA[3]	AKA[4]	Total Amputation	Number of Diabetic Patients at CWM Hospital	Prevalence (%)
2017	93 (3.2%)	37 (1.3%)	187 (6.7%)	27 (1.0%)	344	2831	12.2%
2018	96 (3.2%)	23 (0.8%)	184(6%)	27 (0.9%)	330	3052	10.9%
2019	86 (2.7%)	20 (0.6%)	182 (5%)	25 (0.8%)	313	3244	9.1%

2020	123 (3.8%)	25 (0.8%)	146 (4.5%)	26 (0.8%)	320	3227	9.9%
2021	89 (3.2%)	29 (1%)	152 (5%)	38(1.4%)	308	2792	10.6%
Total	**487**	**134**	**851**	**143**	**1615**	**15146**	**10.6%**

Table: note; 1 - Toe Amputation; 2 - -Forefoot amputation, 3 – Below-knee amputation, 4-Above-knee amputation

II. Qualitative Results

Demographic characteristics

Table 4 shows the demographic data of the 20 respondents that were surveyed. There were 14 males and 6 females. The age range for DFA was 18 to 78 years. The majority of the patients were in the age group of above 51. In terms of educational level, the majority of participants had secondary school education, and few had obtained primary education and tertiary education. Association between health and education has been established and numerous mechanisms through which education influences health have been suggested.

Table 4.4 Respondents' demographic data, n=20.

Individual Information	Frequency	Percentage (%)
Age (years)		
18-30	1	5
31-40	1	5
41-50	4	20
51 -60	8	40
>61	6	30
Gender		
Male	14	70
Female	6	30
Ethnicity		
I-Taukei	10	50
Fijian of Indian Descent	10	50
Education Level		
Primary Level	5	25
Secondary Level	12	60
Tertiary Level	3	15

Thematic Analysis

The thematic analysis of the 20 interviewed DFA respondents produced two themes and subthemes emerging from primary themes. The themes included coping mechanisms and the medication adherence of diabetic amputees. Details of the thematic analysis for the diabetic amputee participants are presented below.

Table 4.5: Thematic Analysis for Diabetic Amputated Patients

THEMES	SUB-THEMES
Coping mechanism	Family Support (Family and friends) Behavioral and Psychological Support Physical support
Medication Adherence	Lack of Knowledge Financial support Supportive health workers
Challenges	Physical support Non-compliance to medication Traditional Belief

5. Discussion

Fiji's diabetic foot amputation (DFA) prevalence rate is 106.6 per 1000 population, higher than the global average of 139.97 to 94.82 DFA per 100,000 population. This may be due to concerns about access to appropriate healthcare services for diabetic management. Fiji spends over $400 million on non-communicable diseases annually, but COVID-19 has led to a decrease in amputations in 2021. Diabetes, a leading cause of foot amputations, contributes to the elevated rate. Efforts to improve diabetes management and foot care have shown a declining trend in specific amputation cases, but continuous efforts and monitoring of DFA trends are necessary to bring Fiji's amputation rates below the global average. The majority of amputees are male, with i-Taukei individuals having a higher risk compared to Indo-Fijian and other ethnic groups. The majority of amputees have type 2 diabetes, accounting for 99% of cases. 49% of diabetic amputees do not undergo HbA1c blood testing before amputation, which can lead to poor blood glucose control and increased risk of complications. Education plays a role in influencing health through various mechanisms, such as knowledge, healthier lifestyles, income, social support, and access to better healthcare.

I. Thematic Analysis

Family Support

Family support plays a significant role in the management of Type 2 diabetes. People with Type 2 diabetes who receive strong support from their families experience better health outcomes and improved overall well-being. The loss of a diabetic foot can be disturbing and is likely to cause significant disruption to many aspects of a person's life. As well as the expected effect on a person's mobility, individuality, and involvement in day-to-day activities, it can also have a significant impact on one's occupation, relationships, community, and leisure involvement. The literature emphasizes how family support can positively impact individuals with DFA. Managing DFA often requires lifestyle changes, such as adopting a healthy diet. Family support can involve participating in these changes together, making it easier for the individual to adhere to a healthier lifestyle. Family involvement in meal planning and preparation can also help ensure that the person with DFA has access to nutritious and balanced meals that align with their dietary needs. Family members can assist in monitoring blood sugar levels and recognizing any potential warning signs of high or low blood sugar. Families can educate themselves about DM and DFA and their management, enabling them to offer informed support and understand the challenges faced by their loved ones.

Family support fosters a positive environment for diabetic amputees, empowering them to manage their condition and promoting teamwork, which is crucial in their journey with deformity.

Behavioral and Psychological Support

Participants going through an amputation experience behavioral and psychological support as they adapt to their normal life pattern after the loss of a limb. Behavioral and psychological support are important components of the rehabilitation process and can greatly improve the participant's overall well-being and quality of life. The literature emphasizes the rehabilitation process, which includes counseling and therapy,

peer support, education and information, goal setting, body image and self-esteem, pain management, assistive devices and training (prosthetics), and long-term follow-up.

Literature explores the attitudes and experiences of foot care services in Ireland among people with diabetes and lower limb amputations. A qualitative study was done with ten participants in the age range of 40 to 72 years (mean = 58 years), with one participant having active foot disease on both feet and the other nine having LLA. This study concludes that the distress and anxiety felt by the participants in the study were reduced by the health professionals who provided sympathetic and reassuring support to the participants.

Physical Support

Physical support plays an important role in the management of DFA. Amputees who receive strong physical support from their families experience better health outcomes and improved overall well-being. Physical support after going through amputation is essential to helping individuals regain their mobility, independence, and functionality. Literature explores physical support involving a combination of medical care, rehabilitation, and assistive devices. Here are some key aspects of physical support after amputation:

By providing comprehensive physical support, individuals who have undergone amputation can optimize their recovery, regain function, and achieve a higher level of independence, ultimately leading to an improved quality of life.

Medication Adherence

The second theme specifies the medication adherence of the DFA respondents in this study, which included a lack of knowledge, financial support, and supportive health workers. Medication adherence support is an essential aspect of care for individuals who have undergone amputation, especially if they are managing other health conditions in addition to the amputation itself. Medication adherence refers to the extent to which patients take their medications as prescribed by their healthcare providers.

Lack of Knowledge

After amputation, individuals are prescribed medications for pain management, infection prevention, and other health issues. Most amputees take 10mg Glipizide twice daily and 500mg Metformin three times a day, while some take 30-unit Mixtard insulin twice a day. Glipizide, a sulfonylurea, helps control high blood glucose levels in type 2 diabetes, preventing kidney damage, blindness, nerve problems, and loss of limbs. However, many patients miss their prescribed medication due to poor adherence and lower education levels. Reasons for missing doses include forgetting to take medication on time, lack of family support, and financial constraints.

Financial Support

Amputation-related expenses, such as medical bills, prosthetic devices, and rehabilitation services, are crucial for recovery and adjusting to life with a limb loss. The Fiji Government's social welfare support scheme helps diabetic-related amputees pay for medication and taxi fares, while immediate families provide basic needs. Financial support for individuals with disabilities, including those who have undergone amputation, can be provided through government assistance programs, nonprofit organizations, workers' compensation, fundraising, and workplace accommodations. Seeking guidance from social workers, disability advocates, or support organizations can help maximize available assistance.

Supportive Health Workers

Health workers are vital in the recovery and rehabilitation of individuals after amputation. They provide empathy, information, and personalized rehabilitation plans, as well as physical therapy, prosthetic evaluation, pain management, emotional support, home adaptations, and education for caregivers. Their goal is to ensure successful recovery and patient comfort, with long-term follow-ups essential for their well-being. Their dedication to patient care and promoting independence contributes to successful rehabilitation and adaptation.

Challenges

Theme 3 highlights the challenges experienced by the diabetic foot amputees. The sub-themes that emerged were availability of physical support, medication non-compliance, late presentation and traditional belief.

Triangulation of the Two Study Methods

Diabetes prevalence in Fiji contributes to high rates of diabetic foot amputation (DFA). However, there is a declining trend in specific amputation cases. Family support is crucial for amputees' health and recovery, with spouses and children playing a significant role. The government's social welfare support scheme provides financial assistance. Poor medication adherence, including forgetting to take medication on time and lack of family support, may contribute to the high DFA prevalence rate. Healthcare workers need to keep their knowledge and skills updated through regular training and maintain resources, infrastructure, and supply chains to ensure quality foot care services.

6. Study Limitations

The researcher was not a full-time student, which was one of the study's weaknesses. He had to continue his research study while working at a health center. Information on the patients was taken from the Patis database of the Ministry of Health. Numerous patient details were not updated in the system since they had changed over time. In numerous instances, the residential location and phone number had been altered. Some patients chose not to take part in the study because they had a bad opinion of it. Although there may have been recollection bias during in-depth interviews, the researcher employed prompts and a translator to help participants remember their history of amputation. Even though the database search was fairly thorough, I double-checked to make sure this analysis each coding and analysis throughout the study. The data was obtained from the experiences of people who had amputations. However, limited information from the participants was gathered.

7. Conclusion

The research highlights health inequalities leading to diabetic foot amputations in Fiji, with a high prevalence of 106.6 DFA per 1000 population. Despite advancements in diabetes management and foot care, the central division still experiences high amputations. Family involvement and direct interaction can provide motivation and balance to amputees' quality of life. Regular HbA1c testing is crucial for improving patient health outcomes and reducing complications. Family support is essential for maintaining health and psychological well-being. Understanding coping mechanisms and promoting empathy can help amputees restore self-agency and self-worth. Poor diabetic medication adherence is also a significant issue, with over half of amputees being nonadherent. The prevalence of below knee DFA is high but somewhat declined over a 5-year period, while big toe DFA remains consistently high. Addressing these health inequalities and promoting family support is essential for improving the quality of life for amputees.

8. Recommendations

Healthcare systems can improve the care and support for individuals with diabetic foot amputations, leading to improved outcomes, increased patient satisfaction, and better quality of life. To achieve this, healthcare professionals should empower and strengthen diabetic foot clinics, providing comprehensive care, wound management, patient education, and regular check-ups. Prioritizing diabetic patients and offering emotional and social support is crucial. Post-amputation care should include dietary control, counseling services, and coping mechanisms. Social welfare packages can provide financial assistance, assistive devices, and other resources to support daily living and rehabilitation needs. Lastly, improving the staff-to-patient ratio is vital for quality care. Allocating resources to hire and train healthcare professionals can help meet the growing demands and complexities of diabetes management, including the prevention and treatment of diabetic foot complications.

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Disclaimer

The findings and conclusions presented in this study are based on data collected from CWM Hospital in the Central Division of Fiji over five years. The authors have made every effort to ensure the accuracy of the data and analysis; however, the retrospective nature of the study may limit the completeness of the data. The recommendations provided are intended to guide clinical practice and public health policy but should be implemented in consideration of local resources and healthcare infrastructure. The authors declare no conflicts of interest.

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