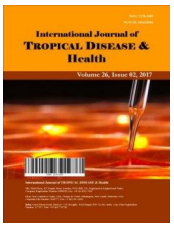

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Epidemiology of Diabetic Emergencies in the Adult Emergency Department of a Tertiary Hospital in South-Eastern Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Author GUIP did the study design and wrote the protocol. Author ANA did the statistical analysis and literature searches while analyses of study were by author GUIP. Both authors read and approved the final manuscript.

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ABSTRACT

Background: Diabetic emergencies or diabetic crises syndrome are life threatening complications of diabetes mellitus. As the case detection of diabetes mellitus increases in Nigeria, adult diabetic Nigerians are likely to be challenged by diabetic emergencies that predispose them to higher risk of disability and premature death.
Aim: The study was aimed at reviewing the epidemiology of diabetic emergencies in the adult emergency department of a tertiary hospital in South-eastern Nigeria.
Materials and Methods: This was a retrospective descriptive study that was conducted on patients who presented with diagnoses of diabetic emergencies to the emergency department of Federal Medical Centre, Umuahia, Nigeria. The sources of data were from patients' case notes; nurses report books, emergency department admission registers and medical records. Information collected were age, sex, time of presentation to the emergency department, month (season) of occurrence, type of diabetic emergency and associated cardiovascular conditions.
Results: The age ranged from 25 years to 81 years with mean age of 52.2±8.4 years. There were

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86 (55.1%) males and 70 (44.9%) females with male to female ratio of 1.2: 1. Eighty-eight (56.4%) of the patients presented during the night time, and eighty-two (52.6%) occurred during dry season. The three most common diabetic emergencies were hyperglycaemic hyperosmolar state (50.6%), diabetic ketoacidosis (41.6%) and hypoglycaemic crisis (7.8%). The most commonly associated cardiovascular condition was hypertension.

Conclusion: This study has demonstrated the variable epidemiology of diabetic emergencies with hyperglycaemic hyperosmolar state being the commonest hyperglycaemic crises syndrome, hypoglycaemic crisis the least common diabetic emergency and hypertension the commonest co-morbid cardiovascular condition. The incident occurred predominantly among the males, young adults, during dry season and most of the patients presented at night time. The emergency department data should inform the need for proactive primary care and diabetic self-management education.

Keywords: Adult Nigerians; diabetic emergencies; emergency department; epidemiology.

1. INTRODUCTION

Diabetes mellitus (DM) is a global health problem with variable distribution in developed and developing countries [1-3]. It is an endocrine-metabolic medical disorder in which there is disturbance of energy homeostasis; and chronic hyperglycaemia occurred to the extent that it has adverse effects on health leading to morbidity, premature and unnecessary mortality among humans worldwide [3,4].

The clinico-pathological features of DM are characterized by acute metabolic decompensation such as hyperglcaemic hyposmolar state (HHS) and diabetic ketoacidosis (DKA) [5,6]. The acute metabolic complications of DM are associated with volume depletion, absolute or relative insulin deficiency and acid-base derangements with potentially disastrous consequences if not detected early and treated promptly [7,8]. The clinical presentations of diabetic emergencies(DE) are variable and are dependent on the period between the onset of metabolic disturbance and presentation to the emergency department(ED) and involve features of hyperglycaemia, ketoacidosis, precipitating factors and associated clinical conditions [7-9].

The increasing burden of DM is gaining a worldwide attention and the prevalence has been reported to be on the rise globally with varying ethnic and racial distributions [1,10,11]. Research studies have shown also that DM is relentlessly increasing in economically affluent countries and at the same time creeping into middle- and low-income countries [1,3,11]. The regional prevalence of DM in Nigeria has been reportedly variable across and within different parts of the country which could be a reflection of cultural, tribal and food values [3,12-15]. However, various hospital and community-based studies in Nigeria have reported a rising prevalence in urban, semi-urban and rural areas of the country with the number of individuals, families and communities affected rising with staggering socio-economic costs [3,12,13]. The national prevalence of DM was estimated at 2.2% by the Expert Committee on non-communicable diseases in 1997 [14] and in 2011, World Health Organization estimated the prevalence of DM in Nigeria of 8.5% (6.9% in males and 10.0% in females) [15]. In a community-based study in the study area, Abia State, South-east Nigeria prevalence of DM of 3.6% was reported [16] and 4.2% was reported in a hospital-based study [12].

Diabetes mellitus is also one of the most common indications for hospital admission and case fatality in Nigeria [8,17-22] and other parts of the world such as Australia [23], India [24] and South Africa [25]. In Nigeria, DM constitutes a significant cause of medical admissions due to poorly-controlled blood glucose and other chronic complications of DM: In Enugu state, South-east Nigeria DM constituted 13.4% of medical admissions [17], and in Port Harcourt, South-south Nigeria, DM contributed to 82.0% of endocrine-related medical admissions [18]. Case fatality of DM has been reported in different regions of the country: In Port Harcourt, South-south Nigeria, case fatality of 17.2% was reported [19]; 22.6% was reported in Lagos, South-west Nigeria [20]; 40% was reported in Ilesa [21], South west Nigeria; 3.4% was reported in Ekiti, South-west Nigeria [22]; 23.7% was reported in Enugu, South-east Nigeria [17] and 3.6% was reported in Benin, South-south Nigeria [8].

Diabetes crises syndrome(DCS) or diabetic emergencies is therefore an important contributor to ED hospitalizations especially in nations in socio-economic and demographic transitions where there are limited options for standard diabetic care [17,24,25]. In Nigerian Africans, DM constituted 7.4% of cause of emergency hospitalizations among geriatric Nigerians in a rural hospital in Imo State, South-east Nigeria [26]; 32.0% ED admission was reported in Lagos, South-west Nigeria [27] and ED mortality of 16.3% was reported in adult emergency department of a tertiary health centre in Ido-Ekiti, South-west Nigeria [28] with hyperglycaemic hyperosmolar state and diabetic ketoacidosis constituting 8.9% and 3.6% of endocrine-related ED death [7].

The prevalence and pattern of hyperglycaemic emergencies have been reported among diabetic patients in Nigeria [7,8,27,29] and other parts of the world like Australia, [23] India [24] and South Africa [25]. In a retrospective study in Benin, South-south Nigeria, prevalence of hyperglycaemic hyperosmolar state of 58.3% and diabetic ketoacidosis of 41.7% was reported [8]; hyperglycaemic hyperosmolar state of 50.0% and diabetic ketoacidosis of 31.0% was reported in a prospective study in Benin, South-south, Nigeria [29]; hyperglycaemic hyperosmolar state of 64.1% and diabetic ketoacidosis of 5.3% was reported in Ido Ekiti; South-west Nigeria [7]; hyperglycaemic hyperosmolar state of 15.0% and diabetic ketoacidosis of 85.0% was reported in Lagos, South-west Nigeria [27]. In other parts of the world such as Australia, the prevalence of diabetic ketoacidosis of 55.0% and hyperglycaemic hyperosmolar state 15.0% was reported [23] while in South Africa, diabetic ketoacidosis of 70.7% and hyperglycaemic hyperosmolar state 29.3% were reported [25].

As a chronic metabolic disease requiring long term complex care, optimal management of DM involves the patients taking their prescribed anti-diabetic medications regularly, adhere to recommended diet and exercise plan as well as keeping a diary of their daily blood glucose measurements [4,12,13,30]. However, there is increasing concerns for the rising incidence of DE [4], poor blood glucose control [4] and poor knowledge of diabetes self-management among diabetic patients in the study area [4,13,31,32] and this calls for situational analysis of the epidemiological profile of diabetic patients that presented to the ED of the hospital with the aim of informing the need for proactive primary-oriented care and diabetes self-management education. It is based on this premise that the authors were motivated to review epidemiology of DE in the adult ED of a tertiary hospital in a resource-limited environment of South-eastern Nigeria.

2. MATERIALS AND METHODS

2.1 Study Design

This was a descriptive study that involved retrospective review of all cases of diabetic emergencies that presented at the Emergency Department of Federal Medical Centre, Umuahia, a tertiary hospital situated in South-eastern Nigeria from January 2008 to December 2012.

2.2 Study Area and Setting

The study was carried out at the Emergency Department of Federal Medical Centre, Umuahia, capital of Abia State, South-eastern Nigeria. Abia State is endowed with abundant mineral and agricultural resources with supply of professionals, skilled, semi-skilled and unskilled manpower. Until recently, Umuahia metropolitan City has witnessed an upsurge in the number of banks, hotels, junk food restaurants in addition to the changing socio-behavioural lifestyles.

The Emergency Department of Federal Medical Centre, Umuahia, Nigeria serves as a surgical and medical unit within the setting of the tertiary hospital. All cases of diabetic emergencies are first seen at the Emergency Department of the Medical Centre before they are admitted into the hospital wards for further management.

2.3 Selection Criteria

The inclusion criteria were the availability of required data on the case notes of patients who were admitted and managed for diabetic emergencies while patients who were brought in dead with history suggestive of diabetic emergencies were excluded from the study. The brought in dead were not recorded in the registers of Emergency Department of the hospital.

2.4 Methods

Data collection was done using data collection proforma which was developed for the study by the authors through detailed review of literature

on diabetic emergencies [1-9,23-29,33-35]. The secondary sources of data were Emergency Department admission registers and case folders of patients who were managed for diabetic emergencies. These were supplemented with data from nurses report note books. The epidemiological profile of patients who had diagnoses of diabetic emergencies were focused on patient's age, sex, time of presentation to the ED of the hospital, season (month) of occurrence, type of diabetic emergencies and associated cardiovascular conditions.

2.5 Operational Definition of Research Variables

Adult patients were classified based on their age into young adults who were aged 18-59 years and elderly patients who were aged 60 years and more [36]. The seasons of occurrence were categorized into two: rainy and dry or harmattan seasons based on the Nigerian seasonal expression [36]. Dry or harmattan season is the period from November to March while rainy season refers to the period from April to October [36]. The time of presentation to the ED was divided into two: day time was defined inclusively as the time from 6.00am to 6.00pm Nigerian time while night time refers exclusively to the time from 6.00pm to 6.00am Nigerian time [37].

2.6 Ethical Approval

Ethical certificate was obtained from the Health Research and Ethics Committee of the hospital.

2.7 Statistical Analysis

The results generated were analysed using software Statistical Package for Social Sciences (SPSS) version 13.0, Microsoft Coperation, Inc. Chicago, IL, USA for the calculation of mean, frequencies and percentages.

3. RESULTS

The age of the patients who presented with diabetic crises syndrome ranged from 25 years to 81 years with mean age of 52.2±8.4 years. There were 86 (55.1%) males and 70 (44.9%) females with male to female ratio of 1.2: 1 [Table 1].

Eighty-eight (56.4%) of the diabetic patients presented during the night time (6 pm-6 am exclusive, Nigeria time) while sixty-eight (43.6%) presented during the day time [Table 2].

Table 1. Age and sex distribution of patients with diabetic crises syndrome

Age group (years)	Sex	
	Male number (%)	Female number (%)
18 – 59	46(53.5)	36(51.4)
≥ 60	40(46.5)	34(48.6)

Table 2. Distribution of diabetic emergencies by time of presentation to the Emergency Department

Time of presentation to ED	Number (%)
Day time (6 am – 6 pm inclusive)	68(43.6)
Night time(6 pm – 6 am exclusive)	88(56.4)

Eighty-two (52.6%) of the diabetic crises syndrome occurred during dry (harmattan) Nigeria season while seventy-four (47.4%) happened during rainy season [Table 3].

Seventy-nine (50.6%) of the cases of diabetic crises syndrome were due to hyperglycaemic hyperosmolar state, sixty-five (41.6%) was diabetic ketoacidosis and twelve (7.8%) resulted from hypoglycaemic crisis [Table 4].

Table 3. Distribution of diabetic emergencies by season of occurrence

Season of occurrence of diabetic emergencies	Number (%)
Dry (Harmattan)	82(52.6)
Rainy	74(47.4)

Table 4. Types of diabetic crises syndrome among the patients

Diabetic crises syndrome	Number (%)
Hyperglycaemic hyperosmolar syndrome	79(50.6)
Diabetic ketoacidosis	65(41.6)
Hypoglycaemic crisis	12(7.8)

The most common associated cardiovascular condition was hypertension (58.3%). Others were hypertensive heart failure (35.3%) and cerebrovascular accident (27.6%) [Table 5].

4. DISCUSSION

This study has demonstrated that diabetic crises syndrome occurred predominantly among young

adults aged 18-59 years when compared with their elderly counterparts. The age of occurrence of diabetic emergencies in this study could be a reflection of the age of patients that bear the greatest burden of diabetes mellitus in developing nations like Nigeria with persons under the age of 60 years having greater complications of diabetes mellitus [1,3,33]. The finding of this study is also in consonance with age predilection for diabetic emergencies reported in some parts of Nigeria such as in Benin, South-south Nigeria [8,29]; Lagos, South-west Nigeria, [27] and Ido-Ekiti, South-west Nigeria [7,28]. Although type 2 diabetes mellitus was previously described as the disease of the old age but recent evidence showed that younger age groups are affected particularly in high risk population and they are likely to present with acute metabolic complications of diabetes mellitus [1,23,34,35]. Moreover, elderly diabetic patients in Nigeria are more likely to have more formal and informal support especially family support in taking medications, following meal pattern when compared with the young adults who are largely independent, socially and economically active [12,13,38,39]. The young adult diabetic patients are more likely to have greater aggregates and clusters of lifestyle risk factors that affect good glycaemic control when compared to the elderly diabetic counterparts [4,12,13,23,39]. The finding of this study therefore underscores the need for proactive interventions for diabetic emergencies to be applied through life course in the management of diabetes mellitus, particularly from the younger adult diabetic patients and maintained up to older diabetic patient population especially in a resource-poor environment where there are limited options for a healthy living and appropriate diabetic care.

Table 5. Associated cardiovascular conditions of diabetic emergencies among the patients

Cardiovascular conditions*	Number (%)
Hypertension	91(58.3)
Heart failure	55(35.3)
Cerebrovascular accident	43(27.6)

**Multiple cardiovascular conditions were recorded for some patients*

This study has shown that higher proportion of male patients presented with diabetic emergencies. Although gender similarities and differences have been reported for type 2 diabetes mellitus [1,3] and diabetic emergencies [23-25] in different parts of the world but male patients bear greater burden of diabetic emergency hospitalizations in Nigeria [7,28,29]. The higher prevalence of diabetic emergencies among the male diabetic patients in this study could be due to socio-behavioural and family factors [12,13,40]. However, male diabetic patients in the study area are more likely to engage in behavioural and lifestyle activities like moderate-excessive alcohol consumptions [13,33,41] and tobacco use [13,33,41] that could lead to poor blood glucose control and precipitation of diabetic crises syndrome. Of great concern in the study area is that men who had diabetes mellitus are generally more reluctant to seek treatment, non-adherent with prescribed medications and diets and attend hospitals when complications of acute metabolic decompensation have occurred [4,13]. The findings of this study therefore beckons for an urgent need for further hospital and community-driven research studies in order to understand the disparity in the gender-related emergency department presentations of diabetic patients in the study area.

Eighty-eight (56.4%) cases of diabetic emergencies presented to the Emergency Department at night time (6pm-6am exclusive). Globally, the occurrence of diabetic emergencies varies throughout the day from time to time [42-44]. However, not much is known about 24-hour time trend in the incidence of diabetic emergencies in Nigeria. The higher frequency of night presentations to the ED in this study could be attributed to delay in decision to go to hospital resulting from self-medications or delay in inter-health facility transfer of patients due to poorly equipped peripheral public and private hospital resources in the study area [26,36,37]. The elucidation of the association between diabetic emergencies and time of the day is very quintessential in various aspects of health care for diabetic emergencies and may be a necessary denominator in describing patient-related factors in access to emergency department services particularly in a resource-poor setting where there are limited options for standard diabetic care. This appears to be one of the ways adult Nigerians will benefit from pre-hospital and hospital diabetic care in emergencies as well as prevention of diabetes-related emergency department disability and premature death.

This study has shown that eighty-two (52.6%) diabetic emergencies occurred during dry or

harmattan season in Nigeria. Globally, the incidence of diabetic emergencies varies from one geo-ecological region to another and from season to season [42,43,45]. Although diabetic emergencies occurred preferentially during the dry season in this study but the evidence for a link between acute metabolic complications of diabetes mellitus and seasons of the year in Nigeria remained largely unknown and unreported in biomedical literature. However, during dry season in Nigeria, the climatic weather condition is hot with severe unfavourable ambient temperature like heat [36,37]. This may result in excessive perspiration thus predisposing to dehydration which could provoke hyperglycaemic crises syndrome among diabetic Nigerians. The role of seasonality in the occurrence of diabetic emergencies in Nigeria cannot be gainsaid in this study and this calls for further research study in other to explore the effects of season of the year on diabetic emergencies in greater detail. This will provide a resounding knowledge of the seasonality in the occurrence of diabetic emergencies for consultative purposes.

This study has shown that the most common hyperglycaemic crises syndrome was hyperglycaemic hyperosmolar syndrome. This finding is in tandem but differs in magnitude with the pattern of hyperglycaemic emergencies reported in different parts of Nigeria with hyperglycaemic hyperosmolar state accounting for substantial cause of emergency department hyperglycaemic hospitalizations followed by diabetic ketoacidosis [7,8,29]. However, this pattern is in contrast with the reports from Lagos, South-west Nigeria [27] and other parts of the world like Johannesburg, South Africa, [25] Chandigarh, India [24] and Victoria, Australia [23]. In a prospective study in Benin, South-south Nigeria, hyperglycaemic hyperosmolar state constituted 50.0% of diabetic hyperglycaemic crises with diabetic ketoacidosis contributing 31.0%; [29] hyperglycaemic hyperosmolar state of 58.3% and diabetic ketoacidosis of 41.7% were reported in a retrospective study in Benin, South-south Nigeria; [8] while in Ido-Ekiti, South-west hyperglycaemic hyperosmolar state constituted 64.1% of emergency hyperglycaemic presentations followed by diabetic ketoacidosis of 5.3% [7]. In contrast, diabetic ketoacidosis of 85.0% and hyperglycaemic hyperosmolar state of 15.0% were reported in Lagos, South-west Nigeria [27], diabetic ketoacidosis of 70.7% and hyperglycaemic hyperosmolar state of 29.3% were reported in Johannesburg, South Africa; whilst in Victoria, [25] Australia, diabetic ketoacidosis of 55.0% and hyperglycaemic hyperosmolar state of 15.0% were reported [23]. Although blood glucose control can be achieved successfully through adherence with medications and lifestyle modifications but the ultimate goal of diabetic management is to prevent the attainment of blood glucose at which emergency presentation would be considered and development of diabetic complications inevitable [4,13,33]. Research studies in Nigeria have shown that adequate blood glucose control [4,33] and lifestyle modifications [13,33] occur only in a fraction of treated diabetic Nigerians. The findings of this study has buttressed the reports that despite widespread awareness of the benefits of goal blood glucose control, concerns regarding its control to the recommended target level constitutes a major cause of worry in diabetic management in the sub-region [4,13,30,33]. Given all the complexities of physician-related and patient-related factors in the optimal management of diabetic patients in Nigeria, it appears evident that a co-ordinated multi-disciplinary and cross-disciplinary approach is needed in order to reduce acute metabolic complications of diabetes in the study area. This requires a dedicated and efficient primary-oriented care for diabetic patients. It is therefore not sufficient to prescribe anti-diabetic medications and lifestyle regimen during clinical encounter with diabetic patients, inquiry about adherence to recommended medications and other diverse care should constitute an important care package for diabetic patients. Since hyperglycaemic emergencies are life-threatening with high risk of mortality, health professionals attending to diabetic patients should be aware of these subtleties as they will affect the quality of care rendered to diabetic patients.

Twelve (7.8%) of the diabetic emergencies was due to hypoglycaemia. Hypoglycaemic crisis syndrome has been reported among diabetic patients in Nigeria [4,7] and in other studies like the United Kingdom Prospective Diabetic Study [46]. The goal of management of diabetes mellitus is to prevent acute blood glucose fluctuations and to reduce the risk of long-term complications [3,34,46]. The reasonable objective of treatment is therefore to approach normal glycaemic excursions without provoking severe or frequent hypoglycaemia [4,47]. Generally, the control of blood glucose is determined by several factors such as patient-related, family-related, and health professional-

related factors [4,12,13]. For effective management of type 2 diabetes mellitus, it is imperative that holistic approach is adopted taking into consideration the prescribed lifestyles amidst other diabetic management protocols. Although hypoglycaemic crisis has array of subjective complaints or warning symptoms [48] that may antedate the occurrence of hypoglycaemic coma but the odds associated with diagnostic utility of warning symptoms should always consider the possibility of hyperglycaemic crises [7,8]. Evidence has shown that tight glycaemic control is rarely achieved safely without provoking hypoglycaemic episodes and this could be potentially harmful [46,47,49,50]. It is therefore vital for patients, care givers and significant others to be educated on warning symptoms of hypoglycaemia and appropriate urgent interventions at home or workplace [49] or during performance of religious rites [50]. Since the risk of hypoglycaemic event outweighs the changes in the surrogate diabetic clinical endpoints, [46] prevention of hypoglycaemia should be one of the primary care concerns in addition to controlling the effects of hyperglycaemia [4,7,46,47,50]. The result of this study therefore brings to the fore, the issue of diabetic self-management education among Nigerian diabetic patients. It is therefore pertinent for physicians to be aware of the variables that cause hypoglycaemic crisis in order to determine appropriate interventional measures as well as adopting a patient-centred approach to the management of diabetes mellitus in the sub-region [51]. The knowledge of these facts is crucial and critical for optimal care of diabetic Nigerians and this will enable diabetic Nigerians benefit from remarkable increase in longevity reportedly observed among diabetic patients in developed countries.

Hypertension was the commonest cardiovascular condition associated with diabetic crises syndrome in this study. The finding of this study is in tandem with the epidemiological pattern of diabetes mellitus in Nigeria with hypertension being the most commonly associated co-morbid condition [7,8,28,33]. Although the prevalence of diabetes mellitus is influenced by aggregates of risk factors but the role of the dysmetabolism resulting from cardio-metabolic syndrome remains relevant in the aetio-pathogenesis [12,41,52]. With the rising burden of hypertension among the Nigerian populace, [52,53] the trend in the diabetic co-morbid concordance with hypertension continues unabated. There is therefore need to identify the co-existence of diabetes and hypertension among Nigerian diabetics in order to offer appropriate diabetic care in addition to other diverse cardiovascular health education, promotion and maintenance which are often neglected in the study area.

5. IMPLICATIONS OF THE STUDY

Emergency department care is one of the mainstay medical services in the survival of patients that need acute medical care particularly patients who presented with diabetic crises syndrome. In Nigeria, diabetic crises syndromes are important cause of emergency department hospitalizations. Of great concern in the study area is the myth that disability or death whether protracted or sudden from diabetic emergencies are frequently attributed to spells on the individual and the family. More so, diabetic emergencies constitute significant indications for healer shopping and patronage of traditional herbal and spiritual homes in the study area. More worrisome is the fact that a large gap remains between burden of diabetic emergencies and epidemiological profile of their presentations to the emergency department of Nigerian hospitals. The findings of this study will therefore beckon on the need for enhanced interventional measures for acute manifestations of dysglycaemic emergencies in the study area.

6. LIMITATIONS OF THE STUDY

The limitations of the study are principally those inherent to retrospective study using secondary data sources and this affected the type of data collected for epidemiological elaboration of the ED diabetic emergencies. More so, the data collected relied on the accuracy of the records. However, there is possibility that patients who were not diagnosed correctly were excluded from the study. In addition, there could be limitation of diagnostic errors resulting in misclassification of hyperglycaemic crises syndrome owing to poor standardization of laboratory diagnostic facilities.

7. CONCLUSION

This study has demonstrated the variable epidemiology of diabetic crises syndrome with hyperglycaemic hyperosmolar state being the most common hyperglycaemic crises syndrome and hypoglycaemic crisis the least common diabetic crises syndromes. The incident occurred predominantly among the males, young adults, during dry season and most of the patients presented at night time. The ED data should

therefore inform the need for proactive primary care, diabetic self-management education and other diverse diabetic services.

CONSENT

It is not applicable.

ETHICAL APPROVAL

Ethical approval was obtained from the Ethics Committee of the hospital.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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