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Full Length Research Paper

Assessment of knowledge of Ebola virus disease management of medical residents in a tertiary medical college

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The Ebola Virus Disease (EVD) outbreak in West Africa in 2014 resulted in cases spreading to other parts of the world, such as the United States of America (USA). A survey was carried out among Meharry Medical College residents to ascertain their knowledge of Center of Disease Control and Prevention (CDC) guidelines on prevention and management of EVD. A structured questionnaire was administered to a cross-section of residents at Meharry Medical College between December 2014 and January 2015. A total of 60 residents participated in the survey. Of these, 11 (18.3%) were psychiatry residents, 5 (8.3%) each were preventive and occupational medicine residents, while 13 (21.7%) and 26 (43.4%) were family and internal medicine residents, respectively. Compared to other specialties, resident physicians in occupational medicine had higher knowledge of the first step in the management of Ebola virus (EBOV) (p=0.042). On whether use of personal protective equipment (PPE) was required for individuals driving or riding in a vehicle carrying human remains of EBOV patients, only 10 respondents (16.7%) answered correctly, with preventive medicine residents performing significantly better than other physicians (p<0.0001). In conclusion, this study identified that resident physicians have a low level of knowledge regarding the presentation, prevention and management of EVD, including handling post-mortem remains. This study highlights the importance of educational interventions to improve knowledge on EVD prevention and management.

Key words: Ebola virus disease, Ebola hemorrhagic fever, infectious disease, awareness, Knowledge, attitude and perception (KAP), medical residents, knowledge, attitudes, Ebola epidemic.

INTRODUCTION

Ebola virus (EBOV) outbreaks have a devastating impact on the health care system, especially in sub-Saharan African countries with a health care system that is sub-par. An outbreak presents major challenges to these countries and their public health systems. EBOV was first discovered near the Ebola River in Zaire, now Democratic Republic of Congo in 1976 (CDC, 2015). Transmission of this virus occurs by direct contact

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through broken skin or mucous membranes; blood or body fluids of an infected Ebola patient, contaminated objects, or through infected fruit bats or primates (CDC, 2015). There have been approximately 20 outbreaks of Ebola virus in Africa with a reported fatality rate of 25 to 90% (WHO, 2015).

Previous outbreaks have been reported in the Democratic Republic of Congo (2008 to 2009, 2012, 2014), Gabon (2002), Republic of Congo (2002 to 2003), and Uganda (2007 to 2008, 2012) (Blaize et al., 2014). Ebola virus is known to be endemic in sub-Saharan Africa. The Ebola outbreak which began in March 2014 affected Sierra Leone, Liberia, Nigeria, Guinea, Mali, Spain, Senegal, and USA. Zaire Ebola virus species, which is the most active of the Ebola Virus Disease (EVDs), was reported to be the etiologic agent of the EVD in Africa (CDC, 2014). The 2014 Ebola outbreak was reported to be the largest and worst in history to date with a case fatality rate of 60 to 87% in the first few months of the outbreak (Sarwar et al., 2015). By August and October 2014, EBOV had crossed international boundaries to spread to countries in Europe and the USA respectively.

Majority of the people who had been infected with Ebola virus in the USA were those who had gone to provide supportive care for Ebola patients in Africa. The onset of reported cases of transmission in the USA resulted in the Center of Disease Control and Prevention (CDC) issuing recommendations to prevent further spread of the virus amongst USA healthcare institutions and the general public. Little is known about the knowledge, attitudes and practices of physicians in the USA and for purposes of this study in the southeast region of the USA, particularly residents who are always the first point of contact for patients that may be admitted into the hospital with EVD. This study assessed the knowledge of CDC recommendations for the prevention and management of EVD amongst resident physicians at Meharry medical college.

MATERIALS AND METHODS

Setting

The study was conducted at Meharry Medical College located in Nashville Tennessee, USA.

Study subjects

Subjects were Meharry medical resident physicians. A total of 60 resident physicians participated in the survey comprising 63.13% of the resident population (n=95). Five specialties were represented: Family medicine, internal medicine, psychiatry, occupational medicine, and preventive medicine.

Survey design and distribution

A cross sectional survey was conducted between December 2014 and January 2015. The survey questionnaire was developed based on a literature review of EVD, specifically from the CDC recommendations on the prevention and management of EVD. The study questionnaire was self-administered during a noon conference or morning report of each residency program, and the questionnaires were collected at the end of the noon conference or morning report. The first section of the survey was demographic information. The subsequent parts of the survey were testing the resident's knowledge on signs and symptoms of EVD, prevention, transmission, treatment, and handling of deceased Ebola patient. A total of 30 items developed from the literature search were tested. The survey was anonymous. The Intuitional Review Board of Meharry Medical College approved the survey after review by the Ethics Committee. There was a disclaimer reinforcing the fact that the survey was voluntary and that no identifying information will be collected to connect them to their responses.

Statistical analysis

The statistical package for social sciences (SPSS) 22.0 (SPSS Inc., Chicago, IL) was used for analysis of the data. The data from the survey were coded using appropriate data library and entered into SPSS 22.0. The data for age was grouped and entered as numerical data while the results from the study was coded using 1 for yes, 2 for no and 0 for omission. Descriptive statistics were reported in terms of percentages. Chi-square test was performed to compare answers between the residencies. $P<0.05$ was set as the statistically significant value.

RESULTS

A total of 60 residents participated in the survey. Of these, 53.3% were male, 46.7% were female, 58.3% were international medical graduates, 41.7% were American Medical Graduates and 43.3% have graduated from medical school within 5 to 10 yrs. with the remaining 56.7% graduated from medical school more than 10 yrs. (Table 1). Majority of the residents (95%) were between 25-49 years of age, with 5% that were older than 50 years of age. Post-graduate year one residents constituted 25%, post graduate year two residents 38.3%, post graduate year three residents 31.7% and post graduate year four residents 5% (Table 1).

In terms of specialty, internal medicine residents were 43.4%, family medicine residents 21.7%, psychiatry residents 18.3%, occupational and preventive medicine residents were each 8.3%. Only 6.7% of the residents correctly identified all the symptoms of EVD. A total of 58.3% of the residents believed washing hands with water or non-alcohol based hand sanitizer is a good hygiene practice. In terms of transmission, 23.7% of the residents believed that EVD could be transmitted through inhalation. With regards to management of EVD, 55% of the residents recognized isolation as the first step in the management of EVD. On whether personal protective equipment (PPE) was required for individuals driving or riding in a vehicle carrying human remains of EVD deceased patient, only 16.7% answered correctly.

There were some demographic differences that were noted such as when assessing knowledge of average

Table 1. Baseline characteristics of respondents.

Characteristics	Number (%)
Age (years)	
18-24	0 (0)
25-34	31 (51.7)
35-49	26 (43.3)
>50	3 (5)
Gender	
Female	28(46.7)
Male	32(53.3)
Specialty	
Psychiatry	11 (18.3)
Preventive Medicine	5 (8.3)
Occupational Medicine	5 (8.3)
Family Medicine	13 (21.7)
Internal Medicine	26 (43.4)
Post-graduate year	
1	15 (25)
2	23 (38.3)
3	19 (31.7)
4	3 (5)
Medical school	
USA/Canada	25 (41.7)
International	35 (58.3)
Medical school graduation year	
<5 years	24 (40)
5-10 years	26 (43.3)
>10 years	10 (16.7)

Table 2. Comparing participant's demographics with knowledge of average symptom time for Ebola virus disease.

Variable	Average symptom time		p-value
	Correct	Incorrect	
Gender			
Male	12 (52.2)	20 (54.1)	0.887
Female	11 (47.8)	17 (45.9)	
Age (years)			
18-24			
25-34	14 (60.9)	17 (45.9)	0.269
35-49	9 (39.1)	17 (45.9)	
>50	0 (0.0)	3 (8.1)	
Specialty			
Internal medicine	12 (52.2)	14 (37.8)	
Family medicine	7 (30.4)	6 (16.2)	
Psychiatry	3 (13.0)	8 (21.6)	0.172
Occupational medicine	1 (4.3)	4 (10.8)	
Preventive medicine	0 (0.0)	5 (13.5)	
Post graduate year			
1	5 (21.7)	10 (27.0)	
2	8 (34.8)	15 (40.5)	0.285
3	10 (43.5)	9 (24.3)	
4	0 (0.0)	3 (8.1)	
Medical school			
US/Canada	12 (52.2)	13 (35.1)	0.193
Foreign	11 (47.8)	24 (64.9)	
Years after graduation			
<5 years	13 (56.5)	11 (29.7)	
5-10 years	10 (43.5)	16 (43.2)	0.013
>10 years	0 (0.0)	10 (27.0)	

symptoms time of EVD (Table 2), recent graduates did better than older graduates (P=0.013). When assessing resident's knowledge of the length of time to monitor health after returning from an EVD infected area (Table 3), recent graduates did better than older graduates (P=0.015). When assessing knowledge of avoiding EVD treatment hospitals or centers (Table 4), younger residents did better than older residents (P=0.040).

When comparing resident's knowledge of first step in the management of EVD patients (Table 5), occupational medicine residents did better than the other groups of residents (P=0.042). When comparing knowledge of preventive measures in handling human remains of EVD patients (Table 6), preventive medicine residents did better than the other residents (P<0.0001). Occupational Medicine and Preventive Medicine residents did better on the knowledge of the first step of management of EVD, and on handling of human remains of deceased EVD patients respectively. Younger residents did better on knowledge of avoiding EVD treatment centers. There was no difference in knowledge of EVD with regards to EVD and the type of medical school (International Medical Graduates vs. American Medical Graduates) that the resident attended. There was no significant difference in postgraduate year levels knowledge of EVD.

DISCUSSION

Resident physicians are usually the first to see patients in most teaching institutions, and should protect themselves against infectious agents. Their knowledge of infectious agents and disease process is critical. Knowledge of EVD is not only important to residents, but to the general public as a whole.

Table 3. Comparing participant's demographics with knowledge of avoidance of Ebola virus disease treatment hospitals.

Variable	Hospital avoidance		p-value
	Correct	Incorrect	
Gender			
Male	19 (59.4)	13 (46.4)	0.316
Female	13 (40.6)	15 (53.6)	
Age (years)			
18-24	-	-	
25-34	21 (65.6)	10 (35.7)	0.040
35-49	9 (28.1)	17 (60.7)	
>50	2 (6.3)	1 (3.6)	
Specialty			
Internal medicine	15 (46.9)	11 (39.3)	
Family medicine	5 (15.6)	8 (28.6)	
Psychiatry	7 (21.9)	4 (14.3)	0.686
Occupational medicine	2 (6.3)	3 (10.7)	
Preventive medicine	3 (9.4)	2 (7.1)	
Post graduate year			
1	10 (31.3)	5 (17.9)	
2	10 (31.3)	13 (46.4)	0.535
3	10 (31.3)	9 (32.1)	
4	2 (6.3)	1 (3.6)	
Medical school			
US/Canada	11 (34.4)	14 (50.0)	0.221
Foreign	21 (65.6)	14 (50.0)	
Years after graduation			
< 5 years	9 (28.1)	15 (53.6)	
5-10 years	18 (56.3)	8 (28.6)	0.078
>10 years	5 (15.6)	5 (17.9)	

Table 4. Comparing participants demographics with knowledge of length of time to monitor health after returning from an Ebola infected area.

Variable	Length of time to monitor health		p-value
	Correct	Incorrect	
Gender			
Male	11 (73.3)	21 (46.7)	0.073
Female	4 (26.7)	24 (53.3)	
Age (years)			
18-24	-	-	
25-34	8 (53.3)	23 (51.1)	0.588
35-49	7 (46.7)	19 (42.2)	
>50	0 (0.0)	3 (6.7)	
Specialty			
Internal medicine	8 (53.3)	18 (40.0)	
Family medicine	2 (13.3)	11 (24.4)	
Psychiatry	1 (6.7)	10 (22.2)	0.436
Occupational medicine	2 (13.3)	3 (6.7)	
Preventive medicine	2 (13.3)	3 (6.7)	
Post graduate year			
1	0 (0.0)	15 (33.3)	
2	7 (46.7)	16 (35.6)	0.075
3	7 (46.7)	12 (26.7)	
4	1 (6.7)	2 (4.4)	
Medical school			
US/Canada	6 (40.0)	19 (42.2)	0.880
Foreign	9 (60.0)	26 (57.8)	
Years after graduation			
< 5 years	4 (26.7)	20 (44.4)	
5-10 years	11 (73.3)	15 (33.3)	0.015
>10 years	0 (0.0)	10 (22.2)	

Although, the 2014 West African Ebola epidemic was prevalent in the news, only 6.7% of the residents at Meharry Medical College identified all of the early symptoms of EVD. Residents exhibited poor knowledge of good hygiene practices; with 58.3% believing washing hands with water or non-alcohol, based sanitizer is a good hygiene practice.

Knowledge of any disease or condition is important. Slightly more than half (55%) of the residents recognized isolation as the first step in the management of EVD, and only 16.7% answered correctly on whether PPE was required for individuals driving or riding in a car carrying human remains of EVD deceased patient.

The results indicated that recent graduates from medical school did better on knowledge of average symptoms time of EVD and length of time to monitor health after returning from an EVD infected area. A possible explanation in the difference of knowledge between recent and older graduate could be attributed to the time lapse since the recent graduates received formal instructions on EVD versus the older graduates.

According to the authors' best knowledge, no study has directly addressed the knowledge of EVD among resident physicians in the USA, limiting comparison with an existing study. However, there have been various other studies where authors have attempted to access the knowledge of EVD among healthcare workers. Some of these studies include the work of Abebe et al. (2016) of Gondar University Hospital in Northwest Ethiopia and Narasimhulu et al. (2015) in New York City (2015).

Table 5. Comparing participants demographics with knowledge of first step in the management of an Ebola virus disease patient.

Variable	First step in management		p-value
	Correct	Incorrect	
Gender			
Male	17 (51.5)	15 (55.6)	0.755
Female	16 (48.5)	12 (44.4)	
Age (years)			
18-24	-	-	
25-34	17 (51.5)	14 (51.9)	
35-49	14 (42.4)	12 (44.4)	0.914
>50	2 (6.1)	1 (3.7)	
Specialty			
Internal medicine	11 (33.3)	15 (55.6)	
Family medicine	10 (30.3)	3 (11.1)	
Psychiatry	4 (12.1)	7 (25.9)	0.042
Occupational medicine	5 (15.2)	0 (0.0)	
Preventive medicine	3 (9.1)	2 (7.4)	
Post graduate year			
1	9 (27.3)	6 (22.2)	
2	14 (42.4)	9 (33.3)	0.685
3	9 (27.3)	10 (37.0)	
4	1 (3.0)	2 (7.4)	
Medical school			
US/Canada	14 (42.4)	11 (40.7)	0.895
Foreign	19 (57.6)	16 (59.3)	
Years after graduation			
< 5 years	16 (48.5)	8 (29.6)	
5-10 years	13 (39.4)	13(48.1)	0.288
>10 years	4 (12.1)	6 (22.2)	

Table 6. Comparing participant's demographics with knowledge of preventive measures like the use of personal protective equipment while in a vehicle carrying human remains of an Ebola virus disease patient.

Variable	PPE requirement		p-value
	Correct	Incorrect	
Gender			
Male	7 (70.0)	25 (50.0)	0.247
Female	3 (30.0)	25 (50.0)	
Age (years)			
18-24			
25-34	3 (30.0)	28 (56.0)	0.292
35-49	6 (60.0)	20 (40.0)	
>50	1 (10.0)	2 (4.0)	
Specialty			
Internal medicine	2 (20.0)	24 (48.0)	
Family medicine	1 (10.0)	12 (24.0)	
Psychiatry	1 (10.0)	10 (20.0)	<0.0001
Occupational medicine	1 (10.0)	4 (8.0)	
Preventive medicine	5 (50.0)	0 (0.0)	
Post graduate year			
1	3 (30.0)	12 (24.0)	
2	3 (30.0)	20 (40.0)	0.753
3	4 (40.0)	15 (30.0)	
4	0 (0.0)	3 (6.0)	
Medical school			
US/Canada	4 (40.0)	21(42.0)	0.907
Foreign	6 (60.0)	29 (58.0)	
Years after graduation			
< 5 years	3 (30.0)	21 (42.0)	0.499

In the first study by Abebe et al. (2016), the authors stratified Healthcare Professionals (HCP) into two groups, physicians and allied health professionals. In that study, they found poor knowledge and negative incorrect beliefs among doctors and allied health professionals (Abebe et al., 2016). The latter study by Narasimhulu et al. (2015) analyzed Healthcare Workers (HCW) attitude towards care of patients with EVD.

In this study, the authors stratified HCWs by attending physicians, resident physicians, nurses and other. The majority of participants in this study (41.2%) were nurses. This study found that there was a linkage between HCWs beliefs about EVD and their willingness to provide care to patients with EVD although this linkage was not a mirror image of their beliefs regarding whether it would be ethical to refuse care for these patients (Narasimhulu et al., 2015). The studies cited previously can add value to the results obtained in this analysis, it demonstrates that at a minimum there is limited knowledge amongst HCWs about EVD and that more training is needed for HCWs.

The data from this study indicates that recent and younger graduates had significantly better knowledge of EVD. Recent graduates are likely to be more current on evolving diseases of epidemic. They are up to date with new treatments and are more likely to apply them. A systematic review evaluating the relationship between clinical experience and quality of health care showed that in terms of current standards of care and of clinical developments, younger physicians were more up to date (Chouldhry et al., 2005).

There was no significant finding between residents who graduated from medical school outside the U.S with

those that graduated in the USA/Canada. We found no significant difference between these two groups of graduates. This was an expected finding since the 2014 West African Ebola epidemic was limited to, West Africa and previous outbreaks have been limited to Central Africa. As with the American Medical Graduates it is possible that the majority of the International Medical Graduates had not previously managed an EVD patient.

Occupational medicine and preventive medicine residents did better on the knowledge of the first step of management of EVD, and on handling of human remains of deceased EVD patients respectively. At Meharry Medical College, the occupational medicine and preventive medicine residents attend the same weekly didactic sessions. Residents are taught preventive measures and global health topics that are included in the American Board of Preventive Medicine Certification Exams. Exposure to these topics at didactics in an effort to meet the Core Competencies for the American Board of Preventive Medicine Certification Exams could possibly explain why the residents in occupational medicine and preventive medicine performed significantly better than other specialties in this aspect. It was interesting to note that the occupational medicine and preventive medicine residents at Meharry Medical College did not outperform residents in other specialties on the remaining questions. The core competencies for the American Board of Preventive Medicine is that every Occupational Medicine and Preventive Medicine resident should be proficient in achieving success in the American Board of Preventive Medicine Certification Exams which should have sufficiently equipped these residents with greater knowledge to outperform their fellow residents of other specialties.

EVD is a public health problem. The most recent epidemic has ended but from previous trend will most likely not be the last EVD epidemic in the world. It is prudent therefore for physicians to be knowledgeable about EVD and emerging diseases that have the potential to overwhelm our public health systems.

The sample size of this study was small, which might limit generalizations. In addition, since it was performed at a single institution, generalization is limited. These findings may not actually reflect the knowledge of the residents because of their busy schedule or possible lack of interest. These results should be an impetus for further research in the knowledge of EVD and emerging diseases that are of public health concern. Intervention programs such as lecture series might improve the knowledge base of residents.

Conclusion

Resident physicians have a low level of knowledge regarding the presentation, prevention and management of EVD, including handling post-mortem remains. This study highlights the importance of educational interventions to improve knowledge, attitude and practices of resident physicians in regards to management and prevention of EVD.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Full Length Research Paper

Smokeless tobacco consumption among public and heavy load drivers in Karachi, Pakistan: A cross-sectional study

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Tobacco use remains a major cause of preventable morbidity and mortality worldwide. The World Health Organization states that 19.1% of the Pakistani population consumes smoked or smokeless tobacco (SLT). Although many population focused studies have focused on the use of SLT in Pakistan, but they have failed to address the use of SLT among laborers, especially the niche population of public and heavy load drivers (that is, transporters). This study aimed to estimate the prevalence of SLT consumption among this population and the relationship of this parameter with knowledge, attitudes, and practices regarding SLT use. From a sample size of 714 participants, 615 responses were obtained, generating an overall response rate of 86%. The prevalence of SLT consumption in the study population was 93.7%; here, gutka was the most frequently consumed preparation (60.2%), followed by naswar (35.8%), paan (32.4%), and Mawa (16.7%). A masticatory habit was the most commonly cited factor leading to dependence (87.8%), followed by the influence of friends and family (83.9%), peer pressure (80.7%), and increased alertness (52.8%). However, 61.3% of participants reported experiencing strong withdrawals upon ceasing SLT use and believed themselves to be addicted and unable to quit usage. These findings suggest that for transporters, a high-risk occupational group dependent on SLT consumption, specific, tailored tobacco-cessation programs and medical assistance are needed to reduce the burden of tobacco-related morbidity and mortality.

Key words: Smokeless tobacco (SLT), tobacco use, gutka, heavy load and public drivers, transporters, Karachi.

INTRODUCTION

For approximately 20% of the human population, the chewing of betel, areca, and tobacco represents an integral component of the cultural fabric, and in such cultures, these substances have been strongly accepted

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among all age groups (Norton, 1998). Reports have described the frequent use of betel, areca, and tobacco in several areas of the South Asian subcontinent (Qidwai et al., 2002; Gupta and Sreevidya, 2004; Qureshi et al., 2013). Although more than 300 million adults in at least 115 countries consume smokeless tobacco (SLT), these products are used with particular frequency in both South and Southeast Asia. For example, SLT is used regularly by a quarter of adults in Bangladesh and India and by 16.3 and 2.4% of male and female Pakistani residents, respectively (Siddiqi et al., 2016).

In Pakistan and most other regions of the Indian subcontinent, the most popular forms of chewed product are paan, chalia, gutka, naswar, tambaku, and naas (Johnson, 2001). Although these products vary with respect to production, all share the main ingredients of betel, areca, and tobacco (IARC, 2004; Mack, 2001). In recent decades, industrially prepared substitutes for these chewing products were introduced to the market. The less expensive nature and a longer shelf life contributed to sales growth and the development of an export market for these products (Johnson, 2001). Studies of the Indian population have attributed an estimated 49 and 90% of oral cancers among men and women to chewing habits (Van-Wyk et al., 1993; Balaram et al., 2002). Similarly, a Pakistani study reported that betel, areca, and tobacco chewing were associated with an 8.5 to 10-fold increase in the risk of oral cancers, after adjusting for other covariates (Merchant et al., 2000). Consistent with the reported prevalence of SLT use, studies have estimated that 58% of all head and neck cancers worldwide occur in South and Southeast Asia (Nair et al., 2004; Ferlay et al., 2015).

To date, a small number of studies have been conducted to estimate the prevalence of chewing habits among different age and occupational groups in Pakistan (Qidwai et al., 2002; Qureshi et al., 2013). One study of hospital outpatients in Karachi City reported betel and tobacco chewing rates of 20 and 17%, respectively (Khan and Qidwai, 2013). In another study, very high rates of daily areca use in different combinations (ranging from 1.3% in a gutka mixture to 52% alone in sweetened form) were twice reported among primary school children, with increasing frequency from lower to higher grades. This finding was attributed to the lack of restrictions regarding the purchase of these products within and outside the school premises (Qureshi et al., 2013).

Another study conducted in Karachi found that approximately 40% of the participants used at least one chewed betel, areca, or tobacco product on a daily basis, with a 2.46-fold higher prevalence among males than females and 1.39-fold higher prevalence among adolescents than adults (Mazahir et al., 2006). Other population studies of SLT consumption have focused on medical students, physicians and staff at tertiary care hospitals (Imam et al., 2007; Khan and Qidwai, 2013), and residents in a squatter settlement (Mazahir et al., 2006). By contrast, no previous studies have evaluated the established prevalence of SLT consumption among transporters, a neglected population in terms of targeted anti-tobacco campaigns.

Observations suggest that majority of public and heavy load drivers (that is, transporters) chew betel quid because of its effect as a stimulant, with the intent to remain awake for longer periods of driving time. In addition, socio-cultural factors that may encourage betel quid and SLT use must be considered when studying transporters in Pakistan. To address the limited data available for this occupational group at high risk for tobacco consumption, a study was conducted in Karachi city, which encompasses a range of ethnic and socio-cultural populations from across Pakistan, with the aims of estimating the prevalence of SLT consumption among transporters and determining the knowledge, attitudes and practices associated with tobacco use in this group.

METHODS

Study design

Sampling

Twenty-one towns within Karachi were divided into three zones: Karachi East, Karachi Central, and Karachi West, each of which contained seven towns. Karachi is a metropolitan and industrial city that serves as a national economic corridor, and its population comprises diverse ethnic and cultural backgrounds. These 21 town sites are representative of this diversity. Using a reported 19.1% prevalence of tobacco consumption in Pakistan (Saqib et al., 2017), a 95% confidence interval, and 5% margin of error; the initial calculated sample size was 238. Hence, the total sample size for all three zones was set as 714.

Study population and location

Initially, 34 transporters were randomly selected for interviews from main transport stations in each of the 21 towns in Karachi. Public and industrial cargo transport stations in the following towns were sampled: Kemari, Port Qasim, Baldia, Orangi, SITE, Saddar Town, Lyari, Landhi, Karachi and Clifton Cantoment, Shirin Jinnah Colony, Akhtar Colony, Punjab Chowrangi, Malir town and Cantonment, Sohrab Goth, Safoora Goth, Korangi Town, Toll Plaza, Gulshan Town, Nazimabad Town, North Nazimabad, and North Karachi. Of the 714 approached drivers, 615 met the inclusion criteria and consented to participate in this survey, yielding an overall response rate of 86%

Operational definitions

SLT

This is also known as chewable or oral tobacco, used in the form of betel quid (pan), gutka (gutkha), mahwa (mawa), and naswar (naas).

Public drivers

These local drivers operate public buses, coaches, wagons, and

Table 1. Socio-demographic characteristics and addiction patterns of heavy load and public drivers

Demographic variables	n	Frequency (%)
Age groups		
≤ 20	43	7.0
21 - 45	493	80.2
> 45	79	12.8
Occupation		
Public drivers	476	77.4
Heavy load drivers	139	22.6
Duty hours		
Short (<6 hrs)	63	10.2
Moderate (7-12 h)	335	54.5
Long (12 -16 h)	208	33.8
Extra-Long (>16 h)	9	1.5
SES (in PKR, Pakistani Rupee)		
Low (<15000 PKR)	369	60.0
Middle (15-30000)	236	38.4
High (>30000)	10	1.6
Addiction profile*		
Tobacco Smoking (Cigarette/Bidi)	353	57.4
Alcohol	111	18.0
Gutka (Gutkha)	370	60.2
Naswar (Naas)	220	35.8
Pan (Betel Quid)	199	32.4
Bettle Nut (Areca Nut)	161	26.2
Mawa (Mahwa)	103	16.7
Perceptions regarding SLT use**		
Perception 1: Improves alertness (or Wakefulness)		
Yes	325	52.8
No	290	47.2
Perception 2: Peer pressure		
Yes	496	80.7
No	119	19.3
Perception 3: Influenced by family or community		
Yes	516	83.9
No	99	16.1
Perception 4: Masticatory habit		
Yes	540	87.8
No	75	12.2
Perception 5: Tried to quit, but addicted		
Yes	377	61.3
No	238	38.7

*(subjects were dependent on multiple addictions, thus percentages are not additive). **SLT comprise of Gutka, Naswar, Pan and Mawa only.

mini-buses (with two axles) and primarily transport passengers within cities or, occasionally, within states.

Heavy load drivers

These drivers are licensed to operate heavy (trucks/ lorries with three or four axles) and extra-heavy vehicles (oil tankers/ industrial cargo trucks with more than four axles).

Transporters

All public and heavy load drivers are generally classified under this broad category.

Duty hours

These were categorized as short (<6 h), moderate (7 to 12 h), long (>12 h), and extra-long routes (>16 h).

Socio-economic status (SES)

This factor was assessed using the average household income and ratio of family members. Specifically, SES was defined using three monthly income (in Pakistani Rupees, PKR) categories: low SES, or an income of <PKR 15000; middle class, or a PKR of 15000 to 30000; and high class, or an income of >PKR 30000.

Inclusion criteria

Licensed drivers aged 18 to 60 years were eligible to participate after consenting to complete the full questionnaire and provide details about their personal lifestyle (for example; SES, addiction history, and knowledge/attitudes related to SLT use).

Exclusion criteria

Drivers who did not provide consent or were unwilling to complete the questionnaire or disclose the required information were excluded from the study.

Ethical concerns

The study protocol was reviewed and approved by the institutional review board (IRB) of Dow University of Health Sciences. Informed and written consent (in Urdu) was obtained from each study participant prior to inclusion in the study.

Study tool

Socio-demographic information was collected using a pre-tested structured questionnaire drafted in the local language (Urdu) to facilitate comprehension.

In addition to demographic information (for example; sex, age, education, ethnicity), the participants were categorized in terms of their duty hours and SES as described in the "Operational Definitions".

An addiction profile (Table 1) was established based on the participant's smoking habits, use of betel nut, use of alcohol, and the use of the four major types of SLT (paan, gutka, mahwa, and naswar).

Table 2. Comparative analysis of "public and heavy load drivers" with "duty hours" and "SLT consumption": results of a chi-square test representing 'occupational dependence.

Factors related	Public drivers' n (%)	Heavy load drivers' n (%)	p-value (chi-square)
SLT Consumption			
Yes	441 (92.6)	136 (97.8)	0.025*
No	35 (7.4)	03 (2.2)	
Duty hours			
<6h	54 (11.3)	09 (6.5)	<0.01*
7-12h	282 (59.2)	53 (38.1)	
>12h	133 (27.9)	75 (54.0)	
Others	7 (1.5)	2 (1.4)	

*Measure of significance, p-value<0.05.

Statistical analysis

The statistical package for social science, version 21.0 (SPSS Inc., Chicago, IL, USA) was used for data entry and analysis. Frequencies and percentages were calculated to obtain summary values. Odds ratios with 95% CIs were computed using logistic regression analysis to assess the degrees of associations between the use of SLT and independent variables. Significance was set at a p-value < 0.05. Variables with p-values ≤ 0.2 in the univariate logistic regression analysis, were further included in the multivariable analysis.

RESULTS

Demographic variables

As noted above, 615 of the 714 approached transporters fulfilled the inclusion criteria (response rate = 86%) in which none of the participants were female. Table 1 presents the socio-demographic details of the study participants. All participants ranged in age from 18 to 60 years, although most of the participant (80%, n = 493) were between 21 and 45 years of age. Approximately 77.4% (n = 476) of the participants were public drivers. A comparative analysis of heavy load drivers and public drivers (Table 2) with respect to duty hours revealed that majority of heavy load drivers reported >12 h (54%), whereas majority of public drivers (59.2%) reported 7 to 12 h which is a significant difference (p-value <0.01). Among all transporters sampled, 60% (n = 369), 38.4% (n = 236), and 1.6% (n = 10) were classified as having a low, middle, and high SES, respectively.

Addiction profile

Table 1 illustrates varied addiction profile amongst which smoking of tobacco, betel nut and alcohol consumption were considered as confounding variables. Table 3 presents a detailed distribution of the use of all types of SLT, either alone or in combination. The prevalence of SLT use among the total sample of transporters was 93.7% (number of drivers using any kind of SLT divided by the total sample (n = 615) × 100). Majority of drivers (n = 328, 53.3%), used a single type of SLT available in Karachi, although 194 (31.5%) participants reported the use of two or more types of SLT. As highlighted above, participants with SLT addictions were also prone to different addiction combination patterns (Table 3) in which drivers also provided multiple responses regarding their perceptions of SLT use (Table 1). Here, roughly 96% of drivers perceived that SLT helped to improve wakefulness and improve work activity and a chewing habit was most frequently cited among the reasons for consuming tobacco products (87.8%), although a majority of participants (80.7%) also reported that they had been introduced into the habit by work colleagues. In response to an inquiry regarding attempts to quit the use of SLT, 61.3% believed that they were addicted after experiencing strong withdrawals during previous attempts to quit.

Occupational dependence

Tables 4 and 5 present the results of analyses that evaluate the relationships of socio-demographic factors with the use of SLT. In the univariate logistic regression analysis, the variables of occupation and duty hours were found to significantly associate with SLT use (respective p-values: 0.009 and 0.0374). Furthermore, the likelihood use of SLT was 1.46 times higher among transporters with duty hours of 7 to 12 (COR: 1.457, 95% CI: 0.831 to 2.544). Similarly, duty hours > 16 induced 3.7 times higher chances use of SLT as compared to transporters with shorter duty hours (COR: 3.727, 95% CI: 0.849 to 16.36) (Table 4). Subsequently, independent variables with p-values ≤0.2 in the univariate analysis were included in the multivariable analysis (Table 5). It was found that the risk of use of SLT among heavy load drivers was 0.634 times versus public drivers (p-value = 0.033). Although moderate, long and extra-long duty

Table 3. Distribution of smokeless tobacco (SLT) type consumption among heavy load and public drivers

Types of SLT (n=615)	Frequency	%
Single Item Users	328	53.3
Combination of two items users	194	31.5
Paan + Gutka	74	12
Paan + Naswar	16	2.6
Paan + Mawa	10	1.6
Mawa + Gutka	27	4.4
Mawa + Naswar	13	2.1
Gutka + Naswar	54	8.8
Combination of three items users	41	6.7
Paan + Gutka + Mawa	9	1.5
Paan + Mawa + Naswar	8	1.3
Paan + Gutka + Naswar	17	2.8
Gutka + Mawa + Naswar	7	1.1
Combination of all four items users		
Gutka+ Mawa + Naswar + Paan	13	2.1
Non users	39	6.3

hours were found to significantly associate with use of SLT in the univariate analysis but this significance was not retained in the multivariable analysis.

DISCUSSION

Oral lesions related to SLT consumption are a significant source of morbidity and mortality and have been identified as the sixth-most common cause of head and neck cancers in Southeast Asia (WHO, 2009). In Pakistan, laborers and individuals with a low SES face a considerable risk of oral malignancy due to the increasing prevalence of oral tobacco use. Our study findings indicate that effective measures to enhance awareness among SLT consumers are urgently needed to reduce the burden of this habit on overall health.

In this study, we evaluated a population of mostly younger male drivers. Our population was similar to that of a previous Indian study in which the majority of study population, which comprised mostly of laborers, followed by drivers and businessman, ranged in age from 20 to 30 years (Narasannavar and Wantamutte, 2014). Similarly, a study conducted of so-called blue collar workers (that is, construction trades, maintenance/repair, production/machinery, transport/material moving) in the USA aimed to highlight occupational dependence on SLT and found that this relationship was most prevalent among the construction trades (Noonan and Duffy, 2014). By contrast, the current study focuses on the niche population of public and heavy load drivers, which is highly dependent on SLT consumption and has been neglected in previous Pakistani studies.

Furthermore, our study coverage of all 21 towns within the metropolis of Karachi is a major strength. Specifically, Karachi serves as the port and largest city of Pakistan and features the highest levels of commercial and business activity, as well as a highly ethnically and culturally diverse population. Therefore, the results from our sample can be easily generalized at a regional level.

Since initiating our study in 2015, extensive search of the related literature has been conducted and accordingly very recent Nepalese study (Saroj et al., 2017) of bus drivers and their staff was identified, which serves as a stepping stone toward highlighting this neglected population. However, the results of that study could not be generalized, as the sample was limited by localization to a single bus station and lacked evidence to indicate occupational dependence. By contrast, this study is unique in highlighting occupational dependence on SLT and proving a statistical relationship between stressful, prolonged duty hours and SLT dependency among public drivers. Furthermore, analysis revealed a statistically greater dependence on SLT use among public drivers, who are more subject to the stresses of heavy (usually urban) traffic, hectic routines, and time zone pressures relative to heavy load drivers, who drive largely in areas with comparatively little traffic congestion (that is, highway routes). It was found that duty hours were an important factor with respect to a dependence on SLT, particularly for those reporting at least moderate duty hours.

Notably, the use of SLT was significantly higher among heavy load drivers with duty hours exceeding 16 h, likely indicating a dependence on SLT products to refresh their minds and relieve the stress of continuous driving. It was also observed that a strong prevalence of low SES was found in this study and similar to the prevalence observed in a previous Pakistani nationwide study (Mazahir et al., 2006). Another study observed that addiction is very strongly correlated with lack of education, awareness and poor dietary patterns (Ahmed, 2016), as observed in this population, considering the study population were skilled laborers (drivers) belonging to low SES.

Betel, a common ingredient of all types of local and industrially prepared SLT (IARC, 2004), has many cultural uses and roles, including its effects as a mild stimulant as well as a source of psychological and physiological addiction (Bhisey, 2012; Norton, 1998). Betel use can increase the plasma concentrations of norepinephrine and epinephrine, thus stimulating the autonomic and central nervous systems to produce a sense of well-being, euphoria, heightened alertness, perspiration, salivation, a sensation of elevated body temperature, thus increased capacity to work (Osborne et al., 2011; IARC, 2004; Chu, 2001).

These theories clearly support the findings regarding

Table 4. Univariate analysis (Crude OR) of factors associated with smokeless tobacco use

Variables	OR (95% CI)	P-value
Age		0.776
≤ 20	1	
21 - 45	0.894 (0.475--1.682)	
> 45	1.049 (0.495--2.226)	
Occupation		0.009*
Public drivers	1	
Heavy-load drivers	0.582 (0.388--0.873)	
Duty hours		0.034*
Short (<6 h)	1	
Moderate (7-12 h)	1.457 (0.831--2.554)	
Long (12 -16 h)	0.945 (0.523--1.710)	
Extra-Long >16 h	3.727 (0.849--16.366)	
Socio economic status		0.318
Low (<15000 PKR)	1	
Moderate (15000-30000)	1.148 (0.823-1.603)	
High (>30000)	2.426 (0.673-8.745)	
Improves alertness		0.084
No	1	
Yes	1.33 (0.962-1.839)	
Peer pressure		0.589
No	1	
Yes	0.89(0.596-1.342)	
Influenced by family or community environment		0.150
No	1	
Yes	1.39(0.887-2.19)	
Masticatory habit		0.141
No	1	
Yes	1.47(0.88-2.46)	

*P-values significant at 5%, OR = odds ratio, CI = confidence interval, PKR = Pakistani rupee.

the significant associations between duty hours and dependence on SLT (Table 2), as well as the widely held perception by drivers that SLT use increases work efficiency by increasing alertness (Table 4). This perception can be attributed to the previous finding that continuous mastication enhances activity levels during long duty hours; in other words, chewing improves wakefulness (Osborne et al., 2011; Chu, 2001). This may be further supported by the observed association of gum chewing with pre-frontal cortex stimulation and, consequently, increased alertness (Sketchley-Kaye et al., 2011). Conclusively, continuous mastication is associated with increased signs of alertness and consciousness.

In a recent survey of SLT consumers in Bangladesh and Pakistan (Azam et al., 2016; Siddiqi et al., 2016), the respondents indicated that their decisions to begin SLT use were influenced by peer pressure, family acceptance, easy access, low price, lack of regulation, wide cultural acceptance, curiosity, and hospitality. Among drivers in our study with a low SES who were unable to afford chewing gum, SLT served as a cost-effective, albeit addictive and alternative option for maintaining alertness during long duty hours. These influences were also found to be highly significant within our study population (Tables 4 and 5). Furthermore, a Pakistani national prevalence study (Qidwai et al., 2002) of tobacco

Table 5. Multivariable analysis (adjusted OR) of factors associated with smokeless tobacco use.

Variables	*OR (95% CI)	P-value
Occupation		0.033*
Local drivers	1	
Highway drivers	0.634 (0.417-0.964)	
Duty hours		0.116
Short (<6 h)	1	
Moderate (7-12 h)	1.438 (0.816-2.534)	
Long (12 -16 h)	1.049 (0.573-1.920)	
Longest (>16 h)	3.749 (0.837-16.797)	
Influenced by family or community environment		0.138
No	1	
Yes	0.705 (0.445-1.118)	

Adjusted for improves alertness and masticatory habit, *P-values significant at 5%, OR - odds ratio, CI= confidence interval.

consumption trends among male residents in which paan was most frequently used, followed by naswar, gutka, hookah, bidi, and shisha smoking, contradicts the findings of the present study, wherein gutka use was highly prevalent (Table 1). Findings were attributed to the soft, easily chewable consistency of gutka and its wide availability at shops and transport stations throughout Karachi. (Johnson, 2001; Gilani and Leon, 2013)

This study has a few limitations of note. Although a sufficient number of drivers were included, the sample predominantly comprised public drivers, which might have affected the results. This imbalance was attributed to the fact that data were obtained only from transit heavy-load transport stations in Karachi, and heavy load drivers might have been on route for long driving periods. In addition, the data regarding SLT use were self-reported and may have been over or under-reported. Moreover, this study did not further 'age-stratify drivers' within the broad range of 21 to 45 years of age, and accordingly opportunity might have been missed to evaluate the role of age in terms of SLT consumption. Finally, it lacked recording further perceptions related to SLT dependance.

Preventive programs will only be effective if SLT users are willing to quit and cooperate with preventive strategies (Saroj et al., 2017; Ahmed, 2016; Kakde et al., 2012). Interestingly in this study, 377 participants (61.3%) reported that they had tried to quit because of emerging awareness and health concerns. However, they resumed use after experiencing strong withdrawal symptoms and because of a perceived occupational dependence on SLT. A similar study of factors related to behavioral interventions aimed at SLT cessation in Pakistan and the UK reported that 33 to 63% of SLT consumers were attempting to cease using these addictive products but were unsuccessful because of peer pressure, isolation, and inconsistent motivation (Siddiqi et al., 2016).

Similarly, as evident (Table 4 and 5) SLT consumption is 3-fold related to extra-long duty hours (>16), which alone is significant in univariate analysis; whereas in the presence of reduced (or No) influence by family or community environment, it might no longer remain significant as seen in multivariable analysis. Therefore, no matter how long the duty hours are, there is a need to raise awareness among these drivers to be aware of poor influences from family and community environment.

Therefore, the tailoring of targets is strongly recommended, preventive SLT cessation programs for this community, in consideration of their physiological and psychological characteristics. Community outreach programs that provide medical and dental consultations and psychological counseling sessions to drivers and their families, as well as a media campaign, would be the most useful resources for a successful “Quit SLT” program.

Conclusion

SLT consumption is widespread among public drivers in Karachi. Although nearly all types of SLT were used by both public and heavy load drivers in our study, gutka was most frequently used, followed by various combinations of SLT types. SLT consumption is widespread among public drivers in Karachi. Although nearly all types of SLT were used by both public and heavy load drivers in our study, Gutka was most frequently used, followed by various combinations of SLT types. The implementation of preventive programs aimed at reducing SLT consumption in this population, should target eliminating poor influences of family and community; as previous programs have neglected this

population. Furthermore, we note that any intervention intended to reduce SLT use should target the risk factors related to its use in given population. Furthermore, we note that any intervention intended to reduce SLT use should target the risk factors related to its use in given population.

ETHICAL APPROVAL

Ethical approval was obtained from the review board of Dow University of Health Sciences. All participants provide informed consent.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Cognitive impairment among type 2 diabetes mellitus patients at Jimma University Specialized Hospital, Southwest Ethiopia

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Cognitive impairment is the major health problem particularly in elderly with type 2 diabetes mellitus. The aim of this study was to determine the magnitude of cognitive impairment and associated factors among type 2 diabetics in Jimma University Specialized Hospital, 2016. Comparative cross sectional study was employed among 105 type 2 diabetes mellitus patients and 105 matched healthy individuals at Jimma University Specialized Hospital using consecutive sampling technique. Mini-mental state examination scale was used to measure cognitive function. Frequency, independent t-test, and logistic regression were carried to present data. Variables with p≤0.05 were considered as significant association between dependent and outcome variables. Prevalence of cognitive impairment among type 2 diabetes mellitus was higher than healthy individuals (53.3%). Age, occupations, fasting blood glucose level, and type of treatment options for diabetics were the predictors of cognitive impairment among type 2 diabetes mellitus patients. The prevalence of cognitive impairment among type 2 diabetes mellitus patients was significantly higher than non-diabetes study participants. This study was intended to offer information on cognitive impairment and associated factors among type 2 diabetes mellitus patients to concerned bodies in designing diagnosis and management strategies particularly focusing on counseling in preventing risk factors.

Key words: Cognitive impairment, type 2 diabetes mellitus, mini-mental state examination, Ethiopia.

INTRODUCTION

Diabetes mellitus (DM) is a chronic endocrine disorder due to disturbance of insulin hormone. Type 2 diabetes mellitus (T2DM) accounts for 90 to 95% of all varieties of DM worldwide. The rise of blood glucose level beyond the physiologic limits would result in complications to different body parts including central nervous system, which is the center of cognition (American Diabetes Association, 2013).

Cognition refers to information processing and application of knowledge which encompasses focused

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attention, executive function, recall, processing language and making decisions (Anderson et al., 2001; Tomar, 2012). T2DM leads to disturbances of brain metabolites (Rajani et al., 2015) and neurotransmitters which are vital for cognition. Memory function appears to be affected in patients with T2DM (Van Harten et al., 2007). Two large cohort studies confirmed that being a diabetic would increase the probabilities of developing cognitive impairment by 1.3 times as compared to non-diabetic populations (Okereke et al., 2008; Tiwari et al., 2012). Predictors of cognitive impairment as evidenced from the study in Pakistan (Musleh et al., 2014) and in India (Sengupta et al., 2014) were age, sex, educational level, area of residence, marital status, unemployment, poverty and chronic illness like hypertension and DM. A study in Korea showed a higher prevalence of cognitive impairment among elderly T2DM patients and predictors were age, educational background and systolic blood pressure (Lee et al., 2014; Mavrodaris et al., 2013). An observational study in 2011 at Tikur Anbesa Referral Hospital, Ethiopia, showed 45% prevalence of cognitive impairment (29.6% mild and 15.4% moderate) among T2DM patients (Tefera et al., 2013).

The largest proportion of the population in Jimma zone which is found in the southwestern part of Ethiopia, chew a plant with its main ingredient, nicotine (neurostimulant), called khat (35.8%), smokes cigarette (11.2%) and consumes alcohol (43.4%) (Lee et al., 2014). Thus, with the aforementioned background and due to many other risk factors, it was expected that cognitive impairment among T2DM patient in the current study area would be high. In addition, the current study would fill the knowledge gap in the area; to the authors' best knowledge, no study had been done in Jimma town that shows the association between cognitive impairment and diabetes.

Lastly, findings from this study may help local, regional and federal policy makers and health professional give attention to integrative health approach to minimize the burden of health problems associated with T2DM. So, the purpose of this study was to determine the impact of diabetes mellitus on human cognition and associated factors that increase the risk of cognitive impairment among T2DM patients in comparison to healthy controls.

MATERIALS AND METHODS

Study setting, design, and population

Institution based comparative cross-sectional study design was employed at Jimma University Specialized Hospital (JUSH) diabetic clinic, Jimma town, located at 352 km Southwest of Addis Ababa, Ethiopia. Data collection was carried out from March 25 to April 25, 2016. All T2DM patients aged 30 years and above attending JUSH Diabetic clinic, having the duration of 1 year and above from diagnosis and all relatively healthy individuals who came to JUSH diabetic clinic and matched for age, sex, and educational level were included. Individuals with gross hand tremor, blindness, deafness, hyperlipidemia, traumatic brain injury and family history of dementia were excluded.

The sample size was determined using two population proportion formula with the assumption of P_1 = 45% (Tefera et al., 2013) and P_2=26% (Vertesi et al., 2001), and confidence level of 95% with power of 80%.

$$n=\frac{(r+1)(Z\alpha/2+Z\beta)2\ P(1-P)}{r(p1-p2)2}=100$$

Where, n = sample size, p1 = proportion of T2DM with cognitive impairment, p2 = proportion of non-diabetes people with cognitive impairment, Zβ = standard normal variate for power, Zα = standard normal variate for level of significance, p1-p_2 = effect size, P = pooled proportion, that is, average proportion (p1+p2)/2, r = ratio of number of participants of cases to controls (1 in this case). For each group, the sample size (n) was 100. After adding a non-response rate of 5%, the total sample size for each group was 105. Consecutive sampling technique was used to select both T2DM patients and healthy control individuals. During the data collection period, there was a total of 1853 DM patients registered for follow-up at JUSH diabetic clinic.

Data collection procedure

Data were collected using pretested interviewer-administered questionnaire which consisted of sociodemographic characteristics, substance use, physical measurements of height and weight, medical history and adapted standardized mini mental state examination (MMSE) for cognition assessment (Tefera et al., 2013). A MMSE evaluates orientation (10 points), registration (3 points), attention and calculation (5 points), recall (3 points), language and praxis (9 points; naming, repetition, 3-stage command, reading, writing and copying) (Vertesi et al., 2001). Diabetes-related questions were filled by reviewing the patients' medical chart as well as testing for fasting blood sugar (FBG) format at the Medical Laboratory Department where patients often get to obtain the baseline FBG status during their routine checkup. International Diabetic Federation cut off points for body mass index (BMI) and blood pressure (BP) and the American Diabetic Association cut off points for fasting blood glucose were used to obtain the baseline BMI, BP and FBG.

Ethical consideration

Ethical clearance was obtained from the Institutional Review Board of Jimma University, College of Health Sciences and Letter of Cooperation was obtained from Jimma University and JUSH. Written informed consent was taken from the study participants to start data collection. Any identifiable issues were eliminated to ascertain confidentiality.

Statistical analysis

Data were checked for its completeness then entered to Epi data version 3.1 and exported to SPSS version 20.0 for windows. Descriptive statistics, independent t-test, and logistic regression model were done. Variables having a $p \leq 0.05$ in the independent t-test were considered as statistically significant and p-value < 0.25 in the binary logistic regression was considered as a candidate for multiple logistic regression. From multiple logistic regression, exposure variables with a p-value < 0.05 with 95% confidence interval were declared as predictors for cognitive impairment.

RESULTS

Socio-demographic and economic characteristics of the study participants

A total of 210 study participants with an equal proportion of T2DM patients and healthy controls were involved. Male to female ratio was 1.06 and majority of respondents 57 (27.1%) were in the age range of 30 to 45 years. Non-diabetes study subjects had a higher income than T2DM patients. Moreover, the mean body mass index was significantly higher among T2DM patients than non-diabetes study subjects as predict (Table 1).

Substance use profiles of study participants

As shown in Table 2, 55 (52.4%), 33 (31.4%), and ten (9.5%) of the T2DM patients had a lifetime of khat chewing, alcohol drinking, and cigarette smoking, respectively compared to 41, 43.8 and 5.7% among healthy subjects. However, from each category, the current proportion of khat chewing, alcohol drinking, cigarette smoking was 34 (61.8), 11 (33.3%), and 2 (20%), respectively compared to 53.5, 39.1, and 33.3% among the healthy subjects (Table 2).

Cognitive impairment among T2DM patients and healthy controls

The joint education adjusted MMSE score of the study participants using the independent t-test, was 24.55 and significantly ($p<0.001$) lower MMSE was observed among T2DM patients compared to the non-diabetic study participants. The burden of cognitive impairment among T2DM patients was significantly higher than for non-diabetes study participants (53.3% versus 31.4%) (Table 3). Table 3 compares the severity of cognitive impairment among T2DM patients with healthy individuals; mild 31 (29.5%) versus 26 (24.8%), moderate 23 (21.9%) versus 7 (6.7%), and severe 2 (1.9%) versus 0 (0%) (Figure 1).

Clinical archives of T2DM patients

The mean duration of diabetes and FBG level were 6.9 years (SD±5.5) and 164.02 mg/dl (SD±68.54), respectively. The most (11, 68.8%) affected people were with 7 to 8 years of disease duration. Seventy-two (68.6%) had hyperglycemia (≥ 126 mg/dl) at the time of data collection; whereas 21 (20%) T2DM patients had history of hypoglycemia (<126 mg/dl) and 43 (41.0%) individuals had comorbid hypertension. Sixty-six (62.9%) T2DM patients rely on oral hypoglycemic agents, whereas 25 (23.8%) used both insulin and oral hypoglycemic agents (Table 4).

Predictors of cognitive impairment among T2DM patients

In the multiple logistic regression analysis, participants' age and occupation, FBG level and treatment options were significantly associated with cognitive impairment. T2DM patients aged ≥62 years and being a farmer by occupation were higher odds for cognitive impairment by 7.5 times [AOR= 7.54, 95% CI (1.38, 41.38)] compared to those age ≤45 years and by 7.38 times [AOR=7.38, CI (1.26-43.15)] compared to employees T2DM patients (Table 4). Moreover, cognitive impairment among T2DM patients who had FBG level greater than or equals to 126 mg/dl is 4.4 times [AOR=4.43, 95% CI (1.14, 17.18)] as likely as cognitive impairment among T2DM patients with FBG level below 126 mg/dl. Furthermore, the odds of cognitive impairment among T2DM patients who used only oral hypoglycemic agents as a treatment option are 5.4 times [AOR=5.39, 95% CI (1.37, 41.18)] the odds of cognitive impairment among T2DM patients who used insulin (Table 5). Substance use related variables were tested for crude association with cognitive impairment in binary logistic regression. Nonetheless, there was no substance related variable with $p<0.25$. Hence, nothing was entered into multiple logistic regression analysis.

DISCUSSION

Cognitive impairment is the neurophysiologic disturbance caused due to neuronal damage and functional defect among neurotransmitters (Umegaki et al., 2013; Ojo and Brooke, 2015). In this study, T2DM was shown to be a risk factor for cognitive impairment. The burden of cognitive impairment among T2DM patients was 53.3% compared to 31.4% among non-diabetic patients, an almost 20% increase among the T2DM patients. This is a severe public health problem that needs attention of researchers, physicians, and policymakers. It was nearly similar to the findings of the study conducted in Tikur Anbesa referral Hospital, Ethiopia (Tefera et al., 2013) and Nigeria (Chukwuemeka et al., 2015) but higher than studies from Saudi Arabia and Republic of China (Eman et al., 2015; Li et al., 2016). Socio-demographic, economic, recruitment criteria's and related factors might be the cause of such epidemiological difference of cognitive impairment among T2DM patients. Individuals with T2DM had been seen to develop the risk of Alzheimer's diseases in the work of Leibson et al. (1997). In addition, a 9 years cohort study showed that T2DM patients would develop Alzheimer's disorders with 65% probabilities than non-diabetic populations (Arvanitakis et al., 2004). In addition, a very long 11 years cohort study reaffirms the incidence of Alzheimer diseases increases by 4.8% among T2DM patients (Huang et al., 2014). These findings supports that diabetes is a risk factor for neurological disorders including cognitive impairment. Persistent hyperglycemia would lead to vascular

Table 1. Proportion of diabetes and non-diabetes study subjects at Jimma University Specialized Hospital, Jimma, Ethiopia.

Variable		Study groups (n=210)		
		Total (n=210) [Frequency (%)]	T2DM group (n=105) [Frequency (%)]	Non-diabetes group (n=105) [Frequency (%)]
Age (years)	Mean±SD	53.53±11.576	53.36±11.674	53.70±11.53
	30-45	57 (27.1)	29 (27.6)	28 (26.7)
	46-55	55 (26.2)	29 (27.6)	26 (24.8)
	56-61	49 (23.3)	22 (21.0)	27 (25.7)
	≥62	49 (23.3)	25 (23.8)	24 (22.9)
Sex	Male	108 (51.4)	54 (51.4)	54 (51.4)
	Female	102 (48.6)	51 (48.6)	51 (48.6)
Religion	Orthodox	85 (40.5)	39 (37.1)	46 (43.8)
	Muslim	95 (45.2)	55 (52.4)	40 (38.1)
	Protestant	22 (15.5)	7 (6.7)	15 (14.3)
	Catholic	8 (3.8)	4 (3.8)	4 (3.8)
Ethnicity	Oromo	116 (55.2)	67 (63.8)	49 (46.7)
	Amhara	50 (23.8)	21 (20.0)	29 (27.6)
	Tigre	16 (7.6)	5 (4.8)	11 (10.5)
	Guraghe	21 (10.0)	8 (7.6)	13 (12.4)
	Other**	7 (3.3)	4 (3.8)	3 (2.9)
Education level	≤Grade 8	126 (60.0)	63 (60)	63 (60)
	Grade 9-12	56 (26.7)	28 (26.7)	28 (26.7)
	College and above	28 (13.3)	14 (13.3)	14 (13.3)
Marital status	Single	6 (2.9)	3 (2.9)	3 (2.9)
	Married	139 (66.2)	84 (80.0)	55 (52.4)
	Divorced	35 (14.3)	8 (7.6)	27 (19.0)
	Widowed	30 (16.7)	10 (9.5)	20 (25.7)
Occupation	Employed	76 (36.2)	33 (31.4)	43 (41.0)
	Merchant	31 (14.8)	10 (9.5)	21 (20.0)
	Farmer	36 (17.1)	26 (24.8)	10 (9.5)
	Housewife	56 (26.7)	31 (29.5)	25 (23.8)
	Daily laborer	4 (1.9)	2 (1.9)	2 (1.9)
	Other	7 (3.3)	3 (2.9)	4 (3.8)
Income (EB)	Mean±SD	1446.67	1213.01±1093.3	1680.33±1287.52*
	≤500	57 (27.1)	32 (30.5)	25 (23.8)
	501-1000	63 (30.0)	37 (35.2)	26 (24.8)
	1001-2000	46 (21.9)	21 (20.0)	25 (23.8)
	≥2001	44 (21.0)	15 (14.3)	29 (27.6)
Residence	Urban	156 (74.3)	74 (70.5)	82(78.1)
	Rural	54 (25.7)	31 (29.5)	23(21.9)
BMI (Kg/m^2)	Mean ±SD	23.473±3.47	24.2±4.2*	22.8±2.43
	<18.5	7 (3.3)	5 (4.8)	2 (1.9)
	18.5-24.9	142 (67.6)	61 (58.1)	81 (77.1)
	25-29.9	48(22.9)	27 (25.7)	21(20.0)
	≥30	13(6.2)	12 (11.4)	1(1.0)

Significant mean, **Adere, Dawuro, Kulo, Keffa. SD, Standard deviation; BMI, body mass index; EB, Ethiopian Birr = 23; USD = 23 EB.

Table 2. Substance use profiles of study participants at Jimma University Specialized Hospital, Jimma, Ethiopia.

Variable	Study groups		
	Total (n=210) [Frequency (%)]	T2DM group (n=105) [Frequency (%)]	Non-diabetes group (n=105) [Frequency (50%)]
Life time khat chewing history			
Yes	98 (53.3)	55 (52.4)	43 (41.0)
No	112 (46.7)	50 (47.6)	62 (59.0)
Current khat chewing			
Yes	57 (58.2)	34 (61.8)	23 (53.5)
No	41 (41.8)	21 (38.2)	20 (46.5)
Life time alcohol drink			
Yes	79 (37.6)	33 (31.4)	46 (43.8)
No	131 (62.4)	72 (68.6)	59 (56.2)
Current alcohol drink			
Yes	29 (36.7)	11 (33.3)	18 (39.1)
No	50 (63.3)	22 (66.7)	28 (60.9)
Life time cigarette smoking			
Yes	16 (7.6)	10 (9.5)	6 (5.7)
No	194 (92.4)	95 (90.5)	99 (94.3)
Current cigarette smoking			
Yes	4 (25.0)	2 (20.0)	2 (33.3)
No	12 (75.0)	8 (80.0)	4 (66.7)

Table 3. Comparison of cognitive status among study groups at Jimma University Specialized Hospital, Jimma, Ethiopia.

Variable		Study groups (n=210)			t/χ^2	p-value
		Total (n=210) Frequency (%)	T2DM group (n=105) Frequency (%)	Non-diabetes group (n=105) Frequency (%)		
Cognitive impairment	Yes	89 (42.4)	56 (53.3)	33 (31.4)	9.438	0.002**
	No	121 (57.6)	49 (46.7)	72 (68.6)		
MMSE score	Mean±SD	24.55±4.9	23.41±5.60	25.70±3.783	-3.466[t]	<0.001**

**Significant; χ^2, Chi-square; t, independent t-test; SD, standard deviation.

dysfunction, oxidative stress and inflammation in tissues of the brain and this could aggravate incidence of cognitive impairment. In the current study, age and occupation were predictive factors of cognitive impairment among socio-demographic and economic variables. It is a general fact that, as age advances cognitive capabilities of individuals also drops dramatically (Sengupta et al., 2014; Lee et al., 2014; Hamed et al., 2013), because neuronal functions become poor in processing and integrations of information. Occupation is one of the key determinants that has been seen associated with many health problems. In the same manner, in our findings, governmental and non-governmental employees of T2DM patients showed a lower incidence of cognitive impairment than other types of occupations (farmers) of the patients. This could be because they received better payment from the employers that would able to cover their living expenses and moreover, seem they are free from work stress and stable than others. Researches are not consistent in the

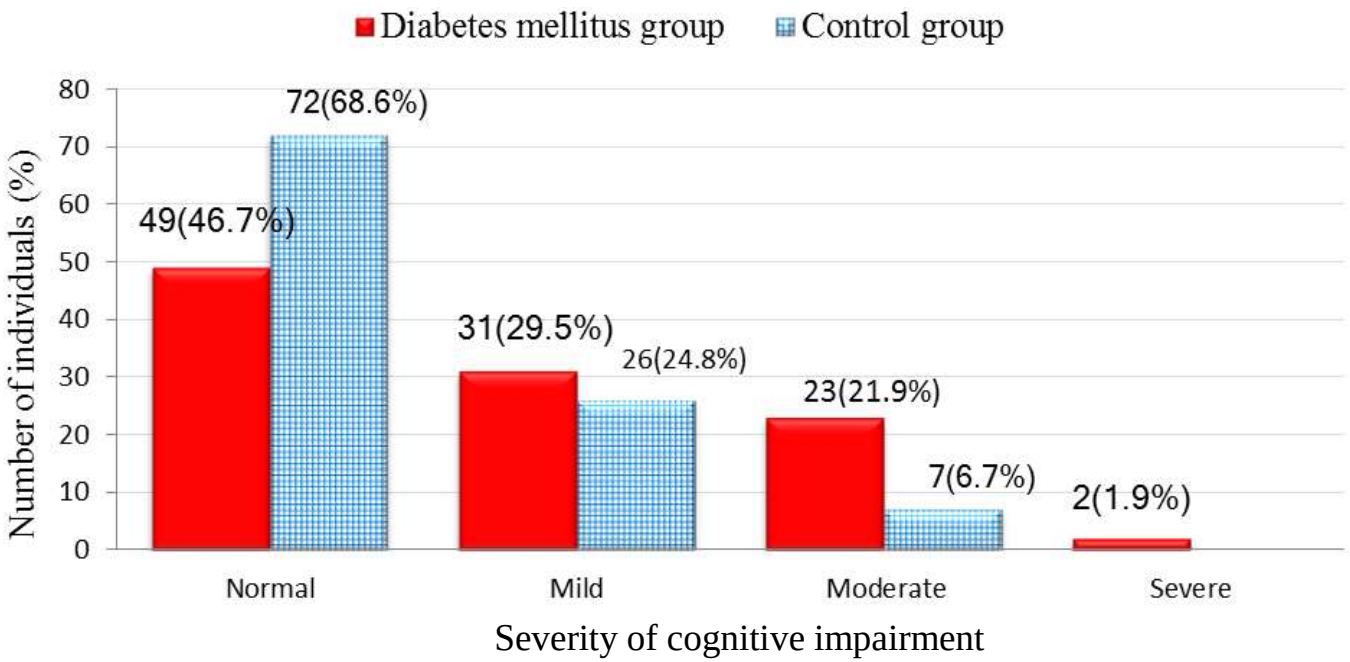

Figure 1. Levels of cognitive status among type 2 diabetes mellitus and healthy controls at Jimma University Specialized Hospital, Jimma, Ethiopia.

Table 4. Sociodemographic covariates and cognitive impairment in binary and multiple logistic regression analysis among Diabetes Mellitus patients at Jimma University Specialized Hospital, Jimma, Ethiopia March to April 2016.

Variable		DM group (n=105)			
		Cognitive impairment			
		Yes [Frequency (%)]	No [Frequency (%)]	COR (95% CI)	AOR (95% CI)
Age (year)	30-45	11 (37.9)	18 (62.1)	1	1
	46-55	14 (48.3)	15 (51.7)	1.53 (0.54-4.35)	1.59 (0.39-6.54)
	56-61	13 (59.1)	9 (40.9)	2.36 (0.76-7.34)	4.6 (0.89-23.81)
	≥62	18 (72.0)	7 (28.0)	4.208 (1.33-13.30)	7.54 (1.38-41.38) **
Sex [N]	Male	26 (48.1)	28 (51.9)	1	-
	Female	30 (58.8)	21 (41.2)	1.54 (0. 71- 3.33)	
Educational level	Grade 8 and lower	47 (74.6)	16 (25.4)	7.34 (2.02-26.70)	2.51 (0.39-16.23)
	Grade 9 - 12	5 (17.9)	23 (82.1)	0.543 (0.12-2.46)	0.27 (0.04-1.71)
	College and above	4 (28.6)	10 (71.4)	1	1
Marital Status [N]	Single	0 (0.0)	3 (100)	0.0	-
	Married	46 (54.8)	38 (45.2)	1	
	Divorced	4 (50.0)	4 (50)	0.83 (0.19-3.53)	
	Widowed	6 (60.0)	4 (40.0)	1.24 (0.33-4.71)	
Occupation	Employed	9 (27.30)	24 (72.7)	1	1
	Merchant	4 (40.0)	6 (60)	1.78 (0.41-7.80)	1.01 (0.16-6.32)
	Farmer	22 (84.6)	4 (15.4)	14.67 (3.95-54.48)	7.38 (1.26-43.15) **
	Housewife	20 (64.5)	11 (35.5)	4.85 (1.68-14.03)	2.72 (0.54-13.77)
	Daily laborer	0 (0.0)	2 (100)	0.0 (-)	0.0 (-)
	Other	1 (33.3)	2 (66.7)	1.33 (0.11-16.57)	0.70 (0.03-19.9)

Table 4. Contd.

Monthly income	≤500	21 (65.6)	11 (34.4)	5.25 (1.35-20.40)	2.28 (0.09-57.91)
	501 - 1000	23 (62.2)	14 (37.8)	4.518 (1.20-16.97)	2.99 (0.14-66.10)
	1001 - 2000	8 (38.1)	13 (61.9)	1.69 (0.40-7.17)	2.61 (0.15-46.29)
	≥2001	4 (26.7)	11 (73.3)	1	1
Residence	Urban	32 (43.2)	42 (56.8)	1	1
	Rural	24 (77.4)	7 (22.6)	4.50 (1.72-11.75)	0.79 (0.14-4.45)
BMI (kg/m^2) ^{N}	<18.5	2 (40.0)	3 (60.0)	0.49 (0.08-3.18)	-
	18.5-24.9	35 (57.4)	26 (42.6)	1	
	25-29.9	14 (51.9)	13 (48.1)	0.80 (0.32-1.99)	
	≥30	5 (41.7)	7 (58.3)	0.53 (0.15-1.86)	

N, Variable not candidate for multiple logistic regression. **Significant at p<0.05.

Table 5. Clinical variables and cognitive impairment in binary and multiple logistic regressions among Type 2 Diabetes Mellitus patients at Jimma University Specialized Hospital, Jimma, Ethiopia.

Variable		Total Frequency (%)	DM group (n=105)			
			Cognitive impairment			
			Yes [Frequency (%)]	No [Frequency (%)]	COR (95 % CI)	AOR (95 % CI)
FBG (mg/dl)	Mean±SD				164.02±68.54	
	<126	33 (31.4)	17 (51.5)	16 (48.5)	1	1
	≥126	72 (68.6)	39 (54.2)	33 (45.8)	0.8 (0.49-2.54)	4.43 (1.14-17.18)**
Disease duration (year)	Mean ±SD				6.883±5.5474	
	1-3	28 (26.7)	13 (46.4)	15 (53.6)	1	1
	4-6	36 (34.3)	18 (50.0)	18 (50.0)	1.15 (0.43-3.10)	0.99 (0.24-4.19)
	7-8	16 (15.2)	11 (68.8)	5 (31.2)	2.54 (0.697-9.24)	1.56 (0.17-14.33)
	≥9	25 (23.8)	14 (56.0)	11 (44.0)	1.47 (0.497-4.34)	2.71 (0.44-16.62)
Hypoglycemia episodes	Yes	21 (20)	13 (61.9)	8 (38.1)	1.55 (0.58-4.13)	3.02 (0.78-11.72)
	No	84 (80)	43 (51.2)	41 (48.8)	1	1
Comorbid HTN	Yes	43 (41)	22 (51.2)	21 (48.8)	0.86 (0.396-1.88)	1.05 (0.33-3.35)
	No	62 (59)	34 (54.8)	28 (45.2)	1	1
Treatment options	Insulin only	14 (13.3)	6 (42.9)	8 (57.1)	1	1
	OHA only	66 (62.9)	39 (59.1)	27 (40.9)	1.93 (0.60-6.19)	5.388 (1.37-41.18)**
	Both	25 (23.8)	11 (44.0)	14 (56.0)	1.048 (0.28-3.92)	2.55 (0.60-26.40)
Study group	DM group	105	56 (53.3)	49 (46.7)	2.49 (1.42,4.38)	p = 0.001
	Control group	105	33 (31.4)	72 (68.6)	1	

1, Reference; **Significant at p<0.05; OHA, Oral hypoglycemic agents; COR, crude odds ratio; AOR, adjusted odds ratio.

relationships of drug therapy and cognitive functions among T2DM patients. For example, a cohort study on elderly females T2DM patients treated with oral hypoglycemic agents for 2 years showed no significant difference in their cognitive function as compared to non-diabetes populations (Logroscino et al., 2004). On the

other hand, patient treatment for 6 months by rosiglitazone, a thiazolidinedione, or glyburide, a sulfonylurea combined with metformin showed improved FBG level and working memory (Ryan et al., 2006). Another study also found that oral hypoglycemic agents and multiple drug therapy were more effective at improving cognitive function than monotherapy (Wu et al., 2003). However, the current finding shows that using oral hypoglycemic agents as treatment options cause cognitive impairment by 5.1 times than using insulin or combined options among T2DM patients. It is difficult to investigate the disagreement of the studies in this regard but it could be an important scenario for the researcher to search and find a solution in the area. Furthermore, the results of this study disclosed that any of the substances used were not associated with cognitive impairment. However, an experimental and cross-sectional study on human showed that khat chewing and alcohol drinking were associated with memory deficits and impair cognitive flexibility (Kimani and Nyongesa, 2008; Wabel, 2011; Colzato et al., 2011; Hoffman and al' Absi, 2013).

Limitations of the study

Interpretation of this study results has the following limitations; first, the sample size was limited and the nature of the design was cross sectional. Thus, 100% certainty could not be inferred for the associations of T2DM and cognitive function. Second, the blood glycated hemoglobin, insulin, inflammatory markers and other were not measured due to lack of fund. Thirdly, brain scan was performed to see injury in the brain that might interfere with cognation as well.

Conclusion

In this study, the independent predictors of cognitive impairment among T2DM patients were age, occupation, FBG, and type of treatment options. Despite the higher proportion of substance use, no substance use related variables were significantly associated with cognitive impairment among T2DM patients. This study was carried out with the intension that it will offer information on cognitive impairment and associated factors among type 2 diabetes mellitus patients to concerned bodies in designing diagnosis and management strategies particularly focusing on counseling in preventing risk factors.

COMFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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