

A CROSS-SECTIONAL SURVEY OF INDIAN EXPATRIATES LIVING IN UNITED ARAB EMIRATES: UNDERSTANDING OF DIABETES MELLITUS AND ASSOCIATED HEALTH PRACTICES

Nelofar Sami Khan, Syed Ilyas Shehnaz, Kadayem Guruswamy Gomathi, Jayakumary Muttappallymyalil

ABSTRACT

Objective: Migrant Indians in different parts of the world have an increased risk of developing Type 2 diabetes mellitus. In this regard it is worthwhile to explore the understanding of Type 2 diabetes mellitus of non-diabetic Indian expatriate population of United Arab Emirates (UAE).

Materials and Methods: A cross-sectional questionnaire-based survey was conducted among a 211 convenience sample. The data was analyzed using SPSS 19 software.

Results: 211 Indians living in UAE with mean age of 36 ± 9.7 years participated in this study. All of them had a minimum of higher secondary level of education. Only 53% identified age >45 years and 42% identified “delivering a baby of more than 4Kg” as risk factors for diabetes. More than half of the participants are overweight or obese. Almost a quarter of them are unaware of the fact that positive family history, obesity and decreased physical activity are major risk factors for developing diabetes. Overall, females and participants with positive family history of diabetes are significantly more knowledgeable. Almost half of them could not link diabetes to the risk of cardiovascular disease and are unaware of complications like loss of sensation in extremities, gangrene, recurrent infection, and dental problems. Many of them mentioned that weight reduction and increased physical activity are beneficial to prevent diabetes, though few exercised regularly.

Conclusion: Major gaps exist in the knowledge of Indians and so it is recommended that more efforts are required to improve the knowledge and promote healthy lifestyle practices of this high risk population.

Keywords: Health Knowledge, Attitudes, Type 2 Diabetes Mellitus, Life style, Risk factors, United Arab Emirates

Citation: Khan NS, Ilyas SS, Gomathi KG, Muttappallymyalil J. A cross-sectional survey of Indian expatriates living in United Arab Emirates: understanding of Diabetes Mellitus and associated health practices. Gulf Medical Journal. 2015;4(1):22-31.

INTRODUCTION

Type 2 diabetes mellitus (T2DM) is a metabolic disease characterized by chronic hyperglycemia and is caused by the combination of defective insulin action and an inadequate insulin secretion. Increasing age, obesity, and insufficient physical activity are the main factors which increase the risk of developing T2DM¹. Mounting global prevalence and expanding economic burden on the society have made T2DM an important area of public health research².

As the primary risks for development of T2DM relates to lifestyle factors and genetic predisposition, effective interventions are needed

to avert or postpone the commencement of T2DM and decrease the risk of long-lasting complications^{3,4}. Knowledge regarding T2DM can contribute to timely recognition of the disease and decrease the prevalence of complications⁵. Health literacy of an individual may empower them to make healthier and superior decisions regarding the access and utilization of the available healthcare services⁶. Additionally, modifications in behavior for the sake of health based on recent evidences, health related advice and public health campaigns are likely to occur first among more educated people⁶⁻⁷. However, it is relevant to note that awareness is a prerequisite but not sufficient in itself to motivate for adoption of proposed changes in self care essential to attain ideal outcomes⁸.

Familiarity with the amount of public knowledge and their practices will help the health educators in the development of effective future

Correspondence: Dr. Nelofar Sami Khan (Ph.D), Associate Professor, Department of Biochemistry, Gulf Medical University, Ajman, UAE, Email: neloferkhan@gmu.ac.ae, Telephone: +971-50-5272308

plans. Many studies had assessed the knowledge about T2DM, but they had mainly focused on the less educated, diabetic population⁹⁻¹⁰. However, evaluating the level of T2DM knowledge among secondary or higher level educated non-diabetic population can also contribute in improving the ongoing and future campaigns for diabetes prevention.

The United Arab Emirates (UAE) is a Middle Eastern country with expatriates constituting about 83% of the total population. The Indian community in UAE is the largest expatriate community (1.75 million) and constitutes 30% of the total UAE population, out of which 15-20% are professionally qualified personnel¹¹. Several studies conducted on migrant Indians in different parts of the world have shown that Indians have an increased risk of developing T2DM and other metabolic disorders¹². Tendency of central obesity (even if BMI is not high), genetic makeup and different social and cultural factors have been reported to increase the susceptibility of migrant Indians to metabolic disorders¹³. As no previous study on the level of knowledge of diabetes among expatriate Indians in Middle East was reported, we thought it is useful to investigate the knowledge and health practices regarding T2DM in this high risk group of people.

The objectives of our research are:

1. To evaluate the T2DM related knowledge, perceptions and health practices of non-diabetic Indian expatriate population of UAE.
2. To measure the disparities in knowledge, perceptions and health practices related to T2DM with respect to gender and family history of T2DM.

Findings of this survey would help in identifying areas of limited knowledge and misconceptions that should be addressed through extra educational efforts. Eventually, this would provide impetus for improvement of current and future programs devoted to public health education.

MATERIALS AND METHODS

Convenience sample of 211 Indians living in Sharjah, UAE participated in a cross-sectional questionnaire-based survey. Participants, not suffering from diabetes and willing to complete the questionnaire took part in the survey. Explanations of the objectives of the study and the guidelines for completing the questionnaires were clearly specified. Secrecy of their information was promised and

informed approval was obtained by the investigators. Ethics Committee of GMU granted approval for this study.

Sample size: The prevalence of knowledge regarding T2DM was assumed to be 50% with 95% confidence and 80% power. The marginal error assumed was 5% and thus a sample size of 400 was calculated. A non response rate of 20% was assumed and hence the total sample observed was 480 and was approximated to 500.

Study instrument & validation procedure: A well-defined questionnaire was created after review of literature^{5,10,14}. Details of the questionnaire and the validation process are same as reported by Khan et al¹⁵.

Preliminary study was done on a group of ten non diabetic adults in order to detect any difficulties regarding the understanding of the questions and accordingly they were rectified.

The instrument had sections covering the Socio-demographic characteristics; Medical history; General knowledge of T2DM; Health related practices; Useful lifestyle changes; Assessment of their own risk of getting T2DM; Sources of information about T2DM.

From the self-reported height and weight of the participants, body mass index (BMI) was calculated from the Formula - Weight (Kg)/[Height(M)]². According to the classification, BMI of 25 to 29.9 was overweight and ≥ 30 Kg/M² was considered as obese¹⁶.

Statistics: Statistical package SPSS version 19 was used for data analysis. Frequencies and percentages described the categorical variables. The association between knowledge & practices vs. gender, and also vs. with/without family history of diabetes were assessed using the Chi-square test of significance. $P \leq 0.05$ was regarded to be statistically significant.

RESULTS

Five hundred questionnaires were distributed, but due to the non-response rate of 49% we reached a sample size of 257 only. Eight of the questionnaires were partially filled and were not included in analyses. Out of the remaining 249 participants, 36 revealed to be diabetic and so were also excluded. Final analysis included 211 participants: 125 (59%) males and 86 (41%) females. Majority of the participants were 25-45 years of age with a mean of 37 ± 9.8 years for males and of 34 ± 9.7 years for females. All the

participants had a minimum of higher secondary level of education and were living with their families in UAE.

Family history of the participants revealed

very high incidence of diabetes (47%), followed by hypertension (42%) and heart attack (28%). Figure. I present their medical history.

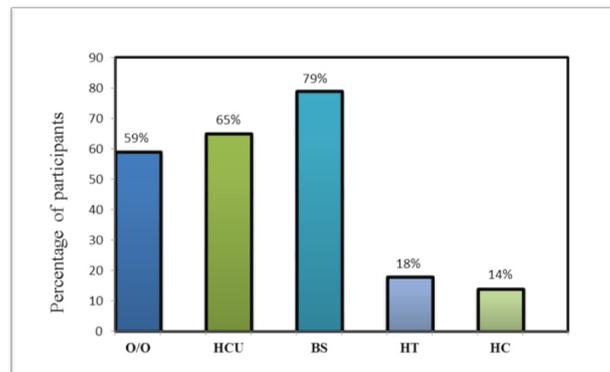


Figure I. Medical History of participants (Indian expatriates living in United Arab Emirates): Percentages of participants found to be Overweight/Obese on the basis of calculated BMI (O/O); reported having a health checkup (HCU) and blood sugar tested (BS) in the last 12 months; self-reported hypertensive (HT), high cholesterol level (HC)

Medical History of participants		%
O/O	Overweight/Obese on the basis of calculated BMI	59%
HCU	Had a health checkup in last 12 months	65%
BS	Had blood sugar tested in last 12 months	79%
HT	Hypertensive (Self-reported)	18%
HC	High cholesterol level (Self-reported)	14%

Table 1 shows the results regarding their general knowledge about T2DM, its risk factors, symptoms and complications. The individual responses were further compared with regard to gender and also with regard to family history of T2DM (Table 1). Majority of the participants knew that T2DM is a non-contagious but chronic disease and that insulin is required for some patients of diabetes. Overall, females and those with family history of diabetes were more knowledgeable about the risk factors, symptoms and complications of T2DM.

Table 1. Knowledge regarding risk factors, symptoms and complications of Type 2 Diabetes Mellitus among the Indian expatriate population living in United Arab Emirates

	Total % of correct responses (N=211)	Gender		Family History of T2DM	
		Male (%) (N=125)	Female (%) (N=86)	No (%) (N=112)	Yes (%) (N=99)
A. General Knowledge of T2DM					
Diabetes is a condition of high blood sugar	82.9	81.6	84.9	81.3	84.8
Diabetes is a condition of inadequate insulin action	72.5	65.6	82.6 ^a	69.6	75.8
Diabetes is non-contagious	93.4	89.6	98.8 ^a	90.2	97 ^b
Diabetes is curable	42.2	41.6	43	38.4	46.5
Insulin is required for some diabetic patients	89.6	86.4	94.2	89.3	89.9
Diabetes is a disease affecting pancreas	62.6	56.8	70.9 ^a	58	67.7
There are several types of diabetes	73.5	68	81.4 ^a	66.1	81.8 ^b
Can diabetes be prevented?	81	77.6	86	76.8	85.9
Diabetes is a long term disease	84.8	82.4	88.4	84.8	84.8
Diabetes is related to life style	81.5	79.2	84.9	80.4	82.8
B. Knowledge of Risk factors for T2DM					
Family History	78.7	73.6	86 ^a	67.9	90.9 ^b
Obesity	73	67.2	81.4 ^a	64.3	82.8 ^b
Decreased physical activity	76.8	79.2	73.3	71.4	82.8 ^b
Age above 45 years old	53.1	55.2	50	51.8	54.5
Pregnancy (delivering a baby more than 4Kg)	42.2	37.6	48.8	35.7	49.5 ^b
Excessive consumption of sugar	63	56.8	72.1 ^a	61.6	64.6
C. Knowledge of Symptoms of T2DM					
Excess feeling of thirst	73	64.8	84.9 ^a	67	79.3 ^b
Excess urination	78.2	72.8	86 ^a	71.4	85.9 ^b
Unexplained Weight loss	67.8	64.8	72.1	58.9	77.8 ^b
Excessive eating	52.1	51.2	53.5	57.1	46.5
Slow healing of cuts and wounds	83.4	82.4	84.9	76.8	90.9 ^b
Tiredness and weakness	82.5	80	85	74.1	91.9 ^b
D. Knowledge of Complications of T2DM					
Eye problems	77.7	72	86 ^a	73.2	82.2
Kidney problems	73.9	72	76.7	66.1	82.8 ^b
Loss of sensation in arms and legs	55	53.6	57	48.2	62.6 ^b
Gangrene in limbs requiring surgical removal	53.1	47.2	61.6 ^a	46.4	60.6 ^b
High risk for Cardiovascular disease	57.3	52	65.1	58	56.6
Oral and dental complications	48.3	41.6	58.1 ^a	44.6	52.5
Recurrent infection	52.6	47.2	60.5	52.7	52.5
Erectile dysfunction / loss of libido	39.8	39.2	40.7	44.6	34.3
T2DM: Type 2 Diabetes Mellitus					
^a Statistically significant at P< 0.05 between males and females using Chi-square test of significance					
^b Statistically significant at P< 0.05 between those with or without family history of diabetes mellitus using Chi-square test of significance					

Table 2 shows the health related behavior and perceptions regarding prevention of T2DM. Increasing the physical activity was perceived by majority of the participants as a most beneficial behavioral change. Most of them were trying to reduce or maintain weight and had healthy dietary

habits, but few exercised regularly. Participants with family history of T2DM had more healthy lifestyle and correct perceptions regarding beneficial changes. A majority (62%) of the participants realized that there is a high possibility for them to develop T2DM in the coming 10 years.

Table 2. Perceptions regarding prevention of T2DM, own risk of developing T2DM, beneficial dietary modifications and health behavior practices among the Indian expatriate population living in United Arab Emirates

	Total % of correct responses (N=211)	Gender		Family History of T2DM	
		Male (%) (N=125)	Female (%) (N=86)	No (%) (N=112)	Yes (%) (N=99)
A. Perceptions about prevention of T2DM					
People who make a good effort to control the risks of getting diabetes are much less likely to get diabetes	67.8	68.8	66.3	60.7	75.8 ^b
Regular exercise and diet may prevent diabetes from developing	80.1	82.4	76.7	74.1	86.9 ^b
Increasing physical activity can help prevent getting diabetes mellitus	89.1	91.2	86	84.8	93.9 ^b
Reducing weight can help prevent getting diabetes mellitus	79.6	79.2	80.2	75	84.8
B. Perceptions about own risk of developing T2DM					
If I don't change my life style behaviors, such as diet or exercise, I am at a risk of getting diabetes over the next 10 years	61.6	63.2	59.3	57.1	66.7
I have recently made changes in my lifestyle behaviors that I believe will lower my chances of getting diabetes	55.9	56.8	54.7	50.9	61.6
I am planning to make changes in my lifestyle behaviors in the near future that I believe will lower my chances of getting diabetes	63.5	60.8	67.4	58.9	68.7
C. Perceptions about dietary modifications to prevent T2DM					
Increasing the consumption of vegetables is beneficial	81	84	76.7	75	87.9 ^b
Increasing the consumption of fruits is beneficial	71.6	78.4 ^a	61.6	69.6	73.7
Reducing the carbohydrate content in diet is beneficial	66.4	68.8	62.8	63.4	69.7
Avoiding too much sweets in diet is beneficial	84.4	84.8	83.7	78.6	90.9
Reducing total calorie intake is beneficial	62.1	59.2	66.3	53.6	71.7 ^b
D. Health behavior practices					
Do you exercise regularly (150min/week)	37	40.8	31.4	37.5	36.4
Are you trying to reduce /maintain weight	74.9	76	73.3	68.8	81.8 ^b

Does your diet include vegetables	82.9	81.6	84.9	76.8	89.9 ^b
Does your diet include fruits	84.4	83.2	86	77.9	91.9 ^b

T2DM: Type 2 Diabetes Mellitus

^a Statistically significant at $P < 0.05$ between males and females using Chi-square test of significance

^b Statistically significant at $P < 0.05$ between those with or without family history of T2DM using Chi-square test of significance

Table 3. Sources and perceptions regarding the information of Type 2 Diabetes Mellitus among the Indian expatriate population living in United Arab Emirates

	Response (%)
What is your source of information regarding diabetes mellitus?	
News papers, Books, magazines or journals	89.1
Internet and world wide web	82.1
Television/Radio	81.5
Friends and relatives	80.6
Health professionals	70.9
Talks and seminars	47.4
Do you think general public need more information about diabetes mellitus?	96
What is the best way to give information to people about diabetes mellitus?	
Radio/T.V/Internet	58.8
Print materials	10.3
Religious sermons	0.5

The participants had multiple sources of information regarding T2DM with the print material topping the list (Table 3). Almost all the participants (96%) thought that general public needs more information about T2DM and identified radio/TV/internet as the best way to impart it.

DISCUSSION

The International Diabetes Federation projects that by 2030 the Middle Eastern Crescent, Sub-Saharan Africa, and India will encounter the maximum increase in number of people with diabetes². A large proportion of expatriate population of Gulf Cooperation Council (GCC) countries have come from India with 1.75 million presently living in UAE alone¹¹. High rates of overweight and obesity have been reported among the multiethnic population of UAE¹⁷. It has also been reported that peninsular Arabs and Asian Indians have a predisposition to insulin resistance. This amalgamation of insulin

resistance and obesity might be the reason for excessively high percentages of pre-diabetes and diabetes in the UAE population¹⁸. In this regard the results of the present study will be relevant in improving the educational programs aiming to reduce the diabetes pandemic in this region.

Knowledge about T2DM in Indian expatriates of UAE reported in this study, is higher compared to other reports, not only from India but also from other GCC countries^{5,10,14,15,19}. This is probably due to the fact that our participants were all educated to a minimum of higher secondary level and associations between the level of education and knowledge has already been reported in several studies^{19,20}. Most of the previous studies have reported that males were more knowledgeable than females, however, in our study, females were found to be more knowledgeable^{14,21}. This may be attributed to increased concern about health and looks among educated females and more interest

in sports, politics and business among the educated male population²².

Majority of our participants (81%) felt that diabetes was preventable, whereas the Chennai Urban Rural Epidemiology Study (CURES-9) from India reported that even among the highly educated professionals, less than 45% felt diabetes was preventable²¹. Results showed that more than half of our participants were under the impression that diabetes can be cured. A recent study on the Saudi non-diabetic subjects also reported a similar misconception prevailing among the population¹⁴. In another study, a quarter of the primary healthcare attendees in Saudi Arabia believe that treatment should be stopped if diabetes is well controlled for months¹⁰. As T2DM is a non-curable but manageable disease, a high proportion of the subjects having misconception/misunderstanding indicate that these issues need to be addressed otherwise it may have a negative impact in controlling the epidemic of T2DM.

Regarding the knowledge on risk factors, almost a quarter of our participants were unaware of the fact that family history, obesity and decreased physical activity were risk factors for the development of T2DM. Similarly, a study conducted in India reported very poor identification of family history (31.2%), obesity (4.5%) and physical inactivity (7.6%) as risk factors by the non-diabetic participants²¹. Many other studies had also reported poor identification of these risk factors by their subjects including the one from Saudi Arabia^{10,15,19}.

As expected, knowledge about these risk factors was significantly greater in members with family history of T2DM. Family history of T2DM is the most important predictor for the risk of developing T2DM and is most significantly associated with the perceived risk of developing diabetes^{21,23}. Though family history cannot be changed, steps can be taken to avert or postpone the beginning of the disease, most importantly, by preventing sedentary lifestyle and obesity²³. Analogous to observations in studies conducted on non-diabetic population in Singapore⁵ and Saudi Arabia¹⁴, nearly half of our participants were not aware of the fact that the risk of developing T2DM increases as the age advances. The delivering of a baby of weight more than 4Kg as a sign of gestational diabetes was least identified as a risk factor for T2DM, and other studies had also reported similar results^{5,15,24}. This is an important area of concern since most women in this study were in the child bearing age. Awareness in this topic must be increased as gestational diabetes is very much

linked with the potential risk of getting T2DM²⁵.

Knowledge of risk factors is absolutely essential to inculcate health protective behavior. It can help to assess risk. Higher the perceived threats, higher are the chances of modifying the behavior as an attempt to circumvent the threat. People may develop a sense of vulnerability which can force and motivate them to adopt the health protective behaviors²⁶.

Due to less awareness about symptoms, T2DM is often diagnosed only when severe complications have already developed³. Knowledge regarding common symptoms of DM in this study, though fair, needs further attention. Regarding complications, eye and kidney related complications were identified by almost three-quarter of the participants. However, only about 50% were aware of the serious complications like loss of sensation in extremities and gangrene requiring limb amputation. This knowledge is important to bring down the number of leg amputations through good preventive practices and education²⁷. Though CVD is a major complication and leading cause of death in T2DM, only 57% of the participants could link diabetes to CVD risk²⁸. Likewise, very few non-diabetic people in India could identify foot problems (21.8%), eye and kidney problems (16%) and CVD risk (5.8%) as complications of T2DM [20]. Very few of our participants were aware that erectile dysfunction (ED) is also one of the complications of T2DM. ED is an under-recognized, under-discussed, and commonly untreated complication of diabetes, though it is easily treatable²⁹.

More than half of our participants were overweight or obese. However, many mentioned that weight reduction and involvement in physical activity has an important role in prevention of diabetes. They also perceived that people who made a good attempt to limit the risks of acquiring diabetes have a low probability to get it. Though this is encouraging it does not appear to have translated into practice since only 37% of them exercised regularly. This shows a major gap between their knowledge and practice. Long working hours of majority of the expatriate population in UAE and very hot weather in summer may be contributing factors to low levels of physical activity. Physical activity levels are declining worldwide, not only in wealthy countries but also in low and middle income countries³⁰. Physical inactivity rises with age and is higher in women than in men³⁰. It is recommended that steps should be taken to motivate the public to be involved in some form of physical activity.

Majority of our participants were also trying to maintain/reduce weight which might be through diet modification as they had good idea about healthy diet and were consuming more of vegetables and fruits, less total calories and sweets.

Compared to other studies, the use of internet for seeking knowledge was tremendously high in this population^{14,20}. UAE is among the most highly internet connected countries in the Middle East. Since the participants were educated and had sufficient access to the internet, this was probably reflected in their knowledge seeking behavior.

Our participants were reasonably well informed about T2DM but we feel the knowledge level is still not ideal as it is a high risk population. While the participants were educated to a minimum of higher secondary level, a quarter of them not recognizing the most common risk factors for T2DM i.e. family history, obesity and low physical activity and half of them not knowing that diabetes increases the risk of CVD, is surprising and disappointing. A very large number of less educated expatriates from the Indian subcontinent also work in the UAE, whose knowledge level is likely to be much less. In addition, a majority (62%) perceived that they were at high risk of developing T2DM over next 10 years due to the high prevalence of family history of diabetes, very high rate of overweight / obesity and low level of physical activity. Hence we advocate that more efforts are required to improve their knowledge regarding T2DM and promote healthy lifestyle practices. This could be achieved by:

1. Training of healthcare professionals and social workers in imparting T2DM related education to general population.
2. Press & media campaigns regarding risk factors, complications and preventive strategies through print material and radio programs in the local languages of the Indian subcontinent.
3. Conducting diabetes education activities through camps with the help of Indian embassy and social welfare organizations.

Improving the degree of public awareness about T2DM along with the strategies motivating behavioral changes could be a factor for generally better health behavior of the society and may lower the risk of acquiring the disease and its complications.

Since this study was performed on a specific group of people and in view of small sample size it may not be possible to generalize the results of this study. A non probability sampling design not involving randomization may have introduced bias. Moreover, as data was collected through a designed

questionnaire with closed ended statements, a more qualitative approach is needed to complement these results in a more precise manner. A high non response rate may also have affected the results in this study. However, given the scarcity of previous research in this population, we consider that our study adds to increasing the understanding about the gaps in T2DM related knowledge.

Our study was the first that examined the T2DM related knowledge and health practices of the non-diabetic expatriate Indian population of UAE. Though educated Indians in UAE were reasonably well informed about T2DM, however, major gaps exist in their knowledge regarding risk factors and complications. Females and participants with family history of T2DM are significantly more knowledgeable compared to those without family history of T2DM. It is recommended that more efforts are required to improve the knowledge regarding diabetes and promote healthy lifestyle practices of this high risk population.

ACKNOWLEDGEMENT

All the necessary facilities were provided by Gulf Medical University, Ajman. Support provided by Prof. Jayadevan Sreedharan and members of the team of Research Division of GMU is highly acknowledged. We are also thankful to the participants for making this study possible.

REFERENCES

1. Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. *Diabetes Care*. 2004;27:S5–10.
2. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diabetes Care*. 2004;27:1047–1053.
3. World Health Organization, Global Strategy on Diet, Physical Activity and Health: A Framework to Monitor and Evaluate Implementation. Geneva: WHO; 2008. Available from: URL: <http://www.who.int/dietphysicalactivity/en/>. Accessed July 2, 2014.
4. Knowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med*. 2002; 346:393-403.
5. Wee HL, Ho HK, Li SC. Public Awareness of Diabetes Mellitus in Singapore. *Singapore Med J*. 2002; 43:128-34.

6. Cutler DM, Lleras Muney A. Education and Health: Evaluating Theories and Evidence. Bethesda, MD: National Bureau of Economic Research; 2006. Available from: URL: http://www.chrp.org/pdf/CutlerLieras_Muney_Education_and_Health.pdf. Accessed May 5, 2014.
7. De Walque D. Education, information, and smoking decisions: evidence from smoking histories, 1940–2000. Washington DC: The World Bank 2004; July 2004; World Bank Policy Research Working Paper No. 3362.
8. Green AJ, Bazata DD, Fox KM, Grandy S. Health-related behaviours of people with diabetes and those with cardiometabolic risk factors: results from SHIELD. *Int J Clin Pract*. 2007; 61(11):1791–1797.
9. Tham KY, Ong JJ, Tan DK, How KY. How much do diabetic patients know about diabetes mellitus and its complications? *Ann Acad Med Singapore*. 2004;33(4):503-509.
10. Aljouidi AS, Taha AZA. Knowledge of diabetes risk factors and preventive measures among attendees of a primary care center in eastern Saudi Arabia. *Ann Saudi Med*. 2009; 29:15-19.
11. Embassy of India, Abu Dhabi, UAE. UAE Indian community. <http://uacindians.org/profile.aspx>. Accessed July 2, 2014.
12. Fryar CD, Hirsch R, Eberhardt MS, Yoon SS, Wright JD. Hypertension, high serum total cholesterol, and diabetes: Racial and ethnic prevalence differences in U.S. adults, 1999–2006. *NCHS Data Brief No.36*; April 2010.
13. Mohan V, Sandeep S, Deepa R, Shah B, Varghese C. Epidemiology of type 2 diabetes: Indian scenario. *Indian J Med Res*. 2007;125:217-230.
14. Mohieldin AH, Alzohairy MA, Hasan M. Awareness of diabetes mellitus among Saudi non-diabetic population in Al-Qassim region, Saudi Arabia. *J Diabetes and Endocrinol*. 2011; 2(2):14-19.
15. Khan N, Gomathi KG, Shehnaz SI, Muttappallymyalil J. Diabetes Mellitus-Related Knowledge among University Students in Ajman, United Arab Emirates. *Sultan Qaboos Univ Med J*. 2012; 12(3):306-314.
16. World Health Organization. Obesity: Preventing and managing the global epidemic. Report of a WHO Consultation. WHO Technical Report, Series 894. Geneva: World Health Organization; 2000. Accessed June 15, 2014.
17. Badrinath P, Al-Shboul QA, Zoubeidi T, Gargoum AS, Ghubash R, El-Rufaie OE, eds. Measuring the health of the nation: United Arab Emirates health and lifestyle survey 2000. Al-Ain, United Arab Emirates: Faculty of Medicine & Health Sciences and College of Business and Economics; 2002.
18. 18. Malik M, Bakir A, Saab BA, King H. Glucose intolerance and associated factors in the multi-ethnic population of the United Arab Emirates: results of a national survey. *Diabetes Res Clin Pract*. 2005;69:188-195.
19. 19. Al Shafaei MA, Al-Shukaili S, Rizvi SG, Al Farsi Y, Khan MA, Ganguly SS, et al. Knowledge and perceptions of diabetes in a semi urban Omani population. *BMC Public Health*. 2008; 8:249-259.
20. 20. Powell CK, Hill EG, Clancy DE. The relationship between health literacy and diabetes knowledge and readiness to take health actions. *Diab Educ*. 2007;33:144-151.
21. 21. Mohan D, Raj D, Shanthirani CS, Datta M, Unwin NC, Kapur A, et al. Awareness and knowledge of diabetes in Chennai-the Chennai Urban Rural Epidemiology study. *J Assoc Physician India*. 2005;53:283-287.
22. 22. Stock C, Wille L, Krämer A. Gender-specific health behaviors of German university students predict the interest in campus health promotion. *Health Prom Int*. 2001;16:145–154.
23. 23. Harwell TS, Dettori N, Flook BN, Priest L, Williamson DF, Helgerson SD, et al. Preventing type 2 diabetes: perceptions about risk and prevention in a population-based sample of adults \geq 45 years of age. *Diabetes Care*. 2001; 24:2007–2008.
24. 24. Pongmesa T, Li SC, Wee HL. A survey of knowledge on diabetes in the central region of Thailand. *Value Health* 2009;12:S110-113.
25. 25. American Diabetes Association. Gestational diabetes mellitus. *Diabetes Care*. 2003; 26(Suppl. 1):S103–S105.
26. 26. Walter FM, Emery J. Perceptions of family history across common diseases: a qualitative study in primary care. *Fam Pract*. 2006;23:472–480.
27. 27. World Health Organization, International Diabetes Foundation. World Diabetes Day: too many people are losing lower limbs unnecessarily to diabetes [press release]. Geneva: WHO; 2005. Available from: URL: <http://www.who>.

- int/mediacentre/news/releases/2005/pr61/en/. Accessed May 7, 2014.
28. Position statement-Diabetes and cardiovascular disease; International Diabetes Federation; July 2003. Available from: URL: <http://www.idf.org/position-statement-diabetes-and-cvd>. Accessed May 6, 2014.
 29. Chu N & Edelman SV. Diabetes and erectile dysfunction. *Clin Diabetes*. 2001;19(1):45-47.
 30. Hallal PC, Andersen LB, Bull FC, Guthold R, Haskell W, Ekelund U. Global physical activity levels: surveillance progress, pitfalls, and prospects. *Lancet*. 2012;380:247-257.