Review Article

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Factors associated with the level of general knowledge of diabetes mellitus in students in the final two years of medical school: a cross sectional study.

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Abstract

Background: *In Peru, there have been no studies on the knowledge of medical students about type 2 diabetes mellitus (DM2) which is relevant to ensure adequate preparation to address one of the pathologies with the highest burden of disease in this country.*

Methods: *Analytical cross-sectional study conducted in students in the last two years of medical school. A virtual survey was conducted using a previously validated questionnaire to find the general knowledge level of DM2. In addition, factors associated with the knowledge level were explored using appropriate hypothesis tests.*

Results: *A total of 127 participants were included, 58 externships and 69 internships. The mean knowledge of DM2 was 67.14% in general and was the same in internships and externships. An association was found between knowledge and living with a person with DM (Coef=1.01 and p=0.015).*

Conclusions: *The average in the questionnaire on knowledge of DM2 is slightly higher than the average found in other studies with questionnaires like the present study. A higher level of knowledge would be associated with living with a person with diabetes mellitus.*

Keywords: Type 2 Diabetes Mellitus, Knowledge Level Of The Disease, Medical Student

Background

Type 2 diabetes mellitus (DM2) is one of the most prevalent chronic diseases worldwide and is on the rise [1]. According to the International Diabetes Federation (IDF), there are currently 463 million adults living with DM2 around the world. As a result, if no measures are taken to control DM2, it is expected that by 2045, 700 million people will suffer from DM2 [2].

In Peru, according to the last systematic review on the incidence and prevalence of DM2, it was calculated that there were approximately 2 new cases per 100 persons per year [3)] Likewise, in the last report on "Burden of Disease in Peru" conducted by the Ministry of Health (MINSA), in the analysis of the burden by disease subcategories, it was found that DM2 represents the fourth cause at the national level of Disability-Adjusted Life-Years (DALYs); while at the regional level of Lima it constituted the first [4. 5] In addition, it is known that DM2 and its both acute and chronic complications represent a substantial economic cost [6]. In 2019, the global health expenditure related to diabetes was 760 billion USD with a projected growth of 825 billion USD per year by 2030 and 845 billion USD by 2045 [7]. Furthermore, in the same year, the IDF reported that the average health expenditure per person with diabetes in Peru was USD 1,135.3 [8].

On the other hand, several studies have shown the importance of education by the health professional towards patients with DM [10-13].

Through this process, information is provided about the disease such as appropriate blood glucose values, the importance of healthy lifestyle behaviors or the consequences of poorly controlled DM2. All this with the aim of improving clinical outcomes, health status and quality of life. [9]. Despite this, multiple studies have shown that there are many patients who do not properly apply the self-care tools and behaviors taught by the healthcare professional. [10, 11].

Because of this, it is essential that health workers, especially at the primary care level, have the necessary tools to be able to provide comprehensive care to the patient with DM2. It is important to mention that there are several models used to evaluate medical education. One of the most widely used is Miller's pyramid, which is used to evaluate clinical skills, competence, and performance. This describes a series of levels that move from theoretical knowledge, which serves as the base of the pyramid, to practical knowledge applied in the clinical setting. Thus, we see the importance of theoretical knowledge, since having a solid base ensures that the higher levels can be developed in an appropriate manner [12]. It has been seen that proper outpatient care at the primary level (training and knowledge on the part of the health care provider, time spent in the consultation, availability of drugs, etc.) is associated with better results such as a reduction in the risk of hospitalization, better glycemic control, and a lower risk of complications (13-15). Similarly, a systematic review on the barriers that prevented efficient management of DM2 in primary care showed that the quality of care provided to patients with diabetes is related to the knowledge level that the health provider has about the disease. This study found that physicians were not confident when prescribing or intensifying treatment, especially when insulin was involved [16]. Likewise, several studies have shown that the knowledge levels of medical students and general practitioners are not the best, especially regarding pharmacological treatment and diet. [17, 18]. Likewise, a study in Mexico applied the survey called Diabetes Knowledge Questionnaire (DKQ-24) to medical students, which is usually applied to people with diabetes to measure whether they have adequate knowledge of their disease. This study revealed that the average level of knowledge in first term students was similar to the knowledge of diabetic patients in the same region (13.43 ± 3.04 vs. 13.1 ± 2.4, respectively); and that the knowledge level increased significantly from the years in which clinical subjects were taken [19]. Also, a more recent study applied a 21-question open-ended questionnaire on diabetes knowledge and concluded that there were large knowledge gaps between medical residents and nurses emphasizing the importance of providing further education to improve the care of patients with DM2 [20]. Another study using the Michigan Diabetes Knowledge Test (MKDT) as an assessment instrument found that senior medical students had less knowledge (score <50%) in questions related to dietary education [21]. Finally, a study was carried out looking at the level of knowledge about diabetic ketoacidosis in medical students and it found that that only 50% of the participants answered most of the questions correctly [22].

Moreover, at the time prior to the current COVID-19 pandemic, students were normally trained in two main ways: through theoretical classes at the university and through clinical practice at the hospital and/or outpatient level. However, once the pandemic arrived, most on-site activities were cancelled. Because of this, 6th-year medical students have not been able to perform clinical practices in hospitals, while most interns were able to have first-hand contact with patients with DM2 and were actively involved in their care, whether at the hospital, outpatient, or emergency level. Thus, the question arises as to whether the fact of having on-site clinical practices influences the knowledge that medical students have about DM2. As we have already mentioned, there are several studies that show that the higher the year of study, the better the knowledge level [23, 24]; however, they do not take into account the fact of having performed on-site clinical practices and having had direct contact with patients with DM2. Finally, a study that evaluated knowledge of DM2 in just graduated general practitioners (who frequently treat patients with DM2) and final-year medical students found that medical students had narrowly lower scores than their counterparts [17].

Additionally, it is relevant to mention the context of the medical education of the students in the last 2 years of medical school who were the research subjects of the present study. In the first place, they all received the Medical Clinic II course, which is a theoretical and practical course that takes place in the 5th year of the medical program and consists of clinical practices, internships in a simulation center, discussion of clinical cases, team-based learning and theoretical classes. This course objective is that the student develops the ability to evaluate, diagnose, propose a pertinent and rational work plan, as well as design general therapeutic and preventive measures for patients with digestive, endocrinological, hematological and rheumatological disorders prevalent in the country. Likewise, due to the COVID-19 pandemic, the on-site clinical practices were cancelled. This meant that the 6th-year medical students could not have an on-site externship while the last-year medical students did have one. Finally, as for the internship, it was developed in a normal way from January to March 2020, then it was suspended due to the pandemic and resumed in September 2020 until April 2021. This last part was semi-face-to-face since the schedule was 6 hours per day (7 am to 1 pm) and the practice was predominantly carried out in the hospital setting.

Since medical students, more specifically those in the last years, will be the physicians who will perform the direct care of patients with DM2 soon due to the Rural and Urban Marginal Service, it is important that they have the correct level of basic knowledge about diabetes. This is fundamental since this is one of the diseases with the highest demand at the outpatient level and is within the group of diseases that has experienced the greatest growth between the years 2002 and 2016 [25]. Therefore, we consider it important to evaluate whether medical externship and internship are prepared from the point of view of knowledge to be able to address one of the most common diseases in Peru. This study will evaluate the level of knowledge and explore factors associated with it, emphasizing the prevention, diagnosis and treatment of patients with DM2 in medical students of the last two years in order to identify which variables affect the knowledge level and whether there is a need to reformulate the study plan for 5th-year medical students in order to propose strategies to improve the training of students and prioritize the topics in which there is a greater lack of knowledge.

Methods

The aim of this study is to explore factors associated with the level of general knowledge of DM2 in students of the last two years of medical school.

Study Design

Analytical cross-sectional study with non-probability consecutive sampling.

Sample Size Calculation

The sample size calculation was made considering that the average test score would be around 66 points with a standard deviation of 19 points based on previous studies [32]. In addition, we expected a difference between those who performed on-site practices and those who did it excellent. Using Stata v14's sampsi command to find the sample size for the comparison of two means, it was estimated that 114 students (57 from each group) would need to be included in the study. Considering a response rate of 50%, a total of 228 students were invited to participate.

Participant Selection

The study included medical students who met the inclusion criteria: students currently in their sixth (6th) or seventh (7th) year of medical school at FAMED-UPCH. Students who did not answer the survey in its entirety or who refused to take part in the study were excluded from the study.

Measuring Instrument

The technique used to obtain information was an online survey using the Google Forms platform, which was spread through social networks (Facebook, Instagram, and WhatsApp). The data collection instrument was a questionnaire consisting of 2 parts. The first was a form on general data of the participant: age, sex, years of studies, existence of family member with diabetes at home, direct participation in the care of the family member with diabetes, modality of the externship, knowledge of guide/s for the care of DM2 and which guide/s would apply to clinical practice.

The second part consisted of a 14-question questionnaire assessing general knowledge of DM2 (prevention, diagnosis, treatment, and management of complications) based on the clinical practice guidelines of the American Diabetes Association (ADA) (26). The questionnaire was given in multiple choice format with one (1) correct and three (3) incorrect options. They were scored as incorrect (0) or correct (1). The minimum and maximum scores were 0 and 14 respectively. Subsequently, these scores were expressed into percentages (%), the optimal percentage being 100%. The average score obtained and the percentage of questions answered correctly were used for comparison due to the lack of a standardized score to categorize the knowledge variable [27].

To perform the content validity of the instrument, 8 professionals (3 endocrinologists, 3 internists and 2 family physicians) were asked to rate the questions in terms of relevance and clarity. Then, the content validity index (CVI) and the content validity ratio (CVR) were calculated. The CVI for relevance was 0.78 (considered excellent) and for clarity was 0.71 (considered good). The cutoff point for CVR was 0.75 according to Lawshe's table. No item had an CVR lower than 0.75 and the CVR of the individual questions ranged between 0.75 and 1. For the reliability of the instrument, a pilot test of 10 students was carried out and the inter-rater agreement was calculated, which was 91% (considered excellent).

The information was consolidated in an Excel spreadsheet. The statistical program STATA v.15 was used for its analysis.

Procedures

The 6th and 7th-year medical students were contacted via Facebook, WhatsApp, and Instagram. A post was created in both groups of internships and externships students with the link to Google Forms where they could fill out the survey from the computer or any mobile device and was available from May 31 to June 2 of this year.

Once participants entered the form, they found an introduction which showed the objectives of the study and the informed consent. This consisted of 3 questions which were: 1) agree to voluntarily participate in the study, 2) authorize the information collected to be used and stored in a database and, finally, 3) agree to answer honestly and without reviewing other sources. Finally, only those participants who answered affirmatively to all the questions were able to complete the surveys.

Analysis Plan

The information was obtained through the Google Forms platform, which automatically consolidates and downloads the results in an Excel spreadsheet.

For the descriptive analysis, categorical variables were expressed as simple frequencies and percentages, while continuous variables were expressed with measures of central tendency and dispersion according to the distribution of the data; mean ± standard deviation for those variables with normal distribution and median and interquartile range for those with non-normal distribution.

To evaluate the association between having performed on-site clinical practice and knowledge about diabetes, the Student's t-test was used to compare the means of knowledge scores between the groups (those who performed on-site clinical practice and those who did not) with $p < 0.05$ being considered statistically significant.

The Pearson's correlation test was used to evaluate the association between knowledge and age, quantitative variables.

In the case of the association between knowledge and the fact of understanding the ADA clinical practice guidelines (CPG), the

Mann Whitney test was applied since the assumptions of the Student's t-test were not met.

For the association between knowledge and the preference to use the CPG (ADA, MINSA or other), the Kruskal Wallis test was applied since the independent variables had 3 categories and the ANOVA assumptions were not met. The Student's t-test was used for the other variables (sex, living with a person with diabetes and participation in diabetes care).

Subsequently, linear regression models were created to estimate mean differences. Models were created with single exposures and then a multivariate model adjusted for age and sex was created to assess the association between diabetes knowledge and care of a person living with DM2. A statistical significance level of $p<0.05$ was considered.

Results

From the 127 participants included in the study, 64% were female. On the other hand, the mean age was 24.4 ± 1.7 years. Regarding the year of study, 69 were internships (54.33%); and 58 were externships (45.67%), of which only the internships completed an externship with on-site practices, while the externships did not have on-site practices. In addition, it was found that 21 participants (16.56%) live with a person with DM2, 61.9% of whom participate in the care of that person (administration of medications such as oral antidiabetics or insulin, food preparation, glycemia control, control of wounds on the feet). Regarding knowledge of clinical practice guidelines (CPG), 54.3% of the participants reported knowing only the ADA CPG, no participant knew just the MINSA CPG, 43.3% knew both CPG and 2.36% did not know any guidelines. Likewise, 90.6% of the participants prefer to apply the ADA CPGs at the time of clinical practice. (See Table 1).

Table 1: Description of Study Participants

(N=127)	
Characteristic	**n (%)**
Male sex	46 (36.2)
Age (years)*	24.4 +- 1.7
Academic Year	
Externship (6to year)	58 (45.7)
Internship (7mo year)	69 (54.3)
Living with a person with DM	21 (16.5)
Participation in the care of a person with DM (n= 21)	13 (61.9)
On-site clinical practices	69 (54.3)
Knowledge of clinical practice guidelines	
Only ADA	69 (54.3)
Only MINSA	0
Both	55 (43.3)
None	3 (2.36)
Prefer to use	

In the DM2 knowledge questionnaire, it was found that the average score obtained was 9.4 ± 1.7 out of a total of 14 points. This translated to a percentage (%) is equivalent to 67.14% of correct answers (See Table 2).

Table 2: Results of the Knowledge Survey

Item	Total n (%)	Score (mean ± SD)	Percentage (%)
Externships	58 (45.7)	9.4 (1.5)	67.14
Internships	69 (54.3)	9.4 (1.9)	67.14
Total	127 (100)	9.4 (1.7)	67.14
* mean ± SD			

Regarding the questions, these were 14 in total and dealt with issues involving diagnostic criteria, preventive measures, pharmacological and non-pharmacological treatment, and prevention of complications. It was evident that most students had knowledge regarding the diagnosis of prediabetes and diabetes mellitus as well as the risk factors for developing diabetes and how to identify symptomatic hypoglycemia, since more than 90% correctly answered most of the questions involving this topic. Moreover, regarding pharmacological and non-pharmacological treatment, mixed results were obtained. 100% of students correctly answered

the question on first-line pharmacological treatment for DM2 and 77% correctly answered the question on diet in patients with DM2. Likewise, in the questions corresponding to treatment goals, slightly more than half of the students knew correctly what they were (56-69%), however, in the question on target blood pressure in patients with DM2 according to the ADA CPG, only 21% answered correctly. As for preventive measures in patients with prediabetes, only 26% of participants answered correctly. Similarly, in the questions on diabetic complications, less than half of the students answered correctly regarding diabetic nephropathy (25-50%). For diabetic retinopathy, 66% answered correctly when the patient should be referred for diabetic retinopathy screening. Finally, 88% of students answered correctly about surveillance in patients with diabetic foot (See Table 3).

Table 3: Percentage (%) of Questions Answered Correctly in the Knowledge Survey

Question	Total n (%)	Internships n (%)	Externshipsn (%)
1 - Risk factors for DM2	119 (93.7)	67 (97.1)	52 (89.7)
2 - Diagnosis of prediabetes	124 (97.6)	67 (97.1)	57 (98.3)
3 - Diagnosis of DM2	119 (93.7)	63 (91.3)	56 (96.6)
4 - Pharmacological treatment	127 (100.0)	(100.0)	58 (100.0)
5 - Signs and symptoms of hypoglycemia	117 (92.1)	63 (91.3)	54 (93.1)
6 - Diabetic retinopathy	84 (66.1)	47 (68.1)	37 (63.8)
7 - Prevention in prediabetes	33 (26.0)	14 (20.3)	19 (32.8)
8 - Diet in DM2	77 (60.6)	41 (59.4)	36 (62.1)
9 - Glycemia goals in DM2	88 (69.3)	50 (72.5)	38 (65.5)
10 - Diabetic nephropathy	64 (50.4)	33 (47.8)	31 (53.4)
11 - Diabetic nephropathy	32 (25.2)	19 (27.5)	13 (22.4)
12 - Target LDL cholesterol	72 (56.7)	36 (52.2)	36 (62.1)
13 - Target blood pressure	27 (21.3)	16 (23.2)	11 (19.0)
14 - Diabetic foot	110 (86.6)	62 (89.9)	48 (82.8)

Factors associated with knowledge

The mean scores obtained were equal in both women and men and the analysis showed no statistically significant association between sex and knowledge. The mean score in internships, who performed on-site clinical practices, and externships, who did not perform on-site clinical practices, was 9.4 in both groups. The analysis showed no statistically significant association. On the other hand, the group of participants who live with a person with DM2 obtained a score of 10.2. On average, those who reported living with and caring for a person with DM2 scored 1.01 (95% CI: 0.2 to 1.82) points higher on the knowledge survey compared to those who did not. No other statistically significant association was found (See Table 4).

Table 4: Factors associated with Knowledge Test Scores

	Score (mean ± SD)	P Value	Mean difference (95% CI)	Coefficient adjusted (95%CI)
Age (years)	9.4 ± 1.7	0.375	-0.08 (-0.26 - 0.10)	-0.08 (-0.25 - 0.09)
Sex				
Female	9.4 ± 1.8	0.926	REF	REF
Male	9.4 ± 1.6		0.03 (-0.61 - 0.67)	-0.07 (-0.71 - 0.56)
Year of studies				
Externship (6th year)	9.4 ± 1.5	0.906	REF	
Internship (7th year)	9.4 ± 1.9		-0.04 (-0.66 - 0.58)	
Living with a person with DM				
No	9.2 ± 1.8	0.015	REF	REF
Yes	10.2 ± 1.5		1.01 (0.20 - 1.82)	1.03 (0.21 - 1.85)
Participation in the care of a person with DM (n= 21)				
No	9.9 ± 1.7	0.283	REF	

Yes	10.5 ± 1.2		0.60 (-0.52 - 1.73)	
On-site clinical practices				
No	9.4 ± 1.5	0.906	REF	
Yes	9.4 ± 1.9		-0.04 (-0.66 - 0.58)	
Knowledge of clinical practice guidelines - ADA				
No	11.0 (10.0-12.0)*	0.064	REF	
Yes	9.0 (8.0 - 10.0)*		-1.65 (-3.65 - 0.36)	
Knowledge of clinical practice guidelines - MINSA				
No	9.4 ± 1.6	0.710	REF	
Yes	9.3 ± 1.9		-0.12 (-0.74 - 0.50)	
Prefer to use				
MINSA	9.0 (8.5 - 10.0)*	0.177	REF	
ADA	9.0 (8.0 - 10.0)*		0.11 (-1.15 - 1.37)	
Other	10.5 (10.0-11.5)*		1.50 (-0.61 - 3.61)	
According to the logistic regression model adjusted for all variables studied, considered statistically significant if <0.05.Age - Pearson correlation, ADA knowledge - Mann Whitney, preferred use - Kruskal Wallis. *Median and interquartile range are shown.				

Discussion

The present study included 127 participants, 58 externships and 69 internships. The average obtained in the DM2 knowledge questionnaire was 67.14% of correct answers (9.4/14) in general and the same in internships and externships. It was found that the score was not as expected and the highest scores were seen in the diagnostic criteria, diabetic foot care and first line treatment items and higher scores were associated with living with a patient with DM2.

Level of General Knowledge

As already mentioned, the average number of correct answers obtained in the DM2 knowledge questionnaire was 67.14%. A study conducted in Iran used a questionnaire like this study and applied it to internists obtaining an average score of 66.29%±19.5; quite like this study (27). However, it should be mentioned that they are not comparable groups since internists have specialized training and have a higher level of analysis and clinical discrimination. Likewise, it should be remembered that this test only evaluated theoretical knowledge and, although it is true that the level of this knowledge is similar in both groups, it is important to mention that there were no questions with clinical cases or practical exercises in which a better score would be expected in the group of internists.

In our study, the highest scores were obtained for diagnostic criteria for DM, diabetic foot care and first-line treatment. In contrast, a recent study in Nigeria assessed the level of knowledge in primary care physicians about DM. The results showed that the lowest level of knowledge was regarding glycemic thresholds for the diagnosis of diabetes (fasting blood glucose, random blood glucose and glycosylated hemoglobin (HbA1c) (28). Importantly, said study found that length of medical practice of more than 10 years and nonparticipation in diabetes training were significant predictors of a poor level of knowledge. These characteristics are not present in the present study population because the questionnaire was given to students in their last two years of medical school who are just starting clinical practice and who frequently take DM training.

Knowledge of Cpgs (Ada Or Minsa)

One way to provide quality care to patients is by evidence-based tools such as clinical practice guidelines (CPG). Thus, one study found that the implementation of ADA CPG in daily practice generated an improvement in attitudes, knowledge, and quality of care (30). However, there are many barriers to the efficient use of CPG (time consumption, impracticality of use, and the attitudes of health care providers toward the use of CPG). A major problem is that health care professionals in clinical settings often lack knowledge about CPGs [29].

In the present study, most externships and internships reported knowledge of ADA CPGs, with 54.3% of participants reporting knowledge of only ADA guidelines, while no participants knew just MINSA CPG, 43.3% knew both CPGs, and 2.36% knew no guidelines at all. Likewise, 90.6% of the total number of participants preferred to apply the ADA CPG to clinical practice and only 6% of these preferred to apply the MINSA CPG. This could be explained by the fact that undergraduate students are more exposed to ADA CPGs during undergraduate training since these are the ones predominantly taught during the Medical Clinic II courses. However, it should be noted that it is important to be aware of the national CPGs of MINSA since these seek to adapt to the context in which we live and are the reference for clinical practice at the primary care level in Peru. Nevertheless, the information provided is limited with respect to therapeutic options, while the ADA CPGs offer a schematic variety of these options.

Association between Knowledge and Living with and Participating in the Care of a Diabetic Patient

Multiple studies have shown the importance of family support in patients with DM. An example of this is the educational interventions that include family or household members of people with diabetes, which have been shown to be more effective than usual care in improving patients' knowledge of their disease and glycemic control [31, 32]. In this regard, our study found a statistically significant association in students who reported living with a person with DM2 who scored higher on the diabetes knowledge questionnaire. This may be because this group of students has more interest in learning about DM since they have a greater stimulus to learn about the subject.

In Italy, a study was conducted in the general population on DM and it was found that people with family members with DM had statistically significantly higher scores [33]. Also, a study on knowledge of DM in students of the last year of medical school found that there was no significant association between a higher level of knowledge about DM and having a family member with this disease, results that differ from this study.

Knowledge of Dm^2 Prevention and Control of Complications

Multiple studies around the world have shown that self-care education is a fundamental pillar in the treatment of patients with diabetes and that patients with a better level of knowledge about their disease have better results in terms of fewer complications and reduced costs [34-36]. However, research has shown that most patients with diabetes are not informed about preventive strategies and the complications that can result from having diabetes [37, 38]. Therefore, it is essential that the health professional in charge of the patient with diabetes provides the patient with the necessary information and tools to empower him/her to make the right decisions and avoid the onset in those individuals with risk factors or the progression in those who already have diabetes. This study found that the questions regarding DM2 prevention measures in patients diagnosed with pre-diabetes were answered correctly by less than 50% of the participants. Likewise, only 25-50% of students correctly answered the questions on diabetic nephropathy. It is important to emphasize the importance of improving knowledge in this area since DM together with hypertension cause more than 80% of end-stage renal disease worldwide [2]. On the other hand, more than half of the students correctly answered the questions regarding retinopathy and diabetic foot, the latter being the one with the highest score (87%).

Relationship Between Level of Knowledge and On-Site Clinical Practice

In this research work, similar percentages of both groups; both the final year students who have done on-site practices during their externship, as well as the externships who did not do on-site practices answered correctly the questions related to the diagnosis of DM2 and management of chronic complications such as diabetic foot. Thus, we see that the percentages in general are similar. In contrast to our study, Andreas Holstein et al. found that medical students who had had manual experience in hospitals (measuring blood glucose with a test strip, administering insulin) had significantly better scores in management of acute complications and practical diabetes therapy [40]. Thus, a finding of our study was that having on-site clinical practice (either at the inpatient or outpatient level) was not associated with a statistically significant higher level of student knowledge. This finding could mean that on-site clinical practices are not of vital importance to have a higher level of knowledge regarding diabetes. However, it should not be forgotten that the evaluation of medical education is not only based on knowledge. As previously explained in Miller's pyramid, assessment is done through different levels starting with knowledge, followed by cognitive level, simulations and finally clinical practices which are at the top of the pyramid. The latter help to improve the capacity for analysis and diagnostic reasoning. It is in view of these results that we see the importance of adding more activities that require clinical practice skills since the value of these lies in the contact with patients, an experience that is not achieved through theoretical knowledge. This ensures that students can obtain both the practical and theoretical skills to perform optimally in the clinical environment.

Role as General Practitioners

This study was the first to evaluate the level of general knowledge about DM2 in medical externships and internships who will soon assume the important role of taking care of patients with diabetes as they are about to perform the Rural and Urban Marginal Service. This stage, with which most medical students begin their role as physicians, is of great relevance since it is where they assume the care of the patient's health in remote areas and in a solitary manner, since most of the time health centers have only one physician. Because of this, it is necessary for students to have the necessary tools, among which we consider elementary a good level of knowledge about DM to be able to correctly address this disease and, if possible, prevent it and generate a good impact on the population. Likewise, all physicians have contact with diabetic patients either directly or indirectly due to the high prevalence and increasing incidence of this disease both worldwide and in Peru (1-2,29) and the great burden of disease that it generates [4, 6. It is therefore of utmost importance to have the general knowledge to be able to refer a patient, when necessary, make the diagnosis at the right time or identify risk factors and intervene in a timely manner before the disease develops.

Conclusions

The knowledge level of diabetes mellitus found was 67.14% of correct answers, a score that coincides with other studies carried out in the world with surveys that cover the same items as this study. The factor associated with the highest level of knowledge of DM was living with a person with DM. It is recommended that the topics of diabetic nephropathy, prevention of prediabetes, and goals in the treatment of diabetes be prioritized in the training of

students in the Medical Clinic II course. Finally, it is recommended that greater emphasis be placed on clinical practice and contact with patients.

List of Abbreviations

DM: diabetes mellitus, DM2: Type 2 diabetes mellitus, HbA1c: glycosylated hemoglobin, CPG: clinical practice guideline, ADA: American Diabetes Association, MINSA: Ministerio de Salud (Ministry of Health), DALYs: Disability-Adjusted Life-Years, IDF: International Diabetes Federation.

Declarations

Ethics approval and consent to participate

All methods were carried out in accordance with relevant guidelines and regulations (declaration of Helsinki). Informed consent was obtained from participants who met the inclusion criteria and agreed to participate. The research project was previously approved by the Research Ethics Committee from the Universidad Peruana Cayetano Heredia.

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