Journal of Student-Run Clinics
Original Study

Prevalence of Diabetes Mellitus, Hypertension, and Dyslipidemia in Student-Run Screening Clinics for Rural Communities in the Sierra Norte of Puebla, Mexico

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Published: March 27, 2018

Abstract

Background: The growing prevalence of hypertension (HTN), diabetes mellitus (DM), and dyslipidemia in Mexico highlights the need for preventative health care services. Rural communities worldwide lack access to such services. The purpose of this study was to describe the prevalence of HTN, DM, and dyslipidemia in student-run screening clinics in rural communities of the Sierra Norte of Puebla, Mexico to better understand the role the clinics play for the patients served.
Methods: Data were collected from patients from rural, Mexican towns participating in free pharmacy student-run screening clinics. Patients consented to have their de-identified information pooled for research. Screenings included blood pressure readings, blood glucose levels, hemoglobin A1C values, and cholesterol levels.
Results: Records from 483 patients were used from a total of 12 clinics. The prevalence of HTN was 38.3%, DM was 20.3%, and dyslipidemia was 45%. The median total cholesterol was 169 mg/dL, triglycerides were 180.5 mg/dL, HDL was 38 mg/dL, and LDL was 88 mg/dL. The most frequent lipid panel abnormality was hypertriglyceridemia with a prevalence of 66.3% followed by low HDL with a prevalence of 55.8%, and hypercholesterolemia was 24.4%.
Conclusions: There was a high prevalence of DM, HTN, and dyslipidemia in pharmacy student-run screening clinics in rural communities of the Sierra Norte of Puebla, Mexico. Future studies should evaluate patient access to primary care and health insurance coverage in order to better understand the value of these student-run clinics in the context of local resources.

Introduction

Chronic, non-communicable diseases like diabetes mellitus (DM), hypertension (HTN) and dyslipidemia have become major health problems in Mexico. While DM is the number one cause of death in Mexico, all three of these disease states are major risk factors for the development of both cardiovascular and cerebrovascular disease which are the second and third cause of death in Mexico, respectively.[1]

The prevalence of DM, HTN, and various forms of dyslipidemia are known in the adult Mexican population through large population-based studies established by the Ministry of Health of Mexico. While other studies may report different prevalence rates, there has been an invariable increase in prevalence over the past 20 years. From 1993 to 2006 the following trends have been noted: DM increased from 6.7% to 14.4%, HTN increased from 23.8% to 30.7%, and hypercholesterolemia increased from 27.1 to 43.6%.[2] The increase in prevalence of these chronic diseases highlights the growing need for preventative services to screen patients who may unknowingly suffer from such conditions, especially in rural areas.

Lack of access to basic preventative services in rural areas is a challenge around the world.[3] Geographic isolation and limited socioeconomic resources contribute to inadequate access. In the poorest and most rural states of Mexico, up to 80% of the population has been found to be uninsured, and for many rural Mexicans a lack of insurance is associated with fewer visits to the hospital and with a physician.[4] While the Mexican government does offer health care to the uninsured, a lack of government resources to administer that care is a reality for many rural communities. This has serious implications for rural Mexicans who try to access preventative health care services.

Basic screening of patients for chronic diseases is an important aspect of preventive care. In rural communities of the United States, student-led community health fairs play an important role in providing access to preventative care services and health education.[5-12] For example, student-led screening clinics can increase access to screening for cardiovascular disease risk factors like hypertension, diabetes, and dyslipidemia.[5,6] Previous studies suggest that free screening services at community health fairs benefit patients who may not be able to pay for the test results,[9,10] and they may function to refer patients to their primary care provider for undiagnosed conditions.[9] An added benefit of student-led health fairs is that students can enhance their appreciation for professional practice in a rural setting.[11,12] These elements attempt to address the gap in access to preventative health care in rural communities.

The value and popularity of student-run health fairs have grown in the United States, but the role of these types of services in rural communities of Mexico is not well-understood. Since 2005, pharmacy students from the University of Minnesota have visited the Sierra Norte region of the state of Puebla, Mexico to provide free screenings and education for DM, HTN, and dyslipidemia in underserved communities. The Sierra Norte of Puebla is a mountainous, rural region inhabited by people who historically self-identify as indigenous. It contains approximately 1,500 communities in 65 municipalities and covers 1/4 of the area of the state of Puebla.[13]

Choosing to screen for these chronic diseases in this population was a byproduct of the extensive training and education in the management of these diseases by University of Minnesota pharmacy students, an awareness of the growing prevalence of these diseases in Mexico, and an awareness of a lack of access to preventative care services in the Sierra Norte of Puebla. The true burden of these chronic diseases in this specific population is unknown to the authors. Many student-run clinic studies describe patient satisfaction, student perceptions, screening rates, and disease-related outcomes, but very few describe the prevalence of specific chronic diseases amongst their patients. Thus, we sought to describe the prevalence of DM, HTN, and dyslipidemia in patients attending pharmacy student-run screening clinics to better understand the role of such preventative care services in the Sierra Norte. To date, the authors have not encountered similar studies conducted in this region.

Methods

Patients and Locations

From May 18-21, 2014, pharmacy students from the University of Minnesota established a total of twelve free, student-run screening clinics to screen patients for DM, HTN, and dyslipidemia. Clinics lasted from nine in the morning until two in the afternoon. Screening clinics were held in rural communities of Jonotla, Tuzamapan de Galeana, and Cuetzalan del Progreso in the Sierra Norte of Puebla, Mexico. Twenty-three pharmacy students were divided into three groups. Each group was stationed in Jonotla, Tuzamapan, or Cuetzalan which have populations of approximately 4,598, 5,983, and 47,433 inhabitants, respectively.[14] Two groups conducted clinic in Jonotla and Tuzamapan for two consecutive days and then traveled to Cuetzalan to each do two more days of screening clinics. The third group conducted clinic every day in Cuetzalan. At a minimum, there were two fluent Spanish speakers in each group.

All student teams were assigned a translator who was familiar with the community. They helped navigate the town and aided in translating to Spanish for patients who only spoke indigenous languages. Patient records were collected from all patients who participated in each clinic, but only records from patients who provided written informed consent to use their de-identified infor-

mation for research were used. This study was given exempt status from the Institutional Review Board at the University of Minnesota on November 15, 2013.

Clinic Setup

All coordination and planning of these screening clinics were performed by pharmacy students at the University of Minnesota. Program associates in Puebla coordinated the locations of the screening clinics by obtaining official documentation of approval from community mayors and/or presidents. Patients were recruited to the clinics by mailing advertising letters to the community mayor before arrival, megaphone announcements during clinic setup, and walk-by visits.

The screening clinics that patients participated in did not take place in formal clinic buildings but rather in physical spaces that were designated by local community members and officials (e.g. outdoor basketball court, local government building, a school, etc.). Similar to some health fairs in the United States, four stations were setup for patients to stop at in an orderly fashion. First, patients were interviewed to obtain pertinent medical information and their blood pressure (BP), heart rate, height, and weight were collected. Then, blood glucose, hemoglobin A1C, and lipid panel tests were performed using point-of-care testing devices. All devices were tested for quality assurance before each clinic. Finally, all patients were counseled on the significance of their results from the clinic. Patients were advised to follow up with their regular doctor to share their results.

Diabetes Assessment and Definitions

Blood glucose levels were measured via TRUEresult® glucometers. Hemoglobin A1C tests were measured with A1CNow® testing devices. A1C tests were only performed if the patient fulfilled one of the following criteria: previous DM diagnosis, fasting blood glucose ≥126 mg/dL, or non-fasting blood glucose ≥200 mg/dL. Diabetes was defined as having one of the following: A1C ≥6.5%, fasting blood glucose ≥126 mg/dL, non-fasting blood glucose ≥200 mg/dL, previous diagnosis, or current antidiabetic medication use. No distinction was made between type 1 and type 2 DM during patient interviews. All patients were encouraged to come to clinic fasting via megaphone advertisements from the town square (if available) and letters delivered to community leaders. Patients were simply asked if they were fasting and what they had eaten or drank during the day of screening to determine their fasting status.

Hypertension Assessment and Definitions

BP was measured either by manual auscultation and a mercury sphygmomanometer or automatic machine. Patients were sitting down and the left or right arm was used for BP measurement depending on patient preference. In most cases BP was only measured one time for each patient. HTN was defined as having one of the following: systolic blood pressure (SBP) ≥140 mmHg, diastolic blood pressure (DBP) ≥90 mmHg, previous diagnosis, or current antihypertensive medication use.

Dyslipidemia Assessment and Definitions

Lipid panels were performed using Cardiochek® PA analyzers. Patients were considered to have dyslipidemia if they had any one of the following: hypercholesterolemia, which was defined as having total cholesterol (TC) ≥200 mg/dL; hypertriglyceridemia, which was defined as having fasting triglycerides (TG) ≥150 mg/dL; low HDL, which was defined as having HDL <40 mg/dL; previous diagnosis, or current cholesterol medication use. Patients were not asked to specify the form of any previous dyslipidemia diagnosis due to difficulty in translating to the indigenous language as well as limitations in health literacy. They were simply asked if the doctor has ever told them that they have high cholesterol. Elevated LDL levels were not defined in this study. The median LDL values and triglyceride values reported in this study were based solely on patients who reported fasting for at least 8 hours prior to testing.

Statistical Methods

SPSS was used for descriptive statistical analysis of the data to show basic frequencies, median, and mean values. All numerical variables are expressed as median except age, BP, A1C, and blood glucose which is expressed as mean ± standard deviation (SD).

Table 1. Demographic Characteristics of Participants (N=483)

Characteristic	% or Mean (SD)
Age	49.6 (15.6)
Female	73.3
Reported previous diagnosis of:	
Hypertension	28.4
Diabetes	18.8
Hyperlipidemia	15.1
Reported medication used to treat:	
Hypertension	16.1
Diabetes	16.8
Hyperlipidemia	6.4
Weight (kg)	62.4 (12)
Height (cm)	151 (9.4)
Body mass index	27.3 (4.5)

Results

A total of 504 patients were screened, 494 records were collected, and 483 records were used for analysis (Table 1); 10 patient records did not contain usable data due to incomplete records or age restrictions and 11 patients did not consent. The mean age was 49.6 ± 15.6 years (range of 18-90 years). More females (73.3%) were screened than males (26.7%). Only 42.2% of patient who were screened at clinics were determined to be fasting. Many patients were considered overweight (40.4%) followed by normal weight (33.1%) and obese patients (24.0%).

Diabetes Mellitus

The prevalence of patients who had been previously diagnosed with DM was 18.8% (N=91), while 1.5% (N=7) were new cases from clinic screening. Taken together, the overall prevalence of DM was 20.3% (N=98) in this patient population. This indicates that 92.9% of patients with diabetes were aware they had DM. Of those who had been previously diagnosed, 89.0% (N=81) reported receiving anti-diabetic medication. A total of 42 patients received an A1C test but only 38 patients had valid readings. Of the valid readings, the mean A1C was 9.7 ± 2.2%. The four additional readings were included in the overall analysis but not the mean calculation because they were greater than 13, and the exact number could not be specified due to A1C Now® device limitations (i.e. the machine read ">13"). Thus, we expect the actual mean A1c to be greater than 9.7 ± 2.2%. A total of 8 patient readings (21.1%) fell below the American Diabetes Association (ADA) recommended goal of <7% and the remaining were at or above 7% (N=30, 78.9%).

Hypertension

In this study, 28.4% (N=137) of patients had been previously diagnosed with HTN, while 9.9% (N=48) accounted for new cases from the screenings. Taken together, the overall prevalence of HTN was 38.3% (N=185) in this patient population. This indicates that 74.1% of hypertensive patients were aware that they had HTN. Of those who had been previously diagnosed, 57.6% (N=79) reported being prescribed an antihypertensive medication.

A total of 43.8% of previously diagnosed hypertensive patients had a SBP reading of 140 mmHg or greater at the time of screening. Of the 346 patients not previously diagnosed with HTN, 38 (11.3%) had a SBP reading of 140 mmHg or greater at the time of screening. A total of 68.5% (N=37) previously diagnosed participants with a systolic reading above 140 mmHg reported being prescribed an antihypertensive and 31.5% (N=17) reported not being prescribed an antihypertensive. Additionally, 24.8% of previously diagnosed participants had a DBP of 90 mmHg or greater while 7.5% of those not previously diagnosed with HTN had a DBP greater than 90 mmHg. Mean SBP was 123.9 ± 21.0 mmHg and mean DBP was 74.8 ± 12.8 mmHg.

New diagnoses were based primarily on SBP readings of greater than or equal to 140 mmHg, with 38 (79.2% of the new diagnoses) falling into this category. Ten other participants (20.8% of the newly diagnosed) were diagnosed with HTN based on a DBP greater than or equal to 90 mmHg. The mean SBP of newly diagnosed HTN participants was 149.3 ± 22.5 mmHg and mean DBP was 88.5 ± 18.4 mmHg.

Dyslipidemias

Out of all patients screened, 45% were considered to have some form of dyslipidemia. The prevalence of hypercholesterolemia was 24% among the total population screened. Hypertriglyceridemia was reported among 66.3% of fasting individuals (N=130). A total of 55.8% of participants

had low HDL (N= 249). Median lipid concentrations for participants who were fasting were: TC 169 mg/dL, TG 190 mg/dL, HDL 38 mg/dL, and LDL 89 mg/dL. A total of 15.1% (N=73) of screened patients reported previous diagnoses of dyslipidemia. Of those patients with a previous diagnosis, 42.5% (N=31) were taking a cholesterol medication.

Discussion

Patients attending student-run screening clinics in rural communities of the Sierra Norte of Puebla have a high prevalence of DM (20.3%), HTN (38.3%), and dyslipidemia (45%). Hypertriglyceridemia was the most common lipid abnormality followed by low HDL and hypercholesterolemia. Nearly 65% of patients were overweight or obese. These results suggest a high prevalence of chronic disease burden amongst participants in our student-run clinics when roughly compared to reported statistics for the general Mexican population. However, there are some limitations to these results.

The population data used for analysis in this study was a result of convenience sampling; data was collected from patients who came to our clinics on their own accord. The effect of this mode of sampling may be evident by the high percentage of patients with a previous diagnosis of chronic disease and female patients. For example, of the 98 patients classified as having DM in this study, 93% of those patients already knew they had it. It is possible that people who have already been diagnosed with diabetes are more likely to attend our clinics due to their health condition (i.e. self-selection bias).

We also note that we classified patients as having diabetes with an A1c of 6.5 or greater using a point-of care test. The ADA recommends the use of a National Glycohemoglobin Standardization Program (NGSP) certified technique in a laboratory setting. While the A1CNow devices used in this study are NGSP-certified, they are a point-of-care test which is not sufficiently accurate to diagnose diabetes per ADA. Thus, this may have influenced values for DM patients. In addition, including a diagnostic criteria that included a random blood glucose reading of greater than 200 mg/dL without accounting for presence of symptoms may have also increased the overall number of new diagnoses; however, of the 7 new diagnosis, only 2 were based off of this criteria.

Of 185 patients classified as having HTN in this study, 137 patients (74%) had a previous HTN diagnosis. Although a majority of patients with HTN were previously diagnosed, more patients were newly classified as having HTN (48) than DM (7). However, the new cases of HTN in these patients should be taken with caution. First, BPs were taken manually. Second, patients attending our clinics only had their BP measured one time. Some experts recommend evaluating BP at three separate visits spaced by at least a one week period for a diagnosis of HTN.[15] Moreover, most BP measurements were performed by pharmacy students and inexperience in correct technique could have led to less than accurate BP readings. Thus, it is possible that patients who were classified as newly hypertensive may not have met this requirement and may be erroneously assigned as hypertensive.

Of those that reported previous diagnosis with HTN, there was a general disparity between diagnosis, prescribing of an antihypertensive, and BP control. The results show that 68.5% of participants that were previously diagnosed with HTN that did not have their BP under control reported being prescribed an antihypertensive. Patients not meeting recommended BP levels (i.e. less than 140/90 per the 8th Joint National Committee's guideline[16]) suggest the presence of under treatment, non-adherence, or incorrect technique in BP measuring. Furthermore, there was a low rate of antihypertensive prescribing (57.6%) among those reporting a previous diagnosis of HTN. This may be due to a lack of access to medications, inability to afford medications, lack of access to a primary care, or successful management with lifestyle changes.

Only 15% of patients reported having been previously diagnosed with dyslipidemia, yet an additional 30% of patients were found to have some form of dyslipidemia in this study. This large increase in "new" cases may be due to the manner in which patients were asked about their cholesterol and the definition of dyslipidemia in this study. In order to avoid confusion about the various forms of dyslipidemia, patients were only asked if they had been previously diagnosed with "high cholesterol." Even though a seemingly small number of patients had a previous diagnosis of

dyslipidemia, they were really asked if they had one form of dyslipidemia: hypercholesterolemia. Dyslipidemia was defined in this study as having any one of the three, previously defined lipid abnormalities: hypercholesterolemia, hypertriglyceridemia, and low HDL. Thus, the number of new diagnoses may be overestimated.

It is difficult to directly compare the prevalence of DM, HTN, and dyslipidemia in this population to the general Mexican adult population given the limitations of this study and differences in methodological techniques between this study and previous epidemiological studies. In particular, some results suggest the general population of our clinic participants does not accurately match the demographics of the local area. For instance, the clinic participants were predominately female (73.3%), which was suggested to be the result of men in the communities tending to their farms during the clinic hours (agriculture is a primary source of work in the areas visited).

Nevertheless, describing the prevalence of DM, HTN, and dyslipidemia in this population highlights the potential value of student-run screening clinics in these regions. The high proportion of patients already diagnosed with chronic disease (i.e. DM and HTN) suggests that the student-run screening clinics may provide valuable follow-up for patients suffering from these conditions. Additionally, the screening clinics also identified undiagnosed and untreated patients, suggesting that student-run screening clinics in this region may function to refer patients with newly discovered chronic conditions to primary care.

Conclusion

Patients who attended pharmacy student-run screening clinics in rural communities of the Sierra Norte of Puebla had a high prevalence of DM, HTN, and dyslipidemia. There was a high prevalence of patients reporting a previous diagnosis and/or use of medications to treat these three chronic conditions suggesting that these student-run screening clinics may provide follow-up information while still screening for index diagnoses. Studies that aim to evaluate patient access to primary care in rural Mexico and the availability of health insurance for individuals living in this region of Puebla would be beneficial to better understand the value of providing such screening clinics.

Acknowledgements

The authors would like to thank Reid Smith and Margarette Kading for their support of this analysis and Patrick Hoheisel, Elisabeth Hanson, Laura Halsey, and Courtney Murphy for their technical assistance. We also want to thank Homero Martinez Garcia for his coordination of all clinic locations in Puebla.

Disclosures

The authors have no conflicts of interest to disclose.

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