

Original Research Article

A cross-sectional analysis of patient-reported awareness, management, and understandings of diabetes and hypertension among cataract patients in rural southern Honduran communities

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ABSTRACT

Background: In Honduras, the prevalence of cataracts, the leading cause of blindness, is rapidly mounting as associated chronic conditions, diabetes and hypertension, are on the rise. The increased demand for cataract surgeries has had the most severe impact on rural communities, as the majority of ophthalmologists serve cities. Additionally, owing to rural healthcare barriers, many rural dwellers have uncontrolled hypertension and diabetes, and consequently, are denied surgical candidacy due to increased surgical risk. Thus, this investigation aims to curb chronic illness in rural Honduran cataract patients by evaluating patient-reported prevalence, management, and local understandings of diabetes and hypertension in the context of socioeconomic data.

Methods: The responses of cataract patients to a poverty scorecard and survey questionnaire were categorized and evaluated according to guidelines in the surrounding literature. Height, weight, blood pressure and glucose levels were also measured for each participant.

Results: 22.0% and 53.7% of all study participants (n=82) were hyperglycemic and hypertensive respectively. Of the hyperglycemic patients, 38.9% had never been diagnosed with diabetes, while the remaining 61.1% appeared to have mismanaged blood glucose levels. 50% of the hypertensive patients had never been diagnosed with hypertension, and the other 50% appeared to have mismanaged blood pressure. More than half of all participants exhibited only a minimal understanding of diabetes and hypertension.

Conclusions: Rural Honduran communities would benefit from regular health screenings and follow-up visits from local doctors. It is important for community health workshops to focus on informing individual health management practices and chronic illness prevention strategies.

Keywords: Cataract, Diabetes, Hypertension, Honduras, Public health

INTRODUCTION

There has been a recent epidemiologic transition in Latin America characterized by increasing prevalence of chronic illnesses. In recent decades, rural to urban migration has accompanied patterns of decreased physical activity.¹ Additionally, direct foreign investment and marketing for heavily processed foods have shifted the diet of populations in Latin America from traditional

diets towards diets high in salts, fats, and sugars.^{1,2} Such is thought to be the case in Honduras, where chronic conditions concerning cardiovascular health and diabetes have become increasingly serious concerns.²

The association between these chronic conditions and eye diseases such as cataracts, the leading cause of preventable blindness in Honduras, has been well-studied.^{3,4} As the number of patients diagnosed with

cardiovascular illnesses and diabetes is on the rise, the figure for people developing cataracts is also increasing rapidly.¹ Although there is a growing need for cataract surgeries, studies have reported that Honduras was one of two countries out of the nineteen Latin American countries, in which there was a decrease in the number of cataract surgeries from 2005 to 2012.⁵

These trends have had the most severe impact on rural communities in Honduras. Of the mere total of 103 ophthalmologists for a population of 8.075 million in Honduras, a large majority serve within urban cities, and it is not known how many actively perform eye surgeries.^{6,7} Additionally, owing to rural healthcare barriers, many rural dwellers have severe and uncontrolled hypertension and diabetes; consequently, outreach programs, including one run by ZOE Eye Clinic in Tegucigalpa, Honduras, often deny these patients candidacy for subsidized cataract surgeries due to increased surgical and post-operational concerns.⁷⁻⁹ Thus, uncontrolled diabetes and cardiovascular risks, such as hypertension, compound harm for eye health; not only do they increase the likelihood of cataract development, they also hinder patients from receiving surgery.

In the literature, commonly identified barriers to cataract surgery in Latin American countries include cost, transportation, lack of awareness, time constraints, and acceptance of condition.⁵ But in addition to these delineated barriers, in light of the increasing prevalence of diabetes and hypertension in Honduras, and the bearing of these conditions on eye health, a closer consideration of lifestyle management, local perceptions, and awareness of diabetes and hypertension is crucial for a foundational approach to enable vulnerable populations to safely receive eye surgery. Thus, this investigation aims to curb chronic illness in rural Honduran cataract patients by evaluating patient-reported prevalence, management, and local understandings of diabetes and hypertension in the context of socioeconomic data.

METHODS

Inclusion criteria

The participants in the study were adult patients from rural Honduran villages diagnosed with cataracts by the ZOE Eye Clinic outreach team during community eye screenings.

Exclusion criteria

Children, pregnant women, and adults free of cataracts were excluded from participation.

Ethical considerations

For this study, institutional review and ethical clearance

were obtained from the Human Research Protection Office at Washington University in St. Louis. Additionally, verbal consent from all study participants, as well as a signed letter of approval from the director of the ZOE Eye Clinic were obtained.

Data collection

Data collection on the field spanned from June 2016 to August 2016. During eye screenings in rural Honduran communities, ZOE Eye Clinic specialists screened for adults with cataracts to identify suitable study participants. Blood glucose levels were measured using a fingerstick blood sample and an Accu-Chek Aviva glucose meter. Height, weight, and blood pressure were each measured using uniform devices across all participants as well. A 10-question poverty scorecard and survey questionnaire were designed to assess socioeconomic status, access to healthcare, awareness of previous diagnoses, management of diabetes and hypertension, as well as perceptions of chronic conditions and eye health. The investigator read the questions aloud to individual participants during a face-to-face interview, and temporarily recorded the responses on paper. Responses were inputted and stored in an encrypted spreadsheet for confidentiality and convenient analysis.

Statistical analysis

Responses were scored, categorized, and analyzed using Microsoft Excel and MINITAB 14 Student. The literature was consulted to identify appropriate guidelines and methods to categorize the data.

Poverty scores, ranging from possible scores of 0 (most likely impoverished) to 100 (least likely impoverished), were tabulated and interpreted relative to the Honduran poverty line using published guidelines by Microfinance Risk Management, L.L.C.¹¹

Due to the logistical challenges of scheduling follow-up testing and ascertaining that all patients fast prior to the blood glucose test, only a single, non-fasting plasma glucose reading was collected for each participant. To quantify and evaluate patient risk for diabetes, the following regression equation was adopted, which demonstrated a sensitivity of 74.1% and specificity of 97.2% using the screening criterion of $p(\text{diabetes}) \geq 0.42$ in a recent study. A more lenient cutoff $p(\text{diabetes}) \geq 0.20$ yielded a sensitivity of 65% and a specificity of 96% in identifying diabetic patients.¹⁰

$P(\text{diabetes}) = 1 / [1 + \exp(-X)]$, where $X = -10.0382 + [0.0331 \times (\text{age in years})] + [0.0308 \times (\text{random plasma glucose in mg/dl})] + [0.25 \times (\text{self-reported postprandial time assessed in hours})] + [0.562 (\text{if female})] + [0.0346 \times (\text{BMI})]$.

Labels and categorization criteria explained

In this study, patients were categorized as “mismanaging” their ailment(s) if they reported that they were previously diagnosed with a particular chronic condition, and yet, related clinical values fell within abnormal ranges at the time of the study. For example, one patient previously diagnosed with diabetes who presented with p (diabetes) ≥ 0.42 and another patient previously diagnosed with hypertension who presented with a blood pressure $\geq 140/90$ mmHg would both be labeled as “mismanaging”. Conversely, a patient was labeled as “managing” their ailment(s) if they reported being previously diagnosed, but presented with pertinent clinical values within normal ranges at the time of the study. Patients were categorized as “unaware” of their ailment(s) if they had abnormal blood pressure or blood glucose values at the time of the study, and reported that they had never been previously diagnosed with hypertension or diabetes respectively.

For the health literacy assessment, patients were asked questions designed to assess their perception of the bearing of diabetes and hypertension on eye health, as well as their perception of the importance of preventative eye checkups. The responses of participants grouped as having a “moderate” understanding demonstrated knowledge that diabetes and hypertension are systemic, but did not demonstrate awareness of the relationship between the chronic conditions and eye health. The responses of people with “good” understanding demonstrated knowledge of the systemic nature of the illness, and its impact on eye health. For the question used to assess the perceived importance of preventative eye checkups, “Moderate” and “good” categories were not assigned to the responses.

RESULTS

A total of 82 patients with cataracts participated in the study. Of the participants, 49 (59.8%) were men and 33 (40.2%) were women. Based on the poverty score analysis, 75% of all participants were likely to be below the national poverty line in Honduras. The poverty score assessment responses are detailed in Table 1.¹¹ The composite distributions of chronic illness prevalence, patient awareness, and management for the participant cohort are schematically summarized in an approximate area-proportional Venn diagram (Figure 1).

Prevalence versus awareness of chronic conditions

18 of 82 participants (22.0%) were hyperglycemic, with p (diabetes) ≥ 0.42 , and random blood glucose samplings >175 mg/dL (Figure 1). Of all participants, 27 (32.9%) had considerable risk for diabetes, with p (diabetes) ≥ 0.20 , and random blood glucose samplings >130 mg/dL. Of the hyperglycemic patients with p (diabetes) ≥ 0.42 , 7 (38.9%) patients were unaware of their condition. Of the patients with p (diabetes) ≥ 0.20 , 14 (51.9%) were unaware of their condition.

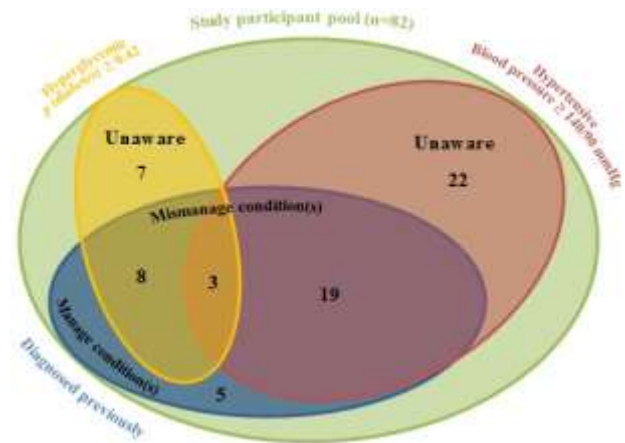


Figure 1: Area-proportional Venn diagram representation of participant cohort.

44 of 82 participants (53.7%) had some form of hypertension, which is defined in the Journal of Hypertension as an arterial pressure of at least 140/90 mmHg.¹¹⁻¹³ Above this value, hypertension can be further categorized into grades of severity. Additionally, 11 (13.4%) of participants had “high-normal” blood pressure, as classified in the literature.¹² All participants are organized by their respective ranges of blood pressures in Table 2. Of patients with hypertension, 50.0% (22) were previously undiagnosed and unaware of their condition. The other 50.0% (22) were previously diagnosed, and had uncontrolled and mismanaged hypertension. None of the patients who presented with “high-normal” blood pressure had been previously made aware of their risks for hypertension.

Hypertension and high plasma fasting glucose increase risk for cardiovascular disease.¹² 9.8% of patients had both p (diabetes) ≥ 0.42 and blood pressure $\geq 140/90$ mmHg. Other factors that contribute to cardiovascular risk include: age ≥ 60 years, BMI ≥ 25 kg/m², sex, SES, and level of education.¹² 6 participants (7.3%) reported being previously diagnosed with a cardiovascular-related illness. Of the other 76 participants that had never been previously diagnosed with a cardiovascular illness, 81.6% (62) had greater than 3 identified factors for increased risk of cardiovascular illness (Table 3).

Management of diabetes and hypertension in previously diagnosed patients

Out of 18 hyperglycemic participants with p (diabetes) ≥ 0.42 , 11 (61.1%) mismanaged their blood glucose levels. 27 participants had p (diabetes) ≥ 0.20 , and 13 of these participants (48.1%), mismanaged their condition. Of the 16 participants who reported being previously diagnosed with diabetes, only 3 (18.8%) appeared to have properly managed diabetes, with p (diabetes) ≤ 0.10 , and random blood glucose concentration of <130 mg/dL upon testing. Additionally, self-management of diabetes in previously diagnosed patients was assessed by daily medication intake and frequency of blood glucose testing.

Table 1: Study participant socioeconomic data.

Poverty scorecard parameters		No. of participants	% of total (n=82) participants
Highest level of education (female head of household)	Diversified or higher	1	1.2
	Primary School	35	42.7
	None, pre-school	41	50
	No female head	5	6.1
Main occupation (male head of household)	Service or industry worker	5	6.1
	Agriculture or no male head	69	84.1
	No data or no occupation	8	9.8
No. of household members receiving a salary	2+	35	42.7
	1	34	41.5
	0	13	15.9
No. of household members ≤ 14 years-old	0	42	51.2
	1	19	23.2
	2	8	9.8
	3	5	6.1
	4	5	6.1
	5+	3	3.7
No. of household bedrooms	4+	4	4.9
	3	11	13.4
	2	34	41.5
	1	33	40.2
Main construction material of house floors	Ceramic tile	2	2.4
	Cement bricks	7	8.5
	Mud, concrete, wood	43	52.4
	Dirt, other	30	36.6
Household source of water	Public network	46	56.1
	Not public network	36	43.9
Functioning refrigerator in home	Yes	39	47.6
	No	43	52.4
Functioning stove w/ 4 burners in home	Yes	74	90.2
	No	8	9.8
Functioning television in home	Yes, with cable	3	3.7
	Yes, without cable	34	41.5
	No	45	54.9

Table 2: Study participant blood pressure ranges.

Blood pressure ranges	No. of participants	% of total (n=82) participants
Normal: 120/80–129/84 mmHg	27	32.9
High-normal: 130/85–139/89 mmHg	11	13.4
Hypertension:		
Grade 1 140–159/90–99 mmHg	29	35.4
Grade 2 160–179/100–109 mmHg	11	13.4
Grade 3 180/110 mmHg	4	4.9

Table 3: Prevalence of cardiovascular risk factors among participants without prior cardiac illness diagnosis.

Cardiovascular Risk Factor	No. of participants	% of cohort (n=76)
Age ≥ 60 years	64	84.2
BMI ≥ 25 kg/m²	23	30.3
Poverty score ≤ 59 units	63	82.9
Highest level of education: Primary school	76	100
Hyperglycemic: p (diabetes) > 0.2	24	31.6
Hypertensive: Blood pressure ≥ 140/90 mmHg	38	50

Table 4: Self-reported management of diabetes in previously diagnosed participants.

Diabetes self-management assessment	No. of participants	% of previously diagnosed participants (n=16)
Diabetes medication taken daily	15	93.8
Blood glucose level check frequency		
Daily	0	0
Every 2-7 days	3	18.8
Every 8 days-3 months	7	43.8
Every 4 months-6 months	3	18.8
Every 7 months-2 years	3	18.8

Table 5: Self-reported management of hypertension in previously diagnosed participants.

Hypertension self-management assessment	No. of participants	% of previously diagnosed participants (n=28)
Hypertension medication taken daily	22	78.6
Blood pressure check frequency		
Every 1-7 days	6	21.4
Every 8 days-2 months	10	35.7
Every 3 months-6 months	7	25
Every 7 months-2 years	5	17.9

Table 6: Local understandings of eye health and chronic illness.

Assessment	% of all study participants (n=82)		
	Good understanding	Moderate understanding	Minimal understanding
Relationship between eye health and diabetes	17.1	26.8	56.1
Relationship between eye health and hypertension	9.8	20.7	69.5
Importance of regular, preventative eye check-ups	29.2		70.8

While 15 (93.8%) of 16 patients diagnosed with diabetes reported taking their medications daily, none of the patients reported checking their blood glucose levels daily. 6 of 16 (37.5%) reported checking their blood glucose levels less than once every 4 months (Table 4). Although the recommended frequency of blood glucose testing can vary from patient to patient, according to Mayo Clinic, testing daily before meals and after bedtime is often recommended for type 2 diabetes patients.¹⁴

Of the 44 people that had a blood pressure value of $\geq 140/90$ mmHg, 22 (50.0%) were previously unaware of their blood pressure status, and 22 (50%) mismanaged their blood pressure. Of the 28 people that reported being previously diagnosed with hypertension, only 6 (21.4%) had controlled blood pressure $\leq 120/80$ mmHg. As done for previously diagnosed diabetes patients, self-management of hypertension in previously diagnosed patients was assessed by daily medication intake and frequency of blood pressure testing. Of the 28 previously diagnosed with hypertension, 22 (78.6%) reported taking their blood pressure medication daily, and 5 (17.9%) reported checking their blood pressure less than once every 7 months (Table 5).

Health literacy assessment

Less than half of the participants had a “good” or “moderate” understanding of the relationship between chronic illness and eye health (Table 6). Although many attributed their understanding to anecdotal events (e.g. a neighbor with diabetes who subsequently became blind), there appeared to be no relationship between the level of understanding of chronic illnesses and the incidence of diagnosis in study participants and their family members. Of the 36 who demonstrated “good” or “moderate” understanding of diabetes and eye health, less than half (47.2%) reported being diagnosed with diabetes, or having diabetic immediate family members. Similarly, for the 25 people with “good” or “moderate” knowledge of the relationship between hypertension and eye health, approximately half (52.0%) were personally diagnosed with hypertension, or had hypertensive immediate family members.

DISCUSSION

Within the group of study participants, the prevalence of hyperglycemic patients with p (diabetes) ≥ 0.42 (22.0%) was threefold higher than what is estimated by the World

Health Organization (WHO) as the national prevalence of diabetes in Honduras for 2016 (7.2%).¹⁵ Similarly, the prevalence of patients in the study with blood pressure $\geq 140/90$ mmHg was 53.7%, and the national figure reported by WHO was 24.3%.¹⁶ The disparity observed between these figures can be largely attributed to cataracts being the primary participation criterion for this study. In light of the association between cataracts and these systemic chronic conditions, it is justified that the prevalence of diabetes and hypertension within a cohort of cataract patients is markedly higher than that observed within the broader, general population. Additionally, given the sample size of 82 used in the study, at the 95% confidence level, the margin of error for these figures is approximately 11.0%. A larger sample size would more strongly assess the prevalence of diabetes and hypertension among cataract patients.

The lack of awareness of personal blood glucose and blood pressure risks underscores the necessity of regular health screenings in hard-to-reach communities. People who had p (diabetes) ≥ 0.42 were on average, more “aware” of their conditions than people with p (diabetes) ≥ 0.20 . This pattern may be partially explained by the lower specificity of the regression equation test at lower p (diabetes) values, which may overestimate risk for some who may not truly have diabetes. However, another explanation that is in line with previous studies is that chronic conditions tend to go undiagnosed before a major health event occurs.¹⁰ It is likely that many patients do not seek medical attention until clinical symptoms become more severe, and begin to interfere with everyday life. Interestingly, a similar pattern in awareness was observed for “high-normal” versus the more severe grades of hypertension. In view of the lack of awareness among participants who have considerable risk for diabetes and elevated blood pressures, accessibility to health workshops and regular community screenings would enable people to track their blood pressure and glucose levels.

Reporting bias is a challenge in assessing the reliability of patient self-reported management data. Nearly all patients diagnosed with diabetes and/or hypertension reported taking their medications daily, despite many being unable to name the medication(s) they were taking. Other factors crucial to self-management of such systemic illnesses that would be important to explore in future studies include diet and level of physical activity.

Furthermore, the absence of a clear relationship between knowledge about chronic illnesses and previous personal or familial diagnoses reflects a lack of communication between healthcare providers and patients. Methods to improve access to regular health screenings and health workshops are crucial for promoting health literacy, particularly in the most vulnerable and under-resourced communities.

CONCLUSION

Among the interviewed cataract patients living within rural Honduran communities, the high prevalence of diabetes and hypertension, high incidence of uncontrolled chronic illness, and minimal knowledge about chronic illness and eye health demand regular health screenings and follow-up visits from local doctors to ensure that threatening chronic conditions are properly managed. It is important that community health workshops are accessible to rural communities, and keenly focus on informing individual health management practices and chronic illness prevention strategies.

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