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Inequalities in health care and behaviour in patients with diabetes and concurrent hypertension in Lahore, Pakistan

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Abstract: The global healthcare delivery system is largely inequitable and patients suffer inequalities in relation to their socioeconomic status (SES). In this study, we applied univariate measures to predict the SES in a sample of patients. We investigated the relationship between patient's SES, adherence to drug, dietary intake and health behaviour. We also investigated if inequalities exist in physician's choice on multisource oral solid hypoglycaemic and antihypertensive drugs in a sample of male type II diabetes mellitus patients with concurrent hypertension. Questionnaires were administered on patients (*N=500*) with diabetes mellitus and concurrent hypertension to determine their SES, prescribed drugs, dietary regime and health behaviour in Lahore, Pakistan. Correlation was determined using chi-square test for category characteristics, Kruskall-Wallis or ANOVA for continuous data variables non-normal or normally distributed data, respectively. The patient's SES was indicated by univariate like income, occupation, and education. Patients with high SES were more adherent to drug, dietary intake and health behaviour (χ^2 =13.16, p<0.001; 34.71, p<0.0001; 79.24, p<0.0001, respectively). Patients with lower SES were prescribed cheaper hypoglycaemic and antihypertensive alternatives than their richer counterparts (p<0.0001). Socioeconomic differentials exist within urban communities; these differentials have direct effects on healthcare delivery and patient health.

Keywords: diabetes mellitus, hypertension, socioeconomic, health behaviour, medication intake, Pakistan

Introduction

Diabetes mellitus and hypertension are common morbidities threatening the world's population at large and extracting a tremendous number of human lives each year. According to a recent estimate, more than 4% of the world's population is estimated to be diabetic by 2030, of those, 75% will belong to developing countries (Shaw *et al.*, 2010). In Pakistan alone, there are 7.1 million diabetic patients and the number is expected to escalate to 13.8 million in 2030 (Shaw *et al.*,, 2010). Despite the absence of a consensus on a universal definition of the socioeconomic status (SES), still it can be defined as a construct or measure that locates the relative hierarchal position of an individual or family in a particular society or community based on their access to scarce and valued resources such as education, wealth and social prestige (Western, 1983). Applied socio-medical research has identified a positive relationship between individual's SES and measures of health outcomes (Brancati *et al.*, 1996, Espelt *et al.*, 2008). The complexity of the SES as core variable implies at least two dimensions to inequality: social and economic. Accumulative research has identified relevant indicators of the economic and social dimensions of the SES in different social and cultural contexts (Espelt *et al.*,, 2008). However, socioeconomic indicators vary widely between countries and societies (Marmot, 1999). Today, there is no universally accepted tool to measure the SES. Researchers have reported different methodologies in measuring SES. These methodologies ranged from using composite measures range from scales like the Duncan socioeconomic index, Nam-Powers occupational status score, British Cambridge social interaction and stratification scale, and

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national statistics socioeconomic classification to using univariate measures such as income, wealth, and education (Wardle *et al.*, 2002).

The global healthcare system is largely inequitable since lower segments suffer from the cumulative effects of living at the disadvantaged end of several conceptual dimensions central to contemporary theory in social epidemiology (Hadden *et al.*, 2003). In industrialized countries, people with higher SES generally report better health than their counterparts with lower SES (Figaro *et al.*, 2009, Lesen *et al.* 2010). Individuals with lower SES suffer disparities in the incidence and prevalence of morbidity and mortality from certain diseases including diabetes and hypertension. In the US, higher incidence of diabetes was reported in African Americans as compared to white Americans. Similarly in Europe, south Asians suffered comparable inequalities (Abate & Chandalia, 2001, Brancati *et al.*,, 1996).

Disparities in healthcare extend to diagnosis, treatment strategy, medicine prescribing and utilization behaviour (Aziz *et al.*, Espelt *et al.*,, 2008, Hadden *et al.*,, 2003, Haider *et al.*, 2006, Huguet *et al.*, 2008, Kunst *et al.*, 1998, Lesen *et al.*,). Studies in Europe revealed that as the treatment of diabetes became more sophisticated, individuals with higher SES tended to respond to new treatment practices and benefited more than individuals with lower SES (Forssas *et al.*, 2003b). Healthcare systems in developing countries are even more inequitable, particularly when inequity is coupled with limited economic resources, treatment accessibility and affordability. Societies in the developed countries are different from those in the developing countries. Differences come from culture, traditions, religion, social, economic and political infrastructure. Therefore, socioeconomic researchers use different tools to measure outcomes in each society.

Recently, categorizing patients into SES classes and correlating socioeconomic indicators with health outcomes have received considerable attention. However, little is known on the relationship between patient's SES and adherence to drug, dietary intake, and health behaviour in developing countries, particularly in diabetes with concurrent hypertension. We conducted this study to investigate if: a) univariate measures can be used as indicators of the SES in a study sample patients from a developing country; b) various patient univariate measures are associated with adherence to drug, dietary intake, and health behaviour; and c) inequality exists in physician's choice on multisource oral solid hypoglycaemic and antihypertensive drugs in a sample of male type II diabetes mellitus patients with concurrent hypertension.

Materials and Methods

Study subjects

We recruited 500 outpatients who were treated for type II diabetes mellitus with concurrent hypertension in 3 outpatient public hospitals, 2 diabetes care centres, and 20 private clinics in Lahore, Pakistan. We assumed that patients with lower and middle SES attend affordable public hospitals and patients with higher SES attend more expensive private clinics and care centres. The sample size was decided in advance and patients were recruited prospectively. The recruitment was to be terminated when 500 participants were consented to participate. In some developing countries, literature showed that men are the decision makers controlling family resources. Men usually decided when family members including dependent children and women should seek healthcare (Shaikh & Hatcher, 2005). Since men play a dominant role in the societies in developing countries, in this study we deliberately recruited a sample of male participants. The recruitment covered different areas in the city to ensure representation of different neighbourhoods and reduce biased selection. The inclusion criteria were adult male individual with type II diabetes mellitus and concurrent hypertension diagnosed since at least one year and stabilized with drug treatment, diet and exercise. All patients were recruited during routine check-up visits. Patients who have had a diabetic or

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hypertensive crisis during the last six months were excluded. Patients were provided verbal description of the study. Participating patients were asked to sign informed consent. Patients were assured of their anonymity. The study protocol was approved by the ethics committee of the Board of Advance Studies and Research, The Islamia University of Bahawalpur.

Univariate measures as socioeconomic indicators

To predict the SES of the patient, a pool of potential indicators of both dimensions of the SES was collected from previous studies (Amin *et al.*, 2010, Durkin *et al.*, 1994, Shavers, 2007, Tiwari & Kumar, 2005). These indicators were pre-tested and validated in different socioeconomic contexts. Related indicators were arranged in categories and compiled into a questionnaire. The tool combined a combination of univariate measures like education, household income, occupation of the head of the household, land ownership, housing ownership, number of persons per room, house floor type, drinking water, toilet type, and main mean of transport to measure the SES. Potential indicators were diversified to facilitate comparison with regional and international studies. The yearly family income was determined as per Ministry of Finance, Pakistan (http://www.finance.gov.pk) definitions. The number of persons per room was determined by dividing the number of household members by the number of rooms in the living house (Tiwari & Kumar, 2005). Occupation and education by years as previously described (Tiwari & Kumar, 2005) and in accordance with studies elsewhere in the world (Forssas *et al.*, 2003a). The mode of transport used by the family was also included as a potential indicator in this study.

During interviews, field workers asked patients to respond in filling in the questionnaire. The questionnaire measured information on patient's demographics, socioeconomic indicators, adherence to drug treatment and devised health behaviour. The questionnaire was originally developed in English. Urdu and Punjabi translated versions were also developed and tested in a pilot trial on 10 individuals before final validation. The inter-rater reliability was tested with Fleiss' generalized kappa ($\varkappa$=88, CI: 82-93.2) and scale reliability with test-retest method (r=0.99). Urdu and Punjabi questionnaires were back translated into English. Correlation between class and indicators was determined using chi-square test for category characteristics, Kruskall-Wallis or ANOVA for continuous data variables non-normal or normally distributed data, respectively.

Inter-rater reliability and scale reliability

Three fieldworkers were recruited and trained for 5 days to interview the study participants. To ensure consistency and absence of large inter-rater variability, the three fieldworkers were asked to conduct interviews and administer questionnaires on 10 individuals with known SES. Inter-rater agreement was determined by kappa statistics (Posner *et al.*, 1990). Scale reliability was tested by test-retest method in a sub-sample of 45 random patients. Each fieldworker was asked to re-contact and administer the questionnaire on 15 patients 2-4 weeks after the first administration (Badia *et al.*, 1999). The same interviewer administered both test and retest. We compared kappa coefficients for dichotomous responses and Pearson correlation coefficients for continuous data.

Data analysis

Patients were interviewed for their diabetes and hypertension history. Adherence to drug intake and health behaviour was determined by a series of questions like the number of doctor visits per year/month, number of blood sugar checkups per day/week/year, number of blood pressure checkups per day/week/year, and adherence to doctor's advice like devised laboratory tests, medication intake, dietary regime, physical exercises and sport. Adherence is defined as the extent to which a person's behaviour – taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider (Haynes, 1979).

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Association between patient's SES and adherence to drug, dietary intake, health behaviour or incidence of depression was tested using chi-square (χ^2) test with Yates correction. Statistical significance was considered when $p<0.05$ after Holm adjustment. Data were treated on the R Project for Statistical Computing (http://www.r-project.org/).

All drugs prescribed for each participant were noted in their proprietary names as were prescribed by physicians. Drugs were classified into their pharmacological or chemical classes. Drugs prescribed for each patient were entered into a spreadsheet, where their prices and prices of their alternatives were entered as determined from Pakistan Drug Manual (Quarterly Medical Channel, Karachi). Alternative in this case means a pharmaceutical equivalent i.e. same active ingredient, salt form, dose and route of administration (brand name or branded generic counterparts). Our analysis was limited to solid oral dosage forms that patients would purchase from the private sector. We compared the price of the prescribed drugs with the prices of their available alternatives using Equation 1:

$$Price\ ratio = \frac{P - Min}{Max - Min} \qquad (1)$$

Where, P is the price of the prescribed drug, Min is the cheapest alternative and Max is the most expensive alternative. We developed the following definitions for the purpose of data analysis: the price of the drug prescribed was considered low if the price ratio was <0.25, middle if 0.25≤ price ratio <0.75 and high if the price ratio ≥0.75. We calculated price ratios per each socioeconomic category. To test the statistical significance of the differences in prescribed drug price ratios between the three socioeconomic categories, mean price ratios were compared with multiple pair-wise comparisons ANOVA with Bonferroni adjustment; our comparison was limited to solid oral drugs with available alternatives. Data were analyzed in SPSS for Windows, release 16.0 (SPSS Inc, Chicago, IL).

Results

Patients' characteristics and SES

A total of 500 patients were included in this study. The mean age of the study patients was 54.6 years. The majority (81.8%) were of the 41-60 years age group. Young (20-40 years) and oldest individuals accounted for 8.2% and 10.0%, respectively. The median family size of lower SES individuals (9) was higher than that of middle (6) and higher (6) SES counterparts.

Correlation between class and indicators was determined using chi-square test for categorical variables, Kruskall-Wallis or ANOVA for continuous data variables non-normal or normally distributed data, respectively. Our results showed that the SES is best indicated by univariate measures (Table 1). Evaluation of the inter-rater reliability of the fieldworkers with Fleiss' generalized kappa showed good agreement (κ=83, CI: 78.1-86.2). The Pearson's correlation coefficient for scale reliability was r=0.99, indicating excellent scale reliability

Table 1: The calculated non-parametric correlation coefficient (Spearman) correlated potential socioeconomic indicators with low, middle or high SES

Variable	Response	No. (%)	Correlation coefficient
	<4,258	130 (26)	
Yearly income in US$	4,258 - 9,125	173 (34.6)	0.88**
	>9,125	197 (39.4)	

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	≥5 persons/room	219 (43.8)	0.81**
No. of person/room¶	2-4 persons/room	153 (30.6)	
	≤1person/room	128 (25.6)	
	Unemployed	198 (39.6)	0.88**
Occupation	Manual/lower administrative	171 (34.2)	
	White collar/Professional	131 (26.2)	
	≤9 years	193 (38.6)	0.87**
Education	10-14 years	180 (36)	
	≥14 years	127 (25.4)	
	Bicycle/public transport	186 (37.2)	0.86**
Transport	Motorbike	185 (37)	
	Car	129 (25.8)	

** Correlation is significant at the 0.01 level (2-tailed); ¶ The number of family members was divided by the number of rooms

Relationship between patient's SES and adherence to drug, diet intake and health behaviour

The bivariate analysis indicates that patients showed varying adherence to drug intake (χ^2=13.16, p<0.001), dietary intake (χ^2=34.71, p<0.001) and health behaviour (χ^2=79.24, p<0.001) in association with their socioeconomic classes. In general, adherences as tested with χ^2 were more pronounced among patients with higher SES than their counterparts with middle and lower SES (Table 2).

Table 2: Bivariate analysis of adherence to drug, dietary intake, and health behaviour in different socioeconomic categories

Characteristic	Response	χ^2	P-value
	High vs. Middle	2.7	0.16 (ns)
	Middle vs. Low	5.47	0.06 (ns)
	High vs. Low	13.16	<0.001
Adherence to diet intake	High vs. Middle	22.16	<0.0001
	Middle vs. Low	1.4	0.28 (ns)
	High vs. Low	34.71	<0.0001
Adherence to health behaviour	High vs. Middle	58.75	<0.0001
	Middle vs. Low	0.99	0.39 (ns)
	High vs. Low	79.24	<0.0001

Relationship between patient's SES and physician's choice on multisource oral solid hypoglycaemic and antihypertensive drugs

We analyzed the relationship between the prescribed drug price and the SES of patients. Prescribed drug price ratios were calculated for all patients in each socioeconomic category. Table 3 shows means of the prescribed drug price ratios in each socioeconomic category. The price of prescribed drugs increased with SES. Physicians tended to prescribe low priced drugs for individuals with lower SES as compared to their counterparts with middle and high SES (p<0.01).

Table 3: Mean prescribed drug price ratios by SES

Medication	Low SES: mean	Middle SES: price ratio	High SES: price

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	price ratio ± SD (n)	± SD (n)	ratio ± SD (n)
ACE inhibitors and Angiotensin II receptor antagonists	0.14 ± 0.11 (109)	0.37** ± 0.12 (113)	0.84** ± 0.16 (116)
Diuretics	0.07 ± 0.10 (53)	0.54** ± 0.12 (40)	0.89** ± 0.04 (15)
Metformin	0.21 ± 0.24 (159)	0.35 ± 0.25 (135)	0.46** ± 0.35 (111)
Repaglinide	0.08 ± 0.15 (65)	0.42** ± 0.16 (48)	0.77** ± 0.23 (25)
Sulphonylureas	0.11 ± 0.17 (157)	0.47** ± 0.16 (114)	0.86** ± 0.14 (87)
Thiazolidinediones	0.10 ± 0.07 (72)	0.30** ± 0.07 (40)	0.81** ± 0.19 (42)
Fixed combination therapy	0.25 ± 0.30 (21)	0.33 ± 0.36 (23)	0.67** ± 0.33 (15)
Overall therapy	**0.12 ± 0.10 (201)**	**0.36** ± 0.12 (164)**	**0.82** ± 0.17 (135)**

Discussion

To the best of our knowledge, this study is the first investigation of the relationship between patient's SES and prescriber's choice of a multisource solid oral dosage form in diabetes with hypertension. Previous studies used univariate measures as indicators to predict the SES of individuals. However, the ability of these tools to predict the SES of male diabetes patients with concurrent hypertension was not tested in Pakistan. Our findings showed that the SES is a measurable attribute using univariate measures like income, occupation, education, mode of transport used and number of persons living per room. We paid special emphasis on the reliability of these univariate measures in predicting the SES of the sample patients. Consistently with previous studies, income and occupation were excellent determinants of the SES (Durkin *et al.*,, 1994, Tiwari & Kumar, 2005). The high inter-rater agreement substantiates the consistency of our method and comparability with other studies (Durkin *et al.*,, 1994, Tiwari & Kumar, 2005).

Patients suffer unequal care due to their SES. In our previous qualitative study, physicians indicated that they categorize their patients into SES and indicators like educational background, compliance, dress and appearance of the patient affected clinical decision making (Shawahna *et al.*, 2012). Physicians indicated that they tend to prescribe differently for patients in accordance with their presumed SES and patients with lower SES may suffer disparities.

Our findings showed disparities in adherence to drug, diet intake and health behaviour as devised by caregivers. Disparities were more pronounced when using the socioeconomically advantaged category as reference, particularly in the most disadvantaged group (high vs. low SES). Our findings were consistent with those of Popham & Mitchell (2007) in which they showed a correlation between accumulating socioeconomic disadvantage and little physical activity. Governmental and non-governmental organizations are continuously paying efforts to reduce inequalities in healthcare (Lillie-Blanton *et al.*, 2008). Despite the amelioration witnessed, reforming the healthcare delivery systems did not lead to completely eliminate these large inequalities (Veugelers & Yip, 2003). Our results show that univariate measures can be used to correlate adherence to drug, diet intake and health behaviour.

Analyzing the drugs that our study patients would purchase from the private sector, disparities in physicians prescribing behaviour were quite evident as characterized with prescribing cheap drug alternatives to patients with lower SES. In line with our findings, Bradley *et al*. (2007) showed that physicians in England tended to prescribe cheaper drugs on long repeat prescription intervals aiming to economize therapy for patients who paid the charges of prescription out of pocket. Similarly, studies in Ireland and Canada showed that the physician's choice on medicine among available alternatives and referring patient to further investigations and specialists were correlated with the patient's SES (Odubanjo *et al.,* 2004; Haider *et al.,* 2006). Healthcare

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expenditures are rising considerably including drug prices. According to a recent estimate, the largest share (46%) of direct cost of diabetes management in Pakistan accounted to drugs (Khowaja *et al.*, 2007). It has also been estimated that the poorest families spend about one-fifth of their income on diabetes management (Khowaja *et al.*,, 2007). One strategy of curtailing healthcare costs is to encourage generic substitution i.e. substituting the prescribed drug with a cheaper alternative with the same active ingredient, salt form, dose and route of administration. Haas *et al*(2005) estimated substantial savings from generic substitutions of prescription medicines in the US.

Our study has a number of limitations. First, although our scale had excellent reliability, our sample size was relatively small and indicators used were self-reported. Second, our study patients sample was limited to adult male individuals, characteristics of the wife and employed children (if any) were totally ignored, however, their inclusion could affect the SES of the household. Third, indicators like possessions of the household were also ignored. In the eastern context, possessions could affect the socioeconomic position of the individual in the society. Finally, the Pakistan pharmaceutical industry has been criticized for dubious promotional campaigns pursued to convince physicians prescribe their brands, especially general practitioners who consider pharmaceutical industry as primary source of information regarding medicines (Rohra *et al.*, 2008); the possibility of biased findings due to the complex physician-industry relationship cannot be ruled out. Therefore, generalization of these results should be done with caution and should take into account these limitations.

Our results lead to a number of conclusions. First, socioeconomic differentials within urban communities in developing countries can be measured using structured scale of combined univariate measures, and can serve as economic and social indicators. Second, patients with higher SES tend to adhere more to medicine, advised dietary regime intake and health behaviour than patients with lower SES. Inequalities in healthcare for patients with diabetes mellitus type II and concurrent hypertension do exist as patient's SES influence the type of drugs described by the physician.

Conflict of interest

The authors declare no conflict of interest

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