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Health Literacy in Familial Hypercholesterolemia: A Cross-National Study

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Abstract

Background: High rates of inadequate health literacy (HL) are associated with maladaptive health outcomes in chronic disease including increased mortality and morbidity rates, poor treatment adherence, and poor health. Adequate HL may be an important factor in the effective treatment and management of Familial Hypercholesterolemia (FH), and may also be implicated in genetic screening for FH among index cases. The present study examined the prevalence and predictors of HL in FH patients attending clinics in seven countries. **Design:** Cross-sectional survey. **Methods:** Consecutive FH patients attending clinics in Australia, Brazil, China, Hong Kong, Malaysia, Taiwan, and the UK completed measures of demographic variables (age, gender, household income, and highest education level) and a brief three-item HL scale. **Results:** Rates of inadequate HL were lowest in the UK (7.0%), Australia (10.0%), Hong Kong (15.7%), and Taiwan (18.0%) samples, with higher rates in the Brazil (22.0%), Malaysia (25.0%), and China (37.0%) samples. Income was an independent predictor of HL levels, accounting for effects of age. HL was also independently related to China national group membership.

Conclusions: Findings indicate non-trivial levels of inadequate HL in samples of FH patients. Consistent with previous research in chronic illness, inadequate HL is related to income as an index of health disparities. Chinese FH patients are more likely to have high rates of inadequate HL independent of income. Current findings highlight the imperative of education interventions targeting FH patients with inadequate HL.

Introduction

Familial hypercholesterolemia (FH) is a form of inherited hyperlipidemia associated with high levels of low-density lipoprotein (LDL) cholesterol from birth. Patients with untreated FH have disproportionately higher risk of early-onset coronary heart disease (CHD) and premature mortality.[1] While treatment regimens have been shown to be highly effective in reducing the excessive risks of CHD and mortality in FH patients, difficulty in identification of FH cases through genetic screening and in treatment adherence represent substantial barriers to successful management of the condition.[1] Although treatment adherence rates are relatively high, a substantial proportion of FH patients fall short of full compliance or follow regimens inconsistently. As patients with FH are generally treated as outpatients, understanding the factors likely to affect treatment adherence is paramount.[2, 3]

Health literacy (HL) is recognized as an important correlate of outcomes for a number of chronic illnesses and medical conditions,[4] including patients with dyslipidemia.[5] HL is the sufficiency of individuals' capacity to understand basic information on medical treatment and healthcare services so that they can make appropriate decisions regarding their health.[6] Low levels of HL have been associated with risk factors and maladaptive outcomes for a number of chronic conditions including numerous cardiovascular diseases.[7] Inadequate HL is also related to poorer adherence to treatment regimens for chronic disease,[8] particularly medication adherence[5] and health screening attendance.[9] Studies have suggested that the mechanisms by which HL relates to poor outcomes is through poor understanding of illness-related information and erroneous lay beliefs about illness and medication.[10, 11] In addition, non-trivial rates of inadequate HL have been identified in the populations of most nations.[12, 13] High rates of inadequate HL are associated with indices of health disparities, including low education, basic literacy, and income. [4, 12] Incidence of inadequate HL has also been shown to vary across national groups, with lower

rates observed in nations with established healthcare systems and higher national income, and in urban regions compared to rural regions, and higher rates observed in regions with indicators of low socioeconomic status such as average income and higher unemployment.[13] Identification of the demographic determinants of HL is, therefore, important to inform the development of interventions to assist patients with inadequate HL with their healthcare decisions.[14]

HL may be an important consideration in the management and treatment of FH.[15] To date, there have been few investigations of the levels and determinants of HL in hypercholesterolemic patients in general, and FH patients in particular. Overall, research has suggested that while the majority of patients identify high cholesterol with cardiovascular risk, few have adequate knowledge of hypercholesterolemia and its effects, or are aware of their own cholesterol levels.[16] To date, no study has formally assessed levels of HL in FH patients, or examined the correlates of HL in this patient group. Given the documented links between HL and outcomes in chronic illness, knowledge of rates and correlates of HL levels in FH patients will provide important information on the prevalence of HL in this patient group and gauge whether it is a factor in FH treatment. Furthermore, HL may feature in decisions to refer patients for subsequent genetic screening for healthcare programs that run cascade screening for FH in blood relatives, so knowledge of rates and determinants of inadequate HL in FH patients may inform efforts to maximize participation in genetic screening and promote greater access to treatment.

The aim of the present study was to evaluate prevalence of inadequate HL among FH patients attending clinics for FH treatment in Australia, Brazil, China, Hong Kong, Malaysia, Taiwan, and the UK. The study also examined the demographic predictors of HL levels: age, gender, education, income, and membership of national group. Rates of inadequate HL were predicted to be higher in older patients and patients with low income and education. Results are

expected to provide data to support the development of interventions to improve understanding of FH pathology and treatment in patients with inadequate HL.

Method

Design and Participants

The current study adopted a cross-sectional survey design. Participants were consecutive patients with a positive diagnosis for FH from a genetic test, or with probable FH identified through a blood test, attending FH clinics in seven countries: Royal Perth Hospital, Australia; Heart Institute (InCor), University of São Paulo Medical School Hospital, Brazil; Beijing Anzhen Hospital, China; Prince of Wales Hospital, Hong Kong; Universiti Teknologi MARA Faculty of Medicine Clinical Training Centre, Malaysia; National Taiwan University Hospital, Taiwan; and UK NHS Trusts in Manchester, Bristol, Coventry and Warwickshire, and Bath. Ethical clearance was obtained from the research ethics committee of each participating clinic. Patients were offered the opportunity to participate by referral from clinic staff between January 2015 and July 2017. Eligible patients were provided with information regarding the study and required to complete an informed consent form prior to participation.

Participants completed a questionnaire containing self-report measures of psychological variables relating to their FH and their treatment in a private waiting room. Participants provided their age, gender, marital status, annual household income stratified by seven income levels relative to national averages, and highest level of formal education in categories relevant to the national group. Binary income and highest education level variables were computed for subsequent analyses. HL was measured using the health literacy screening questions (HLSQ) scale.[17] The HLSQ provides brief screening questions to assess HL in clinical contexts. It has demonstrated good concurrent validity against previously-validated and widely-used measures of HL, the Short Test of Functional Health Literacy in Adults (STOFLA)[18] and Rapid Estimate of

Adult Literacy in Medicine (REALM).[19] Three HLSQ items have shown to have good sensitivity and specificity in detecting patients with inadequate and marginal HL verified using the STOFLA and REALM. For example, values for the area under the receiver operating characteristic curve, in which scale sensitivity scores are plotted against scale false positive rates (1-specificity scores), have been found to approach or exceed .80, with values >.80 indicative of a scale with good accuracy[20]. The HLSQ was chosen because it is short and easy to administer, making it feasible to apply in clinical practice. Participants were presented with three questions: "How confident are you in filling our medical forms by yourself?"; "How often do you have someone help you read hospital materials?"; and "How often do you have problems learning about your medical condition because of difficulty understanding written information?". Responses were provided on five-point scales anchored by *not at all* (1) and *extremely* (5). Scores for each item were summed to give a total HL score between 3 and 15. Binary HL variables for each item, and for the summed total, were computed. Participants with scores > 3 on each item, and > 9 on the total score, were classified as reporting adequate HL and participants with ≤ 3 on each item, and ≤ 9 on the total score, were classified as reporting inadequate HL.[20, 21]

Data were analysed using R. Univariate analyses were conducted to examine effects of demographic variables on HL levels using chi-square tests for categorical variables (gender, education level, income) and independent samples *t*-tests for the continuous variable (age). Effects of national group membership and the demographic variables on HL levels were examined in a hierarchical binary logistic regression analysis with the binary HL variable (coded as 1 = adequate HL, 0 = inadequate HL) as the dependent variable. Age was entered into the analyses as a continuous predictor, and gender, education level, income, and national group membership were included as categorical predictors. Analysis syntax and output files are available from https://osf.io/qvzbc/

Results

Response rates of participants invited to participate in the survey were 52.6%, 100.0%, 94.3%, 85.0%, 83.3%, 74.3%, and 34.7% for the Australia, Brazil, China, Hong Kong, Malaysia, Taiwan, and UK samples, respectively, the overall rate was 66.55%. Data were missing for the gender (2 cases), income (73 cases), and highest education level (44 cases) variables due to incomplete questionnaires and omission errors. Missing data were deleted listwise from the data set. Participant characteristics for each sample are presented in Table 1. Levels of inadequate HL based on the three-item summative score across the national samples ranged from 7.0% to 37.0%. Rates of inadequate HL were below 20% in all samples except the Brazil (22.0%), China (37.0%), and Malaysia (25.0%) samples. Focusing on the separate items from the HL scale, understanding written information about FH presented most problems for patients with close to 50% or more of patients in the Hong Kong, Brazil, Malaysia, Taiwan, and China samples reporting difficulties. Approximately one fifth of patients expressed having lower confidence in completing medical forms, although rates were more than double in the China sample (48.0%), and much lower in the UK sample (6.0%). At least one fifth of patients in all samples reported having someone else help them read hospital materials, with rates highest in Taiwan (86.7%). The latter may represent a feature of the specific cultural group who may be more likely to attend health clinics with relatives, and who may elect to read materials to attendees.

Univariate analyses are presented in Table 2. Patients with inadequate HL were older in the Hong Kong and Brazil samples; were more likely to be female in the Brazil sample; were more likely to report lower income in the Australia, Brazil, and Malaysia samples; and were more likely to report lower education levels in the Brazil, China, and Malaysia samples. There were no other statistically significant differences.

Results of the hierarchical multivariate logistic regression analyses are presented in Table 3. In the first model, HL as a binary variable (1 = adequate HL, 0 = inadequate HL) was regressed on national group membership, with the Australia group membership arbitrarily designated as the reference group. The analysis returned a statistically significant model (χ^2 = 29.19, p < .001, McFadden R^2 = .04), with China group membership (Odds ratio = -1.37, p = .001) associated with higher rates of inadequate HL. In the second model, age and gender were added as predictors of HL alongside national group membership. The analysis yielded a statistically significant model (χ^2 = 38.72, p < .001, McFadden R^2 = .06) with older individuals (Odds ratio = -0.02, p = .017) and patients from the China national group (Odds ratio = -1.57, p < .001) more likely to report inadequate HL. A third model included income and highest education level as additional predictors of HL. The analysis returned a statistically significant model (χ^2 = 57.94, p < .001, R^2 = .09). Income was positively associated with HL (Odds ratio = 0.99, p < .001), and Chinese group membership was negatively associated with HL (Odds ratio = -1.05, p = .019.

Discussion

The present study examined rates of inadequate HL in FH patients attending FH clinics in seven national groups, and examined demographic factors (age, gender, education level, and income) and national group membership as predictors of HL. Rates of inadequate HL of around 20% identified in the current analysis compare favourably with those reported in previous studies.[21] The significantly higher levels of inadequate HL in the sample from China is consistent with research demonstrating elevated levels of inadequate HL in this population.[22] While China has undergone rapid economic development, changes in levels of basic and HL have not kept pace, particularly in rural areas and urban areas with low income. The high levels of inadequate HL is likely to present challenges to maintaining adequate healthcare and reducing mortality and

morbidity from chronic illnesses in a large, aging population. Nationally-coordinated HL

programs in China that coincide with education initiatives aimed at increasing in levels of basic

literacy have been called for.[23] Advocacy of such programs should be endorsed by the national

government and seek to provide education particularly when patients visit primary care facilities

where healthcare professionals may have opportunity to reach a captive audience.

Current findings indicate that FH patients in lower income and education categories were

more likely to report inadequate HL. This is consistent with previous research linking inadequate

HL to indices of health disparities, particularly low income and education levels.[13] Patients with

low incomes and education typically have greater restrictions and access to healthcare, are less

likely to seek healthcare, and are less likely to adhere to treatment. Furthermore, problems

understanding of the pathology and consequences of FH are associated with erroneous beliefs

about the condition and treatment,[24] and may dissuade index case patients with a genetic

diagnosis from providing consent for their blood relatives to be contacted as part of a cascade

screening program.[15] Parallel to this, when consent is granted, limited understanding of FH may

also limit the effectiveness of the index cases as advocates of screening to referees.[15] Taken

together these findings illustrate that patients from lower income communities are likely to

benefit most from educational interventions aimed at promoting understanding of FH, and

screening for, and targeting, these patients is an imperative to counter the insidious effects of

health disparities.[14]

Age was identified as an independent predictor of HL in FH patients, a finding consistent

with research demonstrating age-related variations in HL with older adults more likely to report

inadequate levels of HL.[10] However, effects of age was attenuated to a trivial size when

accounting for the effects of income. Given the documented covariation between HL and indices

of health disparities,[13] the lower levels of income and education in older adults may be driving

the effect of age on HL. This corroborated by the negative correlations of age with income and education, and the positive correlations between income and education. These findings point to the importance of targeting educational interventions to improve HL at patients with low incomes.

Given that a substantive proportion of FH patients in the current samples report inadequate HL, and research documenting relations between inadequate HL and maladaptive outcomes in chronic disease,[4, 25] implementation of interventions to promote clear understanding of the pathology, consequences, and treatment of FH should be regarded a priority.[14, 25] Brief interventions administered by staff in FH clinics aimed at promoting patients' understanding of FH as a specific condition constitute an immediate solution.[15] The brief interventions would be relatively easy, effective, and inexpensive to administer, and could be targeted at patients with inadequate HL identified through an in-clinic screen.[26] Promoting better HL at the population level would require instigation of large-scale education programs led by national health policy and introducing HL education as an essential component in the curricula of healthcare professionals training programs.[27] Such interventions should also be facilitated with initiatives aimed at promoting have universal access to education to improve basic literacy.

The current study has a number of strengths: it is the first study to formally test levels of HL using a valid and reliable instrument in FH patients; the collection of parallel demographic data including income and highest education level enabled examination of the predictors of HL; and data were collected from FH clinics in seven countries permitting identification of national group as a predictor of HL level when accounting for demographic factors. The present research should, therefore, be considered preliminary and future cross-national comparisons in larger samples is warranted as larger data sets on HL in FH patients emerges. We expect current findings to highlight the importance of routine capture of HL data in FH clinics.

Limitations of the study should also be acknowledged. A key limitation is the adoption of a brief HL scale, which focuses solely on patients' ability to read and comprehend the health information in medical contexts. A narrow focus on reading comprehension in HL research has been criticized as neglecting other important components of HL.[28, 29] For example, expert consensus statements have advocated that HL measures tap multiple dimensions including abilities to access, comprehend, and interpret health information, use information accessed to communicate with medical professionals and make decisions on maintaining and improving health, and make calculations in health contexts.[28, 30] Current findings should be interpreted in light of these limitations. For example, reported rates of inadequate HL from current data should be recognized as referring only to patients' ability to read and comprehend written materials, and future research examining HL in FH patients should seek to adopt measures that encompass multiple components of HL. The relatively small sample size in each national group and a high percentage of missing data in the Australia sample were also pertinent limitations. The research also relies exclusively on self-report, and future research should consider cross-validation of self-reported demographic data with hospital records.

Conclusion

Our study is the first to assess HL levels in FH patients. Approximately one fifth of FH patients in the current sample reported inadequate HL, but sample-specific data indicated considerable variability, with incidence rates much higher in patients in the China, Brazil, and Malaysia samples. Our analysis also identified income as an important predictor of inadequate HL, corroborating previous research. Income did not, however, account entirely for the relation between China national group membership and inadequate HL, suggesting incidence of inadequate HL in this group may be attributed to factors other than those included in the current analysis. Coupled with qualitative research suggesting inadequate HL in FH patients,[15] current

findings indicate the imperative for interventions to assist better understanding of the pathology, consequences, and treatment for FH. Brief in-clinic interventions may have utility in promoting understanding and could have important effects on illness-specific outcomes. Current data also adds to evidence identifying non-trivial levels of inadequate HL in many patient groups with chronic illnesses.

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Declaration of conflicting interests

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Author contributions

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Table 1

Sample Characteristics for the Full Sample and Each National Sample

National group	Age M (SD)	Gender	Income	Education	Health literacy Q1	Q2	Q3	Total
Full sample	50.62 (14.20)	50.9	43.2	57.9	22.0	30.4	50.9	19.0
(N = 762)		49.1	56.8	42.1	78.0	69.6	49.1	81.0
Australia	50.65 (13.81)	43.6	35.7	29.6	20.0	19.1	15.5	10.0
(n = 110)		56.4	64.3	70.4	80.0	80.9	84.5	90.0
Brazil	48.73 (15.57)	39.0	16.0	62.0	23.0	30.0	45.0	22.0
(n =100)		61.0	84.0	38.0	77.0	70.0	55.0	78.0
China	43.42 (12.75)	50.0	86.5	52.5	43.0	48.0	72.0	37.0
(n = 100)		50.0	13.5	47.5	57.0	52.0	28.0	63.0
Hong Kong	50.95 (14.55)	48.0	34.1	60.8	17.6	46.1	49.0	15.7
(n = 102)		52.0	65.9	39.2	82.4	53.9	51.0	84.3
Malaysia	49.74 (11.33)	63.0	55.0	74.5	32.0	27.0	63.0	25.0
(n = 100)		37.0	45.0	25.5	68.0	73.0	37.0	75.0
Taiwan	57.72 (13.10)	62.0	73.4	94.0	16.0	25.3	86.7	18.0
(n = 150)		38.0	26.6	6.0	84.0	74.7	13.3	82.0
UK	49.56 (14.11)	46.9	15.7	32.0	6.0	21.0	11.0	7.0
(n =100)		53.1	84.3	68.0	94.0	79.0	89.0	93.0

Note. [a]All values are percentages with the exception of age. Values presented on the upper line are for males, lower income, lower education, and inadequate scores on health literacy item scores and total scale score. Values presented on the lower line are for females, higher income, higher education, and adequate scores on the health literacy item scores and total scale score. Q1 = First question of the health literacy scale: "How confident are you filling out medical forms by yourself?"; Q2 = Second question of the health literacy scale: "How often do you have someone help you read hospital materials?"; Q3 = Third question of the health literacy scale: "How often do you have problems learning about your medical condition because of difficulty understanding written information?"; Total = Sum of scores from the three-item health literacy scale.

Table 2

Univariate Comparisons of Demographic Variables (Age, Gender, Income, and Education) by Health Literacy Level with Univariate Test Statistics for the Full Sample and Each National Sample

National group	Variable and test statistics										
	Age		Gender[a]			Income[a]			Education[a]		
	M	t	M	F	χ^2	Low	Middle /High	χ^2	Low	Middle /High	χ^2
Full sample	52.63	1.54	7.7	10.5	2.67	13.2	5.9	28.47**	14.6	4.5	16.94***
	50.34		41.4	40.3		33.3	47.5		45.0	35.9	
Australia	57.45	1.74	2.7	7.3	0.69	10.0	2.9	6.00*	7.0	5.6	2.06
	49.89		40.9	49.1		15.7	61.4		22.5	64.8	
Brazil	56.05	2.57*	4.0	18.0	4.08*	8.0	14.0	6.87**	19.0	3.0	5.84**
	46.67		35.0	43.0		8.0	70.0		43.0	35.0	
China	44.97	0.93	18.0	19.0	<0.01	33.3	3.1	0.59	25.3	12.1	4.44*
	42.51		32.0	31.0		53.1	10.4		27.3	35.4	
Hong Kong	59.71	2.33*	7.8	7.8	<0.01	6.6	7.7	0.46	10.8	4.9	0.19
	49.49		40.2	44.1		27.5	58.2		50.0	34.3	
Malaysia	50.42	0.35	14.0	11.0	0.36	19.0	6.0	4.86*	9.2	14.3	17.41***
	49.51		49.0	26.0		36.0	39.0		65.3	11.2	
Taiwan	53.78	1.74	8.7	9.3	2.01	15.4	3.5	0.66	16.8	1.3	<0.01
	58.59		53.3	28.7		58.0	23.1		77.2	4.7	
UK	56.14	1.28	5.1	2.0	0.91	3.4	4.5	2.29	5.2	2.1	3.62
	49.04		41.8	51.0		12.4	79.8		26.8	66.0	

Note. [a]Values are percentages. Values presented on the upper line are for inadequate health literacy and values presented on the lower line are for adequate health literacy. M = Males; F = Females.

*$p < .05$ **$p < .01$ ***$p < .001$

Table 3

Results of Hierarchical Multivariate Binary Logistic Regression of Health Literacy on Binary Variables Representing National Group Membership and Demographic (Age, Gender, Education, Income) Variables for FH patients

Variable	Model 1				Model 2				Model 3			
	Odds ratio	SE	z	p	Odds ratio	SE	z	p	Odds ratio	SE	z	p
Brazil	-0.65	0.43	-1.50	.132	-0.68	0.44	-1.57	.117	-0.86	0.46	-1.86	.063
China	-1.37	0.42	-3.31	.001	-1.57	0.43	-3.67	.000	-1.05	0.45	-2.34	.019
Hong Kong	0.12	0.47	-0.26	.793	-0.15	0.47	-0.32	.749	0.12	0.48	-0.24	.811
Malaysia	-0.73	0.43	-1.70	.088	-0.85	0.44	-1.97	.049	-0.60	0.45	-1.32	.187
Taiwan	-0.46	0.42	-1.12	.265	-0.45	0.42	-1.07	.284	-0.01	0.45	-0.02	.987
UK	0.51	0.53	0.96	.338	0.45	0.54	0.84	.402	0.22	0.55	0.41	.684
Age					-0.02	0.01	-2.40	.017	-0.01	0.01	-1.45	.145
Gender[a]					-0.38	0.20	-1.90	.057	-0.32	0.21	-1.57	.117
Education[a]									0.28	0.23	1.21	.227
Income[a]									0.99	0.25	3.99	.000

Note. [a]Binary predictors (gender, education, and income) were coded as 1 = male, high education, high income, and 0 = female, medium/low education, medium/low income. Model 1 = National group membership included as a predictor of health literacy with Australia as the reference group, $\chi^2 = 29.19$, p < .001, McFadden $R^2 = .04$; Model 2 = As Model 1, with age and gender included as additional predictors of health literacy, $\chi^2 = 38.72$, $p < .001$, McFadden $R^2 = .06$; Model 3 = As Model 2, with income and highest education level included as additional predictors of health literacy, $\chi^2 = 57.94$, $p < .001$, McFadden $R^2 = .09$; SE = Standard error of odds ratio; z = Test of difference from null; FH = Familial hypercholesterolemia; UK = United Kingdom.