ORIGINAL RESEARCH

Understanding ethno-cultural differences in cardiac medication adherence behavior: a Canadian study

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Background: There are ethno-cultural differences in cardiac patients' adherence to medications. It is unclear why this occurs. We thus aimed to generate an in-depth understanding about the decision-making process and potential ethno-cultural differences, of white, Chinese, and south Asian cardiac patients when making the decision to adhere to a medication regimen.

Methods: A hierarchical descriptive decision-model was generated based on previous qualitative work, pilot tested, and revised to be more parsimonious. The final model was examined using a novel group of 286 cardiac patients, using their self-reported adherence as the reference. Thereafter, each node was examined to identify decision-making constructs that might be more applicable to white, Chinese or south Asian groups.

Results: Non-adherent south Asians were most likely to identify a lack of receipt of detailed medication information, and less confidence and trust in the health care system and health care professionals. Both Chinese and south Asian participants were less likely to be adherent when they had doubts about western medicine (eg, the effects and safety of the medication). Being able to afford the cost of medications was associated with increased adherence. Being away from home reduced the likelihood of adherence in each group. The overall model had 67.1% concordance with the participants' initial self-reported adherence, largely due to participants' overreporting adherence.

Conclusion: These identified elements of the decision-making process are generally not considered in traditionally used medication adherence questionnaires. Importantly these elements are modifiable and ought to be the focus of both interventions and measurement of medication adherence.

Keywords: cardiac, descriptive decision-modeling, ethno-culture, medication adherence

Introduction

The two largest visible minority groups in Canada are Chinese (from China, Hong Kong, Macau, or Taiwan) and south Asians (from India, Pakistan, Sri Lanka, Bangladesh or Nepal) and are among the fastest growing.[1] Canada's health care providers will need to develop a strategy to meet the potential care delivery challenges for these groups.

Chinese are among the least likely whereas south Asians are among the most likely ethnic groups to develop heart disease.[2–4] Chinese patients have a higher early mortality following a cardiac event than south Asian or white patients, while south Asian and white patients have a greater likelihood of having future cardiac events.[5] A number of studies have revealed that south Asians have higher rates of ischemic heart disease deaths relative to Chines or whites.[4–8] There is a lack of clarity or consensus regarding why this occurs. It is possible that ethnocultural differences in access to, and delivery

of health care may influence management of heart disease and thereby morbidity and mortality outcomes.

Medication adherence has most recently been defined as "the process by which patients take their medications as prescribed".[9] (p696) Adherence to prescribed medications is already a challenge among the general population, and nonadherence is typically influenced by the interaction of several factors. Krousel-Wood et al[10] and others[11,12] have identified that patient- (eg, ethnicity, age, socioeconomic status, health beliefs), provider- (eg, sense of reciprocal respect) and health care system-related (eg, access to understandable information, costs) factors affect medication adherence. The disease itself, and the types and numbers of medications may also influence adherence. Coronary artery disease, for example, requires lifestyle modification and often the use of several medications; many of which have their own side effects, thereby increasing the risk of nonadherence.[10,11]

The majority of patients who suffer a cardiac event will survive the initial event and require chronic (outpatient) management.[13,14] The evidence-based management of coronary artery disease includes adhering to cardiac medications as a core therapy to reduce cardiovascular morbidity and mortality. Adherence to antiplatelet agents, beta blocker, statins and ACE inhibitor or angiotensin receptor blocking agents (medications recommended in international cardiovascular guidelines)[15,16] is associated with 20%–30% reduction in morbidity and mortality following a cardiac event.[15–18] Outside the clinical trial setting, adherence to pharmacotherapy is often poor, thus limiting the extent of therapeutic benefit that can be achieved.[9,19,20] The risks of poor adherence are extensive and may result in disease progression, repeated hospitalizations, and death. The collective economic repercussions for medication nonadherence are estimated to exceed $100 billion per year.[21]

Previous work has shown that Chinese and south Asian cardiac patients are significantly less likely to adhere to their medications,[5] and Chinese and south Asian diabetics who are prescribed cardiac medications are also significantly less likely to adhere to their medications relative to their white counterparts.[22] These study findings clearly highlight important discrepancies in cardiovascular medication adherence between these three ethno-cultural groups.

Adherence to medications is largely controlled by patients (self-managed). It is unknown how recognized (and yet to be discovered) factors work together or how they are prioritized in the context of patients' everyday decision-making to take or not to take their medications as prescribed. We aimed to generate a more in-depth understanding about the decision-making process that people with ACS undergo when faced with making therapeutic choices. The results could lay the groundwork to develop and evaluate ethno-culturally sensitive practices that will help to optimize morbidity and mortality reduction in ethnic patients with heart disease.

Methods
Design
We used a three-phased approach to develop and examine a descriptive decision-model that depicts how whites, Chinese and south Asians who have heart disease make the decision to adhere (or not) to their prescribed medications. We used Gladwin's[23] ethnographic decision-tree modeling approach, to describe how people arrive at their decision, and the role that ethno-culture plays in that decision-making. This is a method used primarily by anthropologists and which has been successfully used by health disciplines[24–29] to model group behavior based on individuals' decision-making. This study protocol received approval from the Conjoint Health Research Ethics Board of the University of Calgary and was undertaken in accordance with the Helsinki Declaration of 1964.

Gladwin's[23] decision-tree modeling approach relies on methodological triangulation. Initially, qualitative interviewing strategies are used to generate data that support the inductive work of building the original model (stage A). The interviews focus on learning about the contexts in which, and criteria that, people use to identify and select among available alternatives. The preliminary decision-tree model is developed and refined through quantitatively (survey methods) "pilot testing" (stage B). Thereafter, a quantitative (survey) method is used for determining if the decision-tree model "works" (stage C). Though our aim was not directed at evaluating the model for accuracy, as we were more concerned about examining ethno-cultural differences in how participants respond to the model questions, we examined concordance of the model outcomes with self-reported adherence. The findings from the qualitative interviews have already been published,[30] thus the description below focuses on stages B and C.

Sample
There were 286 participants in this study. Gladwin[23] suggests a sample of approximately 150 when there are multiple groups and outcomes. This sample size is in keeping with our previous work,[26,27] as well as that of others,[24,25,28,29] who have used this method.

The majority of participants were selected from a cohort of acute coronary syndrome patients who were included in an international study focused on ethnicity and symptoms presentation. Participants of that cohort study were asked if they would agree to be contacted for potential participation in future studies. These potential participants were contacted by telephone to explain the study and the consent process. Written informed consent for this study was obtained by mailing a consent form to the potential participant. Once the consent form was returned to the investigators, the surveys were undertaken by telephone by trained research assistants. After finding difficulty garnering a sample of Chinese participants, we sought additional participants through a Chinese senior's cultural center. There, we asked attendees if a physician told them that they had heart disease (coronary artery disease), and if they were prescribed more than two medications for their heart disease. If these potential participants answered affirmatively to each question, we invited them to participate, obtained their written informed consent, and conducted the interview in person.

Participants were selected based on their self-identified ethnicity of European-white, Chinese or south Asian and their ability to speak English; Cantonese or Mandarin; or Punjabi or Hindi. There was a greater proportion of male south Asian and Chinese participants, and a greater proportion of non-English speaking south Asian participants who agreed to participate in this study relative to the cohort from which participants were recruited. The Chinese participants in this study were older relative to the cohort from which they were initially recruited because many were recruited from a senior's center.

Translation

All study materials were rigorously translated and the details are outlined in a previous publication.[31] Briefly, study materials were professionally translated, as well as validated by "lay" people who speak and read the languages of interest. This process ensures that study materials are indeed accurate and understandable (eg, not too high or low a reading level). All non-English interviews were undertaken by highly trained research assistants who fluently spoke and read both English as well as the non-English language.

Decision-tree model preliminary testing and refinement, stage B

A decision-tree model was developed based on qualitative interviews in stage A.[30] This model was hierarchical and comprised a series of yes/no questions. The questions were translated into traditional and simplified Chinese characters as well as Punjabi and Hindi languages, as described above. The preliminary (pilot) testing of this model was undertaken by administering a survey based on the series of questions in the model to a small sample of 59 novel white (n=25), Chinese (n=9) and south Asian (n=25) participants (eg, they had not participated in stage A). We aimed to identify areas where the model was unclear (eg, question needed to be reworded); "failing" to work in interview format; the translation needed revision; or interviewer error was occurring.[23] Field notes were taken to document any other issues (eg, difficulty with asking questions in the correct order) that arose during this data collection phase. Following these interviews, a more parsimonious model was developed (see Figure 1).

Decision-tree model examination, stage C

Another novel group of participants was recruited to test the final model. First, a short demographic questionnaire was administered to enable characterization of the study sample. These data were analyzed using ANOVA or Chi-square, as appropriate. Then, in keeping with Gladwin's[23] process, the participants were asked to self-report their adherence behavior as: "consistently," "sometimes" or "not at all" adherent to their cardiac mediations. These three potential outcomes were identified through the qualitative work undertaken in stage A.[30] The number of participants whose self-reported adherence matched the outcome of the decision-tree were identified, then divided by the number of participants. This proportion represented the concordance of the self-report with the model outcome. To address our main study aim, we then compared items significantly related to the model outcomes, and item responses based on ethnicity. Chi-squared tests or Fisher's exact tests were used for these analyses. All data were analyzed using IBM SPSS Statistics 23.

Results

As seen in Table 1, 286 participants (117 white, 79 Chinese, 90 south Asian) were surveyed to test the decision-tree model. There were differences in the demographic characteristics examined by ethnic group. There were significantly more men in the south Asian group than there were in the white and Chinese groups. The Chinese were significantly older than the other participants (possibly due to where a portion of them were recruited) and south Asians are known to develop heart disease at a younger age.[32] More than 87% of Chinese surveys and 50% of south Asian surveys were undertaken in languages other than English. The greatest proportion of
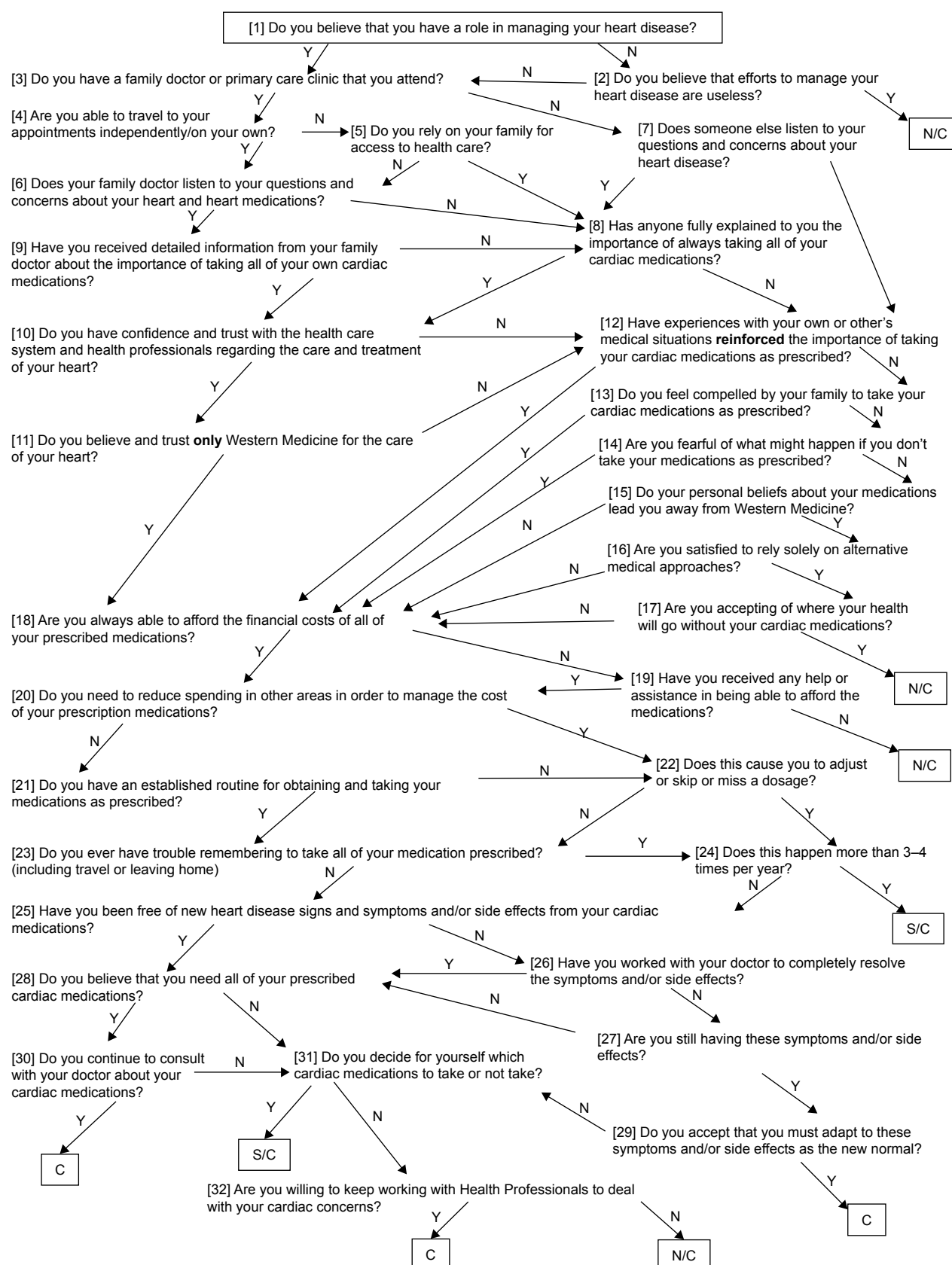
[1] Do you believe that you have a role in managing your heart disease?

Y

[3] Do you have a family doctor or primary care clinic that you attend?

N

[2] Do you believe that efforts to manage your heart disease are useless?

Y

N/C

Y

[4] Are you able to travel to your appointments independently/on your own?

N

[5] Do you rely on your family for access to health care?

N

[7] Does someone else listen to your questions and concerns about your heart disease?

Y

Y

N

[6] Does your family doctor listen to your questions and concerns about your heart and heart medications?

N

Y

[8] Has anyone fully explained to you the importance of always taking all of your cardiac medications?

Y

[9] Have you received detailed information from your family doctor about the importance of taking all of your own cardiac medications?

N

N

Y

[10] Do you have confidence and trust with the health care system and health professionals regarding the care and treatment of your heart?

N

[12] Have experiences with your own or other's medical situations **reinforced** the importance of taking your cardiac medications as prescribed?

N

Y

[13] Do you feel compelled by your family to take your cardiac medications as prescribed?

N

Y

N

[14] Are you fearful of what might happen if you don't take your medications as prescribed?

N

Y

[11] Do you believe and trust **only** Western Medicine for the care of your heart?

Y

[15] Do your personal beliefs about your medications lead you away from Western Medicine?

Y

N

[16] Are you satisfied to rely solely on alternative medical approaches?

Y

N

[17] Are you accepting of where your health will go without your cardiac medications?

N

Y

[18] Are you always able to afford the financial costs of all of your prescribed medications?

N/C

Y

N

[19] Have you received any help or assistance in being able to afford the medications?

Y

N/C

N

[20] Do you need to reduce spending in other areas in order to manage the cost of your prescription medications?

Y

N/C

N

[22] Does this cause you to adjust or skip or miss a dosage?

Y

N

[21] Do you have an established routine for obtaining and taking your medications as prescribed?

Y

N

Y

[24] Does this happen more than 3–4 times per year?

N

Y

[23] Do you ever have trouble remembering to take all of your medication prescribed? (including travel or leaving home)

N

S/C

[25] Have you been free of new heart disease signs and symptoms and/or side effects from your cardiac medications?

Y

N

[26] Have you worked with your doctor to completely resolve the symptoms and/or side effects?

Y

N

[28] Do you believe that you need all of your prescribed cardiac medications?

Y

N

[27] Are you still having these symptoms and/or side effects?

Y

[30] Do you continue to consult with your doctor about your cardiac medications?

N

[31] Do you decide for yourself which cardiac medications to take or not take?

Y

N

N

[29] Do you accept that you must adapt to these symptoms and/or side effects as the new normal?

Y

Y

C

Y

S/C

N

C

[32] Are you willing to keep working with Health Professionals to deal with your cardiac concerns?

Y

C

N

N/C

Figure 1 The decision-tree model which was based on the qualitative interviews in stage A.
Abbreviations: N, no; Y, yes; C, compliant; NC, noncompliant; SC, sometimes compliant.

Table 1 Demographic characteristics of 286 stage C participants

Variable	Ethnic group			*P*-value
	White (n=117) n (%)	**Chinese (n=79)** n (%)	**South Asian (n=90)** n (%)	
No of men	55 (47.0)	43 (54.4)	68 (75.6)	<0.001
Age (mean [SD])	66.99 (10.94)	73.99 (10.46)	63.0 (10.62)	<0.001
Language of survey				<0.001
English	117 (100)	10 (12.7)	45 (50)	
Cantonese	–	29 (36.7)	–	
Mandarin	–	40 (50.6)	–	
Punjabi	–	–	40 (44.4)	
Hindi	–	–	5 (5.6)	
Time in Canada				<0.001
Canadian born	99 (84.6)	–	1 (1.1)	
<5 years in Canada	–	14 (17.7)	1 (1.1)	
5–9 years in Canada	–	12 (15.2)	9 (10)	
10–19 years in Canada	–	8 (10.1)	21 (23.3)	
>20 years in Canada	18 (15.4)	45 (57.0)	58 (64.4)	
Marital status				<0.001
Married/common law	74 (63.2)	51 (64.6)	76 (84.4)	
Divorced/separated	9 (7.7)	1 (1.3)	5 (5.6)	
Widowed	21 (17.9)	25 (31.6)	7 (7.8)	
Single	13 (11.1)	2 (2.5)	2 (2.2)	
Habitation, living with…				<0.001
Spouse only	58 (49.6)	25 (31.6)	17 (18.9)	
Spouse and (un)married children	14 (11.9)	24 (30.4)	56 (62.2)	
(Un)married children/other family	9 (7.7)	20 (25.3)	9 (10)	
Alone/other	36 (30.8)	10 (12.7)	8 (8.9)	
Education				<0.001
None	–	4 (5.1)	5 (5.6)	
<High school[a]	11 (9.4)	30 (38)	21 (23.3)	
High school	27 (23.1)	16 (20.3)	11 (12.2)	
>High school	79 (67.5)	29 (36.7)	53 (58.9)	
Employment status				<0.001
Employed full time	30 (25.6)	9 (11.4)	27 (30)	
Employed part time	10 (8.5)	4 (5.1)	9 (10)	
Not employed (employable or disabled)	9 (7.7)	2 (2.5)	17 (18.9)	
Retired/home maker	68 (58.1)	64 (81)	37 (41.1)	

Note: [a]Or equivalent.

Chinese and south Asians immigrated to Canada >20 years ago. Significantly more south Asians were married and resided in extended family situations relative to other participants. Significantly more whites were educated beyond high school (or equivalent) than others. Given the age difference, significantly more Chinese were retired relative to their counterparts.

To examine decision-making process differences between whites, Chinese and south Asian participants, the dichotomous response to each question in the model (Figure 1) was compared to the model outcome response for each ethnic group (see Table 2 for significant factors). These significant factors are presented here in the order in which they appear in the model. South Asian participants who were not at all

adherent to their cardiac medications were most likely to identify that they had not received detailed information from the family doctor about taking their cardiac medications (Figure 1, Q9). They were also most likely to identify that they did not have confidence and trust in the health care system or health care professionals regarding their treatment (Figure 1, Q10). Whites who were consistently or sometimes adherent to their cardiac medications tended to believe and trust only western medicine for the care of their heart (Figure 1, Q11). All study participants who indicated that they could afford the financial costs of their medications tended to be those who consistently or sometimes took their medications (Figure 1, Q18). Those south Asians who indicated they could not always afford the financial costs,

Table 2 Factors significantly related to the model outcomes by ethnicity[a]

Tree item (# responders w/c/sa)	White (n=117)				Chinese (n=79)				South Asian (n=90)			
	Outcome			P-value	Outcome			P-value	Outcome			P-value
	Consistently (n=94)	Sometimes (n=20)	Not at all (n=3)		Consistently (n=61)	Sometimes (n=16)	Not at all (n=2)		Consistently (n=69)	Sometimes (n=17)	Not at all (n=4)	
Q9 (–/–/64) Have you received detailed information from your family doctor about the importance of taking all of your own cardiac medications?												
Yes									84.4% (41)	53.8% (7)	0% (0)	0.001
No	–	–	–		–	–	–		14.6% (7)	46.2% (6)	100% (3)	
Q10 (–/–/79) Did you have confidence and trust with the health care system and health professionals regarding the care and treatment of your heart?												
Yes									98.3% (59)	93.8% (15)	0% (0)	<0.001
No	–	–	–		–	–	–		1.7% (1)	6.3% (1)	100% (3)	
Q11 (90/–/–) Do you believe and trust ONLY western medicine for the care of your heart?												
Yes	94.6% (70)	73.3% (11)	100% (1)	0.031	–	–	–		–	–	–	
No	5.4% (4)	26.7% (4)	0		–	–	–		–	–	–	
Q18 (117/79/89) Are you always able to afford the financial costs of all of your prescribed medications?												
Yes	97.9% (92)	95% (19)	0% (0)	<0.001	91.8% (56)	87.5% (14)	0% (0)	0.011	91.3% (63)	82.4% (14)	33.3% (1)	0.026
No	2.1% (2)	5.0% (1)	100% (3)		8.2% (5)	12.5% (2)	100% (2)		8.7% (6)	17.6% (3)	66.7% (2)	
Q19 (–/–/11) Have you received any help or assistance in being able to afford the medications?												
Yes	–	–	–		–	–	–		100% (6)	100% (3)	0% (0)	0.018
No	–	–	–		–	–	–		0% (0)	0% (0)	100% (2)	
Q21 (101/–/–) Do you have an established routine for obtaining and taking your medications, as prescribed?												
Yes	100% (85)	87.5% (14)	0% (0)	0.024	–	–	–		–	–	–	
No	0% (0)	12.5% (2)	0% (0)		–	–	–		–	–	–	

				p				p				p
Q23 (113/75/87) Do you ever have trouble remembering to take all of your medication prescribed (including travel or leaving home)?												
Yes	2.1% (2)	84.2% (16)	0% (0)	<0.001	5% (3)	66.7% (10)	0% (0)	<0.001	7.4% (5)	70.6% (12)	50% (1)	<0.001
No	97.9% (92)	15.8% (3)	0% (0)		95% (57)	33.3% (5)	0% (0)		92.6% (63)	29.4% (5)	50% (1)	
Q24 (19/15/19) Does this happen more than 3–4 times per year?												
Yes	0% (0)	100% (17)	0% (0)	0.006	0% (0)	100% (11)	0% (0)	0.001	0% (0)	91.7% (11)	0% (0)	<0.001
No	100% (2)	0% (0)	0% (0)		100% (4)	0% (0)	0% (0)		100% (6)	8.3% (1)	100% (1)	
Q25 (97/–/–) Have you been free of new heart disease signs and symptoms and/or side effects from your cardiac mediations?												
Yes	75.5% (71)	0% (0)	0% (0)	0.018	–	–	–	–	–	–	–	–
No	24.5% (23)	100% (3)	0% (0)		–	–	–		–	–	–	
Q28 (–/61/67) Do you believe that you need all of your prescribed cardiac medications?												
Yes	–	–	–	–	100% (57)	0% (0)	0% (0)	<0.001	93.2% (55)	16.7% (1)	50% (1)	<0.001
No	–	–	–		0% (0)	100% (4)	0% (0)		6.8% (4)	83.3% (5)	50% (1)	
Q29 (15/–/–) Do you accept that you must adapt to these symptoms and/or side effects as the "new normal"?												
Yes	83.3% (10)	0% (0)	0% (0)	0.022	–	–	–	–	–	–	–	–
No	16.7% (2)	100% (3)	0% (0)		–	–	–		–	–	–	
Q31 (13/8/14) Do you decide for yourself which cardiac medications to take or not take?												
Yes	0% (0)	100% (3)	0% (0)	0.003	100% (4)	0% (0)	0% (0)	0.029	0% (0)	83.3% (5)	0% (0)	0.003
No	100% (10)	0% (0)	0% (0)		0% (0)	100% (4)	0% (0)		100% (7)	16.7% (1)	100% (1)	

Note: [a]Not all participants responded to each question in the model because they followed different paths along the decision tree.

Table 3 How ethnicity affected question response[a]

Tree item and response	Ethnicity			*P*-value
	White (n=117)	Chinese (n=79)	South Asian (n=90)	
Q11				
Do you believe and trust ONLY western medicine for the care of your heart?				
Yes	91.1% (82/90)	87.5% (56/64)	74.3% (55/74)	0.013
No	8.9% (8/90)	12.5% (8/64)	25.7% (19/74)	
Q25				
Have you been free of new heart disease signs and symptoms and/or side effects from your cardiac mediations?				
Yes	73.2% (71/97)	81.8% (54/66)	59.7% (46/77)	0.014
No	26.8% (26/97)	18.2% (12/66)	40.3% (31/77)	
Q30				
Do you continue to consult with your doctor about your cardiac medications?				
Yes	100% (74/74)	93% (53/57)	94.9% (56/59)	0.047
No	0% (0/74)	7% (4/57)	5.1% (3/59)	

Note: [a]Not all participants responded to each question in the model because they followed different paths along the decision tree.

and who indicated that they received assistance to pay for their medications were then more likely to be consistently or sometimes adherent than other south Asians (Figure 1, Q19). Whites who indicated that they had an established routine for obtaining and taking medications as prescribed were mostly likely to be consistently or sometimes adherent (Figure 1, Q21). All participants indicated that traveling or leaving home caused some lack of consistency in taking their medications (Figure 1, Q23) and this happened more than 3–4 times per year (Figure 1, Q24). Only white participants indicated that being free of heart disease signs and symptoms and/or side effects from their medications led to them being consistent with taking their cardiac medications (Figure 1, Q25). These white participants were also most likely to accept that they needed to adapt to the signs and symptoms and/or side effects of their medications (Figure 1, Q29). Chinese and south Asian participants who believed they needed all of their prescribed medications were most likely to consistently take their medications (Figure 1, Q28). Those participants that were consistently adherent also indicated that they did not decide for themselves which cardiac medications to take or not to take, while those who were sometimes or not adherent did so (Figure 1, Q31).

To identify questions upon which white, Chinese and south Asian participants significantly differed, we examined each question response relative to the participants' ethnicity. As seen in Table 3, white participants were most likely to respond affirmatively to the question regarding their belief in only western medicine (Figure 1, Q11). South Asian participants were least likely to identify that they had been free of new heart disease signs and symptoms and/or side effects from their cardiac mediations (Figure 1, Q25). There were

slight differences between groups about whether or not they continued to consult with their doctor about their cardiac medications (Figure 1, Q30). Whites were most likely to do so, followed by south Asians, then Chinese.

Finally, there were no significant differences between ethnic groups in outcomes based on their self-report or in model outcomes (Table 4). The overall concordance of the participants' self-report of adherence with the model outcomes was 67.1%. The model was most successful with the white participants (69.2%), followed by the Chinese (65.8%), and south Asians (65.6%). There were 94 failures in total. Most failures (55/94) occurred because participants (whites and south Asians more than Chinese) overreported relative to underreported adherence.

Discussion

We used descriptive decision-modeling to develop a more in-depth understanding of the contextual factors that influence how white, Chinese, and south Asian cardiac patients

Table 4 Self-report and actual model outcomes

Item	Ethnic group			*P*-value
	White (n=117) n (%)	Chinese (n=79) n (%)	South Asian (n=90) n (%)	
Self-report				
Consistently	102 (87.2)	61 (77.2)	75 (83.3)	NS
Sometimes	15 (12.8)	18 (22.8)	15 (16.7)	
Not at all	–	–	–	
Model outcome				
Consistently	94 (80.3)	61 (79.2)	69 (76.7)	NS
Sometimes	20 (17.1)	16 (20.3)	17 (18.9)	
Not at all	3 (2.6)	2 (2.6)	4 (4.4)	

Abbreviation: NS, not significant.

decide to (or not) take their cardiac medications. The model outcomes had a 67.1% concordance with participants' self-reported adherence to their cardiac medications. We noted that more than half of the instances in which there was a lack of concordance was because the participants tended to over-report as opposed to underreport their adherence, relative to the model outcome. We did not consider the participants' self-report as a "gold standard" of measurement, yet this finding is consistent with the general and cardiovascular literature focused on medication adherence.[33,34]

Each participant group (white, Chinese, and south Asian) identified that affordability of medications increased their medication adherence. Though Canada has universal health care, outpatient medications are not part of that benefit. In fact, 10%–12% of Canadians with chronic disease, such as cardio-vascular disease, face financial barriers to managing their illness.[35,36] Having a financial barrier to accessing medications has a detrimental effect on health. Campbell et al[37] showed that after adjustment for relevant demographic variables, chronic disease patients who self-identified having a financial barrier had an increased rate of disease-related hospitalization (incidence rate ratio 1.36 [95% CI: 1.29–1.44]); as well as mortality (incidence rate ratio 1.24 [95% CI: 1.16–1.32]) compared to those without financial barriers. Having a financial barrier to care is a central construct in this model (all but one participant's path through the model lead to this question) and leads to detrimental outcomes.

Each participant group also identified that challenges in remembering to take their medications, especially while traveling or being away from home put them at risk for nonadherence. Medication adherence can be positively influenced by developing regular routines (though this related to the model outcomes only for the white participants). Costa et al[38] identified that comprehensive self-management programs can improve medication adherence in some patients with chronic illness, but this has not been shown conclusively in patients with cardiovascular disease. They posited that the reason for a lack of significant success in enhancing medication adherence is interventions often lack a strong behavior theory basis. Our earlier qualitative work revealed that Chinese and south Asian patients, in particular, travel for extended periods of time and rely heavily on their pharmacist to assist in ensuring that sufficient medication is dispensed. Thereafter having a regular routine in taking medications enhanced adherence.[30]

The model revealed that south Asians participants believed that having good communication with health care provider regarding their medications was an important factor in their adherence. In a related item, having decreased

confidence in their health care provider negatively influenced adherence.

A systematic review by Sohal et al[39] revealed that "language and communication discordance with the health care provider" (p. 7) played an important role in reducing south Asian's capacity to understand information critical to adhering to their diabetes medications. The review also revealed that south Asian diabetic patients tended to want to follow their physician's advice and be adherent, but when lack of communication and mistrust ensued, adherence was decreased. The qualitative work by Ens et al[40] also revealed that "relationships with health care professionals who demonstrated clear communication and cultural awareness was associated with enhanced medication adherence" (p. 1472). Indeed, we found for all patients in our foundational qualitative work, that physician's communication was central to adherence for all participants.[30]

Having some doubt about the need to take all of the prescribed cardiac medications was associated with variability in medication adherence in Chinese and south Asian participants. Our earlier qualitative work revealed that Chinese and south Asian cardiac patients took medications with the hope of being able to reduce or quit taking medications in the future.[30] Further, the systematic review by Sohal et al[39] identified that concerns about "long-term safety" were also central to south Asians' adherence. Indeed, Li and Froelicher[41] also identified that Chinese were less likely to adhere to hypertension medications when they had a lower perceived benefit from taking the medication. Furthermore, differences in health beliefs (eg, viewing disease as a result of fate and preferring self-management over medical visits) are associated with poor adherence to treatment recommendations.[42]

Finally, there were central elements to this inductively generated decision-model that are not currently included in medication adherence scales and may warrant inclusion in further study of medication adherence. Indeed, patients' medication adherence occurs as a result of complex factors,[10–12] and not merely having a routine. This study has revealed that having financial barriers to accessing medications, being able to communicate effectively with the health care provider (eg, physician, pharmacist), and believing in western medicine (eg, the effectiveness and safety of the medication) are additional factors that ought to be considered.

There were limitations to this study. The characteristics of the study sample do not necessarily reflect those whites, Chinese and south Asians who are from the general population (and meet inclusion criteria). For example, there was an obvious gender imbalance in the south Asian group. It is not uncommon to have difficulty recruiting south Asian women

into studies as they are less likely to speak English than men and are often more protected by their family members against intrusion.[43] Also, the Chinese participants were older than expected. This is likely due to participant recruitment from a senior's cultural center. There is no mechanism using Gladwin's[23] methods to control for these differences. Thus, these study findings may lack some generalizability.

Conclusion

It has not been clear why there are ethno-cultural differences in cardiac patients' adherence to medications. Key elements associated with adherence for all participants included affordability of the medications and creating a routine (eg, remembering). South Asian participants were less likely to be adherent when they did not perceive having "good" communication with their health care provider (eg, physician, pharmacist). Both Chinese and south Asian participants were less likely to be adherent when they had doubts about western medicine (eg, the effects and safety of the medication). These elements of the decision-making process are not included in the traditionally used medication adherence questionnaires. Importantly these elements are modifiable and ought to be the focus of both interventions and measurement of medication adherence.

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Disclosure

The authors report no conflicts of interest in this work.

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