

Ethnic differences in illness perceptions, self-efficacy and diabetes self-care

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Abstract

This study assessed differences between Europeans, South Asians and Pacific Islanders in illness perceptions, self-efficacy, self-care, metabolic control and retinopathy in diabetes. We also evaluated the role of illness perceptions and self-efficacy in diabetes self-care and metabolic control within each group. A total of 86 Europeans, 86 South Asians, and 87 Pacific Islanders with type-2 diabetes completed self-report measures of illness perceptions, self-efficacy and self-care. Metabolic control and retinopathy data were collected from patient records. Results showed that Pacific Islanders and South Asians held shorter illness timeline perceptions compared to Europeans. Relative to both the other groups, Pacific Islanders also had elevated scores on three illness perceptions subscales: consequences, identity and emotional representations. They had lower medication-specific self-efficacy as well as poorer medication self-care, metabolic control and retinopathy. In all three groups, self-efficacy was fairly consistently related to self-care, but not to metabolic control. Illness perceptions were less consistently related to self-care, but were associated with metabolic control.

Keywords: *Diabetes mellitus, illness perceptions, self-efficacy, self-care, ethnicity*

Introduction

Type-2 diabetes is recognised as an increasingly important health problem in both developed and developing countries, and evidence shows that diabetes disproportionately affects different ethnic groups. Type-2 diabetes is particularly common among many non-European groups who move to Western countries or who adopt Westernised lifestyles. The prevalence of diabetes is particularly high

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in South Asian communities around the world as well as in urban centres in India (King, Aubert, & Herman, 1998; Ramachandran, Snehalatha, Latha, Manoharan, & Vijay, 1999; Ramachandran, Snehalatha, Latha, Vijay, & Viswanathan, 1997). Pacific Islanders also have a high prevalence of diabetes. Furthermore, future predictions estimate that increases in diabetes prevalence rates may be more severe in some ethnic groups than others. In New Zealand, the prevalence of diabetes is predicted to increase between 1996 and 2011 by 62% in European men and 54% in European women, but by 149% in Pacific men and 144% in Pacific women (Ministry of Health, 2002).

The impact of diabetes also differs between ethnic groups, as some groups develop diabetes at younger ages, have poorer glycaemic control and thus are more severely affected by diabetes complications. Research suggests that Pacific Islanders with diabetes are more likely to suffer from retinopathy, nephropathy and heart disease than their European counterparts (Isaacs & Scott, 1987; Simmons, 1996a, 1996b). South Asians are also more likely than Europeans to suffer from retinopathy and nephropathy, but suffer less diabetic foot disease than Europeans (Chaturvedi et al., 2002; Mather, Chaturvedi, & Kehely, 1998). Some of these ethnic differences may be accounted for by poorer glycaemic control due to a range of psychological, behavioural and social factors.

Behavioural strategies are required both to prevent and control diabetes. Large-scale trials have shown that diabetes patients can significantly decrease their risk of developing complications by maintaining tight glycaemic control (Diabetes Control and Complications Trial Research Group, 1993; UK Prospective Diabetes Study Group, 1998). Diabetes self-management is a challenging task requiring long-term lifestyle changes and significant dedication, as patients must alter their diet, follow a regular exercise programme, take their medications and test their blood sugar levels regularly. Not surprisingly, many studies have shown that adherence or self-care in diabetes is often far from optimal (Cramer, 2004; Johnson, 1992). The terms self-care and adherence are both used to describe the extent to which patients follow their own (or their doctor's) treatment plan. Here, the two treatment terms are used interchangeably. Psychologists have attempted to determine which psychological factors are associated with self-care, so that interventions might be targeted towards altering such factors. Two such factors are illness perceptions and self-efficacy.

Self-efficacy and self-care

Self-efficacy has been defined by Bandura (1986, p. 391): 'as people's judgements of their capabilities to organise and execute courses of action required to attain designated types of performances'. Many studies have found that self-efficacy is associated with diabetes self-care in the areas of diet, exercise and glucose monitoring (Griva, Myers, & Newman, 2000; Johnston-Brooks, Lewis, & Garg, 2002; Kavanagh, Gooley, & Wilson, 1993; Williams & Bond, 2002). Fewer studies have reported relationships between self-efficacy and medication self-care

(Hurley & Shea, 1992; McCaul, Glasgow, & Schafer, 1987). Overall, however, these studies demonstrate that patients with higher levels of self-efficacy have better self-care practices. Some studies report that significant relationships exist between self-efficacy and glycosylated haemoglobin (HbA_{1c}) (Day, Bodmer, & Dunn, 1995; Griva et al., 2000; Johnston-Brooks et al., 2002; Talbot, Nouwen, Gingras, Gosselin, & Audet, 1997), but others have not replicated these findings (Eiser, Riaz, Eiser, Hammersley, & Tooke, 2001; Knecht, Syrjala, Laukkanen, & Knuuttila, 1999; Padgett, 1991; Rapley, 1990; Rose, Fliege, Hildebrandt, Schirop, & Klapp, 2002).

Research has not demonstrated whether self-efficacy plays the same role in diabetes self-care in non-European patient groups. Most previous studies have been conducted in European groups, and the small number of studies conducted in non-European groups have produced more mixed results (Ikeda, Aoki, Saito, Muramatsu, & Suzuki, 2003; Stewart et al., 2000). Skelly, Marshall, Haughey, Davis and Dunford (1995) found that, concurrently, self-efficacy was only related to diet and exercise self-care but that, prospectively, was related to glucose testing and exercise self-care in African-American women. The authors conclude that the effects of self-efficacy are unstable over time with regard to the size of the effect and the regimen components affected. Skaff, Mullan, Fisher and Chesla (2003) found that self-efficacy was associated with diet and exercise behaviours, general health and glycaemic control in Europeans, but no relationships existed between self-efficacy and self-care in Latinos. These studies question the application of self-efficacy into other non-European ethnic groupings.

Illness perceptions and self-care

Illness perceptions are based on Leventhal's Self-Regulation Model, and are measured along five dimensions. These are: identity (perceptions of the label and symptoms of the illness), timeline (perceptions of the length of the illness), cure/control (perceptions of the curability or controllability of the illness), consequences (perceptions of the consequences of the illness) and cause (perceptions of the cause of the illness). A number of studies have demonstrated that relationships exist between illness perceptions and self-care behaviours in a range of medical conditions, including asthma, haemophilia and heart disease (Jessop & Rutter, 2003; Llewellyn, Miners, Lee, Harrington, & Weinman, 2003; Petrie, Weinman, Sharpe, & Buckley, 1996).

A number of studies have also linked illness perceptions to self-care in diabetes. Most studies report that patients who believe their condition is more controllable have better self-care in the areas of diet, exercise and glucose testing (Glasgow, Hampson, Strycker, & Ruggiero, 1997; Griva et al., 2000; Hampson, Glasgow, & Foster, 1995; Hampson, Glasgow, & Toobert, 1990; Skinner & Hampson, 1998; Skinner & Hampson, 2001; Skinner, Hampson, & Fife-Schaw, 2002; Skinner et al., 2003; Skinner, John, & Hampson, 2000). Fewer studies have reported associations between illness perceptions and medication self-care (Griva et al., 2000; Skinner et al., 2002). Several studies have also found that

treatment control perceptions are associated with HbA_{1c} (Griva et al., 2000; Hampson et al., 1995). Most of the research on illness perceptions and diabetes has been conducted in Britain or the USA, and thus the populations studied have been predominantly European. Only one study has examined the role of illness perceptions in diabetes self-care in a group of patients that was not primarily of European origin (Barnes, Moss-Morris, & Kaufusi, 2004). This study was conducted in a mixed Tongan and European sample, and it found few relationships between illness perceptions and self-care. Thus, research has not yet determined whether illness perceptions are important factors in self-care for all cultural groups.

Aims and predictions of the present study

Despite the fact that Europeans are among the ethnic groups least affected by diabetes, much of the health psychology research in type-2 diabetes has been conducted in predominantly European groups. The present study aimed to assess differences in illness perceptions, self-efficacy, self-care, metabolic control and retinopathy between Europeans, South Asians and Pacific Islanders. It also aimed to assess the role of illness perceptions and self-efficacy in diabetes self-care behaviours and metabolic control within each group. Based on previous studies (Barnes et al., 2004; Simmons, 1996b; Simmons, Gatland, Leakehe, & Fleming, 1996), we predicted that Pacific Islanders would have significantly poorer HbA_{1c}, worse retinopathy and poorer self-care than the other groups, and that they would perceive diabetes to have fewer consequences (i.e., believe diabetes to be less serious, which could lead to poorer self-care), a shorter timeline, more symptoms, which in turn would lead to less personal and treatment control, to less understanding of their condition, to be more concerned and exhibit greater emotional representations, and to have lower self-efficacy for diabetes self-care. It was hypothesised that within each ethnic group better self-care and metabolic control would be associated with greater consequences perceptions, longer timeline perceptions and greater perceptions of personal and treatment control.

Method

Participants

The participants were patients recruited at the Auckland Diabetes Centre. The inclusion criteria were: (a) having type-2 diabetes, (b) being of European, South Asian (Indian, Fiji Indian, Sri Lankan, Pakistani or Bangladeshi) or Polynesian (Samoan, Tongan, Cook Islands Maori, Niuean or Tokelauan) descent, and (c) being over 18 years of age. Three hundred and seventy nine people were informed about the study, and 315 met the inclusion/exclusion criteria and were invited to participate. Of these, 290 agreed to participate and gave informed consent. Of these, 259 returned the completed questionnaire, constituting a

Table I. Demographic and clinical characteristics for each ethnic group and the total sample.

Variable	European (<i>n</i> = 86)	South Asian (<i>n</i> = 86)	Pacific Islander (<i>n</i> = 87)	Total sample (<i>n</i> = 259)
Percentage male	63	67	47	59
Mean age (range)	63 (18–87)	58 (28–81)	57 (19–85)	59 (18–87)
Education: Percentage with tertiary/trade qualification	48	51	23	41
Marital status				
Percentage single	15	1	17	11
Percentage married/cohabiting	59	81	60	67
Percentage divorced/separated/widowed	26	18	22	22
Percentage born in New Zealand	62	1	7	23
Mean years lived in New Zealand	52	15	29	32
Mean known duration of Diabetes (years)	8	8	9	8
Mean HbA _{1c} (%)	7.45	7.75	8.34	7.84
Percentage without retinopathy	61	60	37	53
Percentage taking insulin	37	22	55	37.8

response rate of 82%. The sample consisted of 86 Europeans, 86 South Asians and 87 Pacific Islanders. Of the South Asian sample, 57% were Indian, 30% Fiji Indian, 10% Sri Lankan and 2% Bangladeshi. Of the Pacific Island sample, 32% were Samoan, 23% Niuean, 22% Tongan, 18% Cook Islanders and 5% mixed Pacific Island descent. The participants' demographic characteristics are reported in Table I.

There were several significant demographic differences between ethnic groups. As expected from epidemiological data, the Pacific Island sample had a significantly greater proportion of women than the European, $\chi^2(1, N = 173) = 4.29$, $p = 0.038$, or South Asian, $\chi^2(1, N = 173) = 7.29$, $p = 0.007$, samples. There were also significant age differences between the groups, $F(2, 256) = 4.96$, $p = 0.008$. Tukey *post hoc* tests showed that, despite a similar duration of known diabetes, South Asian and Pacific Island subjects were significantly younger than the European subjects.

Educational level was measured on a four-point scale, with the four categories being primary school, secondary school, technical/trade certificate and university/polytechnic education. Around half of the Europeans and South Asians had received higher education, whilst only 23% of the Pacific Islanders had been educated further than secondary school. European and Pacific Island groups had similar proportions of those single, married or divorced/separated/widowed, whereas a higher proportion of South Asians were married and few were single. Europeans were significantly more likely to have been born in New Zealand compared to South Asians, $\chi^2(1, N = 171) = 56.33$, $p < 0.001$, and Pacific Islanders, $\chi^2(1, N = 172) = 72.99$, $p < 0.001$. An analysis of variance (ANOVA) with Bonferroni *post hoc* tests revealed that there were significant differences between all three groups in the mean length of time they had lived in

New Zealand, with Europeans having lived here the longest and South Asians the shortest amount of time, $F(2, 255) = 95.11$, $p < 0.001$. To compare groups in their duration of diabetes an analysis of covariance (ANCOVA) was conducted on rank scores and controlling for age. It showed there were no significant differences in the duration of diabetes between Europeans (Adjusted Mean Rank = 116.05), South Asians (Adjusted Mean Rank = 120.88) and Pacific Islanders (Adjusted Mean Rank = 141.00), $F(2, 247) = 2.99$, $p = 0.052$.

Procedure and measures

Ethical approval for the study was granted by the Ministry of Health's Auckland Ethics Committee. The research materials, including the questionnaire, participant information sheet and consent form, were translated into the following languages: Hindi, Gujarati, Tongan and Samoan. An independent person checked the translations to ensure they were of high quality. Both the translator and the independent checker were native speakers of the translated language in all cases.

Participants were recruited while attending routine clinic appointments at the Auckland Diabetes Centre and its satellite clinics. Patients were approached in the clinic waiting room and the study was explained to them. The inclusion and exclusion criteria were explained, and patients who met the criteria were invited to participate. Informed consent was obtained, and then each patient was given a questionnaire that they could fill in either while waiting for their appointment or at home and return by mail with a freepost envelope. Participants who failed to return their questionnaire were followed up first by telephone and then by mail. HbA_{1c} values, the year each participant was diagnosed with diabetes and retinopathy scores were extracted from the Auckland District Health Board computer database.

Illness perceptions. The Brief Illness Perceptions Questionnaire (BIPQ) (Broadbent, Petrie, Main, & Weinman, 2006) was used to measure illness perceptions along the following dimensions: identity, consequences, timeline, personal control, treatment control, concern, understanding and emotional representations. Each dimension is measured by a single item scored on an 11-point Likert scale, with higher scores indicating stronger endorsement of that item (e.g., high identity scores indicate that the participant experiences more symptoms). A summary score was also calculated by adding all of the BIPQ individual items to reflect the overall positivity or negativity of an individual's illness perceptions. The summary score had an adequate internal consistency with a Cronbach's α ranging from 0.58 to 0.70 in the three ethnic groups. Recent research demonstrates that the BIPQ items have very good test-retest reliability (scale items ranged from 0.42 to 0.75 over 6 weeks in a renal patient sample) and good concurrent, predictive and discriminant validity (Broadbent et al., 2006).

Self-efficacy. The six items measuring diabetes-specific self-efficacy from the Multidimensional Diabetes Questionnaire (Nouwen, Gingras, Talbot, & Bouchard, 2003) were used to measure self-efficacy. Two items assess confidence in following diet, one about testing blood glucose, one about exercise, one about controlling blood glucose and one about following all treatments. For this study, one further item was added asking about confidence in taking medications. These items were scored on an 11-point Likert scale with answers ranging from 0 indicating 'not at all confident' to 100 indicating 'very confident'. Total self-efficacy scores are calculated by taking the average score across all items, and high scores indicate high levels of diabetes-specific self-efficacy. For this study, individual self-efficacy scores for each area of the diabetes regimen were required. To calculate the score for diet, the two relevant items were summed together; whilst for glucose testing, exercise and medication-taking, individual raw scores for the single relevant items were used. Nouwen et al. (2003) reported that the scale has good internal consistency, with a Cronbach's α of 0.86. Using the current data, an internal consistency analysis was conducted using the 7 original items as well as the one additional item on medication self-efficacy. Coefficient α was computed, and this was 0.88, indicating good internal consistency.

Diabetes self-care behaviours. The Summary of Diabetes Self-Care Activities (SDSCA) (Toobert & Glasgow, 1994) is a 12-item measure of diet, exercise, blood glucose monitoring and medication self-care. The questionnaire asks participants to report on the last 7 days, and most items are measured on a 5-point Likert scale, with answers ranging from 'never' to 'always', or '0% (none of the time)' to '100% (all of the time)'. Five items measure dietary self-care, 3 items assess exercise self-care, 2 items ask about blood glucose monitoring and 2 items assess medication-taking behaviour. The SDSCA is scored by converting raw scores to z -scores, which are averaged to form a composite score for each area of the regimen. Higher scores indicate better self-care behaviour. The SDSCA has been used extensively in diabetes research, and reliability coefficients for the current study were acceptable, ranging from 0.71 for diet to 0.84 for exercise. As the medication subscale of the SDSCA usually has little sensitivity, an additional item was added asking participants how many doses of their diabetes medication they had forgotten in the last month. Using this, participants could be divided into two groups: those who were always adherent and those who were not. A total of 135 people reported being always adherent and 90 reported they were not.

Metabolic control. Glycosylated haemoglobin (HbA_{1c}) is a marker of metabolic control and is measured regularly as part of patients' routine care. HbA_{1c} is considered to reflect diabetes control over the preceding 6- to 8-week period and is measured in blood samples using chromatography. High HbA_{1c} values indicate poorer metabolic control, with optimal levels being around 6.5%. Each patient's

most recent result was extracted from the Auckland District Health Board's computer database.

Retinopathy. Retinopathy data were available for 95% of participants from medical records. Following eye testing at the Auckland Diabetes Centre, results on retinopathy were recorded in the computer system as: no retinopathy, mild, moderate or severe retinopathy.

Data analysis

A power analysis was conducted to determine the number of participants required for each ethnic group. These calculations were based on a study by Griva et al. (2000) where correlations between control perceptions and self-care ranged between 0.30 and 0.69. Taking the lower correlation, it was calculated that to have 80% power, with a two-tailed hypothesis at the 0.05 level of significance, 85 subjects would be required per ethnic group. Thus, 255 participants were required overall. The Statistical Package for the Social Sciences (SPSS) was used to carry out the statistical analyses. The data were first screened to ensure that scores approximated a normal distribution. Where the assumptions of the various parametric tests were not met, non-parametric tests were used. Where there was no non-parametric test available (e.g., for ANCOVA), parametric tests were performed on the ranked data. An α level of 0.05 was used for all statistical analyses.

A series of one-way ANOVA, ANCOVA or Kruskal-Wallis tests were conducted to investigate ethnic differences in illness perceptions, self-efficacy, self-care, metabolic control and retinopathy. Since demographic factors were expected to differ between ethnic groups, a series of correlations and *t*-tests were used to assess whether the demographics were also associated with the psychological and outcome variables. Where they were, ANCOVA was used to control for these factors. Tukey *post hoc* tests were used where required, or pairwise comparisons were made using Holm's sequential Bonferroni approach to control for type-1 error.

For each ethnic group, a series of correlations were used to examine relationships between self-care and HbA_{1c} (Spearman's correlations were used for self-care scores, which were skewed, but Pearson correlations were used for HbA_{1c}). For each ethnic group, a series of correlations also examined relationships between demographics and self-care/HbA_{1c}, and between illness perceptions/self-efficacy and self-care/HbA_{1c} values. For dietary self-care, exercise self-care, glucose testing self-care and HbA_{1c}, variables that significantly correlated with each area of self-care or HbA_{1c} (or had a correlation coefficient greater than 0.15) were then entered into a series of multiple regression analyses. For medication self-care, which was converted to a dichotomous variable, binomial logistic regression was used. A range of regression analyses were conducted, and the final model was selected on the basis of theory and the principle of parsimony.

Results

Ethnic group differences

Clinical variables. An ANCOVA was conducted to investigate group differences in mean HbA_{1c}, because it was necessary to control for the covariate age, which was significantly negatively associated with HbA_{1c}, $\beta = -0.24$, $t = -3.97$, $p < 0.001$. The ANCOVA indicated that there was a significant difference between ethnic groups, $F(2, 246) = 5.75$, $MSE = 2.12$, $p = 0.004$. *Post hoc* tests showed that Pacific Islanders (adjusted $M = 8.28$) had significantly poorer metabolic control compared to Europeans (adjusted $M = 7.54$) and South Asians (adjusted $M = 7.71$).

A Kruskal–Wallis test was used to examine ethnic group differences in retinopathy scores. This showed that there was a significant difference between the three groups in retinopathy scores, $\chi^2(2, N = 247) = 14.62$, $p = 0.001$. *Post hoc* tests showed that Pacific Islanders (M rank = 146.03, $n = 84$) had greater levels of retinopathy compared to Europeans (M rank = 112.31, $n = 85$), $z = -3.31$, $p = 0.001$, and South Asians (M rank = 113.01, $n = 78$), $z = -3.18$, $p = 0.001$. There was no significant difference in retinopathy scores between Europeans and South Asians, $z = -0.08$, $p = 0.933$.

Self-care. Mean self-care scores for each ethnic group for each area of the diabetes regimen are presented in Table II. Dietary self-care scores were negatively skewed, so ranked scores were used. To assess group differences in diet behaviour, an ANCOVA was performed on the ranked scores for dietary self-care, as it was necessary to control for age, which was significantly associated with transformed dietary self-care scores, $\beta = 0.19$, $t = 3.10$, $p = 0.002$ (older people had better dietary self-care). The ANCOVA showed that there was no significant difference between the three groups in terms of dietary self-care, $F(2, 246) = 0.45$, $p = 0.637$.

The data for glucose testing self-care was also not normally distributed, and transforming the data did not help this substantially, so glucose testing self-care scores were converted to ranks. An ANCOVA on the rank scores was used to examine ethnic group differences in glucose testing behaviour, as it was once again necessary to control for the covariate age, which was significantly positively associated with ranked glucose testing scores, $\beta = 0.15$, $t = 2.31$, $p = 0.022$.

Table II. Mean scores for dietary, exercise, glucose testing and medication self-care for Europeans, South Asians and Pacific Islanders.

	Dietary self-care (scores transformed and adjusted for age)	Exercise self-care (mean ranks)	Glucose testing self-care (mean ranks adjusted for age)	Medication self-care (mean ranks adjusted for age)
European	4.61 ($n = 82$)	123.83 ($n = 86$)	122.80 ($n = 71$)	123.29 ($n = 75$)
South Asian	4.34 ($n = 84$)	128.76 ($n = 85$)	110.82 ($n = 77$)	118.01 ($n = 71$)
Pacific Islander	4.98 ($n = 85$)	132.96 ($n = 85$)	99.71 ($n = 73$)	101.89 ($n = 81$)

The ANCOVA revealed no significant differences between ethnic groups in terms of their glucose testing self-care behaviour, $F(2, 217) = 2.39$, $p = 0.094$, although there was a trend for Pacific Islanders to test their glucose levels the least often and for Europeans to test the most regularly. A Kruskal–Wallis test showed no significant differences between the ethnic groups in terms of their exercise self-care behaviours, $\chi^2(2, N = 256) = 0.65$, $p = 0.722$.

Medication self-care scores were severely negatively skewed, so the data were ranked and the ranked scores were used to assess ethnic group differences in medication behaviour. It was once again necessary to control for the covariate age, which was significantly associated with medication self-care, $\beta = 0.23$, $t = 3.48$, $p = 0.001$. An ANCOVA, controlling for age, showed a significant difference between the groups in their medication self-care, $F(2, 223) = 4.09$, $MSE = 2340.23$, $p = 0.018$. *Post hoc* tests indicated Pacific Islanders had significantly poorer medication self-care compared to Europeans, $F(1, 223) = 7.44$, $p = 0.007$, as well as South Asians, $F(1, 223) = 4.20$, $p = 0.042$. There was no significant difference in medication self-care between Europeans and South Asians, $F(1, 223) = 0.043$, $p = 0.513$.

Self-efficacy. Self-efficacy scores for each ethnic group are presented in Table III. The adjusted means are presented for dietary, glucose testing, medication and total self-efficacy (where scores have been adjusted for covariates using ANCOVA), whilst the unadjusted means are presented for exercise self-efficacy.

Dietary self-efficacy scores were significantly associated with the covariate age, $\beta = 0.22$, $t = 3.60$, $p < 0.001$, so an ANCOVA was used to assess group differences. This showed that there was a significant difference between the groups in their dietary self-efficacy, $F(2, 253) = 3.59$, $MSE = 431.25$, $p = 0.029$, with South Asians reporting higher levels of dietary self-efficacy compared to Europeans but not Pacific Islanders. Age was also a significant covariate of medication self-efficacy, $\beta = 0.16$, $t = 2.43$, $p = 0.016$, so an ANCOVA was used to control for age while comparing ethnic groups for medication self-efficacy. This showed that there was a significant difference between the groups, $F(2, 227) = 3.73$, $MSE = 162.34$, $p = 0.026$, where Pacific Islanders reported significantly lower medication self-efficacy compared to

Table III. Mean/adjusted mean self-efficacy scores for various areas of the diabetes self-care regimen for Europeans, South Asians and Pacific Islanders.

	Dietary self-efficacy*	Exercise self-efficacy ^a	Glucose testing self-efficacy	Medication self-efficacy*	Total self-efficacy
Europeans	65.95	64.05	79.01	94.20	77.32
South Asians	74.18	67.85	79.99	94.40	77.69
Pacific Islanders	72.29	69.00	74.40	89.51	76.05

^aUnadjusted means.

* $p < 0.05$.

Europeans and South Asians. There was no significant difference in medication self-efficacy between Europeans and South Asians.

An ANOVA showed that there was no significant difference between the ethnic groups in exercise self-efficacy, $F(2, 247) = 0.75$, $p = 0.475$. There was also no group difference in glucose testing self-efficacy, as assessed by ANCOVA, $F(2, 237) = 0.98$, $MSE = 707.03$, $p = 0.378$, which was used to control for the following covariates: age, $\beta = 0.20$, $t = 3.14$, $p = 0.002$, and gender, $\beta = 0.14$, $t = 2.13$, $p = 0.034$. Finally, an ANCOVA was used to assess ethnic differences in total self-efficacy and to control for age, which was significantly associated with total self-efficacy scores, $\beta = 0.22$, $t = 2.51$, $p = 0.013$. This showed that there were no significant differences between the groups in terms of total self-efficacy, $F(2, 253) = 1.96$, $MSE = 321.27$, $p = 0.143$.

In summary, the differences between the ethnic groups were as follows: Pacific Islanders exhibited worse metabolic control and retinopathy compared to Europeans and South Asians. Pacific Islanders also had significantly poorer dietary self-care and medication self-care compared to Europeans and South Asians. Illness perceptions differed between the three groups in a number of ways. Pacific Islanders had greater emotional representations, reported greater diabetes consequences and more symptoms than Europeans and South Asians. Both Pacific Islanders and South Asians reported that diabetes had a shorter timeline than Europeans. South Asians reported higher self-efficacy for diet than Europeans, and Pacific Islanders reported lower medication self-efficacy than Europeans and South Asians.

Illness perceptions. Differences in illness perceptions between the three ethnic groups are presented in Figure 1. For the illness perceptions that had no covariates, the mean scores have been graphed. For those illness perceptions where an ANCOVA has been performed, the adjusted means are graphed. An ANOVA showed that there were significant group differences in consequences perceptions, $F(2, 251) = 5.74$, $p = 0.004$. Tukey *post hoc* tests demonstrated that Pacific Islanders (accurately) perceived that diabetes had greater consequences ($M = 5.30$, $SD = 2.67$) than did Europeans ($M = 4.20$, $SD = 2.77$) and South Asians ($M = 3.98$, $SD = 2.70$). A Kruskal-Wallis Test was used to assess ethnic group differences in timeline perceptions. The test was significant, $\chi^2(2, N = 243) = 19.33$, $p < 0.001$, and *post hoc* tests showed that Europeans (Mean Rank = 144.64, $n = 82$) had significantly longer timeline perceptions than both South Asians (Mean Rank = 116.30, $n = 82$) and Pacific Islanders (Mean Rank = 104.42, $n = 79$). An ANOVA also revealed significant group differences on the identity subscale of the BIPQ (reported symptoms), $F(2, 251) = 9.97$, $p < 0.001$. Tukey's follow-up tests demonstrated that Pacific Islanders reported significantly more symptoms ($M = 5.43$, $SD = 3.03$) than Europeans ($M = 3.65$, $SD = 2.81$) and South Asians ($M = 3.74$, $SD = 2.90$). An ANCOVA was used to assess group differences in emotional representations, as scores on this dimension were significantly associated with the covariate age, $\beta = -0.21$, $t = -3.41$, $p = 0.001$. The test was significant, indicating that there were significant group

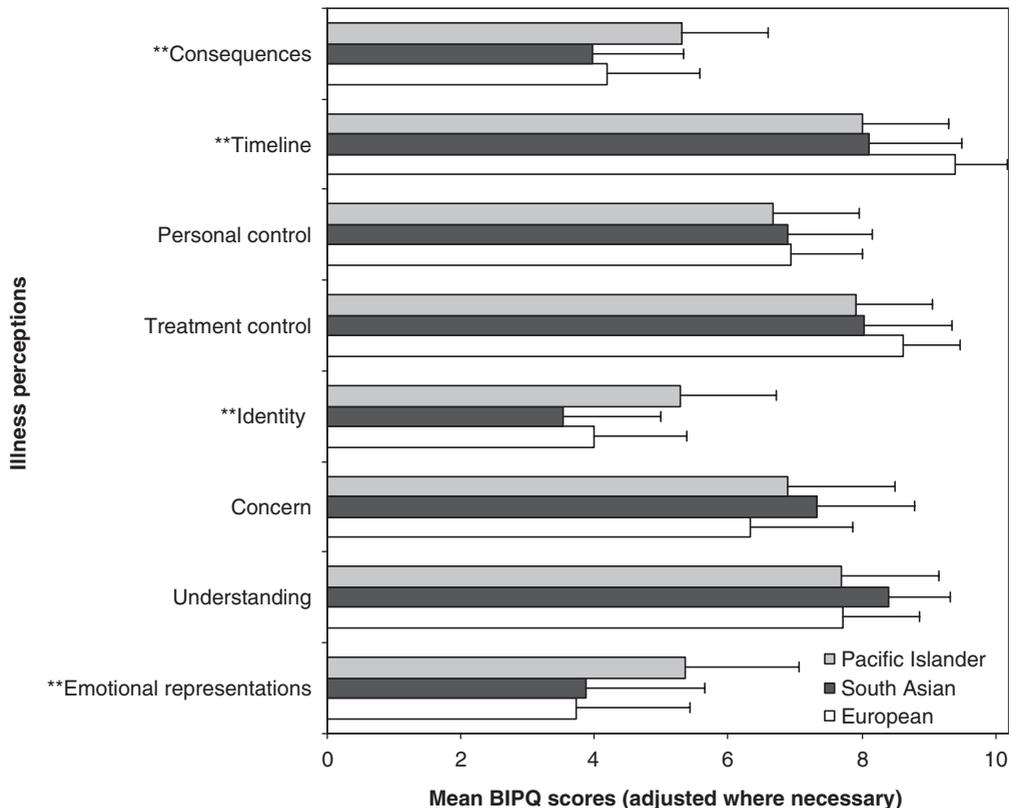


Figure 1. Mean (SDs) brief illness perceptions questionnaire (BIPQ) scores for Europeans, South Asians and Pacific Islanders. * $p < 0.05$, ** $p < 0.01$.

differences in emotional representations, $F(2, 245) = 5.78$, $MSE = 11.64$, $p = 0.004$. Follow-up tests showed that Pacific Islanders were more affected emotionally by their diabetes (adjusted $M = 5.35$) than were South Asians (adjusted $M = 3.86$) and Europeans (adjusted $M = 3.72$). A series of ANOVA tests revealed no ethnic group differences in perceptions of personal control, $F(2, 254) = 3.23$, $p = 0.592$, treatment control, $F(2, 245) = 2.33$, $p = 0.100$, concern, $F(2, 253) = 2.30$, $p = 0.103$, or in perceived understanding of diabetes, $F(2, 252) = 1.81$, $p = 0.166$.

The role of illness perceptions and self-efficacy in diabetes self-care and HbA_{1c}

Univariate analyses in Europeans. Preliminary analyses showed that several demographic factors were associated with self-care and HbA_{1c} in the European group. These demographic variables were controlled for in multivariate analyses, which determine the relationships between psychological variables and self-care/HbA_{1c}. The demographic relationships were as follows: gender was associated with dietary, $z = -2.41$, $p = 0.016$, and medication self-care, $\chi^2(1, N=74) = 7.99$,

$p=0.005$ (in both instances women reported better adherence); older age was associated with better medication self-care, $t(72)=2.38$, $p=0.020$; duration of diabetes was also associated with metabolic control, $r=0.23$, $p=0.040$. A series of Spearman's correlations revealed that no area of self-care was associated with HbA_{1c} nor with retinopathy within the European group.

Table IV displays correlations of illness perceptions/self-efficacy dimensions with dietary self-care, exercise self-care, glucose testing self-care and metabolic control. Psychological factors significantly correlated with dietary self-care in Europeans were personal control perceptions and dietary, exercise, glucose-testing and total self-efficacy. The only factor that significantly correlated with exercise self-care was exercise self-efficacy. No psychological variables had significant univariate correlation coefficients with glucose testing self-care scores. Consequences, personal control, identity, and concern perceptions, emotional representations, illness perceptions summary scores, and dietary, exercise and total self-efficacy were all significantly correlated with HbA_{1c}. All relationships were in the expected direction. Since medication self-care scores were severely skewed, the data was dichotomised, and t -tests were performed to determine which illness perceptions and self-efficacy dimensions were associated with medication self-care (Table V). Understanding was the only illness perception associated with medication self-care. Dietary, glucose testing, medication and total self-efficacy were also significantly associated with medication self-care. A series of correlations revealed that there were no significant relationships between retinopathy and any of the psychological variables.

Univariate analyses in South Asians. Several demographic factors were associated with self-care in the South Asian sample. Age was positively associated with dietary self-care, $r=0.31$, $p=0.004$. Education was negatively associated with glucose testing, $r=-0.25$, $p=0.031$ and medication-taking behaviour, $t(68)=-2.16$, $p=0.034$ (those with little education had better adherence). In the South Asian sample, the only area of self-care that was associated with HbA_{1c} was glucose testing, $r=0.27$, $p=0.018$: those with poor metabolic control tested their glucose more regularly. No area of self-care was associated with retinopathy.

Table IV displays the relationships between illness perceptions/self-efficacy and self-care and HbA_{1c}. This shows that the psychological variables that were significantly associated with dietary self-care were personal control perceptions, BIPQ summary scores and all areas of self-efficacy. Personal control perceptions and all areas of self-efficacy were also correlated with exercise self-care. Treatment control perceptions was the only psychological variable significantly related to glucose-testing self-care scores, and personal control perceptions and emotional representations scores were both significantly correlated with HbA_{1c}. All correlations were in the expected direction. The only psychological variables significantly associated with medication-taking behaviour in South Asians were identity perceptions, BIPQ summary scores and medication self-efficacy (Table V). A series of correlations revealed that there were no significant relationships between retinopathy and any of the psychological variables.

Table IV. Correlations between illness perceptions/self-efficacy and self-care/metabolic control in Europeans, South Asians and Pacific Islanders.

	Consequences			Personal Treatment			Identity Concern			Understanding			Emotional representations			BIPQ summary scores			Glucose testing self-efficacy			Medication self-efficacy			Total self-efficacy					
	Timeline	control	control	control	control	control	control	control	control	control	control	control	control	control	control	control	control	control	control	control	control	control	control	control	control	control				
Dietary	-0.04	0.15	0.26*	0.18	-0.11	-0.02	0.17																							
Exercise	0.02	-0.10	0.04	0.21	-0.10	-0.06	0.08																							
Glucose testing	0.13	0.23	-0.13	0.13	0.22	0.05	0.16																							
HbA _{1c}	0.30**	0.15	-0.31**	-0.02	0.23*	0.45**	-0.06																							
Europeans																														
					-0.16																									
					0.11																									
					<0.00																									
					0.44**																									
South Asians																														
					-0.14																									
					-0.09																									
					0.09																									
					0.44**																									
Dietary	-0.12	-0.08	0.35**	0.21	-0.04	-0.13	0.21																							
Exercise	-0.05	0.04	0.27*	0.15	-0.08	<0.01	0.10																							
Glucose testing	0.21	0.09	0.14	0.28*	0.05	0.06	0.10																							
HbA _{1c}	0.13	0.02	-0.26**	-0.09	0.09	<0.01	-0.06																							
Pacific Islanders																														
					0.28*																									
					-0.12																									
					0.30**																									
					0.16																									
					0.26*																									
Dietary	-0.32**	0.14	0.06	0.18	-0.14	0.03	0.21																							
Exercise	-0.37**	-0.13	0.01	0.05	-0.19	-0.15	-0.03																							
Glucose testing	0.05	0.30*	0.16	0.29*	0.15	0.12	0.17																							
HbA _{1c}	0.21	-0.01	-0.21*	-0.17	0.11	0.19	-0.04																							

* $p < 0.05$, ** $p < 0.01$.

Table V. The *t*-test results for differences in illness perceptions/self-efficacy between those with good ($n=135$) vs. poor ($n=90$) medication self-care for Europeans, South Asians and Pacific Islanders.

	Europeans			South Asians			Pacific Islanders		
	<i>t</i> -statistic	df	<i>p</i> -value	<i>t</i> -statistic	df	<i>p</i> -value	<i>t</i> -statistic	df	<i>p</i> -value
Consequences	0.38	72	0.720	-1.22	69	0.227	-3.18	73	0.002**
Timeline	-1.46	70	0.147	0.28	66	0.781	1.55	70	0.126
Personal control	0.77	72	0.442	1.80	69	0.077	1.06	76	0.291
Treatment control	1.80	71	0.076	1.63	68	0.108	1.99	74	0.050*
Identity	0.86	72	0.395	-2.24	68	0.028*	-0.56	74	0.578
Concern	-0.06	70	0.956	-1.08	69	0.286	-0.72	77	0.473
Understanding	2.57	40	0.012*	0.84	68	0.404	1.70	77	0.093
Emotional representations	-0.48	69	0.635	-1.63	65	0.107	-0.58	76	0.566
BIPQ summary score	-1.01	72	0.318	-2.67	69	0.009**	-1.82	78	0.072
Dietary self-efficacy	2.86	72	0.006**	1.60	69	0.115	2.75	78	0.007**
Exercise self-efficacy	-0.23	70	0.822	0.07	69	0.944	1.23	73	0.224
Glucose testing self-efficacy	2.10	67	0.039*	0.92	69	0.362	1.88	72	0.064
Medication self-efficacy	3.34	72	0.001**	2.94	69	0.004**	2.19	78	0.032*
Total self-efficacy	2.45	72	0.017*	1.50	69	0.138	2.48	78	0.015

* $p < 0.5$, ** $p < 0.01$.

Univariate analyses in Pacific Islanders. Several demographic factors were associated with self-care in the Pacific Island sample. Age was related to glucose testing, $r=0.25$, $p=0.033$, and medication self-care, $t(78)=2.23$, $p=0.029$, as well as HbA_{1c}, $r=-0.35$, $p=0.001$; older people reported better self-care and had lower HbA_{1c}. Those with less education also had lower HbA_{1c}, $r=0.25$, $p=0.031$. Those who had had diabetes for longer reported being better at taking their medication, $t(75)=2.03$, $p=0.046$. Females reported better medication adherence than men, $\chi^2(1, N=78)=4.11$, $p=0.043$. The only area of self-care associated with HbA_{1c} in the Pacific Island sample was medication-taking, as those who were better at taking medication had lower HbA_{1c}, $t(74)=5.22$, $p=0.014$. No area of self-care was significantly associated with retinopathy.

Table IV shows that several illness perceptions and self-efficacy variables were associated with self-care and HbA_{1c} in the Pacific Island sample. Consequences perceptions and all areas of self-efficacy were related to dietary self-care. Consequences perceptions, emotional representations, BIPQ summary scores and dietary, exercise and total self-efficacy were related to exercise self-care. The psychological variables associated with glucose testing self-care were timeline perceptions, treatment control perceptions and dietary (but not glucose testing) self-efficacy. Personal control perceptions, BIPQ summary scores and dietary, glucose testing and medication self-efficacy were all related to HbA_{1c}. All correlations were in the expected direction. Table V shows that, in the Pacific Island sample, those with greater consequences perceptions, less treatment

control beliefs, less dietary self-efficacy and less medication self-efficacy are less likely to be adherent with their medication. A series of correlations revealed that there were no significant relationships between retinopathy and any of the psychological variables.

Multivariate analyses. Multivariate analyses were conducted to confirm the results of the univariate analyses. For each of the following outcome variables in each ethnic group, a multiple linear regression was conducted: dietary self-care, exercise self-care, glucose testing self-care, and HbA_{1c}. For medication self-care, binary logistic regression was used. In total, 15 regression analyses were performed, and these generally supported the results of the univariate analyses. Thus, for the sake of brevity, the regression tables are not presented but are briefly described in the following text.

In the European sample, after controlling for demographics, the psychological variables accounted for a significant proportion of the variance for all areas of self-care, including diet, R^2 change = 0.42, $F(7, 64) = 7.50$, $p < 0.001$; exercise, R^2 change = 0.28, $F(2, 70) = 14.80$, $p < 0.001$; glucose testing, R^2 change = 0.18, $F(2, 63) = 7.06$, $p = 0.002$; medication, $\chi^2(6, N = 65) = 28.20$, $p < 0.001$, $R^2 = 0.48$; and HbA_{1c}, R^2 change = 0.27, $F(8, 66) = 3.29$, $p = 0.003$. For each regression equation, at least one psychological variable had a significant β -weight. For dietary self-care, dietary self-efficacy was the only significant individual predictor, $\beta = 0.70$, $p < 0.001$. For exercise self-care, the significant predictors were educational level, $\beta = 0.26$, $p = 0.013$, treatment control perceptions, $\beta = 0.21$, $p = 0.048$, and exercise self-efficacy, $\beta = 0.45$, $p < 0.001$. For glucose testing self-care, significant predictors were timeline perceptions, $\beta = 0.33$, $p = 0.006$, and glucose testing self-efficacy, $\beta = 0.23$, $p = 0.047$. For medication self-care, the only significant predictor was medication self-efficacy, $\beta = -0.13$, Wald $\chi^2 = 3.99$, $p = 0.046$. For HbA_{1c}, the individual significant predictors were personal control perceptions, $\beta = -0.32$, $p = 0.050$, and concern perceptions, $\beta = 0.43$, $p = 0.014$.

In the South Asian sample, after controlling for demographics, the psychological variables accounted for a significant proportion of the variance for all areas of self-care, including diet, R^2 change = 0.27, $F(5, 71) = 6.00$, $p < 0.001$; exercise, R^2 change = 0.44, $F(4, 74) = 15.16$, $p < 0.001$; glucose testing, R^2 change = 0.19, $F(3, 65) = 5.91$, $p = 0.001$; medication, $\chi^2(7, N = 63) = 26.71$, $p < 0.001$, $R^2 = 0.47$; and HbA_{1c}, R^2 change = 0.13, $F(4, 68) = 2.65$, $p = 0.041$. For each regression equation, at least one psychological variable had a significant β -weight. For dietary self-care, dietary self-efficacy was the only significant individual predictor, $\beta = 0.57$, $p < 0.001$. For exercise self-care, the only significant predictors were educational level, $\beta = 0.19$, $p = 0.035$ and exercise self-efficacy, $\beta = 0.64$, $p < 0.001$. For glucose testing self-care, significant predictors were educational level, $\beta = -0.34$, $p = 0.002$; treatment control perceptions, $\beta = 0.23$, $p = 0.035$; and glucose testing self-efficacy, $\beta = 0.31$, $p = 0.006$. For medication self-care the only significant predictor was medication self-efficacy, $\beta = -0.13$,

Wald $\chi^2 = 6.01$, $p = 0.014$. For HbA_{1c} the only individual significant predictor was emotional representations, $\beta = 0.45$, $p = 0.013$.

In the Pacific Island sample, after controlling for demographics, the psychological variables accounted for a significant proportion of the variance for dietary self-care, R^2 change = 0.35, $F(5, 70) = 7.38$, $p < 0.001$; exercise self-care, R^2 change = 0.24, $F(6, 65) = 3.45$, $p = 0.005$; medication self-care, $\chi^2(3, N = 66) = 14.55$, $p = 0.002$, $R^2 = 0.60$; and HbA_{1c}, R^2 change = 0.23, $F(5, 68) = 4.91$, $p = 0.001$. The psychological variables did not account for a significant proportion of the variance in glucose-testing self-care, R^2 change = 0.13, $F(7, 43) = 1.06$, $p = 0.407$. For each regression equation, at least one psychological variable had a significant β -weight. For dietary self-care, dietary self-efficacy, $\beta = 0.47$, $p < 0.001$; and consequences perceptions, $\beta = -0.38$, $p = 0.029$, were both significant predictors. For exercise self-care, the only significant predictor was exercise self-efficacy, $\beta = 0.40$, $p < 0.001$. For glucose testing self-care, the only significant predictor was timeline perceptions, $\beta = 0.32$, $p = 0.042$. For medication self-care the significant predictors were duration of diabetes, $\beta = -0.15$, Wald $\chi^2 = 4.46$, $p = 0.035$; consequences perceptions, $\beta = 0.60$, Wald $\chi^2 = 7.11$, $p = 0.008$; timeline perceptions, $\beta = -0.39$, Wald $\chi^2 = 5.20$, $p = 0.023$; and medication self-efficacy, $\beta = -0.11$, Wald $\chi^2 = 4.61$, $p = 0.032$. For HbA_{1c} the individual significant predictors were age, $\beta = -0.24$, $p = 0.038$; personal control perceptions, $\beta = -0.29$, $p = 0.047$; concern perceptions, $\beta = 0.46$, $p = 0.001$; and medication self-efficacy, $\beta = -0.35$, $p = 0.004$.

Discussion

A number of differences were found between ethnic groups in their experience of diabetes. In support of previous research and in line with our hypotheses, Pacific Islanders exhibited a more serious clinical picture than both other groups in terms of their metabolic control and rates of diabetic retinopathy (Barnes et al., 2004; Simmons, 1996b). Consistent with this, more Pacific Islanders were taking insulin than the other two ethnic groups. In addition, these results show that Pacific Islanders reported significantly poorer medication self-care compared to the other groups, and they also exhibited a trend for poorer glucose-monitoring behaviours. Contrary to hypotheses, there were no significant differences in reported exercise behaviours between ethnic groups. These findings generally support the results of Barnes et al. (2004), who reported that Tongan diabetes patients had poorer dietary self-care, glucose testing practices and medication adherence compared to Europeans, but that there were no differences in exercise behaviour.

We hypothesised that there would be differences in the ethnic groups in their perceptions, and this is what we found. Pacific Islanders reported greater identity perceptions. That is, they associated more symptoms with their diabetes, which may be related to their poorer metabolic control. Europeans held longer timeline perceptions than both Pacific Islanders and South Asians. This indicates that

fewer members of the latter groups fully understood or agreed with the chronic nature of their condition. Previous research has also reported that Tongans held shorter and more cyclical perceptions of their diabetes than Europeans (Barnes et al., 2004) and that 72% of Tongans believed they could be cured of diabetes (Tottenham, 1999). The present study found that Pacific Islanders reported that their diabetes had more consequences than the other ethnic groups, which was contrary to hypotheses. It was expected that Pacific Islanders would perceive diabetes to be less serious (i.e., have less consequences), which would inevitably lead to poorer self-care behaviour. In contrast, it seems that perhaps Pacific Islanders' perceptions are shaped by their experiences of the disease: their disease is clinically more serious and causes more complications, and thus they perceive it as having more consequences. Pacific Islanders also found their diabetes to be more emotionally distressing than other groups (i.e., had greater emotional representations). Barnes et al. (2004) also found that Tongans were more distressed by their condition, and these results may be because their condition is, on average, clinically more serious and because they have a greater number of diabetes complications. The study found no differences between groups in control, concern or understanding perceptions.

As predicted, there were several ethnic differences in self-efficacy. Pacific Islanders reported lower self-efficacy for taking their medication compared to both Europeans and South Asians, which corresponds with the finding that Pacific Islanders reported lower levels of adherence to medication. South Asians also reported having significantly higher dietary self-efficacy compared to Europeans. However, Pacific Islanders' dietary self-efficacy scores did not differ significantly from South Asians or from Europeans, so self-efficacy is unlikely to explain the ethnic differences in dietary self-care reported earlier.

The study found that there were a number of relationships between illness perceptions and self-efficacy on the one hand and self-care and metabolic control on the other. In all three ethnic groups, self-efficacy was associated with dietary, exercise and medication self-care (in both univariate and multivariate analyses). Self-efficacy was also associated with glucose testing behaviours in Europeans and South Asians, but not in the Pacific Island group. Overall, the results demonstrate that those with higher levels of self-efficacy have better self-care, and this is fairly consistent across ethnic groups. Although the study included only three ethnic groups, it provides more evidence that self-efficacy is a universally important factor in diabetes self-care. The lack of association between self-efficacy and glucose testing in Pacific Islanders may relate to the fact that Pacific Islanders are more likely to have their glucose tests done by a family member; thus individual self-efficacy may be less relevant in this setting (Simmons, 1996a). Also, in this group, financial barriers have been found to be an important barrier to regular glucose testing (Zgibor & Simmons, 2002).

Illness perceptions were also predictive of self-care, but results here were less consistent than the results for self-efficacy. Various types of illness perceptions were related to self-care in univariate analyses, but correlations varied between ethnic groups and no one type of perception consistently predicted self-care.

In multivariate analyses, illness perceptions were also inconsistently related to self-care. Due to the large number of analyses performed, just the multivariate results are discussed in the following text. Results of these multivariate analyses demonstrated that the only group in which illness perceptions were associated with dietary self-care was Pacific Islanders. Here, those who perceived diabetes to have fewer consequences had better dietary self-care.

Illness perceptions were related to glucose testing in all three groups. In the European and Pacific Islands groups, those with shorter timeline perceptions had poorer glucose testing practices. This suggests that those patients with short timeline perceptions either do not understand its chronic nature or attach very little value to testing. Perhaps these individuals believe or hope the disease will soon disappear, and thus see little need to constantly monitor and remind themselves of their disease. In the South Asian group, those with greater treatment control perceptions had better glucose testing self-care, indicating that those who perceived diabetes to be more controllable were more likely to test their sugar levels regularly. Recently research has questioned the relevance of regular glucose testing for patients who are not insulin treated, and suggests that, for those who use diet, exercise and/or oral medications, glucose-monitoring holds limited relevance (Reynolds & Strachan, 2005). Unfortunately, only around a third of the sample in the present study used insulin, so there was insufficient power to test the hypotheses regarding glucose testing separately for the insulin-treated patients.

Illness perceptions were only associated with medication self-care for Pacific Islanders. Here, those who believed diabetes to have fewer consequences and a shorter timeline were more adherent with their medication. This finding that timeline and consequences perceptions are related to medication adherence was identical to the results of Barnes et al. (2004), which combined data from both Europeans and Tongans. Thus, it seems likely that the effect of these perceptions on medication taking behaviour in Pacific Islanders is quite robust. Interestingly, the relationship between consequences perceptions and medication self-care (and also for dietary self-care) was not in the expected direction, as it would be expected that those who perceive diabetes to have greater consequences must take their disease more seriously, and hence would look after themselves better. Perhaps this unexpected relationship is due to a certain group of patients who have had poor self-care practices for some time, and hence diabetes has had more consequences in their lives due to the development of complications.

There was also only one instance where illness perceptions were associated with exercise self-care. This was in Europeans, where those who had greater treatment control perceptions had better exercise self-care. As mentioned earlier, treatment control perceptions were also related to glucose testing self-care in South Asians. These results were in accordance with hypotheses and supported previous research conducted in predominantly European populations, which demonstrated that treatment control perceptions are related to self-care (Glasgow et al., 1997; Griva et al., 2000; Hampson et al., 1995; Hampson et al., 1990; Skinner & Hampson, 1998, 2001; Skinner et al., 2000, 2002, 2003).

In light of this large body of evidence, it was surprising that there were only two instances where treatment control perceptions were associated with self-care. For most areas of self-care, even the univariate correlations with treatment control beliefs were not significant. This may have been due to a ceiling effect in treatment control scores, as most people reported that they perceived treatment to be highly effective. Interestingly, several previous studies have broken down treatment control beliefs into two different variables: perceived ability of the treatment to control diabetes and perceived ability of the treatment to prevent complications (Skinner & Hampson, 1998, 2001; Skinner et al., 2000, 2002, 2003). The studies reported that, of these two, the perceived ability of the treatment to control diabetes was more strongly associated with self-care. The treatment control item in the current study asked about how well participants thought their treatment could help their diabetes, which may tap into either of these ideas or might be different altogether. Overall, it was surprising that illness perceptions were not more strongly related to self-care, and the results provide only limited support for Leventhal's self-regulation model. However, the results do not support the idea that illness perceptions are less relevant in non-European groups, as they were associated with various areas of the treatment regimen in all groups.

It was hypothesised that self-efficacy and illness perceptions would influence metabolic control through their effect on self-care. Surprisingly, there were only two instances where self-care was related to metabolic control in univariate analyses (and no instances in multivariate analyses). These were in the Pacific Island group, where those with better medication self-care had better metabolic control, and in the South Asian group, where those with poorer metabolic control tested their glucose more regularly. Previous studies in type-2 diabetes have seldom found relationships between adherence and HbA_{1c} (Glasgow et al., 1989; Hampson et al., 1990; Skaff et al., 2003; Padgett, 1991). This may be because in type-2 diabetes, there is usually a gradual drift upwards of HbA_{1c} with time when the patient is on oral medications (Turner, Cull, Frighi, & Holman, 1999). Once patients begin insulin treatment, the diabetes is usually well controlled by adjusting the dose when necessary. This phenomenon may obscure the relationship between self-care and metabolic control, as patients who are experiencing the gradual increase in HbA_{1c} may have excellent self-care practices but poor metabolic control, as the medication is not appropriate.

Because there were limited relationships between self-care and HbA_{1c}, it is not surprising that there were only a few significant relationships between illness perceptions/self-efficacy and HbA_{1c}. The only instance where self-efficacy was associated with metabolic control was in the Pacific Island group, where medication self-efficacy was associated with better metabolic control, probably due to the significant relationship between medication self-care and metabolic control. In the European and Pacific Island groups, those who had poorer metabolic control perceived themselves to have less control over their diabetes and were more concerned about their diabetes. In the South Asian group, those who had poorer metabolic control were more emotionally distressed

by their diabetes. Previous research has shown that emotional distress can be associated with poor metabolic control (Lustman, Clouse, Cinchanowski, Hirsch, & Freedland, 2005), although the mechanism by which this occurs is unclear. It is also possible that poor metabolic control produces this emotional distress.

The study had a number of limitations. The data was cross-sectional in nature and thus could not establish causality. It is unclear whether self-efficacy and illness perceptions lead to self-care, or *vice versa*. Future studies may wish to take follow-up measurements to determine the direction of causality. Measurement bias was also a limitation of the study. The self-care data relied entirely on self-report scales, and adherence measures are known to be subject to recall and social desirability biases (Johnson, 1992). The self-care measurement instrument used, the summary of diabetes self-care activities, is a popular scale, but has only limited reliability and validity. Additionally, numeric rating scales were unfamiliar to some of the older and less educated patients, who reported some difficulties in using them. The BIPQ is a new measure that shows promising psychometric properties, but has not been extensively used as yet. Another possible source of measurement bias was the translations. The psychometric properties of these translations have yet to undergo formal investigation, although the reliability statistics for this study support their utility. Another weakness was the limited range of medical data collected. Participants' retinopathy and the most recent HbA_{1c} results were recorded, and each HbA_{1c} result was taken within three months of the time each participant completed the questionnaire. However, there were a few participants whose most recent HbA_{1c} was older than this. Moreover, HbA_{1c} data reflects a longer time period (6–8 weeks) than the self-care measures (1 week). Data on comorbid medical conditions and other diabetes complications was not collected, which would have further strengthened results.

The present findings have implications both for healthcare providers as well as for future research. Patient practitioner interaction is an important determinant of health outcomes, but is often problematic when practitioners of one culture treat patients of another. The results allow healthcare providers to understand some of the ways in which their own views may differ from their patients' and how their patients' views might impact their self-care. The research also has potential utility in health promotion and intervention design. In the area of self-efficacy, interventions have already been tested in predominantly European groups. The present research suggests that such interventions should be just as effective in non-European groups, and this could be tested in future research. In the area of illness perceptions, two different approaches could be taken. Practitioners and researchers may wish to base interventions around the illness perceptions that were identified as important in the various ethnic groups and work within these to encourage patients to have better self-care. Alternately, an intervention could aim to alter patients' perceptions in order to change their self-care practices (Cameron, Petrie, Ellis, Buick & Weinman, 2005; Petrie, Cameron, Ellis, Buick, & Weinman, 2002). In any event, the research demonstrates that the illness

perceptions relevant for one group will differ from those of another group, and so interventions could be targeted for the group of patients one is working with.

Epidemiological studies consistently demonstrate that rates of diabetes are increasing around the world, and the average age of onset continues to drop, to the extent that the current wave of diabetes has been labeled an epidemic. Clearly, proper control of diabetes will only become more of an issue as more people develop diabetes and must live with the disease for longer. This study has identified a number of differences in diabetes related behaviours and cognitions between ethnic groups, and knowledge of these may enable future researchers and healthcare providers to better plan and deliver their services. The research has also demonstrated the importance of self-efficacy theory and illness perceptions in a range of ethnic groups, providing support for psychology theory as well as further support for developing interventions in this area.

References

- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.
- Barnes, L. C., Moss-Morris, R., & Kaufusi, M. (2004). Illness beliefs and adherence in diabetes mellitus: A comparison between Tongan and Europeans patients. *New Zealand Medical Journal*, *117*, 743–751.
- Broadbent, E., Petrie, K. J., Main, J., & Weinman, J. (2006). The Brief Illness Perception Questionnaire (BIPQ). *Journal of Psychosomatic Research*, *60*, 631–637.
- Cameron, L. D., Petrie, K. J., Ellis, C. J., Buick, D., & Weinman, J. (2005). Trait negative affectivity and responses to a health education intervention for myocardial infarction patients. *Psychology and Health*, *20*, 1–18.
- Cramer, J. A. (2004). A systematic review of adherence with medications for diabetes. *Diabetes Care*, *27*, 1218–1224.
- Chaturvedi, N., Abbott, C. A., Whalley, A., Widdows, P., Leggetter, S. Y., & Boulton, A. J. (2002). Risk of diabetes-related amputation in South Asians vs. Europeans in the UK. *Diabetic Medicine*, *19*, 99–104.
- Day, J. L., Bodmer, C. W., & Dunn, O. M. (1995). Development of a questionnaire identifying factors responsible for successful self-management of insulin treated diabetes. *Diabetic Medicine*, *13*, 564–573.
- Diabetes Control and Complications Trial Research Group. (1993). The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *The New England Journal of Medicine*, *329*, 977–986.
- Eiser, J., Riazi, A., Eiser, C., Hammersley, S., & Tooke, J. E. (2001). Predictors of psychological well-being in Types 1 and 2 diabetes. *Psychology & Health*, *16*, 99–110.
- Glasgow, R. E., Hampson, S. E., Strycker, L. A., & Ruggiero, L. (1997). Personal-model beliefs and social-environmental barriers related to diabetes self-management. *Diabetes Care*, *20*, 556–561.
- Glasgow, R. E., Toobert, D. J., Riddle, M., Donnelly, J., Mitchell, D. L., & Calder, D. (1989). Diabetes-specific social learning variables and self-care behaviors among persons with type-II diabetes. *Health Psychology*, *8*, 285–303.
- Griva, K., Myers, L. B., & Newman, S. (2000). Illness perceptions and self efficacy beliefs in adolescents and young adults with insulin dependent diabetes mellitus. *Psychology & Health*, *15*, 733–750.

- Hampson, S. E., Glasgow, R. E., & Toobert, D. J. (1990). Personal models of diabetes and their relations to self-care activities. *Health Psychology, 9*, 632–646.
- Hampson, S. E., Glasgow, R. E., & Foster, L. S. (1995). Personal models of diabetes among older adults: Relationship to self-management and other variables. *Diabetes Educator, 21*, 300–307.
- Hurley, A. C., & Shea, C. A. (1992). Self-efficacy: Strategy for enhancing diabetes self-care. *Diabetes Educator, 18*, 146–150.
- Ikeda, K., Aoki, H., Saito, K., Muramatsu, Y., & Suzuki, T. (2003). Associations of blood glucose control with self-efficacy and rated anxiety/depression in type II diabetes mellitus patients. *Psychological Reports, 92*, 540–544.
- Isaacs, R. D., & Scott, D. J. (1987). Diabetic patient discharges from Middlemore Hospital 1983. *The New Zealand Medical Journal, 100*, 629–631.
- Jessop, D. C., & Rutter, D. (2003). Adherence to asthma medications: The role of illness representations. *Psychology & Health, 18*, 595–612.
- Johnson, S. B. (1992). Methodological issues in diabetes research: Measuring adherence. *Diabetes Care, 15*, 1658–1667.
- Johnston-Brooks, C. H., Lewis, M. A., & Garg, S. (2002). Self-efficacy impacts self-care and HbA1c in young adults with Type I diabetes. *Psychosomatic Medicine, 64*, 43–51.
- Kavanagh, D. J., Gooley, S., & Wilson, P. H. (1993). Prediction of adherence and control in diabetes. *Journal of Behavioral Medicine, 16*, 509–522.
- King, H., Aubert, R. E., & Herman, W. H. (1998). Global burden of diabetes, 1995–2025: Prevalence, numerical estimates, and projections. *Diabetes Care, 21*, 1414–1431.
- Knecht, M. C., Syrjala, A. M., Laukkanen, P., & Knuutila, M. L. (1999). Self-efficacy as a common variable in oral health behavior and diabetes adherence. *European Journal of Oral Sciences, 107*, 89–96.
- Llewellyn, C. D., Miners, A. H., Lee, C. A., Harrington, C., & Weinman, J. (2003). The illness perceptions and treatment beliefs of individuals with severe haemophilia and their role in adherence to home treatment. *Psychology & Health, 18*, 185–200.
- Lustman, P. J., Clouse, R. E., Cinchanowski, P. S., Hirsch, I. B., & Freedland, K. E. (2005). Depression-related hyperglycemia in type 1 diabetes: A mediational approach. *Psychosomatic Medicine, 67*, 195–199.
- Mather, H. M., Chaturvedi, N., & Kehely, A. M. (1998). Comparison of prevalence and risk factors for microalbuminuria in South Asians and Europeans with type 2 diabetes mellitus. *Diabetic Medicine, 15*, 672–677.
- McCaul, K. D., Glasgow, R. E., & Schafer, L. C. (1987). Diabetes regimen behaviors: Predicting adherence. *Medical Care, 25*, 868–881.
- Ministry of Health. (2002). *Public health intelligence occasional bulletin no. 11: Modelling diabetes: A summary*. Wellington: Ministry of Health.
- Nouwen, A., Gingras, J., Talbot, F., & Bouchard, S. (2003). Multidimensional diabetes questionnaire. In B. K. Redman (Ed.), *Measurement tools in patient education* (2nd ed. pp. 93–100). New York: Springer Publishing Company.
- Padgett, D. (1991). Correlates of self-efficacy beliefs among patients with non-insulin dependent diabetes mellitus in Zagreb, Yugoslavia. *Patient Education & Counseling, 18*, 139–147.
- Petrie, K. J., Weinman, J., Sharpe, N., & Buckley, J. (1996). Role of patients' view of their illness in predicting return to work and functioning after myocardial infarction: Longitudinal study. *British Medical Journal, 312*, 1191–1194.
- Petrie, K. J., Cameron, L. D., Ellis, C. J., Buick, D., & Weinman, J. (2002). Changing illness perceptions following myocardial infarction: An early intervention randomized controlled trial. *Psychosomatic Medicine, 64*, 580–586.
- Ramachandran, A., Snehalatha, C., Latha, E., Vijay, V., & Viswanathan, M. (1997). Rising prevalence of NIDDM in an urban population in India. *Diabetologia, 40*, 232–237.

- Ramachandran, A., Snehalatha, C., Latha, E., Manoharan, M., & Vijay, V. (1999). Impacts of urbanisation on the lifestyle and on the prevalence of diabetes in native Asian Indian population. *Diabetes Research & Clinical Practice*, *44*, 207–213.
- Rapley, P. (1990). Adapting to diabetes: Metabolic control and psychosocial variables. *The Australian Journal of Advanced Nursing*, *8*, 41–47.
- Reynolds, R. M., & Strachan, M. W. J. (2005). Home blood glucose monitoring in type 2 diabetes. *British Medical Journal*, *329*, 754–755.
- Rose, M., Fliege, H., Hildebrandt, M., Schirop, T., & Klapp, B. F. (2002). The network of psychological variables in patients with diabetes and their importance for quality of life and metabolic control. *Diabetes Care*, *25*, 35–42.
- Simmons, D. (1996a). Diabetes and its complications in New Zealand: An epidemiological perspective. *The New Zealand Medical Journal*, *109*, 245–247.
- Simmons, D. (1996b). The epidemiology of diabetes and its complications in New Zealand. *Diabetic Medicine*, *13*, 371–375.
- Simmons, D., Gatland, B., Leakehe, L., & Fleming, C. (1996). Ethnic differences in diabetes care in a multiethnic community in New Zealand. *Diabetes Research & Clinical Practice*, *34*, S89–S93.
- Skaff, M. M., Mullan, J. T., Fisher, L., & Chesla, C. A. (2003). A contextual model of control beliefs, behavior, and health: Latino and European Americans with type 2 diabetes. *Psychology & Health*, *18*, 295–312.
- Skelly, A. H., Marshall, J. R., Haughey, B. P., Davis, P. J., & Dunford, R. G. (1995). Self-efficacy and confidence in outcomes as determinants of self-care practices in inner-city, African-American women with non-insulin-dependent diabetes. *Diabetes Educator*, *21*, 38–46.
- Skinner, T., & Hampson, S. E. (1998). Social support and personal models of diabetes in relation to self-care and well-being in adolescents with type I diabetes mellitus. *Journal of Adolescence*, *21*, 703–715.
- Skinner, T., & Hampson, S. E. (2001). Personal models of diabetes in relation to self-care, well-being, and glycemic control. A prospective study in adolescence. *Diabetes Care*, *24*, 828–833.
- Skinner, T., John, M., & Hampson, S. E. (2000). Social support and personal models of diabetes as predictors of self-care and well-being: A longitudinal study of adolescents with diabetes. *Journal of Pediatric Psychology*, *25*, 257–267.
- Skinner, T., Hampson, S. E., & Fife-Schaw, C. (2002). Personality, personal model beliefs, and self-care in adolescents and young adults with Type 1 diabetes. *Health Psychology*, *21*, 61–70.
- Skinner, T., Howells, L., Greene, S. A., Edgart, K., McEvelly, A., & Johansson, A. (2003). Development, reliability and validity of the diabetes illness representations questionnaire: Four studies with adolescents. *Diabetic Medicine*, *20*, 283–289.
- Stewart, S. M., Lee, P. W. H., Low, L. C. K., Cheng, A., Yeung, W., Huen, K. F., et al. (2000). Pathways from emotional adjustment to glycaemic control in youths with diabetes in Hong Kong. *Journal of Pediatric Psychology*, *25*, 393–402.
- Talbot, F., Nouwen, A., Gingras, J., Gosselin, M., & Audet, J. (1997). The assessment of diabetes-related cognitive and social factors: The multidimensional diabetes questionnaire. *Journal of Behavioral Medicine*, *20*, 291–312.
- Toobert, D. J., & Glasgow, R. E. (1994). Assessing diabetes self-management: The summary of diabetes self-care activities questionnaire. In C. Bradley (Ed.), *Handbook of psychology and diabetes: A guide to psychological measurement in diabetes research and practice* (pp. 351–375). Chur: Harwood Academic.
- Tottenham, K. (1999). *The Tongatapu diabetes study*. Upper Hutt: Central Institute of Technology.
- Turner, R. C., Cull, C. A., Frighi, V., & Holman, R. R. (1999). Glycemic control with diet, sulfonylurea, metformin, or insulin in patients with type 2 diabetes mellitus: Progressive requirement for multiple therapies (UKPDS 49). *Journal of the American Medical Association*, *281*, 2005–2012.

- UK Prospective Diabetes Study Group (1998). Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). *Lancet*, 352, 837–853.
- Williams, K. E., & Bond, M. J. (2002). The roles of self-efficacy, outcome expectancies and social support in the self-care behaviours of diabetics. *Psychology, Health & Medicine*, 7, 127–141.
- Zgibor, J. C., & Simmons, D. (2002). Barriers to blood glucose monitoring in a multiethnic community. *Diabetes Care*, 25, 1772–1777.

