# SELF-EFFICACY, SELF-CARE BEHAVIORS AND GLYCEMIC CONTROL AMONG TYPE-2 DIABETES PATIENTS ATTENDING TWO PRIVATE CLINICS IN YANGON, MYANMAR

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**Abstract.** This cross-sectional study aimed to estimate the prevalence of glycemic control and its associated factors among type-2 diabetes patients attending two private clinics in Yangon, Myanmar. Two hundred sixty-six diabetes patients attending two private diabetes clinics in Yangon during February and March, 2009 were included in the study. The participants completed a structured questionnaire. $HbA_{1c}$ was used as the index for glycemic control. The prevalence of successful glycemic control ($HbA_{1c} \leq 7\%$) was 27.1%. The median $HbA_{1c}$ value was 7.8%. About 62.0% of patients had high self-efficacy levels, and 30.8% had good self-care behavior. Multiple logistic regression analysis revealed four variables associated with glycemic control: age ≥60 years (OR 2.46, 95%CI 1.17-5.21), taking one oral hypoglycemic agent (OHA) (OR 2.56, 95%CI 1.26-5.19), being overweight (OR 2.01, 95%CI 1.02-3.95) and having a high self-efficacy level (OR 5.29, 95%CI 2.20-12.75). Interventions to increase diabetic patient self-efficacy levels and self-care behavior, especially related to diet and exercise, are needed to reduce poor glycemic control.

**Key word:** self efficacy, self-care behavior, glycemic control, diabetes, Myanmar

## INTRODUCTION

Diabetes is a significant global health problem. In recent years, the prevalence of this disease has been rising dramatically in developing countries (Wild *et al*, 2000; International Diabetes Federation, 2003). In 2007, the estimated number of diabetics in Myanmar aged 20-79 years was 872,700, with a national prevalence rate of 2.8% (International Diabetes Federation, 2007). In Myanmar, the prevalence of diabetes is increasing due to urbanization, and changes in lifestyle and dietary habits. Care for diabetic patients requires varied resources and involves a substantial economic burden. However, early and appropriate diabetes care can result in good glycemic control, which reduces mortality and prevents or delays the onset of diabetes complications (UKPDS Group, 1998; Genuth *et al*, 2003; Nathan *et al*, 2005).

Previous studies have shown age (Nichols *et al*, 2000), adherence to medica-

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tion (Schectman *et al,* 2002), duration of diabetes (Chen *et al,* 2005), physical activity (Kirt *et al,* 2003; Howteerakul *et al,* 2007; Parchman *et al,* 2007), self-care behavior, and self-efficacy (Wang and Shiu, 2004; Sousa *et al,* 2005; Wu *et al,* 2007) were predictors of glycemic control. Self-care tasks are defined as a set of skilled behaviors undertaken for the management of an individual's illness (Goodall and Halford, 1991). Self-efficacy is the individual's belief in his or her capacity to self-manage chronic disease, as it determines whether or not individuals initiate self-care behaviors (Holman and Lorig, 1992).

Currently, no published literature exists regarding self-efficacy, self-care, and glycemic control, in Myanmar. The current study aimed to estimate the prevalence of effective glycemic control and its associated factors among type-2 diabetes patients in Yangon, Myanmar, using $HbA_{1c}$ measurements to monitor glycemic control, and applying the concept of self-efficacy, which is a known important predictor for the daily self-care activities of patients (Bandura, 2001).

## MATERIALS AND METHODS

The research was conducted in two private diabetes clinics in Yangon. Two hundred sixty-six patients who sought care at the clinic during February and March 2009 were included in the study. Sample size was estimated using a single proportion formula with a 95% confidence interval. Since no published data for glycemic control in Myanmar existed, the prevalence was assumed to be 50%. Precision was set at 6%. The inclusion criteria were: type-2 diabetes patients aged ≥35 years diagnosed with diabetes for ≥1 year(s), patients treated with anti-hyperglycemic medication for at least 6 months at the clinic, being able to read and write and agreeing to participate in the study. The exclusion criteria were: the presence of serious complications (*eg*, renal failure, heart failure). Patients aged <35 years were excluded, because of difficulty differentiating between type 2 and other types of diabetes.

Questionnaires were translated into the Myanmar language and back-translated into English. Two clinics were available from 4:00-8:00 PM during weekdays and 10:00-8:00 PM on Saturdays. Data collection was conducted for 2 hours in each clinic on weekdays, and 4 hours on Saturdays. Patients were informed about the objectives and methods of the study, and asked to participate. After providing informed consent, questionnaires were distributed to the participants. The patient, next-of-kin, or another suitable person (proxy respondent) who accompanied the patient to the clinic, completed the questionnaire. $HbA_{1c}$ values, heights, and weights were obtained from patient records. The Ethics Review Committee of the Faculty of Public Health, Mahidol University, approved the study.

### Measurements

**Baseline characteristics.** The baseline characteristics of the patients included age, sex, marital status, number of living children, body mass index (BMI), duration of diabetes, current medication, status of diabetes complications, and family history of diabetes.

**Self-care behaviors.** Diabetes self-care behaviors consisted of 15 questions from the Summary of Diabetes Self-Care Activities (SDSCA) (Toobert *et al,* 2000) modified according to the context of the Myanmar population. It assessed patient self-care behaviors by diet (7 items), physical exercise (3 items), continuity of treatment (2 items),

and foot care (3 items) during the previous 7 days. Potential scores ranged from 0 to 7, according to the number of days the behavior was practiced during the previous 7 days. A negative score was given for a negative item. Scores of 0-62 were classified as poor self-care behavior, 63-82 as fair, and 83-105 as good. The Cronbach's alpha was 0.727.

**Self efficacy.** Information regarding self-efficacy related to glycemic control was collected via 18 modified questions from the Diabetes Mellitus Self-efficacy Scale (DMSES). Responses were rated on a 5-point Likert scale: "1=not confident, 2=not very confident, 3=confident half the time, 4=usually confident, 5=always confident (McDowell *et al*, 2005). Of the possible total score, a range of 18-53 was classified as poor self-efficacy, 54-71 as fair, and 72-90 as high. The Cronbach's alpha was 0.954.

**Glycemic control.** The diabetes patients underwent $HbA_{1c}$ testing every 6 months in the diabetes clinic. According to the American Diabetes Association, $HbA_{1c}$ values ≤7% are regarded as controlled, whilst >7% are uncontrolled (American Diabetes Association, 2005). Test results for the previous 3 months were obtained from the patient's medical records.

**Data analysis**

Data entry and analysis were performed using SPSS for Windows, version 11.5. Descriptive statistics were used to describe the baseline characteristics of the patients with frequency, median, mean, standard deviation, and range. Associations were expressed as odds ratios (ORs) and 95% confidence intervals (CI). On multiple logistic regression analysis, two models were used with and without self-efficacy. Each model included all variables with a *p*-value ≤0.05 in the 2x2 univariate analysis and biological plausibility. Overall self-care behavior was not entered into the final regression model due to its colinearity with individual domain of self-care, *ie*, diet, physical exercise, medication taking and foot care. The significance level was set at $p < 0.05$.

## RESULTS

**Baseline characteristics**

Of the 266 patients, 57.9% were female. The mean age of the patients was 57.5 years (range 35-83 years); 67.7% were married, 45.5% had 1-3 living children, 38.4% had a BMI within the normal range (18.5-22.9 kg/m$^2$), 24.1% had diabetes for >10 years, and 67.3% were taking >1 oral hypoglycemic agent. Regarding diabetes-related complications, 45.9% had none; the common complications were neuropathy (21.1%), retinopathy (19.9%) and coronary artery disease (19.5%); 26.7% had a father or mother with diabetes (Table 1).

**Prevalence of glycemic control, self-efficacy level, and self-care behavior**

The prevalence of good glycemic control ($HbA_{1c}$ ≤7%) was 27.1%. The median $HbA_{1c}$ value was 7.8%. About 62.0% of the patients had a high self-efficacy level, and 30.8% had good self-care behavior (Table 2).

**Factors associated with glycemic control**

Univariate analysis found 7 variables significantly associated with glycemic control: age ≥60 years, taking one OHA, an ulcerated foot, a high self-efficacy level, overall self-care behavior, self-care for diet, and self-care for physical exercise (Table 3). On multiple logistic regression analysis, two models were used with and without self-efficacy. Model 1, excluding self-efficacy, found 3 variables significantly associated with glycemic control: age ≥60 years, taking one OHA, and self-care for

Table 1
Baseline characteristics of 266 type-2 diabetes patients.

| Characteristics | No. of patients | Percentage |
|---|---|---|
| Sex | | |
| Male | 112 | 42.1 |
| Female | 154 | 57.9 |
| Age (years) | | |
| <60 | 152 | 57.1 |
| ≥60 | 114 | 42.9 |
| Mean = 57.5, SD = 10.9, Range = 35-83 | | |
| Marital status | | |
| Single | 37 | 13.9 |
| Married | 180 | 67.7 |
| Divorced/separated/widowed | 49 | 18.4 |
| No. of living children | | |
| 0 | 41 | 15.4 |
| 1-3 | 121 | 45.5 |
| >3 | 104 | 39.1 |
| Body mass index (BMI, kg/m$^2$ ) [a] | | |
| <18.5 (underweight) | 24 | 9.0 |
| 18.5 - 22.9 (normal weight) | 102 | 38.4 |
| 23.0 - 24.9 (overweight) | 44 | 16.5 |
| ≥25.0 (obese) | 96 | 36.1 |
| Mean = 23.8, SD = 4.4, Range = 15.0-42.6 | | |
| Duration of diabetes (years) | | |
| 1 | 37 | 13.9 |
| 2-4 | 61 | 22.9 |
| 5-10 | 104 | 39.1 |
| >10 | 64 | 24.1 |
| Median = 5.5, Range = 1-40 | | |
| Current medication | | |
| One OHA (oral hypoglycemic agent) | 69 | 25.9 |
| Greater than one OHA | 179 | 67.3 |
| OHA + injected insulin | 18 | 6.8 |
| Complications [b] | | |
| None | 122 | 45.9 |
| Neuropathy | 56 | 21.1 |
| Retinopathy | 53 | 19.9 |
| Coronary artery disease | 52 | 19.5 |
| Ulcerated foot | 24 | 9.0 |
| Nephropathy | 19 | 7.1 |
| Infections (skin/respiratory tract infection) | 14 | 5.3 |
| Cerebrovascular disease | 9 | 3.4 |
| Family history of diabetes | | |
| None | 140 | 52.6 |
| Father/Mother | 71 | 26.7 |
| Siblings | 37 | 13.9 |
| Grandparents | 9 | 3.4 |
| Uncle/Aunt | 9 | 3.4 |

[a]Bodyweight in kilograms divided by the square of the height in meters, the Asian cut-off point for overweight (WHO, 2000) was ≥23 kg/m$^2$; [b] Multiple responses

Table 2
Prevalence of glycemic control, self-efficacy, and self-care behavior in 266 type-2 diabetes patients.

| Variable | No. of patients | Percentage |
|---|---|---|
| $HbA_{1c}$ level (%) | | |
| ≤7 (glycemic level controlled) | 72 | 27.1 |
| >7 (glycemic level not controlled) | 194 | 72.9 |
| Median = 7.8, Mean = 8.3, SD = 1.7, Range = 5-14 | | |
| Self-efficacy (score) | | |
| High (72-90) | 165 | 62.0 |
| Fair (54-71) | 83 | 31.2 |
| Poor (41-53) | 18 | 6.8 |
| Median = 75.0, Mean = 73.6, SD = 10.2 | | |
| Self-care behaviors (score) | | |
| Good (83-102) | 82 | 30.8 |
| Fair (63-82) | 147 | 55.3 |
| Poor (18-62) | 37 | 13.9 |
| Median = 77.0, Mean = 75.3, SD = 13.4 | | |

physical exercise. Model 2, which included self-efficacy, found 4 variables significantly associated with glycemic control: age ≥60 years, taking one OHA, a BMI ≥23 kg/m$^2$, and a high self-efficacy level (Table 4).

## DISCUSSION

The prevalence of good glycemic control was 27.1%, which was quite low. The patients had inadequate diabetes self care. This low proportion of good glycemic control was consistent with the low proportion of good self-care for diet (33.8%) and physical exercise (54.9%). The prevalence of good glycemic control was lower than a previous finding of 33.3% for Thailand (Howteerakul *et al*, 2007), and 75.0% for rural areas in the USA (Wahba and Chang, 2007).

In the current study, good glycemic control was defined by the American Diabetes Association (2003) as a $HbA_{1c}$ level ≤7.0%. However, the American College of Endocrinology/ American Association of Clinical Endocrinologists recommends a goal $HbA_{1c}$ level ≤6.5% (Rodbard *et al*, 2007). The more stringent goal of 6.5% would result in a lower prevalence of good glycemic control.

Patients aged ≥60 years were 2.46 times more likely to have better glycemic control than those aged <60 years. This may be because older patients had better diabetes self-care behavior and a better self-efficacy level than younger patients; this association has been seen in other studies (Nichols *et al*, 2000; Wang and Shiu, 2004; Wahba and Chang, 2007). However, it was not confirmed in a study by Howteerakul *et al* (2007).

Overweight patients (BMI ≥23 kg/m$^2$) were 2.01 times more likely to have better glycemic control than normal and underweight patients, when self-efficacy was added into Model 2. This implies if all patients had the same level of diabetes self-

Table 3
Crude odds ratios (ORs) of selected factors and glycemic control in 266 type-2 diabetes patients.

| Variable | Total | Glycemic control (%) | | OR | 95% CI |
|---|---|---|---|---|---|
| | | Yes | No | | |
| Age (years) | | | | | |
| <60 | 152 | 17.8 | 82.2 | 1.00 | |
| ≥60 | 114 | 30.7 | 69.3 | 2.05 | 1.15, 3.64 |
| Body mass index (BMI, kg/m$^2$) | | | | | |
| <23 (normal/underweight) | 126 | 24.6 | 75.4 | 1.00 | |
| ≥23 (overweight/ obese) | 140 | 29.3 | 70.7 | 1.27 | 0.74, 2.19 |
| Current medication | | | | | |
| Greater than one OHA/insulin | 197 | 18.8 | 81.2 | 1.00 | |
| One OHA | 69 | 36.2 | 63.8 | 2.45 | 1.34, 4.51 |
| Ulcerated foot | | | | | |
| Yes | 24 | 4.2 | 95.8 | 1.00 | |
| No | 242 | 25.2 | 74.8 | 7.51 | 1.03, 58.61 |
| Self-efficacy (score) | | | | | |
| Fair/poor (41-71) | 101 | 7.9 | 92.1 | 1.00 | |
| High (72-90) | 165 | 32.7 | 67.3 | 5.65 | 2.56, 12.48 |
| Self-care behavior (score) | | | | | |
| Fair/poor (18-82) | 184 | 19.0 | 81.0 | 1.00 | |
| Good (83-102) | 82 | 32.9 | 67.1 | 2.09 | 1.16, 3.77 |
| Self-care for diet (score) | | | | | |
| Fair/poor (9-39 ) | 176 | 18.8 | 81.2 | 1.00 | |
| Good (40-49) | 90 | 32.2 | 67.8 | 2.06 | 1.15, 3.69 |
| Self-care for exercise (score) | | | | | |
| Fair/poor (0-8) | 120 | 15.8 | 84.2 | 1.00 | |
| Good (9-21) | 146 | 29.5 | 70.5 | 2.22 | 1.21, 4.07 |

efficacy, patients with a higher BMI were more likely to exercise better glycemic control. They may be aware having a higher BMI can result in a higher risk for getting diabetes complications, such as heart failure, neuropathy, retinopathy or an ulcerated foot. This agrees with the findings of Nicholes *et al* (2000), but not with Howteerakul *et al* (2007) or Wahba and Chang (2007), where no significant association was found between BMI and glycemic control among diabetes patients.

Patients taking only one oral hypoglycemic drug were 2.56 times more likely to have good glycemic control than those taking >1 oral hypoglycemic drug or insulin. This may be because patients who took only one oral hypoglycemic agent prescribed by a physician may have no, or fewer, complications due to better glycemic control, or patients might be confused or forgot to take medicine when prescribed >1 drug per day. The study by Wahba and Chang (2007) found an association between medications taken and glycemic control.

Patients with a high self-efficacy level were 5.29 times more likely to have better

Table 4
Adjusted odds ratios (ORs) for glycemic control among 266 patients, by multiple logistic regression analysis.

| Variable | Model 1 | | Model 2 | |
|---|---|---|---|---|
| | OR | 95%CI | OR | 95%CI |
| Age (years) | | | | |
| <60 | 1.00 | | 1.00 | |
| ≥60 | 2.56 | 1.24, 5.26 | 2.46 | 1.17, 5.21 |
| Body mass index (BMI, kg/m$^2$) | | | | |
| <23 (normal/underweight) | 1.00 | | 1.00 | |
| ≥23 (overweight/ obese) | 1.81 | 0.95, 3.47 | 2.01 | 1.02, 3.95 |
| Current medication | | | | |
| Greater than one OHA/ insulin | 1.00 | | 1.00 | |
| One OHA | 2.23 | 1.13, 3.48 | 2.56 | 1.26, 5.19 |
| Self-care for exercise (score) | | | | |
| Fair/poor (0-8) | 1.00 | | 1.00 | |
| Good (9-21) | 1.98 | 1.02, 3.87 | 1.47 | 0.73, 2.97 |
| Self-efficacy (score) | | | | |
| Fair/poor (41-71) | | | 1.00 | |
| High (72-90) | | | 5.29 | 2.20, 12.75 |

Model 1, adjusted for age, sex, education, medication, BMI, retinopathy, nephropathy, ulcerated foot, self-care for diet, and self-care for physical exercise.
Model 2, adjusted for age, sex, education, medication, BMI, retinopathy, nephropathy, ulcerated foot, self-care for diet, and self-care for physical exercise, and self-efficacy.

glycemic control than those with a fair or low self-efficacy level. This is because self-efficacy has been proven to be the strongest and most useful predictor for the daily self-care of diabetes mellitus, as shown in studies by Wu *et al* (2007), and Wang and Shiu (2004). The study by Sousa *et al* (2005) also found a significant association between self-efficacy and glycemic control. This is in contrast to a study by Chlebowy and Garvin (2006).

When self-efficacy was included (Model 2), self-care for exercise was not significantly associated with glycemic control, although in Model 1 and in previous literature (Kirt *et al*, 2003; Howteerakul *et al*, 2007; Parchman *et al*, 2007), self-care for exercise was found to be a significant predictor of glycemic control among type-2 diabetes patients. A possible explanation is that self-efficacy is a particularly important factor in the process of changing self-care behavior and personal outcomes (Norris *et al*, 2001). Self-efficacy is a strong predictor of glycemic control (Wang and Shiu, 2004; Wu *et al*, 2007); it had the highest coefficient in the model for its potential to affect other variables (data not shown). This resulted in self-care for exercise not being associated with glycemic control when self-efficacy was included (Model 2).

Two limitations of the present study were: 1) it was a hospital-based study with

a small sample size: 2 private diabetes clinics in urban areas of Yangon. Therefore, the prevalence of glycemic control cannot be generalized to diabetes patients in other regions, such as remote areas; 2) self-efficacy level and self-care behavior were more likely to be overestimated due to reliance on self-reported data.

In conclusion, the prevalence of good glycemic control was low. Patients with high self-efficacy levels and good self-care behavior had better glycemic control. These findings support the self-care and self-efficacy model, both being important concepts in patient education and interventions. To improve glycemic control, it is important to raise patient self-efficacy, by patient empowerment through healthcare professionals and the patient's own family. Nurses and health educators at clinics should provide detailed and comprehensible dietary information, and explain the food pyramid and the plate method to each diabetes patient. Patients must be educated to get regular physical exercise to effectively control blood sugar. It may be preferable, if possible, for patients to join a diabetes club and exercise in the clinic. In addition, patients should not be prescribed unnecessary medications, such as vitamins, which can confuse them and result in them not taking important hypoglycemic drugs.

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## REFERENCES

American Diabetes Association. Standards of medical care for patients with diabetes mellitus. *Diabetes Care* 2003; 26(suppl): S33-50.

Bandura A. Social cognitive theory: an agentic perspective. *Annu Rev Psychol* 2001; 52: 1-26.

Chen CC, Li CI, Chen RH, Wang TY, Chang CT, Yei KM. Factors related to poor glycemic control in type 2 diabetic outpatients in a medical center. *Mid Taiwan J Med* 2005; 10: 90-8.

Chlebowy DO, Garvin BJ. Social support, self-efficacy, and outcome expectations: impact on self-care behaviors and glycemic control in Caucasian and African American adults with type 2 diabetes. *Diabetes Educ* 2006; 32: 777-86.

Genuth S, Eastman R, Kahn R, *et al*. American Diabetes Association. Implications of the United Kingdom prospective diabetes study. *Diabetes Care* 2003; 26(suppl): S28-32.

Goodall TA, Halford WK. Self-management of diabetes mellitus: a critical review. *Health Psychol* 1991; 10: 1-8.

Holman H, Lorig K. Perceived self-efficacy in self-management of chronic disease. In: Schwartz R, ed. Self-efficacy: thought control of action. Washington: Hemisphere Publishing, 1992: 305-23.

Howteerakul N, Suwannapong N, Rittichu C, Rawdaree P. Adherence to regimens and glycemic control of patients with type 2 diabetes attending a tertiary hospital clinic. *Asia Pac J Public Health* 2007; 19: 43-9.

International Diabetes Federation. Diabetes atlas Prevalence estimates of diabetes 20-79 years, 2007 (adjusted to the world

population). [Cited 2009 May 30]. Available from: URL: http://www.eatlas.idf.org/atlasff5d.html?id=0

International Diabetes Federation. Diabetes atlas, executive summary. 2nd ed. Belgium: IDF, 2003.

Kirk A, Mutrie N, MacIntyre P, Fisher M. Increasing physical activity in people with type 2 diabetes. *Diabetes Care* 2003; 26: 1186-92.

McDowell J, Courtney M, Edwards H, Shortridge-Baggett L. Validation of the Australian/English version of the Diabetes Management Self-Efficacy Scale. *Int J Nurs Pract* 2005; 11: 177-84.

Nathan DM, Cleary PA, Backlund JY, *et al*. Diabetes Control and Complications Trial/Epidemiology of Diabetes Interventions and Complications (DCCT/EDIC) Study Research Group. Intensive diabetes treatment and cardiovascular disease in patients with type 1 diabetes. *N Engl J Med* 2005; 353: 2643-53.

Nichols GA, Hillier TA, Javor K, Brown JB. Predictors of glycemic control in insulin-using adults with type 2 diabetes. *Diabetes Care* 2000; 23: 273-7.

Norris SL, Engelgau MM, Narayan KM. Effectiveness of self-management training in type 2 diabetes: a systematic review of randomized controlled trials. *Diabetes Care* 2001; 24: 561-87.

Parchman ML, Pugh JA, Wang CP, Romero RL. Glucose control, self-care behaviors, and the presence of the chronic care model in primary care clinics. *Diabetes Care* 2007; 30: 2849-54.

Rodbard HW, Blonde L, Braithwaite SS, *et al*. American Association of Clinical Endocrinologists medical guidelines for clinical practice for the management of diabetes mellitus. *Endocr Pract* 2007; 13 (suppl): 1-68.

Schectman JM, Nadkarni MM, Voss JD. The association between diabetes metabolic control and drug adherence in an indigent population. *Diabetes Care* 2002; 25: 1015-21.

Sousa VD, Zauszniewski JA, Musil CM, Price Lea PJ, Davis SA. Relationships among self-care agency, self-efficacy, self-care, and glycemic control. *Res Theory Nurs Pract* 2005; 19: 217-30.

Toobert DJ, Hampson SE, Glasgow RE. The summary of diabetes self-care activities measure: results from 7 studies and a revised scale. *Diabetes Care* 2000; 23: 943-50.

UK Prospective Diabetes Study (UKPDS) Group. 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* 1998; 352: 837-53.

Wahba H, Chang YF. Factors associated with glycemic control in patients with type 2 diabetes mellitus in rural areas of the United States. *Insulin* 2007; 2: 134-41.

Wang JQ, TY Shiu A. Diabetes self-efficacy and self-care behaviour of Chinese patients living in Shanghai. *J Clin Nurs* 2004; 13: 771-2.

Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diabetes Care* 2004; 27: 1047-53.

World Health Organization (WHO), International Association for the Study of Obesity, International Obesity Task Force. The Asia-Pacific Perspective: Redefining obesity and its treatment. Sydney: Health Communications, 2000. [Cited 2009 May 30]. Available from: URL: http://www.wpro.who.int/internet/resources.ashx/NUT/Redefining+obesity.pdf

Wu SF, Courtney M, Edwards H, *et al*. Self-efficacy, outcome expectations and self-care behaviour in people with type 2 diabetes in Taiwan. *J Clin Nurs* 2007; 16: 250-7.