

Reducing Type 2 Diabetes Mellitus Risk in Women Post Gestational Diabetes Mellitus through Telephone Motivational Interviewing

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Executive Summary

Background

In NSW the incidence of diabetes has escalated by almost 100 per cent in the seven years to 2007 primarily due to the rising incidence of type 2 diabetes mellitus (T2DM) (Diabetes Australia-NSW 2008). Women with past gestational diabetes mellitus (GDM) are at risk of T2DM; in NCAHS 19% of women with T2DM accessing services reported a previous diagnosis of GDM.

Literature review

Type 2 diabetes can be prevented through lifestyle change; people with impaired glucose tolerance (IGT) had a T2DM reduction risk of 58% through lifestyle intervention (Tuomilehto et al. 2001) (Knowler et al. 2002). Increased insulin resistance leading to T2DM occurs in people with IGT, and GDM. Insulin resistance can be reduced by regular increased physical activity and healthy eating. Recommended minimum physical activity for adults is 30 minutes daily at moderate intensity; energy intake reduction through dietary modification is also usually necessary (Lindstrom 2006).

Successful past studies involved structured group education programs with behaviour modification (Knowler et al. 2002), or individualised counselling with guided individual gym sessions (Tuomilehto et al. 2001) as intervention techniques. These methods are impractical for mothers of newborn babies in the geographical area covering 25,570 kilometers serviced by NCAHS. An alternative intervention method is phone based counselling; successful studies support phone counselling (Hayes et al. 2001), (Eakin et al. 2008, Eakin et al. 2007), (Pierce et al. 2007), (Albright et al. 2005).

Providing lifestyle education is a simple knowledge transfer process but does not necessarily result in behavioural change (Swan, Kilmartin & Liaw 2007). Motivational interviewing is a cognitive behavioural technique that aims to help people identify and change behaviours they would like to adopt.

Aim of study

The study aims to determine if motivational interviewing by phone increases lifestyle change in rural women post gestational diabetes.

Method

Women attending diabetes services in NCAHS for GDM routinely receive lifestyle education during their pregnancy. Invitations to participate in the study were given to all women attending the service. The study was a randomised control design with an intervention and a control group. Intervention was over six months for the intervention group only. Baseline tests requested of client's GP were glucose tolerance test (GTT), cholesterol, and triglyceride levels.

Intervention was mail out of educational material with home based phone counselling, through motivational interviewing. Intervention occurred after baseline questionnaires were completed, and prior to follow up questionnaires being administered. All recruited women were asked to complete a standard set of four questionnaires six weeks post natal (baseline) and six months later (follow up). Variables tested were: amount of, and intensity of physical activity; nutritional intake; and self efficacy levels in women expressed as barriers to lifestyle change and confidence level to make change. Data collection occurred between November 2007 and May 2009.

Results

The study recruited 42 women following a GDM pregnancy, 21 in each of the control and intervention groups.

Intervention group

Total physical activity (without housework) increased ($p < 0.05$); metabolic equivalent (MET) score, a measure of intensity of physical activity increased ($p = 0.06$); total sedentary behaviour reduced ($p < 0.05$); total energy intake reduced ($p = 0.05$); total fat reduced ($p < 0.05$); total carbohydrate reduced ($p < 0.05$); glycaemic load reduced ($p < 0.05$). Body mass index and weight decreased and the waist circumference was reduced by four cms.

Control group

Lifestyle variables did not demonstrate an improvement in this group. Body weight increased three kgs, and BMI increased by one kg/m². Due to level of weight gain in this group, compared weight loss in the intervention group, weight change was significant ($p < 0.05$). No reduction occurred in total energy, or total fat intake. Total PA levels and MET scores were reduced by 43% and 46% respectively, and sedentary behaviour decreased slightly (3%).

The limited study size has reduced the power of tests determining the level of significance of change variables. However, this study has demonstrated an improvement in clinically relevant data. A further study with larger participant numbers over a longer period of time may confirm the outcomes of this study.

Conclusion

The main finding of this study was that a strong positive trend in all parameters across lifestyle change variables occurred in the intervention group, but remained unaltered in the control group. If this pattern continues, clients in the intervention group will have a reduced risk of pre diabetes and vascular disease, unlike the higher risk for women in the control group.

Recommendations for the future

To reduce the incidence of T2DM in women post GDM diabetes services in NCAHS need to:

- Develop a process to ensure all women with post GDM are able to access a lifestyle change program;
- Make available client literature promoting healthy lifestyle change;
- Encourage participation of women post GDM in currently available lifestyle programs such as CHEGGS, and the "Get Healthy" program offered since 2009, through NSW Health by phone based counselling;
- Promote the benefits of using motivational interviewing to diabetes service staff and encourage their participation in motivational interviewing training programs.

Definitions

- Gestational diabetes mellitus: (GDM) is a form of carbohydrate intolerance with variable degrees of severity during pregnancy (Hoffman et al. 1998).
- Insulin resistance: is a condition in which the body produces insulin however the muscle, fat, and liver cells do not respond to it adequately, (Alberti and Zimmet 1998).
- Motivational interviewing: "Motivational interviewing is a directive, client-centred counselling style for eliciting behaviour change by helping clients to explore and resolve ambivalence", (Rollnick and Miller 1995), p325.
- Pre diabetes: is the presence of impaired fasting glucose (IFG) and/or impaired glucose tolerance (IGT) (Twiggy et al. 2007).
- Type 2 diabetes: is a disturbance in carbohydrate, protein and lipid metabolism due to insulin deficiency, insulin resistance or both (Van der Graff and Fox 1988).

Abbreviations

Type 2 Diabetes Mellitus (T2DM)

Gestational Diabetes Mellitus (GDM)

Glucose Tolerance Test (GTT)

Impaired Glucose Tolerance (IGT)

North Coast Area Health Service (NCAHS), Body mass index (BMI)

Key words

Type 2 diabetes mellitus, gestational diabetes mellitus, pre diabetes, impaired glucose tolerance, diabetes prevention, lifestyle change, diabetes risk reduction, intervention, glucose tolerance test, motivational interviewing.

Literature Search Strategies

The topic area for the project was defined and the limits of the searches determined. Electronic searches were then undertaken between July 2007 and July 2009.

Inclusion criteria: English language, relevance to the themes listed below, research based articles and expert opinion.

Exclusion criteria: Articles written prior to 1996, and Non-English articles.

The electronic searches through OVID resulted in 65 articles from Medline searches, and 23 from Cinahl searches. Search terms included: Diabetes Mellitus, Type 2 Diabetes, Gestational Diabetes, Impaired Glucose Tolerance, Rural, Lifestyle change, Motivational Interviewing, Nutrition, Exercise, Primary Prevention, Prevention and Control.

The electronic searches conducted explored the following themes:

- T2DM prevention following GDM
- Practical application of the Social Learning Theory
- Lifestyle change studies suitable for implementation in rural locations
- Healthy eating and physical activity recommendations
- Phone based motivational interviewing

The articles obtained were read, analysed and discriminated between. Some articles were eliminated as they were unhelpful to the proposed study. Articles evaluated as being useful were numbered and allocated to pre-identified themes. Article details were then entered onto EndNote Web.

Introduction and Background

The reasons for the study being conducted were:

1. The NCAHS Diabetes Service Plan (2002-2005) highlighted the need to increase lifestyle change counselling services to women following gestational diabetes mellitus (GDM), and increase awareness of type 2 diabetes mellitus (T2DM) risk. Increasing service demands have prevented this study from occurring earlier.
2. The anticipated increased economic costs for health services associated with increased prevalence of T2DM.
3. The burden of chronic disease placed on individuals, especially when the disease is preventable.

Women with a history of GDM are at risk of developing T2DM. Diabetes client health outcome data from North Coast Area Health Service (NCAHS) shows that of 4,260 women with T2DM, 19% (820) reported having a history of GDM (NCAHS 2009). This 19% is likely to be an underestimation as routine testing for GDM in Australia did not occur until 12 years ago. The primary goal of this study is to test the effectiveness of a phone-based lifestyle change intervention to reduce the prevalence of T2DM risk factors for rural women who have a history of GDM.

In New South Wales the prevalence of diabetes is increasing. The increase has resulted in concerns about associated future healthcare costs and the burden of chronic disease for the individual. Diabetes Australia-NSW has reported that 545,000 people are now affected by diabetes in NSW; the incidence rate escalated by almost 100 percent in the seven years to 2007, this increase is largely due to increased incidence of T2DM, as opposed to other types of diabetes (Diabetes Australia-NSW 2008).

Literature Review

Incidence of GDM and progression to T2DM

In Australia the rate of pregnant women developing GDM at about 24th-28th week gestation is five to nine percent (Cheung and Helmink 2006). This study demonstrated that in women with previous GDM, the progression to T2DM is 30% at seven to ten years post pregnancy. In the North Coast area of NSW, women diagnosed with GDM routinely receive advice and education from NCAHS diabetes services on the beneficial effects of following a healthy lifestyle. These women are also advised to have a GTT six weeks postnatal for early identification of IGT or T2DM.

Kim, Newton and Knopp (2002) described the incidence rate for T2DM following GDM varied from six weeks post partum, at 2.6%, to 28 years post partum at 70%. Progression towards T2DM is influenced by time since the pregnancy with GDM, family history of T2DM, ethnicity, being overweight or obese, older age when pregnant with GDM, and the need for insulin injections during GDM (Strehlow and Mestman 2005), (Kim et al. 2002).

Despite awareness of T2DM risk, compliance to recommended follow up with a GTT is poor, with one study showing 41% of women being non compliant (Kaufmann et al. 1999). Of 39 women tested within five years post GDM, eight had developed diabetes and four had pre diabetes (Kaufmann et al. 1999). The recurrent GDM rate in subsequent pregnancies is reported to be up to 70% (Bottalico 2007). This evidence supporting the need to routinely screen post GDM women six weeks post natal to provide early prevention and detection of T2DM or IGT, but there is little evidence this is occurring systematically.

Pregnancy is associated with marked insulin resistance, in some women the insulin resistance is sufficient to lead to the diagnosis of GDM. Insulin resistance is the precursor to both IGT and GDM, when insulin resistance is severe enough the diagnosis of T2DM will result (Fauci et al. 2008). Insulin

resistance is an impaired metabolic response to insulin produced in our body; the response results in cells eg muscle cells, being unable to take up glucose and use it as an energy source to build and repair cells. When blood insulin levels remain high fat cell cannot give up their energy stores to enable people to lose weight (Fauci et al. 2008). Physical activity and maintaining a healthy weight helps the body to respond to insulin more effectively and reduce the risk of T2DM.

Lifestyle interventions

This study reviewed healthy lifestyle interventions centred on disease prevention through the introduction of lifestyle change. The Finnish Diabetes Prevention Study (Tuomilehto et al. 2001) and the Diabetes Prevention Program (Knowler et al. 2002) both studied people with IGT and demonstrated a 58% reduction risk for T2DM through implementation of positive lifestyle changes. The main goals of the Finnish Diabetes Prevention Study were weight reduction, reduced fat intake, and increased physical activity.

In this current study information on healthy lifestyle patterns was sourced from: *Dietary Guidelines for Adults in Australia* (Nutrition Australia 2003); *The Australian Guide to Healthy Eating* (Children's Health Development Foundation 1999); *National Physical Activity Guidelines for Australians* (Commonwealth of Australia 1999).

Current physical activity guidelines (Commonwealth of Australia 1999) for adults recommend a minimum 30 minutes of moderate intensity activity daily, preferably each day in order to limit health risks of chronic disease such as diabetes. To lose weight moderate intensity activity daily of up to 90 minutes is required (Saris 2002). A reduction in energy intake through dietary modification is also usually necessary (Lindstrom 2006). Participation of lactating women in regular physical activity helps maintain adequate production of prolactin, as the prolactin level rises after physical activity (Fauci et al. 2008). Prolactin is a pituitary hormone which acts to induce and maintain lactation enabling a milk supply for the baby.

Control of energy intake can lead to weight reduction when energy intake is less than energy expenditure (Meckling et al. 2004). Moderate weight loss in lactating women of approximately 0.5kg per week, resulting from food intake and physical activity modification demonstrated no adverse effect on infant weight gain (Lovelady et al. 2000). Neither volume nor composition of the women's milk altered. During this study no woman was prescribed a diet of less than 1800kcal per day (equivalent of 7,560kj). Diets of less than 1500kcal per day (equivalent of 6,300kj) can result in decreased breast milk volume (Strode et al. 1986, cited in Dewey 1998).

Recommended levels of macronutrient intakes for lactating women (NHMRC 2009) are:

- Protein: 67 g per day
- Fibre: 30 g per day
- Fat: 65 g per day is the upper acceptable limit
- Carbohydrate: Whilst there are no specific average requirements during pregnancy and lactation it is accepted that additional CHO is required for breast milk production.
- Total energy needs: No single recommendation for total energy food intake is available due to multiple individual factors such as variation in milk production, stage of lactation, weight loss during lactation, and changes in physical activity level.

Choice of intervention method

Methods indicated as being successful for introducing lifestyle changes in people with IGT were participation in a 16 lesson curriculum on diet, exercise, and behaviour modification (Knowler et al. 2002), individualised counselling with a dietitian and guided gym sessions tailored to individual needs (Tuomilehto et al. 2001), and classroom sessions followed by home based phone counselling (Albright et al. 2005). Mail out alone, of lifestyle print media had no effect (Marshall et al. 2004).

The successful studies were conducted over 2.8 years (Knowler et al. 2002) and 3.2 years (Tuomilehto et al. 2001). When endeavouring to implement a behavioural change a period of intervention of at least six months is required for maintenance of the newly acquire behaviour (Diabetes Australia-NSW 2007), a longer intervention of three years would be ideal (Knowler et al. 2002) (Tuomilehto et al. 2001).

While the intensive interventions were useful in the successful studies described previously, in a rural area they would not be ideal. Rural based mothers of newborn babies do not always live within large towns that have specialist services. Classroom based learning is not feasible in rural areas with a widely dispersed population. NCAHS covers 25,570 kilometres and is populated by 480,675 people (Australian Bureau of Statistics 2006).

Factors impacting on the ability of women in this study attending structured sessions included:

- living on farms more than 30 minutes from small towns
- relocating interstate during the study
- large family with young children
- families with a disabled child, and
- return to part time and full time employment by some mothers.

A lack of access to healthy food and physical activity opportunities is also common in rural based populations – these circumstances require a flexible approach to engage these women to commit to a sustainable change in lifestyle. Consequentially this study has drawn together successful methods as described in the literature and included: a mail out of educational material in combination with home based phone counselling using motivational interviewing techniques.

Phone intervention is well supported by past studies (Hayes et al. 2001), (Eakin et al. 2008, Eakin et al. 2007), (Pierce et al. 2007), (Albright et al. 2005). Whilst none of the studies used motivational interviewing, they aimed

to help participants adopt a positive lifestyle change. The basic elements of motivational interviewing were used in this study during phone counselling. This phone based approach is cost effective and flexible for rural based mothers with newborn babies when compared to other approaches identified in the literature, (Knowler et al. 2002), (Tuomilehto et al. 2001). Without phone based intervention it would be difficult to provide motivational interviewing to participants equitably over a large geographical rural health service.

Behavioral change is identified (Bundy 2004) as being:

- influenced by beliefs underlying the behaviour,
- perceived value and benefits of making the behaviour change against perceived barriers,
- beliefs we have about our ability to make change, and
- level of support received from other people.

The goals of motivational interviewing are to explore ambivalence and encourage the person to express their concerns and their reasons for wanting to change their lifestyle (Rollnick and Miller 1995). The goal is not to try and change the person's behaviour but increase the person's motivation so that change occurs from the person. The central strategy of motivational interviewing, reflective listening allows clarification of personal goals and concerns. Reflective listening enables the person to discuss their reasons about making a change and provide an opportunity for the person to explore feelings of ambivalence about the change (West et al. 2007).

The intervention technique used was partly derived from the Transtheoretical Model, Stages of change, (Prochaska and DiClemente 1983). Using this model people can be considered to be in a particular stage of readiness to make change. The stages are pre-contemplative, contemplative, preparation, action, or maintenance.

Choice of questionnaires

In order to determine the extent of lifestyle change undertaken during this study the following questionnaires were administered:

- Demographic Questionnaire
- The Food Frequency Questionnaire (FFQ)
- The Physical Activity and Self Efficacy Survey (PA & SE), and
- The International Physical Activity Questionnaire (IPAQ)

These tools quantified the level and extent of physical activity undertaken, type and frequency of foods consumed, level of self efficacy related to foods consumed and physical activity undertaken, and physical characteristics of the participants, ie weight, height, waist circumference.

Demographic Questionnaire

This form had 25 demographic questions such as ethnicity, maternal weight and height, family history of GDM, T2DM, and hypertension, delivery type, GDM management, the baby's weight and wellness at birth.

The Food Frequency Questionnaire (FFQ)

The 74 item FFQ used was developed by the Cancer Council of Victoria and validated, (Hodge et al. 2000). Items were grouped into food categories and required women to recall types of food and amount consumed over time.

The Physical Activity and Self Efficacy Determinant Survey (PA and SE)

This survey was developed and validated by the Centre for Physical Activity and Health, (van der Ploeg et al. 2007). The questionnaire consisted of the following constructs: nutritional behaviour measured by a food frequency questionnaire (adapted from Flood, Webb and Rangan 2005) and physical activity behaviour, measured with the Active Australia questionnaire developed by the Australian Institute of Health and Welfare (2003).

The use of this PA and SE determinant questionnaire enables identification of participant perceived barriers, social support, and level of self efficacy related to physical activity and healthy eating. The questionnaire determines if motivational interviewing could support women to make a lifestyle change (Van der Ploeg et al. 2008).

The International Physical Activity Questionnaire (IPAQ)

The IPAQ was developed as a tool capable of monitoring physical activity and inactivity across different nationalities. The tool was tested in 12 countries including Australia for validity and reliability. The questionnaire was found reliable both for self administration by the participant, and by telephone administration (Craig et al. 2003).

The IPAQ questionnaire asked participants about the extent of physical activity and inactivity in the last seven days related to: work, transport, housework, yard work, and recreational pursuits. Distinction is made between exertion levels by asking the participant to differentiate between vigorous and moderate physical activity, examples of exertion levels specific to settings are provided.

Study Aim

The study aims to determine if motivational interviewing by phone increases lifestyle change in rural women post gestational diabetes.

Methods

Study Design and Ethics

In July 2007 the NCAHS Human Research Ethics Committee (HREC) met and approved the study and supporting documentation. The study design was a randomised control trial.

Participants and Sampling

All women with newly diagnosed GDM attending NCAHS diabetes services were candidates for inclusion in the study; no exclusion categories were in place. Potential participants were given a prepared envelope with information about the study, a consent form to sign if they agreed to participate, and a

stamped self addressed envelope for return of consent form. The packs were handed out by the diabetes nurse educators or dietitians.

Allocation to the control and intervention groups occurred as women were recruited to the study. An independent person removed a label from a box, with either 'control' or 'intervention' written on it each time a woman was recruited. After recruitment further contact was not made with the participants until after the birth of their baby.

Procedures and Instruments

The following set of four questionnaires was sent to all women for self completion at six week post natal stage (baseline) and 6 months later (follow up):

- The Demographic Questionnaire
- The Food Frequency Questionnaire (FFQ)
- The Physical Activity and Self Efficacy Survey (PA & SE), and
- The International Physical Activity Questionnaire (IPAQ)

All questionnaires were mailed with a stamped return addressed envelope to women recruited in the study. When questionnaires were not returned, participants were contacted by phone and encouraged to complete and return them.

A letter to the participant's general practitioner (GP) requesting a post natal GTT, cholesterol, and triglyceride levels was given to the participant with a request for them to give it to the GP at their six week post natal check up.

Intervention

After the completed baseline questionnaires were returned, intervention began with the intervention group. During this study the intervention group women were encouraged to follow the Australian healthy eating and physical activity guidelines on:

- Choice of foods from each of the food groups;
- Recommended food serve size;
- Reading food labels, and choice of healthy food options when shopping;

- Making healthy choices if purchasing take away foods or dining out;
- Following suitable recommended types and levels of physical activity (Nutrition Australia 2003), (Commonwealth of Australia 1999).

This information was set out in a booklet titled 'Healthy Lifestyle – Healthy Living' and provided to participants in the intervention group. In the booklet there was also information on stages of change (Prochaska and DiClemente 1983), and the benefits of lifestyle change and goal setting.

The lifestyle educational material was mailed to women prior to commencement of phone interventions. The pack contained the Healthy lifestyle – healthy living booklet, plus food and physical activity diaries. Each participant in the intervention group received 10 phone calls at a prearranged time; the frequency of calls was weekly for five weeks, and then monthly for five months. The initial phone call was approximately 30 minutes duration, with the subsequent phone calls ranging from 10 to 20 minutes.

During the first phone call, the content of the educational package was discussed with the woman. The initial five weeks of the program primarily concentrated on providing educational content that would provide a useful basis to women when the counselling began. Education on the recommended Australian dietary and physical activity guidelines was given at this stage.

Through subsequent discussions, interviewers asked the women to identify which stage of change they considered themselves to be in. Discussions with each woman identified perceived barriers, current eating patterns, health beliefs, past experiences at making lifestyle change, and past health history. These discussions resulted in tailored personalised counselling with the credentialed diabetes educator.

Participants in the intervention group were not given prescriptive lifestyle standards to be achieved in this study. Each of the women identified their own

lifestyle goals and was encouraged through motivational interviewing techniques to discuss these, and to identify intervention required to bring about change. Resulting positive change then increased the participant's confidence and motivation to make further change.

Sessions consisted of reviewing:

- Diarised physical activity and healthy eating activities
- Self belief at the time, and satisfaction level with activities undertaken
- Perceived barriers they felt needed to be overcome
- Possible solutions to the barriers
- Additional provision of advice by interviewers when required.

Women were given the opportunity to discuss their perceived benefits of making a lifestyle change, how they could overcome barriers, and how they had overcome barriers in the past and become confident to make change.

Data Collection and Outcome Assessment

Data collection of the baseline and follow up questionnaires took place between November 2007 and May 2009. As questionnaires were returned, data from all questionnaires were entered onto prepared Microsoft Excel spreadsheets, specific to each questionnaire. Cross checks were made of the data entered to ensure accuracy of data entry.

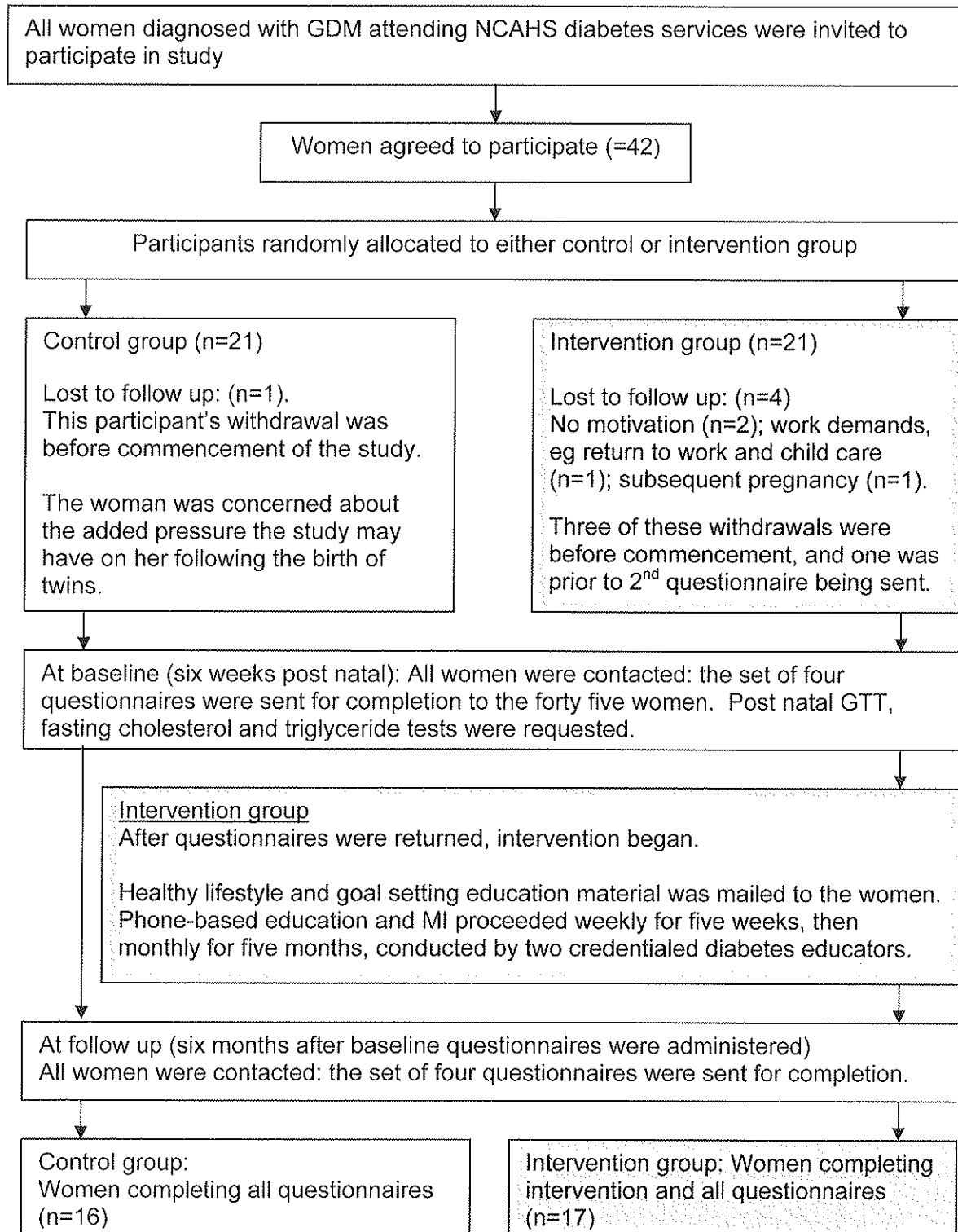
Data Processing and Analysis

Data from both the baseline and follow up questionnaires were transferred from the Excel spreadsheet onto a SPSS 16.0 spreadsheet for analysis.

The total physical activity undertaken per week was calculated and multiplied against the frequency of the activity; the standard deviation (SD), the mean plus independent sample T tests were then calculated. Linear regression analysis was calculated so that quantitative predictions could be determined of one variable compared to another. The metabolic equivalent levels (MET) scores were determined; this score is derived from each type of activity, for example all forms of moderate activity were totalled for the week and then

Results

Figure 1. Illustration of recruitment, retention, and intervention demonstrating the flow of participants through the study:



Personal Characteristics

Tables 1, 2 and 3 represent personal characteristics of women in both groups at baseline.

Table 1. Baseline personal characteristics of the participants in the control and intervention groups

Baseline Characteristics	Baseline	
	Intervention (n=18) Mean (SD)	Control (n=20) Mean (SD)
Age (years)	32.9 (4.9)	32.2 (5.1)
Body mass index (kg/m ²)	29.2 (6.1)	28.5 (4.8)
Weight (kg)	75.3(17.7)	75.9 (13.5)
Waist circumference (cm)	94.4 (12.4)	98.0 (11.4)
No. of children, including new baby	2.4 (1.1)	2.2 (1.5)
Length of breast feeding, months	5.3 (1.06)	6.4 (3.6)
No. of mothers breastfeeding this baby	12	12
Past history, expressed as a percentage:		
Past GDM	39%	32%
Family history GDM	11%	16%
Family history T2DM	61%*	32%
Managed on insulin this pregnancy	28%	58%

*Comparison of intervention versus control group at baseline using Chi² test, p=0.04

Apart from an increased family history of T2DM in the intervention group there was no other statistically significant difference between the groups in table 1 baseline characteristics.

Table 2 details the number and percentage of blood test results within the recommended range and demonstrates a statistically significantly elevated triglyceride level in the control group. Not all participants had tests nor completed all questionnaires. As explained in the methodology, when questionnaires were not completed and returned, endeavors were made by speaking with the women and encouraging them to continue their participation in the project, this had mixed results.

Table 2. Six week post natal blood results of participants in the control and intervention groups.

Blood results	Proportion of women with results in recommended range	
	Intervention	Control
Fasting cholesterol		
< 4 mmol/L* recommended	1/18 (5.56%)	2/16 (12.5%)
Triglyceride		
< 1.5 mmol/L* recommended	13/18 (72.2%)**	6/16 (37.5%)
HDL Cholesterol		
> 1.0 mmol/L* recommended	13/14 (92.9%)	6/7 (85.7%)
Post natal GTT		
Non - Pre diabetes range	13/16 (81.3%)	13/16 (81.3%)

*National Heart Foundation Guidelines (2007)

**Comparison of intervention versus control group at baseline using Chi² test, p<0.004

Table 3 demonstrates weight, waist circumference and body mass index (BMI) at baseline and follow up. A one kilogram reduction in the intervention group with a three kilogram increase in weight in the control group occurred, p<0.05. No other significant difference occurred in body weight or measures for women in these groups, between baseline and follow up.

Table 3. Body shape variables at baseline and follow up of participants in the control and intervention groups

Outcome variable at different times	Baseline		Follow up	
	Intervention (n=18)	Control (n=19)	Intervention (n=15)	Control (n=16)
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Body mass index (kg/m ²)	29.2 (6.2)	28.5 (4.9)	28 (5.7)	29.6 (5.2)
Weight (kg)	75.3 (17.7)	75.9 (13.5)	74.1 (16.3)	79.2 (13.5)*
Waist circumference (cm)	94.4 (11.4)	98 (12.5)	90.5 (12.0)	97.8 (10.8)

*Comparison of intervention versus control group between baseline and follow up using Chi² test, p=0.04

During the study three women from the intervention group had subsequent pregnancies. Glucose tolerance tests were done on these women during their

subsequent pregnancies. Two of the women did not have GDM in their subsequent pregnancy; neither of these women required insulin during their earlier GDM pregnancy. The third woman had GDM again in her subsequent pregnancy; this woman required insulin during both her initial and subsequent GDM pregnancy.

Table 4. Food Frequency variables at baseline and follow up of participants in the control and intervention groups

Food consumption variable	Baseline		Follow Up	
	Intervention (n=16)	Control (n=20)	Intervention (n=17)	Control (n=16)
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Total energy kj/day	8,910 (2798)	7,618 (2706)	6,608 (2610)	7,635 (2476)
Total fat g/ day	90 (31.1)	78 (30.0)	67 (29.2)*	80 (27.9)
Total saturated fat g/ day	38.4 (14.3)	32.6 (13.9)	27.0 (12.2)	33 (12.4)
Total fibre g per day	27 (10.0)	23 (11.0)	21 (9.0)	23 (8.0)
Total carbohydrate (CHO) g /day	223 (72.0)	192 (74)	160 (63.6)*	188 (62.1)
Glycaemic load	115 (39.6)	98 (39.4)	78 (32.2)*	97 (34.3)
Glycaemic index	51 (3.0)	51 (4.3)	49 (3.8)	51 (4.5)

*Comparison of intervention versus control group between baseline and follow up using t test, $p < 0.05$

Table 4 provides the total nutrient intake of all women. The SD and means for control group participants nutrient consumption either increased or stayed constant. Whereas the intervention group means and SD measures for these variables were reduced; this reduction was statistically significant for total intake of fats, carbohydrate intake, and glycaemic load. The glycaemic index remained relatively constant in both groups.

The Physical Activity and Self Efficacy Determinant Survey reflect the physical and emotional well being and health perceptions of participants. The results on **Table 5 (Appendix 1)** demonstrated that women in the intervention group did not perceive a lack of energy ($p < 0.05$), nor the demands of their young baby ($p < 0.05$) to be a barrier to participation in physical activity. However,

considering the relatively large number (47) of variables, and small sample size a definite statement cannot be made regarding changes in self efficacy levels.

Table 6. International Physical Activity Questionnaire (IPAQ) outcome variables six weeks post natal, at baseline and six months later following intervention - without housework physical activity (PA) included.

Outcome variable at different times	Baseline		Follow Up	
	Intervention (n=17)	Control (n= 18)	Intervention ¹ (n= 16)	Control (n= 14)
	Mean (S.D.)	Mean (S.D.)	Mean (S.D.)	Mean (S.D.)
Total work related PA mins/day	72.9 (172.8)	35.0 (122.6)	1.7E2 (243.9)	39.6 (128.3)
Total transport related PA mins/day	80.6 (100.9)	2.2E2 (420.9)	51.9 (72.8)	59.6 (43.6)
Total recreational PA mins/day	90.0 (108.3)	1.5E2 (172.3)	1.7E2 (94.2)	1.31E2 (105.7)
Total PA, without housework PA mins/day	2.4E2 (232.0)	4.1E2 (449.9)	3.8E2 (289.9)*	2.3E2 (216.7)
Total calculated MET score without housework PA mins/day	8.4E2 (729.3)	1.4E3 (1549)	1.2E3 (1134.4)	6.9E2 (527.7)

*Comparison of intervention versus control group between baseline and follow up using t test, $p < 0.05$

Table 6 provides the total amount of physical activity in various locations ie employment (work), transport, and recreational. The amount of work related physical activity may not seem relevant in women six weeks post partum, however this table demonstrates that some women are working six weeks post natal. The table demonstrated a significant difference for the total of all physical activity undertaken between the two groups, with the intervention group being more physically active compared to the control group. The MET score is the calculated intensiveness of the physical activity undertaken.

In the IPAQ follow up questionnaire three participant's responses were excluded prior to analysis; these exclusions were two control group and one intervention group member's responses. The physical activity housework totals for both groups were also excluded. All exclusions were due to over estimation by women of their moderate and vigorous physical activity levels. The removal of these responses occurred as a result of adhering to the IPAQ

Guidelines for Data Processing and Analysis of IPAQ. These guidelines require exclusion of outliers that are unreasonably high with total exercise being greater than 16 hours per day (Sjöström et al. 2005).

Table 7 highlights the predictive relationship of variables between the intervention and control groups, from baseline to follow up. This information demonstrates selected variables for physical activity and nutritional intake in the intervention group.

Table 7. Linear regression analyses comparing selected characteristics and variables of the intervention group to the control group at follow up, while correcting for baseline values of the outcome.

Variable	Regression coefficient B value and 95% CI	P value
Body mass index reduction	-1.5 (-2.8 to -0.58)	0.05
Weight	-0.137 (-7.6 to -0.45)	0.02
Waist Circumference	-0.218 (-10.39 to 0.28)	0.06
Total work physical activity	0.27 (32.3 to 252.0)	0.05
Total transport physical activity	-0.02 (-47.8 to 43.2)	0.15
Total recreational physical activity	0.33 (-7.2 to 136.7)	0.02
Total physical activity (excluding housework) mins/week	198.06 (11.63 to 384.48)	0.04
Total MET mins/week	645.3 (-39.51 to 1330.1)	0.06
Total time spent sitting, mins/week	-580.06 (-1099.7 to -60.4)	0.03
Total energy kJ intake per day	-1,586 (34 to -3206)	0.05
Total fat grams intake per day	-18.9 (-37.0 to -0.95)	0.04
Total saturated fat intake per day	-0.9 (-16.4 to 1.8)	0.11
Total CHO grams intake per day	-41.6 (-81.9 to -1.4)	0.04
Glycaemic load	-25.8 (-47.9 to -3.7)	0.02

..

Discussion

The main finding of this study was that a strong positive trend in all parameters across lifestyle change variables occurred in the intervention group, but remained unaltered in the control group.

Personal characteristics

Personal characteristics of age, BMI, and number of children of women in both groups varied slightly. Of the intervention group women 61% had a family history of GDM and/or T2DM compared to 37% in the control group, $\text{Chi}^2 p=0.13$. In the control group 58% required insulin during their pregnancy, compared to 28% in the intervention group, $\text{Chi}^2 p=0.07$.

Post natal blood testing

During the post natal period difficulty was encountered trying to convince some GPs to order the GTT, and several women seemed ambivalent about having the test. This difficulty was largely overcome by speaking with women on the importance of the test, and also writing to or phoning several GPs on the need for the test. The success rate of participants in this study having the six weeks post natal GTT done was 86%. This success rate exceeded that of (Kaufmann et al. 1999) at 41%.

The baseline post natal GTT results of this current study demonstrated that six women, three from each group already had pre diabetes, an early but reversible stage towards T2DM. Diagnosis of pre diabetes is an indicator for these women and their GPs that future development of T2DM is a strong possibility unless effective intervention occurs to reduce their level of insulin resistance.

At baseline most women in the intervention group (94%) and control group (88%) had elevated fasting cholesterol levels according to National Heart Foundation recommendations (National Heart Foundation 2001). More control group women (63%) had elevated triglyceride levels compared to the

intervention group women (28%). Elevated blood fat is one precursor of heart disease, along with obesity, lack of physical activity, hypertension, and excessive dietary saturated fat.

As described in the results, three women from the intervention group had subsequent pregnancies following their GDM pregnancy. Two women did not have GDM in their subsequent pregnancies. However, the third woman required insulin in her initial GDM related pregnancy, and then developed insulin requiring GDM in her subsequent pregnancy, but has no family history of either T2DM not GDM. Requiring insulin during a pregnancy with GDM, and having a family history of T2DM increases the risk of subsequent T2DM, (Strehlow and Mestman 2005), (Kim et al. 2002).

Changes in physical activity and healthy eating patterns

Intervention group

The intervention group consistently made positive lifestyle changes in the six month period between baseline and follow up. These changes included a reduction in CHI intake consumed, body weight and waist circumference and an increase in physical activity undertaken. During the intervention period mean waist circumference was reduced by four cms to 90, but the mean weight was reduced by only one kg.

Compared to the control group, eating patterns improved in the intervention group from baseline with substantial reduction in intake of total energy nutrients ($p=0.05$), total fat intake ($p<0.05$), and total carbohydrate intake ($p<0.05$), and glycaemic load was reduced ($p<0.05$). Saturated fat intake reduced but the difference compared to baseline was not significant ($p=0.11$).

Changes in the intervention group physical activity related variables increased during the intervention period, compared to the control group. Physical activity levels increased ($p<0.04$), the MET score measuring intensiveness of physical activity increased but was not significant ($p<0.06$), and the extent of sedentary behaviour decreased ($p<0.05$). These changes, if sustained, can lead to reduced predisposition to T2DM, metabolic syndrome, and vascular disease.

Being a rural home based program the activities women chose were less structured than would be expected in large towns and cities. Examples included family bicycle outings, walks on the beach, having a baby stroller with big wheels fitted so the mother could transport the baby around the farm to paddocks and sheds as tasks needed to be done. Women in the intervention group did not perceive a lack of energy ($p<0.05$), nor the demands of their young baby ($p<0.05$) to be barriers to their participation in physical activity.

Control group

In the control group, between baseline and follow up no change in the mean waist circumference occurred, mean body weight increased three kg, and mean BMI increased by one kg/m^2 . Due to weight gain in the control group and weight loss in the intervention group, the difference in mean weight between groups was significant ($p<0.05$).

Eating patterns remained constant in the control group, without reduction in intake of total energy, total fat, or saturated fat; carbohydrate intake remained constant. Total physical activity levels and MET scores were reduced, by 43% and 46% respectively, in the control group over the six month period. The sedentary behaviour decreased slightly (3%). Women in this group are more likely to develop pre diabetes, T2DM, and vascular disease if the current lifestyle patterns remain unchanged.

Limitations of this study have been:

- Self reporting by some clients on questionnaires may have led to over estimated responses. This could be as a result of social desirability bias, and/or recall bias.
- The limited size of this study has reduced the power of tests that determine the significance of the level of change in variables.

size and a short follow up period a definite trend is beginning to emerge with a positive lifestyle change apparent following the intervention.

Recommendations for the future

To reduce the incidence of T2DM in women post GDM diabetes services in NCAHS need to:

- Develop a process to ensure all women with post GDM are able to access a lifestyle change program;
- Make available client literature promoting healthy lifestyle change;
- Encourage participation of women post GDM in currently available lifestyle programs such as CHEGGS, “Get Healthy” as offered since early 2009, through NSW Health by phone based counselling.
- Promote the benefits of using motivational interviewing to diabetes service staff and encourage their participation in motivational interviewing training programs.

A research centre should be encouraged to undertake a larger study in multiple rural sites utilizing similar intervention as described in this study to substantiate these findings.

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Reference list

Alberti, K., Zimmet, P. 1998, 'Definition, diagnosis and classification of diabetes mellitus and its complications', in Part 1: diagnosis and classification of diabetes mellitus provisional report of a WHO consultation, *Diabet Med.*, vol. 15, pp. 539-53.

Albright, C., Pruitt, L., Castro, C., Gonzalez, A., Woo, S., King A. 2005, 'Modifying physical activity in a multiethnic sample of low-income women: one-year results from the IMPACT (Increasing Motivation for Physical ACTivity) project', *Ann Behav Med*, vol. 30, pp. 191-200.

Australian Bureau of Statistics, 2006, 'Australian demographic statistics - LGA populations, Australia, Cat. No. 3218.0', ABS, Canberra. [Online: <http://www.abs.gov.au/ausstats/abs@.nsf/Products/3218.0~2007-08~Main+Features~New+South+Wales>, Australian Bureau of Statistics, Canberra. [Accessed: 8 October 2009].

Bellew, B. 2005, 'Chronic Disease - The Sleeping Giant of Health Expenditure', NSW Health Futures Planning Project., NSW Health.

Bottalico, J. 2007, 'Recurrent gestational diabetes: risk factors, diagnosis, management, and implications', *Semin Perinatol*, vol. 31, pp.176-84.

Britt, E., Hudson, S., Blampied, N. 2004, 'Motivational interviewing in health settings: a review', *Patient Education and Counselling*, vol. 53, pp. 147-155.

Bundy, C. 2004, 'Changing behaviour: using motivational interviewing techniques', *Journal of the Royal Society of Medicine*, 97, Supplement 44, pp. 43-47.

Cheung, N. & Helmink, D. 2006, 'Gestational diabetes: the significance of fasting hyperglycaemia for the development of subsequent diabetes mellitus', *Journal of Diabetes Complications*, vol. 20, pp. 21-25.

Children's Health Development Foundation, 1999, '*The Australian guide to healthy eating*', Department of Health and Ageing, Canberra.

Commonwealth of Australia 1999, *National Physical Activity Guidelines for Australians (Active Australia)*, Department of Health and Ageing, Canberra.

Craig, C., Marshall, A., Sjostrom, M., Bauman, A., Booth, M., Ainsworth, B., Pratt, M., Ekelund, U., Yngve, A., Sallis, J., Oja, P. 2003, 'International physical activity questionnaire:

12-Country reliability and validity', *Medicine and Science in Sports and Exercise*, vol. 35, pp. 1381-1395.

Diabetes Australia-NSW 2008, *Diabetes in New South Wales Atlas: 2008 update*, DA-NSW, Sydney, p. 4.

Diabetes Australia-NSW. 2007, *Type 2 diabetes risk reduction book*. DA-NSW, Sydney.

Dewey, K. 1998, 'Effects of maternal caloric restriction and exercise during lactation', *The Journal of Nutrition*, vol. 128, no. 2, pp. 386S-389S.

Eakin, E., Lawler, S., Vandelanotte, C., Owen, N. 2007, 'Telephone interventions for physical activity and dietary behaviour change: a systematic review', *Am J Prev Med*, vol. 32, pp. 419-34.

Eakin, E., Reeves, M., Lawler, S., Oldenburg, B., Del Mar, C., Wilkie, K., Spencer, A., Battistutta, D., Graves, N. 2008, 'The Logan Healthy Living Program: a cluster randomized trial of a telephone-delivered physical activity and dietary behaviour intervention for primary care patients with type 2 diabetes or hypertension from a socially disadvantaged community rationale, design and recruitment', *Contemp Clin Trials*, vol. 29, pp. 439-54. Epub 2007 Nov 4.

Fauci, A., Braunwald, E., Kasper, D., Hauser, S., Longo, D., Jameson, J., Loscalzo, J. (eds') 2008, *Harrison's Principles of Internal Medicine*, vol. 11, 17th edition, Mc Graw Hill, New York.

Flood, V., Webb, K., Rangan, A. 2005, 'Recommendations for short questions to assess food consumption in children for the NSW Health Surveys', *NSW Centre for Public Health Nutrition*, Sydney.

Garden, F., Moore, H., Jorm, L. 2005, 'The current and future status of the New South Wales population (Summary Report)', *New South Wales Health*. Sydney.

Hayes, J., Boucher, J., Pronk, N., Gehling, E., Spencer, M., Waslaski, J. 2001, 'The role of the certified diabetes educator in telephone counselling', *Diabetes Educ.*, vol. 27, pp. 377-86.

Hodge, A., Patterson, A., Brown, W., Ireland, P., Giles, G. 2000, 'The Anti Cancer Council of Victoria FFQ: Relative validity of nutrient intakes compared with weighed food records in young to middle-aged women in a study of iron supplementation', *Australian and New Zealand Journal of Public Health*, vol. 24, pp. 576-583.

Hoffman, L., Nolan, C., Wilson, J., Oats, J., Simmons, D. 1998, 'Gestational diabetes mellitus-management guidelines', *The Australasian Diabetes in Pregnancy Society. Med J Aust*, vol. 169, pp. 93-7.

Kaufmann, R., Smith, T., Bochantin, T., Khardori, R., Evans M., Steahly L. 1999, 'Failure to obtain follow-up testing for gestational diabetic patients in a rural population', *Obstet Gynecol*, vol. 93, pp. 734-7.

Kim, C., Newton, K., Knopp, R. 2002, 'Gestational diabetes and the incidence of type 2 diabetes: a systematic review', *Diabetes Care*, vol. 25, pp.1862-8.

Knowler, W., Barrett-Connor, E., Fowler, S., Hamman, R., Lachin, J., Walker, E., Nathan, D. 2002, 'Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin', *N Engl J Med.*, vol. 346, pp. 393-403.

Lindstrom, J. 2006, 'Prevention of type 2 diabetes with lifestyle intervention - emphasis on dietary composition and identification of high-risk individuals', *National Public Health Institute, and Department of Public Health, Helsinki.*

Lovelady, C., Garner, K., Moreno, K., Williams, J. 2000, 'The effect of weight loss in overweight, lactating women on the growth of their infants', *The New England Journal of Medicine*, vol. 342, pp. 449-453.

Marshall, A., Bauman, A., Owen, N., Booth, M., Crawford, D., Marcus, B. 2004, 'Reaching out to promote physical activity in Australia: a statewide randomised controlled trial of a stage-targeted intervention', *American Journal of Health Promotion*, vol. 18, pp. 283-287.

Meckling, K., O'Sullivan, C., Saari, D. 2004, 'Comparison of a low-fat diet to a low-carbohydrate diet on weight loss, body composition, and risk factors for diabetes and cardiovascular disease in free-living, overweight men and women', *The Journal of Clinical Endocrinology and Metabolism*, vo. 89, no. 6, pp. 2717-2723.

National Heart Foundation Group 2001, 'Lipid management guidelines 2001 - Summary Paper', *Medical Journal of Australia*, vol. 175, pp. S57-S88.

National Health and Medical Research Council 2006, 'Nutritional Reference values,' [Online] Available: <http://www.nrv.gov.au/nutrients> [Accessed 23 Oct. 2009].

North Coast Area Health Service 2009, '*North Coast Area Health Diabetes Health Outcome Audit and Benchmarking*', NCAHS, Lismore.

Nutrition Australia, 2003 'Dietary Guidelines for Adults in Australia', [Online] www.nutritionaustralia.org/static/nut-adults-diet.php, [Accessed: 1 November 2007].

Pierce, J., Newman, V., Natarajan, L., Flatt, S., Al-Delaimy, W., Caan, B., J. Emond, J., Faerber, S., Hajek, R., Hollenbach, K., Jones, L., Karanja, J., Kealey, S., Madlensky, L., Marshall, J., Ritenbaugh, C., Rock, C., Stefanick, M., Thomson, C., Wasserman, L., Parker, B. 2007, 'Telephone counselling helps maintain long-term adherence to a high-vegetable dietary pattern', *J Nutr.*, vol. 137, pp. 2291-6.

Prochaska, J., DiClemente, C. 1983, 'Stages and processes of self-change of smoking: toward an integrative model of change', *Journal Consult Clinical Psychology*, vol. 51, pp. 390-5.

Rollnick, S., Miller, W. 1995, 'Motivational interviewing: What is MI?' *Behavioural and Cognitive Psychotherapy*, vol. 23, pp. 325-334.

Saris, W., Blair, S., Van Baak, M., Eaton, S., Davies, P., Di Pietro, L., Fogelholm, M., Rissanen, A., Schoeller, D., Swinburn, B., Tremblay, A., Westerterp, K., Wyatt, H. 2003, 'How much physical activity is enough to prevent unhealthy weight gain?' *The international Association for the Study of Obesity, Obesity Review* 4, pp. 101-114 [Online] www.phpc.cam.ac.uk/mst/phtop/t3/optimal_pal.pdf. [Accessed 12 October, 2009].

Sjöström, M., Ainsworth, B., Bauman, A., Bull, F., Craig, C., Sallis, J. 2005, 'Guidelines for data processing and analysis of the international physical activity questionnaire (IPAQ)', [Online] www.ipaq.ki.se, [Accessed 16 July 2009].

Strehlow, S., Mestman, J. 2005, 'Prevention of T2DM in women with a previous history of GDM', *Curr Diab Rep*, vol. 5, pp. 272-7.

Templeton, M., Pieris-Caldwell, I. 2008, 'Gestational diabetes mellitus in Australia, 2005-06', *Australian Institute of Health and Welfare, Canberra, Diabetes series*, no. 10.

Tuomilehto, J., Lindstrom, J., Eriksson, J., Valle, T., Hamalainen, H., Ilanne-Parikka, P., Keinanen-Kiukaanniemi, S., Laakso, M., Louheranta, A., Rastas, M., Salminen, V., Uusitupa, M. 2001, 'Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance', *N Engl J Med*, vol. 344, pp. 1343-50.

Twigg, S., Kamp, M., Davis, T., Flack, J. 2007, 'Prediabetes: a position statement from the Australian Diabetes Society and Australian Diabetes Educators Association', *Medical Journal of Australia*, vol. 186, pp.461-465.

van der Ploeg, H., Smith, B., Wah Cheung, N., Razee, H., Blignault I., Bauman, A. 2008, 'Understanding and measuring health behaviours and related psychosocial factors among women with a history of gestational diabetes mellitu', Sydney: NSW Centre for Physical Activity and Health.

West, D., DiLillo, V., Bursac, Z., Gore, S., Greene, P. 2007 'Motivational interviewing improves weight loss in women with type 2 diabetes', *Diabetes Care*, 30, 1081-7.

Appendix 1 Table 5. Physical activity and self efficacy determinant survey: Outcome variables at baseline and at follow up

Outcome variable at different times	Baseline		Follow up	
	Intervention ¹ (n = 18) Mean (SD)	Control (n = 20) Mean (SD)	Intervention ^{2,3} (n = 17) Mean (SD)	Control (n = 16) Mean (SD)
Physical Activity Barriers “How often does....”				
lack of motivation prevent you from being physically active?	3.0 (1.4)	3.15 (1.2)	2.71 (0.9)	2.88 (1.2)
lack of time prevent you from being physically active?	3.72 (1.2)	3.75 (1.1)	3.65 (0.9)	3.88 (1.2)
family demands prevent you from being physically active?	3.89 (1.1)	3.60 (1.2)	3.82 (0.7)	4.06 (1.2)
lack of energy prevent you from being physically active?	2.94 (1.3)	3.25 (1.0)	2.47 (0.6) *2	3.12 (1.2)
not having anyone to do physical activity with you prevent you from being physically active?	2.83 (1.3)	2.25 (1.1)	2.29 (0.9)	2.06 (1.1)
lack of help with childcare prevent you from being physically active?	3.33 (1.6)	2.95 (1.3)	3.0 (1.2)	3.0 (1.3)
lack of a convenient place to do physical activity prevent you from being physically active?	2.11 (1.1)	2.15 (1.0)	1.94 (0.8)	2.0 (1.3)
being overweight prevent you from being physically active?	1.78 (1.1)	1.65 (0.9)	1.53 (0.7)	2.0 (1.1)
work demands prevent you from being physically active?	2.11 (1.2)	2.4 (1.4)	2.24 (1.4)	2.38 (1.7)
feeling you should put the needs of others in your family before yours prevent you from being physically active?	3.61 (1.2)	3.45 (1.2)	3.53 (1.2)	3.94 (1.2)
not having your extended family nearby to give you support prevent you from being physically active?	2.5 (.9)	2.45 (1.6)	2.71 (1.3)	3.0 (1.6)
Social support for physical activity “How often do/does...”				
your friends encourage you to be physically active?	2.28 (1.2)	2.8 (1.1)	2.71 (0.9)	2.44 (1.2)
your partner encourage you to be physically active?	2.89 (1.3)	3.4 (1.1)	2.94 (0.8)	3.5 (1.3)
the rest of your family encourage you to be physically active?	2.5 (1.4)	2.75 (1.1)	2.88 (1.1)	2.56 (1.0)
your doctor or other health professionals encourage you to be physically active?	2.61 (1.2)	2.95 (1.3)	2.65 (1.1)	2.19 (1.4)
alternative health care providers encourage you to be physically active?	1.78 (1.2)	1.9 (1.2)	1.53 (0.9)	1.5 (1.1)
Self efficacy for physical activity “How confident are you that you can be physically active when...”				
you are tired?	2.94 (0.1)	2.7 (0.9)	2.47 (0.8)	2.94 (0.9)
you feel you don't have time?	3.33 (0.8)	3.0 (0.8)	2.88 (0.9)	3.25 (0.9)
you feel stressed?	2.78 (1.1)	2.7 (0.9)	2.06 (0.8)	2.62 (1.0)
with the demands of your young baby/child?	3.11 (1.0)	3.05 (0.6)	2.71 (0.8)*3	3.38 (0.6)
you have a lot of other demands at home?	3.17 (0.8)	3.05 (0.6)	2.88 (0.9)	2.95 (1.6)
when you have household chores to attend to?	2.89 (0.9)	2.85 (1.0)	2.47 (1.0)	2.31 (1.1)
you feel alone?	2.33 (1.0)	2.10 (1.1)	2.24 (1.0)	2.06 (1.2)
when you feel lazy?	3.06 (0.9)	3.1 (0.9)	2.65 (1.0)	2.31 (1.3)
you feel depressed?	2.39 (1.1)*1	3.05 (0.9)	2.35 (1.1)	2.38 (1.3)

¹Comparing the intervention group to the control group at baseline using an independent T test, *p<0.05

²Comparing the intervention group to the control group at follow up using an independent T test, *p<0.05

³Comparing the intervention group to the control group at follow up using an independent sample T test. *p<0.05

Table 5 continued, Physical activity and self efficacy determinant survey: Outcome variables at baseline and six months later, at follow up.

Outcome variable at different times	Baseline		Follow up	
	Intervention (n = 18) Mean (SD)	Control (n = 20) Mean (SD)	Intervention ¹ (n = 17) Mean (SD)	Control (n = 16) Mean (SD)
Nutrition Barriers "How often does/do..."				
lack of time to prepare healthy foods at home prevent you from eating a healthy diet?	2.72 (1.2)	2.6 (1.0)	2.18 (1.1)	2.62 (1.3)
not knowing how to prepare healthy foods in a way that tastes good prevent you from eating a healthy diet?	1.89 (1.1)	1.7 (0.8)	1.47 (0.6)	1.38 (0.7)
others in your home not liking healthy foods prevent you from eating a healthy diet?	2.22 (1.2)	1.8 (0.9)	1.94 (0.9)	1.56 (0.8)
the cost of fresh fruits and vegetables prevent you from eating a healthy diet?	2.06 (1.2)	2.45 (1.5)	1.88 (1.0)	1.75 (1.2)
difficulty of cooking different meals for different family members prevent you from eating a healthy diet?	2.61 (1.5)	1.85 (1.1)	1.94 (1.0)*	1.25 (0.6)
eating food prepared by others prevent you from eating a healthy diet?	2.61 (1.3)	2.05 (1.0)	2.12 (0.9)	1.69 (1.0)
eating foods that are specific for your culture prevent you from eating a healthy diet?	1.33 (0.8)	1.10 (0.3)	1.18 (0.4)	1.06 (0.3)
having unhealthy snack foods at home prevent you from eating a healthy diet?	2.67 (1.5)	2.47 (1.2)	2.47 (1.3)	2.5 (1.3)
having cravings for sweets prevent you from eating a healthy diet?	3.06 (1.6)	2.76 (1.4)	2.76 (1.4)	3.25 (1.1)
Social support nutrition "How often do/does..."				
your friends encourage you to eat a healthy diet?	2.11 (1.1)	2.25 (1.3)	2.24 (1.1)	2.19 (1.4)
your partner encourage you to eat a healthy diet?	3.0 (1.3)	3.35 (1.4)	2.88 (1.4)	2.75 (1.6)
the rest of your family encourage you to eat a healthy diet?	2.83 (1.5)	2.8 (1.2)	2.88 (1.3)	2.19 (2.5)
your doctor or other health professionals you to eat a healthy diet?	2.94 (1.4)	3.25 (1.4)	3.06 (1.1)	2.5 (1.5)
alternative health care providers encourage you to eat a healthy diet?	1.83 (1.3)	1.9 (1.3)	1.88 (1.3)	1.56 (1.1)
Self efficacy nutrition "How confident are you that you can eat a healthy diet when..."				
you are in a hurry?	2.89 (1.0)	2.6 (1.1)	2.41 (1.0)	2.44 (1.2)
others around you eat unhealthy foods?	2.67 (0.8)	2.55 (1.1)	2.41 (0.9)	2.38 (1.2)
eating out (at restaurants, parties, take away etc)?	2.94 (0.8)	2.5 (1.0)	2.35 (0.9)	2.19 (1.0)
you are feeling alone?	2.5 (1.1)	2.5 (0.9)	2.18 (1.0)	2.12 (1.0)
you are feeling too lazy to cook?	2.83 (0.8)	2.85 (1.1)	2.47 (1.1)	2.69 (1.1)
you are feeling depressed?	2.67 (1.0)	2.85 (1.1)	2.41 (1.2)	2.44 (1.2)
visiting family or friends?	2.44 (0.9)	2.55 (1.0)	2.35 (0.9)	1.94 (1.0)
you have a lot of other demands at home?	2.78 (0.9)	2.6 (0.9)	2.24 (1.0)	2.12 (1.1)

¹Comparing the intervention group to the control group at follow up using an independent sample T test, * p<0.05

Appendix 2

Gestational Diabetes Project Demographic Questionnaire

Please write within the boxes provided or mark "x" with a black pen to indicate your response to the question.

**NORTH COAST
AREA HEALTH SERVICE
NSW HEALTH**

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Name: _____	Your Date of Birth: _____					
Address: _____						
GP: _____	Hospital that the baby was delivered at _____					
Date of baby's birth: _____	Are you of indigenous background? <input type="checkbox"/> No <input type="checkbox"/> Yes					
What was your weight before you became pregnant? <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td><td> </td><td> </td><td> </td></tr></table> . <table border="1" style="display: inline-table; vertical-align: middle;"><tr><td> </td></tr></table> kgs						
1. How many children do you have?	<table border="1" style="display: inline-table;"><tr><td> </td><td> </td></tr></table>					
2. In previous pregnancies have you had gestational diabetes?	<input type="checkbox"/> Yes <input type="checkbox"/> No					
If Yes	<table border="1" style="display: inline-table;"><tr><td> </td><td> </td></tr></table>					
2a. How many times?						
2b. Did you have a glucose tolerance test 6 weeks after that pregnancy?	<input type="checkbox"/> Yes <input type="checkbox"/> No					
2c. If yes, what was the result	<input type="checkbox"/> Normal <input type="checkbox"/> Borderline <input type="checkbox"/> Diabetes <input type="checkbox"/> Don't know					
3. Have you had problems with high blood pressure during this pregnancy:	<input type="checkbox"/> Yes <input type="checkbox"/> No					
4. Do you have a family history of type 2 diabetes	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Dont know					
5. Do you have a family history of gestational diabetes:	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Dont know					
Specific to this pregnancy						
6. How much did your baby weigh at birth:	<table border="1" style="display: inline-table;"><tr><td> </td><td> </td></tr></table> . <table border="1" style="display: inline-table;"><tr><td> </td></tr></table> kgs					
7. What is your current weight:	<table border="1" style="display: inline-table;"><tr><td> </td><td> </td><td> </td><td> </td></tr></table> . <table border="1" style="display: inline-table;"><tr><td> </td></tr></table> kgs					
8. What is your height:	<table border="1" style="display: inline-table;"><tr><td> </td><td> </td><td> </td><td> </td></tr></table> . <table border="1" style="display: inline-table;"><tr><td> </td></tr></table> cms					
9. What type of delivery did you have:	<input type="checkbox"/> Vaginal Delivery <input type="checkbox"/> Caesarean Section					
10. How many weeks did your pregnancy last:	<table border="1" style="display: inline-table;"><tr><td> </td><td> </td></tr></table>					
11. During your pregnancy was your gestational diabetes managed by:						
11a: Diet only:	<input type="checkbox"/> Yes <input type="checkbox"/> No					
11b: Exercise only	<input type="checkbox"/> Yes <input type="checkbox"/> No					
11c: Diet and exercise:	<input type="checkbox"/> Yes <input type="checkbox"/> No					
11d: Diet, exercise and insulin:	<input type="checkbox"/> Yes <input type="checkbox"/> No					
11e: Were you given no special management plan for the diabetes:	<input type="checkbox"/> Yes <input type="checkbox"/> No					
12. If you selected (d): what was the total daily dose of insulin on day prior to delivery:	<table border="1" style="display: inline-table;"><tr><td> </td><td> </td><td> </td></tr></table> units					
13. At what week during the pregnancy was insulin commenced:	<table border="1" style="display: inline-table;"><tr><td> </td><td> </td></tr></table> weeks					
14. Was the baby well after the birth:	<input type="checkbox"/> Yes <input type="checkbox"/> No					
15. Did you have concerns about the baby's health:	<input type="checkbox"/> Yes <input type="checkbox"/> No					

Appendix 3

Gestational Diabetes Project Physical Activity and Self Efficacy Survey

NORTH COAST
AREA HEALTH SERVICE
NSW HEALTH

Please read the question then for each category please fill in the circle related to the frequency of the event.

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Barriers to physical activity

1. How often does the following prevent you from being physically active?

Category	Never	Rarely	Some times	Often	Very often
a) lack of motivation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b) lack of time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c) family demands	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d) lack of energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e) not having anyone to do physical activity with you	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f) lack of help with child care	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g) lack of a convenient place to do physical activity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h) being overweight	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
i) work demands	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
j) feeling you should put the needs of others in your family before yours	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
k) not having your extended family nearby to give you support	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Social Support for physical activity

2. How often do the following people encourage you to be physically active?

Category	Never	Rarely	Some times	Often	Very often
a) your friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b) your partner	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c) the rest of your family	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d) your doctor or other health professionals (eg: physical therapist, nurse etc)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e) alternative health care providers (eg: naturopaths, herbalists etc)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Self efficacy for physical activity

3. How confident are you that you can be physically active in the following situations?

Category	Very confident	Confident	A little confident	Not confident
a) when you are tired	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b) when you feel you don't have time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c) when you feel stressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d) with the demands of your young baby/child	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e) when you have a lot of other demands at home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f) when you have household chores to attend to	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g) when you feel alone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h) when you feel lazy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
i) when you feel depressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please turn over to continue

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Gestational Diabetes Project Physical Activity Survey

Page 2

Barriers to nutrition

4. How often do the following prevent you from eating a healthy diet?

Category	Never	Rarely	Some times	Often	Very often
a) lack of time to prepare healthy foods at home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b) not knowing how to prepare healthy foods in a way that tastes good	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c) others in your home not liking healthy foods	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d) the cost of fresh fruits and vegetables	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e) the difficulty of cooking different meals for different family members	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f) eating food prepared by others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g) eating foods that are specific to your culture	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h) having unhealthy snack foods at home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
i) having cravings for sweets	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Social support nutrition

5. How often did the following people encourage you to eat a healthy diet?

Category	Never	Rarely	Some times	Often	Very often
a) your friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b) your partner	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c) the rest of your family	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d) your doctor or other health professionals (eg: physical therapist, nurse etc)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e) alternative health care providers (eg: naturopaths, herbalists, etc)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Self efficacy nutrition

6. How confident are you that you can eat a healthy diet?

Category	Very confident	Confident	A little confident	Not confident
a) when you are in a hurry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b) when others around you eat unhealthy foods	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c) when eating out (restaurants, parties, take-away etc)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d) when you are feeling alone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e) when you are feeling too lazy to cook	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f) when you are feeling depressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g) when visiting family or friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h) when you have a lot of other demands at home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Thank you for completing this survey.

Gestational Diabetes Project, North Coast Area Health Service, Area Diabetes CNC Judy Reinhardt
Locked Bag 11 Lismore NSW 2480. Tel (02) 6620 2836 Fax (02) 6621 7088
Website www.ncahs.nsw.gov.au

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Appendix 4



Gestational Diabetes Project: Physical Activity Questionnaire

Name: Date of birth:

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**.

Please answer each question even if you do not consider yourself to be an active person.

Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Your answers are important.

THANK YOU FOR PARTICIPATING

Think about all the vigorous and moderate activities that you did in the **last 7 days**.
In answering the following questions,
Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal.
Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal

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Gestational Diabetes Project - International Physical Activity Questionnaire
North Coast Area Health Service: Area Diabetes CNC - Judy Reinhardt
Locked Mail Bag 11, Lismore 2480. Ph. 6620 2836

Gestational Diabetes Project Physical Activity Questionnaire

Please place an X within the box that is applicable to you.

PART 1: JOB-RELATED PHYSICAL ACTIVITY

The first section is about your work. This includes paid jobs, farming, volunteer work, course work, and any other unpaid work that you did outside your home. Do not include unpaid work you might do around your home, like housework, yard work, general maintenance, and caring for your family. These are asked in Part 3

1. Do you currently have a job or do any unpaid work outside your home?

Yes
 No



Skip to PART 2: TRANSPORTATION

The next questions are about all the physical activity you did in the last 7 days as part of your paid or unpaid work. This does not include travelling to and from work.

2. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, heavy construction, or climbing up stairs as part of your work? Think about only those physical activities that you did for at least 10 minutes at a time

days per week
 No vigorous job-related physical activity



Skip to question 4

3. How much time did you usually spend on one of those days doing vigorous physical activities as part of your work?

hours per day
 minutes per day

4. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads as part of your work? Please do not include walking

days per week
 No moderate job-related physical activity



Skip to question 6

5. How much time did you usually spend on one of those days doing moderate physical activities as part of your work?

hours per day
 minutes per day

6. During the last 7 days, on how many days did you walk for at least 10 minutes at a time as part of your work? Please do not count any walking you did to travel to or from work.

days per week
 No job-related walking



Skip to PART 2: TRANSPORTATION

7. How much time did you usually spend on one of those days walking as part of your work?

hours per day
 minutes per day

Gestational Diabetes Project Physical Activity Questionnaire

Please place an X within the box that is applicable to you.

PART 2: TRANSPORTATION PHYSICAL ACTIVITY

These questions are about how you traveled from place to place, including to places like work, shops, movies, and so on.

8. During the last 7 days, on how many days did you travel in a motor vehicle like a train, bus, car, or tram?

days per week

No travelling in a motor vehicle



Skip to question 10

9. How much time did you usually spend on one of those days travelling in a train, bus, car, tram, or other kind of motor vehicle?

hours per day

minutes per day

Now think only about the bicycling and walking you might have done to travel to and from work, to do errands, or to go from place to place.

10. During the last 7 days, on how many days did you bicycle for at least 10 minutes at a time to go from place to place?

days per week

No bicycling from place to place



Skip to question 12

11. How much time did you usually spend on one of those days to bicycle from place to place?

hours per day

minutes per day

12. During the last 7 days, on how many days did you walk for at least 10 minutes at a time to go from place to place?

days per week

No walking from place to place



Skip to PART 3:
HOUSEWORK, HOUSE
MAINTENANCE, AND
CARING FOR FAMILY

13. How much time did you usually spend on one of those days walking from place to place?

hours per day

minutes per day

Gestational Diabetes Project Physical Activity Questionnaire

Please place an X within the box that is applicable to you.

PART 3: HOUSEWORK, HOUSE MAINTENANCE, AND CARING FOR FAMILY

This section is about some of the physical activities you might have done in the last 7 days in and around your home, like housework, gardening, yard work, general maintenance work, and caring for your family.

14. Think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do **vigorous** physical activities like heavy lifting, chopping wood, or digging in the garden or yard?

days per week

No vigorous activity in garden or yard



Skip to question 16

15. How much time did you usually spend on one of those days doing **vigorous** physical activities in the garden or yard?

hours per day

minutes per day

16. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do **moderate** activities like carrying light loads, sweeping, washing windows, and raking in the garden or yard?

days per week

No moderate activity in garden or yard



Skip to question 18

17. How much time did you usually spend on one of those days doing **moderate** physical activities in the garden or yard?

hours per day

minutes per day

18. Once again, think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do **moderate** activities like carrying light loads, washing windows, scrubbing floors and sweeping inside your home?

days per week

No moderate activity inside home



Skip to PART 4:
RECREATION, SPORT
AND LEISURE-TIME
PHYSICAL ACTIVITY

19. How much time did you usually spend on one of those days doing **moderate** physical activities inside your home?

hours per day

minutes per day

Gestational Diabetes Project Physical Activity Questionnaire

Please place an X within the box that is applicable to you.

PART 4: RECREATION, SPORT, AND LEISURE-TIME PHYSICAL ACTIVITY

This section is about all the physical activities that you did in the last 7 days solely for recreation, sport, exercise or leisure. Please do not include any activities you have already mentioned.

20. Not counting any walking you have already mentioned, during the last 7 days, on how many days did you during the last 7 days, on how many days did you walk for at least 10 minutes at a time in your leisure time?

days per week

No walking in leisure time



Skip to question 22

21. How much time did you usually spend on one of those days walking in your leisure time?

hours per day

minutes per day

22. Think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do vigorous physical activities like aerobics, running, fast bicycling, or fast swimming in your leisure time?

days per week

No vigorous activity in leisure time



Skip to question 24

23. How much time did you usually spend on one of those days doing vigorous physical activities in your leisure time?

hours per day

minutes per day

24. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do moderate physical activities like bicycling at a regular pace, swimming at a regular pace, and doubles tennis in your leisure time?

days per week

No moderate activity in leisure time



Skip to PART 5: TIME
SPENT SITTING

25. How much time did you usually spend on one of those days doing moderate physical activities in your leisure time?

hours per day

minutes per day

Gestational Diabetes Project Physical Activity Questionnaire

Please place an X within the box that is applicable to you.

PART 5: TIME SPENT SITTING

The last questions are about the time you spend sitting while at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading or sitting or lying down to watch television. Do not include any time spent sitting in a motor vehicle that you have already told me about.

26. During the last 7 days, how much time did you usually spend sitting on a weekday?

<input type="text"/>	<input type="text"/>	hours per day
<input type="text"/>	<input type="text"/>	minutes per day

27. During the last 7 days, how much time did you usually spend sitting on a weekend day?

<input type="text"/>	<input type="text"/>	hours per day
<input type="text"/>	<input type="text"/>	minutes per day

This is the end of the questionnaire, thank you for participating.