



March 2010 – Knowledge to Action Evidence Summary

What is known about postpartum intervention for women with history of GDM?

Gestational diabetes mellitus (GDM) is a sentinel event in the life of a woman of reproductive age that confers risk to both mother and baby for future development of type 2 diabetes mellitus (T2D) and a host of other complications.

A diagnosis of GDM presents a unique opportunity for early preventive intervention; however, these opportunities for screening and preventive therapy are often missed by health providers around the world and in the Champlain region of Eastern Ontario.

Key Messages

- GDM is a significant risk factor for future development of impaired glucose tolerance (IGT) and T2D.
- Current rates of postpartum screening and intervention in women with a history of GDM (hGDM) are suboptimal.
- Screening recommendations for postpartum management of GDM vary considerably across national and international guideline-producing organizations.
- Both health care providers and women with hGDM face multiple barriers to adequate screening and preventive interventions.
- Few screening and/or preventive therapeutic protocols and/or interventions for women with hGDM have been developed and empirically examined.

Who is this summary for?

This summary was commissioned by the Champlain LHIN and is intended for use by health systems stakeholders, policy- and decision-makers.

Information about this evidence summary.

This report covers a broad collection of recent literature and evidence sources with a search emphasis on systematic reviews.

Evidence summarized from systematic reviews is highlighted in blue boxes, like this one. Systematic reviews are generally favoured over other study designs, because they incorporate evidence from multiple primary studies, instead of reporting evidence from just one study.

This summary includes:

- **Key findings** from a broad collection of recent literature and evidence sources.

This summary does not include:

- **Recommendations;**
- **Additional information** not presented in the literature;
- **Detailed descriptions of the interventions** presented in the studies.

All papers summarized in this document are available by request to skhangura@ohri.ca.

Many sections conclude with a “Bottom line” subsection that provides a statement summarizing the studies highlighted in this document or aims to provide some context; these statements are not meant to address all of the evidence in existence on the subject, rather, that which is featured in this document.

Background

According to the 2008 Canadian Diabetes Association Clinical Practice Guidelines, the prevalence of gestational diabetes mellitus (GDM) in Canada varies around 3.7% for non-Aboriginals and ranges from 8-18% in the Aboriginal population.¹

GDM is often a precursor to type 2 diabetes; a recent systematic review concludes that women with GDM have more than a seven-fold risk of developing type 2 diabetes compared against women with normoglycemic pregnancy.² In addition, the incidence and prevalence of GDM is on the rise.³ ⁴ It is well documented that type 2 diabetes can be prevented or delayed in high-risk individuals.⁵

This evidence summary aims to advance the understanding of effective strategies for postpartum management of women with hGDM and their babies by summarizing the literature in this area.

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Summary of Findings

Postpartum risks of GDM and risk factors for future diabetic complications

Risks to Mothers – Risk of developing T2D

- A 2009 systematic review finds that women with GDM have more than a 7.43 relative risk for future development of T2D compared to women without GDM.²

- A 2008 analysis of Ontario-wide data over a 7yr period found that 20% of women with GDM go on to develop T2D over 9yrs; authors note that GDM is increasing and that women in the study who delivered later (1999-2001) have developed T2D sooner as compared to those who delivered earlier (1995-1996) suggesting that the problem is worsening.⁶
- The Diabetes Prevention Program study authors ran a sub-analysis of women with IGT who had or hadn't had GDM – while both groups entered the study with similar levels of glucose intolerance, the group with hGDM had a significantly higher risk of developing T2D.⁷

Risks to Mothers – Other complications

- In addition to diabetes-specific risks, it is well-documented that women with hGDM are at an increased risk of cardiovascular disease and metabolic syndrome.^{8 9 10 11 12 13}
- A 2002 analysis of postpartum re-hospitalization for 171 high risk pregnancies found that women with GDM have the highest rate of postpartum re-hospitalization among high risk pregnancies and that 47.6% with hGDM returned for acute care visits in the postpartum period; of women returning in the first 8wks postpartum, all had hGDM and most were returning for care of abdominal wound infections.¹⁴

Risks to Mothers – Risk factors for future diabetic complication

- A 2007 systematic review of risk factors for and rates of recurrence of GDM among women with hGDM found that recurrence rates varied by ethnicity and were higher among non-white ethnic minorities.¹⁵

- A 2009 systematic review of 14 studies found “substantial and consistent evidence that anthropometric measures of obesity, gestational age at gestational diabetes diagnosis, and method of glucose control were risk factors for the subsequent development of type 2 diabetes among women with previous gestational diabetes.”¹⁶

- A 2008 AHRQ systematic review examining a number of questions around GDM, including factors that increase risk of development of T2D concludes that “the strongest epidemiological risk factors were anthropometric measures prior to pregnancy and during both the antepartum and postpartum periods.”¹⁷

- A 2002 systematic review of 28 studies found that the relationship between GDM and later onset of T2D varies with length of follow-up; that FPG during pregnancy is a significant predictor of later T2D; that the rate of onset of T2D is more rapid in the first 5yrs postpartum and levels off around 10yrs postpartum.¹⁸

- A sub-analysis of the 2003 Behavioral Risk Factor Surveillance System (BRFSS) (n=158,746) found that women with hGDM had more modifiable risk factors for T2D (low physical activity, higher BMI, obesity) than women with no history of diabetes.¹⁹
- Analysis of data from a 2002 study found that high OGTT values during pregnancy, maternal age >40yrs and insulin use during pregnancy were strong predictors of IGT for women with hGDM at 1yr postpartum.²⁰
- A 2006 analysis of data from the 2001–2003 BRFSS (n=177,420) examined the health behaviours of women with and without hGDM; findings indicate that women with hGDM were older, heavier, had worse self-reported health status and were more likely to be Hispanic or African-American than those without hGDM.²¹

- A 2003 study of 221 subjects found that while a significant proportion of Indo-Asians with hGDM develop T2D, smaller numbers of Caucasian and Afro-Caribbeans do; authors recommend screening for all Indo-Asians and selective screening for others based on other risk factors.²²
- A 2009 Polish study of 318 Caucasian women found that only early diagnosis of GDM, severity of hyperglycemia and use of insulin were predictors of abnormal glucose at 6-12wks postpartum; pre-pregnancy anthropometric measures, family history, age, etc were not found to be associated.²³

Bottom Line

A diagnosis of GDM places a woman at significant future risk for development of T2D in addition to other complications; risk factors that increase this risk are similar to those with IGT and include increasing age, overweight/obesity, ethnic background and severity of GDM

Risks to Babies/Children

- Prenatal exposure to GDM puts babies at risk of several adverse birth and neonatal outcomes, including being large-for-gestational-age, respiratory distress and hypoglycemia.²⁴
- A 2003 Swedish study found that untreated IGT during pregnancy posed a significantly higher risk for premature birth, cesarean section, large for gestational age and macrosomia in infants.²⁵
- Multiple studies have linked prenatal exposure to GDM with a higher risk for development of several conditions later in life; most notably overweight/obesity and T2D,^{26 27 28 29 30 31 32} in addition to potential delays/impairment to neurological function.^{33 34}
- A recently published RCT reports that treatment for even mild GDM can improve birth and neonatal outcomes for babies.³⁵

Risks to Babies/Children – Obesity/overweight

- The 2010 report of a UK study of 10,591 mother/child pairs found that children of mothers with GDM have significantly more obesity at 9-11yrs; however, when adjusted for

maternal pre-pregnancy BMI, this effect disappeared.³⁶

- The 2009 report of a small Polish case-control study found that children born to mothers with GDM (n=29) had more overweight/obesity and insulin abnormalities; authors note that pre-pregnancy BMI was not measured in mothers.³⁷
- A 2003 survey of 14,881 participants in the Growing Up Today Study found a correlation between adolescents whose mothers had hGDM, were born large-for-gestational-age and were obese; authors concede that GDM may only be a marker for obesity, not a causal pathway, as it only partially explained adolescent obesity in this study and other factors e.g. mother's BMI also impact this association.³⁸
- Other studies show similar results: children of mothers with GDM are significantly more likely to be overweight if they were born large-for-gestational-age AND their parents were overweight.^{39 40}
- A 2007 US retrospective study of 9,439 mother/child pairs reports that as hyperglycemia increased in mothers, so too did the risk for obesity in children at 5-7yrs of age; while pregnancy weight gain is reported, pre-pregnancy BMI is not; authors note that GDM treatment reduced the risk of obesity in children and conclude that GDM should be treated during pregnancy.⁴¹
- A 1998 study of 524 mother/child pairs reports no association between GDM and overweight/obesity in children at 5-10yrs; authors note that overweight/obesity in childhood is, however, correlated with the same in parents.⁴²
- A small, 1997 New Zealand study of 20 children born to women born to women with GDM found that those whose mothers were treated with insulin had lower adiposity compared with those whose mothers were treated by diet alone.⁴³
- Studies comparing treatment of GDM with glyburide against insulin have found that infants fare similarly well, indicating that either treatment is effective in improving neonatal outcomes^{44 45}; because glyburide is not believed

to cross the placenta⁴⁶, it is thought to be a safe alternative to insulin.

Risks to Babies/Children – Diabetic and other complications

- Several studies have indicated that, in both high-risk and low-risk ethnic populations, children of women with GDM are at greater risk for developing T2D and pre-diabetes later in life than children of women with normoglycemic pregnancies.^{47 48 49}
- A 2006 review of the evidence on the effect of prenatal exposure to GDM concludes that babies exhibit higher levels of glucose intolerance and insulin secretory defects independent of genetic susceptibility; authors conclude that treatment during pregnancy may confer a benefit to the offspring of mothers with GDM.⁵⁰
- The 2000 report of a study questioned whether prenatal exposure to diabetes is an independent risk factor from genetic predisposition; it examined siblings from mothers before and after diagnosis of T2D; authors found that siblings born after diagnosis of T2D were significantly more likely to develop T2D and obesity later in life.⁵¹
- In support of these findings, a 2006 study analyzing data from a GDM screening program found that women who reported their mothers as having diabetes were twice as likely to have GDM than those reporting their fathers as having diabetes; women whose both parents had diabetes were no more likely to have GDM than those whose mothers alone had diabetes; authors conclude that this may support the theory that in-utero exposure to hyperglycemia creates risk for later development of abnormal glucose metabolism independent of genetic factors.⁵²
- A 1997 German study found that, when compared to children of mothers with pre-existing diabetes, children of mothers with GDM were just as likely to develop IGT in childhood.⁵³
- Several studies have found that children who were exposed to maternal GDM and large-for-gestational-age at birth have a significantly higher risk of developing metabolic syndrome in childhood.^{54 55}

- A 2007 Korean study found that at 5yrs of age, children of mothers with hGDM are more likely to exhibit risk factors for CVD than children of mothers who had IGT.⁵⁶

Bottom Line

While there is evidence linking overweight/obesity and diabetic complications in children with prenatal exposure to GDM, it is yet unclear whether GDM acts alone or in tandem with a host of risk factors e.g. genetic predisposition, parental obesity, etc; additional, large-scale, prospective studies and systematic reviews are needed.

Which diagnostic criteria for GDM are best?

- Debate among experts is ongoing regarding diagnostic criteria for GDM; concerns around missing those women with some level of dysglycemia and the effects of the untreated condition on both mother and child are cause for concern^{57 58 59}; others point out increased costs associated with lowering the diagnostic threshold and treating those with false-positive results, questioning the net benefit.⁶⁰
- Several recent studies have examined levels of dysglycemia during pregnancy that fall below diagnostic criteria for GDM – all have found that any level of dysglycemia during pregnancy puts mothers and babies at risk for a host of disorders e.g. IGT, metabolic syndrome, etc.^{61 62 63}
- A 1995 report from the Toronto Tri-Hospital Gestational Diabetes Project examined levels of carbohydrate intolerance on a variety of outcomes in women without GDM and concluded that: “Increasing maternal carbohydrate intolerance in pregnant women without gestational diabetes is associated with a graded increase in adverse maternal-fetal outcomes.”⁶⁴
- A 1995 study found that women diagnosed with GDM using the lower Coustan cutoff values, as opposed to the National Diabetes Data Group criteria, faced as many risks from later glucose abnormality as those diagnosed using the more liberal criteria.⁶⁵

Postpartum screening recommendations for women with hGDM

- Guidelines for postpartum screening of women with hGDM have conflicted and are blamed in part for poor clinical follow-up.⁶⁶
- The 2008 CDA CPGs recommend a 75g OGTT at 6wks-6mos postpartum and screening as per high-risk groups after that; pre-pregnancy screening for T2D is also recommended.¹
- The 2002 SOGC guidelines recommend postpartum screening with a 75g OGTT at 6-12wks postpartum.⁶⁷
- The WHO recommends screening with a 75g OGTT at >6wks postpartum for women with GDM; no additional recommendations are made.⁶⁸
- The 2008 American Diabetes Association standards of care recommends either a FPG or 75g OGTT with annual repeat testing if IFG/IGT is detected and every 3 years if glycemic levels are normal.⁶⁹
- The American College of Obstetricians and Gynecologists released a consensus statement in the summer of 2009 recommending that women with hGDM be screened with either FPG or OGTT and “managed appropriately.”⁷⁰
- The 2005 Fifth International Workshop-Conference on Gestational Diabetes Mellitus recommends postpartum OGTT at 6-12wks, 1yr and every 3 years after a GDM pregnancy.⁷¹

Bottom Line

In the absence of a global consensus on diagnostic criteria and postpartum screening recommendations, the CDA Clinical Practice Guidelines offer a reasonably evidence-based, Canadian approach to the management of GDM and hGDM.¹

Which postpartum screening test is best?

- Debate lingers among guideline-producing organizations about the value of an FPG against the OGTT: FPG is quick but lacks sensitivity; the OGTT is expensive and time consuming.⁷²

- There is evidence to suggest that many women with hGDM do not return for glucose tolerance testing in the postpartum period⁷³; one study found that the quicker, more convenient FPG is significantly correlated with the results from OGTTs, leading authors to conclude that it is a good indicator of those in need of follow-up.⁷⁴
- A later study, though, points out that while FPG may be adequate for identifying those with T2D, it is a poor indicator of those with impaired glucose tolerance (IGT).⁶⁶
- Because women with hGDM are younger than other populations screened for glucose abnormalities, and therefore stand to suffer the effects for a longer period of time, the OGTT is generally the screening test recommended by most.^{75 76 77 78}

Bottom Line (from an AHRQ systematic review)¹⁷

While guidelines and experts continue to differ on which test is best for management of women with hGDM, most of the scientific literature supports use of the more sensitive OGTT.

Whose responsibility to follow-up on GDM in the postpartum?

- While a 2008 ACOG survey indicates that most (74%) OB/GYNs self-report ordering follow-up testing for patients with hGDM,⁷⁹ a review of lab records for 90 hGDM patients from a large US hospital revealed that only one-third had undergone postpartum glucose screening.⁸⁰
- These results are consistent with a North Carolina survey of health providers in which just 21% reported conducting postpartum T2D testing for women with hGDM.⁸¹
- Many studies have found similarly: postpartum screening of women with hGDM is suboptimal.^{82 83}
- As early as 1998, experts recognized the problem of under-screening was, at least in part, a lack of clarity around who in the clinical continuum should take the primary responsibility to do so.⁸⁴

- The success of T2D prevention efforts for women with hGDM "... lies in a multidisciplinary approach (obstetrician/perinatologist, gynecologist, internist/endocrinologist, nutritionist, diabetes educator, and others) with many overlaps to provide constant reminders and encouragement."⁸⁵

Barriers for women with hGDM to access and adhere to postpartum interventions

- Rates of postpartum screening for women with hGDM are generally reported as suboptimal⁸⁶; one such study found an association between attendance at the postpartum visit and adherence to screening – authors recommend continuity of care in the postpartum period as a way to improve screening rates.⁸⁷
- There is recognition that, while intensive lifestyle interventions have proven effective for prevention of T2D in high risk individuals generally, younger women with infants and children may have more difficulty maintaining a demanding regime due to restrictions on their time and energies.⁸⁸

- A 2009 systematic review and synthesis of 6 studies examining the health beliefs and behaviours of women with hGDM found that women underestimated their risk for developing T2D, were generally physically inactive and had suboptimal dietary intake;
- Authors suggest that these results may be used to develop interventions to increase screening and preventive treatment for this population.⁸⁹

- A 2010 survey of Australian women with hGDM found that levels of physical activity were low and that social support and self-efficacy are significantly associated with improved levels of physical activity, leading authors to conclude that interventions should focus on addressing these psychosocial conditions for women with hGDM.⁹⁰
- A 2008 survey of women with hGDM examining psychosocial barriers to healthy dietary behaviour found that limited time and taste preferences of others in the household were the most common barriers indicated.⁹¹

- A 2009 qualitative study of Australian women with history of GDM found that women underestimate the value of physical activity and demonstrated lack of awareness of its benefits for preventing T2D compared with dietary modifications; identified barriers to uptake of physical activity included lack of time and energy associated with childrearing.⁹²

- A 2008 study of women with hGDM found that while self-reported physical activity levels and dietary habits are positively associated with self-efficacy and social support, BMI is not; authors conclude that: "Further exploration of constructs associated with BMI may be needed to design effective weight-loss interventions in this population."⁹³

- Three separate studies of physical activity and weight loss behaviour among women with hGDM found that the primary barriers identified were lack of time and assistance with child care^{94 95}; high social support and self-efficacy were associated with adequate physical activity levels.⁹⁶

- A 2007 qualitative study of risk perception for development of T2D for 217 women with hGDM found that: "...>90% of women with histories of GDM recognized that GDM was a risk factor for future diabetes, but less than one-fifth of women believed they themselves were at high risk for diabetes because they intended to improve their behavior in the near future."⁹⁷

- A 2003 survey of postpartum lifestyle changes in Danish women with hGDM found that, while women were concerned about their risk for T2D, very few lost weight in the postpartum and none became physically active; while authors conclude that women are unable to change their lifestyles after hGDM, findings suggest that postpartum intervention could improve the ability to implement healthy behaviours.⁹⁸

- A 2007 US study of variance in access to care, risk factors for T2D and more among women with hGDM of varying ethnic backgrounds found that significant differences exist between ethnicities, with Latinas reporting the greatest barriers to access and Asian/Pacific Islanders reporting the greatest access to care.⁹⁹

Barriers for health professionals to postpartum intervention on women with hGDM

- A 1999 US-based qualitative exploration of primary care physicians' perspectives on caring for patients with diabetes revealed that, while physicians are aware of and support current guidelines for diabetes management, they also "...noted the challenge of balancing the multiple goals of ideal diabetes care and the realities of patient adherence, expectations, and circumstances." Authors recommend:
 1. "prioritizing diabetes care recommendations for patients as individuals;
 2. improving physicians' motivational counseling skills and enhancing their ability to deal with challenging patients, and
 3. developing office systems and performance enhancement efforts that support cost-effective practice and patient adherence."¹⁰⁰
- Kapustin identifies the following barriers to optimal management of women with hGDM in a 2008 commentary: "...there are many issues associated with preventive health care for [women with hGDM], including a lack of awareness of the need for lifestyle changes, poor primary care efforts to detect and intervene, and poor healthcare provider adherence to practice recommendations."¹⁰¹
- A 2003 analysis of postpartum screening data for GDM patients before and after the publication of CDA guidelines recommending postpartum OGTTs found that no patients were screened according to the recommendations and no increase in rates of any kind of screening for these patients; authors recommend that "Further strategies aimed at increasing physician awareness of the importance of early identification of patients with IGT, management of this population, and appropriate screening are required."¹⁰²

Bottom Line

Qualitative studies providing information on barriers that women with hGDM and their physicians face in managing and reducing future risk may help inform intervention research as it develops in this area.

Interventions to increase postpartum screening for women with hGDM

- A 2009 RCT examining postal reminders for postpartum screening of patients with history of GDM found a significant increase in adherence to CDA guidelines; authors conclude that "evidence-based guidelines must be reinforced with evidence-based implementation strategies... Care providers should consider implementing a structured approach to postpartum follow-up in women with GDM... Further studies on screening barriers, the exploration of other methods of communicating screening recommendations, and the assurance of performance of screening for diabetes mellitus in this high-risk group are required."¹⁰³
- A 2009 Australian study of women with hGDM found that factors associated with returning for screening included: being provided with written information, individualized risk reduction advice, care from an endocrinologist, diabetes educator or obstetrician.¹⁰⁴
- A 2007 qualitative study examining the association between preventive counseling for women with hGDM and postpartum behaviour found that, while provision of a lab slip in addition to preventive counseling improved rates of screening, preventive counseling alone was neither associated with an improvement in diet nor physical activity levels.¹⁰⁵
- A 2009 retrospective analysis found that the addition of a one-on-one counseling session for women with GDM at 37-38wks gestation significantly increased rates of postpartum screening from 33% to 53% ($p < 0.001$).¹⁰⁶
- A 2008 US study found that the addition of a case manager-nurse to the postpartum care pathway for women with hGDM increased postpartum glucose screening rates from 18% to 57% at a large hospital in the southwestern US; authors note that women in the study who failed to return for postpartum screening had suffered more severe GDM than those who returned and had more serious risk factors for developing T2D (higher BMI, greater use of meds/insulin during pregnancy, etc)¹⁰⁷

- A 2003 US study finds that of 158 women with hGDM followed in the postpartum by a comprehensive diabetic care program, only 52 (34%) actually underwent screening; authors conclude that: "... despite a comprehensive care program, the utilization of postpartum diabetic testing was poor... This indicates a need for further education and emphasis on postpartum screening for the obstetric care providers and the patients."¹⁰⁸
- A 2009 study presents a risk algorithm that, using readily available data, takes into account the importance of postpartum screening for hGDM, while focusing on the identification of those at highest-risk for developing T2D in an effort to "...ensure that the majority of postpartum diabetes is identified."¹⁰⁹

Bottom Line

Intervention research to improve rates of glucose screening among women with hGDM is in its infancy; one-on-one counseling seems to have positively impacted screening rates thus far; innovative models of care must be trialed to address suboptimal postpartum screening rates among women with hGDM.

Interventions for the prevention of T2D in women with hGDM

- While intervention studies for postpartum management of hGDM are few in number, most recommendations agree that prevention efforts should mimic those for patients at high-risk for T2D with a focus on risk awareness, lifestyle modification and pharmacologic intervention, as needed.

Diet and Physical Activity Interventions

- Many experts recommend postpartum diet and exercise prescription as a matter of course for women with hGDM.¹¹⁰
- Weight loss by restriction of food intake is consistently identified in the literature as a key lifestyle modification needed in postpartum women hGDM to prevent and/or reduce the risk of developing T2D.¹¹¹
- Intensive lifestyle intervention (diet and exercise) was found to be highly effective in

delaying and preventing T2D in women with hGDM.⁷

- In the summary of a symposium on diabetic pregnancy, one physician notes: "It is estimated that it takes 40 hours of intensive education to equip the woman with the skills required for self-management and normalization of blood glucose."¹¹²
- The 2007 Canadian trial of a dietary intervention for women with GDM showed that, while adherence was maintained through pregnancy, it was not maintained through 6 months postpartum; authors conclude that: "Women with GDM made changes in eating patterns during pregnancy, but these were not maintained postpartum. Further intervention is recommended during the postpartum period for women with GDM to sustain changes made during pregnancy."¹¹³
- While studies have addressed postpartum physical activity interventions for weight reduction in obese and overweight women, none to-date have specifically addressed women with hGDM.¹¹⁴

• A 2007 Cochrane systematic review of various lifestyle interventions for reduction of weight in postpartum women in the general population found that interventions addressing diet and those addressing diet and physical activity were effective in reducing weight¹¹⁵; while not focused on women with hGDM, these interventions may provide the framework for development of similar interventions for women with hGDM.

- Additional recommendations for T2D prevention interventions include improved care pathways addressing the problem of hGDM, physician prompts and reminders, potentially through the use EHRs, as well as patient reminders.¹⁰¹
- The New York City Department of Health and Mental Hygiene has implemented a Gestational Diabetes Initiative that is leveraging community health resources to increase awareness, screening and T2D preventive management intervention for women with hGDM.¹¹⁶

- The Nutrition, Exercise and Lifestyle Intervention Program (NELIP) has been developed for women at high-risk for and those with GDM; it has shown to reduce occurrence of the disease and postpartum type 2 diabetes.^{117 118}
- England et. al. recommend 3 steps for the management of women with a hGDM:
 1. Postpartum screening;
 2. Long-term screening strategy;
 3. Referral and intervention for T2D prevention.
- The National Diabetes Education Program is led by the NIH and CDC and has developed a “Tip Sheet” for women with hGDM.¹¹⁹
- Case et. al. propose 3 steps for managing women with hGDM in the postpartum:
 1. Postpartum screening;
 2. Planning for behaviour modification;
 3. Making and sustaining lifestyle changes.
 - The authors have adapted a series of clinical steps based on the health belief model.⁷²

Case et. al. 2006: Health Belief Model modified for postpartum management of GDM

Patient Belief	Clinical Interventions
Perceived susceptibility	Define the epidemiology for gestational diabetes mellitus and type 2 diabetes and the patient’s risk factors for type 2 diabetes that are in direct relation to their behaviors (obesity, poor diet, sedentary lifestyle) and educate on other diseases (cardiac, musculoskeletal, etc) for which they are at higher risk
Perceived severity	Specify consequences of the risks (explain health results of type 2 diabetes and cardiovascular disease)
Perceived benefits	Define an action plan for diet modification, exercise, and weight loss (how, where, when); provide literature from the American Diabetes Association [<i>Canadian Diabetes Association for Canada</i>] that addresses diets and exercise plans; show positive benefits the patient can expect
Perceived barriers	Identify and reduce barriers through reinforcement, incentives, assistance, community support groups
Cues to action	Provide how-to information (diets/exercise plans), promote awareness and reminder cues
Self-efficacy	Refer to support groups (exercise/weight loss); nutrition specialist; provide encouragement and positive feedback, praising goal attainments

Breastfeeding

- The CDA 2008 Clinical Practice Guidelines recommend that women with hGDM should breastfeed as this may reduce obesity in the child, which is a risk factor for T2D.¹

- A 2005 systematic review of 12 observational studies examined rates of breastfeeding among diabetic women, effect of lactation on maternal development of T2D and impact of breastfeeding on development of T2D in infants; the study concludes that fewer women with diabetes (including GDM) breastfeed than those without and that women and babies “may” experience a protective benefit from future development of T2D by breastfeeding.¹²⁰

- A 2007 WHO systematic review identified 5 papers addressing the benefit of breastfeeding for reducing risk of T2D in offspring and found that “Studies assessing the risk of type-2 diabetes reported a protective effect of breastfeeding, with a pooled odds ratio of 0.63 (95% CI: 0.45–0.89) in breastfed compared to non-breastfed subjects.”
- However, due to a lack of studies and the quality of those that exist, authors conclude that: “At this stage, it is not possible to draw firm conclusions about the long term effect of breastfeeding on the risk of type-2 diabetes and related outcomes. Further studies are badly needed on this topic.”¹²¹

- Several early studies indicated that breastfeeding among women with hGDM lowers glucose levels and increases HDL levels^{122 123 124}; a small, more recent case-control study supports these findings and shows that breastfeeding may reduce later development of T2D in offspring.¹²⁵
- A 2009 pilot study of early breastfeeding (delivery room and during hospital stay) for 84 infants of mothers with hGDM concludes that breastfed neonates demonstrate significant glycemic benefits compared to those who are formula-fed.¹²⁶
- A 2008 literature review points out that while there is some evidence to associate breastfeeding with improved weight outcomes for offspring in later life among the general population, this evidence is not yet available for mothers with diabetes or hGDM; the author concludes that: “Given the paucity of the evidence and equivocal findings about the long-term effects of breast-feeding on future health of women with diabetes during pregnancy and their infants, further research is recommended.”¹²⁷
- A 2008 retrospective chart review of 592 women with hGDM found no association between breastfeeding and development of abnormal glucose metabolism.¹²⁸
- A 2008 study of 2,516 women in the general population found breastfeeding to significantly lower the risk of developing metabolic syndrome; it also found that never having breastfed was associated with having impaired glucose levels; duration of lactation was not associated with impaired glucose levels.¹²⁹
- A 2006 German study of children of mothers with hGDM found that not breastfeeding or breastfeeding for a short period of time significantly correlated with overweight and obesity in childhood.¹³⁰
- A 2005 sub-analysis of the UK Nurses’ Health Study II (n=116,171) examining the effect of duration of lactation on subsequent development of T2D found that “Lactation had no effect on diabetes risk in the gestational diabetes group, with a covariate-adjusted HR of 0.96 (95% CI, 0.84-1.09) per additional year of lactation.”¹³¹
- While a 2005 systematic review found that women with hGDM are less likely to breastfeed than the general population¹²⁰, a 2009 UK study found women with hGDM to have similar rates of breastfeeding as those in the general population; authors note that study participants were exposed to a “Baby-Friendly Initiative” program during which women receive counseling to encourage breastfeeding; authors suggest such an intervention may be in part responsible for the higher rates of breastfeeding and recommend further study of such intervention.¹³²
- While a small 2002 study of 112 mother/child pairs found that children who ingested breast milk from diabetic mothers had more overweight/obesity later in life^{133 134}, a larger 2006 study (n=15,253) found that the prevalence of overweight/obesity was not adversely affected by the mother’s diabetic status and that breastfeeding confers a benefit to the child regardless of the mother’s diabetic status.¹³⁵

Bottom Line: Breastfeeding and hGDM
Evidence remains inconclusive on the benefit of breastfeeding to risk of future development of T2D in both mother and child. However, the protective benefit from future overweight and obesity in children has been established; as this is a risk factor for development of abnormal glucose metabolism and T2D, and no disadvantage has been conclusively identified for diabetic women breastfeeding their infants, breastfeeding is generally recommended for all new mothers, including those with hGDM.

Pharmacotherapy

- The TRIPOD RCT randomized 266 Latina women with hGDM to early or late intervention with thiazolidinedione treatment; results showed that the early intervention group developed T2D significantly less often than the late intervention group suggesting that early medical intervention may protect women with hGDM against T2D.^{136 137}
- Subanalyses of the DPP study data indicate that metformin is significantly more effective in women with IGT and hGDM than those with IGT and without hGDM.⁷

Contraception

A large 2008 AHRQ systematic review addressing multiple research questions around GDM found 2 studies addressing the issue of contraception for women with hGDM; authors conclude “that the limited number of studies available and the overall very low grade of evidence made it difficult to draw any firm conclusions regarding the relationship between progestin-only contraception and the development of type 2 diabetes among women with gestational diabetes.”¹⁷

- A 2008 retrospective chart review of 592 women with hGDM found no association between method of contraception and development of abnormal glucose metabolism.¹²⁸

Bottom Line

Generally, physical activity, calorie-restricted diet and breastfeeding are recommended for postpartum women with hGDM.

Formal intervention research to manage hGDM and prevent future T2D remains in its infancy; while several approaches are and have been implemented, few have been empirically investigated; RCTs and systematic reviews are needed.

Cost effectiveness of postpartum follow-up of GDM

- A 1993 US-based study describing an economic model of cost savings associated with preventing T2D by management of women with hGDM in the postpartum demonstrated a potential cost-savings of \$330 million over the course of 10 years.¹³⁸
- A 2007 economic forecasting model of costs associated with various screening regimes using FPG, OGTT and A1C as interventions for women with hGDM projects that: “Screening every 3 years with OGTTs results in the lowest cost per case of detected diabetes.”¹³⁹
- “Follow-up studies of women with GDM are necessary to establish the most efficient and cost-effective approach to postpartum screening for type 2 diabetes.”⁷²

Gaps in the evidence and research recommendations

- “In high-risk groups, GDM is considered a significant initiating factor for type 2 diabetes, so prevention is crucial. Unfortunately, few prospective studies have been done in this area... Future studies should include the role of physical activity on subsequent type II diabetes incidence in women who were at risk for GDM during pregnancy.”¹⁴⁰
- “Research is needed to determine how to maximize patient and provider compliance with recommendations for postpartum screening... Health care providers and public health workers face numerous challenges in developing and implementing an intervention for this population, and it is likely that meaningful reductions in risk will require a multilevel approach that includes patient and provider education, development of efficient mechanisms for the transfer of medical information among providers, establishment of readily available interventions, and environmental changes that support physical activity and healthy eating. Translation research will be critical in addressing this important public health issue.”
- Authors of a large 2008 systematic review conclude that: “We did not identify any studies that examined the relationship between lifestyle factors, such as physical activity and diet, and the development of type 2 diabetes in women with prior gestational diabetes. We therefore concluded that no evidence exists to determine whether maternal lifestyle affects the risk of developing type 2 diabetes after having gestational diabetes.”¹⁷
- “Several studies have examined the effect of a healthy lifestyle in women after they give birth, but none has specifically assessed a healthy lifestyle intervention in women with a history of GDM... Postpartum studies of healthy diet and exercise plans should now be performed specifically in women with a history of GDM in order to determine the potential benefit and to evaluate the most effective way to achieve lifestyle modification in this population.”¹⁴¹

Ongoing studies of interventions for women with hGDM

The following studies were located using the National Institute of Health ClinicalTrials.gov Web site and represent ongoing work in the area of intervention research designed to improve postpartum glucose screening and/or prevent T2D in women with hGDM:

- A Polish RCT of women with hGDM is examining the impact of a lifestyle intervention alone against a lifestyle intervention with the addition of metformin for the prevention of T2D; the study began in 2005, is expected to recruit 300 patients and is listed as recruiting.¹⁴²
- A Louisiana-based study of women with hGDM seeks to identify a most effective postpartum screening strategy in order to develop an “outreach effort to provide screening for previous gestational diabetic mothers without adequate medical coverage following delivery”; the study began in 2009, is expected to recruit 100 patients and is listed as currently recruiting.¹⁴³
- A Quebec study is examining the effectiveness of screening women with hGDM for abnormal glucose in the 48 hours postpartum as compared with testing at the 6-12 wk postpartum appointment; the study began in 2008, is expected to recruit 115 patients and is listed as recruiting.¹⁴⁴
- A California-based study of women with hGDM seeks to examine the effectiveness of a lifestyle intervention on reducing the recurrence of GDM in future pregnancies; the study began in 2009, is expected to recruit 60 patients and is listed as currently recruiting.¹⁴⁵
- An Ontario-based study seeks to trial the NELIP program in a cohort of women with hGDM against conventional management; there is no information provided on trial start or expected end dates, recruitment expectation or status of the project.¹⁴⁶
- A German, double-blind, phase II RCT is examining vildagliptin treatment against placebo for the prevention of T2D in women with hGDM who were insulin dependent during pregnancy; the study began in 2008, is expected to recruit 140 patients and is listed as currently recruiting.¹⁴⁷
- A California-based study is examining the impact of *Promotoras* (Hispanic community health workers) providing education and follow-up to women with hGDM on postpartum glucose screening rates and adherence to preventive care; the study began in 2008, is expected to recruit 240 participants and is listed as not yet recruiting.¹⁴⁸

Additional Information

This summary was produced by:

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Conflict of Interest

None declared

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