Review of projects addressing gestational diabetes mellitus supported by the World Diabetes Foundation in the period 2002-2010

Gestational diabetes mellitus

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2011

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# Table of Contents

1. Introduction ...................................................................................................................... 1

2. Methodology ..................................................................................................................... 2
   2.1. Data collection ............................................................................................................ 2
       2.1.1. Identification of projects ........................................................................................ 2
       2.1.2. Interviews and questionnaires ............................................................................... 3
   2.2. Analysis ...................................................................................................................... 3
       2.2.1. Identifying categories and themes ........................................................................ 3

3. Results .............................................................................................................................. 4
   3.1. Ensuring the basic infrastructure ................................................................................. 6
       3.1.1. Standard protocols and guidelines ........................................................................ 6
       3.1.2. Training of health care providers ........................................................................... 7
       3.1.3. Health care providers’ reception of the project .................................................... 10
       3.1.4. Establish or strengthen clinics ............................................................................. 11
   3.2. Detecting GDM ......................................................................................................... 11
       3.2.1. Screening procedure and diagnostic criteria ....................................................... 11
       3.2.2. Reasons for selecting diagnostic criteria ............................................................. 15
       3.2.3. Selective or universal screening ......................................................................... 17
       3.2.4. Time of detection ............................................................................................... 20
       3.2.5. GDM prevalence ................................................................................................ 20
       3.2.6. Barriers and challenges to early detection of GDM ............................................. 21
       3.2.7. Solutions and opportunities to ensure early detection of GDM ............................ 25
   3.3. Treatment and care for GDM .................................................................................... 27
       3.3.1. Barriers to treatment and follow-up ..................................................................... 32
       3.3.2. Solutions and opportunities to ensuring proper treatment and follow-up .......... 37
   3.4. Creating awareness and influencing decision-making ............................................... 39
       3.4.1. Ensuring supply .................................................................................................. 39
       3.4.2. Generating demand ............................................................................................ 41
       3.4.3. Addressing both sides ......................................................................................... 42
   3.5. Summary of findings ................................................................................................ . 42

4. Strengths and limitations of this review ....................................................................... 45

5. Guidance for programmatic interventions ................................................................... 46

6. Conclusion ..................................................................................................................... 48

7. References...................................................................................................................... 49
1. Introduction

With an estimated number of 285 million people having the disease diabetes already constitutes a major challenge to public health globally. The projected increase of more than 50% in this figure over the next 20 years (1), urgently calls for preventive efforts.

One approach to prevent the rising burden of diabetes is to address the issue of gestational diabetes mellitus (GDM), defined as any degree of glucose intolerance with onset or first recognition during pregnancy (2). It is well known that women with undiagnosed or poorly managed GDM as well as their infant are at increased risk of developing type 2 diabetes later in their lives if preventive measures are not taken. A recent meta-analysis reported that pregnant women with GDM have a sevenfold increased risk of developing type 2 diabetes compared to women who did not have diabetes during their pregnancy (3). Likewise, the offspring of women with GDM have an up to eightfold increase in the risk of diabetes compared to the offspring of women without diabetes in pregnancy (4). A study on Pima Indian children found that approximately 35% of attributable risk for diabetes among the children could be assigned to exposure to diabetes in utero (5). If the child is exposed to both maternal diabetes and obesity in utero, the risk of type 2 diabetes is additionally increased (6). In instances where action is taken through lifestyle modifications or pharmaceutical intervention studies have shown that it is possible to prevent or delay the onset of type 2 diabetes in high-risk individuals (7-9) including women with a history of GDM (10;11). Addressing GDM thus constitutes a window of opportunity for early intervention and reduction of the future burden of type 2 diabetes.

In addition to the increased risk of developing type 2 diabetes, there are other compelling reasons for addressing GDM. These include elevated risk of adverse pregnancy outcomes, including maternal- and peri-natal mortality, obstructed labour, spontaneous abortion, congenital abnormalities and macrosomia (12). In addition, women with a history of GDM are also at increased risk of cardiovascular disease (13;14).

The prevalence rate of GDM is unknown in many countries, but it is in general said to reflect the prevalence of prediabetes (IGT) in young reproductive women as well as background prevalence of type 2 diabetes in the given population (15), and it is estimated that among some high risk groups the prevalence rate may be as high as 30% (12). Studies from developing countries are particularly sparse, but studies from Pakistan, Sri Lanka, Ethiopia, South Africa, Nigeria, Iran, Thailand and India have found prevalence rates between 0.6% and 18.9% (16-27). In addition to ethnic differences, the variation in prevalence rates may be due to the use of different diagnostic criteria: how long back the studies were done, the age of the women and whether the studied population resides in urban or rural areas. Nonetheless, with rapid urbanisation, changing diets, decreasing physical activity, the trend towards delayed marriage and older maternal age as well as the growing epidemics of obesity and type 2 diabetes the prevalence of GDM may very well be on the rise (28). In countries where appropriate care for obstetrical emergencies is lacking, GDM may have particularly severe consequences for the health and well-being of the mother.
The World Diabetes Foundation (WDF) is an independent, non-commercial foundation, dedicated to support prevention and treatment of diabetes in developing countries through awareness, education and capacity-building. The WDF was established in 2002 and has since then supported more than 250 projects in 96 countries. As a largely unexplored area, GDM has been identified as one of the key focus areas of WDF, and WDF is therefore actively seeking to encourage and inspire local partners to integrate GDM components on top of existing diagnostic and basic treatment capacities. Increasingly, projects in the area of GDM have therefore received financial support from WDF. Concurrently, the WDF has been strongly involved in advocacy at a regional and global level to increase attention and action directed towards addressing GDM on a global scale.

The aim of this report is to get an overview of the projects and to collect lessons learned with special emphasis on the main challenges and barriers that WDF-supported projects have experienced during implementation of a GDM programme and in the process of doing so pinpointing future directions for the work on prevention and treatment of GDM.

2. Methodology

2.1. Data collection

2.1.1. Identification of projects

All applications from WDF-supported projects, approved by the WDF Board of Directors in the period 2002-2010, were screened for the keywords „GDM“, „gestation“*, „pregnan“* and „mother“. Project applications that contained one or more of these keywords were then examined in more detail to ensure that they actually include components or activities related to gestational diabetes. Projects where the keywords only appeared in relation to applicant’s previous experience, other services provided at involved health facilities, exclusion criteria (e.g. pregnant women were specifically mentioned as not being part of the target group), or in other contexts not related to GDM (e.g. the word “mother” were mentioned in relation to children’s diet) were excluded. In addition, global advocacy projects, e.g. conferences and expert meetings, were excluded as well. This resulted in a list of projects where GDM was included to some extent. These projects were then carefully examined to assess whether GDM was a main component of the project or not. Projects where women with a history of GDM were included in the target group together with persons with other risk factors for type 2 diabetes (e.g. obesity, family history of diabetes), but with no specific objectives related to GDM, and projects where GDM was included in the training curriculum, but otherwise was not a component of action of the project were excluded. The remaining projects were reviewed and divided into two groups: a group of projects where GDM was the main component; and a group of projects where GDM was addressed to some extent among other components in the project. A list comprising of the projects in these two groups was then distributed to the responsible WDF programme coordinators. The programme coordinators were then asked to examine the list to ensure that no projects which did not meet the selection criteria appeared on the list, that no projects were missing on the list and that the categorisation of the projects was correct. Projects where the Project Partnership
Agreement with WDF had not yet been signed (as of March 2011) were excluded. The projects remaining in the group of projects where GDM comprises the main component as well as one national programme, where the GDM component is substantial, were included in the subsequent review.

2.1.2. Interviews and questionnaires
Purposive sampling technique was used to select the respondents, i.e. respondents were selected based on their relevance to the research question and their ability to contribute with new and relevant information (29). The approach to the purposive sampling was comprehensive as all relevant respondents were included. A questionnaire was sent to the identified respondent, who was typically also the person responsible for the implementation of the project. In the letter accompanying the questionnaire the respondents were informed that their response would not be depicted anonymously and were also asked to participate in an interview two to six weeks later. The overall purpose of the review was also mentioned. The interviews were based on a semi-structured interview-guide and were conducted over the phone or in person in April and May 2011. Prior to the interview, the respondents were again informed about the purpose of the review and approval to record the interview was obtained. The interview guide and questionnaire were developed based on reports from the projects, existing literature and certain broad issues e.g. cultural barriers, which we wanted to ensure were covered as little information on such was available from existing literature. The questions in the interview guide and questionnaire were mainly open-ended to gather exploratory information, i.e. qualitative information - to better understand the topic under review - as open-ended questions give the respondents the opportunity to give responses that reflect their own point of view and what they believe is important rather than confirming the views of the researcher (30).

2.2. Analysis

2.2.1. Identifying categories and themes
Data analysis was an ongoing activity, starting with a review of all project materials. These include the application, semi-annual progress reports and project completion reports. Field visit reports written by WDF programme coordinators were also reviewed. This was followed by the analysis of the interviews and questionnaires. Making the analysis an ongoing activity enable the researcher to be more aware of emerging themes and allow for these themes to be explored more in-depth in subsequent interviews. The interviews were transcribed in their full length to ensure transparency.

Content analysis was used to analyse the data and the project material, interviews and questionnaires were therefore coded by developing categories for the different topics that were revealed in the data. The categories were then reviewed to make sure that no overlapping categories were describing the same phenomena, and subsequently organised into core themes. Categories and themes related to key components, activities conducted, challenges faced, opportunities identified, key outcomes, screening and diagnosis methods used, barriers from the women’s perspective and from within the health system, etc.
3. Results

In the period 2002-2010, WDF has granted support to 253 projects. Out of this sample one or more of the keywords appeared in 77 (30.5%) project applications. Of these 23 were excluded as the project itself was not related to gestational diabetes. Among the 54 projects that were then carefully examined, four (1.6%) were global advocacy projects and 21 (8.3%) included GDM to a lesser extent (six mentioned women with GDM in relation to inclusion criteria, but did not otherwise address GDM, 14 included it as part of the training curriculum and one as part of a larger media campaign addressing diabetes in general), but GDM was not part of the objectives and the projects were therefore excluded. Of the remaining 29 (11.5%) projects, 14 (5.5%) were either national programmes addressing GDM (2 projects) and therefore had a substantial size and scope, or were primarily a GDM programme (12 projects). As the Project Partnership Agreement had not yet been signed for three of the projects (one national programme and two projects primarily dealing with GDM) a total of 11 projects were included in this review. The projects are listed in table 1.

Five of the projects are being or have been implemented in India, two in Latin American and the Caribbean, two in Sub-Saharan Africa, and one in China and Sudan, respectively. Two of the Indian projects were implemented by the same partner so a total of 10 different partner organisations or groups of partner organisations are in charge of the implementation of the 11 projects. Two projects, Kenya and Cuba, are implemented by either the Ministry of Health or national government institutions. The remaining projects are implemented by local NGOs, local or international research institutions, hospitals or private initiatives. However, almost all of the projects are collaborating with national or state health authorities.

The questionnaire was sent to all ten partner organisations, and all ten were asked to participate in an interview. All ten responded to the questionnaire and nine agreed to participate in the interview. The partner organisation that did not agree to participate in the interview instead replied to the questions in the interview-guide in writing via email.

The first WDF-supported GDM project, 04-067, was approved by the WDF Board of Directors in June 2004. The project was completed in January 2010, and it is the only GDM project which has been completed to date. The remaining 10 projects were approved in the period November 2006 to September 2010. Four of these are at the beginning or less than mid-way through the implementation, three are mid-way or three-quarters into implementation, and three are almost at the end or about to be completed. As all of the projects are not completed or are the same stage of implementation, the respondents’ responses are thus given based on very different conditions.

Six of the projects are targeting urban, semi-urban and rural populations. One project, 08-381, is exclusively targeting a rural population, namely in a rural district in Karnataka, India. The last four projects are targeting a combination of urban and semi-urban or rural populations.
Table 1 Overview of projects included in review

<table>
<thead>
<tr>
<th>WDF project number</th>
<th>Country</th>
<th>Project title</th>
<th>Objective</th>
<th>Implementing partner</th>
<th>Collaborating partners</th>
<th>Grant from WDF</th>
<th>Project period</th>
</tr>
</thead>
<tbody>
<tr>
<td>04-067</td>
<td>India, Tamil Nadu</td>
<td>Gestational Diabetes Mellitus – Awareness Creation, Prevention and Control in the Community</td>
<td>Create awareness among the public, particularly women’s groups, medical, paramedical, non-medical and public health professionals on the implications of abnormal glucose tolerance during pregnancy and about the preventive and control measures to be followed; and to train HCPs involved in maternal and child health care in the diagnostic procedures of screening, diagnose and proper management of GDM using appropriate, simple and cost-effective techniques.</td>
<td>Dr. V. Seshiah Diabetes Care and Research Institute</td>
<td>Department of Public Health &amp; Preventive Medicine, Tamil Nadu; The Municipal Corporation of Chennai; Local NGOs and women’s self help groups</td>
<td>EUR 231,531.51</td>
<td>Aug. 2004 – Jan. 2010</td>
</tr>
<tr>
<td>06-196</td>
<td>Cuba</td>
<td>Completion of the Diabetes and Pregnancy Services Network in all the provincial capitals in Cuba</td>
<td>Improving the clinical and obstetrical care to diabetic pregnant women in Cuba</td>
<td>Instituto Nacional de Endocrinología, Hospital Ginecobstétrico “Ramón Gelez, Coro”</td>
<td>The Maternity and Infant Program; the National Group of Obstetrics and Gynaecology; the National Group of Endocrinology; the National Committee on Diabetes and Pregnancy</td>
<td>EUR 259,665</td>
<td>Aug. 2007 – Oct. 2012</td>
</tr>
<tr>
<td>06-207</td>
<td>Sudan</td>
<td>Gestational Diabetes Mellitus Control Project</td>
<td>Improve the health status of mothers with GDM and to achieve healthy outcome of their pregnancy</td>
<td>Sudan Fertility Care Association</td>
<td>UNPPA Sudan Country Office; Federal Ministry of Health</td>
<td>EUR 125,000</td>
<td>June 2007 – Aug. 2012</td>
</tr>
<tr>
<td>07-278</td>
<td>Cameroon</td>
<td>Improving screening, management, and outcome of gestational diabetes in urban and rural Sub Saharan Africa</td>
<td>Raise awareness, build capacity, and provide key data on the magnitude and outcome of gestational diabetes in six provinces of Cameroon in order to inform policies and strengthen the National Diabetes Programme</td>
<td>Institute of Health and Society, University of Newcastle</td>
<td>Cameroon Burden of Diabetes Project; Ministry of Health</td>
<td>EUR 350,000</td>
<td>Oct. 2008 – Aug. 2012</td>
</tr>
<tr>
<td>08-312</td>
<td>India, Tamil Nadu</td>
<td>Extension of project on Gestational Diabetes Mellitus – Awareness Creation, Prevention and Control in the Community</td>
<td>Train the health staff to create awareness among the public, particularly women’s groups, medical, paramedical, non-medical and the public health professionals on the implications of abnormal glucose intolerance during pregnancy and about the preventive and control measures to be followed.</td>
<td>Dr. V. Seshiah Diabetes Care and Research Institute</td>
<td>Centre for Health Education and Development; Department of Public Health &amp; Preventive Medicine, Government of Tamil Nadu</td>
<td>EUR 230,650</td>
<td>Aug. 2008 – July 2012</td>
</tr>
<tr>
<td>08-381</td>
<td>India, Karnataka</td>
<td>Addressing Gestational Diabetes Mellitus in a rural and tribal Population of Mysore District, India</td>
<td>Develop a comprehensive and sustainable model for the identification and appropriate management of GDM among pregnant women focused on safe delivery and child wellbeing</td>
<td>Swami Vivekananda Youth Movement</td>
<td>Prashasa Health Consultants Pvt Ltd</td>
<td>USD 140,201</td>
<td>March 2009 – March 2012</td>
</tr>
<tr>
<td>09-417</td>
<td>Jamaica/Panama</td>
<td>Strengthening Diagnosis and Treatment of Gestational Diabetes through Reinforced Maternal and Child Health Services</td>
<td>Improve the timely diagnosis and treatment of GDM and use this as an opportunity to strengthen maternal and child health services and encourage the adaptation of the WHO Model of Antenatal Care including GDM prevention, diagnosis and treatment</td>
<td>International Centre for Migration, Health and Development</td>
<td>Ministry of Health of Panama; Ministry of Health of Jamaica</td>
<td>USD 372,400</td>
<td>Oct. 2009 – July 2012</td>
</tr>
<tr>
<td>09-436</td>
<td>Kenya (National Programme)</td>
<td>Mainstreaming Comprehensive Diabetes Care in Kenya</td>
<td>Improve management of GDM at the maternal and child health clinics and strengthen the referral system from the community to the national level</td>
<td>Ministry of Public Health and Sanitation; The Kenya Diabetes Management and Information Centre</td>
<td>The Kenya Diabetes Association; the Kenya Diabetes Study Group; Kenya Diabetes Educators; the World Health Organization</td>
<td>EUR 1,215,334</td>
<td>Aug. 2009 – March 2015</td>
</tr>
<tr>
<td>10-500</td>
<td>India, Delhi, Jharkhand, Punjab and Uttar Pradesh</td>
<td>A Multi Media Approach for Awareness Generation on Gestational Diabetes and Its Management in selected districts of India</td>
<td>Create a favourable environment for mainstreaming GDM in existing maternal and child health regimen by awareness at the community level and building pressure through them at the policy level.</td>
<td>Jagran Peeth</td>
<td>Jagran Prakashan Limited; local government health department; Indian Medical Association; Lions Club; Rotary International; Private health care facilities.</td>
<td>USD 600,000</td>
<td>June 2010 – March 2012</td>
</tr>
<tr>
<td>10-517</td>
<td>China</td>
<td>China HCP centers – establishment and training dissemination</td>
<td>Build capacity for HCPs to prevent, control and manage pregnancies with diabetes and to create awareness among pregnant women in 900 hospitals in China</td>
<td>Peking University First Hospital</td>
<td>Ministry of Health of China; Novo Nordisk (China)</td>
<td>Euro 790,350</td>
<td>Nov. 2010 – Aug. 2013</td>
</tr>
<tr>
<td>10-551</td>
<td>India, Punjab</td>
<td>Gestational Diabetes in Punjab</td>
<td>To create and implement sustainable awareness, education, screening, intervention and treatment capacities of diabetes in pregnancy (GDM) within the public and private health care system, as well as in the general population, in the Northern India state of Punjab</td>
<td>Deep Hospital</td>
<td>Jagran Peeth; Sri Rama Charitable Hospital; Iqbal Hospital; Novo Nordisk; Steno Diabetes Center; Health Strategies International; Government Medical Colleges in Patiala, Amritsar and Faridkot; Municipal Corporation in Ludhiana; Department of Health and Family Welfare in Ludhiana; Copenhagen University; University of California, San Francisco.</td>
<td>USD 217,566</td>
<td>Jan. 2011 – April 2013</td>
</tr>
</tbody>
</table>

1. Original grant was EUR 328,996, but only EUR 231,531 was used by partner.
2. Objective related to GDM – not the overall objective for the National Programme.
3.1. Ensuring the basic infrastructure

It is characteristic for many of the projects that they - prior to the commencement of detection, treatment or awareness activities - have to ensure that the basic infrastructure related to GDM in the health care system is in place. Therefore, the starting point for many of the projects has been to secure the human-, knowledge- and material resources required for the implementation.

To ensure the availability of skilled human resources with adequate competencies and knowledge standard protocols and guidelines for diagnosis and management have been developed. Also, training sessions for health care providers have been conducted by several of the projects.

3.1.1. Standard protocols and guidelines

More specifically, standard protocols on diagnosis and management of GDM have been developed in India (04-067, 08-381), Sudan (06-207) and Cameroon (07-278). In Kenya, GDM is included in the protocol for diabetes in general, and the project in China (10-517) is currently planning a revision of their GDM protocol. Overall, the protocols have been developed based on international or regional guidelines, especially the guidelines of the International Diabetes Federation (IDF), and adapted to the local context. In addition to procedures related to screening, diagnosis and management of GDM, the protocol from Sudan is also addressing the issue of registration. Moreover, the protocol developed by the project in Karnataka, India (08-381), includes a component on community education.

A couple of the projects have reported challenges with either developing or disseminating and implementing the protocols. Hence, the project in Cameroon initially intended to base the protocol on international guidelines for the diagnosis and management of GDM. Yet, in the pilot phase of the project, it was discovered that many women were unable to provide the required background information (weight prior to pregnancy, family history of diabetes, etc), making it very complicated to screen based on risk factors as recommended by the guidelines of a number of leading organisations in the field (31-34). The project therefore had to start by identifying and validating a combination of different criteria and tests to find the one which has the highest sensitivity and specificity suitable for the local context while at the same time taking the level of cost-effectiveness into account. The use of various criteria and tests for screening and diagnosis of GDM will be further elaborated in section 3.2. In Sudan, the challenges faced related to the dissemination and implementation of the protocol as the project experienced reluctance among doctors to use and follow the protocol, particularly as most of them had already been exposed to other regimens for handling GDM cases. The protocol was the first of its kind in Sudan and was developed based on the IDF guideline and local obstetric guidelines. How health care providers in general have received the projects will be further described in section 3.1.3.
3.1.2. Training of health care providers

To disseminate the protocols and secure support among various health care providers while at the same time building capacity and skills among them to ensure early diagnosis of GDM and improve the delivery of care, all projects have conducted training or sensitisation activities. From the various project documents included in this review, it appears that there are notable variations in the overall approach to the training, the participants, the contents and the duration of the training.

Overall, when analysing the projects’ description of their training components, two approaches emerge: firstly one which places the training in the context of reproductive health and safe motherhood; and secondly one where the overall focus is more directed at diabetes in general.

“The training will focus on early diagnosis, treatment and follow-up of gestational diabetes and other essential mother and child health promotion and protection themes”

Project application, 09-417 Jamaica and Panama

Thus, in contrast to the stated approach in the project from Jamaica and Panama (09-417), two overall components of the training course are listed in the project application for the first project from Tamil Nadu, India (04-067), namely „Diabetes Mellitus“ and „Gestational Diabetes Mellitus (GDM)“, indicating an approach focused on the context of diabetes in general. The selected approach tends to reflect the professional background or previous experience of the project partner or organisation, but can also be seen as a reflection of a more general phenomenon surrounding GDM, namely that it represents an intersection between to medical specialities (gynaecology & obstetrics and endocrinology) with all the challenges which this may entail. One example which illustrates the divergence related to GDM is the debate on which screening and diagnostic criteria to use and whether these are based on the prediction of the women’s risk of developing type 2 diabetes after pregnancy, or her risk of adverse pregnancy outcomes (35). The use of various diagnostic criteria will be further processed in section 3.2.

The contents of the training curriculum differ from project to project, with some curricula placing more emphasis on obstetrical management and others more on the association with type 2 diabetes. Nevertheless, the core of the curriculum across all projects addresses the screening, diagnosis and management of GDM. The issue of reproductive health versus diabetes in general comes in when the issue of GDM is placed in a larger context, e.g. why timely diagnosis and treatment is important. Table 2 provides an overview of all the different topics that are covered in the training curriculum by one or more projects.
Table 2 Topics covered in projects’ training curriculum

- Overview of the problem of GDM globally and nationally
- What are the socio-biological factors contributing to GDM
- Metabolic adjustment during pregnancy and pathophysiology of GDM
- Prevention of GDM
- Risk factors and identification of women at risk for GDM
- When to screen for GDM
- Who in particular should be screened for GDM
- Performance of screening test for GDM
- Diagnosis of GDM
- Need for repeat screening in GDM negative mothers
- Laboratory procedures
- Difficulties when conducting screening for GDM and how to overcome them
- Management of GDM, including diet, exercise and insulin
- Implications of uncontrolled/undiagnosed GDM on the mother and foetus/child
- Usage of glucometer
- Importance of follow-up during pregnancy
- Referral
- Motivation and education of mothers about screening, treatment and follow-up
- Self care including foot care and insulin injections and insulin storing
- How to improve compliance
- Psychosocial aspects of diagnosis, treatment (including diet and exercise) and follow-up of GDM
- Community based management of GDM
- Misconceptions of insulin
- Cost-effectiveness of timely diagnosis and treatment of GDM
- Management of low- and overweight in women with GDM
- Obstetrical management in diabetes and pregnancy
- Perinatal monitoring
- Antepartum intensive care
- Congenital anomalies in diabetes and pregnancy
- Management of low and high birth weight in diabetes and pregnancy
- Postnatal care for women with diabetes
- Importance of encouraging breast feeding
- Diabetes retinopathy and pregnancy
- Diabetes nephropathy and pregnancy
- Pregnancy in diabetes adolescent
- Contraception in women with diabetes
- Relationship between GDM and maternal care in general
- Safe and healthy delivery
- Psychosocial aspects of pregnancy and delivery
- The association between GDM and T2DM and the implications of GDM for the future magnitude of T2DM
- Overview of the problem of T2DM globally and nationally
- Symptoms and signs of T2DM
- Importance of early detection of T2DM
- Methods for detection of T2DM
- Management of T2DM and importance of regular follow-up
- Complications of T2DM
- Methods for registration
- Methods for surveillance
- Methods for awareness creation
- Health promotion, including promotion of preventive behavioural lifestyle changes
- Community education techniques
- Measurement of blood pressure and body mass index (BMI)
- Nutrition assessment

“Who to train?” is another example of a question where the projects have found different answers. This may to a great extent reflect the local health care system, availability of human resources and the approach and focus of the projects. However, all projects are training medical doctors and most are also training clinical and/or public health nurses. Other professions represented include dieticians, midwives, educators, laboratory technicians, clinical officers, paramedics, health facilitators, accredited social and health activists (ASHAs), auxiliary nurse midwives, anganawadi workers and multi-purpose health workers. The project in Cameroon (07-278) and the project in Jamaica and Panama (09-417) are also training traditional birth attendants/midwives on the importance of early detection of GDM and referral of the women to formally trained health care providers. Training of mid- and low-
skilled health care providers, who are not internationally recognised (in opposition to doctors and nurses), and who tend to be more anchored in the local community is likely to be beneficial as it has been indicated that these health care providers tend to be less prone to migration (36) and therefore enhances the chance of continuity of services if other requirements (e.g. consumables) are in place.

Most of the projects are targeting primary level health care providers in their training, but many are also training or sensitising higher level health care providers, e.g. to ensure support for the project, secure referral pathways or to use them as trainers. The majority of the projects are training health care providers from the public or government health sector, but some, and particularly the projects in India also include health care providers from private for-profit and non-profit health facilities. This may be attributable to the structure of the health systems in the specific area or country.

At least six of the projects (04-067, 07-278, 08-312, 09-417, 10-517, 10-551) employ a training of trainers approach where a smaller number of health care providers are trained as trainers through an extensive training course. The trained trainers will subsequently be in charge of training other health care providers in less extensive training sessions. The use of the training of trainers approach has been found to be an effective way of escalating the number of health care providers reached in limited resource settings throughout the world (37-39).

The approximate number of health care providers trained /to be trained by each project is listed in table 3. It should be noted that the numbers given are expected estimates unless the project is completed or has already exceeded the estimated number.

<table>
<thead>
<tr>
<th>WDF project number</th>
<th>Number of health care providers trained</th>
</tr>
</thead>
<tbody>
<tr>
<td>04-067</td>
<td>2,550</td>
</tr>
<tr>
<td>06-196</td>
<td>368</td>
</tr>
<tr>
<td>06-207</td>
<td>90</td>
</tr>
<tr>
<td>07-278</td>
<td>450</td>
</tr>
<tr>
<td>08-312</td>
<td>13,860</td>
</tr>
<tr>
<td>08-381</td>
<td>944</td>
</tr>
<tr>
<td>09-417</td>
<td>440</td>
</tr>
<tr>
<td>09-436</td>
<td>200</td>
</tr>
<tr>
<td>10-500</td>
<td>200</td>
</tr>
<tr>
<td>10-517</td>
<td>4,725</td>
</tr>
<tr>
<td>10-551</td>
<td>3,060</td>
</tr>
</tbody>
</table>

The duration of the training course varies depending on the profession of the trainees and whether they are trained as trainers. Overall, the duration ranges from one day and up to approximately one month of training - with the majority or trainings lasting two to five days.
3.1.3. Health care providers’ reception of the project

In the interviews it was explored how, according to the respondents’ opinion, the health care providers had received the project. The general picture is that the efforts, including the training opportunity, have been well received by the majority of the health care providers who are involved in one way or the other. Initially, many of the health care providers were unaware about the problem of GDM; however, as a result of the training or sensitisation conducted by the project many are now aware of the issue and see the need for the project and their own role in the implementation. This is especially the case when the health care providers have become familiar with the consequences of untreated GDM and seen the impact of early detection and treatment.

“People were quite willing to learn about the disease once they understood the implications it had on maternal and infant mortality. So many people could correlate the details of the disease with their own clinical experience about why some mothers didn’t do well or why some lost the foetuses.”

Dr. Sridevi Seetharam, 08-381 Karnataka, India

Hence, knowing it will improve one’s professional skills and thereby improve the quality of the services seems to be a motivating factor for the health care providers in their involvement with and support to the project. One respondent (04-067 & 08-312) also emphasised the importance of the personal interaction between the project manager or coordinator and the health care providers with the former having to be particular attentive to communicating about the project in a sensible way and adapting the activities in a manner that is as convenient as possible for the health care providers. On the other hand, some respondents also reported that they still experienced resistance from some of the health care providers, who do not see the point in addressing GDM and perceive it to be a waste of time.

“They feel it is a nonsense thing and I am just wasting time and I want them to also waste time.”

Dr. Geeti Arora, 10-551 Punjab, India

Some respondents reported that although the health care providers might see the point, it is not considered urgent enough to prompt action when other issues perceived to be more pressing are competing for the time and effort of the health care providers.

“Traditionally this is an area where the predominant diseases are the communicable diseases and much is required for malaria and HIV/AIDS. You will find that our clinics are so geared for promoting prevention of maternal to child transmission that trying now to introduce the issue of GDM takes time”.

Dr. William Maina, 09-436 Kenya

Having the support of the superiors of the health care providers is mentioned as key in some of the interviews. Not only are the health care providers more motivated to support the project and conduct the screening and treatment if they are told to do so by their superiors. The need for support from the health authorities is also required to ensure the health care providers have the necessary equipment and working conditions to carry out the work.
“Field staff can be trained, field staff can be motivated, field staff can be encouraged and become willing to do it, as long as they have the way and tools to do it. It is no good asking field staff to do something that they don’t have the equipment to do, the time to do or the knowledge to do”.

Dr. Manuel Carballo, 09-417 Jamaica and Panama

The issue of ensuring support from health authorities and decision-makers will be further explored in section 3.4.1.

3.1.4. Establish or strengthen clinics
To ensure that the trained health care providers have the requirements needed to carry out what they have been trained to do, many of the projects have also sought to secure basic infrastructure of the health system through procurement of equipment to strengthen existing clinics or to establish new clinics (06-196, 06-207, 07-278, 08-312 (sponsored by MoH), 08-381, 09-417, 09-436, 10-517). Depending on the project and the project area or country the strengthened clinics are antenatal care clinics, maternal and child health clinics or primary health care clinics. This again seems to be dependent on the local health system and the earlier mentioned dichotomisation between the endocrinology/diabetes-rooted and obstetric/gynaecology-rooted approaches to GDM. The purchased equipment and materials can be divided into three categories; 1) technical equipment for record keeping and administration such as computers, printers, scanners, copy machines and digital cameras 2) equipment for diagnosing and monitoring GDM, including glucometers, HbA1c test kits and various laboratory equipments 3) equipment for monitoring foetal development e.g. for ultrasonography and cardiotocography.

3.2. Detecting GDM

3.2.1. Screening procedure and diagnostic criteria
Screening of GDM is a key activity in many of the projects. Thus, nine of 11 projects list screening as an activity in their project, and it is also part of the two remaining projects (09-417, 10-500) either indirectly as an outcome of training or through collaboration with partners. The purpose of screening for GDM is twofold; to ensure timely detection of GDM and subsequently proper treatment to decrease the risk of adverse pregnancy outcomes and future type 2 diabetes among women in the project area, and to collect data on the prevalence of GDM to be used for research and advocacy purposes and through that ensuring early detection and proper management of GDM for a larger number of women.

The screening procedure and diagnostic criteria used by the projects vary substantially (Table 4). A number of different tests for GDM exist and different tests are being employed by the projects. Some tests require the pregnant women to drink a glucose solution (challenge tests) whereas others are measuring glucose levels in blood samples without subjecting the patient to a glucose solution (non-challenge tests). The latter category of tests can either be taken in the fasting state, 2 hours after a meal or at any random time. If the plasma glucose level in one of these tests is higher than certain cut-off values and this is confirmed on a subsequent day, the diagnosis is then made. Prior to 2010, the American
The challenge tests can be performed in a two-step or one-step approach. The two-step test involves a screening procedure involving the drinking of a 50 g glucose solution with glucose levels measured 1 hour after (glucose challenge test/GCT). The cut-off point for positive screen is set at either 140 mg/dl (7.8 mmol/l) or 130 mg/dl (7.2 mmol/l). If the latter is used, a higher proportion of women with GDM will be detected (sensitivity is improved), but the specificity is hampered, meaning that more women without GDM will be required to be further tested (false-positive). If the level found are above these cut-off values the patient has to undergo an oral glucose tolerance test (OGTT) after an overnight fast before the diagnosis can be confirmed. This method was recommended by the Fifth International Workshop Conference on GDM held in 2007 and by ADA in 2010 (32;33). Among the GDM projects included in this review, the project from Karnataka, India (08-381), is the only one employing a two-step challenge test.

The one-step approach also involves an OGTT after an overnight fast but without the GCT performed previously. A blood sample is drawn while the woman is in the fasting state whereupon a glucose solution of either 75 g or 100 g is administered to the patient to drink, and measurements of blood glucose levels after 2 hours and sometimes also after 1 and/or 3 hours, are performed. The World Health Organization (WHO) and the International Association of Diabetes in Pregnancy Study Groups (IADPSG), among others, recommend the one-step approach (40;41). Since 2011 ADA has been recommending the same approach as IADPSG (42). The different glucose solutions and cut-off points used by different organisations are listed in Table 5. The one-step approach is by far the most widely used among the included GDM projects as five of the projects (04-067, 08-312, 09-436, 10-517, 10-551) follow this procedure, although 08-312 from Tamil Nadu, India, noted that they conduct the 75 g OGTT even if the woman is not fasting.

A fourth approach is also being utilised by the projects in Cuba (06-196) and Cameroon (07-278) and in low resource settings by the project in China (10-517). The patient is subjected to a non-challenge test and depending on the result of the test, the woman might undergo a 75 g OGTT. In Cuba, all abnormal readings are subjected to an OGTT whereas in Cameroon, it is only women with readings in the borderline area who are subjected to an OGTT while women with high glucose levels in the non-challenge test are immediately diagnosed with GDM without having the OGTT performed.

The difference in diagnostic criteria is, however, not only centred around the type of test to be used, but also which cut-off values diagnosis should be based on. As mentioned five projects follow the test procedure recommended by WHO and IADPSG; however, while the two bodies recommend the same procedure they do not recommend the exact same cut-off values. The project in China (10-517) follows the cut-off values recommended by IADPSG. These cut-off values are also followed by the project in Karnataka, India (08-381), although they follow ADA 2010/Fifth International Workshop-Conference on GDM for the Diabetes Association (ADA) recommended this particular approach, using the following cut-off values: fasting plasma glucose (FPG) > 126mg/dl (7.0 mmol/l), 2-hour postprandial or random test > 200 mg/dl (11.1 mmol/l) (31). This method is only followed by the project in Sudan (06-207).
interpretation of the GCT results. The projects in Kenya (09-436) and Punjab, India (10-551),
draw both fasting and 2 hour post-OGTT blood samples, but rely mainly on the latter for
diagnosis using a cut-off value of 140 mg/dl (7.8 mmol/l), which is identical with the 2 hour
post-OGTT cut-off value recommended by WHO. The two projects in Tamil Nadu, India, (04-
067, 08-312) only measure glucose values 2 hour post-OGTT, but also use the 140 mg/dl
(7.8 mmol/l) as the cut-off for diagnosis. Although it does not follow the exact recommended
procedure the project in Cameroon (07-278) follows the cut-off values recommended by
IADPSG. The project in Cuba uses a cut-off value for fasting plasma glucose which lies
between that recommended by IADPSG and WHO, but confirms it with the 2 hour post-
OGTT value employed by the WHO. The project in Sudan (06-207) uses a cut-off value of
120 mg/dl (6.7 mmol/l), which is significantly lower than the 200 mg/dl (11.1 mmol/l)
recommended for random non-challenge test by ADA in 2003.
<table>
<thead>
<tr>
<th>WDF Project number</th>
<th>Country</th>
<th>Test used</th>
<th>Cut-off values</th>
<th>Universal or risk factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>04-067</td>
<td>India, Tamil Nadu</td>
<td>75 g OGTT</td>
<td><em>Plasma glucose</em> 2 h OGTT ≥ 140 mg/dl (7.8 mmol/l)</td>
<td>Universal</td>
</tr>
<tr>
<td>06-196</td>
<td>Cuba</td>
<td>Fasting non-challenge test confirmed by a 75 g OGTT</td>
<td><em>Plasma glucose</em> Fasting ≥ 100 mg/dl (5.6 mmol/l)</td>
<td>Universal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2h OGTT ≥ 140 mg/dl (7.8 mmol/l)</td>
<td></td>
</tr>
<tr>
<td>06-207</td>
<td>Sudan</td>
<td>Random non-challenge test</td>
<td><em>Blood glucose</em></td>
<td>Selective</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&gt;120 mg/dl (6.7 mmol/l)</td>
<td></td>
</tr>
<tr>
<td>07-278</td>
<td>Camer oon</td>
<td>Fasting non-challenge test with borderline cases confirmed by 75 g OGTT</td>
<td><em>Blood glucose</em> Fasting &gt; 92 mg/dl (5.1 mmol/l)</td>
<td>Universal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fasting: 80-92 mg/dl (4.4-5.1 mmol/l) → OGTT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><em>Plasma glucose</em> 1-h OGTT &gt; 180 mg/dl (10.0 mmol/l)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2-h OGTT &gt; 153 mg/dl (8.5 mmol/l)</td>
<td></td>
</tr>
<tr>
<td>08-312</td>
<td>India, Tamil Nadu</td>
<td>75 g OGTT (irrespective of fasting or non fasting)</td>
<td><em>Plasma glucose</em> 2 h ≥ 140 mg/dl (7.8 mmol/l)</td>
<td>Universal</td>
</tr>
<tr>
<td>08-381</td>
<td>India, Karnataka</td>
<td>50 g GCT confirmed by 75 g OGTT</td>
<td><em>Plasma glucose</em> GCT &gt; 130mg/dl (7.2 mmol/l) → OGTT</td>
<td>Universal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fasting &gt;92 mg/dl (5.1 mmol/l)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 h OGTT &gt; 180mg (10.0 mmol/l) 2 h OGTT &gt; 153 mg/dl (8.5 mmol/l)</td>
<td></td>
</tr>
<tr>
<td>09-436</td>
<td>Kenya</td>
<td>75 g OGTT</td>
<td><em>Plasma glucose</em> Fasting &gt; 126 mg/dl (7.0 mmol/l)</td>
<td>Selective</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2 h OGTT &gt; 140 mg/dl (7.8 mmol/l)</td>
<td></td>
</tr>
<tr>
<td>10-517</td>
<td>China</td>
<td>75 g OGTT OR Fasting non-challenge test confirmed by 75 g OGTT</td>
<td><em>Plasma glucose</em> Fasting ≥ 92 mg/dl (5.1 mmol/l) → OGTT</td>
<td>Universal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1-h OGTT ≥ 180 mg/dl (10.0 mmol/l) 2-h OGTT ≥ 153 mg/dl (8.5 mmol/l)</td>
<td></td>
</tr>
<tr>
<td>10-551</td>
<td>India, Punjab</td>
<td>75 g OGTT</td>
<td><em>Plasma glucose</em> 2-h OGTT: 140 mg/dl (7.8 mmol/l)</td>
<td>Universal</td>
</tr>
</tbody>
</table>
Table 5 Overview of recommendations for diagnostic criteria for GDM

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Type of test</th>
<th>Glucose load (g)</th>
<th>Cut-off points</th>
<th>Who should be screened?</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHO 1999 (41)</td>
<td>One-step</td>
<td>75</td>
<td>FPG: 126 mg/dl (7.0 mmol/l) OR 2-h: 140 mg/dl (7.8 mmol/l)</td>
<td>Not mentioned</td>
</tr>
<tr>
<td>ADA 2003 (31)</td>
<td>Fasting or random non-challenge test in general. The OGTT recognised as a valid test.</td>
<td>NA</td>
<td>FPG: 126 mg/dl (7.0 mmol/l) Random: 200 mg/dl (11.1 mmol/l)</td>
<td>Selective</td>
</tr>
<tr>
<td>ADA 2010 (32)</td>
<td>Two- or one-step 50 (GCT) and 100 (OGTT)</td>
<td>GCT: 140 mg/dl (7.8 mmol/l) or 130 mg/dl (7.2 mmol/L) OGTT: FPG 95 mg/dl (5.3 mmol/l) 1-h 180 mg/dl (10.0 mmol/l) 2-h 155 mg/dl (8.6 mmol/l) 3-h 140 mg/dl (7.8 mmol/l)</td>
<td>Selective</td>
<td></td>
</tr>
<tr>
<td>ADA 2011 (42)</td>
<td>One-step</td>
<td>75</td>
<td>FPG 92 mg/dl (5.1 mmol/l) 1-h: 180 mg/dl (10.0 mmol/l) 2-h: 153 mg/dl (8.5 mmol/l)</td>
<td>Universal</td>
</tr>
<tr>
<td>IADPSG 2010 (40)</td>
<td>One-step</td>
<td>75</td>
<td>FPG 92 mg/dl (5.1 mmol/l) 1-h: 180 mg/dl (10.0 mmol/l) 2-h: 153 mg/dl (8.5 mmol/l)</td>
<td>Universal</td>
</tr>
<tr>
<td>Fifth International Workshop Conference on GDM 2007(33)</td>
<td>Two- or one-step 50 (GCT) and 75 OR 100 (OGTT)</td>
<td>GCT: 140 mg/dl (7.8 mmol/l) or 130 mg/dl (7.2 mmol/L) OGTT 75 g: FPG 95 mg/dl (5.3 mmol/l) 1-h 180 mg/dl (10.0 mmol/l) 2-h 155 mg/dl (8.6 mmol/l) 3-h 140 mg/dl (7.8 mmol/l) – 3 h only measured for 100 g OGTT</td>
<td>Selective</td>
<td></td>
</tr>
<tr>
<td>NICE 2008 (34)</td>
<td>One-step</td>
<td>75</td>
<td>FPG 126 mg/dl (7.0 mmol/l) 2-h: 140 mg/dl (7.8 mmol/l)</td>
<td>Selective</td>
</tr>
</tbody>
</table>

3.2.2. Reasons for selecting diagnostic criteria

In the interviews the respondents were asked about the reasons for selecting the employed test and cut-off values. Many replied that they had selected the test and/or cut-off values because they were recommended by a certain international or internationally acclaimed organisation or technical body.
“Before the WDF project in China we also used the different diagnostic criteria including the ADA, the WHO and the National Diabetes Data Group, but since last year when the new diagnostic criteria by the International Association of Diabetes in Pregnancy Study Group was published in Diabetes Care most of the hospitals decided to use the new diagnostic criteria.”

Prof. Huixia Yang, 10-517 China

As was the case in China, the projects in Cameroon (07-278) and Karnataka, India (08-381), also reported shifting to the tests and/or cut-off criteria recommended by the IADPSG after it was published in 2010. In addition, the respondent from Cameroon noted that the cut-off criteria recommended by IADPSG were very much in line with local results; making it a matter of course to employ the IADPSG cut-off values.

Whether it being the IADPSG, the WHO or the ADA recommendations, following a widely accepted guideline also offers the opportunity to compare results and to have a standardised way of diagnosing GDM across different populations. The benefit of having comparable data was also mentioned as a motive for selecting a specific diagnostic criterion, for instance by the respondent from Punjab in North India (10-551) who is referring to results from 04-067 in Tamil Nadu in South India.

“If we have to compare data or if we are to see the increase of GDM from South India to North India then we have to use the same methodology for screening. I cannot use a different method if I really want to figure out why Dr. Seshiah got 17% and I am only getting 10%”.

Dr. Geeti Arora, 10-551 Punjab, India

A couple of projects (06-207, 09-436) reported to have selected the test and cut-off values because it was the approach already being used by practitioners in the country and was the one recommended by national experts.

“There are different schools for screening, but we set our own from the long experiences of the senior diabetologists and senior obstetricians who did the GDM protocol.”

Dr. Siham Ahmed Balla, 06-207 Sudan

A final motive for selecting a test revolves around the feasibility of performing the test. One issue is a reduction in the number of steps and blood samples which have to be drawn. The respondents from the projects in Tamil Nadu, India (04-067 & 08-312), thus refer to it as being easier for both the women and the health care provider to use the one-step approach with only the 2 hour post-OGTT measurement. Especially, in comparison with the two-step approach, which is performed over two days, the one-step approach offers an advantage in terms of feasibility as the test can be performed in one day only and the women therefore do not have to come back to the health centre on a subsequent day. Interestingly, feasibility is also given as an argument in favour of the two-step approach.

“Some protocols which recommended fasting glucose screening were hard for us to implement, because it is difficult for us to access the women early in the morning in a fasting
The fact that the first step of the two-step approach can be done without the woman being in a fasting state can thus be an advantage when there are difficulties in reaching the women while they are fasting.

Moreover, part of the difference in diagnostic criteria among the projects is likely to be explained by the fact that there has not been any international consensus on the use of methods and thresholds for diagnosing GDM. The academic debate on which approach to use has been protracted, and part of it has revolved around whether thresholds could be identified above which maternal hyperglycaemia is an independent risk factor for adverse pregnancy outcomes (35). The various diagnostic criteria recommended by most of the international or internationally acclaimed organisations and associations are based on the prediction of the risk of developing diabetes postpartum or on the OGTT diagnostic criteria for impaired glucose tolerance and diabetes in the non-pregnant population (33-35;41). The cut-off criteria recommended by the IADPSG on the other hand are based on the prediction of the risk of adverse pregnancy outcomes (40). Thus, the IADPSG operates with a lower fasting glucose level but a higher 2 hour post OGTT level compared to the WHO. It is important to note this difference in the origin of the thresholds when reviewing and comparing the two approaches.

3.2.3. Selective or universal screening

As there is divergence in the tests and cut-off points recommended by various technical organisations and employed by the WDF project partners, there is also disagreement over whom to screen. One of the most recent of the recommendations, the IADPSG, recommends universal screening i.e. that all pregnant women are screened for GDM (40). However, the American Diabetes Association prior to 2011, the Fifth International Workshop Conference on GDM and the National Institute for Health and Clinical Excellence (NICE) all recommend that the decision of whom to screen is taken based on a risk factor assessment i.e. selective screening (31-34); thus, women with one or more of specified risk factors should be offered testing for GDM. Seven of the nine projects, which are actively detecting GDM, apply universal screening whereas two projects, Kenya (09-436) and Sudan (06-207) are only screening pregnant women with one or more risk factors. The risk factors that are assessed are listed in table 6.
Table 6 *Overview of risk factors used for selective screening*

<table>
<thead>
<tr>
<th>WDF project number</th>
<th>Risk factors which should be determined</th>
</tr>
</thead>
<tbody>
<tr>
<td>06-207</td>
<td>Overweight, obesity, pre-gestational diabetes, family history of diabetes, history of GDM, diagnosis of PCOS, previous baby weighing &gt; 4 kg, history of unexplained stillbirth, history of baby with birth defect, glucosuria, high blood pressure, history of repeated, unexplained abortions.</td>
</tr>
<tr>
<td>09-436</td>
<td>Age &gt; 25 years, BMI &gt; 25 kg/m², history of GDM, history of glucosuria, previous baby weighing &gt; 4 kg, history of poor obstetric outcome, family history of diabetes, known impaired glucose tolerance, known diabetic fasting glucose, grand multipara.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Risk factors which should be determined</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Diabetes Association 2003 (31)</td>
<td>Obesity, age &gt; 25 years, member of ethnic group with average or high prevalence of GDM, family history of diabetes, history of abnormal glucose tolerance, history of poor obstetrical outcome.</td>
</tr>
<tr>
<td>American Diabetes Association 2010 (32)</td>
<td>Obesity, history of GDM, previous baby that was large-for-gestational age, presence of glucosuria, diagnosis of PCOS, family history of type 2 diabetes, age &gt; 25 years, member of ethnic group with average or high prevalence of GDM, history of abnormal glucose tolerance, history of poor obstetrical outcome.</td>
</tr>
<tr>
<td>Fifth International Workshop Conference on GDM 2007 (33)</td>
<td>Obesity, family history of type 2 diabetes, history of GDM, previous history of impaired glucose metabolism, previous history of glucosuria, age &gt; 25 years, low or high birth weight, history of poor obstetric outcome, member of ethnic group with average or high prevalence of GDM.</td>
</tr>
<tr>
<td>NICE 2008 (34)</td>
<td>BMI &gt; 30 kg/m², previous baby weighing ≥ 4.5 kg, history of GDM, family history of diabetes, member of ethnic group with high prevalence of diabetes (South Asian, Black Caribbean or Middle Eastern).</td>
</tr>
</tbody>
</table>

The reasoning for selecting universal or selective screening was explored in the interviews. The main reason given by the respondents as to why selective screening was preferred revolved around the issue of cost-effectiveness.

“One of the things is that if you look at the general prevalence of GDM it is about four to five percent. If you did the population-based screening for pregnant mothers you would see that out of every 100 you would be screening 96 who are not likely to have the disease, and since they are paying for this service it is not practical to take 96 screenings when you are only expecting four cases to be positive… It is just to minimise the economic perspective of it. We have to minimise the number of strips we use, which probably would not have been necessary, bearing in mind that the surprise is not very regular.”

Dr. William Maina, 09-436 Kenya
The notion appears to be that the prevalence simply is not high enough to make it cost-effective to screen all women for GDM considering that the women in the Kenyan project have to pay for the service themselves. Reversely, the contention of prevalence or how high a risk the local population has for GDM is also used to argue against basing screening on a risk-factor assessment.

“Most western studies indicate that Indian ethnicity increases the risk for gestational diabetes. Since all our women are of Indian origin by default all of them are at higher risk of GDM.”

Dr. Sridevi Seetharam, 08-381 Karnataka, India

Another issue is whether the risk factors listed in Table 6 are valid in the various local contexts that the projects are working in. The project in Cameroon (07-278) for instance did a pilot study of 920 women and found that the risk factors were very weak in picking up women with GDM and thus by using risk factor-based screening a number of women with GDM would not be detected (43). This finding is supported by statements from other partners as well. Two possible explanations for this are revealed in the interviews. First of all, some projects, especially the Indian ones, reported that obesity is not a very good indicator for GDM as many of the Indian women are not obese, but still have GDM.

“Typically with this risk factor screening we will be missing a lot of women. These women are thin, they are small and low weight, they were not obese but GDM positive, so the BMI does not reflect that much. Nor does the family history because when she says that nobody in her family has diabetes I suspect it is because nobody has been tested it is not that nobody has. So relying on risk factors is going to be very difficult.”

Dr. Madhuri S. Balaji, 04-067 & 08-312 Tamil Nadu, India

The quote from Dr. Balaji also leads to the second problem, namely the issue of reporting bias when the women respond to questions on diabetes among first-degree relatives or birth weight. Either the women might not be aware or as indicated in the quote the pool of undetected diabetes may be so vast that the women’s family members have or had diabetes without knowing it. In Cameroon it was not only family history of diabetes and issues of weight that were problematic, but also risk factors related to previous pregnancies.

“When you start looking at data on previous pregnancy it is amazing the number of “I don’t know” answers that we had for things like different outcomes of pregnancy or different things that could have happened in the pregnancy that can be used as risk factor for gestational diabetes in the current pregnancy. There were so many “No” or “I don’t know” that the sensitivity of risk factors was not good at all.”

Dr. Eugene Sobngwi, 07-278 Cameroon

However, other project partners using the risk-factor based screening or with previous experience with it (06-196, 09-207, 09-417) reported that they are not having difficulties in using the risk factor-based screening and that the women in their area in general are able to respond to the questions in the risk-factor assessment.
The main argument in favour of risk factor-based screening for GDM appears to be issues of cost; however, other partners argue that their entire population of pregnant women is at-risk due to the ethnicity and the use of risk-factor assessments therefore is futile. The validity of the risk-factor assessment is by some considered weak or questionable at best whereas others report no problems with the sensitivity of the risk factor-based screening. These findings reflect also the larger ongoing academic debate on whether universal or selective screening based on risk factors should be utilised. Hence, the cost of conducting the tests for GDM makes it desirable to identify a method where only some women would have to undergo the expensive tests and screening according to risk factors may offer such an opportunity. The problem is that by only screening women with identifiable risk factors some cases of GDM will inevitably be missed and the question is if missing a proportion of women with GDM is acceptable or in other words how low a sensitivity we are willing to accept. If more risk-factors are included or the thresholds of the risk factors, e.g. maternal age, are lowered sensitivity will be improved, but more non-GDM women will have to undergo the expensive test and the whole aim of selective screening is watered down (44). Thus the issue is basically a matter of the cost of performing the tests versus the risk of missing women with GDM and the cost hereto pertaining i.e. the cost-effectiveness.

3.2.4. Time of detection

The various guidelines listed in table 5 all recommend that screening for GDM is undertaken in the 24\textsuperscript{th} to 28\textsuperscript{th} weeks of gestation. They all also note that efforts, typically in the form of risk assessments, should be made at the first prenatal visit to detect potential overt diabetes i.e. undetected pre-gestational diabetes (31-34;40-42). Almost all the projects engaged in detection of GDM reported that they screen the women at 24\textsuperscript{th} to 28\textsuperscript{th} weeks of gestation or at least that this is what their protocol states. From the interviews it is clear that it is not always possible to screen the women in this period of pregnancy.

"Most of our mothers attend the antenatal clinic quite late, maybe after 28\textsuperscript{th} week, and this is something which the department of reproductive health are trying to address by sensitising them to come to the clinic as soon as they discover they are pregnant so that they can be followed up and in case of any complication necessary action is taken."

Dr. William Maina, 09-436 Kenya

Consequently, screening women for GDM in the 24\textsuperscript{th} to 28\textsuperscript{th} weeks of gestation cannot always be done and neither can risk assessment for overt diabetes as the first antenatal care visit sometimes takes place after this period. If women do attend antenatal care prior to 24\textsuperscript{th} weeks it is moreover not always certain that they will return while in the 24\textsuperscript{th} to 28\textsuperscript{th} weeks of gestation to have the test performed. Some projects (08-312, 07-278) are in consequence therefore conducting the test whenever a woman attends antenatal care for the first time regardless of gestational week.

3.2.5. GDM prevalence

The projects that are testing pregnant women for GDM are also collecting the data to enable statistical analysis and thus obtaining the prevalence rate of GDM in the project population. However, eight of the projects are far enough in the implementation to allow for data analysis. The prevalence rates identified by these eight projects are depicted in table 7. The
prevalence differs quite substantially from less than 1% in project in Karnataka, India (08-381), which focuses on a very rural population, to around 17% among the urban population covered by the first project in Tamil Nadu, India (04-067) and the populations covered by its extension (08-312) and the project in Cameroon (07-278).

Yet, as the projects are using different diagnostic criteria the prevalence rates are not directly comparable. The project in Cameroon (07-278) reported two prevalence rates, one based on WHO cut-off criteria and one based on IADPSG thresholds. As the test performed is the same the result showcase an example of how different the identified prevalence rate is according to two of the most widely used diagnostic criteria. In addition to diagnostic criteria employed, the prevalence of GDM risk factors in the surveyed population also influences the prevalence and can help explain the differences in GDM prevalence. Hence, especially ethnicity and the average age of the women are factors that likely differ among the various project populations and therefore may be a contributing factor in the identified prevalence rates. The rates identified and reported by the first project in Tamil Nadu, India, for instance clearly show how the prevalence rate of GDM differs depending on the population being urban, semi-urban or rural.

### Table 7 Prevalence of GDM

<table>
<thead>
<tr>
<th>WDF Project number</th>
<th>Country</th>
<th>Criteria used</th>
<th>Prevalence of GDM</th>
<th>Approximate number of people screened</th>
</tr>
</thead>
<tbody>
<tr>
<td>04-067</td>
<td>India, Tamil Nadu</td>
<td>WHO (2 hour)</td>
<td>urban 17.8%</td>
<td>Urban 4151</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>semi-urban 13.8%</td>
<td>Semi-urban 3960</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>rural 9.9%</td>
<td>Rural 3945</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total 12,056</td>
</tr>
<tr>
<td>06-196</td>
<td>Cuba</td>
<td>Fasting: none WHO (2 hour)</td>
<td>4.8%</td>
<td>25,066</td>
</tr>
<tr>
<td>06-207</td>
<td>Sudan</td>
<td>Random blood glucose above 120 mg/dl</td>
<td>2.3%</td>
<td>7,551</td>
</tr>
<tr>
<td>07-278</td>
<td>Cameroon</td>
<td>WHO and IADPSG</td>
<td>5% WHO and 17% IADPSG</td>
<td>12,000</td>
</tr>
<tr>
<td>08-312</td>
<td>India, Tamil Nadu</td>
<td>WHO (2 hour)</td>
<td>16-17%</td>
<td>12,500</td>
</tr>
<tr>
<td>08-381</td>
<td>India, Karnataka</td>
<td>ADA/IADPSG</td>
<td>Less than 1%</td>
<td>2,054</td>
</tr>
<tr>
<td>10-517</td>
<td>China</td>
<td>IADPSG</td>
<td>12.2%</td>
<td>26,459</td>
</tr>
<tr>
<td>10-551</td>
<td>India, Punjab</td>
<td>WHO</td>
<td>10%</td>
<td>1,150</td>
</tr>
</tbody>
</table>

3.2.6. Barriers and challenges to early detection of GDM

In addition to already mentioned barriers and challenges to ensure early detection of GDM, such as identifying a detection strategy and the issue of pregnant women not attending antenatal care in the recommended gestational period for GDM screening, a number of
barriers or challenges emerged in the analysis of the interviews. These will be described in this section.

The barriers can in general be divided into two categories: those pertaining to the health system, including clinical aspects, and those concerning more socio-economic, social or psychological aspects pertaining to society or the individual woman.

Barriers in the health system are to a large extent a question of the basic infrastructure for early detection not being in place. First of all, many of the respondents mentioned the issue of staff as a hindrance for early detection of GDM. The project in Kenya (09-436) for instance reported that many of the health facilities are understaffed and the available staff has many other tasks and diseases to address and that it therefore can be difficult to prioritise testing for GDM. Two of the respondents from India (10-500, 10-551) mentioned that in their area it is not so much the number of available health care providers, but more an issue of not having enough female health care providers or more specifically: female doctors.

“In many of the primary health care centres they don’t have female doctors and still in India women usually don’t want to discuss this kind of issues with male doctors”.

Mr. Vishwamohan Prasad, 10-500 India

Consequently, if no female doctor is available some women will not attend the clinic and early detection of GDM – at least in that specific clinic – will be hampered. In fact this may be an important barrier for women to not attend antenatal services in many areas. The final issue highlighted concerning health care providers was lack of knowledge and training. Thus, many of the respondents reported that the general knowledge on GDM among health care providers is very limited and some explained it by stressing that GDM, and to some extent also diabetes in general, receives no or only very little attention in the curricula in medical schools as well as in continuing medical education. As a result many health care providers are unaware of how to perform the test and interpret the results and, moreover, not even aware of the importance of referring pregnant women to be tested at health facilities that have trained staff. Once health care providers have received training, it can be challenging to maintain them in the area of GDM as turnover of staff is quite frequent in some places. If knowledge has not been passed on to other health care providers, it poses a real challenge to early detection of GDM in the given setting.

“It is mainly a problem with staff. Trained staff that might be posted elsewhere, so you are not sure that people you’ve trained will still be there one, two, three years later. So how to ensure that the message will go across to the whole team – that is a bit challenging.”

Dr. Eugene Sobngwi, 07-278 Cameroon

However, even at health facilities where the health care providers have been trained or are aware of the importance of early detection of GDM other issues may prevent it from taking place. Thus, lack of standard protocols and, especially, lack of necessary consumables and equipment were stressed as major challenges.
“When we wanted the government centres also to adopt the testing in their antenatal care we realised that they do not have the consumables like the glucose powder or equipment for biochemical analysis for glucose, and there are frequent power cuts, so they were not able to separate the plasma in time.”

Dr. Sridevi Seetharam, 08-381 Karnataka, India

As this statement indicates there is both the challenge of having a properly equipped laboratory for analysing the blood samples taken as part of the OGTT test as well as a challenge of even having the consumables to perform the test, including the glucose solution. Other challenges related to the test itself were also stressed in the interviews. According to recommendations and guidelines the women, for example, have to be fasting for the OGTT.

“We tell them to come in fasting but they do not come fasting, because they typically believe that a pregnant woman should not be fasting for many hours. If she lives really near the health centre and she comes in time - by 7.30 AM in the morning - that is okay for fasting, I guess. But if she lives far off by the time she reaches the health centre it will be 10.30 in the morning and that means she has been fasting overnight for more than 12 hours and I don’t think she is going to do it. So these women tend to eat something during the travel time, so they don’t report to us in the fasting state.”

Dr. Madhuri S. Balaji, 04-067 & 08-312 Tamil Nadu, India

Thus, for various reasons many of the respondents stated that a significant proportion of women attending the antenatal care clinics are not fasting and it can be very difficult to then ask them to come back in the fasting state another day. Moreover, drinking the glucose solution used in the OGTT makes some of the women feel nauseous and, consequently, some end up vomiting. If this is the case, the OGTT also has to be rescheduled for another day. Finally, if all these preliminaries are in place the woman has to sit at the health centre and wait for two hours before the test can be completed – a wait which some women find too long and therefore leave before the test is complete.

However, one aspect is the supply side, i.e. having the services in place, another is the demand side. A number of issues were mentioned by the respondents as being a barrier or impediment for the women to seek out testing for GDM. Some of these issues specifically concern GDM whereas others are issues related to antenatal care in general. As already touched upon in section 3.2.4., the pregnant women do not always attend the antenatal care clinic in the optimal time for the GDM test. Various explanations for this delay in demand for services and the at times complete lack of demand for such services are present in the data. Firstly, a reiterated statement is that the women are not coming in time for the test simply because they do not feel sick.

“They don’t feel anything. They feel they are okay…As they don’t feel anything they don’t come on time. This is the most difficult thing we have in our programme.”

Dr. Manuel Vera, 06-196 Cuba
One thing is not feeling sick because one does not have any symptoms but some women think they are not at risk of GDM, and therefore do not see the point in getting screened for GDM.

“They think they are very young and have no diabetes in their family, so they don’t think they should do the test for GDM”.

Prof. Huixia Yang, 10-517 China

These issues may be reflecting a lack of awareness among the women on the importance of being tested for GDM as such awareness – at least prior to the project – was reported as being a problem by some of the respondents.

“The other barrier we had was lack of awareness about the importance of screening… The prevalence was low in our area compared to Chennai and some parts of Karnataka as well so for people to sit up and take notice and take the condition more seriously we had to do very intense awareness generation.”

Dr. Sridevi Seetharam, 08-381 Karnataka, India

Other issues which were pointed out, particularly by the North Indian respondents, revolved around the pregnant woman’s status in society and how important her health is viewed. Overall, the picture that emerged was that women’s health is not given much importance in the society.

“The health of a women in India is the most neglected, under-looked and deficient system of the whole country. People cannot be bothered. They are just not bothered about the health of women whether it is diabetes or anything else.”

Dr. Geeti Arora, 10-551 Punjab, India

At the same time it is not the woman herself who makes most decisions concerning her own health - those decisions are generally made by her husband and/or in-laws, and if they make the decision that she should not attend antenatal care or not have a specific test performed it is very difficult for her to demand the test.

“Whether a woman should go for antenatal check-up or not is a decision taken by her husband, if she goes there and she finds that there is some problem, what kind of treatment, which doctors she should consult etc – all these decision are being taken by the male counterpart.”

Mr. Vishwamohan Prasad, 10-500 India

In addition, it can be highly stigmatising for a woman to be diagnosed with GDM and the consequences in her family life can be intimidating.

“That fear inside her that everything will go wrong in her life. Even if it is a risk or recommendation from a doctor, a call from a doctor that „you are at risk of getting diabetes” or „the child will get affected with some borderline hyperglycaemia” would probably ruin her
family life - her husband would not look upon her nicely or her mother-in-law will always be sarcastic in her remarks."

Dr. Geeti Arora, 10-551 Punjab, India

Therefore, some women refuse the test simply because they fear the consequences of its result. Finally there were a number of more practical aspects mentioned which impact the women’s demand for GDM testing. Related to the woman’s role in society - many women are taking care of the children and doing other chores related to the household. Being too busy to have time for attending antenatal care and GDM testing was therefore cited as another barrier to ensure early detection of GDM. The issue revolves around both the time consumed on the test and the time spent on transport to and from the health centre. The transport to the health centre was also reported as potentially problematic in relation to distance, e.g. if the woman had to walk to the health centre or be there early in the morning to have the test while still fasting, and in terms of cost, for instance the bus fare.

“For women in remote villages and also in tribal hamlets access to the hospitals was a major barrier...In the tribal areas not only geographical access, but also lack of resources to reach the hospital in terms of bus fare or being able to forego their daily wages or for the sheer presence of somebody who would escort them to the hospital”

Dr. Sridevi Seetharam, 08-381 Karnataka, India

In some projects the testing for GDM is free of charge whereas in other projects a user-fee is charged for the test. Therefore, whether the cost of the test is a challenge appears to depend very much on the local context, however, both the respondents from Kenya (09-436) and Cameroon (07-278) voiced concern about how introduction of user-fees would impact on the proportion of pregnant women who would undergo testing for GDM.

3.2.7. Solutions and opportunities to ensure early detection of GDM

Thus, a number of issues have been identified as barriers or challenges to ensure early detection of GDM, yet, solutions or attempts to address some of these barriers were also evident in the interviews. To start with, different solutions have been found by the projects to the challenges related to the test itself. The issue of the women not coming in the fasting state is for instance given as a reason why the project in Karnataka, India (08-381) decided to use the GCT because this can be done irrespective of the women being fasting. However, other respondents spoke against the use of the GCT followed by OGTT as this two-step method was considered to be too troublesome compared to the one-step approach. The respondent from the projects in Tamil Nadu, India (04-067 & 08-312), therefore had identified another solution to get around the problem with fasting and referred to own research having shown that the 75 g glucose solution is such a huge load on the carbo-metabolism that having a meal does not make any difference to the results of the 2 hour OGTT (45). Accordingly, the project was now encouraging health care providers to initiate the 2 hour OGTT, even if the woman has had breakfast. To be entirely independent of the women appearing for the test fasting, the project has completely skipped measuring the fasting plasma glucose.
Another group of projects (06-196, 07-278, 10-517 in low resource areas) have decided to stick with the fasting measurements, but are instead reducing the number of OGTTs performed. By only conducting the OGTT on women with abnormal or borderline fasting results they are able to reduce the number of OGTTs required and hence decrease the time consumption and consumables used. The respondent from Cameroon (07-278), however, did note that the project is having problems with women not coming fasting and therefore call for GDM diagnostic cut-off criteria for postprandial measurements irrespective of the OGTT. The project in Sudan (06-207) is the only project performing testing for GDM without relying on either the women coming in a fasting state or the process of the OGTT.

Another aspect related to the test is whether glucose levels are measured in capillary whole blood or venous plasma. Most guidelines recommend measurements taken in venous plasma, however, this places higher demand on the laboratory equipment available at the health centres compared to the use of capillary whole blood, which is typically measured with a glucometer. Consequently, some projects are relying on or experimenting with measuring the glucose in capillary whole blood simply because it is more feasible and gives an immediate result. However, as glucose levels in capillary whole blood in general are 10-15% lower than glucose levels in plasma (46;47), a conversion is needed to compare measurements from whole blood and plasma. Yet, this may not be ideal for diagnostic purposes as variation on an individual basis may be too great and the risk of misclassification unbearable (48).

Finally, to address the issue of lack of consumables needed for the OGTT, in this case the need for a 75 g glucose solution, the respondent from Kenya mentioned that the project is experimenting with substituting the solution with sugar-heavy beverages.

“It is a challenge to have the right 75 grams of glucose in all health facilities. We are trying to see if we can recommend 300 ml of Sprite. One of the diabetes educators is working on this problem to see if we can deliver an equivalence of the 75 grams of glucose. Sometimes taking glucose may be very nauseating for pregnant mothers and we don't have the right sort of preparation for glucose to give to these mothers for the 2 hour glucose tolerance test.”

Dr. William Maina, 09-436 Kenya

To address the issue of the infrastructure, particularly related to staff, most of the projects are training health care providers as described in section 3.1.2. However, in addition to conducting training courses for health care providers, undertaking training sessions for medical and nursing students, or working with medical and nursing schools on strengthening GDM in the curricula was also mentioned as possible strategies for addressing the lack of knowledge and awareness among health care providers. Regarding the challenge of staff turn-over many of the projects have attempted to obviate this by employing a training of trainers approach, as also mentioned in section 3.1.2. Anticipating that the acquired knowledge and skills will be shared with the trainees’ colleagues, and thereby increasing the likelihood that the relevant services will continue irrespective of whether individual health care providers leave the health centre. Whether this has been successful cannot be answered by the available data at this stage.
Moreover, support from the government, decision-makers and other health authorities is mentioned by many as the key issue to ensure that the health care system is capable of adequately ensuring early and correct testing for GDM. This aspect will be further explored in section 3.4.1. Creating awareness has been the main strategy for many of the projects in order to address some of the challenges related to the demand side. The issue of awareness will be described in more details in section 3.4.2, but in short awareness raising has been focused on both informing the woman as well as her relatives about the importance of being tested. As to the latter group, in the Indian context the sensitisation has very much focused on the implications for the child. In addition to this, many of the respondents had noticed that when confronted with the information on GDM, most women were highly motivated to follow the instructions given and seek testing for GDM because they, in general, want to be healthy mothers and do what is good for their child. However, one thing is to sensitise and motivate the women, ensuring that they have the opportunity to go for the testing is another. The challenge of transportation to/from the health centre is one example of how the women’s opportunity to seek testing can be hampered. One of the projects, the one in Karnataka, India (08-381), has occasionally tried out solutions to address this issue among the tribal population in the project area.

“For the tribal women we developed a model where a health worker would collect all these women in one particular hamlet and escort them by bus to the hospital or sometimes they were even brought by our hospital van. So their entire antenatal care work up was completed, including the GCT screening and also an ultrasound scan and they were brought back home. With this we were able to reach I think about 70 to 80 tribal women, and nearly 80% of these women were visiting the hospital for the first time”.

Dr. Sridevi Seetharam, 08-381 Karnataka, India

Although this may not be feasible in all contexts, inclusion of transportation services in the antenatal care services is an example of how thinking out-of-the-box can create a situation where the women not only become aware of the importance of attending antenatal care, but are also given the opportunity to do so.

A final strategy to increase the uptake for GDM screening was provided by the respondent from Kenya (09-436) and is concerned about linking GDM testing with other services which the pregnant women are already exposed to or demanding, for instance, prevention of maternal and child transmission of HIV. Making GDM an integrated part of an „antenatal care package” could potentially increase demand among those women already prone to attend antenatal care.

3.3. Treatment and care for GDM

As was also the case for detection of GDM nine of the projects have listed provision of treatment and care as an integrated component of their project. Three different regimens are employed, namely diet, exercise and pharmaceuticals, typically insulin. Of the three, diet or
meal plan is by far the most widely regimen applied by the nine projects. Thus, when a woman is first diagnosed with GDM she is initially put on a diet in all nine projects. Five of the projects (04-067, 07-278, 08-381, 09-436, 10-517) also recommend that the woman combines the diet with exercise. One to two weeks after her blood glucose is assessed and, if still above targeted levels, insulin is prescribed. Not all projects have come sufficiently far in their implementation to have analysed data, but among those, who have, the proportion of women with GDM, who require insulin, varies from 5% in Cameroon and Tamil Nadu, India, to 30-40% in two of the Indian projects (see table 8). Yet, sample size, i.e. the number of women with GDM, differs substantially wherefore some of the figures should be interpreted with caution. The proportion of women requiring medical treatment may also vary depending on the diagnostic cut off – when the cut off value is high obviously the glucose intolerance is more serious and cannot be controlled by diet and physical activity.

Table 8 Overview of women with GDM and proportion treated with insulin

<table>
<thead>
<tr>
<th>WDF Project number</th>
<th>Country</th>
<th>% of women with GDM treated with insulin</th>
<th>Total number of women with GDM treated</th>
</tr>
</thead>
<tbody>
<tr>
<td>04-067</td>
<td>India, Tamil Nadu</td>
<td>5%</td>
<td>1,679</td>
</tr>
<tr>
<td>06-196</td>
<td>Cuba</td>
<td>Around 25%</td>
<td>2,747</td>
</tr>
<tr>
<td>07-278</td>
<td>Cameroon</td>
<td>max 5%</td>
<td>381</td>
</tr>
<tr>
<td>08-312</td>
<td>India, Tamil Nadu</td>
<td>10%</td>
<td>1,538</td>
</tr>
<tr>
<td>08-381</td>
<td>India, Karnataka</td>
<td>Around 30%</td>
<td>20</td>
</tr>
<tr>
<td>10-517</td>
<td>China</td>
<td>20-25%</td>
<td>3,230</td>
</tr>
<tr>
<td>10-551</td>
<td>India, Punjab</td>
<td>40% (just begun)</td>
<td>85</td>
</tr>
</tbody>
</table>

Patient education or counselling is also part of the services offered by the health care centres in relation to GDM. Four different target groups for patient education are identified in the data collected for this review, namely all women attending antenatal care, women at high risk for GDM and/or type 2 diabetes but whose blood glucose is currently normal, women diagnosed with GDM, and family members of women with GDM. All projects offer counselling to women diagnosed with GDM and most also conduct some level of education for all women attending antenatal care. Only the project in China (10-517) and the project in Cameroon (07-278) are in addition hereto giving specific attention to those with risk factors, but currently normal blood glucose levels, whereas at least six of the projects (04-067, 06-196, 08-312, 08-381, 09-417, 10-517) provide education to the family members of women diagnosed with GDM. The message given differs to some extent depending on the target group. Table 9 provides collected overview of the different messages and aspects, which are disseminated and covered in the education and counselling of the four target groups. Before their GDM or their risk of GDM and type 2 diabetes are detected women with GDM and women at high-risk for GDM and type 2 diabetes are part of the group of women attending antenatal care and they are therefore also exposed to the messages and aspects listed in the first column.
Table 9  Overview of information related to GDM given to various groups

<table>
<thead>
<tr>
<th>All women attending antenatal care</th>
<th>Women at high-risk for GDM</th>
<th>Women with GDM</th>
<th>Family members of women with GDM</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Diet</td>
<td>• Good blood glucose control can change the maternal and infant health</td>
<td>• Insulin</td>
<td>• Prevention and control aspects of GDM and diabetes in general</td>
</tr>
<tr>
<td>• Exercise</td>
<td></td>
<td>• Diet</td>
<td></td>
</tr>
<tr>
<td>• Ideal body weight.</td>
<td></td>
<td>• Exercise</td>
<td>• The importance of good control of GDM including benefits to mother and child</td>
</tr>
<tr>
<td>• Lifestyle modifications in general</td>
<td></td>
<td>• The importance of good control of GDM including benefits to mother and child</td>
<td></td>
</tr>
<tr>
<td>• GDM in general</td>
<td></td>
<td>• Assessment of blood sugar levels</td>
<td></td>
</tr>
<tr>
<td>• Risk factors for GDM</td>
<td></td>
<td>• Importance of followup during pregnancy, delivery and postpartum</td>
<td></td>
</tr>
<tr>
<td>• Consequences of uncontrolled GDM, including adverse pregnancy outcomes, risk of type 2 diabetes and obesity</td>
<td></td>
<td>• How to deal with diabetes while travelling or fasting</td>
<td></td>
</tr>
<tr>
<td>• Importance of early detection of GDM and that screening should be done in 24-28 weeks of gestation</td>
<td></td>
<td>• Hypoglycaemia</td>
<td></td>
</tr>
<tr>
<td>• Must be screened because it is good for the woman and her child – one test can save two lives</td>
<td></td>
<td>• Early signs and symptoms of complications</td>
<td></td>
</tr>
<tr>
<td>• Prevention and treatment of GDM</td>
<td></td>
<td>• Utilisation of health services</td>
<td></td>
</tr>
<tr>
<td>• General prevention of T2DM</td>
<td></td>
<td>• Social support in groups</td>
<td></td>
</tr>
<tr>
<td>• Importance of getting antenatal care check-ups early</td>
<td></td>
<td></td>
<td>• Importance of follow-up during pregnancy, delivery and postpartum</td>
</tr>
<tr>
<td>• Importance of getting at least 3 antenatal care check-ups</td>
<td></td>
<td></td>
<td>• Importance of antenatal care</td>
</tr>
<tr>
<td>• Utilisation of health services</td>
<td></td>
<td></td>
<td>• Safe motherhoo d</td>
</tr>
<tr>
<td>• Nutrition in pregnancy</td>
<td></td>
<td></td>
<td>• The family’s role</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Some projects (04-067, 08-312, 08-381) have trained doctors and otherwise strengthened the antenatal care services at primary level to monitor and manage women with GDM. Others are implementing referral structures so that women detected at primary health care level are referred to more specialised health facilities (06-196, 06-207, 09-436, 10-517). In the project in Cameroon (07-278) the women are referred to a district medical officer if treatment targets are not achieved within one week.

Most of the projects reported that the women are seen once every second week according to the protocol. The project in Cuba (06-196) monitors the women on a daily basis whereas the project in China (10-517) admits women with GDM requiring insulin. When the time of delivery is approaching some of the projects intensify the monitoring. More specifically, the project in Karnataka, India (08-381), increases the frequency of monitoring visits from one visit every second week to one per week. In Cuba, women in need of insulin are admitted eight weeks before the expected date of delivery and also in Cameroon (07-278) and Punjab, India, (10-551) are the women closely monitored at the time of delivery.

The different treatment targets used by the projects are shown in table 10. Some of the projects aim for glucose level targets measured in plasma whereas others indicate their targets for whole blood glucose. As mentioned earlier, a conversion is needed to compare measurements from whole blood and blood plasma. Nevertheless, the targets used differ quite substantially, and it seems that at present there is no consensus on which targets to aim for. The lack of uniformity in the employed treatment targets may be a reflection of the lack of standardisation at an international level. Hence, in table 11, the treatment targets recommended by some of the international or internationally acclaimed organisations are depicted. However, even though standardisation is lacking there are some general notions that recur, including fasting levels between 90 and 100 mg/dl and 1 and 2 hour postprandial thresholds of 140 mg/dl and 120 mg/dl, respectively.
<table>
<thead>
<tr>
<th>WDF Project number</th>
<th>Treatment targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>04-067</td>
<td><strong>Plasma glucose</strong> Fasting &lt; 90 mg/dl (5.0 mmol/l) 2 h postprandial &lt; 120 mg/dl (6.7 mmol/l)</td>
</tr>
<tr>
<td>06-196</td>
<td><strong>Plasma glucose</strong> Fasting &lt; 94 mg/dl (5.2 mmol/l) 2 h postprandial &lt; 114 mg/dl (6.3 mmol/l) Mean value &lt; 90 mg/dl (5.0 mmol/l)</td>
</tr>
<tr>
<td>06-207</td>
<td><strong>Plasma glucose</strong> Fasting &lt; 110 mg/dl (6.1 mmol/l) Postprandial &lt; 140 mg/dl (7.8 mmol/l) OR <strong>Whole blood glucose</strong> Fasting &lt; 100 mg/dl (5.6 mmol/l) Postprandial &lt; 130 mg/dl (7.2 mmol/l) OR HBA1C &lt; 6.5%</td>
</tr>
<tr>
<td>07-278</td>
<td><strong>Whole blood glucose</strong> Fasting &lt; 90-100 mg/dl (5.0-5.6 mmol/l) Postprandial &lt; 140 mg/dl (7.8 mmol/l)</td>
</tr>
<tr>
<td>08-312</td>
<td><strong>Plasma glucose</strong> Fasting &lt; 90 mg/dl (5.0 mmol/l) 2 h postprandial &lt; 120 mg/dl (6.7 mmol/l)</td>
</tr>
<tr>
<td>08-381</td>
<td><strong>Plasma glucose</strong> Fasting glucose &lt; 96 mg/dl (5.3 mmol/l)</td>
</tr>
<tr>
<td>09-436</td>
<td><strong>Whole blood glucose</strong> Preprandial: 63-99 mg/dl (3.5-5.5 mmol/l) 2 h postprandial: 90-120 mg/dl (5.0-6.7 mmol/l)</td>
</tr>
<tr>
<td>10-517</td>
<td><strong>Whole blood glucose</strong> Fasting &lt; 96 mg/dl (5.3 mmol/l) <strong>Plasma glucose</strong> 2-h postprandial &lt; 120 mg/dl (6.7 mmol/l)</td>
</tr>
<tr>
<td>10-551</td>
<td><strong>Plasma glucose</strong> Fasting &lt; 100 mg/dl (5.6 mmol/l) Post lunch/prandial &lt; 140 mg/dl (7.8 mmol/l)</td>
</tr>
</tbody>
</table>
Table 11 Overview of recommended treatment targets

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Treatment targets</th>
</tr>
</thead>
</table>
| Fifth International Workshop-Conference on GDM 2007 (33) | Whole blood glucose  
Fasting < 96 mg/dl (5.3 mmol/l)  
1 h postprandial < 140 mg/dl (7.8 mmol/l)  
2 h postprandial < 120 mg/dl (6.7 mmol/l) |
| The National Institute for Health and Clinical Excellence (NICE) 2008 (34) | Whole blood glucose  
Fasting: 63-106 mg/dl (3.5-5.9 mmol/l)  
1 h postprandial < 140 mg/dl (7.8 mmol/l) |
| Canadian Diabetes Association 2008 (49) | Plasma glucose  
Fasting and preprandial: 68-94 mg/dl (3.8-5.2 mmol/l)  
1 h postprandial: 99-139 mg/dl (5.5-7.7 mmol/l)  
2 h postprandial: 90-119 mg/dl (5.0-6.6 mmol/l) |

After delivery most women with GDM will have a normal glucose regulation, however, some will have overt diabetes, impaired fasting glucose or impaired glucose tolerance. To be able to detect these women and ensure that their treatment is continued, it is generally recommended that women with GDM are screened for diabetes around six weeks postpartum (34;49;50). All the projects that are active in provision of care to women with GDM include postpartum screening for diabetes in their service delivery. For three of the projects (04-067, 08-381, 10-551) details on the follow-up are available, which indicate that in addition to the screening approximately six weeks after delivery, screening is also conducted six months and one year after delivery. However, although many partners reported that the women are highly motivated for treatment while pregnant; all but the project in Kenya (09-436) reported difficulties in following the women postpartum.

“Once they have delivered only 20-25% of women are coming back to us. This is my regular experience.”

Dr. Geeti Arora 10-551 Punjab, India

The reasons for these difficulties and proposed solutions will be addressed in the following section.

3.3.1. Barriers to treatment and follow-up

As was the case in the section on barriers and challenges related to early detection of GDM the barriers related to treatment and follow-up can generally also be divided into barriers within the health system and those pertaining to societal and individual issues.

The issue of not having the infrastructure in place, including the shortage of trained health care providers, is not only impacting on the detection of GDM, but also on the treatment. Especially for those women who require insulin management this can be problematic as some respondents reported that the health care providers in general are not sufficiently trained to be confident in prescribing insulin.
“Our health care personnel in the country are still afraid of insulin. They still try to stay far away from insulin, so when they reach a stage where they have to prescribe insulin it becomes a problem. Only few doctors for example would be used to prescribe insulin.”

Dr. Eugene Sobngwi, 07-278 Cameroon

Having health care providers, who are not adequately trained and feel uncomfortable with prescribing insulin to women with GDM, who require such treatment, can greatly hamper efforts to normalise the woman’s glucose levels and thus have severe consequences for the health of the mother and child. As mentioned above, some of the projects immediately refer the women to specialised clinics and these projects do not report any problems of this kind. However, these projects may on the other hand experience problems with the women being unable to access the services. The respondent from China (10-517) also noted problems with the knowledge among health care providers on proper diet and meal plans for women with GDM.

“In some hospitals it is very difficult to manage GDM even when we diagnose the patient early, because we do not have enough dieticians.”

Prof. Huixia Yang, 10-517 China

Hence, not only among the 5-40% who needs insulin can the treatment be problematic even the basic treatment of GDM – diet – can pose a challenge when there is no dietician or other staff who are trained on diet counselling related to GDM.

Another issue is the cost of treatment, i.e. whether a service-fee for treatment is charged or not. In the projects from Tamil Nadu, India (04-067 & 08-312), and the project in Cuba (06-196) treatment services are offered free of cost to women with GDM. In Cameroon (07-278), Kenya (09-436) and Punjab, India (10-551), a fee is charged for the treatment and the fee is the same for all women with GDM. Contrary to this the project in China (10-517) utilises a variable payment scheme where the poorest are charged a lesser fee than those with average or high income. The project in Karnataka, India (08-381), also employs a variable payment scheme, however, here the poorest are not charged at all, but those who can afford to pay the full fee or partial payment are charged accordingly. Information on the cost of insulin is provided by three projects. In Cuba (06-196) and Kenya (09-436) insulin is provided at subsidised rates to make it affordable to most women whereas insulin in the project in Sudan (06-207) is provided free of charge to those women, who are covered by a health insurance scheme. Moreover, although not provided within the actual health system as such the cost of following the recommended diet can also be a challenge.

“The other obstacle will always be whether changing a diet is economically feasible. I think we should really pay a lot of attention to that when we are dealing with GDM.”

Dr. Manuel Carballo, 09-417 Jamaica and Panama

In addition, one of the respondents from India noted that although services within the government health care system may be offered free of charge or at subsidised rates, the lack of trained health care providers in reality sometimes leaves women with GDM with no other choice than to seek out care at private health facilities with considerable higher service
charges. Yet, this option is not possible for women with GDM belonging to the poorer segments of society and their GDM will consequently most likely go untreated, if detected at all. Thus, the cost of the treatment regimens as well as fee for services, i.e. consultations and tests, may in some contexts constitute a barrier towards ensuring proper treatment.

One thing is the provision of the specific treatment regimens, another is the regular monitoring of the woman’s glucose levels and consequential modification of treatment. In other words, the continuous follow-up of the women before, during and after delivery. Again, lack of training of health care providers to ensure that they are aware of the importance of continuous follow-up was mentioned.

Another issue mentioned is associated with referral systems and feedback-mechanisms and pertains to the projects where treatment is not conducted at the primary health care level but at more specialised clinics. Here, women, who are referred to other clinics for care, may be lost between the referring and the reference health facility, if neither of the two follows up on whether she actually attends the latter institution. In addition, because there are no feedback mechanisms, the health care providers at the primary health care level also risk loosing touch with the benefits of managing GDM and therefore might consider it less important to refer the women for specialised care, or if unwilling to deal with GDM, may refer all cases to specialist centres.

As was the case for detection of GDM, societal and individual aspects also play a role in ensuring proper treatment and follow-up of women with GDM. Just as transportation to the health centre, both in terms of the cost and the distance posed a challenge to early detection, it remains a huge barrier for ensuring proper treatment and follow-up. This may in fact be an even greater challenge for treatment and follow-up as the women are required to report for follow up approximately every second week.

“I think it was mainly because they didn’t have extra money to come for another visit to the hospital because it can be challenging for some of those women just to afford coming to the hospital for one antenatal care visit.”

Dr. Eugene Sobngwi, 07-278 Cameroon

Moreover, from the interviews, it is also evident that in some countries there are certain cultural issues which can hamper treatment of GDM. First of all, related to diet, some respondents reported on local perceptions of what the ideal body size of woman is, and that this is typically not very conducive to motivating a woman to go on a strict diet and/or loose weight.

“In Jamaica for example the ideal body size is big… So when you are dealing with people who have a body image which means that being large and heavy is quite acceptable and maybe even attractive then it is very difficult to try and get people to change their diet.”

Dr. Manuel Carballo, 09-417 Jamaica and Panama

The issue of diet or loosing weight during pregnancy may be particularly sensitive in some areas.
“People are not comfortable about the idea of not gaining enough weight during pregnancy. They just feel it means you are sick, that you have some sort of disease. So they would want to put on some weight during pregnancy, and when I say „some weight“ the understanding of „putting on some weight“ can vary a lot. So the idea of putting on weight during pregnancy is something important to them. In urban areas it won’t be the same, but in semi-urban and rural areas they are not even expected to lose weight after giving birth so they are sometimes overfed by the family after delivery just to keep as big as they were doing pregnancy.”

Dr. Eugene Sobngwi, 07-278 Cameroon

Notions like these are not only problematic for treatment of GDM, but also for the postpartum prevention of future onset of type 2 diabetes. Other aspects related to diet were also brought forward. For instance, the respondent from Karnataka, India (08-381), noted that in India it is a custom to encourage pregnant women to eat sweets and certain snacks, and people would bring such things when they visit. Thus, being on a strict diet where such things are banned can be a damper on the celebrations of the pregnancy and child birth within the family and motivation to follow the diet may be lost.

Yet, other notions in society were also mentioned, including that it would not always be considered appropriate for a woman in India to have special low-calorie food for herself as she is expected to eat the same as the rest of the family and not attract much attention to herself and her needs. The respondent from Cameroon (07-278) raised the issue of people only eating few times a day, but then in return eating very large portions as an obstacle for compliance to meal plans. The respondent added that this practice was mainly due to the arrangements of the working hours in the country and that most people would not have a lunch break, but only eat in the morning and then again when coming back home in the late afternoon or early evening.

Barriers related to physical activity were not mentioned, however this does not necessarily mean that no such barriers exist but more likely reflect that only half of the projects are recommending it - and even then it is not the main treatment regimen. Difficulties related to insulin were on the other hand brought forward, for instance myths related to the effects of insulin.

“When we talk about insulin they just run away from us... Some people come back and they will want to know more about it, but they just want us to treat them with diet control or they will keep their sugar high, because for them insulin is a big thing. They don’t want to purchase insulin. There are myths here: that insulin will destroy the tissue, that it will damage them, that it will last or that the mother will die or something will happen to the child. So there are also myths and wrong notions which have to be clarified while treating a GDM mother.”

Dr. Geeti Arora, 10-551 Punjab, India

Thus, cultural perceptions about the various treatment regimens may be counterproductive to ensuring treatment of GDM and will have to be addressed in order to ensure compliance to treatment.
Moreover, some of the same cultural notions about women and the importance of their health, which were described as impacting the detection of GDM, are also influencing the woman’s access to the treatment regimens. Sometime the family may not consider her health to be important enough to spend the extra money on a certain diet or insulin and, in some areas, it can therefore be difficult to ensure proper treatment because the woman’s family and herself do not place sufficient emphasis on her health to properly comply with it. This may especially be the case after delivery as the health of the woman is no longer seen as influencing the health of the baby.

“When they are pregnant they know that whatever is happening to them is going to directly reflect on the child, so they want all the tests and everything done that benefits the child...But once she delivers the child is a different person now. It is away from her body, and she doesn’t believe that taking care of herself is going to benefit her child anymore. She will do anything for her child again, but not for herself. Now she is viewing them as a separate entity and that is why she is not motivated to do anything for herself.”

Dr. Madhuri S. Balaji, 04-067 & 08-312 Tamil Nadu, India

The regular follow-up of women diagnosed with GDM is also influenced by cultural perceptions or local customs. This can be particularly challenging and may help explaining why the vast majority of the projects have difficulties in ensuring good follow-up. Hence, some respondents noted that in their area, women tend to move to the home of their mother before delivery, and as that can be somewhat far away and perhaps in the coverage area of another health centre, the health care provider, who has been monitoring her blood glucose, is unable to follow her for the period just before, during and subsequently after delivery. If the pregnant woman does not seek out health care at a health centre near her maternal home, or the health care providers at this health centre are not trained on GDM, this move can be problematic.

Another common issue that influences the postpartum follow-up is that some women do not see the point in continuing the follow-up as the pregnancy is over and they are feeling fine and are now preoccupied with other things.

“I think for many women they don’t understand what advantages there might be to continue to come in or be seen by somebody. I mean, the baby is born and they are back to work or on to another pregnancy or whatever it is, but they don’t necessarily understand the advantage or the benefits of follow-up.”

Dr. Manuel Carballo, 09-417 Jamaica and Panama

Some of the respondents elaborated further on the issue of time, noting that while some women receive extra help from family members during pregnancy, this often ends once the baby has been born.

“They get busy with taking care of the child and then they have to get back to their routine household responsibilities so they could miss up on follow-up visits. Usually during pregnancy, at least in some families, she would be taken off a lot of physical chores. She
would probably get more attention and things like that. After that, generally the child care
takes more importance and her follow-up visits could easily get neglected.”
  Dr. Sridevi Seetharam, 08-381 Karnataka, India

Time therefore becomes an issue which for some women can be difficult to find enough of to
spend on postpartum follow-up visits, especially if one feels fine or otherwise do not really
see the benefits of such follow-up services.

Another aspect noted by the respondent from Punjab, India (10-551), is that the women
might fear the consequences if they are diagnosed with overt diabetes. Just as some women
would fear the consequence of being diagnosed with GDM, a diagnosis of overt diabetes
can be devastating for her in financial, emotional and social terms. As a result, some women
will refrain themselves from going for follow-up, or some will only do it on the condition that
the husband or in-laws are not informed accordingly.

3.3.2. Solutions and opportunities to ensuring proper treatment and follow-up

Many of the project partners have taken different steps to improve the treatment and follow-
up by addressing some of these challenges. These efforts are accounted for in the following
and include both initiatives targeting the health system as well as the community.

The project in China (10-517), for instance, reported that they have tried to solve the lack of
dieticians by training doctors and nurses on diet counselling and developing nutrition books
for patients which are easily understandable and display how the patient can make healthy
meals every day. The issue of health care providers’ reluctance to prescribe insulin has also
been addressed by some of the projects through training and so has the issue of regular
follow-up.

“After the training programme, more and more doctors think that „we should do the follow-up
of the GDM patients even after delivery“ because women with GDM will be back with type 2
diabetes in the future and also the babies of the GDM mothers will develop diabetes in the
future. So after we had the training programme for the doctors they would like to do the
follow-up for the GDM patients.”

  Prof. Huixia Yang, 10-517 China

Through enhanced emphasis on the importance of follow-up in relation to the long-term
implications for the mother and child, some respondents reported that health care providers
are paying more attention to it. Likewise, the need for follow-up is also stressed by many
projects in patient education sessions. One respondent from India (10-551) noted that it may
be necessary to conduct separate education sessions for the woman and her family in order
to really emphasise the importance of adherence to treatment, including insulin, and regular
monitoring through follow-up visits.

Other projects have focused more on ensuring that women with GDM will have their blood
sugar monitored, etc, - even if they do not attend the antenatal care clinic offering GDM
services, but seek out health services at other centres - e.g. because they have migrated to
their maternal home. The project in Cuba (06-196) seeks to involve the family doctor through
follow-up measures if the women do not return to the GDM clinics. The project in Karnataka, India (08-381) is planning to introduce a follow-up card, where the procedures that should be undertaken during a follow-up visit, are listed. A woman with GDM that has migrated can then present this card to the health care provider in the area to which she has moved, and he or she can then ensure that the procedure is followed - an approach which is also suggested by the respondent from the multi-state project in India (10-500). This approach of course requires that the health care providers are trained to conduct the procedures and interpret the results. Other projects, including the one in Cameroon (07-278) and the one in Punjab, India (10-551), have made a GDM registry where they among other things have registered the women’s home address and mobile phone numbers. None of the projects have attempted to for example remind the women about follow-up visits via SMS; however, both respondents foresee that this might also be a means to improve follow-up in the future.

Some projects, including the Kenyan project (09-436), which reported that they had no significant problems with follow-up, are utilising the fact that many women return to the primary health centre to have their child immunised as a way of following up women with GDM postpartum. The projects that have employed this approach reported that it was their impression that it had improved postpartum follow-up.

“The best way to target them is on immunization day, because they are going to come back on immunisation day with the child. However, again there is one more point: it is not necessarily the mother that brings the child for the immunization. It can be the grandparent or somebody else.”

Dr. Madhuri S. Balaji, 04-067 & 08-312 Tamil Nadu, India

Thus, coupling postpartum GDM follow-up with infant immunisation should therefore not be considered a magic bullet. Nonetheless, together with other initiatives making this linkage may improve the uptake. However, if one really wants to address the barriers in the health care system, the government and/or health authorities have to be involved.

“The message has to be conveyed to the government policies also because they are the ones who are actually delivering services”

Dr. Geeti Arora, 10-551 Punjab, India

Moreover, not all barriers to treatment and follow-up can necessarily be addressed within the health system, wherefore many projects are also targeting the community, especially pregnant women and their family, in their efforts to address these barriers.

One approach may be the implementation of outreach activities to raise awareness of the importance of follow-up, and also to conduct the follow-up in the community e.g. at the woman’s home. Although, at an initial stage, many of the respondents reported that they consider or attempt to see how community health workers or village nurses could be trained and equipped to monitor the blood glucose levels of women with GDM and provide counselling and information on referral, if necessary.
"The answer we have found consistently is to develop out-reach worker capacity. Get people who can go and visit mothers rather than wait for mothers to come into clinics."

Dr. Manuel Carballo, 09-417 Jamaica and Panama

Finally, in India policy initiatives have been taken at state level to improve antenatal care attendance and pregnancy outcomes, which can also have a positive impact on GDM follow-up. Hence, some of the respondents from India noted that their state governments have already, or are considering, introducing financial incentives. Such incentives include schemes where women delivering at formal health institutions receive a certain amount of money. Policy initiatives may thus also be a means to improve treatment and follow-up. Efforts taken by the projects included in this review to influence policy-making and awareness creation will be described in the following section.

3.4. Creating awareness and influencing decision-making

Most of the projects are involved in activities aimed at raising awareness and eventually influence decision-making. Some activities are focused on ensuring that the supply side is in order, i.e. that the health care services related to GDM are available and of sufficient quality. Other activities are aimed at generating demand for these services.

3.4.1. Ensuring supply
At least six of the projects (04-067, 06-207, 08-381, 09-417, 10-500 and 10-551) are involved in activities that aim to influence the decision-making of politicians and health authorities and subsequently improve the supply of GDM related services. In addition, other projects have perhaps not defined it as a distinct activity, but are nonetheless collaborating with decision-makers - typically health authorities - regularly informing them and taking their views on various matters into consideration. The objective of these efforts is mainly to either ensure support for one’s own project, e.g. granting of permission to train government employed health care providers, and/or to influence decision-makers to include GDM related services as part of routine antenatal care provision. Accordingly the main target group is national, state and district level politicians as well as health authorities such as officials in the ministries of health or district health departments. Two of the Indian projects (08-381, 10-500), which are involved in community-based activities, are at the same time also targeting community leaders. The activities conducted mainly include formal and informal meetings and workshops, but also comprise active involvement of the mass media, e.g. through publication of articles in newspapers.

In general, most respondents involved in this field reported that they are receiving good support from the politicians and health authorities and some are reporting on positive outcomes of these efforts. Following the first project in Tamil Nadu, India (04-067), the state government of Tamil Nadu e.g. issued a government order for universal screening for GDM. Two of the other projects in India (10-500, 10-551) likewise reported that governments in Punjab and New Delhi have also announced that efforts will be commenced to make GDM part of routine antenatal care services. The respondent from the project in Jamaica and Panama (09-417) in turn noted that officials are now talking more openly about the problem.
Yet challenges in terms of mustering support from decision-makers and authorities were also revealed in the data. For instance many respondents reported that it could be difficult to really get the attention of these people due to competing priorities and other diseases which are perceived to need more urgent attention.

“The reality is that a lot of the countries in which we will have to go on and collectively promote GDM are countries with all sorts of other maternal and child, antenatal or reproductive health care problems that are still not being faced either”

Dr. Manuel Carballo, 09-417 Jamaica and Panama

The respondent from Tamil Nadu, India (04-067 & 08-312) noted that some decision-makers and officials may, moreover, be afraid that they will be put in the pillory if they support the project and something goes wrong. In this instance it may be easier and more convenient not to display support.

“If I sign it off and say „not applicable“ or I do not want this project nobody is going to ask me why, because for „no“ and „not giving permission“ there is no explanation needed”.

Dr. Madhuri S. Balaji, 04-067 & 08-312 Tamil Nadu, India

Thus, if decision-makers and officials are only gauged by the initiatives they commence and support, and not so much on not doing anything and if they are uncertain about the benefits of addressing GDM, this can be a barrier in securing their support. Finally, just because initial support for GDM, e.g. in the form of a policy instrument, has been granted it does not necessarily mean that the supply side of GDM related health services is well-functioning.

“It is two things announcing anything and implementing anything – issuing a circular and implementing on the ground. So now we think that the second part of this intervention will be to make the implementation effectively down the line”.

Mr. Anand Madhab, 10-500 India

Hence, support and commitment has to be ensured all through and beyond the implementation to ensure a sustainable supply of GDM services in the health care system.

The respondents also brought forward a number of approaches to overcome these barriers and ensure sufficient support from decision-makers and health authorities. Two of the partners from India (04-067 & 08-312, 10-551) emphasised the importance of being well-connected and nurturing one’s relationship with these people. Down this line, it was also mentioned that it is important to be extra meticulous in the planning and implementation to ensure that the supporting decision-makers and officials could not be blamed for anything bad, and the respondent from Karnataka, India (08-381) stressed the significance of involving these people as early on in the process as possible - a strategy which was supported by the respondent from Cameroon (07-278).

“The good strategy is to right from the beginning plan with the health authorities. They should not be surprised by what you bring to them. You should plan. Even if it is not in a formal way, at least informal discussion should be held with all the key people in the
Some respondents mentioned that they are trying to address the barriers by using their project as an example of how GDM can be addressed and showcasing the impact on adverse pregnancy outcomes. In this regard, two of the respondents (09-417, 10-551) also emphasised the importance of showing how cost-effective it is to address GDM. In addition, the respondents from the projects in Kenya (09-436) and Jamaica and Panama (09-417) noted the possibility of placing GDM in the larger context of the Millennium Development Goals when trying to convince decision-makers about the importance of addressing GDM.

Other approaches related more to joining hands with other stakeholders, e.g. professional associations for obstetricians and gynaecologists, to be able to speak with a stronger voice and to have their support in other phases of the project as well. A couple of respondents also emphasised the important role which mass media could play in shaping decision-making through demand generation.

### 3.4.2. Generating demand

Many of the projects are also engaged in demand-generating awareness activities, targeting women of reproductive age, their families and/or the general population to augment the likelihood that pregnant women will seek out and request GDM related health services. Mass media, such as TV, radio and newspapers, are utilised by most of the projects (06-196, 06-207, 07-278, 09-417, 10-500, 10-517, 10-551) whereas activities in the community, such as street plays and village meetings, are conducted by two of the Indian projects (08-381, 10-500) and the project in Jamaica and Panama. Some projects (04-067, 07-278, 08-312, 08-381, 09-417) link their awareness generating activities with their patient education activities making the two indistinct. The message conveyed by the awareness raising activities focus mainly on the importance of being tested for GDM, including the risk associated with non-detected and non-treated GDM. Two of the Indian projects (10-500, 10-551) are collaborating on raising awareness in Punjab, India, and are therefore imparting the same message, namely that „one test can save two lives“. Some projects include information about the treatment, especially lifestyle modification, and why postpartum follow-up is necessary. The projects in Karnataka, India (08-381) and Jamaica and Panama (09-417) also stress the importance of social support to pregnant women from their family and community.

When probed about which means of communication they find to be most effective in raising awareness, the responses vary substantially. Hence, three of the projects (06-196, 07-278, 10-517) replied that movies and health related programmes on TV had been most effective whereas others reported that dissemination of the message through health care providers and health workers was most effective. Particularly, as interpersonal communication not only raise awareness, but also has a positive behavioural impact. However, whether the activities conducted raised the level of awareness and induced a behavioural change is not possible to assess based on the data collected for this review.
Few barriers towards generating demand were identified in the data, and these pertained mainly to operational challenges such as it being time consuming to develop the awareness materials, language barriers in multilingual areas, problems with reaching remote areas because of bad roads and unexpected cancellations from external collaborators.

3.4.3. Addressing both sides

Most of the projects have sought to address both the supply and demand side for GDM related health services, however, they have not all addressed both sides concurrently, nor with similar endeavours. Nonetheless, a key message conveyed by many of the respondents is that one side cannot be addressed without the other being in place, or better yet: is being addressed simultaneously.

“The awareness generation will generate demand but if there is no infrastructure support to respond to the demand the programme will fall flat, so both should go hand in hand – awareness generation and strengthening the infrastructure to support testing”.

Dr. Sridevi Seetharam, 08-381 Karnataka, India

“If we want to call people to get screened for GDM and we don’t have treatment for them I think it is not very good for us, because what is the sense in getting to know you have a disease and yet you cannot access the treatment for that?”.

Dr. William Maina, 09-436 Kenya

Addressing the supply side without addressing the demand side will, in areas where awareness is low and attendance for antenatal care likewise, most likely be inefficient in addressing the GDM problem. Addressing the demand side without having the supply side in place and thus not being able to offer testing and treatment is on the other hand unethical. Consequently, according to most respondents both sides should be assessed and addressed, if necessary, in projects focusing on GDM.

3.5. Summary of findings

This review of 11 WDF supported projects related to GDM has described the main components of the projects, showcased variations and commonalities in the projects’ approaches, highlighted lessons learned and identified barriers and challenges for early detection and proper treatment of GDM.

Ensuring the existence of basic infrastructure in the health system was part of many of the projects. Efforts include development of protocols on GDM diagnosis and management, training of health care providers and strengthening or establishment of clinics to focus on GDM through procurement of equipment and consumables. In general, the respondents reported that health care providers in their given area have been very receptive to the objectives of the project interventions. Factors identified which could help improve the health care providers’ reception of the project include good personal relations between health care providers and project team, making it convenient for the health care providers to carry out the work and securing support from their superiors. Reasons provided for poor reception
include competing priorities, lack of time, not seeing the point in engaging in the work and not having the needed equipment, consumables and support from one’s superiors.

The majority of the projects engaged in screening activities, but the approaches employed by the individual projects differ in terms of the application of screening procedure and diagnostic criteria and in terms of whether all pregnant women are tested or only those with GDM risk factors. Reasons given by the respondents for selecting the given approach include recommendations from international or internationally acclaimed organisations and associations, allowing for comparability of results, approach already used in the country/area, feasibility of test, cost-effectiveness and validity in the local contexts. Likewise, the prevalence rates identified by the projects also offer great variation, which may be due to the differences in diagnostic criteria and prevalence of risk factors such as ethnicity, maternal age and place of residence. Most of the projects reported that they aim to test women for GDM between 24th and 28th weeks of gestation, but at the same time most projects also reported difficulties in achieving the aim in practice.

A number of barriers to early detection of GDM were identified. These can, in general, be divided into barriers related to the health system and those related to more socio-economic, social and psychological aspects and include the basic infrastructure of the health system not being in place, which involves lack of trained staff, protocols, equipment and consumables, time consuming tests and requirements for the women to be fasting, women not feeling sick or at risk of GDM, fear of stigmatisation if diagnosed with GDM, the importance being attached to women’s health and decision-making related to women’s health, the cost, the distance traversed and the time spent to get to the health facility and have the test done. The respondents identified different ways of addressing these barriers, including change or adaptation of tests, training of medical and nursing students, ensuring support from decision-makers and health authorities, and linking GDM testing with other services, e.g. prevention of maternal to child transmission of HIV.

Depending on the project, 60-95% of women with GDM do not require insulin, but can reach recommended blood glucose levels with diet alone or in combination with physical activity. In addition to such treatment, all projects offer patient education to women with GDM, many also provide education to all women attending antenatal care and/or the family members of women with GDM. Few pay special attention to women with normal glucose levels, who have risk factors for GDM. The women are typically monitored fortnightly at either the antenatal care clinics or at specialised health institutions, but some projects also intensify monitoring as delivery approaches or insulin is required. The treatment targets used by the projects differ, and consensus seems not to be present neither between the projects, nor in comparison to recommendations from international and internationally acclaimed organisations and associations. The picture is further complicated by some projects indicating treatment targets in whole blood and others in plasma.

Although the projects seek to follow the women postpartum, many reported difficulties in doing so, and a number of barriers which inhibit proper treatment and follow-up were identified. Some of these barriers pertain to the health care system and include lack of basic infrastructure, including lack of trained health care providers and lack of insulin, cost of
treatment, and lack of referral system and feedback mechanisms. Societal and individual issues were also identified as barriers, including perceptions of ideal body weight and weight-gain during pregnancy, local practices such as eating sweets during pregnancy and timing and size of meals, importance of women’s health, whether it is considered appropriate for a pregnant woman to have a special diet, myths about insulin, migration, women’s perceptions of their health status, fear of stigmatisation, lack of time and the distance to and cost of going to the health care facility.

Approaches to address some of the above barriers were also reported, including training of health care providers, development of education materials, emphasis on the long-term implications for the mother and child, and the importance of follow-up before health care providers and in the patient education sessions, introducing individual education sessions for women with GDM and their families, development of follow-up- and reminder-systems, linking up with immunisation services and other maternal and child care services, ensuring support from government and/or other health authorities, targeting the community with awareness activities and training of community-based health workers and policy measures such as the introduction of financial incentives.

Most projects have also undertaken activities to raise awareness and influence the decision-making process in order to generate a demand for GDM services and/or ensure that the supply side is in place. Different types of decision-makers have been targeted, including politicians, officials and community leaders. In general, respondents noted that they have received good support from decision-makers and some respondents also reported positive outcomes of their efforts. However, barriers towards obtaining support also exist and include competing priorities with areas which are perceived to be more urgent than GDM, and the reputational risk associated with the engagement of decision-makers if a project they have supported fares badly. Moreover, it is important to note that the supply side of GDM services is not addressed by policies alone, but requires strengthening and support of the basic infrastructure as well. Gaining support from decision-makers was reported to be facilitated by good relations between the project partner and the decision-makers, involving decision-makers from the initial planning phase of the project, being extra meticulous in the planning and implementation, showcasing the outcome of one’s project, advocating for GDM services within the context of the Millennium Development Goals, conveying one’s message through mass media and form alliances with other organisations and associations.

Demand generating activities have targeted women of reproductive health, their families and/or the general population. Mass media, community-based activities and linkages with patient education were reported to be among the main modes of generating demand by the projects. In the data, few barriers towards demand generation were identified.

Finally it was emphasised that it is of the utmost importance that both the demand and supply sides are addressed in order to ensure early detection and proper treatment of GDM.
4. Strengths and limitations of this review

When interpreting the results of this review one must do so in the light of its limitations and strengths. First of all, only WDF-supported projects where GDM constituted a main component of the project were included in this review. Projects where GDM constituted a minor component may have different experiences than the ones identified in this review. Moreover, projects where the Project Partnership Agreement between WDF and the partner had not yet been signed were excluded as it was assessed that these projects were too early in the implementation phase to have gained relevant experience. This may, however, have had the consequence that the newest developments within the field are not adequately considered in this review. In addition, as only WDF-supported projects are included non-WDF supported projects on GDM may likewise have faced different barriers and challenges, particularly related to funding.

In the process of selecting projects for the instant review, the list of projects where GDM is addressed to some extent was shared with WDF programme coordinators to ensure that no projects had been missed out in the screening process - and to validate the categorisation of projects according to the magnitude of the GDM component - and thus the subsequent inclusion in the review.

As WDF only supports projects in developing countries, none of the projects included in this review are from high income countries, and the review is therefore limited in its consideration of cross-income experiences and barriers in ensuring early detection and proper treatment of GDM. The included projects are implemented in eight different countries in Asia, Africa and Latin America and although the findings are limited to low- and middle income countries the review takes into account field experiences from various cultural contexts.

Another aspect to note is that only one of the projects in this review has been completed and that the remaining ten projects are at varying stages of their implementation, hence, some of the respondents only have a few months of experience on which they can base their response. Consequently it can be argued that this impacts their ability to contribute with relevant information. On the other hand, this can also be viewed as enriching the data as it ensures that barriers at all stages of implementation are represented and provides information on the early phases of implementation which may otherwise have been subject to recall bias, i.e. the response is affected by the respondent’s memory, among the respondents at later stages of implementation. The fact that most projects are not completed and data available is limited, it increases uncertainty of the various numbers provided e.g. proportion of women with GDM needing insulin etc and must therefore be interpreted with caution. On the other hand the projects have already screened over 95,000 women and identified almost ten thousand pregnant women and therefore the available experience is no way trivial.

In qualitative research methodology courtesy bias is a common bias. It refers to the tendency for respondents to give answers which they think the interviewer wants to hear. This form of bias may be particularly relevant considering the fact that the interviewer
represented WDF and all respondents have received financial support from WDF. However, to minimise courtesy bias as much as possible, attempts were made to create a good interview environment and it was emphasised that both positive and negative experiences were important to showcase to enhance learning. In the interviews, many of the respondents appeared quite willing to share the challenges they had faced and the errors they had made. Based on the latter assumption it does not seem as if the respondents have tried to conjure up a particular positive image of their project or experiences.

There are other elements in the interviews which might have influenced the validity of the study. For instance, the issue of language barriers as all interviews were conducted in English which is not the native language of most of the respondents nor of the interviewer. On the other hand, the advantage of conducting the interviews in English was that it obviated the need for an interpreter, which might have introduced another bias as the translation is affected by the interpreter’s opinion about the subject. The same problem pertains to the reviewed documents which are likewise written in English.

Reliability of the study was sought enhanced through transparency of methodology, i.e. by being explicit about the chosen research strategy and methodology, for example, by openly displaying the data collection and analysis process. This enables others to test the quality of the theoretical constructs. Transparency was further enhanced through the transcription of the interviews.

Methodological triangulation, i.e. the use of two or more methods to gather data, was used in the study and this not only increases the understanding of the research topic and enriches the description of a certain phenomenon, it also increases the validity of the data and reduces the risk of bias as it enables the cross examination of information. Validity could have been further enhanced if more methods of data collection had been included, or if data had been gathered through several sampling strategies. For example, if focus group discussions with health care providers or women with GDM had been undertaken.

5. Guidance for programmatic interventions

Based on this review, some guidance for future implementers of GDM programmes and projects can be extracted. First of all, and in spite of the aforementioned barriers, the projects in this review have showcased that it is possible to implement a GDM programme that seeks to ensure early detection and timely and proper treatment of GDM among a large population of women. Yet, this does not mean that there is no room for improvements, nor that there are no obstacles – there are, but the experience gained from the projects in this review set examples for future projects to overcome some of these hindrances.

Secondly, as comparable prevalence data is useful for both advocacy and health care planning purposes there is an urgent need to establish screening procedure and diagnostic criteria for GDM which are simple, clearly understandable, feasible and easily used at the point of care. In other words we need to move away from grand academic discussion
focusing purely on sensitivity and specificity to what can actually be done at the basic care level. Similarly, guidelines on what constitutes good control and care, which are feasible on the ground and possible to implement in health systems in low- and middle income countries, are urgently needed.

Thirdly, in order to ensure early detection and proper treatment of GDM it is vital that both the supply side and demand side of GDM services are addressed. Early detection and proper treatment will not take place if fully stocked health facilities and trained health care providers are in place, but there are no pregnant women coming for GDM services or antenatal care nor will it happen if these women come to the health centre for GDM testing or treatment, but there are no equipment and consumables to perform the test or the health care providers are unaware of how to perform it or interpret its results. Thus addressing supply and demand of GDM services should go hand-in-hand.

As illustrated in this review GDM resides in the borderland between the fields of diabetes and maternal health. Some of the projects included in this review lean more towards the former and others more towards the latter and though it is difficult, based on this review, to identify which is the best sort, it is nonetheless necessary that we start to talk about balancing the diabetes and maternal health parts when addressing GDM, and more importantly that we instead of perceiving it as a singular clinical issue make it a public health issue that needs to be addressed in order to prevent diabetes and improve maternal and child health.

Furthermore, the experience from the projects also indicate that decision-makers; whether it be government level politicians and officials or community leaders, should be informed and involved from the planning phase of the project, or as early as possible, and throughout the implementation and completion of the project as this will help ensure support for improving both supply and demand of GDM services and increase the likelihood that such services will sustain after the project is completed. In this regard it is also important to consider how the necessary resources required for GDM services are made available to ensure that stated support from decision-makers is not just lip service but actually result in implementation of GDM services on the ground.

In addition, collaboration and coordination with other organisations, especially associations of obstetricians & gynaecologists, should also be sought throughout the planning and implementation to ensure expertise and support.

Awareness of GDM and the implications which untreated GDM may have for the mother and child were in general reported to be low not only among pregnant women and the general population, but also among health care providers and decision-makers. Thus, raising awareness is necessary for enhancement of both the demand and supply sides. Regardless of this, it is important to emphasise that early detection of GDM and proper treatment can prevent or postpone adverse outcomes of GDM.

With regard to the demand side, both mass media, community-based activities, including interpersonal communication, should be considered as efficient channels to convey key
messages whereas other channels might be more effective in terms of inducing behavioural changes. It is also important that cultural and social norms and practices are taken into consideration both in the awareness activities and in the structuring and organisation of services within the health care system.

In addition to ensuring support from decision-makers, it will often also be necessary to raise awareness and build capacity among health care providers. Particularly, through training components that can help ensure that the supply side of GDM services is in place and of good quality. Based on the experiences of the projects, it could be considered to employ a training of trainers approach and to train both clinical and community-based health care providers and workers. Moreover, a more long-term approach is to introduce or enhance the importance given to GDM in the curricula in medical and nursing schools.

Moreover, it is key that GDM services are offered in a manner that makes them available to pregnant women. Therefore, detection of GDM and postpartum follow-up should take place in health care facilities that offer antenatal care and maternal and child health services, simply because these are places which many pregnant women and new mothers are already visiting for other services, e.g. immunisation. Furthermore, if not entirely free of charge the services should be offered at a cost which is affordable to all women, or a variable payment scheme could be introduced. To reach women, who are not attending antenatal care services, community-based interventions are also required.

Finally, it is worth noting that the experiences of the projects in this review indicate that the majority of women with GDM can reach treatment targets without the need for insulin. For most of these women the treatment that needs to be provided will thus mainly consist of counselling and social support related to diet and physical activity. However, it is vital that the issue of difficulty in providing continued follow-up postpartum is addressed in order to prevent diabetes in the mother and offspring and that messages regarding prevention of future diabetes and messages from maternal and child health programmes are integrated.

6. Conclusion

In this report GDM projects supported by WDF have been reviewed with special attention given to the different components, the lessons learned and the barriers faced by the projects. Solutions and opportunities to address barriers and challenges have likewise been highlighted. The projects have sought to ensure that the basic infrastructure is in place, introduced or strengthened detection and treatment of GDM, created awareness and influenced decision-making. Barriers and challenges were present in most of these efforts and could, in general, be considered as either pertaining to the health system or societal and individual issues. The review includes a number of points for guidance of future programmes on GDM, which may be useful for future implementers in their joint efforts to ensure early detection and proper treatment of GDM as well as address the issue of future prevention of diabetes.
7. References

Reference List


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