MOTHER

A smartphone-and Internet-based interactive system to support the management of women with a first time diagnosis of Gestational Diabetes Mellitus

Prepared by: Dr Marlien Varnfield
Report for: Metro South Hospital and Health Service

June 2017
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Acknowledgments

Metro South Hospital and Health Service Investigators

Principal Investigator:
Dr Wendy Dutton
Divisional Director of Women’s and Children’s Services, Metro South Health.

Co-Investigators:
Dr Joel Iedema, Director of Medicine, Redland Hospital;
Dr Rachel Stoney, Director Nutrition and Dietetics, Redland Hospital;
Roisine Warwick, Diabetes Educator (Clinical nurse consultant). Redland Hospital;
Janet Knowles, Nurse Unit Manager, Women and Birthing, Redland Hospital;
Barbara Kleine, Senior Dietician, Redland Hospital;
Denis Morton, Chronic Disease Team Leader, Redland Hospital;
Sue Pager Acting Director, Engagement, Innovation Collaborative Team, Metro South Health;
Liesel Higgins, Redesign Manager (Clinical), Transformation, Innovation, Collaborative Team, Metro South Health.
Summary

The project aims to develop and evaluate a smartphone- and Internet-based interactive system to support women with a first time diagnosis of Gestational Diabetes Mellitus (GDM) and to improve GDM service provision at Redland Hospital.

Gestational diabetes mellitus (GDM) is becoming more common in Australia, affecting thousands of pregnant women. Between 5% and 10% of pregnant women will develop GDM and this usually occurs around the 24th to 28th week of pregnancy. Scientific evidence shows that controlling glucose levels can result in reduced risk of foetal complications (such as macrosomia) and increased maternal quality of life. However, due to a number of systemic (increase in health care cost, dwindling economic resources; inadequate communication between multidisciplinary care teams) and patient barriers (non-adherence to BGL testing as set out be clinical guidelines; inconvenience in attending clinic visits), impediments to optimal maternal health exist.

To address the above mentioned problems, this project is establishing and will soon trial an alternative digital care system focusing on user adoption, improving multidisciplinary care co-ordination and decreasing the number of unnecessary ante-natal GDM clinic visits at Redland Hospital. The project brings together the Metro South Hospital and Health Service (MSHHS) and AEHRC to devise an engaging platform to meet the needs of GDM clients and their clinicians.

Progress to date:

On the 15th June, the following progress has been made:

1. Regular GDM Working group meetings commenced in September 2016 after approval of funding through MSH ICT. These meetings were attended by research investigators, clinicians, MSHHS IT and also CSIRO engineers. Discussions included detailed consultations on requirements for the smartphone apps (Android and iOS) and clinician portal.
2. CSIRO engineers have developed smartphone apps (Android and iOS), and the clinician web portal. This platform, called M♡THER, will soon be evaluated among 30-40 women with a first time diagnosis of Gestational Diabetes Mellitus to ascertain user adoption and service adeptness.
3. Ethics approvals have been obtained (HREC/16/QPAH/785 – SSA/16/QPAH/786)
4. Research Collaboration Agreement was signed between MSHHS via the Redland Hospital and the Australian e-Health Research Centre, CSIRO.
5. User manuals have been developed for clients and clinicians on the use of the portal and the app.
1 Introduction

1.1 Background

Gestational diabetes mellitus (GDM) is a condition that occurs during pregnancy for some women and is one of the most common medical complications of pregnancy [1]. Hormones produced during pregnancy may lead to insulin resistance, resulting in higher than normal blood glucose levels (BGL). GDM is becoming more common in Australia with known risk factors including: increasing maternal age, maternal obesity, ethnicity, previous diagnosis of GDM, Polycystic Ovarian Syndrome, early testing for GDM and the recent introduction of lower diagnostic criteria for the diagnosis of GDM [2]. In Queensland, incidence rose from 4.9% to 8% between 2006—2013 [2]. Changes to the diagnostic criteria is likely to have significantly further increased this incidence. GDM usually occurs around the 24th to 28th week of pregnancy and scientific evidence shows that controlling glucose levels can result in reduced risk of foetal complications (such as macrosomia) and increased maternal quality of life [3]. However, due to a number of systemic (increase in health care cost, dwindling economic resources; inadequate communication between multidiscipline care teams) and patient barriers (non-adherence to BGL testing as set out be clinical guidelines; inconvenience in attending clinic visits), impediments to optimal maternal health exist.

In addition:

- An increasing number of pregnant women are being diagnosed, which leads to increasing numbers in clinics [4];
- Health care costs are increasing: costs of outpatient visits to primary and secondary care, cost of inpatient hospital care before and after delivery, the use of insulin, delivery costs and babies’ stay in the neonatal intensive care unit [5];
- A large number of pregnant women are working and have to attend multiple appointments at different times with different health care professionals which is often not convenient or practical. This could be aggravated by large travelling distances, inadequate or no independent means of transportation, or needing to rest to avoid preterm delivery [6];
- This could lead to poor attendance and adherence [7];
- Diagnosed individuals need to closely monitor their BGLs multiple times during the day, to see if their levels are within the recommended ranges [2].

Issues for Redland Hospital:

GDM affects 16% of pregnant women engaged with maternity services at Redland Hospital in the Metro South Health and Hospital Service (MSHHS). At Redland Hospital, recording of BGLs occurs through paper based diaries, provided by Redland Hospital, after confirmed diagnosis of GDM. Following diagnosis of GDM and after attendance at a GDM Group Education session, women are required to monitor their BGLs four times per day as per the guidelines set out in the “Queensland Clinical Guidelines for Gestational Diabetes Mellitus, 2015”[2]. Thereafter, and until delivery of their baby, women with GDM are required to continue to test their BGLs according to clinical need (generally four times a day but may be reduced if BGLs consistent with good control). These results are then brought along, by the patient, to their regular clinic check-ups.

Currently, the results in the first stage of monitoring, post-diagnosis, need to be reviewed regularly by the multidisciplinary team.
Several problems are presenting themselves with the paper-based system:

1. The patients need to remember to take the diaries everywhere they go, or, record BGLs somewhere and then re-record them into their diary at a later time. Not only is this inconvenient to the patient, but it also increases the risk of recording them incorrectly or losing them all together.

2. Results from the paper-based diaries reach the clinical team in a variety of ways, or not at all in many instances. Examples include email, fax, and telephone calls to clinical staff. It then relies on the clinical staff to record these results in the patient’s file.

3. Not all of the team are reliably viewing the results as they do not necessarily receive them. For example, the results may be viewed by the Doctor on call for the GDM team, however, the results might not then reach the Dietitian.

4. Risks to the patient and unborn baby exist in the current system with staff not being able to reliably view these results. There is a risk of missing an alert of several high or low blood sugars in a row. This could have serious medical consequences if the mother or guardian is unaware of these risks.

To address the problems mentioned above, this project has developed and will soon trial an innovative information communication technology (ICT) enabled care process for women with a first time diagnosis of GDM. Leveraging from a validated design that links post heart attack patients to clinicians throughout a cardiac rehabilitation program [8], we have designed and developed a platform comprised of a smartphone App and web portal (Mobile Technology for a Mother or ‘M♡THER’) that will support women with GDM through their gestational period. We believe that not only will the platform improve the health outcomes and quality of life for women with GDM, but it will also reduce costs to the health system by enabling clinicians to provide more timely interventions when appropriate and reducing unnecessary visits to GDM antenatal clinics.

Mobile health (mHealth) that includes both web-based and smartphone applications (Apps), has been increasingly used in the management of patients with chronic disease [9]. As a technology platform, smartphones have the unique capacity to integrate different functional modules such as monitoring, tracking, memory and communication to manage personal health [10]. mHealth, therefore, has been increasingly used by healthcare providers to deliver multimedia communication and information for feedback at a personal level to patients. Some studies have demonstrated the effectiveness of mHealth in self-management skills and medication adherence for patients with diabetes [11]. At Redland Hospital, the results of a survey to determine access, experience and preference for use of mobile technology as an adjunct and/or alternative to traditional face to face clinical care in women with GDM, indicated that patients would benefit from being offered a choice of individualised options including mobile technology and face to face clinical care [12].

We therefore believe that the developed M♡THER platform to support not only the women who are pregnant, but also health-care practitioners, will offer several benefits to the provision of GDM care at Redland Hospital. These include improved care co-ordination, avoidance of unnecessary face to face appointments and reduction in multiple appointments to individual health care practitioners at different times as we have developed a co-ordinated care model supported by multidisciplinary review. The platform are soon to be tested with the research focusing on user adoption, and the impact on care co-ordination and ante-natal GDM clinic visits at Redland Hospital when implementing this interactive system.
1.2 Research Aims

The aims of the research are to:

I. Determine adoption (use and user satisfaction) of the MOTHER support system for women with first time diagnosis of gestational diabetes mellitus (GDM) attending GDM Services at Redland Hospital;

II. Improve the multidisciplinary care co-ordination between healthcare practitioners providing care for these women to optimise adherence to established guidelines of care for GDM;

III. Optimise health care utilisation and patient experience by reducing the number of low-utility clinic visits at GDM Services at Redland Hospital and expediting access to services where required.

In order to achieve the research aims, we will:

i. Evaluate adoption (use and user satisfaction) of the MOTHER system for women with first time diagnosis of GDM attending GDM Services at Redland Hospital through responses to user surveys,

ii. Examine the number of BGL reviews by different healthcare practitioners providing care, the number of BGL’s outside of recommended treatment target, the recorded frequency of antenatal contact for these women and the time to commencement of treatment compared to an historic cohort retrospective medical record review of women treated for GDM at Redland Hospital,

iii. Determine the number of occasions of service including antenatal, endocrinology, diabetes educator and dietitian compared with the historical cohort.

1.3 Hypothesis:

Primary Hypothesis: A smartphone- and Internet-based interactive support system for women with first time diagnosis of gestational diabetes mellitus (GDM) attending GDM Services at Redland Hospital will be acceptable and convenient for all users.

Secondary Hypotheses: The multidisciplinary care co-ordination between healthcare practitioners providing care for women with first time diagnosis of GDM will improve in aligning with QLD Clinical Guidelines thereby reducing the number of low utility clinic visits and expediting access to GDM antenatal services where required at Redland Hospital.

1.4 Key Research question:

Is the MOTHER smartphone-and Internet-based interactive system to support women with a first time diagnosis of Gestational Diabetes Mellitus (GDM) adopted by users and does it improve GDM service provision at Redland Hospital?

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1 May include, midwife, nurse practitioner, endocrinologist, obstetrician, physician, dietitian, credentialed diabetes educator, general practitioner (GP), GP obstetrician, paediatrician/neonatologist, lactation consultant, indigenous health worker, exercise physiologist or other health professional as appropriate to the clinical circumstances

2 The term antenatal contact includes all forms of interaction between the pregnant woman and her healthcare providers for the purpose of providing antenatal care. For example, telephone consults, SMS messaging, email, home visits, scheduled hospital appointments, videoconference or telehealth discussions
2 Methodology

2.1 MOTHER Platform Development

Working group meetings were regularly attended by CSIRO engineers and MSHHS IT since September 2016 following approval of funding. Early discussions included detailed consultations on requirements for the smartphone apps (Android and iOS) and clinician portal.

After initial development of the platform, clinicians at Redland hospital were invited to test the platform by registering on the portal, creating users and downloading the MOTHER app to their smartphone. They had the opportunity to test different features of both the clinician portal and the app.

Financial support was secured in March 2017 to support a clinician through implementation phase at Redland Hospital. Unfortunately the Research Agreement between MSHHS and CSIRO was delayed which meant that the implementation phase could not commence on time. However, the clinician appointed in the role contributed tremendously in identifying issues and communicating these to the CSIRO engineering team.

A spreadsheet was created of all issues/suggested changes and the progress recorded. All issues with the portal and apps have been addressed and some of the suggestions will be addressed after the feasibility study as the budgeted engineering time has been exhausted.

2.2 Feasibility study

2.2.1 Study design

Internal pilot study; Preliminary observations and analysis.

2.2.2 Setting

Gestational Diabetes Mellitus Services at Redland Hospital, Metro South Hospital and Health Services, Queensland.

2.2.3 Study population

Recruitment

The target population is women with first time diagnosis of GDM. Diagnosis of GDM is based on results of the fasting 75 g oral glucose tolerance test (OGTT) performed during pregnancy (24-28 weeks gestation) as outlined in Figure 1:
Inclusion criteria
The inclusion criteria to be used for recruiting participants for this study are:

i. a confirmed 1st OGTT diagnosis of GDM diagnosed between K24-28;
ii. at least 16 years of age;
iii. referred from general practitioner for antenatal care at Redland Hospital prior to K20;
iv. owning and ability to use smart mobile phone (both Androids and Apple phones);
v. ability (and willingness) to upload data either via WiFi or Mobile Data
vi. ability to speak and understand English.

Exclusion criteria
The exclusion criteria include women who have:

i. other types of diabetes;
ii. other illnesses that will limit participation e.g. chronic kidney disease (stage3-4);
iii. a known history of major psychiatric illness.
Endpoints

The primary endpoint is user adoption and satisfaction based on a patient satisfaction survey.

The secondary endpoints include:

i. Number of BGL clinical reviews by individual clinicians or multidisciplinary team
ii. Adherence to BGL testing recommendations measured by number of missed test results
iii. Number of BGLs per week above recommended target range
iv. Occasions of service related to GDM attended by women
v. Time to commencement of therapy for GDM not within recommended treatment targets.

The wellbeing and care of the woman who is pregnant and of her foetus will take precedence over any research considerations and the ethical considerations specific to the research involving women who are pregnant as outlined by the National Statement on Ethical Conduct in Human Research 2015 will be followed [13].

2.2.4 Sampling and sampling methods

Purposive sampling technique will be used in this project as all women with first diagnosis of GDM attending the GDM services at Redland Hospital who meet eligibility criteria will be will be approached by antenatal medical staff to participate in the study. After being informed and provided with the Participant Information Sheet, interested individuals will be asked to sign the Participant Consent Form. Women with GDM who do not wish to be involved in the research will be offered the routine antenatal care but will be excluded from data analysis. The project aims to recruit up to 40 participants.

2.2.5 Study procedure

Blood glucose meters provided by Roche, will be provided to all women with diagnosed GDM. Participants recruited into the study will receive usual care as outlined in Figure 2 as well as access to the MOTHER App. They will be instructed by their diabetes educator on how to use the App and will also receive a user manual. All consumers will be advised to regularly testing their BGL’s as per clinical guidelines [2].

Figure 2: Usual care path for women diagnosed with GDM
2.2.6 Intervention

The M♡THER solution utilises innovative technologies which integrates the Internet, smartphones, measurement devices and multimedia content to support women with GDM throughout diagnosis to child birth. The M♡THER system is illustrated in Figure 3:

Figure 3: Schematic illustration of a GDM support platform using M♡THER

Women who choose to, and consent to participate in the research study will be instructed on how to install the M♡THER App to their smartphone and they will be provided access to the App through an Internet-based healthcare practitioner Web Portal.

The smartphone is carried by the patient throughout the day to allow for data capture (such as BGL, weight, exercise, stress, sleep, symptoms, any medication for GDM they are taking), and also for delivering motivational and reminder notifications and providing educational multimedia content (such as links to educational materials regarding diet or exercise in GDM). The App provides visual (graphical) and textual reports on entered data and the entries on the App automatically update to the clinician web portal. The system also has the capability to deliver electronic reminders to assist in BGL testing, medication management and appointment scheduling according to preference. The web-portal is password protected and enables all healthcare practitioners providing care to view the participants’ progress during weekly case-conference discussions to provide early care intervention dependent on the advice of the clinical review. Data can also be reviewed by the healthcare practitioners during clinic appointments to aid in discussions with patients.

The project aims to recruit 30-40 participants to the study but the final sample size will be determined by the quantity of enrolments during the allocated recruitment time period (3 months).
### 2.2.7 Data collection

The following data will be collected during the study:

<table>
<thead>
<tr>
<th>Measure</th>
<th>Time of collection</th>
<th>Collected by</th>
<th>Collected from</th>
<th>Collected at</th>
</tr>
</thead>
<tbody>
<tr>
<td>App and portal usage</td>
<td>From enrolment in study to delivery</td>
<td>CSIRO researcher</td>
<td>Data Server logs</td>
<td>CSIRO</td>
</tr>
<tr>
<td>User perceptions (women with GDM and Health practitioners)</td>
<td>Post delivery</td>
<td>GDM Services</td>
<td>User satisfaction questionnaires</td>
<td>GDM Services at Redland Hospital</td>
</tr>
<tr>
<td>BGL reviews</td>
<td>Weekly</td>
<td>GDM Services</td>
<td>GDM Services logs</td>
<td>GDM Services at Redland Hospital</td>
</tr>
<tr>
<td>BGL excursions</td>
<td>During clinic appointments and/or weekly case conferences</td>
<td>Healthcare practitioners in GDM service</td>
<td>Clinician web portal</td>
<td>GDM Services at Redland Hospital</td>
</tr>
<tr>
<td>Frequency of ante-natal contact</td>
<td>At contact</td>
<td>Healthcare practitioners in GDM service</td>
<td>GDM Services logs</td>
<td>GDM Services at Redland Hospital</td>
</tr>
<tr>
<td>Time to treatment (review with relevant health care professionals and commencement of medication if required)</td>
<td>From enrolment to delivery</td>
<td>GDM Services</td>
<td>GDM Services logs</td>
<td>GDM Services at Redland Hospital</td>
</tr>
<tr>
<td>Ante-natal clinic visits</td>
<td>From enrolment to delivery</td>
<td>GDM Services</td>
<td>GDM Services logs</td>
<td>GDM Services at Redland Hospital</td>
</tr>
</tbody>
</table>

All questionnaires to the participants in the study will be administered with the assistance of their healthcare provider.

Historic data for comparison (number of BGL reviews by healthcare practitioners providing care, recorded frequency of antenatal contact for participants, time to treatment, education and medication treatment if required and number of ante-natal clinic visits) will be obtained through retrospective analysis of an equivalent number of medical records for women with GDM. This review will be performed by one of the GDM team members by a matched comparison of the recruited participants in characteristics (age and pre pregnancy weight) and numbers.

### 2.3 Data Analysis

At CSIRO, analyses will be carried out on data server logs, service delivery related data and de-identified patient data provided by Redland Hospital. Use of the MOTHER system will be determined by examining the frequency and quantity of data uploads to the portal from participants’ smartphones and logins by healthcare practitioners to the web portal. User perceptions of the system will be assessed by evaluating responses to survey questionnaires. These results will be reported in a descriptive form.
Number of BGL reviews by healthcare practitioners providing care, recorded frequency of antenatal contact for participants, time to treatment, number of BGLs above recommended treatment targets and number of ante-natal clinic visits will be quantified by examining GDM Services logs (for historic data) as well as web portal (CSIRO data server logs). To compare results from the research cohort to retrospective data we will use independent t-tests to understand the differences between before and after the implementation. Baseline comparisons of trial cohorts using administrative data will be undertaken by Chi-squared test for categorical variables and one-way analysis of variance for continuous variables, with non-parametric equivalent tests used where appropriate.

2.3.1 Risk Management

The table below details the key risks identified and measures in place to mitigate the risks:

<table>
<thead>
<tr>
<th>No</th>
<th>Risk Event</th>
<th>Mitigating Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Participants have a smart phone but do not have the internet access necessary for them to upload the data</td>
<td>There is a setting in both IOS and Android smartphones to restrict data transfer to WiFi and the App is developed to use this setting. The amount of information that needs to be uploaded is minimal and unlikely to be significant in the users total data usage. Data entered are stored in the App until uploaded to the portal so if data transfer is restricted to WiFi all stored data will upload as soon as WiFi connection is available.</td>
</tr>
<tr>
<td>2</td>
<td>Delivery of blood glucose level device connectivity to every mobile phone</td>
<td>Have a contingency plan of manual entry if wireless connectivity cannot be established</td>
</tr>
<tr>
<td>3</td>
<td>Expectation that data uploaded would be reviewed or acted upon immediately</td>
<td>The App is primarily a recording and patient information tool. It would be made clear (verbally and in print) to the participants that data uploaded to the web portal would NOT be reviewed or acted upon immediately. If the patient has immediate concerns they would be advised to contact antenatal services at Redland Hospital as is current practice.</td>
</tr>
<tr>
<td>4</td>
<td>Loss of data security, confidentiality and privacy.</td>
<td>Data security and confidentiality and patient privacy will be managed according to the requirements of Information Security Management (ISO/IEC 27001) and will comply with the National Privacy Principles in the Privacy Act.</td>
</tr>
<tr>
<td>5</td>
<td>GDM Services key healthcare practitioners for reviewing data not available due to restructure of staff allocation and hence delay</td>
<td>Have contingency of part-time dedicated clinical personnel</td>
</tr>
</tbody>
</table>

Data risk management

To ensure the security of information during the research project the following measures will be implemented:

- Data delivered from source systems shall be stored in encrypted form on a password secured computer to ensure that accidental loss of media will not result in disclosure of sensitive data.
- Passwords shall be delivered separate from the media (via phone or email).
- Media used for transport shall be erased after use.
- Data cleaning, manipulation, analysis, and preparation of manuscripts shall be performed on desktops and laptops used by the project team. These are all protected by corporate level security and all use strict password protection policies. This protects us against disclosure from loss/theft of hardware.
- At project completion, all investigators will be asked to delete project files to ensure that no residual or intermediate files exist.
- After project completion, information relating to the project will be stored in encrypted form on a secure password protected computer in the principal researcher’s office for a period of 5 years to ensure that results can be verified or reproduced if the need arises. After this period, the files shall be deleted and destroyed.

At CSIRO

- Analyses by CSIRO researcher will be carried out on health services information and clinical outcomes on de-identified patient data only. All results will be reported collectively. Individuals will not be identifiable in any publication arising from the research.
- Paper copies and computer records on PC drives Identifiers will be removed by MSHHS staff prior to CSIRO researchers’ access. The identifiable information will reside on a Queensland Health (QH) server with restricted access.
- CSIRO research staff will only be given access to de-identified records. The de-identified patient data and records that will be used by CSIRO outside QH premises will be stored in a locked cabinet in an office at the Australian e-Health Research Centre, with limited access.
- All data transmitted electronically will be encrypted using current government standards. All electronic data that is stored will be done so at CSIRO in a secure data centre.
- All access to data will be controlled by authentication and authorisation protocols designed to ensure the data is protected and only accessible by authorised persons

2.4 Dissemination of results or reporting findings

Results will be shared through internal reports (progress and final), publications in refereed journals and conference proceedings. Patient details and the data collected will be kept anonymous. Patients will not be identifiable and their personal information will not be divulged.
3 Progress

3.1 M♡THER Platform

3.1.1 Clinician Web Portal

The clinician portal was designed, developed and tested with the input from clinicians who will be actively involved in the care of the users and the following figures are screenshots of the portal.

The Web-portal is password protected and is used by treating clinicians to view the progress of their clients.

New client are are created by clinicians and the portal is used to individualise the app for each client.

To create a new client: Enter in demographic Details on the new page:

Create New Patient

Enter in their program details-
Tick the suitable boxes about what should be monitored:

- Alcohol
- Fruit
- Smoking
- Vegetables
- Blood Glucose
- Heart Rate
- Soft Drinks
- Water
- Blood Pressure
- Oxygen Saturation
- Steps
- Body Weight
- Sleep
- Stress Level

Add goals; click on the add goals button, enter the details and then press save:

Add Goal

Steps
Goal Type
Daily total
Measurement
Steps
Start Date
14/06/2017

Blood Glucose
Goal Type
Measurement
Measurement
Blood Glucose
Goal Lower bound
Steps
Goal Upper bound
Steps
Start Date
14/06/2017

Client details should appear in the list that you have been directed to:

Perkins, Amber (Mrs)
Bom 06-Mar-1987 (30 yrs)
URN YYYY

Due
Diagnosis
24-Nov-2017
28-Mar-1996

Management - Diet
Start Not Started
Adherence
Reviews
Selecting the client results in being directed to a page where their progress can be seen through the program:

In the summary section, edit the details of the program, add new goals or monitor other features:

<table>
<thead>
<tr>
<th>Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
</tr>
<tr>
<td>Fruit</td>
</tr>
<tr>
<td>Smoking</td>
</tr>
<tr>
<td>Vegetables</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
</tr>
<tr>
<td>Daily Steps</td>
</tr>
<tr>
<td>Blood Glucose</td>
</tr>
<tr>
<td>Context</td>
</tr>
</tbody>
</table>
Also in the summary section, start the program by clicking start. Once program can be paused and stopped -

In the Weekly review section, client recorded data appear -

In the weekly review section new topics can be added and previous topics reviewed by pressing dates at the top-
In the custom graphs section, graphs can be customised to combine and correlate clients’ measures and track their progress. To do this, click on create graphs-

**Add a custom graph**

Select up to 4 measures

- Alcohol
- Blood Glucose
- Blood Pressure
- Body Weight
- Fruit
- Heart Rate
- Oxygen Saturation
- Sleep
- Smoking
- Soft Drinks
- Steps
- Stress Level
- Vegetables
- Water

Create  Cancel

In the Education Links section, add or remove links that clients can access-

**Education Links**

<table>
<thead>
<tr>
<th>Display Name</th>
<th>URL</th>
<th>Remove</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes Australia</td>
<td><a href="https://www.diabetesaustralia.com.au">https://www.diabetesaustralia.com.au</a></td>
<td></td>
</tr>
</tbody>
</table>

To add a link, click ‘add link’ and enter in the details required and press save-

**Add Education Link**

Add Custom Link

- Display Name
- URL

Save  Cancel
In the alert manager section alerts that have been raised can be viewed -

<table>
<thead>
<tr>
<th>Raised</th>
<th>For</th>
<th>Severity</th>
<th>Detail</th>
<th>Cleared</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.1.2 M♡THER App

The M♡THER App is available in the App Store (iOS) and Play Store (Android). A Username and Password are needed to activate the app and these are emailed (through the clinician portal) to an address accessible on the client’s smartphone.

The following figures show screenshots from the iOS app:

Users have to agree to the Terms of Use -
The home page appears-

![Home Page Screenshot]

In order to receive messages from clinicians, select Allow-

![Notification Choice]

The Roche glucometer used in the study has Bluetooth connectivity and to use this feature the Bluetooth should be turned on-

![Bluetooth Setting]

The Health Measures that appear in the client’s app are specifically selected by the clinician through discussion with the client. In the ‘Health Measures’ section, health and lifestyle measures are recorded and monitored –
For example blood glucose level, to add an entry press the plus sign in the top right hand corner.

Enter data and then press save.
At the bottom there are different tabs which record your process.
In the “Exercise” section you can record and monitor your daily activities.
The ‘Symptoms’ section records any symptoms experienced-

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<th>Save</th>
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</table>

**Symptoms**

- **Bloating**
  - 12 June 2017
  - 03:17 pm
  - Severity: Medium
  - Duration: 14 mins
  - Activity: Light
  - Medication: None Taken

Listen to your body and watch for symptoms of over exertion. Do not push through pain or undue fatigue.

- **Diarrhoea**
- **Loss of Appetite**
- **Nausea**

In the ‘Goals’ section you can review the goals set in conjunction with your clinician-

<table>
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<tr>
<th>Goals</th>
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</table>

Lifestyle changes are easier to commit to and achieve when you have goals to work towards. When you reach the target you have set, step things up a bit.

- **Steps**
  - Mon 12/06/2017
  - More than 5000 steps

- **Blood Glucose**
  - Mon 12/06/2017
  - Between 5 & 10 mmol/l
The ‘Education’ section contains informational videos and access to helpful websites-

<table>
<thead>
<tr>
<th>Information</th>
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<tbody>
<tr>
<td>Metformin Information</td>
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<thead>
<tr>
<th>Links</th>
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<tbody>
<tr>
<td>Diabetes Australia</td>
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<tr>
<td>The Glycaemic Index</td>
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In the ‘Settings’ section, adjust the settings-

<table>
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<th>Cancel</th>
<th>Settings</th>
<th>Save</th>
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<tbody>
<tr>
<td></td>
<td>BGL ANALYSIS SETTINGS</td>
<td></td>
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<tr>
<td></td>
<td>Low Threshold</td>
<td>3.</td>
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<td></td>
<td>High Threshold</td>
<td>8.</td>
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<tr>
<td></td>
<td>SERVER SYNCHRONISATION</td>
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<tr>
<td></td>
<td>Server Protocol</td>
<td>https</td>
</tr>
<tr>
<td></td>
<td>Server URL</td>
<td>motor.csiro.au/gd</td>
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<tr>
<td></td>
<td>Reset</td>
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<tr>
<td></td>
<td>Upload Data Now</td>
<td></td>
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<tr>
<td></td>
<td>PEDOMETER</td>
<td></td>
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<tr>
<td></td>
<td>Use iPhone to track steps</td>
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</table>
3.2 Feasibility study

The feasibility study will commence towards the end of June 2017 after the Research Collaboration Agreement has been signed and the SSA approval. However, the following progress has been made:

1. Research proposal completed and approved through Ethics (HREC and SSA)
2. Roles have been identified in terms of recruitment, monitoring and follow-up
3. User manuals were developed (Clinician and Client)
4. Study population has been identified

3.3 Dissemination

The M♡THER project has been submitted and accepted as presentations:

2. Poster presentation at the HISA HIC Conference 6-9 August 2017, Brisbane
4 Discussion

4.1 MOTHER Platform

The MOTHER platform has been developed according to the requirements of MSHHS clinicians and further modified after the clinicians had opportunity to ‘test’ the portal and the smartphone apps. The platform will be supported by CSIRO engineering team for the duration of the feasibility study and will endeavour to provide the following response times:

* During Business Hours CSIRO will provide a response to technical queries raised by MSHHS within 24 hours.
* CSIRO will respond to 90% of technical queries within 24 hours.
* CSIRO strives for 100% uptime of our servers; however this is out of the control of the AeHRC.
* With regards to upgrades to any of the technology for the Project:
  - CSIRO and MSHHS will discuss requirements at monthly meetings and agree to what upgrades will be made available within the following two fortnightly releases.
  - CSIRO will provide at least 1 (one) month advance notice of when key staff will not be available and the above timelines may not be met.
  - CSIRO will provide monthly reports of use of the app and portal.
* The app and portal are made available for the Project only and will not be available after the conclusion of the Project unless further arrangements are made.

4.2 Feasibility study

Recruit and consent of be women with first time diagnosis of GDM attending the Redland Hospital will commence end June/early July.

**MNHHS Staff will:**
- Provide ongoing clinical care of consented patients as normal
- Train patients on how to use the app
- Administer user questionnaires
- De-identify survey data and provide to CSIRO
- Provide CSIRO with hospital/clinic service logs for analysis
- Source historical data from hospital/clinic logs for comparison

**CSIRO researchers will:**
- Evaluate responses to questionnaires
- Analyse the hospital logs for the service utilisation which includes de-identified patient data such as number of visits, date and duration of the visits.
- Write reports regarding the requirements, process and outcomes from the pilot study/research (any Personal Information to be de-identified)
- Prepare publications (any Personal Information to be de-identified)
5 References


AT CSIRO, WE DO THE EXTRAORDINARY EVERY DAY

We innovate for tomorrow and help improve today – for our customers, all Australians and the world.

Our innovations contribute billions of dollars to the Australian economy every year. As the largest patent holder in the nation, our vast wealth of intellectual property has led to more than 150 spin-off companies.

With more than 5,000 experts and a burning desire to get things done, we are Australia’s catalyst for innovation.

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