FACTORS ASSOCIATED WITH EFFECTIVENESS OF ANTENATAL SCREENING PROGRAMME FOR GESTATIONAL DIABETES MELLITUS AMONG MOTHERS DELIVERED AT SECONDARY CARE HOSPITALS IN MATARA DISTRICT

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2017

FACTORS ASSOCIATED WITH EFFECTIVENESS OF ANTENATAL SCREENING PROGRAMME FOR GESTATIONAL DIABETES MELLITUS AMONG MOTHERS DELIVERED AT SECONDARY CARE HOSPITALS IN MATARA DISTRICT

Dissertation for final examination MSc Community Medicine course – 2017

Declaration

I declare that the work presented in dissertation is my original work, and generated from the research conducted by me to fulfil the part requirement of the degree of MSc Community Medicine and content of this have not been submitted in part or full elsewhere either or concurrently for any other degree

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I confirm that I supervised the above indicated work of the candidate and above declaration of the candidate is true.

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ABSTRACT

Introduction: Gestational Diabetes Mellitus (GDM) is defined as 'any degree of glucose intolerance with onset or first recognition during pregnancy' and accounts for adverse maternal and perinatal outcomes. By early detection and prompt glycaemic control adverse outcomes can be minimized, thus universal screening for GDM is recommended. Universal screening for GDM is carried out twice during antenatal period at field antenatal clinics with non-fasting (Oral Glucose Challenge Test) OGCT since 2014.

Objective: To assess factors associated with effectiveness of antenatal screening programme for gestational diabetes mellitus (GDM) among mothers delivered at secondary care hospitals in Matara district

Methods: A descriptive, cross sectional study was conducted among 423 post-partum mothers delivered at three secondary care hospitals in Matara district, recruited using a proportionate sampling technique. Data on socio-demographic, family and pregnancy related characteristics, awareness on GDM, screening process and service provision were collected from participants using a pre-tested, interviewer administered questionnaire and from Medical Officer of Health (MOH) offices using a data record sheet. Data was analysed using SPSS software. Chi square test and Fisher's exact test were used to test the association between variables.

Results: Response rate of the study was 92.3%. GDM screening at field clinics showed high coverage for both first and second screening tests (91.4% and 94.5% respectively) and timeliness was relatively low (72.4% and 59.5% respectively). In both screening tests, proper documentation of test results (76.8% and 65.4% respectively) and referral following positive screening (47.7% and 21.2% respectively) Were substantially low Only 6.8% and 9.0% were diagnosed to have GDM among mothers with positive first and second screening results respectively.

Awareness of availability of screening at field level was high (92.8%), however, awareness on timing of tests, intended response to a positive screening test and adverse outcomes of GDM were low. Availability of logistics for screening was insufficient at the time of both tests (22.7% and 11.5% respectively). Higher coverage was positively associated with higher maternal education level (p=0.021 and 0.025), primiparity (p=0.033), having no living children (p=0.03), planned pregnancy (p=0.00), lesser distance to nearest laboratory (p=0.02) having family support (p=0.025) and better awareness of test (p=0.00). Timeliness was positively associated with performing screening at field clinics (p=0.00 and 0.007), not being employed during pregnancy (p=0.005), planned pregnancy (p=0.023), awareness on test (p=0.001) and adverse

outcomes (p=0.025) and availability of logistics at (p=0.007). Proper documentation of results positively associated with performing screening at field clinics (p= 0.00 and 0.00) and availability of logistics (p=0.009).

Conclusions and recommendations: Despite higher coverage, antenatal GDM screening programme needs improvement in other aspects of screening process such as timeliness, proper documentation and appropriate referral. Poor maternal awareness on consequences of GDM and response to positive screening was also observed. The findings favour screening at field clinics and suggests that the service provision should be streamlined with uninterrupted logistic supply. Enhanced training of field health care workers and health education and promotion of antenatal mothers are recommended to further improve the effectiveness of the GDM screening programme.

Key words: Gestational Diabetes Mellitus (GDM) screening, associated factors, antenatal mothers.

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LIST OF ABBREVIATIONS & SYMBOLS

ADA	American Diabetes Association
BH	Base Hospitals
BMI	Body Mass Index
DIPSI	Diabetes in Pregnancy Study Group of India
DGH	District General Hospital
FHB	Family Health Bureau
GDM	Gestational diabetes mellitus
GCT	Glucose Challenge Test
PGIM	Post Graduate Institute of Medicine
HAPO	Hyperglycaemia and Adverse Pregnancy Outcomes
IADPSG	International Association of Diabetes and Pregnancy Study Groups
IDF	International Diabetes Federation
FIGO	International Federation of Gynaecology and Obstetrics
NICE	National Institute for Health and Care Excellence
OGCT	Oral Glucose Challenge Test
OGTT	Oral Glucose Tolerance Test
PPBS	Post Prandial Blood Sugar
PIH	Pregnancy Induced Hypertension
PHM	Public Health Midwife
SEARO	South East Asian Region
SJGH	Sri Jayewardenepura General Hospital
SLCOG	Sri Lanka College of Obstetricians and Gynaecologists
IUD	Intra Uterine Death
WINGS	Women in India with GDM Strategy
WHO	World Health Organization

1 INTRODUCTION

1.1. Background information

Gestational diabetes mellitus (GDM) is defined as 'any degree of glucose intolerance with onset or first recognition during pregnancy' (American Diabetes Association, 2013). It is associated with adverse maternal and perinatal outcomes. Hyperglycaemia and Adverse Pregnancy Outcomes (HAPO) study which conducted at multiple centres around the world among multinational and ethnically diverse pregnant women, has shown that maternal hyperglycaemia during pregnancy is associated with increased C-peptide (secreted with insulin) levels in neonates, leading to macrosomia and increased adiposity (The HAPO Study Cooperative Research Group, 2009). It has also been shown that maternal hyperglycaemia is associated with obesity and glucose intolerance in later life of offspring (Hillier et al., 2007). As well, GDM is associated with several adverse maternal outcomes. A consistent association of GDM is shown with perinatal mortality, pre-eclampsia and caesarean sections (Wendland et al., 2012).

An increasing trend in prevalence of GDM was observed during past two decades (Ferrara, 2007) and it is estimated to have a global prevalence of 1% to 14% (American Diabetes Association, 2013). Highest prevalence is noted in South East Asian Region (SEARO) and more than 90% of the estimated cases are found in low and middle income countries (Guariguata, Linnenkamp, Beagley, Whiting, & Cho, 2014). Advanced maternal age, increased maternal pre-pregnancy Body Mass Index (BMI), family history of diabetes and past history of GDM are established risk factors for GDM (Ferrara, 2007).

In Sri Lanka as well, prevalence of GDM has been increasing over past two decades. In a study conducted at antenatal clinic of Sri Jayawardenapura Hospital in 1998, the prevalence of GDM was observed to be 5.5% (Siribaddana, Deshabandu, Rajapakse, Silva, & Fernando, 1998). A community based study conducted in Homagama Medical Officer of Health (MOH) area in 2004 had shown a prevalence of 10.3% (Ginige , 2004) and a recent community based study conducted in Gampaha district shows a prevalence of 13.9% (Sudasinghe, Ginige, & Wijeyaratne, 2016).

As demonstrated in HAPO study, maternal glucose intolerance has shown a linear relationship with adverse pregnancy outcomes. (The HAPO Study Cooperative Research Group, 2009) and it is highlighted that early detection and treatment of maternal glucose intolerance is needed to prevent adverse outcomes. For early detection of GDM, screening plays a major role.

Several diagnostic criteria have been proposed to screen and diagnosis of GDM since the first attempt by O'Sullivan and Mahan (O'Sullivan & Mahan, 1964). Among these the diagnostic criteria recommended by the International Association of Diabetes and Pregnancy Study Groups (IADPSG) has been widely recognized and accepted by several scientific bodies. It has been accepted by American Diabetes Association (ADA) in 2011 (American Diabetes Association, 2011), World Health Organization (WHO) in 2013(World Health Organization, 2013) and The International Federation of Gynaecology and Obstetrics (FIGO) (Hod et al., 2015).

Though highly valid and scientifically sound diagnostic criteria have been recommended, health care system barriers and client related barriers hinder the application of them in low and middle income countries (B. Bhavadharini, Uma, Saravanan, & Mohan, 2016)(B. Bhavadharini et al., 2016). To overcome these barriers Diabetes in Pregnancy Study Group of India (DIPSI) suggested a simplified test based on WHO criteria of 1999, in which they recommended performing 75g Oral Glucose Tolerance Test (OGTT) on pregnant mothers irrespective of their fasting state and checking plasma glucose value in 2 hours duration (Anjalakshi et al., 2009). A plasma glucose value of 140mg/dl has been considered as the cut-off point, similar to that of WHO 1999 criteria. In that study, the recommended test has been compared with WHO criteria where it has shown 100% sensitivity and specificity (Anjalakshi et al., 2009). Despite several recent studies failing to reproduce similar results, the test recommended by DIPSI has been widely used in many parts of India, Sri Lanka and other south Asian countries, because of the simplicity (B. Bhavadharini et al., 2016). Sri Lanka College of Obstetricians and Gynaecologists(SLCOG) has also recommended DIPSI test as an screening test due to its low cost, ability to diagnose GDM with a single test and convenience for the mother as no fasting is required (Motha & Dias, 2014). However, despite economic and technical feasibility of the test, it has recently been shown that non-fasting OGCT has a low sensitivity compared to both WHO criteria and IADPSG criteria. In a study conducted at antenatal clinics in a tertiary care hospital in Sri Lanka, it was found to have sensitivity and specificity of 40.6% and 94.4% respectively (Herath, Weerarathna, & Umesha, 2015).

Initially screening for GDM in the field antenatal clinics was done by testing urine sugar using Benedict's test or urine strips when available (Family Health Bureau, 2011). Subsequently screening of pregnant mother with risk factors using blood sugar was introduced to maternal care package. Accordingly 2-hour Post Prandial Blood Sugar (PPBS) test had been performed as a screening test only for mothers who have been identified to have risk factors for GDM (BMI above 25kg/m^2, maternal weight at booking visit > 65 kg, mother's age >35yrs, previous macrosomic babies weighing 3.5 kg or above, previous gestational diabetes, history of Intra

Uterine Death (IUD), intrapartum death or neonatal death, recurrent Pregnancy Induced Hypertension (PIH), polycystic Ovary Syndrome, women on long term steroids, antiepileptic or anti-psychotics, previous late miscarriages or three or more consecutive miscarries at first trimester, family history of diabetes (1st degree relative with diabetes), acanthosis nigricans, essential Hypertension) (Family Health Bureau, 2011). However, the inadequacy of this selective GDM screening programme based on risk factors has been pointed out in several studies. An increase of prevalence of GDM was shown during universal screening over selective screening using both WHO and IADPSG criteria (Dahanayaka et al., 2012). At the same time need of a universal screening programme was highlighted in those studies (Dahanayaka et al., 2012),(Meththananda Herath, Weerarathna, & Weerasinghe, 2016). In 2014, universal screening for GDM at field antenatal clinics using non-fasting Oral Glucose Challenge Test (OGCT) was started, where 75g OGTT is performed on pregnant mothers irrespective of their fasting state and plasma glucose level is checked in 2 hours duration.

According to the Guideline on screening Diabetes during pregnancy (Ministry of Health Sri Lanka, 2014) all pregnant mothers should be screened for GDM with non-fasting OGCT at booking visit or before 12 weeks and between 24 -28 weeks of Period Of Amenorrhoea (POA). Non-fasting OGCT is performed at field antenatal clinics by Public Health Midwife (PHM). In this test 75g of glucose dissolved in 300ml of water is given as a glucose challenge irrespective of the fasting stage and plasma glucose level is measured by a glucometer after two hours using capillary blood. If plasma glucose value is more than 140mg/dl such pregnant mothers should be referred for specialized obstetric care for diagnostic investigations and further management of GDM. In addition to non-fasting OGCT, post prandial blood sugar (PPBS) test has been recommended as an alternative test for pregnant mothers who do not tolerate glucose or for places with no facilities to perform non-fasting OGCT. Here, the cut-off value is more than 120mg/dl. Following the test, the results should be documented in the Pregnancy Record (H512 A and B) and if needed, the pregnant mothers should be referred to specialized care. Logistics needed for screening test such as glucometers, glucometer strips and 75g glucose sachets were provided by Family Health Bureau (FHB) (Ministry of Health Sri Lanka, 2014).

Despite the guidelines which are to be universally applied throughout the country, there can be client and health system related barriers that can hinder implementation of the screening programme (B. Bhavadharini et al., 2016). Those have not been assessed for Sri Lankan context. Client related factors includes; low maternal education level, lower economic status, nuclear family structure and large household size (Matsumura & Gubhaju, 2001) "Unwantedness" of pregnancy and increased parity can be added to that. In addition client's

awareness, motivation and transport to nearest health institution are also associated with implementation of screening programme (Fotso, Ezeh, Madise, Ziraba, & Ogollah, 2009) On the other hand, there are service related issues such as lack of trained personnel, drugs and equipment which can impede the implementation of the programme.

Thus, these client and service related factors can affect any stage of screening programme, namely performing screening test, documentation, referral and diagnosis, and hence the outcome which is early detection of GDM. Thereby, those factors will alter the effectiveness of the programme. Considering the above, this study was designed to assess the effectiveness of the antenatal screening programme for GDM in terms of the coverage, timeliness, proper documentation of results, proportion of appropriate referrals and the ultimate correct diagnosis.

1.2. Justification

In 2015, at the General Assembly of United Nations, the Sustainable Development Goals (SDG) have been adopted by 193 member countries including Sri Lanka. Among the17 goals addressing various sectors, goal number 3 is directly related to health and its theme is to ensure healthy lives and promote well-being for all, at all ages (World Health Organization Sri Lanka, 2017). Target 1, 2 and 4 of goal 3 aims to reduce maternal deaths, neonatal and under 5 year deaths and premature deaths due to non-communicable diseases respectively.

Sri Lanka's Maternal and Child Health Policy emphasises on safe outcomes for both mother and newborn through provision of quality care during pregnancy, delivery and postpartum period (Policy goal 2). Reduction of perinatal and neonatal morbidity and mortality through provision of quality care is emphasized by goal 3 (Family Health Bureau (FHB), 2012). In addition, National Health Strategic Master Plan 2016 - 2025 placed a weight on maternal and child wellbeing. At the same time, percentage of new cases of hypertension and diabetes, referred by and to PHM has been identified as an indicator to assess achievements in maternal care programme (Ministry of Health, 2013).

As GDM is associated with adverse perinatal outcomes (Wendland et al., 2012) and risk of developing non-communicable diseases in later life of the offspring (Hillier et al., 2007). Early detection and adequate treatment of GDM will be a much important strategy to reduce maternal and neonatal mortality and morbidity and in turn premature mortality due to non-communicable diseases. Therefore, universal screening of antenatal mothers has been adopted by the maternal care programme since 2015. A screening programme for GDM needs to have a good coverage, timeliness and organized mechanism for referral and diagnosing. Since it was incorporated to existing maternal care programme in which VDRL screening during

antenatal period has achieved coverage of 98.7% (Ministry of Health Sri Lanka, 2017). Thus it can be predicted to have a good coverage for GDM screening as well. However, to ensure effectiveness of the programme, possible factors that hinder achievement of a higher coverage should be identified and eliminated or minimized. Coverage of GDM screening among pregnant mothers is being monitored through reproductive health management information system, but it is not used as an indicator of service provision. Though sensitivity, specificity and cut-off values have been studied for non-fasting OGCT (Herath et al., 2015) implementation of the screening programme at the field level has not been looked in to until present.

In this study, effectiveness of screening programme was assessed in terms of coverage, timeliness, proper documentation and referral, attendance for specialized care and subsequent diagnosis. At the same time, client and service related factors that are associated with above parameters were assessed. Therefore, finding of the study will suggest measures to improve many aspects of the programme, thereby ensuring the achievements of maternal and child health policy goals. In addition, this study will pave way for further studies on the quality of implementation screening programme

This study was conducted in three secondary care hospitals of Matara district, which belongs to the Southern Province. Matara district consists of a multi-ethnic population including Sinhala, Tamil and Sri Lanka Moor and includes urban, rural and estate populations (Department of Census and Statistics Sri Lanka, 2012) The three secondary care hospitals in Matara district (namely; District General Hospital (DGH) Matara, Base Hospitals (BH) Kamburupitiya and Deniyaya) accounted for more than 95% (10,008/10,456) of deliveries taken place in the district in 2016. Assuming demographic, socio-economic and health related characteristics of pregnant mothers delivered at those hospitals remain same throughout the year; a representative sample was drawn, facilitating the generalization of the findings. The sample was studied to assess the effectiveness and associated factors of the screening programme at antenatal clinics with the following objectives.

1.3 General objective

- To assess factors associated with effectiveness of antenatal screening programme for gestational diabetes mellitus (GDM) among mothers delivered at secondary care hospitals in Matara district

1.4 Specific objectives

- To assess the effectiveness of antenatal screening programme for GDM among mothers delivered at secondary care hospitals in Matara district in terms of selected aspects
- To assess the early detection of GDM by antenatal screening programme for GDM among mothers delivered at secondary care hospitals in Matara district
- To assess the awareness of antenatal screening programme for GDM at field antenatal clinics among mothers delivered in secondary care hospitals in Matara district

To identify the client factors and service related factors associated with effectiveness of antenatal screening programme for GDM

2. LITRATURE REVIEW

Gestational diabetes mellitus (GDM) and its screening has been a topic for wide range of studies in the world and in Sri Lanka as well. GDM has been widely studied in respect to its pathophysiology, complications and sensitivity, specificity and cut off values of various screening tests. A thorough literature survey has been done through search applications including Google scholar, Medline and Mendeley for studies available online and Post-Graduate Institute of Medicine (PGIM) library repository for theses and dissertations using key words "gestational diabetes mellitus", "screening", "health seeking behavior", "antenatal screening"

2.1. Gestational Diabetes Mellitus (GDM)

GDM is defined as 'any degree of glucose intolerance with onset or first recognition during pregnancy' (American Diabetes Association, 2013). Though this definition does not differentiate pre-existing diabetes detected during pregnancy from GDM, it facilitates application of uniform strategies to detect GDM (American Diabetes Association, 2013). Therefore, this definition has been widely used in studies at both global and local settings. In addition, Sri Lanka College of Obstetricians and Gynaecologists (SLCOG) has adopted this definition (Motha & Dias, 2015).

GDM occurs due to reduced insulin secretion by pancreatic β-cells and peripheral insulin resistance which is aggravated or brought forward by the insulin resistance during the pregnancy (Siddiqui et al., 2013). During the course of pregnancy insulin resistance occurs because of certain hormonal changes, mainly human placental lactogen progesterone, cortisol, growth hormone and prolactin. And cytokines such as Tumor Necrosis Factor-alpha (TNF-α) secreted by the placenta (Motha & Dias, 2015).

GDM can cause serious adverse consequences for both the mother and the baby. A study on Hyperglycaemia and Adverse Pregnancy Outcomes (HAPO) was conducted in 2009. It included over 23, 000 pregnant mothers who are multinational and ethnically diverse, recruited from multiple centres around the world. In that study, glucose intolerance was measured with 75g oral glucose tolerance test, at 24-32 weeks of Period of Amenorrhoea (POA). That cohort was followed up and outcome of pregnancy was assessed. Umbilical cord-blood C-peptide level, birth weight, neonatal hypoglycaemia, and rate of caesarean delivery were assessed as primary outcomes and foetal adiposity, preeclampsia, birth trauma, admission to NICU and shoulder dystocia as secondary outcomes. Study showed a linear relationship between maternal blood glucose levels (fating, 1hour and 2hour value following 75g glucose load) during the antenatal period and all primary and secondary outcomes even with the

adjustments for confounding factors. Hence the study concluded that adverse pregnancy outcomes are continuously increased with maternal blood glucose levels (The HAPO Study Cooperative Research Group, 2009).

Another cohort study, conducted in California, which included 46,230 pregnant mothers shows a positive association between maternal hyperglycaemia and spontaneous preterm births with a relative risk of 1.42 (95%CI: 1.15-1.77) (Hedderson, Ferrara, & Sacks, 2003). A systemic review of 28 studies that investigated subjects for GDM and subsequently for type 2 diabetes mellitus, showed increased cumulative incidence of type 2 diabetes mellitus among those who had GDM (Kim, Newton, & Knopp, 2002).

It has been shown that prevalence of GDM has been increasing during last 2 decades contributing not only to adverse maternal and perinatal outcomes but also to increase in obesity and diabetes in offspring. This makes GDM important as a public health problem which needs attention at every part of the world (Ferrara, 2007). American Diabetes Association (ADA) estimated a prevalence of GDM of 7%, ranging from 1% to 14%, by their position statement in 2013 (American Diabetes Association, 2013). Following that, in a study by Guariguata, L *et al* published in 2014 GDM prevalence was estimated as 16.9%. In that study 47 studies from 34 countries were included and reported prevalence of GDM has been reviewed and standardized according to WHO diagnostic criteria to determine the age specific prevalence. Then GDM prevalence for each country and region has been calculated using standardized prevalence of GDM, age specific fertility rate and diabetes atlas formed by International Diabetes Federation (IDF). The same study shows that highest prevalence is in SEARO region which is 25% and more than 90% of the cases are from low and middle income countries (Guariguata et al., 2014). Studies conducted in United States found to have higher prevalence of GDM among Native American, Asian, Hispanic and Afro-American women (Ferrara, 2007). Advanced maternal age, family history of diabetes and maternal obesity are established risk factors for GDM.

As with global situation, Sri Lanka also has an increasing trend in GDM. A study conducted at antenatal clinics of Sri Jayewardenepura General Hospital (SJGH) in 1998 with the participation of 721 pregnant mothers showed a GDM prevalence of 5.5%. Same study shows that increased maternal age and obesity is associated with GDM, while failing to demonstrate an association for other established risk factors (Siribaddana et al., 1998). Whereas in 2004, a community based study conducted in Homagama MOH area showed a prevalence of 10.3 % (Ginige PS, 2004). Confirming the increasing trend, a recent community based study conducted in Gampaha district concluded that the prevalence of GDM among pregnant mothers who

attended field antenatal clinics was 13.9 % (Sudasinghe et al., 2016).

2.2. Screening for GDM

2.2.1 Evolution of screening

As shown by HAPO study, maternal hyperglycaemia is the determinant of several adverse pregnancy outcomes (The HAPO Study Cooperative Research Group, 2009). Therefore, maintaining normoglycaemia during the antenatal period is important for prevention of these adverse outcomes. Early detection of hyperglycaemia plays a key role in achieving glycaemic control. There, the screening comes into play.

Screening has been defined as 'systematic application of a test or enquiry to identify individuals at sufficient risk of a specific disorder to warrant further investigation or direct preventive action, amongst persons who have not sought medical attention on account of symptoms of that disorder' (Wald, 2001).

Screening for GDM was initially proposed in 1964 by O'Sullivan and Mahan based on a study of 752 pregnant mothers. They suggested to screen pregnant mothers with 50g 1hour Glucose Challenge Test (GCT) and subject the screening test positive (more than 140mg/dl) mother to diagnostic test which is 100g 3hour GCT (O'Sullivan & Mahan, 1964). Since then several criteria were suggested for screening and diagnosis of GDM. However, a consensus on a diagnostic criterion, whom to be screened and when to screen is yet to be made. Table 2.1 shows a summary of criteria for diagnosis of proposed since 1964 up to 2015 (B. Bhavadharini et al., 2016).

Until well-known HAPO study was done, diagnostic criteria for GDM had been made focusing on future risk of type 2 diabetes rather than adverse pregnancy outcomes, which were based on relatively old data (B. Bhavadharini et al., 2016). Then the HAPO study was designed to clarify the association between adverse pregnancy outcome and a maternal glucose intolerance level lower than that of overt diabetes mellitus (The HAPO Study Cooperative Research Group, 2009). After reviewing published and unpublished data of HAPO study and several other studies consistent with HAPO study, International Association of Diabetes and Pregnancy Study Group (IADPSG) consensus panel have suggested new diagnostic criteria (Table 2.1) (International Association of Diabetes and Pregnancy Study Groups Consensus Panel, 2010). That has been widely recognized and accepted by several scientific bodies. It has been accepted by American Diabetes Association (ADA) in 2011 (American Diabetes Association, 2011), World Health Organization (WHO) in 2013 (World Health Organization, 2013), and The International Federation of Gynaecology and Obstetrics (FIGO) (Hod et al., 2015).

Latest National Institute for Health and Care Excellence (NICE) guidelines for management of diabetes in pregnancy, which was based on cost benefit analysis on WHO guidance on screening and diagnosis of GDM, suggested a higher cut off for fasting blood glucose level and a lower cut off for two hour blood glucose value (The National Institute for Health and Care Excellence (NICE), 2015).

Table 2.1 Diagnostic criteria proposed for GDM adopted from (B. Bhavadharini et al., 2016)

Criteria	Year	Approach	Glucose load	Blood glucose level mg/dl (mmol/l)			
				Fasting	1 hour	2 hour	3hour
O'Sullivan & Mahan	1964	2 step	100	90 (5.0)	165 (9.2)	145(8.1)	125(6.9)
National Diabetes Data Group (NDDG)	1979	2 step	100	105 (5.8)	190 (10.6)	165 (9.2)	145 (8.1)
Carpenter & Coustan	1982	2 step	100	95 (5.3)	180 (10.0)	155 (8.6)	140 (7.8)
World Health Organization (WHO)	1999	1 step	75	126a (7.0)	–	140 (7.8)	–
American Diabetes Association (ADA)	2004	2 step	100	95 (5.3)	180 (10.0)	155 (8.6)	140 (7.8)
Latin American Diabetes Association (ALAD)b	2008	2 step	75	100 (5.5)	–	140 (7.8)	–
International Association of Diabetes and Pregnancy Study Groups (IADPSG)	2010	1 step	75	92 (5.1)	180 (10.0)	153 (8.5)	–
World Health Organization 2013 criteria (revised, same as IADPSG)	2013	1 step	75	92 (5.1)	180 (10.0)	153 (8.5)	–
National Institute for Health and Care Excellence (NICE)	2015	1 step	75	101 (5.6)	–	140 (7.8)	–

Though scientifically sound and valid screening and diagnostic criteria were available, implementation of screening programmes are affected by client and service related barriers in

low resource settings (B. Bhavadharini et al., 2016). As it was estimated that 90% of GDM cases are in low and middle income countries, (Guariguata et al., 2014) it is much important to come out with measures to overcome these barriers. Diabetes In Pregnancy Study Group in India (DIPSI) proposed a simple method of screening to overcome the need of fasting for screening (Anjalakshi et al., 2009). It was based on a single centred study conducted in southern India. In that study, 800 pregnant mothers were subjected to 75g Glucose Challenge Test (GCT) and blood glucose level was checked in two hours and subsequently they underwent OGTT as recommended by WHO criteria in 1999, following 72 hours of first test. It was found that there was no statistically significant difference between two methods in diagnosing GDM by using same two hour cut off value (140mg/dl) (Anjalakshi et al., 2009).

Women in India with GDM Strategy (WINGS) project was launched in collaboration with IDF and Madras Diabetes Research Foundation to come up with solutions for the barriers of screening and management of GDM in low resource settings. Main aim of this project was to replicate DIPSI study and to compare capillary blood glucose measurement with venous blood glucose measurements. Both of these alternatives were believed to be effective in low resource settings (B. Bhavadharini et al., 2016). However, it has been shown that non-fasting OGCT (DIPSI criteria) has a low sensitivity against WHO (1999) and IADPSG criteria (27.7 % and 22.6 % respectively) (Mohan et al., 2014). Another study that compared capillary blood glucose measurements with venous blood glucose measurements suggested using low cut off points to increase sensitivity. The observed sensitivity levels for cut off of 140, 120 and 110 mg/dl were 62.3 %, 78.3 % and 92.5 % respectively (Balaji Bhavadharini et al., 2016).

2.2.2 GDM screening in the Sri Lankan setting

In Sri Lanka, screening for GDM has been incorporated to a well-established maternal care programme(Ministry of Health Sri Lanka, 2017). It is recommended to check urine for sugar and protein in every field clinic visit by Benedict's test (for sugar) or a urine dipstick if available. Initially, risk factor (Box 01) based blood investigations were carried out at booking visit and universal screening was done at 24-28 weeks of POA. Post Prandial Blood Sugar (PPBS) test was recommended as the screening test and cut off was set at 120mg/dl (Family Health Bureau, 2011).

Figure 2. 1 Risk factors to offer PPBS at booking visit for GDM screening. adopted from (Family Health Bureau, 2011)

- Body Mass Index above 25kg/m2
- Maternal weight at booking visit > 65 kg
- Mother's age >35yrs
- Previous macrosomic babies weighing 3.5 kg or above
- Previous gestational diabetes
- History of Intra Uterine Death, Intrapartum death, Neonatal death
- Recurrent Pregnancy Induced Hypertension
- Polycystic Ovary Syndrome
- Women on long term steroids, antiepileptic, anti-psychotics
- Previous late miscarriages or three or more consecutive miscarries at first trimester
- Family history of diabetes (1st degree relative with diabetes)
- Acanthosis Nigricans
- Essential Hypertension

In a study conducted in Homagama MOH area with the participation of 853 pregnant mothers attending antenatal clinics, a low sensitivity of Benedict's test and urine dipstick was shown. In that study selected screening tests including Benedict and urine dipstick test were validated against 75g OGTT at 24-28 weeks of POA (Wijeyaratne, Ginige, Arasalingam, Egodage, & Wijewardhena, 2006). It was found that sensitivity of random Benedict's and dipstick test were 10.4 % and 16.6 % respectively. However, in this study a glucometer and capillary blood were used to check two hour OGTT value, which could have caused a reduction in identified cases resulting in a falsely high sensitivity.

Inadequacy of risk based screening for GDM in antenatal mothers has been repeatedly shown by many local studies. A study conducted three MOH areas in Anuradhapura district concluded that one third of the cases of GDM will be missed by the risk based screening when validated against IADPSG criteria (Dahanayaka et al., 2012). In this study, 405 pregnant mothers were subjected to 75g OGTT at POA of 24 -28 weeks. Of them, 43 mothers were positive for either WHO or IADPSG criteria and 36 were positive for IADPSG criteria. Among these 36 only 22 (61.1%) were detected by risk based screening. Another similar study conducted at antenatal clinics of a tertiary referral centre has shown that detection rate of GDM is low when risk based screening is low (Meththananda Herath et al., 2016). This study has subjected pregnant mothers at 24-28 weeks of POA to 75g OGTT and universal and risk based screening and findings were compared with both WHO and IADPSG criteria. Detection of GDM cases was reduced from 23.2 % to 20.1 % for IADPSG criteria and from 18.1 % to 15.7 % for WHO criteria, when risk based screening was applied in place of universal screening.

Universal screening for GDM at field antenatal clinics using non-fasting Oral Glucose Challenge Test (OGCT) was started in 2014. According to these latest Guidelines on screening Diabetes during pregnancy (Ministry of Health Sri Lanka, 2014), all pregnant mothers should be screened for GDM with non-fasting OGCT at booking visit or before 12 weeks and between 24 - 28 weeks of POA. Non fasting OGCT is needed to be performed at field antenatal clinics by public health midwife. In this test 75g of glucose is given as a glucose challenge irrespective of the fasting stage and plasma glucose level is measured by a glucometer after two hours using capillary blood. If plasma glucose value is more than 140mg/dl such pregnant mothers should be referred for specialized obstetric care for diagnostic investigations and further management of GDM. In addition to non-fasting OGCT, PPBS test has been recommended as an alternative test for pregnant mothers who do not tolerate glucose or for places with no facilities to perform non-fasting OGCT. The cut-off value for this test is more than 120mg/dl. Following the test, results should be documented in the pregnancy record (H512 A and B) and if needed pregnant mothers should be referred to specialized care. Logistics needed for screening test such as glucometers, glucometer strips and 75g glucose sachets were provided by FHB (Ministry of Health Sri Lanka, 2014).

However, in consistence with WINGS studies, low sensitivity of this non-fasting OGCT has been shown in a study conducted at antenatal clinics of a tertiary care hospital. In this study 296 pregnant mothers at 24-28 weeks of POA were subjected to 75g non-fasting OGCT and to standard OGTT after one week of the former test. It has been found that non-fasting OGCT had a low sensitivity (40.6 %) when compared with IADPSG criteria and current cut off (140mg/dl) is not sensitive enough to detect GDM as well (Herath et al., 2015).

A study conducted at a large private hospital in India has proven the benefit of universal screening by demonstrating reduction of early induction of labour, Caesarean section rate and the rate of macrosomia (Rajagopalan & Sooriyakala, 2013). This study was conducted among 753 pregnant mothers who underwent non-fasting OGCT at booking, 26 and 34 weeks of POA and those diagnosed with GDM were managed with diet, exercise and medical treatment.

2.3. Factors associated with effective implementation of screening programmes for GDM

Though screening and early diagnosis can reduce adverse outcomes, a good coverage of quality screening test and correct referral and follow-up is essential to achieve good results from a screening programme (Sankaranarayanan, Budukh, & Rajkumar, 2001). In low resource settings, mainly in low and middle income countries like Sri Lanka, certain barriers will hinder achieving good coverage, timeliness, correct referral and adequate follow-up. Those can be broadly divided in to client related barriers and health care system barriers. Some of those

barriers were highlighted in a review article published in India with respect to Indian context (B. Bhavadharini et al., 2016). Those barriers were summarized in table 2.2.

Table 2. 2 Barriers to effective screening programme. Adopted from (B. Bhavadharini et al., 2016)

Health care system barriers	Patient barriers
• Lack of experienced staff • Lack of trained phlebotomists • Lack of diagnostic facilities and standardized laboratories • Lack of facilities for Storage and transport of blood samples	• Coming for check up in the fasting state • Late contact with health care system • Lack of awareness about GDM and its complications • Distance to the primary health centre/ higher centres • Undergoing the OGTT in the fasting state

2.3.1. Client characteristics

Numbers of studies and reviews have been conducted to assess determinants of antenatal care seeking and utilization of screening services. In those studies several socio-demographic and pregnancy related factors have been identified as determinants of antenatal care seeking and utilization of screening services.

2.3.1.1 Factors associated with antenatal care seeking

A systematic review that have reviewed 28 papers on factors associated with utilization of antenatal care in developing countries was concluded that maternal education, husband's education, marital status, availability of antenatal care services, cost of health services, household income, mother's employment, media exposure and having a history of obstetric complications had been identified commonly as positive associations with antenatal care utilization. Further, parity has been shown a statistically significant negative effect on adequate attendance (Simkhada, Van Teijlingen, Porter, & Simkhada, 2008).

A study that investigate timing of antenatal care seeking among women in Bangladesh concluded that maternal age, women's education, residence, wealth index, pregnancy intention status, child's birth order, and wanting more children were the important determinants of antenatal care seeking and its timeliness (Kamal, Hassan, & Islam, 2015).

A study conducted in Nepal, where antenatal care service utilization is relatively low, to study factors associated with utilization of antenatal care and it has shown statistically significant

positive associations between utilization of antenatal care and higher education and higher economic status and being in extended and female headed families (Matsumura & Gubhaju, 2001).

Adding to associated factors, unintended and mistimed (unplanned) pregnancies were assessed against attendance and timing to antenatal care using Demographic and Health Survey data in Kenya. That study has been shown a statistically significant association between unplanned pregnancies and non-attendance and delayed attendance to antenatal care (Ochako & Gichuhi, 2016). Another study conducted among antenatal mothers in Ethiopia has also shown a statistically significant association between unintended pregnancies and attendance to antenatal care (OR: 0.75, 95% CI, 0.58-0.97) (Wado, Afework, & Hindin, 2013). The same study showed that attendance to antenatal care was also associated with women's education, urban residence, wealth and distance from health facility.

2.3.1.2 Factors associated with utilization of screening services

Similar to utilization of antenatal care, utilization of screening programmes has been influenced by many factors.

A systematic review of 58 papers highlighted that greater distance to the place of screening, residing in an urban and richer area and high parity have been negatively associated with participation in GDM screening (Nielsen, Kapur, Damm, de Courten, & Bygbjerg, 2014). But most of papers reviewed (n=54, 93%) were from high income countries and only four were from low and middle income countries.

It has been shown that age, education, highw2 household income, smoking and job status were associated (p-value <0.05) with participation in cervical cancer screening in a national wide cross sectional study among young Korean women aged 15 – 39 years (Chang et al., 2017). After age stratification (15-29 years and 30-39 years), a dose-response between participation in cervical cancer screening and total household income in the 30-39 age group was seen.

A cross sectional study conducted in a group of 18 – 49 year old women concluded a strong positive association of uptake of cervical cancer screening programme with age, level of education and income levels (Morema, Atieli, Onyango, Omondi, & Ouma, 2014). A similar study conducted in England also elaborated the association between education and uptake of cervical cancer screening (Sabates & Feinstein, 2006).

A prospective study conducted at District General Hospital Ampara, also assessed timely dating ultrasound scan (USS) among 211 pregnant mothers against similar independent variables to

previous studies. In this study only POA at booking visit has a significant association with timely dating scan. Though it is statistically not significant, elder the age, low parity and less distance to hospital have shown positive associations with timely USS

2.4.2. Awareness on screening

Awareness of a screening programme among target population is an important determinant to ensure good coverage, timeliness, correct referral and follow-up. Studies have consistently shown association between knowledge and awareness and good uptake of screening programme.

It was shown, even after controlling for confounding, knowledge on cervical cancer and its prevention has a positive association with uptake of screening programme (OR = 8.90, 95%CI = 2.14-16.03) (Lyimo & Beran, 2012). Similarly, a cross sectional study on coverage of cervical screening shoed that Knowledge on the signs and symptoms of cervical cancer has a strong association with being screened for cervical cancer ($P < 0.0001$). Furthermore, those who didn't know about the disease ($P < 0.0001$) or aware about susceptibility to it ($P = 0.02$) had a higher likelihood of not being screened.

Another study has compared difference of factors associated between attendance and non-attendance of breast cancer screening. In that study, knowledge on both breast cancer and mammography (screening test) have been shown to associated with good uptake of screening test and the latter found to be more strongly associated (Chouliara, Power, Swanson, & Johnstone, 2002).

A study was conducted in south India to assess awareness in various aspects of GDM. That study has shown that 85 % were aware of GDM. At the same time only 55 % were aware of the screening test at 12-16 week of POA and only 8.3 % and 11 % were aware of screening at 24-28 weeks of POA and of performing OGTT for screening. In addition, 75.8 % aware of adverse effect to the child and 52.5 % were aware of maternal adverse effects (Vanishree Shriraam, Rani, Sathiyasekaran, & Mahadevan, 2013).

2.4.3. Service related factors

A study conducted in three Sub-Saharan African countries shown that attendance and timing of antenatal care visits have been influenced by interaction between client and health care worker and how well antenatal care services respond to needs of the clients (Pell et al., 2013). The same study concluded that factors related to service provision have an important influence on antenatal care attendance.

Several studies including a systematic review, that has reviewed on screening of GDM (Nielsen et al., 2014), have shown negative association of distance to place of screening, hence the accessibility, with attendance to GDM screening. Further, it has been estimated that the probability of attending for GDM screening is reduced by 1.8% [95% CI: 1.2% to 2.4%] for every additional 10km of travel. Similarly, attendance to cervical screening programme has also been negatively associated with the distance to place of screening (Lyimo & Beran, 2012).

In addition to accessibility it has also been shown that lack of consumables for screening test and equipment is a major barrier to provide screening services for GDM (Nielsen et al., 2014)

Though Sri Lanka has well established maternal care programme evolved throughout many decades and have covered all districts (Ministry of Health Sri Lanka, 2017), poor quality of antenatal care services has been shown to have poor quality in two studies conducted in Colombo and Gampaha districts (Prathapan, Lindmark, Fonseka, Lokubalasooriya, & Prathapan, 2011) (Pinidiyapathirage & Wickremasinghe, 2007).

3. METHODS

3.1 Study design

A descriptive cross sectional study was carried out among a cross section of mothers delivered at secondary care hospitals in Matara district

3.2 Study setting

Study was conducted at three secondary care hospitals in Matara district. Those are District General Hospital (DGH) Matara, Base Hospital (BH) Kamburupitiya and Base Hospital Dniyaya. According to Maternal Care Statistics Return 2016 of Matara district, those three hospitals have accounted for more than 95 % of deliveries taken place in the Matatra district in 2016.

3.3 Study period

Study was conducted form 18th of August to 8th of September 2017 at DGH Matara, BH Kamburupitiya and BH Deniyaya. It was assumed that demographic, socio-economic and other health related characteristics of mothers delivered at those hospitals has no seasonal variation.

3.4 Study population

All mothers who delivered at secondary care hospitals (Base hospitals and above) in Matara district

3.5 Study sample

A sample of mothers delivered at secondary care hospitals in Matara district during the study period were recruited as the study sample.

Inclusion criteria

- All mothers delivered in secondary care hospitals in Matara district during the study period
- Mothers who were registered at field antenatal clinics
- Period of amenorrhoea > 28weeks

Exclusion criteria

- Mothers with diabetes mellitus prior to pregnancy
- Mothers who are not registered in field antenatal clinics

3.6 Sample size calculation

Sample size was calculated using the following formula (Lwanga & Lemeshow, 1991)

$$n = \frac{[Z]^2 \mathrm{p}(1-\mathrm{p})}{d^2}$$

- Z = corresponding to the 95% confidence interval = 1.96
- d = degree of precision required = 5%
- p = estimated population proportion of the characteristic of interest = 0.5 (There are multiple proportions to be determined in this study and estimated proportions are not available for all of them. Therefore, 0.5 was taken as estimated population proportion)

By applying above values in the equation, the calculated sample size was 384 mothers. Allowing a further 10% to account for non-response rate, the final sample size was 423 mothers.

3.7 Sampling technique

Non-probability convenient sampling method was used to recruit the sample. Numbers of pregnant mothers to be drawn from each of the three hospitals were calculated proportionate to the number of deliveries taken place at each hospital in August 2016. Details regarding deliveries were obtained from maternal care statistic return 2016 of Matara district. There have been 827 deliveries at three relevant hospitals,that distributed as follows; GDH Matara – 727, BH Kamburupitiya – 89, BH Deniyaya -11. When calculated sample size is proportionately allocated to each hospital, size of the samples needed from each hospital were as follows; GDH Matara – 371, BH Kamburupitiya – 45, BH Deniyaya -7.

All pregnant mothers delivered within previous 24 hours were selected to the study and the list was prepared using the birth registers at the labour room. Twenty four hours were calculated from 6.00 am of previous day to 6.00 am of date of data collection. While preparing the list, in addition to birth rigisters post-natal ward admission registers was looked in to for the completeness of the list generated. All post-partum mothers delivered within the previous 24 hours were interviewed and those who meet inclusion criteria were invited to participate in the study.

3.6 study instruments

An interviewer administered questionnaire (Annexure III) and two data record sheets (annexure V & VI) were used as data collection instruments.

3.6.1. Interviewer administered questionnaire

Questionnaire consisted of three main parts. First part consisted of questions on general information, socio-demographic factors, family details, pregnancy related details and details on acsess to health cere. Second part contained question to assess awareness on screening test and adverse outcomes of GDM. Third part was designed as a checklist to get details on two screening tests.

Questionnaire was prepared by principal investigator under the guidance of the supervisor in English language and translated to Sinhala language by principle investigator. The Sinhala version was back-translated by a bilingual expert to check compatibility with the first draft. In addition, Sinhala translation was translated to Tamil language and back-translated by two independent translators. Any discrepancies were rectified by discussing with translators.

3.6.2 Data record sheets

Two data record sheets were designed to collect data on availability of Public Health Midwives (PHMM) and logistics to perform non-fasting OGCT in relevant MOH areas during the time period corresponding to the duration of pregnancy of the participant mothers (from October 2016 to July 2017). First sheet was design to record data on vacant PHM areas in each MOH area in Matara district. And second sheet was designed to collect data on availability of glucometers, adequate amount of glucose strips, lancets and glucose sachets in each MOH area.

The two data record sheets were prepared by principal investigator under the guidance of the supervisor. The content of the data record sheets were discussed with two MOOH in Matara district to ensure the ability to collect data.

3.7 Pre testing

Questionnaire was pre tested at DGH Matara among 20 post-partum mothers at post-natal ward well before the study assuming that probability of data contamination is minimal as post-partum mothers are admitted to post-partum wards only after delivery. There acceptability and wording of questions were assessed and appropriate changes were made. The time taken to complete the questionnaire and other logistic issues were also noted.

3.8 Data collection

All eligible post-partum mothers identified from the list were informed regarding the study by principal investigator. A consent form was provided with information on the purpose and nature of the study, voluntary participation and potential benefits of the study. Then written consent was obtained to collect data. Data collection was entirely done by principal investigator therefore uniformity of data collection was ensured. Post-partum mothers were interviewed at the bed side ensuring maximum confidentiality possible at the setting and causing minimum discomfort and disturbance to their activities with the baby. Post-partum mothers who delivered vaginally were interviewed within 24 hours following delivery. Those who delivered by a caesarean section were interviewed on day two to make them more comfortable. Majority of the study subjects were Sinhala speaking and whenever a subject had difficulty in understanding Sinhala, interview was conducted in the language familiar to them with the help of a Tamil speaking Medical Officer at DGH Matara and BH Deniyaya. Assistance of a nursing officer was obtained in data collection at BH Kamburupitiya.

First two parts of the questionnaire has been filled by interviewing the subjects and third part was filled by interviewing the subjects and examining relevant records to extract/verify the necessary information. Pregnancy Record maintained at field clinic (H512), clinic records maintained at specialized clinics and all investigation reports were examined to extract data regarding two screening tests. Dates and period of amenorrhoea corresponding to the date of performing screening tests were verified by cross checking with investigation reports and Pregnancy record and vice versa. Place of screening test and type of screening test was inquired from the subjects and cross-checked with available reports.

All MOH offices in Matara district were visited to collect data on availability of PHMM and other logistics related to antenatal screening of GDM. Vacant PHM areas from October 2016 to July 2017 (the time period corresponding to the duration of pregnancy of the participant mothers) were recorded for each MOH area. Availability of logistics was recorded as follows.

- Availability of at least one functioning glucometer was considered as glucometer being available.
- Monthly requirement of other logistics were calculated from usage during 2016. Availability of monthly requirement of glucose strips, lancets and glucose sachets as stock balance was recorded for each month of concern. Then data ware obtained from record available with the PHMM and SPHMM.

3.9 Methods adopted to ensure quality of data

Following measures were taken to ensure data quality at design level, during preparation of data collection tool and data collection.

Secondary care hospitals were selected as the study setting to achieve an adequate sample size and a wider coverage during one month period of time allocated for data collection, thereby increasing validity and generalizability of findings. All pregnant mothers who have gone through field antenatal care programme were studied by selecting post-partum mothers as study population. In addition, the whole picture of antenatal care received by the subjects could be captured by studying post-partum mothers.

An interviewer administered questionnaire was used for data collection to improve response rate. Questionnaire was designed in a way that questions are worded in simple language and arranged in a sequential manner to ensure understanding and ease of administration. All data collection instruments have been developed after discussing with the supervisor (a consultant community physician) and two experienced MOOH to ensure content validity. Pre-testing of the data collection instruments was done to ensure clarity and to prevent ambiguity.

During data collection several measures were taken to improve quality of data. Informed voluntary consent, assurance of privacy and keeping subjects at comfort were done to increase compliance with study and hence to get accurate data. Data collection from those who have difficulties in understanding Sinhala was done with the help of translator. A Tamil questionnaire was used to collect data from these subjects, with the help of translator.

Data collection was entirely done by the principal investigator. Thus data collection was uniform with no inter-observer variation. During data collection on screening test data in records and reports was cross-checked with questioning subjects to ensure accuracy of data.

All MOH offices in Matara district (which provided antenatal care for the majority of participating mothers) have been visited personally by the principal investigator to obtain quality data on availability of PHMM and logistics for GDM screening. The few MOH offices in other districts were contacted over the phone to get details on vacant PHM areas to ensure completeness.

3.10 Data analysis

All data were coded and entered into a database created using SPSS statistical software (Version 21)

Descriptive statistics was used to describe socio-demographic and family and pregnancy related characteristics. Means/Standard deviations and frequencies were calculated for selected variables. Further, service related factors such as availability of PHM and logistics were described as frequencies.

Awareness of the screening test was described by the responses to questions for assessing the awareness. Awareness was assessed in three aspects as awareness on the screening test, awareness on reaction to an abnormal screening test and awareness on adverse outcomes of GDM as defined under section 3.12

Effectiveness of screening programme was assessed using selected aspects as defined in section 3.12. Frequencies were calculated for coverage of screening in study sample, timeliness and proper documentation of screening test results, appropriate referrals to specialized care, attendance to specialized care and further investigation. In addition, characteristics of screening programme further described in terms of means and median of POA of screening test and frequencies of type of test performed, place where screening test was done, type of diagnostic test performed and place where diagnostic investigation was done.

For the purpose of cross tabulation independent variables with more than two categories and continuous variables were re-coded in to new variables as follows.

- Highest level of education was re-categorized as below G.C.E. Advanced Level and G.C.E. Advanced Level and above.
- Occupation during pregnancy period was re-categorized as employed during pregnancy and not employed during pregnancy.
- Both distance to nearest hospital and distance to nearest laboratory was re-categorized as less than 30minutes reach and more than 30minutes reach.
- Average monthly family income was re-categorized as below and above 39,000 Sri Lankan rupees[(which is the median value for study sample and correspond with that of Household Income and Expenditure Survey 2012)(Department of Census and Statistics Sri Lanka, 2013)]

- Number of living children was re-categorized as no living children and no living children.
- Parity was re-categorized as primiparous and multiparous.

Cross tabulation between dependant and independent variables were done to assess their association. Significance testing was done using Chi Square test and Fisher's Exact test appropriately. The level of significance was set at 0.05.

3.11 Ethical considerations

Data collection was carried out after obtaining administrative approval from the Director, GH, Matara, Medical Superintendent, BH Kamburupitiya and Deniyaya. Relevant consultant Obstetrician and Gynaecologist In Charge was informed with the permission from Head of Institution prior to data collection. Administrative approval for data collection at MOH offices was obtained from Regional Director of Health Services Matara. Informed written consent was obtained from all participants before data collection. Participants were explained regarding the study by principal investigator. A consent form has been provided with information on the purpose and nature of the study, voluntary participation and potential benefits of the study. In the consent form it was highlighted that the care received by participant would not get affected if they do not consent or refrain from answering a question. Data collection was carried out with minimal disturbance to participants and ward activities. Anonymity and confidentiality of collected information was ensured and the participants were informed that collected data would not be divulged to a third party other than publishing in scientific documents. Privacy has been established as much as possible during data collection to make participants more comfortable. Ethical clearance for the study was obtained from Ethical Review Committee, Faculty of Medicine, University of Ruhuna, prior to implementation of the study.

3.12 Definition of variables

- PHM and MOH area of residence – PHM and MOH area where the participant lived most of the pregnancy period
- Occupation during the pregnancy – occupation during pregnancy was recorded and then categorized as International Standard Classification of Occupations (International Labour Organization, 2010)
- Distance to hospital – time taken to reach nearest hospital that provide specialized care, by routine transport method. It was categorized as <30min, 30min – 1hour and > 1hour

- Distance to laboratory – time taken to reach nearest laboratory that provides blood sugar assessment. It was categorized as <30min, 30min – 1hour and > 1hour
- Average monthly family income – total family income in Sri Lankan Rupees (LKR) was recorded and then categorized as <15000, 15000-30000, 30000-45000, 45000-60000 and > 60000 (in LKR)
- Family type – a family with members other than mother, father and children were categorized as "extended" families and rest were categorized as "nuclear" families
- Family support – having at least one person to help in day to day activities during pregnancy was categorized as "having family support" and those who have no such help were categorized as having "no family support"
- Parity – number of pregnancies including current pregnancy
- Awareness of the test – if participant was aware that a screening test is being done at field clinic, they were categorised as "aware only". If participant could name the test as well they were categorized as "aware and know the test" other responses categorized as "not aware"
- Awareness of timing of the test – responses were recorded as follows; 1. First visit to field clinic, 2. Before 12 weeks of POA, 3. 24 -28 weeks of POA, 4. Other responses and 5. Don't know
- The responses for awareness of the type of test and timing of the test were amalgamated to create the variable "awareness of the test". – if a woman was aware of screening test and timing of both screening tests they were categorized as "being aware", while others were categorized as " not aware"
- Awareness on adverse effects – awareness of adverse effects was defined as ability to mention at least one maternal or neonatal adverse effect.
- Screening test – It was defined as screening test done if any documented evidence of screening test is available in Pregnancy Record or investigation reports.
- Timing of screening test – if screening test was done at field clinic, documented POA at the time of screening was recorded as POA timing of screening test. It was crosschecked with the clinic date for accuracy.

  If the test was done at a private lab or hospital, the corresponding POA was calculated and recorded.
- Coverage of screening test – proportion of pregnant mothers who underwent screening test among all mothers studied.

- Timeliness of screening test – proportion of timely screened among those who screened. Correct timing of test is as follows; first screening – at booking visit or before 12weeks, second screening – 24-28 weeks
- Proper documentation of the test – documentation of POA and second hour value of screening test at the relevant cage in Pregnancy record
- Appropriate referral – referral of mothers with positive test result to a specialized care centre
- Availability of PHM – resident PHM area of the woman has an allocated PHM not as acting or in contract basis.
- Availability of logistics – availability of at least one functioning glucometer and monthly requirement of blood lancets, glucometer strips and 75g glucose sachets as the book balance at the beginning of the month

4. RESULTS

According to birth registers at labour rooms and admission books at wards during the period of data collection, the total number of deliveries during the study period was 459. Thirty six mothers have not consented and non-response rate was 7.8 %. Three mothers were excluded due to non-availability of records and reports, leading to a final sample size of 420 mothers. Percentages of mothers enrolled from DGH Matara, BH Kamburupitiya and BH Deniyaya were 87.6%, 10.7% and 1.7% respectively.

4.1 Socio-demographic characteristics of study sample

Majority, 94.8%, was Sinhalese and the remaining 5.2% was Muslims and Tamils. Age at last birth day of participant ranged from 18 years to 42 years with a mean of 29 [95% Confidence Interval (CI) 28.5 – 29.5] years. There were 375 (89.3%) of mothers who reside in Matara district and 45 (10.7%) were from other districts. Table 4.1 shows socio-demographic characteristics of the study sample.

Table 4. 1 Socio-demographic characteristics of study sample (n=420)

Characteristics of mothers (n=420)	Number	Percentage (%)
Nationality		
Sinhala	398	94.8
Muslim	14	3.3
Tamil	8	1.9
Marital status		
Legally married	417	99.3
Living together	2	0.5
Married but separated	1	0.2
Highest education level attained		
No school education	2	0.5
Grade 1-5	8	1.9
Grade6-11	80	19.1
G. C. E. Ordinary Level	161	38.3
G. C. E. Advanced Level	118	28.1
Tertiary education	51	12.1
Occupation during pregnancy		
Professionals	54	12.9
Clerical and supportive workers	17	4.0
Craft and trade related workers	8	1.9
Plant and machine operators	15	3.6
Elementary occupations	8	1.9
Not employed	318	75.7

Only 0.5% of the sample had no school education and among those who had school education 78.5% had education up to G.C.E Ordinary Level or above. Majority of the sample (75.7%) wer not employed during pregnancy period.

4.2 Family and pregnancy related details

Median average monthly family income was 39,000 [Inter Quartile Range (IQR) 29,000 – 49,000] Sri Lankan Rupees (LKR). It showed a positively skewed distribution ranging from 5,000 LKR to 260,000 LKR. Family and pregnancy related characteristics are summarized in Table 4.2

Table 4. 2 Family and pregnancy related details (n=420)

Family and pregnancy related characteristics	Number	Percentage (%)
Family type		
Extended family	259	61.7
Nuclear family	161	38.3
Number of living children		
No children	166	39.5
1	179	42.6
2	59	14.0
3 or more	16	3.8
Family support		
Yes	345	82.1
No	75	17.9
Average monthly family income (LKR)		
Less than 15,000	17	4.0
15,000 – 29,999	86	20.5
30,000 – 44,999	159	37.9
45,000 – 60,000	82	19.5
More than 60,000	76	18.1
Parity		
1	137	32.6
2	153	36.4
3 or more	130	31.0
Planned pregnancy		
Yes	356	84.8
No	64	15.2

There were 32.6% of primi mothers and 39.5% of mothers with no living children other than the newborn. It is important to note that 15.2% of pregnancies were unintended among the study sample.

4.3 Service related characteristics

Factors that could affect service provision such as availability of PHM for area of residence and availability of logistics needed to perform the screening test (glucometer, blood lancets, glucometer strips and glucose sachets) has been summarized in Table 4.4. Glucometers were available at all MOH offices at all time. Therefore 100% availability of glucometers was noted for both first and second screening.

When assessing the availability of PHMM and logistics, the appropriate month in which a subject should undergo screening test was calculated using POA based on last regular menstrual period. Then availability of PHM and logistics were checked for the relevant month. The data for assessing the availability were obtained from the records available at relevant MOH offices.

Table 4. 3 Service related characteristics

Availability of logistics / PHM	First screening	Second screening
Availability of PHM		
Yes	394 (94.5%)	362 (86.8%)
No	23 (5.5%)	55 (13.2%)
Total [a]	417 (100.0%)	417 (100.0%)
Availability of lancets		
Yes	309 (82.4%)	320 (85.3%)
No	66 (17.6%)	55 (14.7%)
Total [b]	375 (100.0%)	375 (100.0%)
Availability of strips		
Yes	314 (83.7%)	266 (70.9%)
No	61 (16.3%)	109 (29.1%)
Total [b]	375 (100.0%)	375 (100.0%)
Availability of glucose sachets		
Yes	87 (23.2%)	54 (14.4%)
No	288 (76.8%)	321 (85.6%)
Total [b]	375 (100.0%)	375 (100.0%)

[a] data on availability of PHM could not be obtained for 3 cases

[b] data on availability of logistics was obtained only from MOHs in Matara district due to feasibility issues.

Availability of PHM for relevant PHM area of residence were 94.5% at the time period of first screening test and it has been reduced to 86.85% when it came to time of second screening test. Availability of glucose sachets was relatively low at the time of both first and second screening tests.

4.4 Accessibility to health care facility

Accessibility to healthcare services has been characterized by the time taken to reach to participant's usual health care provider by routine way of transport. Table 4.2 summarized characteristics of accessibility among study sample.

Table 4. 4 Accessibility to healthcare in study sample (n=420)

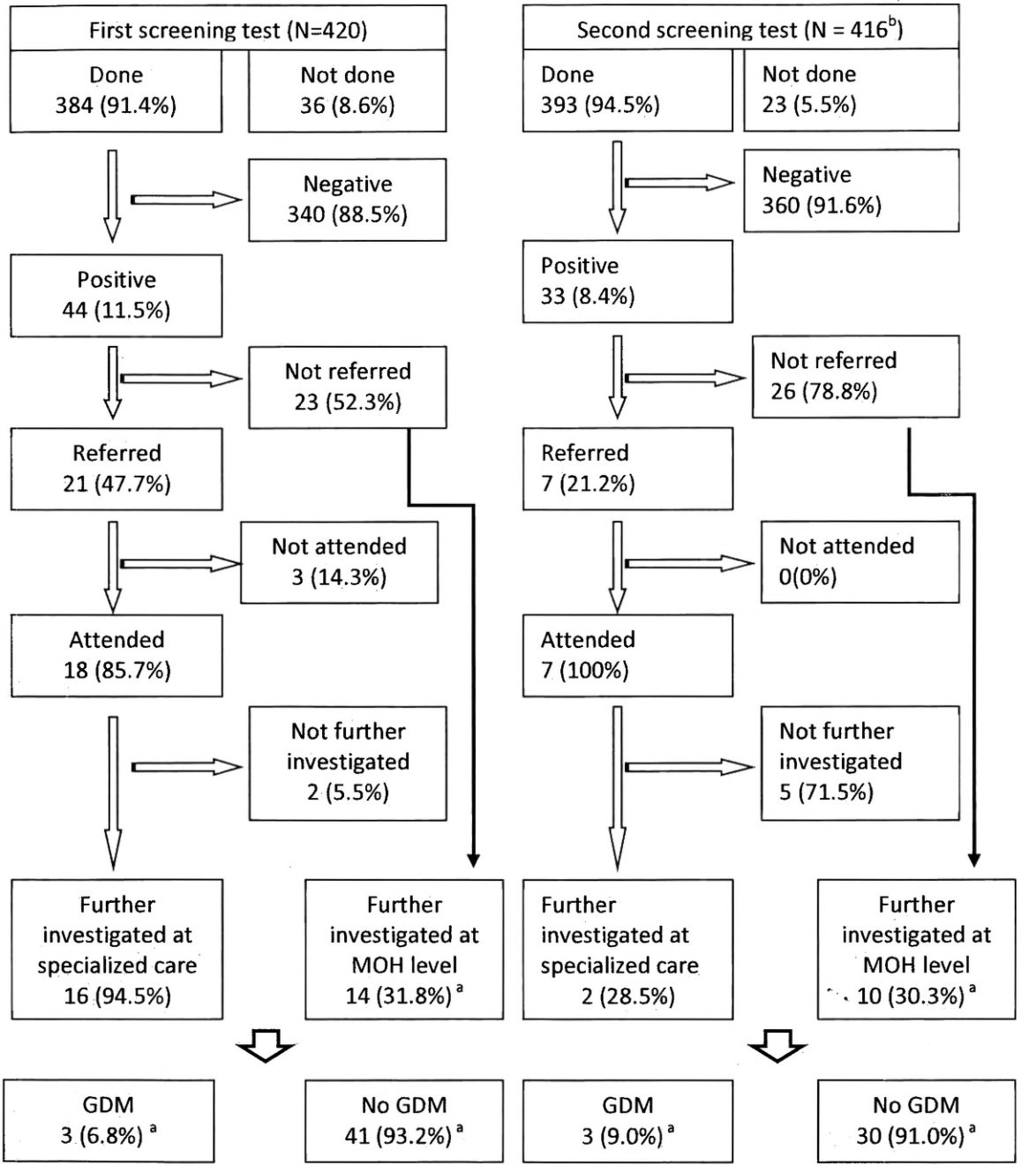
Distance to healthcare facility	Number	Percentage
Distance to nearest hospital with specialized care (time taken to reach by routine way of transport)		
< 30 min	174	41.4
30 min – 1 hour	180	42.9
> 1 hour	66	15.7
Distance to nearest laboratory (time taken to reach by routine way of transport)		
< 30 min	385	91.7
30 min - 1hour	34	8.1
> 1hour	1	0.2
Total	**420**	**100.0**

Nearly 85% of mothers were in a distance of less than one hour reach to their routine specialized care hospital. But there were 15% of mothers who have to spend more than one hour to reach to specialized care. More than 91% of mothers had access to laboratory with blood sugar testing within 30 minutes.

4.5 Screening process

Process of screening in study sample is displayed in the form of a flow chart in Figure 4.1. Characteristics of implementation of screening programme such as POA of screening, place of screening, documentation of results, referral and further investigations have been summarized in Table 4.5 and 4.6.

Figure 4. 1 Flow chart showing the screening process in study sample



[a] Percentages are for screening test positive women.
[b] four mothers were diagnosed to have GDM prior to screening

4.6 Description of selected aspects of implementation of screening programme

Coverage, referral of screening positive mothers to specialized care, attendance to specialized care and further investigation were main steps of the screening programme. Timeliness and proper documentation is related to quality of coverage. These have been assessed in terms of frequencies in the study. Coverage among study sample, proper documentation and timeliness among those who underwent screening, referral and further investigation among those who had positive results, attendance to specialized care among those who referred and diagnosis of GDM among those who had positive screening test results have been summarized as frequencies in table 4.6

Table 4. 6 Description of selected aspects of the implementation of screening programme

Aspect of screening programme	First screening		Second screening	
	Number / Total	%	Number / Total	%
Coverage	384 / 420	91.4	393 / 416	94.5
Timeliness	278 / 384	72.4	234 / 393	59.5
Documentation	295 / 384	76.8	265 / 393	65.4
Referral	21 /44	47.7	7 / 33	21.2
Attend specialized care	18 / 21	85.7	7 / 7	100.0
Further investigation	31 /44	70.4	12 / 33	36.4
At specialized care	17 / 31	54.8	4 /12	33.3
At MOH level	14 / 31	55.2	8 / 12	66.7
Diagnosis of GDM	3 / 44	6.8	3 / 33	9.0

GDM screening had good coverage above 90% and referral of mothers with positive results shown quite low. Though it is recommended to refer all pregnant mothers with positive results to specialized care, 55.2% and 66.7% were further investigated at MOH level for first and second screening respectively.

4.7 Description of selected characteristics of the screening process underwent by the mothers

Selected characteristics related to process of screening such as POA of screening test, place where screening tests have been performed, the test used as screening test, place where further investigation of positive mothers were carried out and test performed as diagnostic investigation were summarized in table 4.7.

Table 4. 7 Description of selected characteristics of the screening process underwent by the mothers

Characteristic	First screening		First screening	
POA at screening				
Mean	10.6 weeks (95% CI – 10.3 – 10.9)		27.9 weeks (95% CI – 27.6 -28.1)	
Median	10.0 weeks (IQR – 7.5 -12.5)		28.0 weeks (IQR – 26.5 -29.5)	
	Number	Percentage (%)	Number	Percentage (%)
Place of screening				
Field clinic	147	38.3	119	30.3
Hospital	66	17.2	39	9.9
Private hospital	171	44.5	235	59.8
Total	384	100.0	393	100.0
Test performed				
OGCT	265	69.0	224	57.0
PPBS	79	20.6	130	33.1
OGTT	34	8.9	34	8.7
Other	6	1.5	5	1.2
Total	384	100.0	393	100.0
Place of further investigation				
Specialized care [a]	8	25.8	0	0.0
Other [b]	23	74.2	12	100.0
Total	31	100.0	12	100.0
Test used for further investigation				
OGTT	26	83.9	10	83.3
Other	5	16.1	2	16.7
Total	31	100.0	12	100.0

[a] at government specialized care hospital
[b] at MOH or at private consultation from obstetricians

It is important to note that only 38.3% and 30.3% of screening test were performed at field for first and second screening respectively. At the same time further investigation at government specialized care was quite low as 25.8% 0.0% for first and second screening.

4.8 Awareness of GDM screening at field antenatal clinics

Responses to questions used to assess awareness on screening test, abnormal test results and adverse outcomes of GDM are summarized in Table 4.7.

Table 4. 8 Awareness of GDM screening at field antenatal clinics (n=420)

Level of awareness		Number	Percentage (%)
Awareness on availability of the screening test at field clinic			
Aware of screening and know the test performed [a]		311	74.0
Aware of screening only		78	18.6
Not aware		31	7.4
Awareness on timing of first screening test [b]			
Yes		268	63.8
No		152	36.2
Awareness on timing of second screening test [c]			
Yes		261	62.1
No		159	37.9
What should be done if screening test is not normal			
Don't know		349	83.1
Attend hospital antenatal clinic		43	10.2
Consult an Obstetrician		28	6.7
Awareness on adverse pregnancy outcomes of GDM [d]			
Maternal	Yes	51	12.1
	No	369	87.9
Foetal/Neonatal	Yes	102	24.3
	No	318	75.7
Total		**420**	**100.0**

[a] able to mention that glucose is being checked at field antenatal clinics
[b] aware that first screening test should be done before 12 weeks of POA
[c] aware second screening should be done between 24-28 weeks of POA
[d] ability to name at least one adverse outcome

Although the majority (74%) of the mothers were aware about the availability of GDM screening and the test used, a considerable proportion (over 36%) were unaware of the timing of the test. It is important to note that awareness regarding response to abnormal results and adverse outcomes of GDM was relatively low (less than 25%) in the study population.

4.9 Factors associated with effective implementation of the antenatal screening programme for GDM at the field clinics

Factors associated with the effective implementation of the screening programme were assessed under the following areas.

1. Socio-demographic factors
2. Family and pregnancy related characteristics
3. Service provision related characteristics
4. Mother's awareness of the screening programme and adverse outcomes of GDM

The association of above factors were assessed in relation to the coverage, timeliness, proper documentation and attendance to specialized care following positive screening test results of the first and second screening tests. Chi square test or Fisher's exact test was used to determine the significance of association between variables and a p value of 0.05 was considered as cut off for establishing significance.

4.9.1 Factors associated with coverage of first screening test

The association between the selected factors and the coverage of the first screening test was assessed. The findings are summarized in Table 4.9.1.1, 4.9.1.2, 4.9.1.3 and 4.9.1.4.

Table 4.9.1.1 Association of socio-demographic characteristics and the performance of first screening test

Characteristic	First screening test		Total	P - value
	Done	Not done		
	No (%)	No (%)	No (%)	
Highest education level attained				
G.C.E. Advanced Level and above	161 (95.3)	8 (4.7)	169 (100.0)	0.021
below G.C.E. Advanced Level	223 (88.8)	28 (11.2)	251(100.0)	
Employed during pregnancy				
Yes	92 (90.2)	10 (9.8)	102 (100.0)	0.609
No	292 (91.8)	26 (8.2)	318 (100.0)	
Total	**384 (91.4)**	**36 (8.6)**	**420 (100.0)**	

Only higher education level (G.C.E. Advanced Level and above) showed a positive association with good coverage. Coverage was greater among those with higher educational qualifications (p=0.021). Though a slight difference in coverage was observed in employed and non-employed groups, it was not statistically significant.

Table 4.9.1.2 Association of family and pregnancy related characteristics and the performance of first screening test

Family and pregnancy related characteristics	First screening test		Total Number (%)	p - value
	Done	Not done		
	No (%)	No (%)		
Family type				
Extended family	237 (91.5)	22 (8.5)	259 (100.0)	0.943
Nuclear family	147 (91.3)	14(8.7)	161 (100.0)	
Living children				
Yes	224 (88.2)	30 (11.8)	254 (100.0)	0.003
No	160 (96.4)	6 (3.6)	166 (100.0)	
Family support				
Yes	319 (92.5)	26 (7.5)	345 (100.0)	.104
No	65 (86.7)	10 (13.3)	75 (100.0)	
Average monthly family income (LKR)				
Below median [a]	194 (92.4)	16 (7.6)	210 (100.0)	0.486
Median and above	190 (90.5)	20 (9.5)	210 (100.0)	
Parity				
Primiparous	131 (95.6)	6 (4.4)	137 (100.0)	0.033
Multiparous	253 (89.4)	30 (10.6)	283 (100.0)	
Planned pregnancy				
Yes	335 (94.1)	21(5.9)	356 (100.0)	0.000
No	49 (76.5)	15 (23.5)	64 (100.0)	
Total	**384 (91.4)**	**36(8.6)**	**420 (100.0)**	

[a] 39,000 LKR

Statistically significant associations with performance of have been found for not having living children, primipara and planned pregnancy. Having no living children had positive influence on performance of first screening (p =0.003). primiparity (p= 0.033) and planned pregnancy (p =0.000) also associated with better performance of first screening. Average monthly family income, having family support and family type did not show association with performance of first screening

4.9.1.3 Association of characteristics related to accessibility and service provision and the performance of first screening test

Characteristics related to service provision was assessed for an association with performance of first screening test. Time taken to reach nearest hospital with specialized care and laboratory with blood sugar checking has been considered as accessibility factors. Availability of PHM and all logistics (glucometer, blood lancets, glucometer strips and glucose sachets) needed to perform non-fasting OGCT at field clinics considered as factors of service provision. Summary of associations has been included in table 4.9.1.3

Table 4.9.1.3 Association of characteristics related to service provision and the performance of first screening test

Characteristics related to service provision	First screening test		Total	
	Done	Not done		
	Number (%)	Number (%)	Number (%)	P - value
Distance to nearest hospital with specialized care				
< 30min	160 (92.0)	14 (8.0)	174 (100.0)	0.746
> 30min	224 (91.1)	22 (8.9)	246 (100.0)	
Total	384 (91.4)	36 (8.6)	420 (100.0)	
Distance to nearest laboratory				
< 30min	352 (91.4)	33 (8.6)	385 (100.0)	1.00
> 30min	32 (91.4)	3 (8.6)	35 (100.0)	
Total	384 (91.4)	36 (8.6)	420 (100.0)	
Availability of PHM				
Yes	360 (91.4)	34 (8.6)	394 (100)	1.00
No	21 (91.3)	2(8.7)	23 (100)	
Total	381 (91.4)	36 (8.6)	417 (100)	
Availability of logistics				
Yes	73 (85.9)	12 (14.1)	85 (100)	.140
No	266 (91.7)	24 (8.3)	290 (100)	
Total	339 (90.4)	36 (9.6)	375 (100)	

None of factors related to accessibility and service provision was found to have associated with performance of first screening test.

4.9.1.4 Association of awareness of screening programme and the performance of first screening test

Association of the awareness of screening test and adverse outcome of GDM and performance of screening test has been assessed in the study. Being aware of availability of screening at field clinics and its timing considered as awareness of the test. Being able to nominate at least one adverse outcome considered as awareness on adverse outcome. Association of awareness and performance of first screening was summarized in table 4.9.1.4

Table 4.9.1.4 Association of awareness of screening programme and the performance of first screening test

Awareness of screening test	First screening test		Total	
	Done	Not done		
	Number (%)	Number (%)	Number (%)	P - value
Awareness of test				
Yes	181 (92.8)	14 (7.2)	195 (100.0)	.343
No	203 (90.2)	22 (9.8)	225 (100.0)	
Awareness of adverse outcomes				
Yes	108 (94.7)	6 (5.3)	114 (100.0)	.139
No	276 (90.1)	30 (9.9)	306 (100.0)	
Total	**384 (91.4)**	**36 (8.6)**	**420 (100.0)**	

No statistically significant association was shown between awareness and performance of first screening.

4.9.2 Factors associated with coverage of second screening test

Similar to first screening test association between coverage of second screening test was assessed for following factors.

1. Socio-demographic factors
2. Family and pregnancy related characteristics
3. Service provision related characteristics
4. Mother's awareness of the screening programme and adverse outcomes of GDM

Associations between coverage of second screening with above mentioned factors have been summarized in Table 4.9.2.1, 4.9.2.2, 4.9.2.3 and 4.9.2.4

Table 4.9.2.1 Association of socio-demographic characteristics and the performance of second screening test

Characteristic	Second screening test		Total	P - value
	Done	Not done		
	No (%)	No (%)	No (%)	
Highest education level attained				
G.C.E. Advanced Level and above	161 (97.6)	4 (2.4)	165 (100.0)	0.025
below G.C.E. Advanced Level	232 (92.4)	19 (7.6)	251(100.0)	
Employed during pregnancy				
Yes	95 (93.1)	7 (6.9)	102 (100.0)	0.609
No	298 (94.9)	16 (5.1)	314 (100.0)	
Total	**393 (94.5)**	**23 (5.5)**	**416 (100.0)**	

Similar to performance of first screening, better performance of second screening was also associated with higher education level (p =0.025)

Table 4.9.2.2 Association of family and pregnancy related characteristics and the performance of second screening test

Family and pregnancy related characteristics	Second screening test		Total Number (%)	p - value
	Done	Not done		
	No (%)	No (%)		
Family type				
Extended family	245 (95.0)	13 (5.0)	258 (100.0)	0.576
Nuclear family	148 (93.7)	10 (6.3)	158 (100.0)	
Living children				
Yes	240 (94.9)	13 (5.1)	253 (100.0)	0.664
No	153 (93.9)	10 (6.1)	163 (100.0)	
Family support				
Yes	328 (95.6)	15 (4.4)	343 (100.0)	0.025
No	65 (89.0)	8 (11.0)	73 (100.0)	
Average monthly family income (LKR)				
Below median [a]	195 (94.2)	12 (5.8)	207 (100.0)	0.812
Median and above	198 (94.7)	11 (5.3)	209 (100.0)	
Parity				
Primiparous	126 (94.0)	8 (6.0)	134 (100.0)	0.786
Multiparous	267 (94.7)	15 (5.3)	282 (100.0)	
Planned pregnancy				
Yes	335 (95.2)	17 (4.8)	352(100.0)	0.143
No	58 (90.6)	6 (9.4)	64 (100.0)	
Total	**393 (94.5)**	**23 (5.5)**	**416 (100.0)**	

[a] 39,000 LKR

Only family support was found to be associated significantly with better performance of second screening test (p = 0.025). Though planned pregnancy seems to be associated with better performance of second screening test it was not statistically significant.

4.9.2.3 Association of characteristics related to accessibility and service provision and the performance of second screening test

Characteristics related to service provision was assessed for an association with performance of first screening test. Time taken to reach nearest hospital with specialized care and laboratory with blood sugar checking has been considered as accessibility factors. Availability of PHM and all logistics (glucometer, blood lancets, glucometer strips and glucose sachets) needed to perform non-fasting OGCT at field clinics considered as factors of service provision. Summary of associations has been included in table 4.9.1.3

Table 4.9.2.3 Association of characteristics related to service provision and the performance of second screening test

Characteristics related to service provision	Second screening test		Total	
	Done	Not done		
	Number (%)	Number (%)	Number (%)	P - value
Distance to nearest hospital with specialized care				
< 30min	162 (94.7)	9 (5.3)	171 (100.0)	0.843
> 30min	231 (94.3)	14 (5.7)	245 (100.0)	
Total	393 (94.5)	23 (5.5)	416 (100.0)	
Distance to nearest laboratory				
< 30min	364 (95.5)	17 (4.5)	381 (100.0)	0.002
> 30min	29 (82.9)	6 (17.1)	35 (100.0)	
Total	393 (94.5)	23 (5.5)	416 (100.0)	
Availability of PHM				
Yes	341 (94.5)	20 (5.5)	361 (100.0)	. 229
No	49 (94.2)	3 (5.8)	55 (100.0)	
Total	390 (94.4)	23 (5.6)	413 (100.0)	
Availability of logistics				
Yes	41 (95.3)	2 (4.7)	43 (100.0)	1.000
No	311 (93.9)	20 (6.1)	331 (100.0)	
Total	352 (94.1)	22 (5.9)	374 (100.0)	

Lesser distance to a laboratory services has shown a positive association with performance of second screening test (p = 0.002)

4.9.2.4 Association of awareness of screening programme and the performance of second screening test

Association of the awareness of screening test and adverse outcome of GDM and performance of screening test has been assessed in the study. Being aware of availability of screening at field clinics and its timing considered as awareness of the test. Being able to nominate at least one adverse outcome considered as awareness on adverse outcome. Association of awareness and performance of first screening was summarized in table 4.9.1.4

Table 4.9.2.4 Association of awareness of screening programme and the performance of second screening test

Awareness of screening test	Second screening test		Total	
	Done	Not done		
	Number (%)	Number (%)	Number (%)	P - value
Awareness of test				
Yes	192 (99.5)	1 (0.5)	193 (100)	0.000
No	201 (90.1)	22 (9.9)	223 (100)	
Awareness of adverse outcomes				
Yes	109 (96.5)	4 (3.5)	113 (100)	0.278
No	284 (93.7)	19 (6.3)	303 (100)	
Total	393 (94.5)	23 (5.5)	416 (100)	

4.9.3 Factors associated with timeliness of first screening test

The association between the selected factors and the timeliness of the first screening test was assessed. The findings are summarized in Table 4.9.3.1, 4.9.3.2, 4.9.3.3 and 4.9.3.4.

Table 4.9.3.1 Association of socio-demographic characteristics and the timeliness of first screening test

Characteristic	First screening test		Total	P - value
	Timely	Delayed		
	No (%)	No (%)	No (%)	
Highest education level attained				
G.C.E. Advanced Level and above	121 (75.2)	40 (24.8)	161 (100.0)	0.304
below G.C.E. Advanced Level	157 (70.4)	66 (29.6)	223 (100.0)	
Employed during pregnancy				
Yes	56 (60.9)	36 (39.1)	92 (100.0)	0.005
No	222 (76.0)	70 (24.0)	292 (100.0)	
Total	**278 (72.4)**	**106 (27.6)**	**384 (100.0)**	

Not being employed during pregnancy has shown to be positively associated with better timelines (p=.005). Higher education was also positively associated with better timeliness but it was not statistically significant (p >0.05)

Table 4.9.3.2 Association of family and pregnancy related characteristics and the timeliness of first screening test

Family and pregnancy related characteristics	First screening test		Total Number (%)	p - value
	Timely	Delayed		
	No (%)	No (%)		
Family type				
Extended family	169 (71.3)	68 (28.7)	237 (100.0)	0.545
Nuclear family	109 (74.1)	38 (25.9)	147 (100.0)	
Living children				
Yes	156 (69.6)	68 (30.4)	224 (100.0)	0.153
No	122 (76.3)	38 (23.8)	160 (100.0)	
Family support				
Yes	230 (72.1)	89 (27.9)	319 (100.0)	.774
No	48 (73.9)	17 (26.1)	65 (100.0)	
Average monthly family income (LKR)				
Below median [a]	140 (72.2)	54 (27.8).	194 (100.0)	0.919
Median and above	138 (72.6)	52 (27.4)	190 (100.0)	
Parity				
Primiparous	102 (77.9)	29 (22.1)	131 (100.0)	0.085
Multiparous	176 (69.6)	77 (30.4)	253 (100.0)	
Planned pregnancy				
Yes	249 (74.3)	86 (25.7)	335 (100.0)	0.023
No	29 (59.2)	20 (40.8)	49 (100.0)	
Total	**278 (72.4)**	**106 (27.6)**	**384 (100.0)**	

[a] 39,000 LKR

Planned pregnancy was positively associated with better timeliness (p= 0.023). And primi parity seems to be associated with better coverage but it was not statistically significant (p=0.85).

4.9.3.3 Association of characteristics related to accessibility and service provision and the timeliness of first screening test

Characteristics related to service provision was assessed for an association with the timeliness of first screening test. Time taken to reach nearest hospital with specialized care and laboratory with blood sugar checking has been considered as accessibility factors because screening test has been performed at government hospital and private laboratories as well. Therefore association between place of screening and timeliness was also assessed. Availability of PHM and all logistics (glucometer, blood lancets, glucometer strips and glucose sachets) needed to perform non-fasting OGCT at field clinics considered as factors of service provision. Summary of associations has been included in table 4.9.3.3

Table 4.9.3.3. Association of characteristics related to service provision and the performance of first screening test

Characteristics related to service provision	First screening test		Total	P - value
	Timely Number (%)	Delayed Number (%)	Number (%)	
Distance to nearest hospital with specialized care				
< 30min	112 (70.0)	48 (30.0)	160 (100.0)	0.375
> 30min	166 (74.1)	58 (25.9)	224 (100.0)	
Total	278 (72.3)	106 (27.6)	384 (100.0)	
Distance to nearest laboratory				
< 30min	256 (72.7)	96 (27.3)	352 (100.0)	0.630
> 30min	22 (68.7)	10 (31.3)	32 (100.0)	
Total	278 (72.3)	106 (27.6)	384 (100.0)	
Place of first screening test				
Field	125 (85.0)	22 (15.0)	147 (100)	0.00
Other	153 (64.6)	84 (35.4)	237(100)	
Total	278 (72.3)	106 (27.6)	384 (100)	
Availability of PHM				
Yes	264 (73.3)	96 (26.7)	360 (100.0)	0.613
No	14 (76.7)	7 (33.3)	21(100.0)	
Total	278 (73.0)	103 (27.0)	381(100.0)	
Availability of logistics				
Yes	52 (71.2)	21 (28.8)	73 (100.0)	0.766
No	196 (73.7)	70 (26.3)	266 (100.0)	
Total	248 (73.2)	91 (26.8)	339 (100.0)	

Only performing first screening at field clinics was significantly (p=0.000) associated with better timeliness of first screening.

4.9.3.4 Association of awareness of screening programme and the timeliness of first screening test

Association of the awareness of screening test and adverse outcome of GDM and timeliness of screening test has been assessed in the study. Being aware of availability of screening at field clinics and its timing considered as awareness of the test. Being able to nominate at least one adverse outcome considered as awareness on adverse outcome. Association of awareness and performance of first screening was summarized in table 4.9.3.4

Table 4.9.3.4 Association of awareness of screening programme and the timeliness of first screening test

Awareness of screening test	First screening test		Total	
	Timely	Delayed		
	Number (%)	Number (%)	Number (%)	P - value
Awareness of test				
Yes	146 (80.7)	35 (19.3)	181 (100.0)	0.001
No	132 (65.0)	71 (35.0)	203 (100.0)	
Awareness of adverse outcomes				
Yes	87 (80.6)	21 (19.4)	108 (100.0)	0.025
No	191 (69.2)	85 (30.8)	276 (100.0)	
Total	**278 (72.3)**	**106 (27.6)**	**384 (100.0)**	

Awareness on both test and adverse outcomes were associated with better timeliness of first screening. p-values were 0.001 and 0..25 respectively

4.9.4 Factors associated with timeliness of second screening test

Similar to first screening test association between timeliness of second screening test was assessed. Associations between coverage of second screening with above mentioned factors have been summarized in Table 4.9.4.1, 4.9.4.2, 4.9.4.3 and 4.9.4.4

Table 4.9.4.1 Association of socio-demographic characteristics and the timeliness of second screening test

Characteristic	Second screening test		Total	P - value
	Timely	Delayed		
	No (%)	No (%)	No (%)	
Highest education level attained				
G.C.E. Advanced Level and above	98 (60.9)	63 (39.1)	161 (100)	0.655
below G.C.E. Advanced Level	136 (58.9)	96 (41.1)	232 (100)	
Employed during pregnancy				
Yes	173 (38.1)	125 (41.9)	298 (100)	0.337
No	61 (64.2)	34 (35.8)	95 (100)	
Total	**234 (59.5)**	**159 (40.5)**	**393 (100)**	

Both education level and employ status was not significantly associated with timeliness of second screening test.

Table 4.9.4.2 Association of family and pregnancy related characteristics and the timeliness of second screening test

Family and pregnancy related characteristics	Second screening test		Total Number (%)	p - value
	Timely	Delayed		
	No (%)	No (%)		
Family type				
Extended family	146 (59.6)	99 (40.4)	245 (100.0)	0.979
Nuclear family	88 (59.5)	60 (40.5)	148 (100.0)	
Living children				
Yes	149 (62.1)	91 (37.9)	240 (100.0)	0.199
No	85 (55.6)	68 (44.4)	153 (100.0)	
Family support				
Yes	199(60.7)	129 (39.3)	328 (100.0)	0.306
No	35 (53.9)	30 (46.1)	65 (100.0)	
Average monthly family income (LKR)				
Below median [a]	104 (53.3)	91 (46.7)	195 (100.0)	0.919
Median and above	130 (65.7)	68 (34.3)	198 (100.0)	
Parity				
Primiparous	70 (55.6)	56 (44.4)	126 (100.0)	0.269
Multiparous	164 (61.4)	103 (38.6)	267(100.0)	
Planned pregnancy				
Yes	204 (60.9)	131 (39.1)	335 (100.0)	0.189
No	30 (51.8)	28 (48.2)	58 (100.0)	
Total	**234 (59.5)**	**159 (40.5)**	**393 (100.0)**	

[a] 39,000 LKR

None of family and pregnancy factors was associated significantly with timeliness of second screening test.

4.9.4.3 Association of characteristics related to accessibility and service provision and the timeliness of second screening test

Characteristics related to service provision was assessed for an association with the timeliness of second screening test. Time taken to reach nearest hospital with specialized care and laboratory with blood sugar checking has been considered as accessibility factors because screening test has been performed at government hospital and private laboratories as well. Therefore association between place of screening and timeliness was also assessed. Availability of PHM and all logistics (glucometer, blood lancets, glucometer strips and glucose sachets) needed to perform non-fasting OGCT at field clinics considered as factors of service provision. Summary of associations has been included in table 4.9.3.3

Table 4.9.4.3 Association of characteristics related to service provision and the performance of second screening test

Characteristics related to service provision	Second screening test		Total	P - value
	Timely Number (%)	Delayed Number (%)	Number (%)	
Distance to nearest hospital with specialized care				
< 30min	95 (58.6)	67 (41.4)	162 (100.0)	0.761
> 30min	139 (60.2)	92 (39.8)	231 (100.0)	
Total	234 (59.5)	159 (40.5)	393 (100.0)	
Distance to nearest laboratory				
< 30min	218 (59.9)	146 (40.1)	364 (100.0)	0.618
> 30min	16 (55.2)	13 (44.8)	29 (100.0)	
Total	234 (59.5)	159 (40.5)	393 (100.0)	
Place of first screening test				
Field	83 (69.7)	36 (30.3)	119 (100.0)	0.007
Other	151 (55.1)	123 (44.9)	274 (100.0)	
Total	234 (59.5)	159 (40.5)	393 (100.0)	
Availability of PHM				
Yes	204 (59.8)	137 (40.2)	341 (100.0)	1.00
No	29 (59.2)	20 (40.8)	49 (100.0)	
Total	233 (59.8)	157 (40.2)	390 (100.0)	
Availability of logistics				
Yes	33 (80.5)	8 (19.5)	41 (100.0)	0.002
No	173 (55.6)	138 (44.4)	311 (100.0)	
Total	206 (58.5)	146 (41.5)	352 (100.0)	

Preforming second screening at field clinics was positively associated with better timeliness of second screening test and association was statistically significant (p=0.007). Availability of

logistics at MOH level also positively associated with timeliness of second screening test (p= 0.002)

4.9.4.4 Association of awareness of screening programme and the timeliness of second screening test

Association of the awareness of screening test and adverse outcome of GDM and timeliness of screening test has been assessed in the study. Being aware of availability of screening at field clinics and its timing considered as awareness of the test. Being able to nominate at least one adverse outcome considered as awareness on adverse outcome. Association of awareness and performance of first screening was summarized in table 4.9.4.4

Table 4.9.4.4 Association of awareness of screening programme and the timeliness of second screening test

Awareness of screening test	Second screening test		Total	
	Timely	Delayed		
	Number (%)	Number (%)	Number (%)	P - value
Awareness of test				
Yes	119 (62.0)	73 (38.0)	192 (100.0)	0.336
No	115 (57.2)	86 (42.8)	201 (100.0)	
Awareness of adverse outcomes				
Yes	68 (62.4)	41 (37.6)	109 (100.0)	0.477
No	166 (58.5)	118 (41.5)	284 (100.0)	
Total	**234 (59.5)**	**159 (40.5)**	**393 (100.0)**	

4.9.5 Association of factors related to service provision with proper documentation of screening test results

Factors related to service provision was assessed for association with proper documentation of test result on Pregnancy Record. Here availability of PHM and logistics and place of screening was assessed against proper documentation of screening results. Summary of cross tabulation has been shown in Tables 4.9.5.1 and 4.9.5.2

Table 4.9.5.1 Factors associated with documentation of first screening test results

Associated factor	Documentation of test result		Total	P - value
	Correct	Incorrect		
	Number (%)	Number (%)	Number (%)	
Availability of PHM				
Yes	279 (77.5)	81 (22.5)	360 (100.0)	.286
No	14 (66.7)	7 (33.3)	21 (100.0)	
Total	293 (76.9)	88 (23.1)	381 (100.0)	
Availability of logistics				
Yes	49 (67.1)	24 (32.9)	73 (100.0)	0.009
No	218 (82.0)	48 (18.0)	266 (100.0)	
Total	267 (78.8)	72 (21.2)	339 (100.0)	
Place of second screening test				
Field	145 (98.6)	2 (1.4)	147 (100.0)	0.000
Other	150 (63.3)	87 (36.7)	237 (100.0)	
Total	295 (76.8)	89 (23.2)	384 (100.0)	

Availability of logistics (p= 0.009) and performing screening test at field clinics (p=0.000) are positively associated with correct documentation of first screening test.

Table 4.9.5.2 Factors associated with documentation of second screening test results

Associated factor	Documentation of test result		Total	P - value
	Yes	No		
	Number (%)	Number (%)	Number (%)	
Availability of PHM				
Yes	237 (69.5)	104 (30.5)	341 (100.0)	0.101
No	28 (57.1)	21 (42.9)	49 (100.0)	
Total	265 (68.0)	125 (32.0)	390 (100.0)	
Availability of logistics				
Yes	29 (70.1)	12 (29.3)	41 (100.0)	.859
No	212 (68.2)	99 (31.8)	311 (100.0)	
Total	241 (68.5)	111 (31.5)	352 (100.0)	
Place of second screening test				
Field	113 (95.0)	6 (5.0)	119 (100.0)	0.000
Other	152 (55.5)	122 (44.5)	274 (100.0)	
Total	265 (67.4)	128 (32.6)	393 (100.0)	

4.9.6 Factors associated with attendance to specialized care following positive first screening test

Socio-demographic factors, family and pregnancy related factors, factors related to health service provision and awareness on response to positive screening test were assessed for the association with attendance to specialized care.

Table 4.9.6.1 Association of socio-demographic characteristics and attendance to specialized care following positive first screening test

Characteristic	Attend to specialized care No (%)	Not attend to specialized care No (%)	Total No (%)	P - value
Highest education level attained				
G.C.E. Advanced Level and above	11 (100.0)	0 (0.0)	11 (100.0)	0.09
below G.C.E. Advanced Level	7 (70)	3 (30)	10 (100.0)	
Employed during pregnancy				
Yes	3 (100.0)	0 (0.0)	3 (100.0)	1.00
No	15 (83.3)	3 (16.7)	18 (100.0)	
Total	18 (85.7)	3 (14.3)	21 (100.0)	

Higher education level was found to be associated with higher attendance to specialized care but it is not statistically significant (p= 0.09)

Table 4.9.6.2 Association of family and pregnancy related characteristics and attendance to specialized care following positive first screening test

Family and pregnancy related characteristics	Attend to specialized care	Not attend to specialized care	Total Number (%)	p - value
	No (%)	No (%)		
Family type				
Extended family	10 (77.0)	3 (23.0)	13 (100.0)	0.257
Nuclear family	8 (100)	0 (0)	8 (100.0)	
Living children				
Yes	16 (88.9)	2 (11.1)	18 (100.0)	0.386
No	2 (66.7)	1 (33.3)	3 (100.0)	
Family support				
Yes	14 (82.4)	3 (17.6)	17 (100.0)	0.511
No	4 (100)	0 (0)	4 (100.0)	
Average monthly family income (LKR)				
Below median [a]	7 (87.5)	1 (12.5)	8 (100.0)	0.919
Median and above	11 (84.6)	1 (15.4)	13 (100.0)	
Parity				
Primiparous	2 (100)	0 (0)	2 (100.0)	1.00
Multiparous	16 (84.2)	3 (15.8)	19 (100.0)	
Planned pregnancy				
Yes	15 (83.3)	3 (16.7)	18 (100.0)	.655
No	3 (100)	0 (0)	3 (100.0)	
Total	18 (85.7)	3 (14.3)	21 (100.0)	

[a] 39,000 LKR

4.9.6.3 Association of characteristics related to accessibility and service provision and attendance to specialized care following positive first screening test

Characteristics related to service provision was assessed for an association with attendance to specialized care following positive first screening test. Time taken to reach nearest hospital with specialized care has been considered as accessibility factor. Availability of PHM was considered as PHM can motivate pregnant mothers to attend specialized care. Summary of associations has been included in table 4.9.6.3

Table 4.9.6.3 Association of characteristics related to service provision and attendance to specialized care following positive first screening test

Characteristics related to service provision	Attend to specialized care Number (%)	Not attend to specialized care Number (%)	Total Number (%)	P - value
Distance to nearest hospital with specialized care				
< 30min	5 (71.4)	2 (28.6)	7 (100.0)	0.521
> 30min	13 (93.9)	1 (7.1)	14 (100.0)	
Total	18 (85.7)	3 (14.3)	21 (100.0)	
Availability of PHM				
Yes	16 (84.2)	3 (15.8)	19 (100.0)	1.00
No	2 (100)	0 (0)	2 (100.0)	
Total	18 (85.7)	3 (14.3)	21 (100.0)	

4.9.6.4 Association of awareness of screening programme and attendance to specialized care following positive first screening test

Association of the awareness of screening test and adverse outcome of GDM and attendance to specialized care following positive first screening test has been assessed in the study. Being aware of availability of screening at field clinics and its timing considered as awareness of the test. Being able to nominate at least one adverse outcome considered as awareness on adverse outcome. Association of awareness and performance of first screening was summarized in table 4.9.4.4

Table 4.9.6.4 Association of awareness of screening programme and attendance to specialized care following positive first screening test

Awareness of screening test	Attend to specialized care Number (%)	Not attend to specialized care Number %)	Total Number (%)	P - value
Awareness of respond to positive screening test				
Yes	11 (100.0)	0 (0.0)	11 (100.0)	0.09
No	7 (70.0)	3 (30.0)	10 (100.0)	
Awareness of adverse outcomes				
Yes	4 (100.0)	0 (0.0)	4 (100.0)	1.00
No	14 (82.4)	3 (17.6)	17 (100.0)	
Total	18 (85.7)	3 (14.3)	21 (100.0)	

5. DISCUSSION

5.1 Study methodology

In achieving targets of Sustainable Development Goal (SDG), the control of maternal and neonatal deaths and premature deaths due to non-communicable diseases play a major role (World Health Organization Sri Lanka, 2017). As GDM can account for all above three types of deaths, it needs early detection and prompt glycaemic control (Hillier et al., 2007)(Wendland et al., 2012). Universal screening of pregnant mothers for GDM has been adopted by Sri Lanka in 2014 (Ministry of Health Sri Lanka, 2014). Since the implementation, the application of screening programme has not been studied. Moreover, the Ministry of Health aimed at a high coverage of screening test and high level referrals to specialized care from field level. Hence, it is important to assess implementation of screening programme to identify its strengths and weaknesses and their associated factors.

This study was conducted to assess the effectiveness of antenatal screening programme for GDM and factors associated with effectiveness, focusing on mothers delivered at District General Hospital Matara and Base Hospital Kamburupitiya and Deniyaya, Matara district. Effectiveness was assessed using selected aspects such as coverage, timeliness, documentation of test results, referring screening positive mothers to specialized care and diagnosing GDM. Furthermore, socio-demographic, client related and health care provision related factors associated with effectiveness have been assessed during the study.

Study was conducted as a descriptive cross sectional survey. According to (Hennekens & Buring, 1987) 'Cross sectional surveys provide information about the frequency and characteristics of a disease by furnishing a snapshot of the health experience of the population at a specified time'. In addition, they can provide data on diseases, disabilities, utilization of health care resources and relevant socio demographic and personal characteristics and those can be used for effective health care planning (Hennekens & Buring, 1987). However, with a cross sectional design it is difficult to determine whether exposure preceded or resulted from the outcome. Yet whenever exposure variable is unalterable it can determine the association (Hennekens & Buring, 1987). Factors assessed in this study, apart from the awareness of the test, were not likely to be subjected to change during the 10 month period of pregnancy. Therefore, cross sectional design was considered as the most appropriate design to achieve the desired study objectives.

This study was conducted among post-partum mothers to ensure inclusion of all mothers those who received the entire antenatal care experience at field level and a hospital based approach was used to extract adequate sample size within a short period of time. Sample size

was calculated using estimated prevalence as 0.5 for the purpose of having large sample size, because estimates for anticipated population proportions of all selected indicators, i.e. coverage, timeliness, proper documentation, were not available.

Response rate for the study was 92.2 %. As it is recommended, a response rate more than 70% will facilitate generalization of findings to study population (Passmore, Dobbie, Parchman, & Tysinger, 2002). And the higher response rate will increase external validity of the test. The questionnaire for data collection was prepared by principal investigator with the guidance of supervisor and translated and back translated by independent bilingual experts to Sinhala and Tamil. Data collection was solely done by the principal investigator with the help of a translator with medical knowledge whenever necessary. Hence, validity of the data and uniformity of data collection was ensured. Ethical clearance was obtained from Ethical Review Committee of Faculty of Medicine University of Ruhuna. Data analysis was done using SPSS software. As data set was comprised of discrete data, to compare proportions of two independent samples chi square test was used. A p-value less than 0.05 has been taken as significant.

5.2 Characteristics of study sample

Majority (94.8%) of the study sample were Sinhalese (n=398) and percentage of Tamils and Muslims were 1.9% and 3.3% respectively. This corresponds with ethnic distribution of Southern Province published by the Department of Census and Statistics in 2012 which shows percentages of Sinhala, Tamil and Muslim population as 95%, 1.7% and 2.9% respectively (Department of Census and Statistics Sri Lanka, 2012). As study was conducted among post-partum mothers 99.3% of study population were legally married. Only 0.5% of study population had no formal education and 40% has had passed G.C.E. Advanced Level or tertiary education. Percentage of non-school attendants is similar to that of national figure (0.6%) in 2012 (Department of Census and Statistics Sri Lanka, 2013). There were 75.7% of unemployed women in study population and it correspond with the provincial statistics in 2012 (Department of Census and Statistics Sri Lanka, 2012). In contrast, the Median average household income in this sample was 39,000 LKR, compared to Sothern Provincial figures of 43,605 LKR (Department of Census and, 2017). This discrepancy might be due to the fact that household income and expenditure survey has included monetary and non-monetary income whereas the study only included monetary income. On the other hand, the study included mothers who delivered at government health care facilities and therefore, a small proportion of mothers from high income households who deliver in private health care institutions were not included in the sample.

Though it has been shown that average distance to a health care facility is 6km and average time to reach is 42 minutes in a previous study (Weerasinghe & Fernando, 2009) 15.7% of our study sample had to travel more than one hour to reach nearest specialized care hospital. By passing nearest health facility and difficulties in travelling may have accounted for this discrepancy.

5.3 Service provision characteristics

Availability of PHMM for area of residence of the mothers at the time of first and second screening was 94.5% and 86.8% respectively. It corresponds with the percentage of PHM availability in Matara district which is 90% at the end of 2016 according to the Maternal and Child Heath (MCH) Return summery of Matara district. It is also in consistence with the availability of PHM per 3,000 in Family Health Bureau (FHB) annual report 2014 which was 0.8 (Family Health bureau, 2015).

When it comes to logistics availability, the glucometers were available at all MOH offices and lancets and glucometer strips in majority (Table 4.3). However, availability of glucose sachets was 23.2% and 14.4% at the time of first and second screening tests respectively. It was a result of lack of supply.

5.4 Effectiveness of the antenatal screening programme for GDM

Selected indicators of effectiveness of the implementation of antenatal screening programme for GDM have been summarized in table 4.6.

5.5.1 Coverage

Screening programme had a high coverage reaching 91.4% and 94.5% at first and second screening respectively. MCH return summery in Matara district shows coverage of 93.4% and 94.9% for first and second screening respectively. Relatively low coverage for first screening could be due to delayed booking visit. It has been noted that 6.4% pregnancies were registered after 12 weeks of POA.(Family Health bureau, 2015) And it has been shown that timely dating ultrasound scan is associated with early booking visit as well.(Dias, Fernando, Kumarasiri, & Padeniya, 2015) Though coverage is high, only 38.3% of first screening test and 30.3% of second screening test were performed at field clinics. Others were performed either at a hospital or a private laboratory. Among first and second screening test 44.5% and 59.8% respectively has been done at private laboratories and it exceeds national figure of out of pocket expenditure which is 40%. (Ministry of Health Sri Lanka, 2016) In more than 98% of the instances, recommended screening test (OGCT) had been performed. Only 1.5% of the first screening and 1.2% of the second screening tests have deviated from the guideline. (Table 4.6)

5.5.2 Timeliness

First screening within 12 weeks of POA and second screening within 24-28 weeks were considered as timely screening. First and second screening had been performed in a timely manner in 72.4% and 59.5% respectively. Mean and median POA at first screening test were 10.57 and 10 weeks and shows relatively better timeliness. Whereas mean and median POA at second screening was reported as 27.87 and 28 weeks respectively and it is closer towards the upper limit of recommended POA to perform second screening (Ministry of Health Sri Lanka, 2014). As 69.7% of second screening tests had been done at a hospital or a private laboratory, it can pose a delay in because it would take some time to attend to a hospital or a private laboratory when pregnant mothers were advised to get the screening test done from either of above rather than performing the test at field antenatal clinic.

5.5.3. Proper documentation of screening test results

Correct documentation of screening test results and POA at the time of the test in appropriate cages in pregnancy record was considered as correct documentation. Percentages of correct documentation of first and second screening tests were 76.8% and 65.4%. Similar to the timeliness, correct documentation of screening test results was relatively low in second screening. A study conducted at tertiary care hospital in Canada to assess documentation of antenatal record it has been found that documentation of GDM screening was 78.3%. it is relatively in consistence with that of first screening(McDonald, Machold, Marshall, & Kingston, 2014). Relatively low correct documentation of second screening could also be attributed to screening test not being done at field clinics

5.5.4 Referral of mothers with positive screening test results

Percentages of mothers referred to specialized care among those who had a positive screening test results were 47.7% and 21.2% for first and second screening tests respectively. Though it has been recommended to refer all mothers with positive test results (Ministry of Health Sri Lanka, 2014), it has not being implemented at field level

5.5.5 Attendance to specialized care

Though referral of screening positive mothers to specialized care was low among the sample, attendance to specialized care among those referred was found to be better. It was shown that 85.7% and 100.0% of those who were referred following first and second screening tests have attended specialized care.

5.5.6 Further investigation of mothers with positive GDM screening results

It has been recommended to refer all mothers with positive screening tests and to investigate at specialized care unit (Ministry of Health Sri Lanka, 2014). According to the findings of this study further investigation was performed at MOH level also. Performance of further investigation was summarized in Table 4.6.

It has been identified that lack of consensus on screening test and cut off values and poor awareness of clinicians on GDM were barriers to a GDM screening programme (Buckley et al., 2012). But in Sri Lanka guideline for GDM screening has been furnished (Ministry of Health Sri Lanka, 2014)and at the same time professional bodies like Sri Lanka College of Obstetricians and Gynaecologists (SLCOG) has also recommended test and cut off values for screening (Motha & Dias, 2015). Lack of awareness among clinicians or discrepancies in personal practice may account for the differences.

5.5.7 Ultimate diagnosis of screening positive mothers

Only 3 (6.8%) out of 44 mothers with a positive result at first screening and 3 (9.0%) out of 33 mothers who were positive for GDM at second screening positive mothers were diagnosed to have GDM by the confirmatory test. It has been shown that non-fasting OGCT has low sensitivity (40.6%) in a study conducted at tertiary care hospital (Herath et al., 2015). Here in this study it has been reduced further. There could be errors when screening test is performed at field setting resulting high false positive values.

5.6 Awareness of GDM screening programme

Approximately 93% of the study sample was aware that GDM screening is carried out at field antenatal clinics (Table 4.4). At the same time, 63.8% and 62.1% were aware of the timing of first and second screening test respectively. However, it is impossible to determine whether awareness was present before screening test or they became aware after going through the test, which is an inherent weakness of a cross sectional study (Hennekens & Buring, 1987). In contrast to high awareness of the test, only 16.9% was aware of the response to an abnormal screening test result. At the same time, only 12.1% and 24.3% were aware of adverse maternal and neonatal outcome respectively. This supports the assumption that awareness has improved as a result of undergoing tests rather than being due to awareness programmes at field level.

Study conducted in a primary care unit in India has shown 74.2% of participants have good knowledge on GDM (V Shriraam, Rani, Sathiyasekaran, & Mahadevan, 2013)

5.7 Factors associated with selected aspects of screening process

5.7.1 Coverage

Factors associated with coverage of both screening tests have been summarized in tables from 4.9.1.1 to 4.9.2.4. In consistence with a systematic review and several studies that assessed health seeking behaviour of pregnant mothers, a higher education level above G.C.E. Advanced Level shows a positive association with better coverage of both screening tests (Simkhada et al., 2008) (Kamal et al., 2015). In addition, better coverage for first screening test was associated with planned pregnancy and primi parity as observed in the above studies. Similarly, it showed a positive association between better coverage and having no living children. Positive association shown for planned pregnancy, primi parity and having no children could be due to the early registration to antenatal care at field level.

However, the present study also revealed some contrasting findings compared to similar studies assessing health seeking behaviour. Though there have been evidences that working mothers who have higher education and more autonomy has better health seeking behaviour (Fotso et al., 2009)(Matsumura & Gubhaju, 2001) in this study no statistically significant difference was found between coverage of first screening tests and being employed during pregnancy. Though higher family income level was known to be associated with better usage of health services (Fotso et al., 2009), there was no significant difference in coverage between those who have monthly income more than median and those who have less than median. Despite evidence of better health care utilization among mothers from extended families (Matsumura & Gubhaju, 2001), no statistically significant association was shown between having extended family or family support and coverage of first screening. Though lack of staff and facilities act as a barrier to implement screening programs properly in low middle income settings (B. Bhavadharini et al., 2016), availability of PHM and logistics for the test was not significantly associated with coverage.

In contrast to the coverage of first screening test, having family support showed statistically significant association with better coverage of second screening. Planned pregnancy, primi parity and having no living children did not show any association with better coverage of second screening test. Awareness of the test and lesser distance to laboratory have shown statistically significant associations with better coverage of second screening test. Similar to first screening being employed during pregnancy, family income and family type were not associated with coverage of second screening

5.7.2 Timeliness

Factors associated with timeliness of both screening tests have been summarized in tables from 4.9.3.1 to 4.9.4.4 Similar to coverage of first screening test, timeliness was also associated positively with planned pregnancy. At the same time, timeliness was also associated with not being employed during pregnancy. Mothers with unplanned pregnancy tend to get registered with a delay and mothers who are working might have had difficulties to attend clinics. Hence, it could contribute to affect the timeliness of first screening test. It has been evident from previous studies that planned pregnancy or "wantedness" of a pregnancy has been associated with better health seeking behaviour (Ochako & Gichuhi, 2016)

Awareness of the test and adverse outcomes of GDM has shown positive association with better timeliness at first screening test. As it is a limitation of a cross sectional study design it is impossible to determine whether the mothers get awareness prior to the test or following test. (Hennekens & Buring, 1987) If study participants have acquired knowledge due to going through screening process awareness could show a false association between awareness and timeliness whereas who did not go through screening process has poor awareness. Similar to coverage, timeliness of the first screening has not shown a significant association with higher income, extended family, having family support and availability of PHM or logistics.

Level of education and time taken to reach hospital or laboratory did not show an association with timeliness of both first and second screening. A higher income was shown to be associated with better timeliness in second screening as shown in two previous studies on utilization of cervical cancer screening programme (Chang et al., 2017) (Morema et al., 2014) When the screening test performed at field clinic had better timeliness. It is obvious that it would take time to attend to hospital or laboratory to get screening done after particular mothers was advised to get screening done. Thus, performing the screening test at a place other than field clinic could affect timeliness. As non-availability of logistics could force health staff to refer pregnant mothers to a private laboratory or a government hospital for screening, such referrals would take time and alter timeliness. None of the other factors assessed such as education, awareness or pregnancy related factors were associated with timeliness of second screening test

5.7.3. Documentation of screening test result

Performing test at field clinics was associated with proper documentation of both screening test results. Lack of awareness and motivation has been suggested to associate with poor documentation in a study to assess documentation of antenatal weight gain (McDonald et al., 2014). Thus performing test at private laboratory or hospital could associated with lack of awareness to interpret investigation report and lead to poor documentation

Availability of logistics was associated with proper documentation of test results of first screening test, but there was no such association with documentation of second screening test results.

5.7.4 Attendance to specialized care.

Factors associated with attendance to specialized care were assessed only for first screening test. Only a higher education level was associated with better attendance to specialized care. Similar association between utilization of screening services and higher education has been shown in a study conducted in England (Sabates & Feinstein, 2006). On the other hand, there was less number of cases (n=21) for the analysis and it might have altered power of association.

5.6 Limitations of the study

The study sample was extracted from mothers who delivered at secondary care hospitals in Matara district. Though study sample is expected to be representative of pregnant mothers in Matara district, a certain proportion of the study population might have beeen draining to Teaching Hospital Mahamodara in Galle district. At the same time, it should be noted that there were mothers who delivered at DGH, Matara whose district of residence was not Matara (n=45, 10.3%). Moreover, this sample did not include mothers delivering at private hospitals, who could represent a different socio-cultural background. However, as these proportions are relatively small, it could be safely assumed that its effect on the generalizability of findings is minimal.

For those who resided in districts other than Matara district, data on availability of logistics have not been collected due to feasibility issues. Those (n=45) have been excluded from the analysis only for the section on availability of logistics.

It was impossible to determine the association between awareness and outcome variables as the study could not establish temporal relationship between awareness and outcome variables. It was a limitation of cross sectional studies. However, the other factors assessed were relatively fixed for the duration of the study concerned. Therefore, apart from awareness

other factors associated with outcome variables could be assessed without an error.

Association between logistic availability and timeliness and documentation of result might be confounded with place of screening. Screening at field clinics is associated with availability of logistics and timeliness and documentation of screening test results. If place of screening has associated with both factors independently it could act as a cofounder and give false association.

Lesser number of subjects (n=21) were available to assess factors associated with attendance to specialized care. It might affect the validity and reliability of the results.

In the current study mothers with negative screening test results have not undergone a diagnostic test and considered as not having GDM. Thus, false negative screening test results were not looked into.

Though this study assessed client and health care delivery related factors, factors with health care providers such as PHM and MOH remain to be assessed to achieve the completeness.

5.7 Outcome of the study

This study has been conducted to assess effectiveness of GDM screening programme at field antenatal clinics and to identify client and service related factors associated with effectiveness. Effectiveness has been assessed in relation to selected aspects; i.e. coverage, timeliness, documentation of results, appropriate referrals, further investigation and ultimate diagnosis. Factors associated with coverage, timeliness, documentation and attendance to specialized care were identified.

Findings of this study will be useful in improvement of the quality of screening programme and hence the effectiveness of the screening programme for early detection of GDM and to reduce adverse outcome during pregnancy, perinatal period and later life of both the mother and the child.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

In this study GDM screening programme at field antenatal clinics shows a good coverage of 91.4% and 94.5% for first and second screening respectively. And timeliness and proper documentation of first screening was relatively low (72.4% and 76.8% respectively) when compared to higher coverage. Despite higher coverage, timeliness and proper documentation was further low for second screening (59.5% and 65.4% respectively). When it comes to percentage of appropriate referral of mothers with positive screening test results, has become further down to less than half for first screening and just above 1 / 5^{th} for second. Attendance to specialized care following referral was higher showing 85.7% and 100% for first and second screening respectively.

Though it is recommended to perform diagnostic investigation on mothers those who has positive screening test results, further investigation was found to be remained low as 70.4% and 36.4% of first and second screening respectively. At the same time, nearly half and one third of further investigations first and second screening test positive mothers were performed at specializes care as recommended by screening guideline. Only 6.8% and 9.0% were diagnosed to have GDM among mothers with positive screening results. It indicates low detection rate of GDM from screening programme.

The majority of the mothers who participated in study were aware of the screening test done at field clinics (over 90%); however, less than $2/3^{rd}$ of the sample were aware of the timing of the test. A large majority (over 75%) were unaware of the need for specialized care and maternal and neonatal consequences of GDM

Coverage has been positively associated with higher education level for both first and second screening tests. Higher education level above G.C.E Ordinary Level has associated with higher coverage ($p = 0.021$ and 0.25 respectively). Coverage of first screening test alone associated positively with no living children ($p=0.03$), primi parity ($p=0.033$) and planned pregnancy ($p=0.00$) and coverage of second screening test positively associated with lesser distance to nearest laboratory ($p=0.02$), having family support during the pregnancy ($p=0.025$) and awareness of the test ($p= 0.00$).

Timeliness of both first and second screening was positively associated with performance of screening test at field clinics ($p= 0.00$ and 0.007 respectively). Timeliness of first screening alone associated with following client related factors; not employed during pregnancy

(p=0.005), planned pregnancy (p=0.023) and awareness on test (p=0.001) and adverse outcomes (p=0.025) and timeliness of second screening was associated positively with availability of logistics at MOH level (p=0.007)

Proper documentation of first and second screening results was positively associated with associated with performance of screening test at field clinics (p= 0.00 and 0.00 respectively), further proper documentation of first screening results was associated positively with availability of logistics at MOH level (p=0.009)

Attendance to specialized care was seemed to be associated positively with higher education. But that was not statistically significance.

6.2 Recommendations

- Though coverage for both screening tests exceeds 90%, measures are needed to be taken to increase it further to ensure all mothers are screened.

- Despite high coverage, it has been shown that the timeliness of the screening test, correct documentation of screening test results and referral for specialized care were relatively low. Therefore, it is important to assess knowledge, attitude and practices regarding screening of GDM among health care providers. This will help identify reasons for the observed deficiencies and introduce mechanisms to facilitate improvement of screening programme.

- Since awareness of importance of GDM screening and attendance fo specialized care was substantially low, health education and promotion efforts on GDM, should be enhanced to address these knowledge gaps.

- Inadequacies in logistic availability has affected quality of GDM screening programme; particularly timeliness. It is essential to streamline logistic supply to field level.

- This study has done an assessment on quantitative aspects (coverage, timeliness, documentation and referral) of the screening process. Therefore, a knowledge gap exists on the qualitative aspects of the screening process. Further studies that can assess and identify push and pull factors for utilization of screening, place of screening and attendance to specialized care are highly recommended.

Though sensitivity, specificity and cut off values for non-fasting OGCT at tertiary care settings has been assessed, those parameters have not been evaluated for screening test performed at field antenatal clinics. In this study, detection of GDM following current screening procedure was low compared other studies, indicating possible differences in the implementation of the screening process. Therefore, it is recommended to assess above parameters with regards to screening process at field antenatal clinics.

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ACKNOWLEDGEMENTS

To the Director and academic staff of Post Graduate Institute of Medicine, University of Colombo for the provision of the opportunity to learn research through conducting a research

To the Board of Studies for Community Medicine for the guidance to carry out successful study

To the supervisor of the research work Dr. C. J. Wijesinghe (senior lecture in community medicine, Faculty of medicine, University of Ruhuna) for the immense support and guidance given form the beginning.

To Regional Director of Health Services Matara district, for permitting to carry out the study in the district.

To the Director of District General Hospital Matara for permitting to carry out the study in the hospital.

To Medical Superintendents of Base Hospital Kamburupitiya and Deniyaya for permitting to carry out the study in the hospitals.

To all Consultant Obstetricians and Gynecologist in charge and all categories of staff at the post-natal wards where data collection taken place for their immense support during data collection.

All Medical Officers of Health and subordinate staff in Matara district for their immense support during data collection.

All post –partum mothers who participate in the study for their support in data collection and bearing me even with their discomfort..

ANNEXES

Annexure I Consent form (English)

(Identification details of principal investigator and supervisor has been removed)

Consent form

As a part of the requirements of my postgraduate training, I have planned to conduct a study to assess the factors associated with Factors associated with effectiveness of antenatal screening programme for gestational diabetes mellitus among mothers delivered at district General Hospital, Matara, Base Hospital, Kamburupitiya and Base Hospital, Deniyaya.

You are kindly invited to participate in a study. Whether or not to take part is entirely your decision and it will not affect the care you receive from the hospital in any way.

In this study you will be asked 23 questions by an interviewer (the chief investigator) regarding your general information, details of family, pregnancy related details and screening tests that you have undergone. In addition your pregnancy record and other clinical records related to pregnancy will be examined by the interviewer to extract relevant data. Data obtained by above means will be kept anonymous and confidential. And they will only be published in scientific documents. You are free to refrain from answering the questions and providing the data from your records, if you are not willing to, and doing so will not affect the care you will receive.

This study will find strengths and weaknesses of the screening programme and factors that are associated with effectiveness of programme. Though there are no direct benefits o you from this study, the knowledge gained from the study will be useful for further development of screening programme which will benefit the community and yourself in future. Also, there will be no potential harm to you by consenting to take part in this study.

If you have any questions you can ask me directly at any time through above telephone number or ask any other doctor at the ward in any case you need.

****

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily to participate in this research.

Name of the Participant _____

Signature of the Participant _____ Date

_____

Day/month/year

Annexure II Consent form (Sinhala)

(Identification details of principal investigator and supervisor has been removed)

කැමැත්ත ප්‍රකාශ කිරීම

මම, වෛද්‍ය ජී. ජේ. චන්දන, වෛද්‍ය විද්‍යා පශ්චාත් උපාධි ආයතනයේ ප්‍රජා වෛද්‍ය විද්‍යා විද්‍යාපති උපාධි අපේක්ෂකයෙක් වෙමි.මාගේ පශ්චාත් උපාධි පුහුණුවේ කොටසක් ලෙස, මාතර මහ රෝහල, කඹුරුපිටිය මූලික රෝහල, දෙනියාය මූලික රෝහල යන රෝහල් වල ප්‍රසූතිය සිදු කල සියළු මව්වරුන් අතර ගර්භනී අවධියේ ඇතිවන දියවැඩියාව පෙර හඳුනාගැනීමේ වැඩසටහනේ සඵලතාව සහ ඊට සම්බන්ධ කරුණු පිළිඹඳ අධ්‍යයනයක් සිදුකිරීමට සැලසුම් කර ඇත්තෙමි

සඳහා සහබාගී වීමට ඔබට කාරුණිකව ඇරයුම් කර සිටිමි. සහබාගී වීම හෝ නොවීම ඔබේ තීරනයක් වන අතර එමගින් රෝහල තුල ඔබේ ප්‍රතිකාරයට බලපෑමක් ඇති නොකෙරේ.

මෙම අධ්‍යයනයේදී ඔබ වෙත සාමාන්‍ය තොරතුරු, පවුලේ තොරතුරු, ගර්භනී බාවය සම්බන්ධ තොරතුරු සහ ඔබ සිදුකරවාගත් පෙර හඳුනාගැනීමේ පරීක්ෂණ සම්බන්ධයෙන් ප්‍රශ්න 23 ක් සම්මුඛ පරීක්ෂකයකු (මා) විසින් යොමු කරනු ඇත. ඊට අමතරව ඔබගේ ගර්භනී සටහන් පත සහ ගර්භනී බාවය සම්බන්ධ අනෙක් සායනික සටහන් සම්මුඛ පරීක්ෂක විසින් පරීක්ෂා කරනු ඇත. ඉහත ආකාර වලින් ලබාගන්නා තොරතුරු නිර්නාමික වන අතර රහස්‍යබාවය සුරැකේ. සහ එම තොරතුරු විද්‍යාත්මක ලේඛණ වල පමණක් ප්‍රකාශනය කෙරේ.ඔබට ඔබ අකමැති වේ නම් ප්‍රශ්න සඳහා පිළිතුරු ලබා දීමෙන් සහ වාර්තා වලින් දත්ත ලබාදීමෙන් වැලකී සිටිය හැක

මෙම අධ්‍යයනය පෙර හඳුනාගැනීමේ ක්‍රියාවලියේ හැකියාවන් සහ දුර්වලතාවන් සහ ක්‍රියාවලියේ සඵලතාව සම්බන්ධ කරුණු හඳුනාගනු ඇත. ඔබටත් සමාජයටත් වාසිදායක වන පෙර හඳුනාගැනීමේ ක්‍රියාවලියේ සංවර්ධනය සඳහා අධ්‍යයනය මගින් ලබාගන්නා දැනුම උපකාරී වනු ඇත. තවද මෙම පරීක්ෂණයට සහබාගී වීම මගින් ඔබට හානියක් සිදුනොවේ

මෙම අධ්‍යයනය සම්බන්ධව ඔබට ගැටළු ඇත්නම් ඕනෑම අවස්තාවක මා ඉහත දුරකතන අංකයෙන් හෝ අවශ්‍ය නම් වාට්ටුවේ වෙනත් වෛද්‍යවරයෙකු විමසිය හැක.

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මම ඉහත තොරතුරු කියවන ලදී/ මා වෙත කියවා දෙන ලදී. ඒ පිළිඹඳ ප්‍රශ්න ඇසීමට මා හට අවස්ථාව ලැබුණු අතර මා අසන ලද ප්‍රශ්න වලට සෑහීමට පත්විය හැකි පිළිතුරු ලැබුණි. මෙම පරීක්ෂණය සඳහා සහභාගී වීමට කැමැත්ත ප්‍රකාශ කරමි.

සහභාගී වන්නාගේ නම_____

සහභාගී වන්නාගේ අත්සන _____

දිනය _____

Annexure III Interviewer administered questionnaire (English)

Factors associated with effectiveness of antenatal screening programme for gestational diabetes mellitus among mothers delivered at secondary care hospitals in Matara district

Date			Index no	

Part 1.

POA at delivery		LRMP			

A. General information

1. PHM area where you have lived most of the pregnancy period:

   .....

2. MOH area where you have lived most of the pregnancy period:

   .....

3. Age at last birthday: - .....

4. Nationality: -

Sinhala	
Tamil	
Muslim	
Burgher	
Other	

5. Religion: -

Buddhist	
Hindu	
Islam	
Christian	
Other	

6. Marital state: -

Unmarried	
Living together	
Married	
Married and separated	
Divorced	
Widowed	

7. Highest level of education attained: -

No school education		Passed G.C.E.(Advanced level)	
Grade 1-5		Tertiary education (diploma/ degree or equivalent)	
Grade 6-11			
Passed general certificate of education(G.C.E) (ordinary level)			

8. Occupation during pregnancy period: - .....

9. Distance to nearest hospital providing specialised care (obstetrician is available), by routine way of transport:-

Less than 30 minutes	
30 minutes – 1hour	
More than 1 hour	

10. Distance to nearest laboratory (private/ government hospital) that can provide blood sugar testing, by routine way of transport: -

Less than 30 minutes	
30 minutes – 1hour	
More than 1 hour	

B. Details of the family

1. Number of living children: - .....
2. Average monthly family income: - .....
3. Are there any other relatives lived with your family except you're, your husband and children: -

Yes	No

4. Did you have at least one relative to help in her daily activities during pregnant period: -

Yes	No

C. Pregnancy related details

1. How many times have you got pregnant (including previous abortions and this pregnancy):- .....
2. Was this a planned pregnancy: -

Yes	No

Part 2. Knowledge on the test

1. Are you aware that diabetes in pregnancy is being screened at field antenatal clinics: -

Yes	No

If yes, what is being tested: -

Glucose	
Haemoglobin	
Glucose and haemoglobin	
Other responses	
Don't know	

2. At how many weeks of pregnancy this test should be performed: -

Frist visit to field clinic	
Before 12 weeks	
24 -28 weeks	
Other responses	
Don't know	

3. What you should do if that test becomes abnormal: -

Consult an Obstetrician	
Attend hospital antenatal clinic	
Don't know	

4. What adverse effects can occur if blood sugar is not controlled during pregnancy: -

Maternal adverse effect/s		Neonatal adverse effect/s	

Part 3. Details of antenatal screening for GDM (check list)

Frist screening test

1. Screening test :- Done ☐ not done ☐
2. POA at test: - .....
   Booking visit ☐ Other visit ☐
3. Where the test has been done: -
   a. field clinic ☐
   b. hospital ☐
   c. private laboratory ☐
4. What is the test performed:-

Test	FBS	OGTT	Non-fasting OGCT	PPBS	Hb A_{1C}
Value					
Cut-off value	92mg/dl	150mg/dl 2hr value	140mg/dl	120mg/dl	6.5%

5. Positive ☐ Negative ☐
6. If positive: -
   a. Not referred ☐
   b. Referred ☐
      i. Attend antenatal clinic at hospital ☐
      ii. Consult a VOG ☐
      iii. Not attended ☐
   c. Further investigated ☐

At specialized care institute			Other		
Test	FBS	OGTT	Non-fasting OGCT	PPBS	Hb A_{1C}
Value					
Cut-off value	92mg/dl	153mg/dl 2hr value	140mg/dl	120mg/dl	6.5%

7. Documentation of test results in given cage on pregnancy record (H512 A): -
   a. POA at test: - Yes | No
   b. Value of test: - Yes | No
8. Ultimate diagnosis: -
   a. Gestational diabetes mellitus ☐
   b. No gestational diabetes mellitus ☐

Second screening test

1. Screening test :- Done ☐ not done ☐
2. POA at test: - .....
3. Where the test has been done: -
   a. field clinic ☐
   b. hospital ☐
   c. private laboratory ☐
4. What is the test performed:-

Test	FBS	OGTT	Non-fasting OGCT	PPBS	Hb A_{1C}
Value					
Cut-off value	92mg/dl	153mg/dl 2hr value	140mg/dl	120mg/dl	6.5%

5. Positive ☐ Negative ☐
6. If positive: -
   a. Not referred ☐
   b. Referred ☐
      i. Attend antenatal clinic at hospital ☐
      ii. Consult a VOG ☐
      iii. Not attended ☐
   c. Further investigated ☐

At specialized care institute			Other		
Test	FBS	OGTT	Non-fasting OGCT	PPBS	Hb A_{1C}
Value					
Cut-off value	92mg/dl	153mg/dl 2hr value	140mg/dl	120mg/dl	6.5%

7. Documentation of test results in given cage on pregnancy record (H512 A): -
   a. POA at test: - Yes | No
   b. Value of test: - Yes | No
8. Ultimate diagnosis: -
   a. Gestational diabetes mellitus ☐
   b. No gestational diabetes mellitus ☐

Annexure IV Interviewer administered questionnaire (Sinhala)

POA at delivery		LRMP			

මාතර දිස්ත්‍රික්කයේ ද්විතීක සත්කාර රෝහල් වල ප්‍රසූතිය සිදු කල මව්වරුන් අතර ගර්භනී අවධියේ ඇතිවන දියවැඩියාව පෙර හඳුනාගැනීමේ වැඩසටහනේ සඵලතාව සහ ඊට සම්බන්ධ කරුණු පිළිඹඳ අධ්‍යයනය

<u>කොටස 1</u>

දිනය			අනු අංකය	

<u>අ. සාමාන්‍ය තොරතුරු</u>

1. ගර්භනී අවධියෙන් වැඩි කොටසක් වාසය කල පවුල් සෞඛ්‍ය සේවා නිලධාරී කොට්ඨාශය: -

   .....

2. ගර්භනී අවධියෙන් වැඩි කොටසක් වාසය කල සෞඛ්‍ය වෛද්‍ය නිලධාරී කොට්ඨාශය: -

   .....

3. පසුගිය උපන් දිනයට වයස: - .....

4. ජාතිය: - .....

සිංහල	
දෙමල	
මුස්ලිම්	
බර්ගර්	
වෙනත්	

5. ආගම: -

සිංහල	
දෙමල	
මුස්ලිම්	
බර්ගර්	
වෙනත්	

6. විවාහක තත්වය: -

අවිවාහක	
එක්ව ජීවත්වන	
විවාහක	
විවාහක වෙන්වුණ	
දික්කසාද	
වැන්දඹු	

7. ලබාගත් ඉහල ම අධ්‍යාපන සුදුසුකම: -

පාසල් අධ්‍යාපනයක් නැත	
වසර 1-5	
වසර 6-11	
අධ්‍යාපන පොදු සහතිකපත්‍ර (අ.පො.ස) සාමාන්‍ය පෙළ සමත්	

අ.පො.ස උසස් පෙළ සමත්	
තෘතීක අධ්‍යාපනය (ඩිප්ලෝමා/ උපාධි හෝ සමාන)	

8. ගර්භනී අවධියේ රැකියාව: - .....

9. ආසන්නත ම විශේෂඥ සේවා සපයන (ප්‍රසව හා නාරිවෙද විශේෂඥ වෛද්‍ය වරයකු සහිත) රෝහලට දුර, දෛනික ප්‍රවාහන මාධ්‍යයෙන්: -

මිනිත්තු 30 ට අඩු	
මිනිත්තු 30 - පැය 1	
පැය 1 ට වැඩි	

10. ආසන්නත ම රුධිර සීනි පරීක්ෂණ සිදුකරන රසායනාගාරයට (පෞද්ගලික/ රජයේ රෝහල්) දුර, දෛනික ප්‍රවාහන මාධ්‍යයෙන්: -

මිනිත්තු 30 ට අඩු	
මිනිත්තු 30 - පැය 1	
පැය 1 ට වැඩි	

ආ. පවුලේ තොරතුරු

1. ජීවත්ව සිටින ළමුන් ගනන: - .....
2. පවුලේ දල මාසික ආදායම: - .....
3. ඔබ, සැමියා සහ දරුවන් හැර ඔබගේ පවුල සමග ජීවත් වන වෙනත් ඥාතීන් සිටීද: -

ඔව්	නැත

4. ගර්භනී අවධිය තුල ඔබගේ දෛනික කටයුතු වලදී උදව් වීමට එක් ඥාතියෙකු හෝ සිටියේද: -

ඔව්	නැත

ඇ. ගර්භනී බාවය සම්බන්ධ තොරතුරු

1. ඔබ කොපමණ වතාවක් ගර්භනී වී ඇද්ද (මෙම ගර්භනී බාවය සහ ගබ්සා ද සමග): - .....
2. මෙවර ගර්භනී බාවය බලාපොරොත්තු ව සිටියේද : -

ඔව්	නැත

කොටස 2

පරීක්ෂණය පිළිඹඳ දැනුම

1. ක්ෂේත්‍ර පූර්ව ප්‍රසව සායනයේදී ගර්භනී අවධියේ ඇතිවන දියවැඩියාව පෙර හඳුනාගැනීමේ පරීක්ෂාව සිදුකරන බව ඔබ දන්නවාද ?

ඔව්	නැත

පිළිතුර ඔව් නම් පරීක්ෂා කරන්නේ මොනවාද	
සීනි	
හිමොග්ලොබින්	
සීනි සහ හිමොග්ලොබින්	
වෙනත් පිළිතුරු	
නොදනී	

2. එම පරීක්ෂණය සිදු කල යුත්තේ ගර්භනී අවධියේ කවර සති වලදීද?

පළමු ක්ෂේත්‍ර සායන වාරයේ දී	
සති 12 ට පෙර	
සති 24 -28	
වෙනත් පිළිතුරු	
නොදනී	

3. එම පරීක්ෂණයේ ප්‍රතිඵල සාමාන්‍ය නොවුණ හොත් ඔබ නල යුත්තේ කුමක් ද?

විශෙෂඥ ප්‍රසව හා නාරීවේද වෛද්‍යවරයෙකු හමුවීම	
රෝහලේ පූර්ව ප්‍රසව සායනයට යොමුවීම	
නොදනී	

4. ගර්භනී කාලයේදී රුධිර සීනි මට්ටම ඉහල යාම නිසා ඇතිවිය හැකි අහිතකර තත්ව මොනවාද?

මවට ඇතිවන අහිතකර තත්ව		දරුවාට ඇතිවන අහිතකර තත්ව	

Annexure V Data record sheet 01

Data record sheets

Availability of public health midwifes at MOH areas in Matara district

MOH area _____

PHM area / Month	October/ 2016	November/ 2016	December/ 2016	January/ 2017	February/ 2017	March / 2017	April / 2017	May / 2017	June / 2017	July /2017

Annexure VI Data record sheet 02

Availability of logistics for non-Fasting OGCT at MOH offices in Matara district

MOH area: - _____

Month	Glucometer		Glucose strips		Lancets		75g glucose sachets	
	# available	# functioning	Monthly requirement	Amount available	Monthly requirement	Amount available	Monthly requirement	Amount available
October/ 2016								
November/ 2016								
December/ 2016								
January/ 2017								
February/ 2017								
March/ 2017								
April/ 2017								
May / 2017								
June/ 2017								
July/ 2017								
August/ 2017								