A Randomized Controlled Trial on the Effectiveness of Short Message Service (SMS) Reminders in Improving Postpartum Follow-up among Gestational Diabetes Mellitus Patients

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Abstract

Objective. This study assessed whether short message service (SMS) reminders would improve follow-up rate among gestational diabetes mellitus (GDM) patients by 12 weeks postpartum.

Methodology. In this single-center, single-blind randomized controlled trial, we assigned 308 patients with GDM to either of 2 arms, usual care alone versus usual care with SMS reminders. In the usual care group, 154 patients received a 10-minute short lecture on GDM and a 75 g oral glucose tolerance test (OGTT) request prior to discharge. In the SMS group, 154 patients received twice a week SMS reminders at 4 weeks, 8 weeks, and 10 weeks after delivery in addition to usual care. The primary outcome was clinic visit within 6 to 12 weeks postpartum with a 75 g OGTT result.

Results. In our population, the overall follow-up rate was 19.8% (61/308). Follow up rates were 20.1% (31/154) for the usual care group and 19.5% (30/154) for the SMS. The addition of SMS reminders was not associated with an increase in follow-up rate at 12 weeks postpartum (adjusted RR 0.98, 95% CI 0.63-1.52; p=0.932). The use of insulin or metformin for GDM control was associated with increased follow-up (adjusted RR 1.92, 95% CI 1.20-3.07; p=0.006).

Conclusion. SMS reminders did not improve postpartum follow-up rate among GDM patients at 12 weeks postpartum.

Key words: gestational diabetes, short message service, reminder system

INTRODUCTION

The prevalence of gestational diabetes mellitus is reported to be as high as 14% among Filipinos, based on the ASEAN Federation of Endocrine Societies (AFES) Study Group on Diabetes in Pregnancy. Following GDM, 35 to 60% of women develop type 2 diabetes within 10 years. The incidence of postpartum glucose intolerance among Filipino GDM patients was reported to be as high as 42% (overt diabetes in 7.3% and prediabetes in 34.7%). Subclinical glucose intolerance during pregnancy is also associated with a dose-related increase in cardiovascular disease later in life. Taking into account these long-term implications, early identification of postpartum type 2 diabetes mellitus risk and glucose intolerance is imperative. This can be done by postpartum glucose screening as this presents an opportunity for education and primary diabetes prevention.

The Philippine Clinical Practice Guidelines on the Diagnosis and Management of Diabetes Mellitus recommend that women with GDM be screened for persistent glucose abnormality at 6 to 12 weeks postpartum. However, in our institution, follow-up rates are generally poor, as most are lost to follow-up after discharge from the hospital. Studies from the United States and Australia also report low postpartum screening, with rates ranging from 19 to 73%. There are efforts to increase awareness focusing mainly on education, as it has been demonstrated that women who are better educated on the importance of postpartum testing are more likely to follow-up. The need to identify simple and innovative strategies to augment current care protocols may serve to improve postpartum glucose testing and follow-up. Among GDM patients, postpartum postal reminders, telephone calls and emails were shown to increase screening rates as reported by other studies. A meta-analysis of postpartum screening practices among Asian women with a known history of GDM showed that postpartum testing rate ranged from 13 to 82% during routine care, as compared to 67 to 95% of women who received SMS or call interventions in the studies. The intention behind putting a reminder system in place overrides not only an avenue for continuity of care, but also a continual of awareness of the risk for development of diabetes.

In 2015, our National Telehealth Center reported that there were 114.6 million mobile connections in the country. Given the widespread use of texting and mobile phones and the evidence to support their use, numerous text messaging programs for health promotion have
been developed. Studies on the use of short message service in health care, particularly among human immunodeficiency virus patients and persons with type 2 diabetes mellitus, showed improved adherence to treatment and increased appointment attendance. Locally, SMS as an adjunct to standard diabetes care has been shown to improve adherence to diet and exercise, supporting disease self-management. An SMS reminder system among postpartum GDM patients in Australia was demonstrated to increase overall postpartum screening rate. In a local study on GDM patients which implemented persistent SMS reminders or calls for scheduled postpartum 75 g oral glucose tolerance test (OGTT), the reported follow-up rate was 71.6%.

Given the prevalent use of mobile phones among Filipinos and the low cost of text messaging (PhP 1.00 equivalent to ~USD 0.020 per standard 160-character SMS), a reminder system through text messaging may prove to be an inexpensive, effective, feasible and culture-appropriate strategy to improve rates of postpartum glucose testing and follow-up.

This study aimed to compare the effectiveness of SMS reminders in addition to usual care in improving follow-up and postpartum glucose testing among GDM patients. We also determined the association of follow-up and socio-demographic and perinatal characteristics, including clinical and neonatal outcomes, and among postpartum GDM patients. We also described self-reported barriers and facilitators for postpartum testing.

**METHODOLOGY**

**Study design and participants**

This study was a single-blind randomized controlled trial that was conducted at the Philippine General Hospital, a tertiary teaching hospital in Manila. A concurrent qualitative method approach through survey questions was used to identify self-reported barriers and facilitators for postpartum follow-up. Ethics approval was obtained from the University of the Philippines Manila Research Ethics Board.

Participants were eligible for inclusion if they were diagnosed with GDM during their most recent pregnancy by their physician, or based on criteria from the International Association of Diabetes and Pregnancy Study Group (IADPSG) or the Philippine Obstetric and Gynecological Society (POGS). They should have access to a personal mobile phone (not a shared phone), be able to read and write in Filipino, have normal capillary blood glucose (CBG) upon discharge (fasting blood glucose (FBG) <108 mg/dL and 2-hour postprandial blood glucose (PPBG) <144 mg/dL) and with written informed consent. The diagnosis of GDM based on the IADPSG and POGS criteria is summarized in Table 1.

![Table 1](image)

| Criteria for diagnosing gestational diabetes mellitus and overt diabetes in pregnancy | IADPSG | POGS |
|---|---|---|
| 75 g OGTT: | | |
| Fasting plasma glucose, mg/dL | ≥92 | ≥92 |
| 1-hour post-load plasma glucose, mg/dL | ≥180 | | |
| 2-hour post-load plasma glucose, mg/dL | ≥153 | ≥140 |
| Overt diabetes: | | |
| Fasting plasma glucose, mg/dL | ≥126 | ≥126 |
| HbA1c, % | ≥6.5 | ≥6.5 |
| Random plasma glucose, mg/dL | ≥200 | ≥200 |

International Association of Diabetes and Pregnancy Study Groups

1. Criteria for diagnosis entails at least one abnormal value
2. Oral glucose tolerance test
3. Plus confirmation with fasting glucose or HbA1c

Sample size calculation for 2 independent proportions assumed an estimated baseline follow-up rate of 20%. Stata version 13.0 sample size calculator was used to estimate the sample size. To detect a 15% absolute improvement in follow-up from 20% to 35%, with 80% power, at 95% confidence interval, 5% error, and accounting for 10% data loss inherent in SMS, the sample size needed was computed at 308.

**Description of study procedure**

All participants admitted for delivery who were referred to the Section of Endocrinology, Diabetes and Metabolism for co-management of GDM, were assessed for eligibility. The primary investigator obtained informed consent if they met the inclusion criteria.

Eligible participants were randomized to either usual care or SMS (in addition to usual care) groups. Randomization was carried out in a 1:1 ratio using a computer-generated random allocation sequence. Allocation of treatment was done by third party personnel, using sequential sealed opaque envelopes. The outcome assessor and primary physician were blinded to treatment allocations. Blinding of the participants was not possible due to the nature of the intervention. Baseline socio-demographic characteristics, GDM status and maternal and fetal outcomes were abstracted from inpatient records and written in data collection forms. Additional information not indicated in the inpatient records was obtained by interview by the primary investigator.

**Study intervention**

Prior to discharge, the usual care group received a 10-minute lecture on postpartum GDM care and a 75 g OGTT request form. Explicit instructions were given pertaining to the laboratory location and timing of testing at 6 to 12 weeks postpartum. Follow-up visit with test results was also advised.

In addition to the above usual care, the SMS group received twice a week SMS reminders. The SMS were sent at 4, 8 and 10 weeks after delivery: one SMS on a weekday (Wednesday) and one on a weekend (Saturday). The messages in Filipino language contained a short reminder on different aspects of GDM postpartum care.
and reiteration of written instructions for follow-up (Appendix A). The participants were not required to reply to these reminders. The content of the SMS was derived from a discussion with an endocrinologist who is also a medical informatics specialist. The SMS were sent manually by the study investigators. The overall cost of sending the text messages for the 154 participants in the SMS group was PhP 924.00, equivalent to USD 17.74 to 19.67 based on the current exchange rate during the course of the study. No monetary incentive was given to the participants to avoid any effect on follow-up.

An independent outcome assessor evaluated the participants on clinic follow-up. The date and results of the OGTT were recorded. If the OGTT results were abnormal, the participant was referred to her respective endocrinologist for subsequent follow-up and intervention. At the end of the clinic consult, each participant was asked a survey question on why they came for follow-up (Appendix B). If the participant belonged to the SMS group, she was asked the number of SMS reminders received.

All the participants who did not follow-up at 12 weeks postpartum were contacted through voice call to answer the survey questions (Appendix B). Responses were recorded verbatim. If a participant could not be reached on the first call, SMS were sent and she was again contacted on a different day. At least 3 attempts at varied times and on different days were made to reach the participant. The patient was then listed as not contactable if any of the following were encountered: phone number cannot be completed as dialed, subscriber cannot be reached, phone number is unattended or out of coverage area, call ended or dropped, wrong number, or ringing but with no answer on all attempts.

Outcome assessment

The primary outcome was follow-up defined as a clinic visit within 12 weeks postpartum with 75 g OGTT results. The follow-up rate for each group was calculated as the number of participants who followed-up divided by total number of participants in the group multiplied by 100. Participants who did not come for follow-up or came for clinic visit after the 3-month time period were labeled as non-follow-up. Participants who did not bring an OGTT result on clinic visit were considered as follow up, given another OGTT request and advised to come back within the time period.

Responses to survey questions were examined and grouped for emerging themes, and then classified as self-reported barriers and facilitators to postpartum follow-up.

Data analysis

Descriptive analyses were performed and bivariate analyses were run by follow-up status. The percentages across independent variables by follow-up status were calculated. The significance of the main effects of the different independent variables on the follow-up status was determined by bivariate analysis using Mann-Whitney U test for continuous data, while chi-square and Fisher’s exact tests were used to compare categorical data. Bivariate analysis was initially performed to have an idea of the nature of the strength of association of each independent variable and the outcome variable. A bivariate test resulting to a p-value ≤0.25 was considered a candidate for the multivariable model. Multivariate logistic regression with backward selection strategy was then performed to determine the factors associated with follow-up, while taking into account all other associated factors. The significance level for removal of a variable in the model was 0.05. Risk ratios (RR), 95% confidence interval (CI), and p values were derived. All statistical analyses were performed using Stata 14 for Windows® (StataCorp LP, College Station, TX, USA). Outcome comparisons were made according to treatment allocation, on an intention-to-treat analysis.

RESULTS

Recruitment and participant flow

Recruitment was performed from April 2017 until March 2018 when the pre-specified sample size was reached. Follow-up of study outcomes was completed by June 2018. Out of the 336 participants assessed for eligibility, 28 were excluded. Twenty-four met different exclusion criteria: 12 had overt diabetes, 2 did not meet postpartum glucose cut-offs and were sent home on diabetes medication, 4 did not have a personal mobile phone, 4 had twin gestation in the index pregnancy, one had required long-term steroid treatment during the postpartum period for idiopathic thrombocytopenia, and one had neonatal death. There were 3 patients who did not give consent to participate, while another was excluded because of poor comprehension of instructions from a speech impediment (Figure 1).

Participants were randomized to either usual care (n=154) or SMS (n=154) groups. It was presumed that 151 participants received their text reminders. Three participants reported that no text reminders were received due to change of phone number, subscriber identity module (SIM) card malfunction and inability of mobile unit to receive SMS. A total of 81 (26.3%) participants could not be contacted at the end of the follow-up period [34 (22%) from the usual care group and 46 (30%) from the SMS group]. At the end of the study, these participants were considered as non follow-up, in accordance with an intention-to-treat analysis. During the follow up period, one participant died due to eclampsia in the immediate postpartum period.

Socio-demographic characteristics of included women

There were no significant differences in socio-demographic characteristics between the 2 groups. The mean age for both groups was 31 years. Approximately 60% of participants have college level education. The distribution of other demographic (monthly household income, employment status and parental status) and anthropometric characteristics (pre-pregnant weight and body mass index (BMI)) were similar in both groups (Table 2).

Perinatal factors

There were no significant differences in maternal factors between the groups. Antenatal 75 g OGTT results were available for 295 participants. The 13 patients without
actual OGTT results on admission were physician-diagnosed and on active outpatient follow-up with an endocrinologist during their current pregnancy (Table 3).

More participants in the SMS group had a history of preterm delivery (3.9% in the usual care, 9.1% in the SMS groups). On the other hand, more participants in the usual care group delivered pre-term in the index pregnancy (19.5% in the usual care, 7.1% in the SMS groups). Consequently, a higher rate of neonatal hypoglycemia was recorded in the usual care compared to the SMS group (22.1% versus 13.6%, \( p = 0.053 \)) but this difference did not reach statistical significance. Birth weights and neonatal ICU admissions were similar in both groups (Table 3).

![Figure 1. Participant flow diagram.](image-url)
OGTT was not done at that time of clinic visit (Table 4). (3%) had unknown glycemic status because the postpartum DM was newly diagnosed in 3 (4.6%) participants. Two most common condition (11 participants, 16.7%). Type 2 pre-diabetes, with impaired fasting glucose (IFG) as the (63.6%) had normal glucose status. Nineteen (28.8%) had Among those who were able to return for follow-up, 42 (63.6%) came after the prescribed 6 to 12 week postpartum period and were then considered as non-follow-up. The groups) came after the prescribed 6 to 12 week postpartum pregnancy. After adjusting for these factors, the addition of SMS to usual care did not increase follow up after 12 weeks pregnancy. Patients who used insulin or metformin for glycemic control during pregnancy. After adjusting for these factors, the addition of SMS to usual care did not increase follow up after 12 weeks pregnancy (adjusted RR 0.98, 95% CI 0.63-1.52; p=0.932). Patients who used insulin or metformin during pregnancy were twice more likely to follow-up after delivery (adjusted RR 1.92, 95% CI 1.20-3.07; p=0.006) (Table 5).

### Table 3. Maternal factors at trial entry

| Factor               | Total (n=308) | Usual care (n=154) | Usual care + SMS (n=154) |
|----------------------|---------------|---------------------|--------------------------|
| GDM b control (%)    | 256 (83.1)    | 125 (81.2)          | 131 (85.1)               |
| Diet                 | 52 (16.9)     | 29 (18.8)           | 23 (14.9)                |
| Gravidity            |               |                     |                          |
| Primigravid          | 86 (27.9)     | 48 (31.2)           | 38 (24.7)                |
| Multigravid          | 222 (72.1)    | 106 (68.8)          | 116 (75.3)               |
| Past obstetric history (%) |          |                     |                          |
| GDM b                | 13 (4.2)      | 9 (5.6)             | 4 (2.6)                  |
| Preterm delivery     | 20 (6.5)      | 6 (3.9)             | 14 (9.1)                 |
| Abortion stillbirth  | 68 (22.1)     | 31 (20.1)           | 37 (24.0)                |
| Macrosomia           | 15 (4.9)      | 7 (4.6)             | 8 (5.2)                  |
| Neonatal death       | 13 (4.2)      | 6 (3.9)             | 7 (4.6)                  |
| Gestational hypertension | 21 (6.8) | 8 (5.2)             | 13 (8.4)                 |
| Other post medical history (%) |         |                     |                          |
| Neonatal death       | 91 (29.6)     | 45 (29.2)           | 46 (29.9)                |
| Smoking              | 14 (4.6)      | 8 (5.2)             | 6 (3.9)                  |
| Family history of diabetes (%) | 110 (35.7) | 58 (37.7)           | 52 (33.8)                |
| Breastfeeding (%)    | 307 (99.7)    | 153 (99.4)          | 154 (100.0)              |
| Mode of delivery (%) |               |                     |                          |
| Spontaneous or assisted vaginal delivery | 142 (46.1) | 75 (48.7)          | 67 (43.5)                |
| Caesarean section    | 166 (53.9)    | 79 (51.3)           | 87 (56.5)                |
| Neonatal Outcomes (%) |             |                     |                          |
| Gestational age at birth |          |                     |                          |
| Preterm              | 41 (13.3)     | 30 (19.5)           | 11 (7.1)                 |
| Full term            | 267 (86.7)    | 124 (80.5)          | 143 (92.9)               |
| Birthweight          |               |                     |                          |
| Small for gestational age | 9 (2.9) | 5 (3.2)             | 4 (2.8)                  |
| Appropriate for gestational age | 286 (92.9) | 142 (92.2)        | 144 (93.5)               |
| Large for gestational age | 13 (4.2) | 7 (4.6)             | 6 (3.9)                  |
| Neonatal hypoglycemia | 55 (17.9)    | 34 (22.1)           | 21 (13.6)                |
| Neonatal intensive care unit admission | 80 (26.0) | 44 (28.6)          | 36 (23.4)                |

* a SMS, short message service  
b GDM, gestational diabetes mellitus  
c Necrotic death in previous pregnancies (excluding current/index pregnancy)  
d Limited to first-degree relatives  
e Pertains to index pregnancy  
f Definitions are based on guidelines used by Department of Pediatrics, Section of Neonatology, Philippine General Hospital

### Table 4. Postpartum follow-up rates and glucose status

| Outcome              | Total (n=308) | Usual care (n=154) | Usual care + SMS (n=154) |
|----------------------|---------------|---------------------|--------------------------|
| Follow-up status (%) |               |                     |                          |
| Follow-up            | 61 (19.8)     | 31 (20.1)           | 30 (19.5)                |
| No follow-up         | 247 (80.2)    | 123 (79.9)          | 124 (80.5)               |
| Postpartum glucose status (%) |          |                     |                          |
| Normal               | 42 (63.6)     | 24 (70.6)           | 18 (56.2)                |
| IFG g                | 11 (16.7)     | 3 (8.8)             | 8 (25.0)                 |
| IGT g                | 6 (9.1)       | 2 (5.9)             | 4 (12.5)                 |
| IFG g + IGT g        | 2 (3.0)       | 1 (2.9)             | 1 (3.1)                  |
| Type 2 DM a          | 3 (4.6)       | 2 (5.9)             | 1 (3.1)                  |
| Unknown              | 2 (3.0)       | 2 (5.9)             | 0 (0)                    |

* a SMS, short message service  
  p<0.886  
g IFG, impaired fasting glucose  
  IGT, impaired glucose tolerance  
  DM, diabetes mellitus

### Postpartum follow-up and glucose status

A total of 66 participants came for postpartum visit, resulting to an overall follow-up rate of 19.8%. Five participants (3 from the usual care and 2 from the SMS groups) came after the prescribed 6 to 12 week postpartum period and were then considered as non-follow-up. The difference in follow-up rates between groups was not statistically significant (Table 4).

Among those who were able to return for follow-up, 42 (63.6%) had normal glucose status. Nineteen (28.8%) had pre-diabetes, with impaired fasting glucose (IFG) as the most common condition (11 participants, 16.7%). Type 2 DM was newly diagnosed in 3 (4.6%) participants. Two (3%) had unknown glycemic status because the postpartum OGTT was not done at that time of clinic visit (Table 4). The study was only powered to detect a difference in the follow-up rates between the usual care and SMS groups. The factors associated with follow-up were explored nonetheless to better characterize our population of GDM patients. A bivariate analysis was done to determine the association of demographic and maternal characteristics, including clinical and neonatal outcomes and follow-up (Appendix C). Participants were more likely to come for postpartum follow up if they were older, had a monthly household income at or above minimum wage, and used insulin or metformin for glycemic control during pregnancy. After adjusting for these factors, the addition of SMS to usual care did not increase follow up after 12 weeks postpartum (adjusted RR 0.98, 95% CI 0.63-1.52; p=0.932). Patients who used insulin or metformin during pregnancy were twice more likely to follow-up after delivery (adjusted RR 1.92, 95% CI 1.20-3.07; p=0.006) (Table 5).
Because of the significant number of participants who did not follow-up, a post hoc per protocol analysis was performed, excluding 34 patients from the usual care group and 47 from the SMS group who were unreachable at the end of 12 weeks (Appendix D). The results were similar in both intention-to-treat and per-protocol analyses.

**Self-reported barriers and facilitators for postpartum follow-up**

The participants who came for postpartum reassessment were asked about their reasons for follow-up. The most common reason cited by the responders (n=66) was the need to know their glucose status after pregnancy. Among those who did not follow-up, most reported child care difficulties as the reason for not returning for clinic visit. Table 6 cites the themes identified as facilitators and barriers for follow-up based on open-ended responses.

**DISCUSSION**

The results indicate that SMS reminders in addition to usual care did not improve follow-up among GDM patients at 12 weeks postpartum in our center. In addition, the postpartum testing rates were suboptimal (<50%) for both groups. We found that the use of insulin or metformin for GDM control was significantly associated with higher follow-up rate, among the various factors examined. Identification of self-reported facilitators and barriers to follow-up gave us an overall context of the suboptimal outcome of postpartum follow-up in our setting.

Our findings are similar to the results of the DIAMIND study. The investigators reported that SMS reminders did not increase postpartum OGTT, fasting plasma glucose or HbA1c completion, despite a higher overall screening rate of 82%. This was attributed to the concurrent receipt of postal reminders under the national reminder scheme and an OGTT recommendation in the follow-up treatment plan. The findings of a study done in an Asian population reported a better follow-up rate in contrast to our study, at 66.6 to 94.9%, after being recalled by SMS reminder, phone call or invitation to join in studies. A high follow-up rate was reported by Malong in a similar Filipino cohort, possibly attributable not only to persistent SMS or call reminders, but also because the cost of OGTT was free for the patients. While employing a reminder system similar to the aforementioned studies, we investigated the effect of SMS reminders alone, without any concurrent reminder system or monetary incentives that may have affected the rate of follow-up. Another difference is that all of the studies had considerably longer follow-up duration of up to a mean of 22.8 months. Our trial specified follow-up within the recommended 6 to 12 weeks postpartum. This may possibly coincide with the period of adjustment...
to new parenting roles, which took precedence over postpartum follow-up, regardless of an SMS reminder. This was also observed in a study on a South Asian population in Australia. Although majority of the women were aware of the importance of OGTT screening, they struggled with the lack of support in the immediate postpartum period, and many were unable to attend for routine OGTT screening at 6 weeks postpartum leading to postponement of testing. While SMS may seem like a simple platform to employ behavioral intervention, it may not be the case for this particular subset of patients.

The open-ended responses to the survey questions provided insight into the reasons for lack of follow-up. Logistics such as child care difficulties, work and transfer of residence were identified by the participants as the most common reasons for non-follow-up. From those who were unable to return for follow-up, 5 patients had attended postpartum consult in a center within closer proximity to their home or workplace. Financial limitation was cited as the fourth most common reason for non-follow-up based on the survey. Postpartum follow-up is not covered by PhilHealth, our national social insurance program, making it an out-of-pocket expense. Follow-up visits possibly take a low priority in resource allocation for some individuals. These concerns come into play in any behavioral outcome and may have played a major role in the low overall follow-up rates. These barriers to follow-up cannot be addressed by any reminder system alone.

Another technology-based consideration is that about 26.3% of our participants were deemed not reachable by the end of the study period. Our pre-specified data loss at 10% may have underestimated real life attrition among those receiving SMS intervention in our setting.

The use of insulin or metformin for GDM control was significantly associated with higher follow-up in our trial. Apart from the additional intervention of medication use, these women are compelled to come for more regular ante partum follow-up particularly for medication adjustment and monitoring. This may have allowed for more physician-patient interaction and more opportunities to make the patients aware of their condition and the implications on their health, as opposed to their diet-only counterparts. This factor, along with older age, nulliparity and higher income or education, were identified to be socio-cultural-economic factors that affect follow-up. As can be surmised from the survey responses of the participants. Strategies to make postpartum follow-up universal, more accessible, more affordable and closer to local hospitals and health centers may serve to improve overall follow-up rates. Simplifying postpartum follow-up by incorporating pediatric, obstetric and medical follow up in a single clinic within the same schedule may be a viable option for future healthcare systems planning.

CONCLUSION

SMS reminders did not improve postpartum follow-up rate among GDM patients at 12 weeks postpartum in our setting. Among the factors examined, the use of insulin or metformin was independently associated with increased follow-up rate. Strategies addressing accessibility and affordability of postpartum care may serve to improve overall follow-up rates.

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All authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure
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APPENDICES

Appendix A. Teaching material and short message service content

| Teaching material                                                                 | Short message service                                                                 |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| Ito ang ABCDEF ng GDM pagkapanganan.                                              | Sender: PGH OPD DIABETES CLINIC                                                      |
| (This is the ABCDEF of GDM after delivery.)                                       | Ang mga nagka-GDM ay pwedeng magka-diabetes. Mag-follow-up 6-12 na limggo pagkapanganan. |
| (Assessment:                                                                      | Dalinh ang results ng 75 g OGTT sa Medicine Academic Complex Monday 8am.              |
| Ang mga nagka-GDM ay pwedeng magka-diabetes.                                      | (Persons who have had GDM may have diabetes. Follow-up 6 to 12 weeks after delivery. |
| Anim sa 10 na may GDM ay pwedeng magkadiabetes sa loob ng 10 taon. Samakatuwid,  | Bring your 75 g OGTT results to the Medicine Academic Complex Monday 8am.)           |
| mainain na magpakonsulta pagkapangananan.                                         |                                                                                        |
| Magpasuri ng 75 g OGTT at mag follow-up 6 hanggang 12 limggo pagkapanganan.       |                                                                                        |
| (Assessment:                                                                      |                                                                                        |
| Persons who have had GDM may have diabetes.                                        |                                                                                        |
| Six out of 10 persons who had GDM may have diabetes in the next 10 years.          |                                                                                        |
| Therefore, it is good to seek consult after delivery.                              |                                                                                        |
| Have a 75 g OGTT done and follow-up 6 to 12 weeks after delivery.                  |                                                                                        |
| Breastfeeding:                                                                    |                                                                                        |
| Pwedeng makaiwas sa diabetes ang pagpapasuso.                                     |                                                                                        |
| Bukod sa benepisyo ng breastmilk sa sanggol, ang breastfeeding ay nagbabunyan ng |                                                                                        |
| mas mababang peligro ng pagkakaraon ng patuloy na abnormal na blood sugar sa ina. |                                                                                        |
| (Breastfeeding:                                                                   |                                                                                        |
| Breastfeeding may help prevent diabetes.                                          |                                                                                        |
| Aside from the benefits of breastmilk to the newborn, breastfeeding may confer    |                                                                                        |
| a lower risk of persistently elevated blood sugar to the nursing mother.)         |                                                                                        |
| Contraception:                                                                    |                                                                                        |
| Mag-agwat ng pagbubunyis para di magka-diabetes. Magplano ng pamilya. Ang         |                                                                                        |
| magkasusud na pagbubunyis ay nagbabunyan ng 3x mas mataas na peligro ng diabetes   |                                                                                        |
| sa ina.                                                                           |                                                                                        |
| (Contraception:                                                                   |                                                                                        |
| Provide sufficient time in between pregnancies to avoid diabetes. Practice family  |                                                                                        |
| planning. Consecutive pregnancies confer a threefold increase in the risk of       |                                                                                        |
| diabetes in the mother.)                                                          |                                                                                        |
| Diet:                                                                            |                                                                                        |
| Sundin ang tamang diet para makaiwas sa diabetes.                                 |                                                                                        |
| Ang tamang diet ay kaugnay ng mas mababang panganib ng pagkakaraon ng diabetes    |                                                                                        |
| sa hinalarap.                                                                     |                                                                                        |
| (Diet:                                                                           |                                                                                        |
| Eat a proper diet to avoid diabetes.                                              |                                                                                        |
| A proper diet is linked to a lower risk of developing diabetes.                    |                                                                                        |
| (Ehersisyo:                                                                      |                                                                                        |
| Mag-ehersisyo para pumatay at makaiwas sa diabetes.                               |                                                                                        |
| Ang regular na ehersisyo ay makatutulong sa panunumbalik sa tamang limbag at     |                                                                                        |
| panalitlhing malusog ang pangangatalan.                                           |                                                                                        |
| (Ehersisyo:                                                                      |                                                                                        |
| Exercise to lose weight and prevent diabetes.                                     |                                                                                        |
| Regular exercise helps revert to proper weight and maintain health.)               |                                                                                        |
| Family:                                                                          |                                                                                        |
| Kailangan ang suporta ng pamilya para iwas diabetes.                              |                                                                                        |
| Upang masyos sa malsagawa ang ABCDEF ng GDM, hikayating ang suporta ng pamilya.    |                                                                                        |
| Family:                                                                          |                                                                                        |
| Family support is needed to prevent diabetes.                                     |                                                                                        |
| To help follow the ABCDEF of GDM, enlist the support of your family.               |                                                                                        |

Appendix B. Survey Questions

| Usual Care                  | Usual Care + SMS |
|-----------------------------|------------------|
| Follow-up                   |                  |
| Ano po ang nag-uudyok na inyo na mag-follow-up? | Ano po ang nag-uudyok na inyo na mag-follow-up? |
| (What motivated you to return for follow-up?) | Natanggap ninyo po ba ang mga paalala sa text messages? |
|                             | Ilang paalala po ang inyong natanggap? |
|                             | (What motivated you to return for follow-up?) |
|                             | Did you receive the SMS reminders? |
|                             | How many reminders did you receive? |
| No follow-up                |                  |
| Ano po ang mga dahlinan kung bakit hindi kayo nakababaliw para sa follow-up? | Ano po ang mga dahlinan kung bakit hindi kayo nakababaliw para sa follow-up? |
| (What are your reasons for not being able to return for follow-up?) | Natanggap ninyo po ba ang mga paalala sa text messages? |
|                             | Ilang paalala po ang inyong natanggap? |
|                             | (What are your reasons for not being able to return for follow-up?) |
|                             | Did you receive the SMS reminders? |
|                             | How many reminders did you receive? |
### Appendix C. Bivariate analysis of factors associated with follow-up

| Characteristic                                           | Total (n=308) | With follow-up (n=61) | No follow-up (n=247) | \( p \) value |
|----------------------------------------------------------|---------------|-----------------------|----------------------|---------------|
|                                                          | n or mean %   | n or mean % within category | n or mean % within category |               |
| Study group                                              |               |                       |                      |               |
| Usual care                                               | 154 50.0      | 31 20.1               | 123 123             | 0.886b        |
| Usual care + SMS\(^*\)                                   | 154 50.0      | 30 19.5               | 124 124             |               |
| Age in years                                             |               |                       |                      |               |
| ≤19                                                      | 5 1.6         | 1 20.0                | 4 80.0              |               |
| 20-29                                                    | 111 36.0      | 16 14.4               | 95 85.6             |               |
| 30-39                                                    | 157 51.0      | 36 22.9               | 121 77.1            |               |
| ≥40                                                      | 35 11.4       | 8 22.9                | 27 77.1             |               |
| Mean age, year (SD\(^+\))                               | 31.6 (6.3)    | 31.4 (6.3)            | 32.5 (6.0)          |               |
| Median age, year                                         | 32.0          | 31.0                  | 33.0                | 0.150c        |
| Highest level of education (%)                          |               |                       |                      |               |
| Secondary and below                                     | 122 39.6      | 21 17.2               | 101 82.8            |               |
| College level and above                                 | 186 60.4      | 40 21.5               | 146 78.5            |               |
| Employment status (%)                                   |               |                       |                      |               |
| Unemployed                                               | 189 61.4      | 37 19.6               | 152 80.4            |               |
| Employed                                                 | 119 38.6      | 24 20.2               | 95 79.8             | 0.899b        |
| Parental status (%)                                      |               |                       |                      |               |
| Single parent                                            | 15 4.9        | 3 20.0                | 12 80.0             |               |
| With partner                                             | 293 95.1      | 58 19.8               | 235 80.2            | 0.985c        |
| Monthly household income\(^%\)                          |               |                       |                      |               |
| Below minimum wage                                       | 112 36.4      | 17 15.2               | 95 84.8             |               |
| Minimum wage and above                                  | 196 63.6      | 44 22.4               | 152 77.6            | 0.124\(^a\)\(^b\) |
| Mean pregestational BMI, kg/m² (SD\(^+\))                | 23.9 (4.1)    | 23.9 (3.6)            | 23.9 (4.2)          |               |
| Median pregestational BMI, kg/m²                         | 23.4          | 23.4                  | 23.3                | 0.832\(^c\)   |
| Pregestational BMI, kg/m²                                 |               |                       |                      |               |
| Underweight                                              | 15 4.9        | 2 13.3                | 13 86.7             |               |
| Normal                                                   | 179 58.1      | 32 17.9               | 147 82.1            |               |
| Overweight                                               | 90 29.2       | 24 26.7               | 66 73.3             |               |
| Obese                                                    | 24 7.8        | 3 12.5                | 21 87.5             | 0.282\(^a\)   |
| Basis of diagnosis                                       |               |                       |                      |               |
| IADPSG\(^d\)                                            | 242 78.6      | 46 19.0               | 196 81.0            |               |
| POGS\(^e\)                                              | 53 17.2       | 11 20.8               | 42 79.2             | 0.771         |
| GDM control                                              |               |                       |                      |               |
| Diet                                                     | 256 83.1      | 43 16.8               | 213 83.2            |               |
| Insulin/Metformin                                        | 52 16.9       | 18 34.6               | 34 65.4             | 0.003\(^b\)   |
| Gravidity                                                |               |                       |                      |               |
| Primagravid                                              | 86 27.9       | 17 19.8               | 69 80.2             |               |
| Multigravid                                              | 222 72.1      | 44 19.8               | 178 80.2            | 0.992         |
| Presence of any obstetric history                        |               |                       |                      |               |
| Yes                                                      | 108 35.1      | 21 19.4               | 87 80.6             |               |
| No                                                       | 200 64.9      | 40 20.0               | 160 80.0            | 0.907\(^b\)   |
| Other past medical history                               |               |                       |                      |               |
| Yes                                                      | 91 29.6       | 19 20.9               | 72 79.1             |               |
| No                                                       | 217 70.4      | 42 19.4               | 175 80.6            | 0.759\(^b\)   |
| Smoking                                                  |               |                       |                      |               |
| Yes                                                      | 14 4.6        | 1 7.1                 | 13 92.9             |               |
| No                                                       | 294 95.4      | 60 20.4               | 234 79.6            | 0.317\(^b\)   |
| Family history of diabetes                              |               |                       |                      |               |
| Yes                                                      | 110 35.7      | 24 21.8               | 86 78.2             |               |
| No                                                       | 198 64.3      | 37 18.7               | 161 81.3            | 0.509\(^b\)   |
| Mode of delivery                                         |               |                       |                      |               |
| Spontaneous/assisted vaginal delivery                    | 142 46.1      | 32 22.5               | 110 77.5            |               |
| Caesarean section                                        | 166 53.9      | 29 17.5               | 137 82.5            | 0.266\(^b\)   |
| Gestational age at birth                                 |               |                       |                      |               |
| Preterm                                                  | 41 13.3       | 9 22.0                | 32 78.0             |               |
| Full term                                                | 267 86.7      | 52 19.5               | 215 80.5            | 0.711         |
| Birthweight                                              |               |                       |                      |               |
| Small for gestational age                                | 9 2.9         | 1 11.1                | 8 88.9              |               |
| Appropriate for gestational age                          | 286 92.9      | 58 20.3               | 228 79.7            |               |
| Large for gestational age                                | 13 4.2        | 2 15.4                | 11 84.6             | 0.916\(^a\)   |
| Neonatal hypoglycemia                                    |               |                       |                      |               |
| Yes                                                      | 55 17.9       | 11 20.0               | 44 80.0             |               |
| No                                                       | 253 82.1      | 50 19.8               | 203 80.2            | 0.968\(^b\)   |
| Neonatal intensive care unit admission                   |               |                       |                      |               |
| Yes                                                      | 80 26.0       | 15 18.8               | 65 81.2             |               |
| No                                                       | 228 74.0      | 46 20.2               | 182 79.8            | 0.783\(^b\)   |

\(^*\) SMS, short message service  
\(^a\) Chi-square test  
\(^b\) SD, standard deviation  
\(^c\) Mann-Whitney test  
\(^d\) Fisher’s exact test  
\(^e\) BMI, body mass index  
\(^f\) Fisher’s exact test  
\(^g\) IADPSG, International Association of Diabetes and Pregnancy Study Groups  
\(^h\) POGS, Philippine Obstetrical and Gynecological Society  
\(^i\) GDM, gestational diabetes mellitus  
\(^j\) Included in multiple logistic regression analysisDM, gestational diabetes mellitus
### Appendix D. Logistic regression analysis of factors associated with follow-up, per protocol analysis, n=227

| Variable                      | Unadjusted association | Adjusted association |
|-------------------------------|------------------------|----------------------|
|                               | RR (95% CI)            | p value              | RR (95% CI)          | p value              |
| **Study group**               |                        |                      |                      |                      |
| Usual care                    | 1.00 (reference)       |                      | 1.00 (reference)     |                      |
| Usual care + SMS\(^b\)        | 1.08 (0.70-1.66)       | 0.708                | 1.09 (0.71-1.67)     | 0.689                |
| **Education**                 |                        |                      |                      |                      |
| Secondary and below           | 1.00 (reference)       |                      | 1.00 (reference)     |                      |
| College level and above       | 1.34 (0.85-2.12)       | 0.203                | 1.19 (0.75-1.90)     | 0.452                |
| **Monthly household income**  |                        |                      |                      |                      |
| Below minimum wage            | 1.00 (reference)       |                      | 1.00 (reference)     |                      |
| Minimum wage and above        | 1.38 (0.84-2.25)       | 0.195                | 1.23 (0.75-2.04)     | 0.402                |
| **Age, year**                 |                        |                      |                      |                      |
|                               | 1.02 (0.99-1.06)       | 0.154                | 1.02 (0.98-1.06)     | 0.204                |
| **GDM\(^c\) control**        |                        |                      |                      |                      |
| Diet                          | 1.00 (reference)       |                      | 1.00 (reference)     |                      |
| Insulin/metformin             | 1.79 (1.15-2.77)       | 0.009                | 1.61 (1.04-2.51)     | 0.032                |
| **Mode of delivery**          |                        |                      |                      |                      |
| Spontaneous/assisted vaginal delivery | 1.00 (reference) |                | 1.00 (reference)     |                      |
| Caesarean section             | 0.75 (0.49-1.15)       | 0.195                | 0.70 (0.46-1.07)     | 0.108                |

\(^a\) CI, confidence interval
\(^b\) SMS, short message service
\(^c\) GDM, gestational diabetes mellitus
\(^d\) Mann-Whitney test
\(^e\) Fisher’s exact test
\(^f\) BMI, body mass index