



# Effectiveness of the "Hybrid-Midwifery" Model Based on WhatsApp Group and Home Visit on Early Detection of Pregnancy Danger Signs and Anxiety in Primigravida Mothers

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## ABSTRACT

**Background:** Delayed recognition of pregnancy danger signs contributes to maternal and neonatal morbidity and mortality. Conventional antenatal education is often limited by time constraints, resulting in inadequate knowledge retention and persistent anxiety, particularly among primigravida mothers. Hybrid models integrating digital education and personalized support may enhance both cognitive and psychological outcomes during pregnancy.

**Method:** A quasi-experimental pretest–posttest control group study was conducted among 70 third-trimester primigravida mothers in Deli Serdang Regency, North Sumatra, Indonesia. Participants were recruited through purposive sampling and allocated into an intervention group (n=35) and a control group (n=35). The intervention group received a 4-week Hybrid-Midwifery program consisting of WhatsApp-based education and individualized home visits, while the control group received standard antenatal care. Knowledge of pregnancy danger signs was assessed using a validated questionnaire (Cronbach's  $\alpha=0.813$ ), and anxiety was measured using the Hamilton Anxiety Rating Scale (HARS). Data were analyzed using paired and independent t-tests.

**Result:** The intervention group demonstrated significantly higher post-test knowledge scores than the control group ( $84.50 \pm 5.20$  vs.  $62.10 \pm 6.35$ ; mean difference=22.40, 95% CI: 19.10–25.70;  $p<0.001$ ; Cohen's  $d=3.87$ ). Anxiety levels were significantly lower in the intervention group than in the control group at post-test ( $11.20 \pm 2.15$  vs.  $20.40 \pm 3.10$ ; mean difference=9.20, 95% CI: 7.85–10.55;  $p<0.001$ ; Cohen's  $d=3.48$ ).

**Conclusion:** The Hybrid-Midwifery model was associated with substantial improvements in knowledge of pregnancy danger signs and significant reductions in anxiety among primigravida mothers. This integrated digital-humanistic approach may serve as a feasible complementary strategy for strengthening antenatal care services in primary healthcare settings.

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## INTRODUCTION

Maternal Mortality Rate (MMR) and Infant Mortality Rate (IMR) remain critical public health indicators requiring urgent intervention in Indonesia, particularly in North Sumatra Province. According to the Deli Serdang District Health Office, maternal deaths increased to 131 cases in 2023, corresponding to an MMR of 366 per 100,000 live births, which remains substantially higher than the national development target established in the National Medium-Term Development Plan (RPJMN). During the same period, 127 infant deaths were recorded. The implementation of the Maternal Perinatal Death Notification (MPDN) system has improved the completeness of maternal and neonatal mortality reporting, enabling more accurate surveillance and evaluation of maternal health outcomes (Dinas Kesehatan Kabupaten Deli Serdang, 2024; Kementerian Kesehatan RI, 2024).

One of the major contributors to maternal mortality is the delayed recognition and response to pregnancy complications, particularly the first and second delays described in the Three Delays Model proposed by Thaddeus and Maine (1994). Failure to recognize danger signs during pregnancy, including severe headache, visual disturbances, vaginal bleeding, or reduced fetal movement, may delay care-seeking and referral, increasing the risk of adverse maternal and neonatal outcomes (Thaddeus & Maine, 1994; World Health Organization [WHO], 2023). Improving maternal knowledge of pregnancy danger signs is therefore considered an important strategy for reducing preventable maternal deaths.

Antenatal Care (ANC) services delivered through primary healthcare centers and independent midwifery practices constitute the primary channel for maternal health education in Indonesia. However, health education during ANC is often constrained by limited consultation time, high client volume, and a predominance of provider-centered communication, which may reduce information retention among pregnant women. Primigravida mothers are particularly vulnerable because they frequently experience uncertainty and anxiety related to pregnancy, childbirth, and the transition to motherhood (Hariati et al., 2023; World Health Organization, 2022).

The rapid expansion of mobile health (mHealth) technologies has created new opportunities for improving maternal health literacy and antenatal care outcomes. Systematic reviews have demonstrated that mobile messaging interventions can improve attendance at antenatal care visits, increase maternal knowledge, and enhance engagement with healthcare services (Daly et al., 2022; Darmawati et al., 2022). In Indonesia, WhatsApp is among the most widely used communication platforms and offers a practical, accessible, and low-cost medium for delivering maternal health education across diverse populations (Puspitasari & Wulandari, 2021).

Despite these advantages, digital-only interventions may not adequately address the interpersonal and emotional dimensions of maternity care. Watson's Theory of Human Caring emphasizes that effective care extends beyond information provision and requires genuine human connection, emotional support, and therapeutic interaction (Watson, 2008). Evidence suggests that continuity of care models incorporating direct interaction between midwives and pregnant women are associated with reduced anxiety and improved maternal experiences (Birara et al., 2024; Hariati et al., 2023).

Although previous studies have demonstrated the effectiveness of WhatsApp-based antenatal education and home-visit interventions, these approaches have generally been evaluated separately or focused on a single outcome, such as knowledge improvement, service utilization, or anxiety reduction. Limited evidence exists regarding structured models that intentionally integrate digital education and face-to-face psychosocial support within a comprehensive antenatal care framework, particularly among primigravida mothers.

The Hybrid-Midwifery model was developed to address this gap by combining the strengths of digital and in-person care. Through WhatsApp-based education, pregnant women receive

standardized, repeated, and easily accessible information regarding pregnancy danger signs, while scheduled home visits provide individualized counseling, emotional reassurance, anxiety assessment, and relationship-building with midwives. This integrated approach is expected to simultaneously enhance cognitive preparedness and emotional well-being among primigravida mothers, who often experience greater uncertainty due to their lack of previous pregnancy experience (Bandura, 1986; Watson, 2008).

To date, evidence regarding the effectiveness of integrated digital-humanistic antenatal care models remains limited, particularly in low-resource primary healthcare settings. Therefore, this study evaluates the effectiveness of the Hybrid-Midwifery model in improving knowledge of pregnancy danger signs and reducing anxiety among primigravida mothers in Deli Serdang Regency, North Sumatra.

## METHOD

### Research Design

This study employed a quantitative quasi-experimental design using a Pretest–Posttest Control Group Design to evaluate the effectiveness of the Hybrid-Midwifery model on improving knowledge of pregnancy danger signs and reducing anxiety levels among primigravida mothers compared with standard antenatal care. The quasi-experimental approach was selected because participant allocation to intervention and control groups was conducted without randomization. To ensure transparent and comprehensive reporting of the intervention, study procedures, participant flow, and outcome assessment, this study followed the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) Statement guidelines for non-randomized intervention studies.

### Setting and Ethical Clearance

The study was conducted in the working area of Tuntungan Community Health Center, Pancurbatu District, Deli Serdang Regency, North Sumatra, from February to April 2025. Ethical approval was obtained from the Health Research Ethics Committee of Universitas Prima Indonesia (No. 053/KEPK/UNPRI/I/2025). All respondents provided written informed consent prior to enrollment.

### Population and Sample

The target population comprised all third-trimester primigravida mothers in the study area. Participants were recruited using purposive sampling based on the following criteria: primigravida mothers at 28–34 weeks of gestation, active WhatsApp smartphone users, possessing basic digital literacy, and residing in the study area. Mothers with severe obstetric complications (e.g., severe preeclampsia or placenta previa) or a history of psychiatric disorders were excluded. Sample size was calculated using G\*Power version 3.1 with a significance level of 0.05, power of 80%, and an effect size of 0.70, resulting in a minimum of 31 participants per group; after adding 10% for potential attrition, 35 participants were included in each group. Because this study employed a quasi-experimental design, participants were not randomly assigned. Instead, eligible mothers were allocated to the intervention or control group according to their antenatal care service area to minimize contamination between groups. Baseline demographic and obstetric characteristics were assessed to ensure group comparability and reduce potential selection bias. The final sample consisted of 70 respondents, with 35 participants in the Hybrid-Midwifery group and 35 participants in the standard care group.

### Procedures

The control group received standard antenatal care according to Indonesian Ministry of Health guidelines, including routine antenatal examinations and Communication, Information, and

Education (CIE) delivered through the Maternal and Child Health (MCH) handbook. In addition to standard care, the intervention group received the 4-week Hybrid-Midwifery program consisting of digital and humanistic components. The digital component was delivered through a researcher-managed WhatsApp group, where participants received two educational sessions per week (approximately 20–30 minutes/session) containing infographics, short videos (2–3 minutes), and discussion materials covering pregnancy danger signs, appropriate responses to obstetric emergencies, stress management, relaxation techniques, birth preparedness, and maternal self-monitoring. Participants could ask questions and receive responses from the midwife within 24 hours. The humanistic component consisted of one individualized home visit during the third week, lasting approximately 45–60 minutes, during which the midwife conducted maternal assessment, evaluated participants' understanding of the educational content, reinforced key messages, and provided personalized counseling and psychological support. Intervention fidelity was monitored using standardized educational materials, a home-visit checklist, attendance records, WhatsApp participation logs, and supervision by the principal investigator to ensure consistency of intervention delivery.

### Instrument

Measurements were conducted at pretest (pre-intervention) and posttest (Week 4) using: (1) A 15-item multiple-choice knowledge questionnaire adapted from the MCH handbook. Content validity of the knowledge questionnaire was assessed by three experts in maternal and midwifery care. The instrument demonstrated satisfactory content validity with a Content Validity Index (CVI) above 0.80. Reliability testing involving 30 pregnant women outside the study area yielded a Cronbach's alpha coefficient of 0.813, indicating good internal consistency; and (2) The Hamilton Anxiety Rating Scale (HARS) a 14-item gold-standard instrument assessing anxiety symptom severity on a Likert scale (0–4), where higher scores indicate greater anxiety (Hamilton, 1959).

### Analysis Plan

Univariate analysis described respondent characteristics. Bivariate analysis used Shapiro-Wilk normality testing ( $n < 50$  per group), Paired Sample T-test for within-group pre-post comparisons, and Independent Sample T-test for between-group comparisons at posttest. Non-parametric alternatives (Wilcoxon, Mann-Whitney U) were pre-specified if normality assumptions were violated. Significance level:  $p < 0.05$  (Nursalam, 2020).

## RESULTS AND DISCUSSION

### Results

#### Perceived Health Status Among Lecturers

All 70 enrolled participants completed the study, resulting in a retention rate of 100%. The final sample consisted of 35 participants in the Hybrid-Midwifery intervention group and 35 participants in the standard antenatal care control group.

**Table 1. Baseline Characteristics of Participants by Study Group (n = 70)**

Characteristics	Intervention Group (n=35)	Control Group (n=35)	p-value
<b>Age</b>			<b>0.812</b>
< 20 years	4 (11.4%)	5 (14.3%)	
20–35 years	27 (77.1%)	25 (71.4%)	
> 35 years	4 (11.4%)	5 (14.3%)	
<b>Education</b>			<b>0.675</b>

<b>Primary/Secondary</b>	21 (60.0%)	23 (65.7%)
<b>University</b>	14 (40.0%)	12 (34.3%)
<b>Employment</b>		<b>0.781</b>
<b>Employed</b>	12 (34.3%)	13 (37.1%)
<b>Housewife</b>	<b>23 (65.7%)</b>	<b>22 (62.9%)</b>

The majority of participants in both groups were aged 20–35 years, had primary to secondary education, and were housewives. No statistically significant differences were observed between the intervention and control groups for age, education level, or employment status (all  $p > 0.05$ ). These findings indicate that the groups were comparable at baseline, thereby supporting the internal validity of subsequent intervention-effect comparisons.

**Table 2. Effect of Hybrid-Midwifery Intervention on Knowledge of Pregnancy Danger Signs)**

Outcome	Intervention Mean $\pm$ SD	Control Mean $\pm$ SD	Mean Difference	95% CI	Cohen's d	p-value
Pre-test	55.33 $\pm$ 6.12	54.80 $\pm$ 5.95	0.53	-2.55–3.61	-	0.735
Post-test	84.50 $\pm$ 5.20	62.10 $\pm$ 6.35	22.40	19.10–25.70	3.87	<0.001
Change Score	+29.17	+7.30	21.87	18.40–25.34	3.55	<0.001

Table 2 shows that knowledge scores regarding pregnancy danger signs improved in both groups following the intervention period. In the intervention group, the mean score increased from 55.33  $\pm$  6.12 at baseline to 84.50  $\pm$  5.20 at post-test, representing a mean increase of 29.17 points ( $p < 0.001$ ). In contrast, the control group showed a smaller improvement, from 54.80  $\pm$  5.95 to 62.10  $\pm$  6.35, with a mean increase of 7.30 points ( $p = 0.021$ ). No significant difference was observed between groups at baseline (mean difference = 0.53;  $p = 0.735$ ), indicating comparable initial knowledge levels. However, post-test scores were significantly higher in the intervention group than in the control group, with a mean difference of 22.40 points (95% CI: 19.10–25.70;  $p < 0.001$ ). The improvement in knowledge was also greater in the intervention group than in the control group (29.17 vs. 7.30 points), yielding a between-group change score difference of 21.87 points. The large effect size observed (Cohen's  $d = 3.87$ ) indicates that the Hybrid-Midwifery model was associated with a substantial improvement in mothers' knowledge of pregnancy danger signs.

**Table 3. Effect of Hybrid-Midwifery Intervention on Anxiety Levels (HARS Score)**

Outcome	Intervention Mean $\pm$ SD	Control Mean $\pm$ SD	Mean Difference	95% CI	Cohen's d	p-value
Pre-test	24.15 $\pm$ 3.45	23.80 $\pm$ 3.60	0.35	-1.45–2.15	-	0.698
Post-test	11.20 $\pm$ 2.15	20.40 $\pm$ 3.10	9.20	7.85–10.55	3.48	<0.001
Change Score	-12.95	-3.40	9.55	7.12–11.98	2.87	<0.001

Table 3 shows that anxiety levels decreased in both groups following the intervention period; however, the reduction was substantially greater in the Hybrid-Midwifery group. The mean HARS score in the intervention group decreased from 24.15  $\pm$  3.45 at baseline to 11.20  $\pm$  2.15 at post-test, representing a mean reduction of 12.95 points ( $p < 0.001$ ). In comparison, the control group demonstrated a smaller decrease from 23.80  $\pm$  3.60 to 20.40  $\pm$  3.10, with a mean reduction of 3.40 points ( $p = 0.045$ ). No significant difference was observed between groups at baseline (mean difference = 0.35;  $p = 0.698$ ), indicating comparable initial anxiety levels. However, post-test anxiety scores were significantly lower in the intervention group than in the control group, with a mean difference of 9.20 points (95% CI: 7.85–10.55;  $p < 0.001$ ). The large effect size (Cohen's  $d$

= 3.48) suggests that the Hybrid-Midwifery model was highly effective in reducing anxiety among primigravida mothers.

## Discussion

The findings suggest that the effectiveness of the Hybrid-Midwifery model arises from the complementary interaction between digital health education and human-centered antenatal support. Rather than functioning independently, the WhatsApp-based educational component and home-visit intervention appear to address different but interconnected dimensions of maternal health. The digital component primarily strengthens cognitive preparedness by improving access to information and reinforcing learning, whereas the home-visit component promotes emotional security through personalized interaction and psychosocial support. This dual mechanism may explain why the intervention was associated with improvements in both maternal knowledge and anxiety outcomes.

From a cognitive perspective, repeated exposure to educational content through WhatsApp may facilitate information retention and comprehension. According to Mayer's Cognitive Theory of Multimedia Learning, information presented simultaneously through visual and verbal channels promotes deeper processing and stronger memory formation than single-channel communication (Mayer, 2014). In the present study, educational materials were delivered through infographics, videos, and interactive discussions, allowing participants to review content repeatedly at their own pace. Such flexibility is particularly important for primigravida mothers, who often encounter pregnancy-related information for the first time and require continuous reinforcement. Recent evidence from a systematic review by Liang et al. (2025) demonstrated that mobile-based antenatal interventions significantly improve maternal self-management, knowledge acquisition, and adherence to recommended health behaviors. Similarly, the World Health Organization has emphasized the growing role of digital health technologies in expanding access to maternal health information and supporting continuity of care, particularly in resource-limited settings (WHO, 2023).

However, improved knowledge alone may not fully account for the substantial reduction in anxiety observed among participants. Pregnancy-related anxiety is influenced by multiple factors, including uncertainty regarding childbirth, fear of complications, perceived lack of control, and inadequate social support (Dennis et al., 2017). Therefore, the home-visit component may represent a critical active ingredient of the intervention. Through face-to-face interaction, individualized counseling, active listening, and emotional reassurance, midwives can establish therapeutic relationships that foster trust and confidence. This interpretation is consistent with Watson's Theory of Human Caring, which emphasizes authentic presence and interpersonal connection as fundamental elements of healing and psychological well-being (Watson, 2008). Research has shown that supportive relationships with healthcare providers are associated with lower levels of antenatal anxiety, greater maternal confidence, and more positive pregnancy experiences (Downe et al., 2018).

An important finding of this study is that the integrated model appears to generate benefits beyond those typically reported for single-modality interventions. Previous studies have demonstrated the effectiveness of digital health education in improving maternal knowledge and self-care behaviors, while separate studies have shown that home visits and continuity-of-care models can reduce anxiety and enhance maternal satisfaction (McCarthy et al., 2022; Birara et al., 2024). Nevertheless, evidence evaluating the simultaneous integration of these approaches remains limited. The present findings suggest that combining continuous digital communication with personalized face-to-face support may create a synergistic effect. Digital platforms ensure frequent access to information and timely consultation, whereas home visits provide opportunities for emotional support, clarification of misunderstandings, and individualized care. Together, these components address both informational and psychosocial needs, which are often inseparable during pregnancy.

The results also have important implications for antenatal care delivery in low-resource settings. Conventional antenatal services frequently face challenges related to limited consultation time, shortages of healthcare personnel, and barriers to repeated maternal education. The widespread availability of smartphones and WhatsApp offers an opportunity to extend antenatal support beyond clinic visits without requiring substantial additional infrastructure. This finding aligns with recent international recommendations advocating blended care models that integrate digital innovation with person-centered maternal healthcare to improve accessibility, continuity, and quality of care (WHO, 2023; UNFPA, 2024). Consequently, the Hybrid-Midwifery model may represent a feasible strategy for strengthening antenatal care services in primary healthcare settings across Indonesia and other low- and middle-income countries.

Despite these promising findings, not all participants achieved optimal post-intervention outcomes. This suggests that intervention effectiveness may be influenced by factors beyond program exposure alone, including educational attainment, health literacy, family support, cultural beliefs, and individual engagement with digital technologies. Previous studies have shown that women with stronger social support networks and higher health literacy are more likely to benefit from maternal health education programs (Shorey et al., 2022). Future studies should therefore examine potential moderating factors and assess the long-term sustainability of intervention effects on maternal health behaviors, birth preparedness, and pregnancy outcomes.

### **Limitations**

The study has several limitations. First, the 4-week intervention duration precludes assessment of long-term effects on actual delivery outcomes, neonatal health, or postpartum mental health. Second, HARS assessment relied exclusively on self-report without objective biomolecular corroboration (e.g., salivary cortisol). Third, the single-center design limits generalizability. Future research should employ multicenter RCT designs with extended follow-up through the postpartum period to confirm durability of effects.

Another limitation is the use of a quasi-experimental design without random allocation, which may introduce selection bias despite baseline homogeneity between groups. In addition, participants were aware of their involvement in the intervention, potentially contributing to a Hawthorne effect that may have influenced behavioral responses and questionnaire outcomes.

### **Implications and Research Contribution**

This study provides evidence that a low-cost, scalable hybrid model leveraging existing digital infrastructure (WhatsApp) combined with midwife home visits can be meaningfully integrated into Indonesia's primary antenatal care framework without requiring significant additional resources. The model directly addresses two of the most critical preventable contributors to maternal mortality: inadequate danger sign knowledge and unmanaged antenatal anxiety. Policymakers and health service managers should consider piloting the Hybrid-Midwifery model as a complementary standard protocol in Puskesmas and PMB settings across high-MMR regions of Indonesia.

## **CONCLUSION**

The Hybrid-Midwifery model integrating structured digital education via WhatsApp Group with individualized Home Visit support is proven significantly more effective than conventional antenatal care in improving pregnancy danger sign knowledge and reducing anxiety among primigravida mothers in Deli Serdang Regency. The model successfully bridges the efficiency of low-cost digital technology with the principles of women-centered midwifery care, addressing both cognitive and psychoemotional dimensions of maternal vulnerability.

## SUGGESTIONS

Based on these findings, the following recommendations are proposed: (1) Independent midwifery practices (PMB) and Puskesmas in high-MMR districts should adopt the Hybrid-Midwifery model as a supplementary standard protocol within existing ANC programs; (2) The Indonesian Ministry of Health should consider incorporating this model into national midwifery competency training as a structured digital-humanistic care approach; (3) Future research should utilize multicenter RCT designs with extended follow-up, objective anxiety biomarkers, and cost-effectiveness analyses to strengthen the evidence base for national policy adoption.

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