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Development of Caregiver Empowerment Model in Caring for Mothers with Gestational Diabetes Mellitus

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ABSTRACT

Introduction: Gestational Diabetes Mellitus (GDM) is a condition of elevated blood glucose levels during pregnancy, usually around 24 weeks of gestation, and contributes to approximately 3 million stillbirths annually. It increases the maternal mortality risk up to four times and poses long-term health risks. More than 50% of women with GDM are at risk of developing type 2 diabetes mellitus later in life. This study aims to develop a caregiver empowerment model for supporting mothers with GDM, based on the caregiver empowerment theory with a family-centred nursing approach.
Methods: This model focuses on family caregiver factors and maternal GDM factors, as well as their influence on filial values, resources, appraisal, and caregiver outcomes. This study employs an explanatory design with a cross-sectional approach. The population comprises family caregivers of mothers with GDM who visited six community health centres (Puskesmas) in Tuban Regency. A total of 81 caregivers meeting the inclusion criteria were selected through systematic random sampling. Research variables include family caregiver factors, maternal GDM factors, filial values, resources, appraisal, and caregiver outcomes. Data were collected via questionnaires and analysed using Structural Equation Modelling-Partial Least Squares (SEM-PLS) after validity and reliability testing.
Results: The results indicate that family caregiver factors (X1) significantly influence filial values (X3) and caregiver outcomes (Y1), while resources (X4) significantly affect appraisal (X5), with a T-value above 1.96 and a positive coefficient. The finding this model provides a new conceptual and practical contribution to maternal health interventions, particularly in strengthening family-based support systems for GDM management.
Conclusion: In conclusion, the caregiver empowerment model for supporting mothers with GDM demonstrates that family caregiver factors influence filial values and caregiver outcomes, while resources affect appraisal.

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INTRODUCTION

Maternal mortality remains a critical public health issue in Indonesia. According to the Indonesian Ministry of Health, the maternal mortality rate (MMR) is 305 per 100,000 live births, still far from the 2024 target of 183 per 100,000 live births (1). The leading causes of maternal death include postpartum complications such as haemorrhage, infection, hypertensive disorders, obstetric complications, and unsafe abortions (1-4). In 2020, Indonesia recorded 4,627 maternal deaths, primarily due to haemorrhage, hypertensive disorders in pregnancy, and cardiovascular complications (1).

Gestational Diabetes Mellitus (GDM) has emerged as a significant contributor to maternal and neonatal mortality (5-8). The prevalence of GDM in Indonesia ranges from 1.9% to 3.6% of pregnancies, with an increasing trend in Surabaya between 2015 and 2018 (9-13). Globally, GDM accounts for approximately 3.04 million stillbirths annually and increases maternal mortality risk up to fourfold (14). Although GDM is a temporary condition, more than 50% of affected women develop type 2 diabetes mellitus (T2DM) within 5–10 years postpartum (15-17). Moreover, infants born to mothers with GDM have a higher risk of childhood obesity, T2DM, and metabolic disorders.

Recent data from the Tuban District Health Office (2022) indicate that among 9,785 pregnant women screened for blood glucose, 102 had blood glucose levels exceeding 140 mg/dL, concentrated in four Puskesmas (Senori, Parengan, Palang, and Semanding) (18). Given the critical role of family support in maternal care, the Family-Centered Nursing (FCN) approach emphasises the family as the primary unit in healthcare provision. As a system, disruptions in one family member's health can impact overall family well-being. The family performs essential functions, including affective, socialisation, reproductive, economic, and healthcare maintenance roles, with the latter being crucial for preventing and managing health conditions within the family unit (19,20).

Gestational Diabetes Mellitus (GDM) is an increasingly prevalent condition, with recent data indicating that its incidence in Southeast Asia ranges between 10%–25%, including a rising trend in Indonesia. The condition contributes significantly to maternal and neonatal morbidity and mortality, underscoring the urgent need for effective management strategies that involve not only mothers but also their primary support systems. Previous studies have highlighted the importance of family empowerment in caregiving. Jannah et al. (2019) found that caregiver outcomes such as well-being, personal growth, and health were significantly influenced by family caregiver factors, appraisal, and available resources (21). Similarly, Yasin & Eldooma, (2024) emphasised the necessity of family support in diabetes management (22), while Maria-Ioanna, & Patra, (2022) demonstrated a significant relationship between family education and psychosocial risk reduction (23). Family stress in caring for GDM patients aligns with the FCN model, which advocates for empowering families as primary caregivers.

While previous studies have explored caregiver roles in chronic illness management, limited research has developed a structured caregiver empowerment model tailored to GDM management. This study introduces an innovative approach by integrating the Caregiver Empowerment Model within the FCN framework, focusing on key determinants such as family caregiver factors, appraisal, resources, and caregiver outcomes. This study aims to develop a caregiver empowerment model for supporting mothers with GDM. The findings will serve as a foundation for enhancing caregiver education and assistance, ultimately improving maternal and neonatal health outcomes in Indonesia.

METHOD

Research Type

This study employs an explanatory research design with a cross-sectional approach. The purpose of this method is to measure the relationship between exposure and disease, conditions, or outcomes within a specific population. The cross-sectional approach involves observations or measurements at a single point in time, meaning it does not establish causality but rather explores relationships between variables at a given moment. The population comprises family caregivers of mothers with GDM who visited five community health centres (Puskesmas) in Tuban Regency. Especially for qualitative research, the time and place of research needs to be written down clearly (for quantitative research, it is also necessary).

Population and Sample/Informants

The population in this study consists of all family caregivers accompanying mothers with GDM who visited six Puskesmas and the maternity clinic at Dr. R. Koesma Regional Hospital in Tuban Regency, totalling 102 family caregivers. The research sample includes a subset of families of mothers with GDM who meet the inclusion criteria, with a total sample size of 81 caregivers.

The sampling technique used is systematic random sampling. The inclusion criteria involve male or female family members who directly care for mothers with GDM at home, are physically and mentally healthy, literate, and willing to participate in the study. The exclusion criteria include family members who are not directly involved in the daily care of mothers with GDM, those who are illiterate, and those who refuse to participate.

The independent variables in this study are family caregiver factors, maternal GDM factors, filial values, resources, and appraisal, while the dependent variable is caregiver outcomes.

Research Location

The study was conducted in five community health centres (Puskesmas) in Tuban Regency.

Instrumentation or Tools

Data collection in this study was conducted using a questionnaire. The questionnaire consisted of Instrument A (family caregiver factors, maternal GDM factors, filial values, resources, and appraisal) and Instrument B (caregiver outcomes). These instruments were adapted from the Caregiver Empowerment Model (CEM) and had undergone validity and reliability testing. The reliability test results indicated that all questionnaire items were reliable, with a Cronbach's alpha value of 0.759 (21). Data were collected using questionnaires and analysed using Structural Equation Modelling-Partial Least Squares (SEM-PLS), following validity and reliability testing.

Data Collection Procedures

Before participating in the study, respondents were provided with detailed information regarding the research objectives, benefits, rights to withdraw, potential risks (if any), and instructions for completing the questionnaire. This explanation was given by the researcher, accompanied by the midwife coordinators at each Puskesmas and the head of the maternity clinic. Participation was entirely voluntary, with no coercion involved. To ensure respondent confidentiality, the questionnaire did not include names; instead, anonymous coding was applied by the researcher. Data tabulation was conducted solely by the researcher to maintain the privacy and security of respondent information.

Data Analysis

Data were collected using a questionnaire and analysed using Structural Equation Modelling-Partial Least Squares (SEM-PLS). Before analysis, the questionnaire underwent validity and reliability testing to ensure the accuracy and consistency of the measurements.

Ethical Approval

This study was conducted after obtaining official approval from the relevant authorities. Permission was granted by the Investment and One-Stop Integrated Service Office under permit number 070/216/1.S/414.111.3/2024. Additionally, ethical clearance was obtained from the Health Research Ethics Committee (KEPK) of Poltekkes Kemenkes Surabaya, with certificate number EA/2286/KEPK-Poltekkes_Sby/V/2024.

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RESULTS

Table 1. Respondent Characteristic

Indicator	Category	n	%
Age	Teenagers (18-25 years old)	11	13.6
	Adults (26- 45 years old)	58	71.6
	Elderly (46-65 years old)	12	14.8

Gender	Male	72	88.9
	Female	9	11.1
Education	Primary education (elementary, junior high school)	25	30.9
	Secondary education (high school)	50	61.7
	Higher Education (D3, S1, S2, S3)	6	7.4
Income	<Rp 1.851.083	19	23.5
	>Rp 1.851.083	62	76.5
Status	Husband	74	91.4
	Mother/In-law	3	3.7
	Child/In-law	2	2.5
	Other family	2	2.5

Table 1 shows that the majority of family caregivers were adults (26–45 years old), male, had a secondary education (high school), earned more than Rp 1.851.083. and were the husbands of the pregnant women.

Table 2. Family caregiver factors (self-efficacy, knowledge, time)

Variable	**Category**	**n**	**%**
Self-efficacy	Low	28	34.6
	Medium	39	48.1
	High	14	17.3
Total		81	100
Knowledge	Low	40	49.4
	Medium	24	29.6
	High	17	21
Total		81	100
Caring time	Medium	75	92,6
	Long	6	7.4
Total		81	100

Table 2 shows that nearly half (48.1%) of family caregivers had moderate self-efficacy, while 49.4% had low knowledge levels, and 92.6% spent a moderate amount of time on caregiving.

Table 3. Maternal factors of DMG

Indicator	**Category**	**n**	**%**
Age	Teenagers (18-25 years old)	19	23.5
	Adults (26- 45 years old)	62	76.5
	Elderly (46-65 years old)	0	0.0
Total		81	100
Therapy adherence	Compliant	52	64.2
	Non-compliant	29	35.8
Total		81	100
Duration of illness	≤ 3 months	75	92,6
	≥ 3 months	6	7.4
Total		81	100
Blood sugar level monitored	Performed	42	51.9
	Not Performed	39	48.1
Total		81	100
Physical Activity	Regular	62	76.5
	Not Regular	19	23.5
Total		81	100
Setting a healthy eating pattern	Compliant	39	48.1
healthy eating	Not compliant	42	51.9
Total		81	100

Table 3 shows that the majority of pregnant women with gestational diabetes mellitus (GDM) in this study were adults aged 26–45 years. Most of them adhered to therapy**,** regularly monitored their blood glucose levels**,** and engaged in physical activity for at least 30 minutes per day or 150 minutes per week. Additionally, nearly all participants had been diagnosed with GDM for ≤ 3 months.

Table 4. Fillial Variable Value

Indicator	Category	n	%
Responsibility	Less	20	24.7
	Fair	25	30,9
	Good	36	44.4
Total		81	100
Respect	Less	2	2.5
	Enough	19	23.5
	Good	60	74.1
Total		81	100
Care	Less	1	1.2
	Enough	45	55.6
	Good	35	43.2
Total		81	100

Table 4 shows that for the filial values variable, nearly half (44.4%) of the participants demonstrated good responsibility**,** the majority (74.1%) showed a good level of respect, and more than half (55.6%) exhibited a moderate level of care.

Table 5. Resources, Appraisal and Caregiver Outcomes

Indicator	Category	n	%
Personal	Bad	37	45.7
	Good	44	54.3
Total		81	100
Family	Bad	39	48.1
	Good	42	51.9
Total		81	100
Community	Bad	36	44.4
	Good	45	55.6
Total		81	100
Appraisal	Challenge	43	53.1
	Stressor	38	46.9
Total		81	100
Healthy	Less	1	1.2
	Fair	32	39.5
	Good	48	59.3
Total		81	100
Personal Growth	Less	1	1.2
	Enough	2	2.5
	Good	78	96.3
Total		81	100
Prosperous	Less	2	2.5
	Enough	27	33.3
	Good	52	64.2
Total		81	100

Table 5 shows that the resources variable was found to be mostly in the good category across all indicators, including personal, family, and community resources. Most of the appraisal variables (53.1%) are challenges. The Caregiver Outcomes show that the majority of health indicators fall into the good category (59.3%), almost all personal growth indicators are in the good category (96.3%), and most well-being indicators are also in the good category (64.2%).

Table 6. Research Hypothesis Testing

Effect	Coefficient	T-Statistics (O/STDEV)	p-Values
Family Caregiver Factor (X1) -> Filial Values (X3)	0.615	4.990	0.000
Family Caregiver Factor (X1) -> Appraisal (X5)	0.067	0.757	0.449
Family caregiver factor (X1) -> Caregiver outcomes (Y1)	0.665	5.376	0.000
DMG mother factor (X2) -> Filial Values (X3)	0.082	0.626	0.531
DMG mother factor (X2) -> Appraisal (X5)	-0.027	0.281	0.779
DMG mother factor (X2) -> caregiver outcomes (Y1)	-0.101	0.997	0.319
Resources (X4) -> Appraisal (X5)	0.725	12.909	0.000
Resources (X4) -> Caregiver outcomes (Y1)	-0.017	0.201	0.841
Appraisal (X5) -> Caregiver outcomes (Y1)	-0.071	0.806	0.420

Table 6 shows that the variable Family Caregiver Factors (X1) on Filial Values (X3), Family Caregiver Factors (X1) on Caregiver Outcomes (Y1), and Resources (X4) on Appraisal (X5) show a t-value greater than 1.96 with a positive value, indicating that these variables have a significant influence.

The Influence of Family Caregiver Factors (X1) on Filial Values (X3)

Family factors contribute to empowering family caregivers in caring for pregnant women with gestational diabetes mellitus (GDM). These factors include age, education level, gender, income, family relationship status, and length of caregiving. Among these, gender, relationship status, self-efficacy, and knowledge are the most influential. Caring for pregnant women with GDM requires special attention from the family, particularly from the involved caregivers. Filial values such as responsibility, respect, and care serve as an essential foundation in caregiving. Various factors such as gender, relationship status, self-efficacy, and knowledge affect how caregivers internalize and practice these values (24-26). Gender plays a significant role in how individuals perceive and implement filial values. In many social and cultural contexts, research has shown that the majority of caregivers for pregnant women with GDM are men, specifically husbands. Husbands are often expected to be the primary caregivers, especially in family caregiving situations such as caring for pregnant women with GDM. This is related to social norms that place husbands in caregiving roles. Husbands of pregnant women with GDM tend to score higher in responsibility and care values, as they are typically more involved in both physical and emotional caregiving tasks (27,28).

In cultures where caregiving roles are emphasized, husbands are more likely to exhibit greater care, both emotionally and physically. They feel a greater responsibility to ensure the health of the pregnant woman and to ensure the caregiving process runs smoothly. Additionally, husbands demonstrate strong respect for the role of pregnancy and maternal health, making them more likely to engage in communication and caregiving. Furthermore, their role often includes financial support or providing necessary resources for caregiving, which is another form of responsibility (29,30).

Self-efficacy plays a crucial role, with nearly half (48.1%) of caregivers falling into the moderate category. Self-efficacy refers to one's belief in their ability to perform tasks or handle challenges effectively. It is associated with an individual's ability to manage stress and regulate themselves. It also pertains to a person's perception of their capability to organize and execute actions to demonstrate specific skills (31,32)

Apart from self-efficacy, caregiver knowledge also plays a role in empowering caregivers to care for pregnant women with GDM. The research findings indicate that nearly half (49.4%) of caregivers have low knowledge levels. Despite this, responsibility is in the good category for nearly half (44.4%) of caregivers, and respect is in the good category for the majority (74.1%) of caregivers. This suggests that other factors support husbands in caring for pregnant women with GDM. Knowledge is the result of awareness that occurs after an individual perceives a specific object through their senses—vision, hearing, smell, taste, and touch (33). Most human knowledge is obtained through the eyes and ears. Knowledge can also be defined as facts or information considered true based on empirical testing or logical reasoning. Family knowledge about caring for pregnant women with diabetes mellitus is directly related to the family's ability to adapt to difficult situations. Adaptability is a crucial initial step in family empowerment, ensuring they can handle the challenges of caring for a pregnant woman with GDM.

Research findings indicate that the core filial values of family caregivers responsibility, respect, and care significantly influence caregivers' appraisal of their ability to care for pregnant women with GDM, as well as caregiver outcomes. Filial values act as indicators of family empowerment, which includes responsibility, respect, and care. In this study, responsibility and care were categorized as moderate, while respect was in the good category. Empowerment is a continuous process aimed at enhancing one's abilities and independence to improve their quality of life. This process involves fostering their empowerment to improve their lives through their own strengths. The goal of empowerment is to enable individuals to solve their own problems by providing trust and authority, which fosters a sense of responsibility. Family caregiver empowerment is a mechanism that facilitates improvements in family caregiving capabilities as a positive impact of nursing interventions, health promotion activities, and cultural suitability, all of which influence caregiving actions and family development.

The Influence of Family Caregiver Factors (X1) on Caregiver Outcomes (Y1)

Caring for a pregnant woman with GDM requires intensive effort from the family, particularly the husband as the primary caregiver. This situation demands not only physical and medical attention but also has emotional and social impacts on the caregiver. Factors such as gender, relationship status (particularly as a husband), self-efficacy, and knowledge play crucial roles in determining caregiving outcomes in terms of physical health, personal growth, and overall well-being (34,35).

Caregiver outcomes in this study consist of three indicators: perceived health, personal growth, and psychological well-being. Research findings indicate that most of these indicators fall into the good category. Good perceived health is closely related to education and knowledge levels (36). The majority of caregivers have at least a high school education, with a smaller portion having higher education. Studies have shown that higher education levels are negatively correlated with stress and caregiving burdens. It is assumed that the higher a caregiver's education, the better their ability to handle stressful caregiving situations (37,38). Older caregivers tend to experience higher anxiety and may struggle with caregiving, while very young caregivers may find it challenging to meet the necessary caregiving demands optimally.

Personal growth and well-being are influenced by various factors, including age. Research suggests that age is correlated with stress levels in caregiving. Older caregivers tend to have higher anxiety, whereas younger caregivers may lack experience in providing optimal care. Additionally, self-efficacy is essential in determining caregiving outcomes. Caregivers with high self-efficacy feel more capable of handling challenges in caring for pregnant women with GDM, leading to better health, personal growth, and well-being. Those with high self-efficacy are better at managing stress, making proactive care plans, and ensuring proper glucose monitoring and diet adherence.

Research findings show that nearly half (49.4%) of caregivers have low knowledge levels. However, responsibility (44.4%) and respect (74.1%) are in the good category. Other supporting factors include personal, family, and community support, with the majority of indicators in the good category.

Personal, family, and community support helps caregivers make better care decisions, reducing stress associated with caregiving uncertainty. A well-supported caregiver is more likely to experience personal growth and feel valued, positively impacting their psychological well-being.

The Influence of Resources (X4) on Appraisal (X5)

Research findings indicate that resources significantly influence appraisal. Resources are shaped by three indicators: personal, family, and community support, all of which are in the good category in this study. Personal factors, such as viewing caregiving as a religious duty, help reduce caregiver burden. Harmonious family support also lightens the caregiver's load, allowing them to be more flexible and resilient in facing caregiving challenges. On the other hand, caregivers without adequate family support may feel isolated, worsening their emotional and physical burdens (39,40).

Family support helps caregivers feel less alone and fosters emotional stability. It is also crucial to receive social support from the surrounding environment, as it provides emotional and physical comfort. Social support, such as community recognition and encouragement, helps caregivers reduce the caregiving burden and achieve better caregiving outcomes.

Gestational diabetes mellitus (GDM) requires intensive family involvement, particularly from caregivers. The available resources whether personal, family, or community greatly impact how a caregiver perceives their situation, whether as a challenge or as a source of stress. Appraising the situation correctly is crucial as it determines how caregivers respond and manage their caregiving responsibilities effectively.

Limitations and Cautions

This study has several limitations. First, the cross-sectional design limits the ability to infer causality between the variables studied, such as family caregiver factors and caregiver outcomes. Longitudinal studies are needed to confirm these relationships over time. Second, the research was conducted in a specific geographic area (Tuban Regency), which may limit the generalizability of the findings to other regions with different sociocultural or healthcare contexts. Third, self-reported data may introduce bias due to social desirability or recall inaccuracies, particularly in measuring sensitive variables like self-efficacy and knowledge. Finally, while the study used SEM-PLS for analysis, it did not explore potential moderating or mediating variables that could further clarify the relationships between caregiver empowerment components.

Recommendations for Future Research

Future studies should consider employing a longitudinal or mixed-methods design to examine changes in caregiver empowerment and outcomes over time. Expanding the research to include diverse geographic and cultural settings would enhance the generalizability of the caregiver empowerment model. Additionally, incorporating qualitative methods such as in-depth interviews or focus groups could provide richer insights into the experiences, challenges, and needs of caregivers for women with GDM. Further research should also investigate potential mediators (e.g., psychological resilience) or moderators (e.g., family support level, healthcare access) that may influence the relationship between caregiver factors and caregiver outcomes. Lastly, intervention-based studies are encouraged to assess the effectiveness of structured caregiver education and support programs in improving both maternal and neonatal health outcomes.

CONCLUSION

The conclusion of this study on the development of a caregiver empowerment model for supporting pregnant women with gestational diabetes mellitus (GDM), based on the Caregiver Empowerment Model (CEM) and Family-Centered Nursing (FCN) theory, reveals that family caregiver factors significantly influence filial values and caregiver outcomes. Additionally, resources play a crucial role in shaping appraisal within the caregiving process. Future studies should consider employing a longitudinal or mixed-methods design to examine changes in caregiver empowerment and outcomes over time. Expanding the research to include diverse geographic and cultural settings would enhance the generalizability of the caregiver empowerment model.

AUTHOR'S CONTRIBUTION STATEMENT

All researchers in this article contributed to the Conceptualization, Methodology, Software, Validation, Formal Analysis, Investigation, Resources, Data Curation, Writing – Original Draft Preparation, Writing – Review & Editing, Visualization, Supervision, Project Administration, and Funding Acquisition.

CONFLICTS OF INTEREST

There is no conflict of interest in this research.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

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