Determining the status of preconception care model in pregnant woman of Gorgan city (North of Iran) using structural equation modeling (SEM)

Narjes Sadat Borghei, Tayebeh Ebady, Roghaieh Bayrami[1], Roya Nikbakht[2]

Abstract:

BACKGROUND: Preconception reduces unplanned pregnancies and plays an important role in reducing maternal and infant mortality. Considering the importance of these care services, this study was conducted to determine the status of preconception care (PCC) model with Structural Equation Modeling (SEM).

MATERIALS AND METHODS: This cross-sectional descriptive study was conducted on 394 pregnant women referring to Gorgan's health centers. Samples were selected by multi-stage stratified sampling method. The instrument used in this research was a researcher-made questionnaire by Bayrami. Data were analyzed using R software version 4.1.4. Structural equation modeling (SEM) with weighted least square mean and variance method was used to fit the conceptual model and the significance level of the tests was considered 0.05.

RESULTS: The results showed that PCC model was deemed appropriate as optimum conditions indicators of goodness of fit; knowledge with a coefficient of 0.182 leads to self-efficacy (SE), and SE affects the accessibility of facilities with a coefficient of 0.465 and the expected outcome with a coefficient of 0.500. After facility structure with a coefficient of 0.500, SE construct with a coefficient of 0.215 had the most effect on performing PCC behavior.

CONCLUSIONS: Facilities and SE as a key element of empowerment have an important role in promoting PCC. Identifying the factors associated with this care appears to help health policymakers to planning for these caregivers more precise and sensitive.

Keywords:

Behavior, knowledge, preconception care, pregnancy, self-efficacy

Department of Midwifery, School of Nursing and Midwifery, Counseling and Reproductive Health Research Centre, Golestan University of Medical Sciences, Gorgan, Iran, [1]Department of Midwifery, School of Nursing and Midwifery, Patient Safety Research Center, Urmia University of Medical Sciences, Urmia, Iran, [2]Department of Biostatistics and Epidemiology, Faculty of Health, Golestan University of Medical Sciences, Gorgan, Iran

Address for correspondence:
Prof. Roya Nikbakht, Department of Biostatistics and Epidemiology, Faculty of Health, Golestan University of Medical Sciences, Gorgan, Iran.
E-mail: roya.nikbakht2011@gmail.com

Introduction

Preconception care (PCC) is a set of interventions intended to identify and to modify biomedical, behavioral, and social risks in reproductive-age women.[1] The goal of PCC is to improve pregnancy outcomes through prevention of disease and management of risk factors that affect pregnancy outcome and the health of future generations.[2]

Maternal mortality due to complications of pregnancy and childbirth is responsible for 529,000 women death worldwide each year.[3] Risk of maternal and infant mortality and pregnancy-related complications can be reduced by increasing access to quality preconception (before pregnancy) and interconception (between pregnancies) care.[4] Despite persistent adverse pregnancy outcomes and although the benefits of PCC have been established, the delivery and uptake of PCC remain low. PCC rates

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varied across countries, with the rate in the United States (2014) 32.6%[5] and in Italy (2014) 83.5%.[6] The rate of PCC in urban and rural areas of Iran as a whole (2015) was 48.6%, compared to 36.5% in urban communities. In Golestan Province (North of Iran), the rate of this care (2016) was 31% in urban and 63.9% in rural communities, lower than the national average. Given the goal of increase the coverage of PCC by at least 50% by the end of 2020,[7] to plan in this regard, the factors related to this important care should be well known, and by modifying the programs, it will be possible to promote PCC.[8]

In one systematic review study, seven main themes were identified as barriers to use PCC including: preconditions, emotions and beliefs, perceived need, knowledge and experience, social structure, accessibility, and provider characteristics.[9] Other important barriers included, low awareness of women,[10] low education,[11] lack of time,[11,12] unwanted pregnancies,[13] lack of access to care,[14] gender inequality,[15] and lack of financial resources.[14]

If we consider PCC as behavior, increased care will be considered as behavior change. Therefore, social cognitive theory (SCT) can be used as the most common theory in changing health behavior. The central premise of this theory is reciprocal determinism, which is the interaction of person, environment, and behavior.[16] There have been very few studies assessing the determinations of PCC, and so far, no studies have been conducted in our province. By identifying the determinants, more precise planning can be done to improve the quality of care and increase the percentage of coverage of these

cares. Therefore, this study aimed to determine the descriptive model of PCC with path analysis methods in Golestan Province.

Conceptual model of research

Bandura's SCT is a multidimensional factor structure. Self-efficacy (SE) operates in accordance with individual health goals, outcome expectation, facilities, and perceived environmental barriers to regulating human motivation, behavior, and health.[17] According to this theory, planned support and promotion of public health can pave the way for communities that seek to control environmental and social factors that affect health behaviors and health outcomes.[18]

Researches show that knowledge increases SE[19,20] and people with high SE have more outcome expectation.[21] In addition, self-sufficient people benefit more from the available facilities in the environment,[22,23] because SE is a strong predictor of health behavior and can affect the intention to start or change behavior.[24] On the other hand, facilities[25] and outcome expectation also affect the performance of behavior.[26] Some researches have been used social cognitive theory to predict behaviors such as parenting skills[27] and daily activity.[28] In this study, the researchers are considering the importance of PCC, using Bandura's SCT to study the determinants of PCC behavior [Figure 1].

This conceptual model is derived from SCT. Knowledge, SE, and outcome expectation constructs from individual factors and access to facilities from environmental factors[29,30] were measured as an influential factor on PCC behavior in this study.
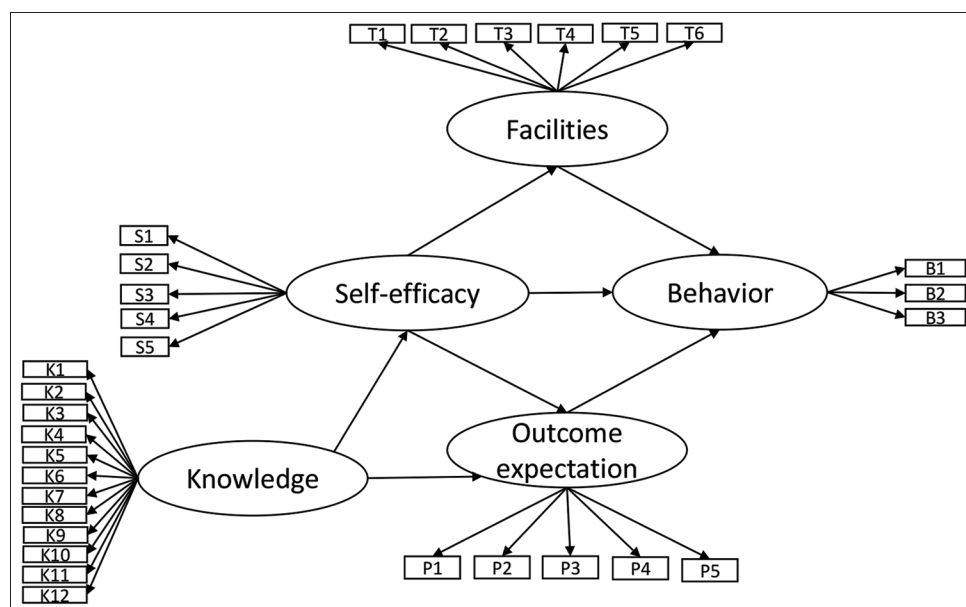

Figure 1: Conceptual framework of the study

Materials and Methods

Study design and setting

This cross-sectional study was conducted on pregnant women who referred to six health centers and stations of Gorgan city in the second half of 2018, for routine prenatal care.

This study was conducted in Gorgan, the capital of Golestan Province in Northeast of Iran, located in South of the Caspian Sea (36° 50' 21.48" N, 54° 26' 39.84" E).

Study participants and sampling

All samples were selected from 1921 pregnant women who received PCC at health centers or private section, thus we deal with a limited population to determine the sample size that prevalence was considered 0.5. The maximum sample size of limited population with $P = 0.5$, d = 0.01, Z = 1.96, $N = 1921$, and $P < 0.05$ was obtained 394 based on below formula:

$$n = \frac{Nz^2 \, p \, (1 - p)}{Nd^2 + z^2 \, p \, (1 - p)}$$

After the research proposal was approved by the ethics committee of Gorgan University of Medical Sciences and permission was obtained, multi-stage stratified sampling was performed. To calculate the required number of samples in each health center, the sample size ($n = 394$) was divided by the total number of pregnant women in the six health center and the result was multiplied by the population covered by each section. To recruit women from each center, the list of all eligible women for inclusion in the study was extracted using the continuous care records. They were invited to attend the center to participate in the study. After explaining the objectives of the study and ensuring confidentiality, and obtaining written informed consent, the participants were asked to complete the questionnaire. The study questionnaires were completed via self-reporting techniques. Inclusion criteria were as follows: women with wanted pregnancy who were resident in Gorgan until the end of pregnancy and had prepregnancy care documentation, and exclusion criteria were unwilling to cooperate and incomplete completion of the questionnaire.

Data collection tool and technique

The predicting preconception health Behavior questionnaire was used. This questionnaire had been designed by Bayrami. The face validity of this questionnaire was done in both qualitative and quantitative ways. The content validity ratio and content validity index were used in quantitative method by the criteria of relevance, clarity, and simplicity and Cronbach's alpha coefficient was used to determine the reliability by internal consistency of the questionnaire.

Cronbach's alpha for the questions of facility structure was obtained by omitting a 0.735 question, the expectation construct of 0.827, and the SE construct of 0.755. Cronbach's alpha for the knowledge questions was 0.752.[31]

The main variable (independent variable) of this study was behavior (3 question: B1–B3), these questions points were given to the answer "yes = 1" and 1 to "no = 0," and other variables including knowledge (12 question: K1–K12), facility (6 question: T1–T6), outcome expectation (5 question: P1–P5), and SE (5 question: S1–S5) were considered as independent and mediator variables. Each of the above-mentioned constructs was recorded on a Likert scale from 1 to 7 from strongly disagree to strongly agree, respectively.[31]

Data were analyzed using R software version 4.1.4 and Lavaan package. Ordinal structural equation modeling (SEM) and binary SEM were used to fit the conceptual data. Weighted least square mean and variance (WLSMV) method was used to fit the model. First, the model became fit with all the data and variables, which named first in Table 1 and then the goodness of fit reported, all of which were in the range, but the coefficients of some variables were <0.4, which had to be removed, and this was done step by step, and finally for the last model, reported goodness indicators again and it was reported named it final in Table 1. Fit indices, such RMSEA, SMR, CFI, and TLI, have been used for this purpose. Acceptable values of RMSEA and SMR should be <0.08 and values of CFI and TLI should be >0.9.

Due to the fact that the behavioral, knowledge, facility, outcome expectation, and SE variables are not directly observable and were measured with a questionnaire, they were considered as latent variables. The main basis of data analysis was the structural equation modeling (SEM) that was used to fit the conceptual model and the significance level of the tests was considered 0.05. Initially, modeling was performed based on latent variables by considering all the questions of each variable, but due to the fact that the coefficients of some of these variables were <0.4, they were removed and the final model was performed based on the remaining variables in the model. The final model was implemented based on the remaining variables in the model, the results of which are given in the following tables and diagrams.

Table 1: Model fit summary

Model	RMSEA	SMR	CFI	TLI
First	0.058	0.070	0.940	0.935
Final	0.045	0.058	0.987	0.984

RMSEA: Root Mean Square Error of Approximation. SMR: Squared Multiple Correlation. CFI: Confirmatory Fit Index. TLI: Tucker Lewis Index

Ethical considerations

All ethical considerations of this study based on Declaration of Helsinki such as receiving conscious inform consent and ensuring privacy of the private information of participators were followed. This research is approved by the research deputy of Golestan University of Medical Sciences, with ethical code IR.GOUMS.REC.1396.168.

Results

This study was conducted on 394 pregnant women. The mean age of the participants was 28.47 ± 5.37 years; of the participants, 43.9% had college education. Most of the women were housewives (87.1%) and of the Fars ethnicity (79.9%). About 54.1% of the samples had average family income and 95.4% of them had insurance. Other background characteristics of the study participants are shown in Table 2.

The results of the study showed that pregnant women who referring to health centers and offices received acceptable help and education from midwives and gynecologists (74.4%). They had favorable opinions toward physical environment of health centers and offices (65.3%). The insurance had a positive role in referring samples to health centers and offices (30%) and posters installed in health centers and offices were somewhat helpful (30.7%).

Step 1: Confirmatory analysis of the main constructs

Confirmation of the main constructs; self- efficacy, outcome expectation and facilities was done. All

Table 2: Demographic characteristics of the participants

Variable	*n*(%)
Age	
≥35	354 (89.8)
<35	40 (10.2)
Education	
School	66 (16.8)
High school and diploma	155 (39.3)
License and higher	173 (43.9)
Job	
Housewife	343 (87.1)
Employed	51 (12.9)
Ethnicity	
Fars	315 (79.9)
Sistani	51 (12.9)
Turkmen	13 (3.3)
Other	15 (3.9)
Family income	
Less than adequate	170 (43.1)
Adequate	213 (54.1)
More than adequate	11 (2.8)
Health insurance	
Yes	376 (95.4)
No	18 (4.6)

item of outcome expectation and self- efficacy construct in questionnaire were confirmed because the Chi-square statistic with $P < 0.05$ was significant and all model fit indices were acceptable and RMSEA was <0.05 But in the facility construct, after removing 3 items of questionnaire (4-5-6) the model were confirmed and in knowledge factor only 3 items remained in questionnaire (3,4,12) after confirmation.

Step 2: Structural equation modeling (SEM)

In this section, using R software, the research models are evaluated for goodness of fit and also the indirect and total effects are examined.

Goodness of fit of research model

As shown in Table 1, the goodness-of-fit indices in the above model are good and indicate the fact that the model is appropriate and the variables regulated by the theoretical framework of research are reasonable. As seen in Table 3, the results of nonstandardized and standardized regression coefficients estimation of SEM using WLSMV method showed that, among the three variables of SE, facilities, and expectation of outcome, the most important variable affecting the dependent variable was facility structure with a coefficient of 0.500. The knowledge with a coefficient of 0.182 leads to SE, and SE affects the accessibility of facilities with a coefficient of 0.465 and the outcome expectation with a coefficient of 0.500. After facility structure with a coefficient of 0.500, SE construct with a coefficient of 0.215 had the most effect on performing PCC behavior [Figure 2].

As seen in Table 4, knowledge had a significant indirect effect on outcome expectation; in fact, SE was a significant mediator. SE was also a significant mediator between knowledge and facilities, meaning that knowledge indirectly affects facilities. On the other hand, knowledge has an effect on behavior through two mediators of SE and expectation, which also has a significant effect. The outcome expectation variable is a significant mediator between SE and behavior. Finally, the most indirect effect is related to SE and facilities-mediated behavior.

Discussion

Given the importance of Preconception care and the inadequate care in this Province, using Bandura's SCT, the question of why some people do not seek this behavior was answered. As can be seen, the results of structural equation analysis showed that facility construct directly and indirectly play an important role, even as a mediator was the most important construct to predicting preconception care behavior.

The results of Sohrabi and Albalushi study showed that the majority of clients were satisfied from clinic

Table 3: Nonstandardized and standardized regression coefficients estimation of structural equation modeling using weighted least square mean and variance method

Regressions	Nonstandard coefficient	Standard coefficient	SE	P
Knowledge→Outcome expectation	0.054	0.005	0.587	0.926
Self-efficacy→Outcome expectation	0.393	0.500	0.050	<0.001
Knowledge→Self-efficacy	2.570	0.182	1.032	0.013
Outcome expectation→Behavior	0.081	0.169	0.037	0.029
Self-efficacy→Behavior	0.081	0.215	0.034	0.018
Facilities→Behavior	0.156	0.500	0.024	<0.001
Self-efficacy→Facilities	0.563	0.465	0.064	<0.001

SE=Standard error
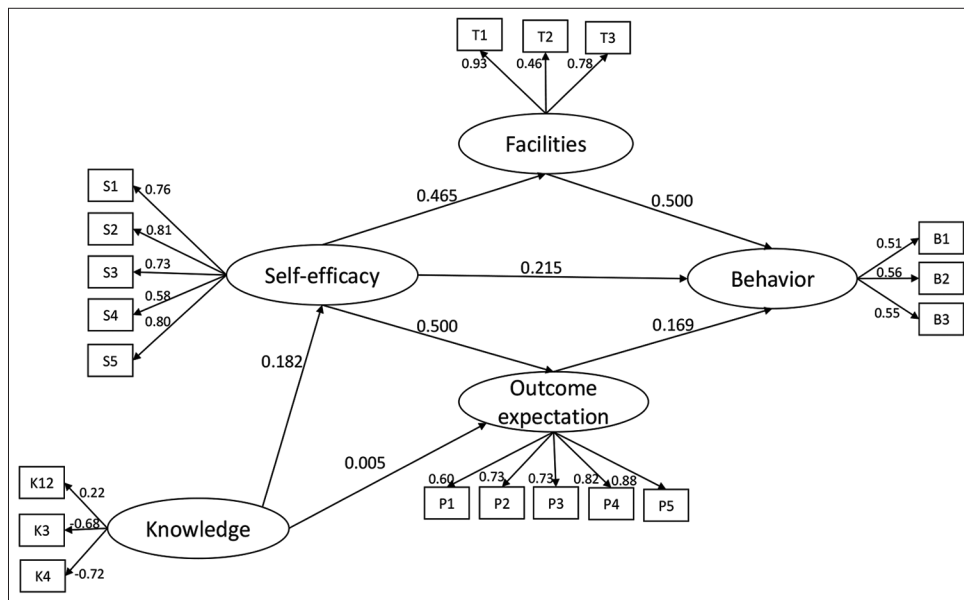
Figure 2: Standardized coefficients of structural equation modeling (SEM) for the final model

opening hours, comprehensiveness of services, adequacy of health center personnel, physician attendance in health centers and clinics, clinic facilities, staff response to customer inquiries, time spent visiting, respectful behavior of staff, and waiting time.[32]

Furthermore, the positive impact of health insurance on increasing use of PCC facilities has been shown in several studies.[23,25,33] In this study, midwives and gynecologists provided 15.9% and 64.5% of PCC, respectively. Mastroiacovo *et al.* also showed that gynecologists have provided 58% of PCC.[34] This is in line with the results of the present study. Based on the results of the present study, the level of PCC in health centers by midwives was low. The reason for midwives' care inefficiency can be attributed to the fact that the Health System Evolution Plan has defined a wide range of tasks for staffs, which may not give them sufficient time to perform their specialized activities. According to other studies, the main factors that identified as responsible for the poor quality of midwifery care were inadequate time, which is in line with the results of the present study.[35-37]

In the present study, the results of SEM analysis showed that expectation outcome as one of the SCT constructs could predict the PCC. If people believe that PCC improves the health of the mother and baby, then they will do more. In the research by Resnick *et al.*, there was a significant relationship between outcome expectation and exercise SE.[26] In a qualitative study by Hosli *et al.* in the Netherlands, women who had not positive outcome expectation about PCC services were also more likely not to use.[21]

In the present study, knowledge factor was identified as an important factor for person's SE. In other words, people who were more aware were more likely to self-administer PPC. Supporting from women raises their awareness and helps them make better decisions about fertility and health.[38] Roudsari *et al.* concluded that people's knowledge and attitude about the importance of PCC has an impact on health behaviors such as folic acid consumption, physical activity, and blood tests.[39] Frey and Files showed that almost all women were aware of the importance of health

Table 4: Direct, indirect, and total effects (*P*) using weighted least square mean and variance method

Variables	Knowledge	Self-efficacy	Outcome expectation	Facilities
Self-efficacy				
Direct effect	0.182 (0.013)	-	-	-
Indirect effect	-	-	-	-
Total effects	0.182 (0.013)			
Outcome expectation				
Direct effect	0.005 (0.926)	0.500 (<0.001)	-	-
Indirect effect	0.091 (0.017)			
Total effects	0.096 (0.144)	0.500 (<0.001)		
Facilities				
Direct effect		0.465 (<0.001)	-	-
Indirect effect	0.084 (0.016)[e]	-	-	-
Total effects	0.084 (0.016)	0.465 (<0.001)		
Behavior				
Direct effect	-	0.215 (0.018)	0.169 (0.029)	0.500 (<0.001)
Indirect effect	0.039 (0.103)[c]	0.085 (0.033)[a]	-	-
	0.001 (0.927)[d]	0.233 (<0.001)[b]		
	0.042 (0.022)[f]			
	0.015 (0.100)[g]			
Total effects	0.097 (0.025)	0.533 (<0.001)	0.169 (0.029)	0.500 (<0.001)

[a]Indirect effect of self-efficacy on behavior with mediation outcome expectation, [b]Indirect effect of self-efficacy on Behavior with mediation facilities, [c]Indirect effect of knowledge on behavior with mediation self-efficacy, [d]Indirect effect of knowledge on Behavior with mediation outcome expectation, [e]Indirect effect of knowledge on facilities with mediation self-efficacy, [f]Indirect effect of knowledge on behavior with mediations self-efficacy and facilities, [g]Indirect effect of knowledge on behavior with mediations self-efficacy and outcome expectation

promotion before their pregnancy and knew the best time to receive information before becoming pregnant. However, only 39% of them remembered what the health workers said.[11] However in the other study in Iran, the majority of women did not seek PCC despite having sufficient knowledge and good attitudes. They believed that midwives could play a vital role in promoting PCC in women.[40]

In the present study, the results of structural equation analysis showed that SE as one of the SCT constructs was able to predict the PCC in participating women. Kordi *et al.* in their study concluded that SE was able to predict self-care behaviors in women with gestational diabetes.[41] In addition, Farideh in their study showed that short-term prepregnancy health education increases the intention of iron and folic acid consumption among women who were planning to become pregnant, but it did not effect on nutritional SE.[42] The results of other study in Iran showed that SE was the most important factor influencing follow-up of healthy behaviors and healthy lifestyle. Therefore, efforts to promote SE by enhancing cultural programs in health system planning and raising public awareness should be addressed by health authorities.[43]

This result indicates that health education and awareness rising do not always lead to behavior change and other factors such as facilities influence this process. According to the findings in this study, it is emphasized that health professionals consider the role of SE as one of the important indicators in health behavior change.

Limitations and suggestions

In the present study, the mediating role of variables was more carefully studied compared to other studies. The WLSMV method in SEM was used to estimate the coefficients, which is a new method. The limitation of this study was the inability to collect samples from the entire province.

Most studies have emphasized the effect of SE construct on PCC, but in the present study, the role of facilities has been evaluated as more important. Future research need for free PCC services assessment.

Conclusions

In all, we evaluated affecting factors to PCC and their relationships according to the SCT constructs and planning constructs. Planning can bridge PCC gap in investigations based on the SCT. Sufficient facilities were one of the important factors affecting the increasing the coverage of PCC, so it is recommended that policymakers consider the issue of free PCC services. On the other hand, knowledge played an important role in this behavior, so utilizing existing capacities, continuing education, sensitization of health workers and, in parallel, improving the knowledge of families are important steps in improving the PCC coverage.

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Conflicts of interest

There are no conflicts of interest.

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