Development of Efficacy Based Foot Care by Family Models to Family Behavior in Prevention of Diabetic Foot Ulcer

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ABSTRACT

The incidence of diabetic foot ulcer (DFU) in the world is increasing due to poor family behavior. Family behavior is influenced by various factors including efficacy. The purpose of this study was to develop a model of family-based foot care by family efficacy in improving family behavior in the prevention of DFU. A cross-sectional approach with 108 people with multistage cluster random sampling. This research instrument used a questionnaire modified NIHM Family efficacy scale and foot care behavior scale for diabetes (FCBS). Data was analyzed using Structural Equation Modeling (SEM) based on variance or Partial Least Squares (PLS). Development of a family efficacy-based foot care by family model, after the path analysis study and formulate strategic issues through focus group discussions and expert discussions in accordance with the research conducted. The influence of family factors (p=0,00), DM patient factors (p=0,01), health facilities (p=0.04) and information factors (p=0,00) showed a t-statistic > 1.96 and p-value < 0.05. This means that there was a significant influence on all of these variables on family efficacy. The resulting coefficient was positive 0.285 and it means the development of efficacy-based foot care by family tends to improve family behavior in the prevention of DFU. The model of developing foot care by family has a major influence on family behavior in the prevention of DFU. Family factors become the strongest factor affecting efficacy-based foot care by family, thus families with strong efficacy are important in improving family behavior in the prevention of diabetic foot ulcer.

INTRODUCTION

Family involvement in the management of DM patient management such as blood glucose monitoring, food intake, physical activity and foot care to prevent foot injuries is needed [1]. The family is the main source of support in the behavior of preventing foot injuries in DM patients, so it is very important to include the family as part of diabetes foot injury prevention behavior. One of the determining factors in achieving behavior is efficacy. Family efficacy refers to confidence in the ability of the family to be able to regulate and take action to achieve goals [2]. This approach refers to the concept Bandura's collective efficacy, where a group will be able to achieve the best results if it is based on belief in the ability of the group to do the best behaviour in achieving a goal [3]. Family involvement in the management of DM patients can improve cohesion, competence and family relationships [2].

Referring to the results of foot care research for patients with DM, many studies have stated that there are significant changes in the behavior of preventing foot injuries after health education interventions [4], but in reality the incidence of foot injuries is higher [5]. The global prevalence so far has not found official report either from WHO or from several articles about how many DFU occurences exist in the world, but several report of events have exixted and repoted in several regions, such as DFU event in Oceania which reached 3%, the events in North America is event higher at 13%, it is also reported that the average rate is 6.4%. there are also resports of DFU or annual necrosis in patients with diabetes found to be around 2% to 5% and people suffering from DM have a lifetime risk ranging from 15% Keywords: behavior, foot care, family efficacy, prevention, DFU

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to 20% will experience DFU. 13% in North America, with a global average of 6.4% [6]. WHO states that every 30 seconds an amputation is performed in patients with DM and it is reported that 50-80% of amputations in the lower extremities are performed in people with DM [7], it was also reported that 85% of lower extremity amputations were preceded by DFU which caused gangrene or infection. [8]. It was reported in Indonesia that the risk of foot injuries in people with DM is 55.4% and the prevalence of foot injuries is 12% -20%[9]. This shows that the incidence of DFU is increasing every year.

The family is the smallest unit in the community, the ability of families to care for family members who suffer from DM will have a good impact on the health of people with DM. Family health conditions will affect the people in a family, which can have an impact on stress, relationships, communication, ignorance or various other situations [10]. DM conditions will last a long time and are lifelong for sufferers[11], so that families are expected to be able to perform preventive behaviors against complications, one of which is foot care by family (FCbF) which aims to prevent foot injuries (DFU). Aplication of social cognitive theory carried out in families is expected that families are able to understand family behaviour, families are able to predict and make changes to the behaviour that exists in a family. The family system was chosen to be studied because it affects almost every aspect of every individual's social development in a family, as well as the interralationships of relationships between individuals who influence each other in a family. Family with a good socioeconomic are usually more able to maintain relationships and motivation among family members, however in this case

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it is not the main benchmark, it can be seen from the results of several studies that state that with poor economic status, providing motivation and support given other family is also good by looking at the level of knowledge and family cultural relation [3]. Almost all research is always centered on humans individually and exclusively carried out in certain groups. but if we talk about family, then a family member does not live their lives independently, many things can be achieved by working together through interdependent efforts between family members [3]. Social cognitive theory extends the concept of human agency to collective agencies that are rooted in family beliefs in the form of collective efficacy which we call family efficacy [2]. To show how a family is able to do a family success, then some things can be done by the family by gathering the knowledge needed, learning and improving skills, increasing family potential from the resources they have, providing strong mutual support, increasing the ability to do an alliance between family members or people around him, and doing a joint work to achieve an outcome expected by the family in general.

Family efficacy is a family's belief in its ability to be able to regulate and take action in achieving its goals [2]. There are 3 main things forming family efficacy, namely relational, pragmatig and value-laden [12]. In family applications with DM sufferers, family efficacy has not been developed much, so far the focus of research has been on individuals as subjects who have not integrated families much. Increasing strong family confidence will be able to form good behaviour [13] especially in the prevention of DFU. The purpose of this study was to develop a family efficacy-based foot care model for preventing the incidence of diabetic foot ulcer.

METHODS

This study used analytic observational by analyzing several factors that influence family efficacy in preventing diabetic foot ulcer using a cross sectional approach. The study population was a nuclear family with family members of patients with type 2 DM, with criteria 1) family head, 2) living together with DM patients, 3) age 18-50 years, 4) recorded as a family of DM patients. The number of samples was 108 people with multi-stage cluster sampling. The family efficacy instrument used a modified NIHM Family efficacy scale [14]. Preventive behavior instrument using foot care behavior scale for diabetes (FCBS) [15], a family instrument developed from Friedman [10], information instrument developed from Ajzen [16]. Data analysis used structural equation modeling (SEM) based on variant or component better known as partial least squares (PLS). A family efficacy model was developed after a path analysis of study and formulating strategic issues through focus group discussions (FGD) and expert discussions. The FGDs were held and expert discussions were conducted to evaluate the new models found and prepare the forms of nursing intervention resulting from the development of the model. A statement of medical research ethics issued by the Health research ethics committee of the Faculty of Nursing Universitas Airlangga, Surabaya, Indonesia per number 2046-KEPK/2020.

RESULTS

Characteristics of Research Respondents

The study was conducted on families who have family members suffering from DM. overall the family showed an average age of 37.65 years (SD= 12.4467; CI= 35.27-40.03), duration of care for DM sufferers was 4.25 years (SD = 4.07; CI= 3,47-5,02), with an average junior high school education of 22.2% (24/108), high school 42.6% (46/108) and a graduate 22.2% (24/108), average income below the regional minimum income (UMR) as much as 70.4% (76/108), according to UMR 20.4% (22/108), the role in the family structure as the head of the family is 37.0% (40/108), children 39.8 (43/108).

Indicator	Category	Frequency	%
Family	Male	52	48.1
Gender	Female	56	51.9
	17-25 years old	30	27.8
	26-35 years old	14	13.0
Family age	36-45 years old	28	25.9
	46-55 years old	23	21.3
	56-65 years old	13	12.0
Family Education	Elementary school	14	13.0
	Middle School	24	22.2
	High school	46	42.6
	University	24	22.2
	Below the	76	70.4
Family Income	Minimum wage		
	According to the	22	20.4
	minimum wage		
	More than the	10	9.3
	minimum wage		
D 1	Head of family	40	37.0
Family	Couple	25	23.1
Suucture	Child	43	39.8

Table 1. Characteristics of respondents

Inner Model Evaluation

Evaluation of the structural model or inner model is a stage to evaluate the *goodness of fit* which includes the coefficient of determination and predictive relevance and hypothesis testing. The coefficient of determination (R^2) is used to determine the magnitude of the ability of endogenous variables to explain the diversity of exogenous variables, or in other words to determine the magnitude of the contribution of exogenous variables to endogenous variables.

Table 2. Determination Coefficient Results	(R ²))
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Dependent Variable	R 1-R Square Square		R Square Total	
Family efficacy (X5)	0.645	0.355	0.725	
Family Behavior (Y1)	0.081	0.919	0.725	

R-square value of the *Family efficacy* (X5) variable worth 0.645 or 64.5%. This can indicate that the diversity variable of *Family efficacy* (X5) able to be explained by variables Family factors (X1), Patient factor (X2), Health care facilities (X3), and Information factor (X4) by 64.5%. Or in other words the contribution of influence Family factors (X1), Patient factor (X2), Health care facilities (X3), and Information factor (X4) to *Family efficacy* (X5) by 64.5%. While the remaining 35.5% is contributed by other variables not discussed in this study.

Variabel Dependen	SSO	SSE	Q ² (=1- SSE/SSO)
Family efficacy (X5)	324,000	169,231	0,478
Perilaku keluarga (Y1)	108,000	101,529	0,060

Table 3. Predictive Relevance (Q²)

The Q2 value can be used to measure how well the observational value generated by the model and also the estimated parameters. Q2 value = 0.478 is greater than 0 (zero) indicates that the model is said to be good enough.

Effect of Family Efficacy on Family Behavior

Significance testing is used to determine whether there is an influence of exogenous variables on endogenous variables. The test results carried out with the criteria that if the value T-statistics \geq T-table (1.96) or P-value <significant alpha 5% or 0.05, then there is a significant influence of exogenous variables on endogenous variables. Significance and model testing results can be known through the figures and table 4.

Hypothesis testing in the development of the model shows that influence of family factors to family efficacy (p = 0.00), patients factor to family efficacy (p = 0.018), health care facilities to family efficacy (p = 0.047), information factor to family efficacy (p = 0.000), indicate there is a significant effect on family efficacy. The effect of

family efficacy on family behavior in the prevention of diabetic foot injuries also showed a significant effect (p = 0.003). Thus, it can be interpreted that the higher t-statistic value is a family factor with a value of 3.681; this means the family factor is the strongest factor affecting family efficacy. The resulting coefficient is positive 0.317. Thus it can be interpreted, the better family factors (X1) then it tends to increase family efficacy (X5), so the role of the family is very important in improving the behavior of family members in the prevention of DFU.

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Effect	Original Sample (O)	T Statistics (O / STDEV)	P Values		
Family factors (X1) -> Family efficacy (X5)	0.317	3.681	0.000		
Patient Factor (X2) -> Family efficacy (X5)	0.196	2.365	0.018		
Health care facilities (X3) -> Family efficacy (X5)	0.192	1.993	0.047		
Information factor (X4) -> <i>Family efficacy</i> (X5)	0.280	3.594	0.000		
Family efficacy (X5) -> Family behavior (Y1)	0.285	2.962	0.003		

Table 4. Factors Affecting Family Efficacy



Figure 1. Inner Model of Foot Care Development by Family Against Family Behavior in Prevention of DFU

Discussion

Family factors are the strongest factors affecting family efficacy, so the role of the family is very important in improving the behavior of family members to prevent the incidence of DFU. The family is an entry point in providing nursing services in the community, to determine the risk of family health problems, the involvement of all family members is very large, where the presence of family members who need ongoing health assistance due to diabetic foot ulcer [17]. One of the tasks of family health is being able to take care of family members who experience health problems [10].

Family efficacy is a family's belief in its ability to be able to regulate and take action in achieving its goals [2]. In carrying out family efficacy, the family must have sufficient knowledge of health problems, the ability and expertise shown in conducting behavior, and qualified potential resources in dealing with change so as to be

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able to provide strong mutual support, form alliances between family members, and work together all family members to secure what they cannot achieve so that the family has the same goals and focus in seeing the health problems that exist in the family. The findings from the meta-analysis show that perceived family efficacy can improve the quality and function of the family in a particular group. The wider the interdependence in the existing social system in the family, it can be said that the higher the possibility of efficacy results felt in the family. There are 3 main things forming family efficacy, namely relational, pragmatig and value-laden [2]. Family relationships are based on mutual acceptance and open communication, mutual assistance and the ability to be independent as individuals and families. In an atmosphere of open communication between family members, families tend to tell their family members about the concerns, activities, and dilemmas they face by family in each of their social life in non-family contexts. This information allows other family members to provide guidance and support and to identify potential problem situations that may require assistance and monitoring, good and sufficient information that each family member has, will provide the skills of each family member in providing support, guidance and direction to all family members, so as to identify the occurrence of problems that exist in a family, so that other family members will know the type assistance that can be given as well as monitoring the things they can do to solve the problem [14]. Families who have perceived perceptions of parenting, partner, and high efficacy is expected to increase the strong efficacy of the family, not only will improve communication, but also will increase knowledge, selection of good behavior, showing the ability to do an activity, good attitude, good mood and happy and family not easy blame others for failing [3].

The ability of the family to show confidence in their competence in performing foot care, shows that pragmatic family efficacy can improve family competence in performing foot care, this can be seen in the behavior taken by the family when taking diabetes foot injury prevention measures, where families help each other and provide support good knowledge and competence that they have are able to perform preventive behavior properly. This variables representing this domain include behavior in carrying out family parenting practices such as the involvement of all family members in monitoring the condition of the feet of their family members, then providing and setting rules / limits on what may and may not be done, for example the use of footwear routine and proper washing of feet, remind each other in taking preventative behavior, and always take preventative measures together in a happy atmosphere. This domain plays an important role in improving the behavior of every family member in performing foot care and prevention of diabetes foot injuries. This can be seen from the results of the AVE value (0.918) which means that both factors have validity greater than 0.5, which means that the factor is also capable of accurately measuring latent variables. Two specific aspects of pragmatic family success, namely control and monitoring carried out by the family [12]. Family pragmatic can influence directly on family efficacy, where the behavior carried out by a family will be seen from the ability of the family to modify the environment, the role and involvement of each family member and how all family members jointly solve a problem they face [18]. Research

by Sukartini et al (2020) states that family factors are the biggest driving factor in influencing family attitudes and behavior in the prevention of diabetic foot ulcer, several supporting factors which include the availability of health facilities, accessibility of health resources, and therapy programs provided are also important factors in influencing family efficacy in performing a behavior [19]. This is also supported by the strength of information owned by the family, experience and a good family emotional condition that is also able to improve family efficacy in this study.

Value-laden demonstrates confidence in the ability of the family that results from values supported by the family, such as the strength that comes from the beliefs or religious / cultural values of the family in carrying out any behavior, is still influenced by a culture passed down through generations and is believed by their ancestors, nowadays it is often ignored by a small number of families, and most families have have their own perceptions about the belief in performing a foot care behavior, then the family will believe it can avoid and prevent foot injuries [20]. The linkage of these three concepts makes a strengthening of efficacy in performing foot care behavior in preventing diabetic foot ulcer. Value-filled effectiveness, for example, can depend on relational or pragmatic efficacy to carry on family cultural values from one generation to another. This ability then allows families to become more professional in making demands and gaps between their heritage and culture [19]. Another aspect that is also able to increase efficacy in the family is a good and lucky family economic status, further increasing good relationships in the family. While family type and coping factors owned by the family are slightly reduced in influencing family efficacy, this is due to the knowledge and information possessed by the family has led to the collectivity of a family rather than individualism, so that family efficacy is stronger and hopes to be able to do a preventative behavior which is good for other family members. [20].

Family efficacy is not just predictions about how actions or behaviors that will be carried out by the family, but family beliefs are determinants of how beliefs in one's abilities, actions taken, thought patterns and emotional reactions experienced in certain situations [21]. The choice of action is an important factor in shaping family efficacy, because this is the basis for the view of the success of the family in running certain skills, if the selection of actions taken is appropriate and able to solve the problem, it will be able to increase the family's efficacy [22]. So each intervention must pay attention to the stage of family change in dealing with problems, for example families are not ready to make changes in behavior, then providing counseling or providing education is still not needed [23]. Appropriate interventions include providing service guarantees if the individual has the desire to know further complications and that's when material can be given so that family awareness arises about the importance of solving health problems [24]. Awareness that is formed will become a lifestyle in maintaining quality of life with a variety of actions, the family will maintain its life so that it is better and normal, and will do everything possible to improve the quality of life, so as to form preventive behavior, lifestyle behavior and ultimately be able to reduce the risk of complications in that individual [25].

Conclusion

Family factor is the strongest factor in influencing family efficacy, so it can improve the behavior of family members in performing foot care in preventing diabetic foot injuries. Families become an entry point in efforts to prevent wound behavior, the better the ability of families to establish relationships between families, family competencies and values that are believed to be family, will be able to improve behavior in the treatment and prevention of DFU. The efficacy-based foot care by family (FCbF) development model can be used as a good intervention in the community.

Acknowledgement

The researcher would like to thank all the respondents who participated, Directorate of Research and Community Service, Deputy for Research and Technology Strengthening and Development of the Ministry of Research and Technology / National Agency for Research and Innovation of the Republic of Indonesia for funding this research.

Conflict of interest

None, there is no conflict of interest in the research conducted

REFERENCES

- McEwen MM, Pasvogel A, Murdaugh CL. Family selfefficacy for diabetes management: psychometric testing. Journal of nursing measurement. 2016 Jan 1;24(1):32E-43E. https://doi.org/10.1891/1061-3749.24.1.32
- Kao TS, Lupiya CM, Clemen-Stone S. Family efficacy as a protective factor against immigrant adolescent risky behavior: A literature review. Journal of Holistic Nursing. 2014 Sep;32(3):202-16. https://doi.org/10.1177%2F0898010113518840
- Bandura A, Caprara GV, Barbaranelli C, Regalia C, Scabini E. Impact of family efficacy beliefs on quality of family functioning and satisfaction with family life. Applied Psychology. 2011 Jul;60(3):421-48. https://doi.org/10.1111/j.1464-0597.2010.00442.x
- 4. Nguyen TP, Edwards H, Do TN, Finlayson K. Effectiveness of a theory-based foot care education program (3STEPFUN) in improving foot self-care behaviours and foot risk factors for ulceration in people with type 2 diabetes. Diabetes Research and Clinical Practice. 2019 Jun 1; 152:29-38. https://doi.org/10.1016/j.diabres.2019.05.003
- 5. International Diabetes Federation (IDF), *IDF Diabetes Atlas 8th edition*. 2017.
- Chun DI, Kim S, Kim J, Yang HJ, Kim JH, Cho JH, Yi Y, Kim WJ, Won SH. Epidemiology and burden of diabetic foot ulcer and peripheral arterial disease in Korea. Journal of Clinical Medicine. 2019 May;8(5):748. https://doi.org/10.3390/jcm8050748
- Zhang P, Lu J, Jing Y, Tang S, Zhu D, Bi Y. Global epidemiology of diabetic foot ulceration: a systematic review and meta-analysis. Annals of medicine. 2017 Feb 17;49(2):106-16. https://doi.org/10.1080/07853890.2016.1231932
- Al-Hariri MT, Al-Enazi AS, Alshammari DM, Bahamdan AS, Al-Khtani SM, Al-Abdulwahab AA. Descriptive study on the knowledge, attitudes and practices regarding the diabetic foot. Journal of Taibah University Medical Sciences. 2017 Dec

1;12(6):492-6.

https://doi.org/10.1016/j.jtumed.2017.02.001

- Yusuf S, Okuwa M, Irwan M, Rassa S, Laitung B, Thalib A, Kasim S, Sanada H, Nakatani T, Sugama J. Prevalence and risk factor of diabetic foot ulcers in a regional hospital, eastern Indonesia. Open Journal of Nursing. 2016 Jan 18;6(1):1-0. http://dx.doi.org/10.4236/ojn.2016.61001
- Friedman MM, Bowden VR, Jones EG. Buku ajar keperawatan keluarga: Riset, teori, dan praktek. Jakarta: Egc. 2010:5-6.
- 11. Huda N, Widayanti DM. Simple Foot Elevator (SFE) Tools to Promote Comfort for Diabetic Patient during Wound Care. InHealth Science International Conference (HSIC 2017) 2017 Oct. Atlantis Press. https://dx.doi.org/10.2991/hsic-17.2017.31
- 12. C. H. Caldwell, "Family Efficacy within Ethnically Diverse Families :," vol. x, no. x, pp. 1–17, 2015.
- Biçer EK, Enç N. Evaluation of foot care and selfefficacy in patients with diabetes in Turkey: an interventional study. International journal of diabetes in developing countries. 2016 Sep 1;36(3):334-44. https://doi.org/10.1007/s13410-016-0464-y
- 14. R. Peshawaria and D. Bailey, *Nimh family efficacy scale*. 2000.
- 15. García-Inzunza JA, Valles-Medina AM, Muñoz FA, Delgadillo-Ramos G, Compean-Ortiz LG. Validity of the Mexican version of the combined Foot Care Confidence/Foot-Care Behavior scale for diabetes. Revista Panamericana de Salud Pública. 2015; 38:35-41.
- 16. Ajzen I. The theory of planned behaviour is alive and well, and not ready to retire: a commentary on Sniehotta, Presseau, and Araújo-Soares. Health psychology review. 2015 Jan 1;9(2):131-7. https://doi.org/10.1080/17437199.2014.883474
- Huda N, Sukartini T, Pratiwi NW. The Impact of Self Efficacy on the Foot Care Behavior of Type 2 Diabetes Mellitus Patients in Indonesia. Jurnal Ners. 2019;14(2):181-6. http://dx.doi.org/10.20473/jn.v14i2.16741
- Jugert P, Greenaway KH, Barth M, Büchner R, Eisentraut S, Fritsche I. Collective efficacy increases pro-environmental intentions through increasing self-efficacy. Journal of Environmental Psychology. 2016 Dec 1; 48:12-23. https://doi.org/10.1016/j.jenvp.2016.08.003
- Chiwanga FS, Njelekela MA. Diabetic foot: prevalence, knowledge, and foot self-care practices among diabetic patients in Dar es Salaam, Tanzaniaa cross-sectional study. Journal of foot and ankle research. 2015 Dec 1;8(1):20. https://doi.org/10.1186/s13047-015-0080-y
- 20. Anjaswarni T, Nursalam N, Widati S, Yusuf A, Tristiana RD. Development of a self-efficacy model in junior and senior high school students based on religiosity and family determinants: a cross sectional approach. International Journal of Adolescent Medicine and Health. 2019 Dec 28;1(ahead-of-print). https://doi.org/10.1515/ijamh-2019-0023
- Huda N, Nursalam N, Sukartini T, Pratiwi SA, Irawandi D. The Impact of Family Confidence on Foot Care Behavior by Family Members Suffering from Diabetes Mellitus. International Journal of Psychosocial Rehabilitation. 2020;24(7).

- Sharoni SK, Rahman HA, Minhat HS, Ghazali SS, Ong MH. A self-efficacy education programme on foot self-care behaviour among older patients with diabetes in a public long-term care institution, Malaysia: a Quasi-experimental Pilot Study. BMJ open. 2017 Jun 1;7(6). http://dx.doi.org/10.1136/bmjopen-2016-014393
- 23. Pourhaji F, Delshad MH, Ammari AA, Pourhaji R. Foot-care self-efficacy beliefs, physical self-concept and actual foot-care behavior in people with diabetes mellitus. International Journal of Musculoskeletal Pain Prevention. 2016 Sep 10;1(3):101-7.
- D'Souza MS, Karkada SN, Parahoo K, Venkatesaperumal R, Achora S, Cayaban AR. Selfefficacy and self-care behaviours among adults with type 2 diabetes. Applied Nursing Research. 2017 Aug 1; 36:25-32. https://doi.org/10.1016/j.apnr.2017.05.004
- Park M, Lee M, Jeong H, Jeong M, Go Y. Patient-and family-centered care interventions for improving the quality of health care: a review of systematic reviews. International journal of nursing studies. 2018 Nov 1; 87:69-83. https://doi.org/10.1016/j.ijnurstu.2018.07.006