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Original article

Application of Donabedian framework of structure, process and outcome in diabetes management among elderlies living in nursing homes in Isfahan, Iran

Zahra Noori [1], Parvaneh Khorasani [1, 2], Habibollah Hosseini [3,*]

[1] Nursing and Midwifery Care Research Center, School of Nursing and Midwifery, Isfahan University of Medical Sciences, Isfahan, Iran.
[2] Department of Community Health & Gerontological Nursing, School of Nursing and Midwifery, Isfahan University of Medical Sciences, Isfahan, Iran.
[3] Health Department, Faculty of Nursing and Midwifery, Isfahan University of Medical Sciences, Isfahan, Iran.

***. Corresponding author:** Habibollah Hosseini, Health Department, Faculty of Nursing and Midwifery, Isfahan University of Medical Sciences, Isfahan, Iran. E-mail: h_hoseini@nm.mui.ac.ir.

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Abstract

Introduction: The purpose of this study was to assess the status of diabetes management among elderly people living in Isfahan nursing homes using the Donabedian framework in three parts: structure, process, and outcome.

Methods: In 2018, the current descriptive-cross-sectional approach was used in 13 nursing homes in Isfahan. Data was collected using a dependable and valid research-created checklist that evaluated diabetes management through three components: organizational structure (8 dimensions and 33 items), processes (3 dimensions and 23 items), and outcomes (2 dimensions and 7 items). Data was collected by observing the equipment and human resources, interviewing key informants and nurses, reviewing documents, and collecting blood and urine samples under standard conditions.

Results: Structure, process, and outcome mean scores were 34.5±2.6, 38.5±5.9, and 65.6±13.9, respectively. The highest and lowest structure scores were associated with "referral system" and "trained personnel," respectively; process scores were associated with "counseling and risk factor reduction" and "immunization," and outcome scores with "physical examination and history taking" and "documentation of laboratory results." The mean score of structure was found to have a direct relationship with process and outcome ($p < 0.05$). There was also a direct relationship ($p < 0.05$) between the mean process and outcome scores. Linear regression analysis revealed that structure was a significant predictor of outcome ($p = 0.01$).

Conclusions: The findings revealed some issues with the structure, process, and outcome of providing appropriate diabetes management care in nursing homes. To achieve positive results in this area, it is necessary to focus on the human resources, facilities, and equipment required to manage diabetes in nursing homes.

Keywords: Elderly, Nursing home, Diabetes management, Model and theory, Donabedian framework, Quality control

Introduction

Iran's most recent census, conducted in 2016, revealed a population of 9.27 percent of people aged 60 and up, with a projected increase to 17.5 percent by 2030. (1). Although it is expected that a significant percentage of the elderly will move to nursing homes in the near future to receive the care they require (2), the necessary infrastructure for this purpose has not yet been provided (3, 4). The health of the elderly and the pattern of service delivery to them are two of the most important concerns of community health service organizations; however, these conditions are at a low-to-moderate level (5).

Diabetes is one of the world's chronic and growing health problems that is most prevalent among the elderly (6). According to the International Diabetes Federation (IDF), the aging of the world's populations will increase the proportion of elderly people living with diabetes by 2045. (7). Caring for such patients is a major concern, and the problem is exacerbated in "nursing homes" (8). Diabetes in the elderly is estimated to be 14.4 percent in Iran (9), and the global incidence of diabetes in the elderly living in nursing homes is reported to be between 11 and 36 percent, indicating an increasing trend across all countries (6). Despite this, little is known about the characteristics, severity of symptoms, disease management, and care and management outcomes of diabetes among nursing home residents (10). Blood sugar control is recognized as a major concern in these settings (11).

Admission of diabetic elderly people to nursing homes with inadequate facilities and care processes will have complex and costly consequences. Having multiple diseases at the same time has resulted in the majority of these elderly people needing to take multiple medications at the same time and experiencing physical limitations or severe cognitive disorders (12). The occurrence of multiple and non-specific symptoms, usually associated with impaired functional and cognitive capacity, has posed a unique challenge to diabetes management in the elderly (13). Furthermore, they may be admitted to a nursing home with other underlying or acute conditions such as heart failure, stroke, Alzheimer's disease, and pelvic fractures, making diabetes treatment and management a lower priority (14). Elderly patients in these settings may also have insufficient food intake due to high blood sugar, anorexia, difficulty swallowing, and a lack of a flexible and specific diet. Because of the gravity of the situation, these patients are more vulnerable to hypoglycemia than other age groups and may suffer from malnutrition and weight loss (15). These issues point to a "need for diabetes management in nursing homes." When evaluating and planning for the elderly with diabetes, diabetes management and related care should be considered, with a focus on preventive measures and limitations caused by aging (16).

Diabetes management based on a set of standards is effective in lowering costs; thus, it appears to be critical to do it in a high-quality manner in nursing homes (17, 18). To assess the quality and quantity of diabetes management, management techniques and standard evaluation models must be considered. The Donabedian framework is the most widely used model in evaluating the quality of health care in this regard, and it evaluates care in three areas: structure, process, and outcome. Structure refers to all of the factors that affect the context in which care is delivered, including the quantity and quality of human resources, facilities, equipment, and physical environment; process refers to the process of providing and receiving services and care; and outcome refers to the effects of services on patients' well-being (19, 20).

According to our research, no study on the quality of diabetes management in Iranian nursing homes has been conducted. Because of this, and the importance of the issue, the purpose of this study was to assess the status of diabetes management in elderly people living in nursing homes in Isfahan using the Donabedian framework, in order to provide the data needed for better policy and planning in this area.

Materials and Methods

In 2018, the current descriptive-cross-sectional approach was used in 13 nursing homes in Isfahan. After receiving approval from the Isfahan University of Medical Sciences ethics committee and a proposal code of 396702, data was collected by presenting the necessary permissions and the introduction letter from Isfahan University of Medical Sciences to the Welfare Department and related organizations in the city.

Data Collection Tool

The main data collection checklist was designed in three parts: organizational structure, processes, and diabetes management outcomes, based on an extensive review of the literature and current guidelines for diabetes care in the elderly, as well as expert opinions and nursing and other medical staff's experiences. Data was collected after determining its validity and reliability by observing the equipment and human resources, interviewing key informants and nurses, reviewing documents, and collecting blood and urine samples under standard conditions. The checklist's face and content validity were confirmed by polling 13 university professors and relevant experts. Inter-observer and test re-test (with a 10-day interval) reliability methods were used to confirm the

checklist's reliability in terms of process and outcome, and it was confirmed with a sample of 20 elderly people with diabetes living in nursing homes. In the final version, 63 items with a correlation greater than 0.90 were retained (structure: 33 items across 8 dimensions; process: 23 items across 3 dimensions; and outcome: 7 items across 2 dimensions). Scoring is based on a two-item Likert scale (Yes/No) for structure, a three-item Likert scale (complete/incomplete/not done) for process, and a three-item Likert scale (acceptable/relatively acceptable/unacceptable) for outcome. In addition, an 11-item demographic questionnaire was completed for each elderly person.

Sampling

There are 500 elderly people living in 13 nursing homes in Isfahan, according to reports. The centers were chosen from a list of all nursing homes covered by the Welfare Department of Isfahan, and sampling was done by referring to the centers, obtaining the officials' agreement, and attracting the participation of elderly with diabetes. After completing the code and identity card for each nursing home, data on the structure of diabetes management were collected by reviewing available documents, observing equipment, and interviewing key informants (heads, internal managers, nurses, physicians, and other caregivers, and elderly) (in terms of type of service: public, charitable, or private). Data on the elderly was also gathered by consulting their medical records.

Ethical considerations

Sampling was carried out after obtaining the code of ethics and presenting the necessary permission and the introduction letter. When the researcher entered nursing homes during working hours, he or she introduced himself or herself to the manager, staff, and patients before collecting data. It should be noted that each participant provided informed consent.

Data Analysis

Data were summarized in Excel after collection and analyzed by statistics professors after being transferred from Excel to SPSS for Windows version 18. After determining the mean scores, the results were presented in descriptive tables (mean and standard deviation). Pearson's correlation coefficient and multiple linear regression analysis were used to examine research hypotheses.

Results

This study included 11 nursing homes and 75 elderly people with diabetes. Of the total number of elderly people, 52 (69.3%) were female and 23 (30.7%) were male. The participants' average age was 75.67±10.63 years, with ages ranging from 60 to 96. Their average BMI was 26.74±5.23, with a range of 21.51 to 31.97. The majority of them (56%) were obese or overweight, had no spouse (61%) and were illiterate (50.7%). Table 1 contains additional demographic information. Table 2 displays the scores for the various structure, process, and outcome dimensions of diabetes management (Min score = 0 and Max score = 100). Table 3 also shows the relationship between the main structure, process, and outcome scores for diabetes management in the elderly and the correlation coefficients in regression analysis.
Table 4 shows the mean total score of the diabetes management process and its dimensions.

Discussion

The status of diabetes management in nursing homes in Isfahan was evaluated using the Donabedian framework in terms of structure, process, and outcomes in this study. The findings revealed some issues in terms of capability in providing appropriate diabetes management care in nursing homes. Limited personnel training and necessary continuing medical education can be mentioned in this regard.
Furthermore, data collected on participants' demographic characteristics were compared to other similar studies. In this regard, 75 of the 500 elderly living in Isfahan nursing homes had diabetes, with the majority of them being female and overweight. These findings are consistent with the findings of Al Alfi's study (21).
Diabetes care in nursing homes is jeopardized by an inefficient structure that does not support standard processes. Because the diabetes management questionnaire based on the Donabedian framework was the first in our country and was used for the first time, it was not possible to compare the results of all three parts of structure, process, and outcome with other similar studies. This is because most studies have only looked at one or two aspects of structure and process. For example, in Brittney's study, only data on intermediate-term outcomes and diabetes care and management processes were collected (11). The current study found that, while there were no guidelines for diabetes monitoring and management in most nursing homes, diabetes care for the elderly was provided at a primary and basic level, so that a nursing staff shortage overshadowed diabetes management.

Table 1. Participants' demographic characteristics

variables		No.	%	variables		freq.	relative freq.
BMI	underweight	16	21.3	presence of other underlying diseases (comorbidity)	one disease	27	36%
	normal	17	22.7		two diseases	42	56%
	overweight	17	22.7		more than two diseases	6	8%
	obese	25	25	dependency in daily personal activities	completely independent	53	70.7%
Marital status	single	7	9.3		relatively dependent	7	9.3%
	married	7	9.3		completely dependent	27	36%
	without a spouse	61	81.4	cognitive status	normal	27	36%
Educational level	illiterate	38	5.7		moderate impairment	46	61.3%
	primary school	25	33.3		severe impairment	2	2.7%
	higher	12	16	life expectancy	long	19	25.3%
					moderate	52	69.4%
					limited	4	5.3%
				History of diabetes	less than 5 years	2	2.7%
					5-10 years	4	5.3%
					more than 10 years	19	25.3%
					unknown	50	66.7%

In terms of structure, all 11 nursing homes had a resident or an on-call physician present, a resident nurse present during all three shifts, and the availability of a glucometer, testing kits and needles, lancing device, safety box, blood pressure monitor, and glucagon vial. Ketone testing kits, on the other hand, were not available in any of the centers.

In terms of diabetes care and management processes and procedures, blood pressure measurement and recording were completed only partially for 12 elderly people (16%) and completely for 63 (63%) (84 percent). It was done for 100% of the samples in Al Alfi's study, 98 percent in Brittney's study, and 73% in Garcia's study (21). The rates reported in the first two studies are nearly identical to the findings of our study. BMI measurement and recording were not performed for 54.7 percent of the elderly in this study; however, it was done partially for 41.3 percent and completely for 4%. It was done for 98.1 percent of the samples in Al Alfi's study, and weight measurement was done for 100 percent of them at each visit. Despite the fact that the previous study was conducted in 2004, the rates of both measurements are higher in the current study. Leg examination and recording by a nurse were not performed for 20% of the elderly in this study; however, it was done in part for 57.3 percent and completely for 22.7 percent. It was done for 68.9 percent of samples in Garcia's study and 76.3 percent in Brittney's study, indicating higher rates than in our study. Referring a patient for an accurate leg examination and recording it, as well as conducting a monofilament test by a physician in terms of anesthesia, pulse, and wound, were not performed for 80 percent of the elderly in this study; however, it was done partially for 17.3 percent and completely for 2.7 percent (11). Brittney's study found that 69.4 percent of samples were examined by a podiatrist, which is higher than our study. Referring a patient for an eye examination was not done for 80 percent of the elderly, but it was done partially for 14.7 percent and completely for 5.3 percent. Only two elderly people received the recommended screening test, and they did so at the time of admission; none were examined by an ophthalmologist while in the nursing homes. This examination was performed for 54.3 percent of

samples in Brittney's study, which is higher than in our study. In Al Alfi's study, 97.5 percent of samples were referred to an ophthalmologist on an annual basis, and 34.6 percent of samples were examined, both rates higher than in our study. Oral and dental examinations and recording were not performed for 74.7 percent of the elderly in this study; however, they were done partially for 22.7 percent and completely for 2.7 percent. The HbA1c test and recording were not performed for 69.3 percent of the elderly; however, it was performed in part for 21.3 percent and entirely for 9.3 percent (21).

Table 2. Scores of different dimensions of structure, process and outcome regarding diabetes management (Min score= 0 and Max score = 100)

Different parts of diabetes management	Different dimensions	M±SD
structure	presence of human resources in nursing home	49.67±2.89
	existence of necessary equipment for glucose testing	49.00±2.52
	existence of necessary equipment for eye examination and care	35.33±22.92
	existence of necessary equipment for BMI measurement	29.78±6.87
	existence of documenting and reporting forms	13.11±5.84
	presence of trained personnel about diabetes	12.22±5.70
	existence of other facilities	41.24±3.63
	existence of a referral system	50.00±0
	total score (out of 100)	34.54±2.66
Process	check-up, taking history, physical examination, getting laboratory tests	36.33±15.91
	immunization	32.89±16.67
	counseling and reducing risk factors	41.17±17.19
	total score (out of 100)	38.49±15.92
Outcome	appropriate results in examinations and taking history	72.22±20.38
	appropriate results in laboratory documentation	61.73±15.01
	total score (out of 100)	65.60±13.89

Table 3. Relationship between the main scores of structure, process and outcome regarding diabetes management in elderlies and correlation coefficients in regression analysis

Variable	process		outcome		Unstandardized coefficients	standardized coefficients	t	p-value
	r	p	r	p				
Structure	0.318	0.005	0.355	0.002	1.905	0.318	2.86	0.005
Process	-	-	0.257	0.03	1.590	0.304	2.65	0.01
Outcome	-	-	-	-	0.140	0.160	1.40	0.17

Table 4. Mean total score of process regarding diabetes management and its dimensions

Dimensions	M	SD
Total score	38.49	15.92
Taking history, physical examination, getting laboratory tests	36.33	15.91
Immunization	32.89	16.67
Counseling and reducing risk factors	41.17	17.19

In terms of structure, all 11 nursing homes had a resident or an on-call physician present, a resident nurse present during all three shifts, and the availability of a glucometer, testing kits and needles, lancing device, safety box, blood pressure monitor, and glucagon vial. Ketone testing kits, on the other hand, were not available in any of the centers.

In terms of diabetes care and management processes and procedures, blood pressure measurement and recording were completed only partially for 12 elderly people (16%) and completely for 63 (63%) (84 percent). It was done for 100% of the samples in Al Alfi's study, 98 percent in Brittney's study, and 73% in Garcia's study (21). The rates reported in the first two studies are nearly identical to the findings of our study. BMI measurement and recording were not performed for 54.7 percent of the elderly in this study; however, it was done partially for 41.3 percent and completely for 4%. It was done for 98.1 percent of the samples in Al Alfi's study, and weight measurement was done for 100 percent of them at each visit. Despite the fact that the previous study was conducted in 2004, the rates of both measurements are higher in the current study. Leg examination and recording by a nurse were not performed for 20% of the elderly in this study; however, it was done in part for 57.3 percent and completely for 22.7 percent. It was done for 68.9 percent of samples in Garcia's study and 76.3 percent in Brittney's study, indicating higher rates than in our study. Referring a patient for an accurate leg examination and recording it, as well as conducting a monofilament test by a physician in terms of anesthesia, pulse, and wound, were not performed for 80 percent of the elderly in this study; however, it was done partially for 17.3 percent and completely for 2.7 percent (11). Brittney's study found that 69.4 percent of samples were examined by a podiatrist, which is higher than our study. Referring a patient for an eye examination was not done for 80 percent of the elderly, but it was done partially for 14.7 percent and completely for 5.3 percent. Only two elderly people received the recommended screening test, and they did so at the time of admission; none were examined by an ophthalmologist while in the nursing homes. This examination was performed for 54.3 percent of samples in Brittney's study, which is higher than in our study. In Al Alfi's study, 97.5 percent of samples were referred to an ophthalmologist on an annual basis, and 34.6 percent of samples were examined, both rates higher than in our study. Oral and dental examinations and recording were not performed for 74.7 percent of the elderly in this study; however, they were done partially for 22.7 percent and completely for 2.7 percent. The HbA1c test and recording were not performed for 69.3 percent of the elderly; however, it was performed in part for 21.3 percent and entirely for 9.3 percent (21).

The FBS test and recording were not performed for 16 percent of the elderly in this study; however, it was performed incompletely for 30.7 percent and completely for 53.3 percent. It was done for 97.5 percent of samples in each visit in Al Alfi's study,

which is higher than in our study. The BS test and recording were not performed for 24 percent of the elderly in this study; however, it was done partially for 52 percent and completely for 24 percent. It was done for 73.4 percent of samples in Garcia's study, which is higher than in our study. The fasting lipid profile test and recording it were not performed for 30.7 percent of the elderly in this study; however, it was done partially for 48 percent and completely for 21.3 percent. In Al Alfi's study, 91.8 percent of samples were tested for cholesterol, and 64.8 percent were tested for triglycerides (21). A lipid profile test was performed on 77.6 percent of the samples in Brittney's study. These findings are more significant than those found in our study. The UACR test was not performed in Al Alfi's study. Estimating and recording eGFR, as well as measuring serum creatinine, were not performed for 92 percent of the elderly in this study; however, it was done partially for 3.5 percent and completely for 7.5 percent (21).

In this study, 50.7 percent of the elderly were not vaccinated or recorded; however, 20 percent were vaccinated and 29.3 percent were recorded completely. Pneumococcal vaccination and recording were not performed for 96 percent of the elderly, but it was done partially for 2.7 percent and completely for 1.3 percent. Hepatitis vaccination and recording were not performed for 100% of the elderly in this study. Tobacco cessation counseling and recording were not provided to 97.3 percent of the elderly; however, it was provided in part to 1.3 percent and completely to 1.3 percent. Aspirin therapy and its documentation were not provided to 64 percent of the elderly; however, it was provided in part to 2.7 percent and completely to 33.3 percent. Feldman's study had a higher rate of aspirin therapy than ours, with 57 percent of the elderly taking aspirin or clopidogrel bisulfate (13). Referring a patient for a mental status examination and recording it were not performed for 85.3 percent of the elderly in this study; however, it was done partially for 6.7 percent and completely for 8%. For 46.7 percent of the elderly, ACE inhibitors were not taken and recorded; however, it was done partially for 4 percent and completely for 49.3 percent. 73.3 percent of the elderly did not perform exercises or keep track of them. However, it was only done partially for 20% and completely for 2.7 percent. Having a diet and keeping track of it were not done for 18.7 percent of the elderly; however, it was done for 18.7 percent of the elderly. Fitzpatrick's study found that all of the elderly had an appropriate diet, indicating a better condition than ours. In this study, evaluating and recording drug use was not done for 1.3 percent of the elderly, but it was done partially for 17.3 percent and completely for 81.3 percent. Self-monitoring and recording blood glucose levels were not performed by 82.7 percent of the elderly; however, it was done in part by 13.3 percent and completely by 7 percent.

In terms of diabetes management outcomes in nursing homes, 4% of the elderly had unacceptable blood pressure ranges, 28% had relatively acceptable ranges, and 68% had acceptable blood pressure ranges. In Al Alfi's study, 36.5 percent had acceptable blood pressure ranges, 28.3 percent had relatively acceptable ranges, and 35.2 percent had unacceptable ranges, indicating that blood pressure was better controlled in our study. In our study, 13.3% of the elderly had unacceptable ranges, 60% had relatively acceptable ranges, and 26.7 percent had acceptable ranges (21). In Al Alfi's study, 15.7 percent of samples had normal BMI, 32.7 percent were overweight, 49.7 percent were obese, and 1.9 percent had no data, indicating that BMI values in our study were closer to the normal range. In our study, the condition of the elderly legs examined by a nurse was unacceptable for 4%, relatively acceptable for 36%, and acceptable for 6%. The condition of the legs was better in Al Alfi's study than in ours, as it was only unacceptable for 2.5 percent of the samples. Fitzpatrick's study found no diabetic foot ulcers during examination, which is better than ours. In this study, 13% of the elderly had unacceptable HbA1c ranges, 18.7% had relatively acceptable ranges, and 69.3% had acceptable HbA1c ranges. HbA1c values were not available in Al Alfi's study, but they were in the acceptable range for 36.2 of the samples in Brittney's study. In this study, 17.3% of the elderly had unacceptable fasting lipid profile ranges, 69.3% had relatively acceptable ranges, and 13.3% had acceptable fasting lipid profile ranges. This was acceptable for 45.6 percent in Al Alfi's study, unacceptable for 32.7 percent, and not recorded for 21.7 percent, which was lower than our study (21). Brittney's study found that only 2.9 percent of samples had an acceptable fasting lipid profile range, which was lower than ours. In this study, 17.3% of the elderly had unacceptable fasting blood sugar ranges, 28% had relatively acceptable ranges, and 54.7 percent had acceptable fasting blood sugar ranges (11). In this study, 58.7 percent of participants had relatively acceptable UACR ranges, while 41.3 percent had acceptable UACR ranges. There was no study that looked at UACR in the context of diabetes management. 21.3 percent of participants had unacceptable eGFR ranges, 72 percent had relatively acceptable ranges, and 6.7 percent had acceptable eGFR ranges in this study. eGFR values were not estimated in Al Alfi's study, and only BUN and creatinine levels were available; BUN levels were within the normal range in 97.5 percent of samples, and creatinine levels were within the normal range in 98.2 percent of samples (21).

Limitation

This study was conducted in a specific setting, which limited the findings' generalizability.

Conclusion

The findings of this study on diabetes management based on the Donabedian framework among elderly people with diabetes living in nursing homes in Isfahan revealed that diabetes management in these settings is incomplete, and structural and process modifications are needed to improve the outcome. This study demonstrates that we are far from meeting diabetes management standards, and that improvements in equipment and financial resources, as well as process optimization, are required to improve outcomes (controlling diabetes and its complications in elderly people living in nursing homes). It is suggested that the findings of this study be used to compile internal regulations and announce relevant guidelines to the appropriate authorities (Ministry of Health and Welfare Organization). Furthermore, more research is needed to assess the efficacy of the suggested interventions, which include developing local diabetes management guidelines and implementing them in nursing homes; documenting and recording care; and personnel education about care guidelines and procedures based on required diabetes management standards in nursing homes.

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