Care Effectiveness and Standards of Dementia Special Care Units for Older Adults with Dementia in Pension Industry

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Abstract

Dementia special care units (D-SCUs) is increasingly becoming the main mode of care for older adults internationally. As little is known about D-SCUs in China, this study aimed to analyze care efficiency and summarize the standards of Chinese D-SCUs.A questionnaire survey and in-depth interviews were conducted between June 2018 and July 2019 in six cities in China. Quantitative data about basic information and care satisfaction were collected from 25 care facilities. Qualitative data about the standards of the D-SCUs were collected fromthree cities that had issued such standards. Data envelopment analysis (DEA) was used to evaluate the care efficiency of D-SCUs, and grounded theory was used to analyze qualitative data.Among the 25 surveyed facilities, 12 had established D-SCUs, of which eight(66.67%) were effective facilities. Thirteen facilities did not establish D-SCUs, of which two(15.38%) were effective facilities.Technical efficiency, pure technical efficiency, and scale efficiency of care facilities with D-SCUs were higher than those of without (P=0.016, P=0.022, and P=0.021, respectively). Standards regarding location, environment, beds, and service items varied among the three cities that had issued standards for D-SCUs.The D-SCU care mode is effective and professional, and can be further promoted in the development of pension industry in China. Further investigation into D-SCUs and related standard is needed.

Keywords: *Dementia, dementia special care unit, care mode, effectiveness, pensionindustry*

I. Introduction

Dementia is a chronic and progressive degenerative central nervous system syndromeof epidemic proportions. Itmanifests as a series of cognitive impairments, difficulties with emotional control, and social behavior problems. Dementia isthe fourth most common cause of death after heart disease, cancer, and stroke [1,2], with one new case diagnosed every three seconds around the world. Fifty million people globally were living with dementia in 2019, and the number will more than triple to 152 million by 2050. The total estimated cost of dementia will reach USD 1 trillion in 2018 and is expected to reach USD 2 trillion by 2030[3].

China has become an aging society in the past 20 years, and the incidenceof dementiais increasing rapidly in the country. Twelve million older adults were estimated to have dementia in China in 2019, accounting for approximately 5% of the older population[4], and ranking first in the world. The number of older Chinese adults with dementia account for 40% of the total number of older adults with dementia in the Asia-Pacific region, and about 20% of the total number of older adults with dementia worldwide[5].Due to the particularity of the syndrome, older adults with dementia experience more care difficulty and pressure than those from the general population. At present, older adults with dementia in China predominantly receives home-based care; however, this care mode not only places families under serious pressure to provide care, but also lacks professionalism[6-8]. As a result, the quality of life of older adults with dementia and their family caregivers is generally low[8]. Care for older adults with dementia has created serious challenges in social development, social security, and long-term care systems.

Institutional care is one of the main ways for older adults with dementia to obtain professional care[9]. The lifestyles of older adults with dementia in these care facilities include isolation (not living with other older adults) and mixed (living with other older adults). Dementia special careunits (D-SCUs)aim to provide supportive social and physical environments for older adults with dementia through specialized structural design, staffing, and activity plans, and is the main mode for realizing isolated living. In the past decade, the number of D-SCUs has steadily increased internationally [10,11]. However, in China, long-term care systems for older people with dementia have not yet been established[7]. Resources such as care facilities, equipment, and professional caregivers are very limited, and only a small number of care facilities are willing or able to accept older adults with dementia. Even fewer institutions have established D-SCUs for their care. At present, a guiding document for the establishment of D-SCUs has not yet been developed at the national level, although some cities have started exploring this mode of care in recent years. Little is known about the care modes of D-SCUs in China, the effectiveness of this approach, or its suitability for the Chinese context.To address this knowledge gap, in the current study we conducted a questionnaire survey on the care effectiveness of D-SCUs for older adults with dementia in China, as well asin-depth interviews to understand the standards of D-SCU care. We compared the care efficiencies of older adults with dementia between care facilities, with and without D-SCUs, using data envelopment analysis (DEA), and we summarized the D-SCUs of different cities. Our findings can make a meaningful scientific contribution to policy-making and industry development.

II.Methods

2.1 Ethical approval

The study was conducted in accordance with the Declaration of Helsinki, and the study was approved by the Research Ethics Committee of College (NBWY-010). Before the investigation, all participants or their guardians signed an informed consent form. Only when participants could not sign due to cognitive impairment would the guardian sign on their behalf.

2.2 Study sample and data collection

2.2.1 Questionnaire survey.

The survey was conducted between June 2018 and July 2019 in four eastern cities (Shanghai, Qingdao, Ningbo, and Changzhou), one central city (Zhengzhou), andone western city (Chengdu) in China; 25 care facilities that accepted older adults with dementia were selected to participate, usingobjective sampling. The questionnaire consisted of four sections: basic information about the care facility, human resource allocation, establishment of D-SCUs, and care satisfaction of older adults with dementia. Thesections on basic information of the care facility, human resources allocation, and establishment of D-SCUs were completedby facility managers. Older adults with dementia responded to the items on care satisfaction; where a participant could not communicate normally due to impaired cognitive function, their guardian responded to the items.Care satisfaction involved six items: living environment, recreational and fitness equipment, dietary conditions, attitude of nursing staff, knowledge and skills of nursing staff, and service items. Satisfaction was indicated over five levels (5 = very satisfying, 4 = satisfying, 3 = neutral, 2 = dissatisfying, and 1 = very dissatisfying), and the satisfaction score of each surveyed older adult was the average score for the six items. All older residents of the 25 care facilitieswho agreed to participate and met the following inclusion criteria were recruited in the care satisfaction survey. The inclusion criteria were as follows: (a) older than 60 years; and (b) met the Diagnostic Criteria for Dementia (4th edition of the American Diagnostic and Statistical Manual of Mental Disorders). A total of 1046 older adults were surveyed for satisfaction scores.

2.2.2 Semi-structured In-depth Interviews

The “Interview Outline for Civil Affairs or Medical Insurance Department Managers” was developed to understand the standards for D-SCUs at a city level. The interview outline involved establishing standards, management, and D-SCU service modes. Three of the six cities – Shanghai, Qingdao, and Chengdu – had formulated standards for D-SCUs at the city level, and the manager of civil affairs or the medical insurance department in each city was interviewed by two researchers simultaneously. Each interview lasted 20 to 40 minutes and the interview data were

recorded.

2.3 Quantitative analysis

In the quantitative analysis, we followed a two-stage process. First, we surveyed each care facility as a decision-making unit (DMU). The efficiency value of each DMU was calculated using DEA. Second, care efficiencies were compared using statistical significance tests between care facilities with and without D-SCUs. A similar approach was employed in previous studies, such as Ozcan et al.[12] and Björkgren et al.[13]. Means and medians were used to indicate central tendencies of basic input and output information and efficiency values. Because a normal distribution of efficiency scores cannot be assumed in DEA mode[12], differences between the two groups were tested using the nonparametric Wilcox test of median efficiency levels. Deep2.1 and SPSS25.0were used for DEA analysis and statistical significance tests, respectively, with a significance level of a=0.05.

2.3.1 DEA Model

DEA is a quantitative analysis method using linear programming to evaluate the relative effectiveness of comparable DMUs based on multiple inputs and outputs; it does not require specification of functional form[13], andcan handle efficiency evaluation under the conditions of multiple inputs and outputs. Ithas become a common analysis tool for enterprise resource allocation[12-15] as it is completely data-driven and can identify production frontiers.Using DEA to analyze the efficiency of care facilities can avoid the problem of subjectively assigning index weights, minimize arbitrariness, and improvescientificdecision-making and objectivity.

DEA mainly includes the C2R and B2C models. The C2R model is mainly used to evaluate the relative effectiveness of the DMU to determine whether a technology and scale are effective at the same time. The final comprehensive efficiency value, or technical efficiency (TE), is θ, which can be affected by resource utilization and allocation. When θ=1, the DMUj technology is valid, indicating that the management model and scale efficiency have reached the best level under current inputs and outputs. When $0<\theta<1$, the DMUj technology is invalid. The larger the θ value, the higher the efficiency of DMUj relative to other DMUs. The BC2 model decomposes the TE of the DMU into pure technical efficiency (PTE) and scale efficiency (SE). PTE refers to production efficiency,affected by management technology and production technology, and SE generally refers to whether a DMU is operating with optimal production size toproduce a defined output.

$$TE= PTE\times SE \quad (1)$$

2.3.2 Inputs and Outputs

In previous DEA studies of nursing homes, researchers tended to choose the number of different types of nursing home staff[14, 16-18], number of beds[13, 16, 19], and value of fixed assets[13] as input variables, and number of residents[16], satisfaction of residents[15], duration of residents' stay[13, 19, 20], and income[15] as output variables. Based on these studies and the common assumption of labor and capital as the basic inputs for a production function [13], in this DEA model, we used building area, number of open beds, and nursing staff as the inputs. Building area and number of open beds were included as proxies for capital, and the number of nursing staff was included as a proxy for labor. In terms of outputs, we believe that service quality can directly affect service effects and the development of facilities. Thus, outputs can be selected from the perspective of residents, and we chose the number of older adults with dementia, along with their care satisfaction, as outputs in this model.

2.4 Qualitative analysis

All interview data were analyzed by the first authorusing the grounded theory approach[21] and Nvivos 10 software. We performed line-by-line coding of the interview records using a three-stage process involving open coding, axial coding, and selective coding, to identify and name concepts and categories and to determine their relationships[22], and to explore the environment, management, and service standards of D-SCUs.

III.Results

3.1 Efficiency evaluation based on questionnaire survey

3.1.1 Basic information oninputs and outputs

Table 1 showsbasic information on the inputs and outputs of the 25 surveyed facilities. The facilities had an average building area of 20,883.35 m2, an average of 504.60 open beds, and an average of 77.76 caregivers. On average, each facility had 83.56 older adults with dementia, and the average satisfaction of older adults was 4.16 points.

3.1.2 DEA results

Among the 25 facilities, 10 were effective (with an efficiency value of 1), accounting for 40% of the total facilities. The minimum TE was 0.147, withanaverage of 0.65; minimum PTE was 0.813, withanaverage of 0.97; and minimum SE was 0.166, with anaverage of 0.66 (Table 2).

Table1 Basic information on inputs and outputs of the 25 DMUs (surveyed facilities)

DMU	Is there a D-SCU	Inputs			Outputs	
		Building area(m^2)	Number of open beds	Number of nursing staff	Number of older adults with dementia	Satisfaction of the older adults with dementia
DMU1	No	79304	459	185	163	3.87
DMU2	No	3800	809	17	26	4.24
DMU3	Yes	3800	450	18	50	4.35
DMU4	No	11200	811	55	15	4.33
DMU5	Yes	10000	296	48	21	4.13
DMU6	Yes	34547	252	79	23	4.17
DMU7	No	24875	600	73	21	3.93
DMU8	No	1200	66	7	7	4.11
DMU9	Yes	40000	1041	600	786	3.97
DMU10	Yes	600	155	5	6	4.33
DMU11	No	25580	245	18	15	4
DMU12	No	16584	982	101	55	4.27
DMU13	Yes	21500	112	42	50	4.33
DMU14	No	38643	158	87	146	4.05
DMU15	No	56339	66	120	14	4.42
DMU16	Yes	6900	20	37	60	4.17
DMU17	Yes	57000	18	64	30	4.21
DMU18	No	10000	600	31	19	4.37
DMU19	Yes	21116	1000	75	63	4.42
DMU20	Yes	31000	315	130	124	4.86
DMU21	Yes	10828	2780	57	205	3.47
DMU22	Yes	600	620	12	16	3.77
DMU23	No	1000	350	19	17	4.04
DMU24	Yes	4500	290	31	65	4.11
DMU25	No	11167	120	33	92	4.04
Mean		20883.35	504.60	77.76	83.56	4.16

Note:DMU: decision-making unit

Table 2 DEA results of the 25 DMUs (surveyed facilities)

DMUs	TE	PTE	SE
DMU1	0.375	0.813	0.46
DMU2	0.601	0.97	0.62
DMU3	1	1	1
DMU4	0.159	0.959	0.166
DMU5	0.263	0.919	0.287
DMU6	0.208	0.898	0.231
DMU7	0.147	0.851	0.173
DMU8	1	1	1
DMU9	1	1	1

DMU10	1	1	1
DMU11	0.463	0.912	0.507
DMU12	0.256	0.927	0.276
DMU13	0.605	0.999	0.605
DMU14	0.798	1	0.798
DMU15	0.325	1	0.325
DMU16	1	1	1
DMU17	1	1	1
DMU18	0.296	0.984	0.301
DMU19	0.306	0.955	0.321
DMU20	0.442	1	0.442
DMU21	1	1	1
DMU22	1	1	1
DMU23	0.96	0.978	0.982
DMU24	1	1	1
DMU25	1	1	1
Mean	0.648	0.967	0.66
Median	0.605	1	0.62

Note: DMU: decision-making unit, TE: technical efficiency, PTE: pure technical efficiency, SE: scale efficiency

3.1.3 Comparison of efficiency of facilities with and without D-SCUs

Among the 25 surveyed facilities, 12 facilities had established D-SCUs, of which eight (66.67%) were effective facilities. Thirteen facilities did not set up D-SCUs, of which two (15.38%) were effective facilities. Comparing the efficiency of facilities with and without D-SCU, the TE, PTE and SE of the care for older adults with dementia were all statistically different ($P<0.05$). The means (medians) of TE for facilities with and without D-SCUs were 0.8013 (1) and 0.5068 (0.3750), respectively (Table 3).

Table 3 Comparison of the care efficiency of facilities with and without D-SCUs for older adults with dementia

Facilities	**Effective facilities**	**TE**	**PTE**	**SE**
	N（%）	**mean (median)**	**mean (median)**	**mean (median)**
With D-SCUs (n=12)	8（66.67%）	0.8013（1）	0.9894（1）	0.8046（1）
Without D-SCUs (n=13)	2（15.38%）	0.5068（0.3750）	0.9455（0.9704）	0.5261（0.4600）
z		-2.417	-2.287	-2.304
P		0.016	0.022	0.021

Note: TE: technical efficiency, PTE: pure technical efficiency, SE: scale efficiency

3.2Standards of D-SCUs

The standards for establishing D-SCUs in Chengdu, Qingdao, and Shanghai were mainly basedon facility style, area, environment, beds, personnel, and service items. All three cities stipulated that agedcarefacilities could set up D-SCUs. Qingdao and Chengdu also stipulated that medical service facilities could set up D-SCUs. All cities had regulations on environmental standards, care personnel standards, and service items for D-SCUs, but the relevant regulations differed widely and were not very detailed. Other regulations pertained to area standards, bed standards, and manager standards for D-SCUs, as shown in Table 4. Shanghai advocated home-style care, and there were clear regulations on the number of beds and caregivers for each D-SCU, while service items involved physical, psychological, and social dimensions.

IV. Discussion

The results of this study indicated that care efficiency in facilities with D-SCUs was higher than those without D-SCUs. Most facilities with D-SCUs arrange the space to accommodate the physical and mental characteristics of older adults with dementia[23-25], which can not only improve care safety and reduce care risk, but can alsoreduce the physical constraints of older adults with dementia, and increase the space available for activities. D-SCUs generally have dedicated professional care personnel [18,24], able to timeously grasp the needs of older adults,

which should reducethe incidence of psychobehavioral symptoms. Furthermore, most D-SCUs provide more service items for older adults with dementia aside from daily life care, such as social interaction activities and non-pharmacological treatment. Such items can not only enhance social integration, but, more importantly, relieve disease progression. All these factors can improve the care efficiency and satisfaction of older adults with dementia. At present, very limited long-term care facilities in China are willing or have the ability to accept older adults with dementia [7], and most facilities that do, still adopt the traditional mixed-residential mode[26, 27]. In view of the limited care resources in China and the poor care quality of older adults with dementia, adopting the isolated residential mode, that is, establishinga D-SCU, can improve care efficiency and satisfaction of older adults, and should be further promoted.

Some Chinese cities, such as Shanghai, Chengdu, and Qingdao,have issued D-SCU standards and norms atthe city level, incorporating the domains of environment, staffing, and services. In other cities, whilerelevant standards or norms have not yet been issued, care facilities have started exploring their developmentto improve services for older adults with dementia. In general, most Chinese cities and care facilities have not yet realized specialized care for older adults with dementia, and have yet to start exploring the D-SCU care mode. Moreover, while some D-SCU standards do exist, they lack conformity and detail. Qingdao has not developed clear regulations for environmental settings and service personnel, for example. Further high-level explorationof D-SCUs in China is urgently needed to improve care efficiency and quality for older adults with dementia.

Table 4 Standards of D-SCUs in Qingdao, Chengdu,and Shanghai

City	**Facility types allowed to open a D-SCU**	**Area standard**	**Environment standard**	**Bed standard**	**Manager standard**	**Care personnel standard**	**Service items**
Qingdao	(1)Nursing care facilities (2)Medical service facilities (3)Aged care facilities	Not specified	Enclosed management	(1)At least 20 beds should be provided in institutions undertaking long-term care services. (2)At least 8 beds should be provided in the care service chain. (3)Institutions that undertake day care and short-term care services, should set up a number of beds corresponding to the scale of service.	Not specified	At least 2 medical staff, social workers or senior nursing staff trained in dementia care should be provided.	(1)Medical care (2)Life care

Chengdu	(1)Medical service facilities (2)Agedcare facilities (3)Care facilities that provide home care services for older adults	Not specified	Quiet, safe, and comfortable, located on first floor or floors with elevator access. Independent and safe outdoor activity area is required.	Not specified	1 full-time manager	1 registered doctor and 1 registered nurse is required, or a predetermined medical institution can provide timely medical care services. The ratio of caregivers to older adults with dementia should be no less than 1:4.	(1)Life care (2)Safety care (3)Non-therapeutic care (4)Function maintenance
Shanghai	(1)Aged care facilities (2)Care facilities that provide home care services for older adults	(1)The usable area of a single room should not be less than $7m^2$. (2)The usable area of a single bed in a multi-person room should not be less than $5m^2$.	"Small unit" mode, with home-style and humanized spatial layout, creating a family-style living environment.	6-18 beds per unit, 1 or more units can be established.	1 full-time or part-time "care planning commissioner" is required.	The ratio of nursing staff to older adults with dementia should be no less than 1:3, and all personnel should be professionally trained.	(1)Daily care (2)Self-care ability training (3)Moral support (4)Social interaction (5) Support services to families in need in the community

Internationally, attention has been paid to D-SCU standards from as early as 2000, and regulations have been developed for environmental design, care personnel, and service items. After decades of exploration, the overall design concept of D-SCUs tends to be small-scale and group-based [28,29], with a group of six to 14 older adults with dementia, no more than 20, usually residing together[30]. Mindful of the preference for small-scale, home-based living, the design of the care environment in some developed countries considers the characteristics of older adults with dementia, including safety features, circular walking paths, nostalgic aesthetics, lighting, and sound design[31,32]. With regard to caregivers, some countries require caregivers to be professionals, and caregiver-to-resident ratios are regulated. For example, some states in the United States require the ratio of caregivers to older adults with dementia is 1:6 during the day, and 1:10 at night[33], while Japan prescribes a ratio of 1:3[34]. With respect to the service items, some countries follow a people-oriented approach, paying attention to training to improve daily life, rehabilitation care, and care of mental behavior symptoms to delay the progression of the disease. In Japan[34], caregivers of D-SCUs encourage older adults with dementia to do housework, cooking, and ablutions on their own. They also pay attention to non-pharmacological interventions, favoring modalities such as music therapy, nostalgia therapy, and behavior therapy, to positive effect.

V. Limitations

This study has some limitations. First, the sample size of facilities included in the study is small, due to the limited number of facilities that accept older adults with dementia. However, the results indicate that care efficiency for older adults with dementia in facilities with D-SCUs was higher than those without D-SCUs. Second, the information obtained about the standards for establishing D-SCUs lacks detail, mainly because the exploration of the D-SCU care mode is still in its infancy in China. While some cities and institutions have established standards for D-SCUs, the standards vary. Future research on the care mode and efficiency of D-SCU and relevant standards should make use of larger samples.

VI.Conclusions

The specialized care mode provided by D-SCUs in care facilities for older adults with dementia is efficient and should be strategically promoted in China. However, guidelines regarding the establishment of Chinese D-SCUs are lacking. Guidelines for environmental design, care personnel, and service items for D-SCUs must be developed at a high level to standardizethe care mode and improve the quality of care for older adults with dementia.

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