ANALYSIS OF THE INFLUENTIAL FACTORS ON LONG-TERM CARE WITH ANALYTIC **HIERARCHY PROCESS**

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Abstract- Our primary objective is to design a framework for long-term care in Taiwan. Herein, we try to investigate what factors are most influencing the elderly's long-term care. The methodology/approach will be using both qualitative and quantitative methods. Then proposes solutions to apply the AHP method to select long-term care plans while circumstances the priority for criteria must be considered and evaluated simultaneously, which are difficult to quantify or turn into costs that may be due to insufficient information or not enough time. Study findings shows that home care has criteria weight = 0.4019 should be selected in Taiwan because it has the highest weight in the three options. The interviewees pointed out that home care is the option chosen by most Taiwanese citizens, and the next option is institutional care. Therefore, according to experts, if you are intending to invest in the field of long-term care service, Institutional care is a very worthwhile investment option.

Keywords: Long-term care, Analytic Hierarchy Process (AHP), elderly

1 INTRODUCTION

As developing countries are dealing with infectious diseases and malnutrition, and at the same time deal with the rapid increase of non-communicable diseases in the context of the health-care system are much lacking in [1]. In developed countries, old age is the cause of disability and chronic illness. Common disabilities include vision loss, hearing loss, and falls. Around 180 million visually impaired people in the world, about 4% of the elderly people are visually impaired, mainly due to cataracts, glaucoma, macular degeneration, and diabetic retinopathy. Elderly people are also susceptible to metabolic disorders and high blood pressure [2]. Other studies also show that factors such as behavioral attitudes, sedentary lifestyles, unreasonable nutrition, smoking habits, and alcohol consumption also contribute to the quality of the elderly's life. Nevertheless, their research also not research on how to solve the above-summarized event. This type of research can be illustrated using group interviews, materials and mathematical methods. Therefore, this work intends to operate a method of evaluating what factors are most influencing long-term care in choosing which option to be most appropriate to solve the above issues.

2 LITERATURE REVIEW

Long-term care (LTC) includes a variety of services designed to serve people's health care needs when they are not able to carry out their daily activities, the service may be during a short time period or long time period to promote independence, maximize the quality of life of the patient [2-3]. The U.S. Department of Health and Human Services highlighted that people with serious health conditions or disabilities will often seek long-term care. In several cases, long-term care needs arise suddenly, such as after a stroke. Therefore, people should consider and plan for long-term care before they need it. Nevertheless, mostly when people get older and frailer or suffer from a serious illness or disability gets worse [4].

LTC can enhance the life quality of the elderly because they feel their preferences are being considered and their needs are finally met [5].A long-term care facility (LTCF) is usually a place for all people with complex health issues because they need a place to reside and be cared for until they die that they cannot be received in a community setting. LTCF provides these people with necessary and appropriate care services[9-10]. Taiwan is among the countries with a rapidly increasing rate of an aging population because the elderly population index is increasing while the number of voung people marrying late and having few children also increases, hence population rate in labor age will decrease sharply, the shortage of labor is clearly shown by the fact that Taiwan takes a lot of young workers from Vietnam, Indonesia, Thailand, Malaysia every year. Studies of integrated medical treatment indicated that a long-term care system is the most comprehensive system to take care of the elderly in the above situation [12-13]. Therefore, ensuring that there are enough long-term care facilities, as well as taking measures to improve the quality of these facilities, become an urgent issue for Taiwan, which has a certain influence on the society of this country [1][6].

Chiu [5] mentioned that Taiwan applied the LTC plan 1.0 in 2008, and then the LTC plan 2.0 was also started in 2017 to combine community-based LTC systems with disability prevention.

Yeh [20] pointed out that the effectiveness of the LTC plan 2.0 was to identify the major cultural stresses, and institutional policy stresses of Taiwan, thereby easily responding to the aging trend of society. Therefore, it leads to the slow growth of home and community services. The real threat to Taiwan's society is the workforce shortages for LTC in the future. The new workforce is quitting LTC for the following five most common reasons: physical burnout, belittled, overtime, poor pay, and excessive work stress [4].The unequal distribution of long-term resources and their psychological and life support is not enough. Services for people with physical and mental disabilities in the community are still limited, leading to problems such as less budget and more restrictions and not many people signing up for the service. To improve the situation, the government provided long-term care for the 10-year 2.0 plan on September 29 [11].

There is a relationship between the caregivers of a Personal Profile and home and community services. In less urbanized, remote, and isolated areas, the elderly or disabled are more likely to be in the care family at home. People in this group also often have a primary caregiver who is the person's spouse or child. People in urban areas who have good incomes are more likely to be in the category of users of home care services provided by long-term care facilities [21].Long-term care services have brought many benefits to society, especially by reducing the hospitalization rate of the elderly, thereby reducing the burden of care on hospitals and the government. Elderly people with chronic illnesses and disabilities often use long-term care services such as inhome care or institutional care depending on their health status. They always expect to receive the best services from long-term care providers. A good long-term care service needs to be timely, safe, cost-effective, and timesaving. Long-term care services also focus not only on supporting basic activities of daily living but also on developing focused care plans, so that the elderly can have both a comfortable environment and at the same time highly cost-effective[7]. Chen [3] examined the age of the caregiver will affect the long-term care services because the age of the caregiver will affect their health, the younger they are, the more healthy they are, and so they can care for more elderly.

2.1 Relationship Between Long-Term Care And Medical Care

Chung [6] provided evidence that medical care services have an important impact on long-term care options of the elderly with the case study about Taiwan residents. Parks and Novielli [15] mentioned that LTC also involves medical care that requires the expertise of practitioners to deal with many chronic conditions related to elderly people. Figure 1 shows medical care services.





2.2 Factors of Long-Term Care

According to the U.S. Department of Health and Human Services, who often needs long-term care? Mostly depend on some factors such as age, gender, marital status, lifestyle and health history, family history [17]. For instance, elderly people usually need more long-term care than younger people, or women frequently need to seek long-term care than men because they mostly live longer [7]. Farah [8] indicated that have ten factors influential to long-term care in Taiwan and three options frequently of Taiwan residents for longterm care include Home Care, Community-Based Care, Institutional Care. However, their research only use data are people living in Taipei and subjects aged 65 or older. they performed Chi-square analysis After for independence, results illustrated that long-term care preferences had significant associations with gender, ethnic origin, educational level, religion, co-residents, primary caregiver, and receipt of medical assistance. In my opinion, this result is reasonable because their study subjects are 65 years old or older, so most of them are non-income people, therefore the income factor is not an important factor. However, if we research to study subjects less than 65 years old, this factor should also be



Figure 2: Conceptual frame work

considered. Furthermore, their research hasn't considered about comparing all the criteria simultaneously. Hence, we can extend their study by design for long-term care a conceptual AHP model to comparing all the criteria simultaneously. We can also extend research by study both people in Taichung and Taipei with aged less than 65 years old.

Teng [19] explored the factors associated with the use of the National 10-year Long-term Care Plan 2.0 in Taiwan. The results indicate that education is in a favorable direction; welfare status and awareness are both in the permissible aspect; The diagnosis of dementia and the identity cardholder of disability are all in the aspect of the needs of those who are cared for, as well as the gender, age and working conditions of caregivers with significant influence to use by the National 10-year long-term care plan 2.0.

Home care services by government-sponsored, including qualified nurses who regularly come to support specific needs, such as medication monitoring, replacement of nasal cannula or Foley tube, direct medical treatment, rehabilitation. Community-Based care is a long-term care service in day and temporary care [18]. Nursing staff provides care to those people who have serious health conditions or disabilities in an environment that provides medical and rehabilitation services throughout the day. Institutional care services are nursing homes services that provide care for seriously ill elderly patients and shelters that provide 24-hour life care for the elderly.

Conceptual Framework of Long-Term Care for Residents is shown in figure 2.

3 RESEARCH METHOD

Methodology/approach: To use both qualitative and quantitative methods. For the qualitative method: a thorough literature review and in-depth interview will help to develop a framework of factors associated withlong-term care for residents. Furthermore, the Quantitative method: base on the framework design the questionnaire to interviewed experts. A group that includes 10 experts related to long-term care in Taiwan will be interviewed, provided judgments to estimate the factors influence long-term care (which long-term care plan is considered to choose). Also, using Analytical Hierarchy Process (AHP) for weights of each factor. The AHP method has many advantages compared to other multi-goal decision-making methods [16]. When use AHP method we also use a questionnaire to interview decision-makers of [17].

4 DATA ANALYSIS

Suppose for the elderly to choose a long-term care plan, there are a number of proposed options that are included in the comparison option. Note that there may be other screening conditions related to health care within certain eligibility ranges. There are many criteria that can be proposed, depending on actual conditions. Without loss of generality, this study only considers 8 criteria as we mentioned in long-term care framework above. We interview a group that includes 10 experts related to long-term care in Taiwan, provided judgments to estimate the factors influence long-term care.

No.	Workplace Titl	e Experience	
First Ro	ounds of interviews		
1	General Hospital	Specialist Nurse	22
2	General Hospital	Deputy Director of Nursina Department	23
3	Hospital	Group leader Nursing	25
4	Academic institutions (Medical or insurance fields)	Department/Internship Associate Professor.	12
5	Academic institutions (Medical or insurance fields)	Associate Dean	22
Second	ounds of interviews		
6	Insurance company (with experience in medical insurance or long-term Insurance)	Insurance Associate Manager	29
7	Insurance company (with experience in medical insurance or long-term Insurance)	General Manager of Wuzi Development	32
8	Insurance company (with experience in medical insurance or long-term Insurance)	Business Director	27
9	Insurance company (with experience in medical insurance or long-term Insurance)	Business Manager	25
10	Insurance company (with experience in medical insurance or long-term Insurance)	Senior Manager	27

Table 1: Decision making background information

No 1								
Criterion	Gender	Ethnic origin	Education level	Income	Region	Co- residents	Primary caregiver	Receipt of Medical Assistance
Gender	1	1	1/3	1/9	1/2	1/6	1/8	1/7
Ethnic origin	1	1	1/3	1/9	1/2	1/6	1/8	1/8
Education level	3	3	1	1/9	2	1/5	1/4	1/7
Income	9	9	9	1	9	9	8	8
Region	2	2	1/2	1/9	1	1	1/2	1/2
Co-residents	6	6	5	1/9	1	1	1/2	1/2
Primary caregiver	8	8	4	1/8	2	2	1	1
Receipt of Medical Assistance	7	8	7	1/8	2	2	1	1
Note C1=0.13	368; CR = 0).0970						
No 2								
Criterion	Gender	Ethnic origin	Education level	Income	Region	Co- residents	Primary caregiver	Receipt of Medical Assistance
Gender	1	1/4	1/4	1/7	1/2	1/8	1/8	1/7
Ethnic origin	4	1	1	1/7	1/3	1/5	1/5	1/9
Education level	4	1	1	1/6	1/3	1/5	1/5	1/6
Income	7	7	6	1	5	2	2	1
Region	2	3	3	1/5	1	1/5	1/5	1/5

Table 2: First round pairwise comparison matrix on the eight long term care factors

Co- residents	8	5	5	1/2	5	1	1	1/5
Primary caregiver	8	5	5	1/2	5	1	1	1/5
Receipt of Medical Assistance	7	9	6	1	5	5	5	1
Note=CI=0.1	149: CR= 0	.0815						

Table 3: 2nd rond pairwise comparsion matrix of the eight long term care factors

No 3								
Criterion	Gender	Ethnic origin	Education level	Income	Region	Co- residents	Primary caregiver	Receipt of Medical Assistance
Gender	1	1/7	1/7	1/7	1/8	1/9	1/5	1/5
Ethnic origin	7	1	1	1/7	1/5	1/7	1/7	1/7
Education level	7	1	1	1/8	1	1/6	1/5	1/7
Income	7	7	8	1	3	1	1	1
Region	8	5	1	1/3	1	1/3	1/3	1/3
Co-residents	9	7	6	1	3	1	1	1
Primary caregiver	5	7	5	1	3	1	1	1
Receipt of Medical Assistance	5	7	7	1	3	1	1	1
Note= $C1=0$.	1374: $CR =$	0.0974						

No 4								
Criterion	Gender	Ethnic origin	Education level	Income	Region	Co- residents	Primary caregiver	ReceiptofMedicalAssistance
Gender	1	1/7	1/9	1/9	7	1/7	1/8	1/7
Ethnic origin	7	1	1/2	1/2	9	1/3	1/4	2
Education level	9	2	1	1/2	7	1/2	1/3	2
Income	9	2	2	1	9	2	1/2	3
Region	1/7	1/9	1/7	1/9	1	1/9	1/9	1/5
Co-residents	7	3	2	1/2	9	1	1/2	3
Primary caregiver	8	4	3	2	9	2	1	7
Receipt of Medical Assistance	7	1/2	1/2	1/3	5	1/3	1/7	1
No 5								
Criterion	Gender	Ethnic origin	Education level	Income	Region	Co- residents	Primary caregiver	Receipt of Medical Assistance
Gender	1	1/2	2	1/3	3	1/4	1/5	1/6
Gender Ethnic origin	1 2	1/2 1	2 3	1/3 1/2	3 4	1/4 1/3	1/5 1/4	1/6 1/5
Gender Ethnic origin Education level	1 2 1/2	1/2 1 1/3	2 3 1	1/3 1/2 1/4	3 4 2	1/4 1/3 1/5	1/5 1/4 1/6	1/6 1/5 1/7
Gender Ethnic origin Education level Income	1 2 1/2 3	1/2 1 1/3 2	2 3 1 4	1/3 1/2 1/4 1	3 4 2 5	1/4 1/3 1/5 1/2	1/5 1/4 1/6 1/3	1/6 1/5 1/7 1/4
Gender Ethnic origin Education level Income Region	1 2 1/2 3 1/3	1/2 1 1/3 2 1/4	2 3 1 4 1/2	1/3 1/2 1/4 1 1/5	3 4 2 5 1	1/4 1/3 1/5 1/2 1/6	1/5 1/4 1/6 1/3 1/7	1/6 1/5 1/7 1/4 1/8
Gender Ethnic origin Education level Income Region Co-residents	1 2 1/2 3 1/3 4	1/2 1 1/3 2 1/4 3	2 3 1 4 1/2 5	1/3 1/2 1/4 1 1/5 2	3 4 2 5 1 6	1/4 1/3 1/5 1/2 1/6 1	1/5 1/4 1/6 1/3 1/7 1/2	1/6 1/5 1/7 1/4 1/8 1/3
Gender Ethnic origin Education level Income Region Co-residents Primary caregiver	1 2 1/2 3 1/3 4 5	1/2 1 1/3 2 1/4 3 4	2 3 1 4 1/2 5 6	1/3 1/2 1/4 1 1/5 2 3	3 4 2 5 1 6 7	1/4 1/3 1/5 1/2 1/6 1 2	1/5 1/4 1/6 1/3 1/7 1/2 1	1/6 1/5 1/7 1/7 1/4 1/8 1/3 1/2
Gender Ethnic origin Education level Income Region Co-residents Primary caregiver Receipt of Medical Assistance	1 2 1/2 3 1/3 4 5 6	1/2 1 1/3 2 1/4 3 4 5	2 3 1 4 1/2 5 6 7	1/3 1/2 1/4 1 1/5 2 3 4	3 4 2 5 1 6 7 8	1/4 1/3 1/5 1/2 1/6 1 2 3	1/5 1/4 1/6 1/3 1/7 1/2 1 2	1/6 1/5 1/7 1/4 1/8 1/3 1/2 1
GenderEthnic originEducationlevelIncomeRegionCo-residentsPrimarycaregiverReceipt ofMedicalAssistanceNote C1=0.041	$ \begin{array}{c} 1 \\ 2 \\ \hline 1/2 \\ \hline 3 \\ 1/3 \\ 4 \\ \hline 5 \\ 6 \\ \hline 7; CR = 0.0 \end{array} $	1/2 1 1/3 2 1/4 3 4 5 0296	2 3 1 4 1/2 5 6 7	1/3 1/2 1/4 1 1/5 2 3 4	3 4 2 5 1 6 7 8	1/4 1/3 1/5 1/2 1/6 1 2 3	1/5 1/4 1/6 1/3 1/7 1/2 1 2	1/6 1/5 1/7 1/4 1/8 1/3 1/2 1

No 6								
Criterion	Gender	Ethnic origin	Education level	Income	Region	Co- residents	Primary caregiver	ReceiptofMedicalAssistance
Gender	1	1/6	2	1/9	3	1/2	1/5	1/5
Ethnic origin	6	1	7	1/9	7	5	2	4
Education level	1/2	1/7	1	1/9	2	1/5	1/6	1/5
Income	9	9	9	1	9	5	3	3
Region	1/3	1/7	1/2	1/9	1	1/5	1/7	1/7
Co-residents	2	1/5	5	1/5	5	1	1/5	1/3
Primary caregiver	5	1/2	6	1/3	7	5	1	2
Receipt of Medical Assistance	5	1/4	5	1/3	7	3	1/2	1
Note C1=0.140	2; CR = 0.0)994						

No 7								
Criterion	Gender	Ethnic origin	Education level	Income	Region	Co- residents	Primary caregiver	ReceiptofMedicalAssistance
Gender	1	1/3	1/5	1/8	1/2	1/6	1/7	1/9
Ethnic origin	3	1	1/2	1/7	2	1/2	1/3	1/9
Education level	5	2	1	1/5	2	1/2	1/2	1/9
Income	8	7	5	1	9	3	2	1/9
Region	2	1/2	1/2	1/9	1	1/5	1/6	1/9
Co-residents	6	2	2	1/3	5	1	1/4	1/9
Primary caregiver	7	3	2	1/2	6	4	1	1/9
Receipt of Medical Assistance	9	9	9	9	9	9	9	1
Note C1=0.1320; CR = 0.0936								

No 8								
Criterion	Gender	Ethnic origin	Education level	Income	Region	Co- residents	Primary caregiver	Receipt of Medical Assistance
Gender	1	1	1	3	3	4	4	1/4
Ethnic origin	1	1	1	1	1/2	1/2	1/2	1/5
Education level	1	1	1	1/3	1	1	1	1/5
Income	1/3	1	3	1	1/2	1/2	1/2	1/5
Region	1/3	2	1	2	1	1/2	1/2	1/3
Co-residents	1/4	2	1	2	2	1	1	1/3
Primary caregiver	1/4	2	1	2	2	1	1	1/3
Receipt of Medical Assistance	4	5	5	5	3	3	3	1
Note C1=0.1312; CR = 0.0930								

Table 4: Weight of the criteria for	r comparing pairwise	of long term care i	n both rounds
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Pairwise comparison Matrix	Criteria weights
Income	0.2515
Receipt of Medical Assistance	0.2290
Primary caregiver	0.1859
Co-residents	0.1299
Ethnic origin	0.0659
Educational level	0.0531
Gender	0.0432
Religion	0.0416

Table 1 shows that first round interview was conducted among the general hospital specialist nurse and deputy director followed by leader nurse, in the academic asspciate professor and dean were involved. Table 2nd round interview was conducted among the insurance company as details are described Table 2 and table 3 indicated several factors affecting such as gender, ethnic origin, education level, income, region, co-resisdents, primary caregiver and receipt of the medical assistance. In the table 2 and 3 test data is colleded in the few round and details mentioned -where Table shows the comparison ratio. Comparison ratio CR < 0.1, which is the standard we can assume that our metrics are reasonably consistent. So, we may continue with the process of decision making using AHP based on the requirement of the elderly person, these criteria weights can be used by the decision-maker for further calculation. From AHP's assessment of eight factors at level 2 in table 4, the elderly people less than 65 believed that income (weight = 0.2515) is relatively important, gender and religion (weight = 0.0432 and weight = 0.0416 respectively) are the least important compared to other factors.



Chart I: Weights of criteria for comparing Pairwise in the first and second round

Figure 3: Weight of criteria of comparing pairwise in the 1st and 2nd round

This study adopted AHP weighting to establish a sequence of the importance of the factors in long-term care. Income is the first factor that most decision-makers in long-term care consider the most significant criterion for evaluation. After reviewing income, decision-makers will look at the "receipt of medical assistance" factor.

We want to note here the chart indicates that income and receipt of medical assistance are more important than other factors. Most experts emphasized that gender and religion are less significant factors in finding a long-care plan. However, if a company or organization provides long-care services that they want

to improve the quality and attract more elderly people to use services, it is also important to establish services that are appropriate for the elderly gender and religion.

Calculating the priority of the options according to each criterion. We set up the corresponding matrices with the size equal to the number of choices. Because there are 8 comparison criteria, it is necessary to calculate 8 matrices. Calculation figures obtained from elderly people's opinions.Summarizing the calculation results in the above steps, we will have the final weights of options when comparing all eight criteria simultaneously.

Table 5: Final	weight of	options for both
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rounds						
The priority mat	rix of options for	Criteria				
all eight	weights					
simultaneously						
Home care	0.4019					
Institutional care	0.3747					
Community-Based	l care	0.2234				

According to the table and the chart above, option 1 (home care) has criteria weight = 0.4019 should be selected in Taiwan condition because it has the highest weight in the three options. The interviewees pointed out that home care is the option chosen by most Taiwanese citizens, and the next option is option 3 (Institutional care). Therefore, according to experts, if you are intending to invest in the field of



Chart II: Final weights of options for the first and second round



long-term care service, Institutional care is a very worthwhile investment option.

5 CONCLUSION

This article shows how to apply the AHP method to the selection of elderly long-term care plans. When the elderly make their long-term care choices without sufficient information, the AHP method is remarkably effective. By comparing pairs of criteria based on how important they are to long-term care, then comparing each pair of options with individual criteria, and combining the above assessments, show that the results of the general comparison are very convincing. The elderly people have concerns with home care most. Most of the experts interviewed said that the long care facilities for the elderly in Taiwan are constantly improving the quality of their services to compete in a fast-changed long-term care environment. According to the government's development policies, the long-term care industry for the elderly can solve the future challenges of the shortage of human resources to care for the elderly, due to the rapidly growing aging population, but the country's birth rate is decreasing day by day.

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