



Quality of Life of the Elderly in Phon Songkhram Sub-District, Non-Sung District, Nakhon Ratchasima Province

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Abstract:- *This study is quantitative research. The objectives of this study were to study social welfare provision to improve the quality of life of the elderly in Phon Songkhram Sub-District, Non-Sung District, Nakhon Ratchasima Province. The samples used in this study were elderly people in Phon Songkhram Sub-district, Non-Sung District, Nakhon Ratchasima Province aged 60 years and over. In 2020, the number of 318 people. The tools used to collect data are characterized by a Questionnaire. The researcher analyzed the data by using a ready-made computer program for processing. The descriptive statistics analyzed were frequency, percentage, mean, and standard deviation. The results of the study were summarized as follows. The overall quality of life of the elderly in Phon Songkhram Sub-District was at a high level. When considering each aspect, it was found that 6 aspects were at a high level, namely, the good mood at a high level, followed by interpersonal relations with a high level of opinion, and social integration at a high level. , The well-being aspect is at a high level, the physical condition is at a high level, and the self-determination aspect is at a high level.*

Keywords: Quality of life, Elderly

Introduction

The global population structure is likely to increase steadily from 6,070.6 million in 2000 to 7,851.4 million in 2025. This is because of the elderly population (age 60 and above), the proportion increased from 10% in 2000 to 15% in 2025. Meanwhile, the population of children (aged 0-14 years) has declined from 30.1% in 2000 to 24.2 percent in 2025. It shows that the population structure is shifting from the past childhood population structure to the aging population or future aging society, and if we look at each region of the world, it is clear that Europe is proportional to the change in population structure into “ The most aging society in the world. That is, the proportion of the elderly population is 21 percent of the total population. Meanwhile, Africa accounts for only 5 percent of the elderly population. The countries with the highest proportion of elderly people in the world are Italy, Japan, Greece, Germany, and Switzerland. These countries have important demographic characteristics such as a relatively low birth rate per thousand population, and a mortality per thousand population as well, but have a relatively high life expectancy. Japan is the only country in Asia with the highest proportion of elderly people in the world (Kongsuwan, D., and Rattanapong, W., 2011).

In Thailand in 1960, the population aged 60 and over was only 1.5 million, or about 5.4% of the total population. But the size of the population from the age of 60 years and above has increased 7 times. Approximately 7.6 million people in 2009, or 11.5 percent of the total population. This situation makes 2009 the year that Thailand has stepped into an aging society completely, meaning that Thailand has an elderly population of more than 10% of the total population. Increasing the size and proportion of the Thai elderly population continues to increase as a result of Thailand's population projection in 2025, the number of elderly people will increase to 14.9 million, or double the elderly population in 2009, and In 2030, there will



be an increase of approximately 17.8 million people or 25 percent (about 1 in 4) of the entire Thai population (Wichawuth, C. et al, 2010, pp. 8-9).

Social welfare provision by the government is considered a mechanism for providing social welfare. At present, government services are focused on public assistance and temporary relief. The state, therefore, does not focus on solving systemic or structural problems. Operational and planning problems are the use of a top-down ordering system. (Top-down), must wait for orders to operate and plan from the center as the main. Lack of participation of people at various levels, causing inadequate welfare provision, giving some importance and partial neglect, guidelines for organizing Welfare is inconsistent with the diverse needs of the people (Wasikasin, W., Wasinarom, S., and Nonpattamadul, K., 2010, p. 24).

The Constitution of the Kingdom of Thailand 2017 stipulates the rights of welfare and welfare for the elderly by stipulating that people, who are over sixty years of age and do not have sufficient income for subsistence, are entitled to welfare benefits of public facilities with dignity, and appropriate assistance from the State and the State must provide assistance and welfare for the elderly; Have a better quality of life and be self-reliant. While the missions, powers, and duties of the local administrative organizations and the missions that have been transferred under the Act Prescribing Plans and Decentralization Procedures to Local Government Organizations 1999, the Tambon Administrative Organization has the powers and duties to assist and promote. Quality of Life Development for the Elderly (Department of Local Administrative Promotion, 2005, p. 1)

Phon Songkhram Sub-District, Non-Sung District, Nakhon Ratchasima Province has social welfare arrangements to improve the quality of life of the elderly such as health check-up services, subsistence payments, recreational activities, and social welfare in various fields. However, such welfare arrangements may not be comprehensive and meet the needs of the elderly. Therefore, for the elderly in Phon Songkhram Sub-district to have a good quality of life and to prepare them for the increasing situation of the elderly, the researcher also studied social welfare arrangements to improve the quality of life of the elderly in the sub-district. Phon Songkhram, Non-Sung District, Nakhon Ratchasima Province to use the results of the study to plan and develop social welfare arrangements for the elderly to have a good quality of life.

Objectives

To study social welfare arrangements to improve the quality of life of the elderly in Phon Songkhram Sub-district, Non-Sung District, Nakhon Ratchasima Province.

Research Conceptual Framework

From the review of related papers and research, the researcher has the following research ideas: The concept of social welfare provision (Khamhom, R., Jongsathitman, J., Vejayachai, A., Sanitwong Na Ayudhya, T., and Chintrakul, P., 1999) consists of six dimensions: health and medical care, revision. Poverty and underprivileged, housing, recreation, life and property safety, and education. The Health Organization's concept of quality of life (WHOQOL Group, 1996; Lalang, P. 2013, p. 10) consists of four dimensions: body, mind, social relationships, and environment. In this study, the researcher studied the social welfare management for the elderly in Phon Songkhram Sub-District, Non-Sung District, Nakhon Ratchasima Province in all 6 dimensions and studied the welfare needs of the elderly in all 4 dimensions as a guideline for organizing. Social welfare to improve the quality of life of the elderly.



Literature Review

1. Concept of quality of life

Quality of life is a metaphorical term that covers a person's state of being physically, emotionally, socially, mentally, and physically, as a way of life or overall well-being of the person. (Kanthasaewee, N.,1988). It is something that every human desiring and is an important matter in life as well as the main goal of population development with the belief that if a person has a good quality of life, development in various fields will be better and faster. (Kompayak, J.,1992). It is sometimes used in the same sense as well-being, happiness, satisfaction in life, health conditions, meaningful life, or life values (Kompayak, J., 1992).

It can be said that the concept of quality-of-life dates back to ancient times, which describes the philosophical, religious, or cultural quality of life as Aristotle believed A good life is a happy life that comes from being well and doing good. In Chinese literary philosophy or medical records, the composition and balance between yin and yang are said to be what gives human beings healthy, happy longevity. In Buddhism, people are taught to do good deeds and live in a middle way for a peaceful life without suffering, worry.

The concept of quality of life is generally divided into two main approaches (WHO, 1985 Nawajinda, A., and Pirothamsiri, K., 1991):

The first approach: Objective well-being is the idea that other people will portray that. What does a person with a socially acceptable quality of life look like? It is the quality of life according to the characteristics that other people assess or assign concerning society, such as setting standards of living (Level of living) or determining that the good quality of Thai people must meet necessities (Jor. m), etc.

Second concept: Subjective well-being is the feeling of a person who describes how, when he perceives well-being, how he feels, what indicates or causes that well-being.

Most were assessed by feelings of satisfaction or dissatisfaction with certain elements of life, life satisfaction, happiness, or overall perception of quality of life (Oleson, 1990).

This concept is popular for assessing the quality of life today. Because it is convenient and fast and believes that the person is the best decision-maker to maintain his well-being. However, to describe the overall picture of well-being or quality of life should be multidimensional, evaluating both the person's existence, being, and satisfaction with that, including life satisfaction. Interest in assessing the quality of life of different groups of people. It began to emerge after World War II during the 1960-the 1970s (Oleson, 1990). The first phase focused on the objective quality of life, such as using income, unemployment, education, or physical fitness as indicators. In 1972, Andrews and White created a tool to assess perceived American well-being in 15 elements is: feeling about living in the United States, feelings about the policies of the central government, local governments, feelings towards economy, community, basic administrative system, education, work, neighbors, friends, living conditions, leisure/activity, relationships with other people, family life and Self (Andrews and Withey,1976) which later in 1978 Flanagan (Oleson, 1990) categorized the quality of life components into five components: (1) Physical well-being and having the necessities of life. (2) Relationship with other people. (3) The presence of social and community activities. (4) Self-improvement and a sense of elation. (5) the presence of recreational activities.

Until now, it was found that the components of quality of life were often unified, covering both objective and subjective aspects such as life satisfaction, self-worth, health condition, socio-economic condition, and family or community relationship (Ferrans and Powers,19921) for the quality of life of Thai people as a whole as well as the country It is clearly defined and measurable that the quality of life of Thai people must meet the basic necessity criteria, which is the lowest necessity that all people should have or should have in their life. A period of time to have a good life and to be able to live happily in society. This indicator of basic needs will be both the end and



tool (means) for all people, genders, and ages to have a good quality of life (Community Development Department, 1991). Although this quality-of-life assessment gives an overview of the quality of life of Thai people across the country. It is a specific, objective assessment that may not match the perceptions or needs of the person being assessed. Because the quality of life is subject to change over time, place and varies with the perception of individuals who have different experiences, ages, environments, social conditions, traditions, or backgrounds. together (Ebersal, 1995; Kompayak, J., 1992), for example. Adolescents may view their quality of life as the triumph of success in which they are freed from the strict rule of parents. Early adulthood may prioritize a successful life through occupation, life satisfaction, interests, or interests. While older adults may view the quality of life as being satisfied with their health status, economic status, social status, social acceptance, or self-worth (Leungamornlert, S., 1994). Therefore, the quality of life of individuals at different ages, places, and situations has different components and assessment methods.

2. Quality of life of the elderly

The term “elderly” was first coined in Thailand at a meeting between senior physicians and seniors from various fields on December 1, 1962 (Janobrom, S., 1991). To convey the meaning in respect, honor, respect, instead of the word "old man" or "old man" for determining who is elderly. There are four criteria for consideration; (1) Actual age that appears It is aging according to human life span. (2) Characteristics of changes in the condition and function of the body such as white hair, long-sightedness, wrinkled skin, etc. (3) Psychological changes intelligence and personality In this manner, a person who is known as an elderly person is characterized by being low-key, fussy, and easily irritable. (4) Changes in social roles, such as quitting work or having reduced social activities (Tantiplachiva, K., and Tantiplachiva, K., 1985; Janobrom, S., 1991)

In general, Thai society considers the elderly to be those who are over 60 years of age without regard for health, ability, or intellectual knowledge. A social role is involved, which is a criterion that international organizations have agreed to be an international standard for determining the onset of age for aging. As a person gets older, degenerative changes increase. , intelligence, memory, knowledge, learning, physical and mental state will change. Decreased ability to perform activities causes changes in roles, social obligations, attitudes, or feelings towards oneself and life different from adolescence/adulthood. As a result, the perception and composition of the image of the elderly's life are different from other ages. Most research reports assessing the quality of life of older adults cover elements of health, economic, social, environmental, life satisfaction, and existing satisfaction (Fillenbaum, 1987 ; Panichacheewakul, P., 1994; Nawajinda). , A., and Piromthamsiri, K., 1991 ; Saengsuwan, J. et al, 2001 ; Somboonprom, C., 1996). A study by Chinanthuya, P. (1993) found that there were 21 components of quality of life in the elderly and 72 indicator variables.

Fillenbaum (1987) compiled dimensions of the well-being of the elderly and found that there should be seven main factors and satisfaction among those factors:

1. Activities of Daily Living-ADL consists of (1) Physical Activities of Daily Living-PADL, i.e. the level of ability to perform activities related to eating, moving the body, dressing, Using the bathroom, toilet, and taking a shower yourself. (2) The Instrumental of Daily Living-I AVL includes the ability to purchase Self-cooking, manage expenses, walk around, and clean the house by yourself.

2. Physical Health consists of an assessment of one's health, current illness, illness with various diseases, use of medical services, activity level.

3. Mental Health) consists of the perception of function, mental illness, and mental function indicators.



4. Social Resource) consists of the size and satisfaction of contacting, interacting, receiving help from friends and family.

5. Economic Resource) consists of the sufficiency of income. the amount of money needed to live in each society and what it takes to live without money

6. Environmental matters) include the safety of the surrounding environment, the organization of the house, etc.

7. Level of strain on caregiver) from family, friends, and community. This concept has been attracted to use as a conceptual framework for studying the quality of life of the elderly in rural Northeastern Thailand, such as the study of Panisa Panichachevakul (1994), Saengsuwan, J. and Faculty (2001), and Somboonprom, C. (1996), etc.

Quality of life of the Thai elderly according to basic needs in urban areas consisted of; (1) Health means the absence of any underlying or chronic diseases, the availability of a hygienic and adequate diet for the body's needs, and access to basic public health services. (2) Environmental aspects include having a durable dwelling, in a hygienic environment free from harmful health disturbances, and having a place to rest/exercise near the community. (3) socio-economic security: having insufficient income for necessary living expenses, average family income, membership in community support groups, life safety, and property, and participation in religious or cultural activities of the community. (4) The aspect of being cared for by the family, community, or other institutions in food, clothing, clothing, and sick care.

However, Miller et al (1986; Janobrom, S., 1991) argued that for the elderly to live a healthy and strong life, there must be a component of (1) Optimism and satisfaction in life. (2) Having love, being ready to give and receive love from others. (3) have faith in what is right. (4) appropriately have self-adherence. (5) Have a sense of humor. (6) have to deal with stress. (7) Empower yourself. (8) Having a relationship with family and community, or it can be said that for the elderly to have a good quality of life, they must be satisfied with life, have a good mental state, self-concept, or self-worth.

Methodology

Scope of content: This study aimed to investigate the quality of life of the elderly by studying the six dimensions of management: the good mood, the interpersonal relationship, the Social integration, the in terms of living conditions, the in good physical. condition, and the self-determination

Scope of Demographics: Data collection from the questionnaire was collected from population groups, namely people in Phon Songkhram Sub-District, Non-Sung District, Nakhon Ratchasima Province, and the sample of elderly people from the age of 60 in Phon Songkhram Sub-District. 2020. The sample group used in this research was 318 elderly people in Phon Songkhram Subdistrict on February 17, 2020, with a total number of 318 people, obtained by selective selection. This research selects the elderly who live in the surrounding communities because the collected data will be analyzed and used as a guideline for improving the quality of life of the elderly in the future.

Scope of time: Research was conducted and data were collected during February 2018. 2020 to March 2020.

Research Tools: The tools used to collect data are Questionnaires which are divided into 3 parts as follows; (1) Part 1 questionnaire on personal characteristics of respondents regarding gender, age, marital status, educational level. (2) Part 2 The questionnaire on the needs of the elderly on factors influencing the development of the elderly's quality of life divided into 6 dimensions: the good mood, the interpersonal relationship, the Social integration,



the in terms of living conditions. , the in good physical condition, the self-determination. (3) Part 3 Recommendations on the needs of the elderly in Phon Songkhram Sub-district.

Data Collection: Data collection for this research was carried out in the following steps; (1) The researcher has contacted and coordinated with the community leaders. local leader Which was given to the village headman of every village in Phon Songkhram Subdistrict, Non-Sung District. (2) 318 revised questionnaires were taken and 318 questionnaires were returned which was distributed to people in the area to ask for cooperation in filling out the questionnaire by explaining the reasons and the need to study to the public when filling out the questionnaire

Data Analysis: Analyze data with ready-made computer programs. by the statistical method as follows: (1) the status of the respondents Use frequency and percentage analysis. (2) Data were analyzed on opinions of elderly people's needs, statistically analyzed by using the Statistical Package for the Social Sciences (SPSS) and statistical percentage (Percentage), mean (\bar{x}), and standard deviation (SD) (Srisa-ard, B.,2010: 120 - 127).

Results

Research on the quality of life of the elderly, Phon Songkhram Sub-district, Non-Sung District, Nakhon Ratchasima Province, details is as follows.

Table 1 An analysis of opinions of elderly people's needs in Phon Songkhram Sub-district, Non-Sung District, Nakhon Ratchasima Province

Needs of the elderly	\bar{x}	S.D	Opinion	Order
1. The good mood	3.72	0.995	High	3
2. The interpersonal relationship	3.76	1.071	High	2
3. The Social integration	3.92	0.990	High	1
4. The terms of living conditions	3.38	1.233	High	6
5. The in good physical condition	3.71	1.153	High	4
6. The self-determination	3.44	1.253	High	5
Total	3.65	1.115	High	

The opinions on the needs of the elderly by summarizing the contents also found that the overall opinion was at a high level ($\bar{x} = 3.65$ and $SD=1.115$) The first is the good mood with a high level of opinion ($\bar{x} = 3.72$, $S.D. = 0.995$) followed by the interpersonal relationship There is a high level of opinion ($\bar{x} = 3.76$, $S.D. = 1.071$) the Social integration has a high level of opinion ($\bar{x} = 3.92$, $S.D. = 0.990$) the in terms of living conditions has a high level of opinion ($\bar{x} = 3.38$, $S.D. = 1.233$) the in good physical condition has a high level of opinion ($\bar{x} = 3.71$, $S.D. = 1.153$) and the self-determination has a high level of opinion ($\bar{x} = 3.44$, $S.D. = 1.253$).

Discussion

From this research, it was found that the quality of life of the elderly was in terms of emotional well-being, interpersonal relationships, social integration, well-being, physical well-being, and self-determination. which can be discussed on a case-by-case basis as follows:

1. The opinions of good mood towards the needs of the elderly were found that the overall good mood had a high level of opinions, the first was easy to get along with others, the opinions were at a high level, followed by being happy with the surroundings with a high level of opinion, Third place is ready to accept life changes. There is a high level of opinion, and fourth was bored at things with moderate opinions.

2. The opinions on the relationship between the people and the needs of the elderly found that the overall social integration had a high level of opinion, First of all, family members are



very attentive and have a high level of opinion, followed by talking with family members normally with a high level of opinion, Third place was also given the importance of discussing matters from family members with a high level of opinion, and the top four family members often left alone with moderate opinions.

3. The opinions on social integration towards the needs of the elderly found that the overall opinion of the well-being condition was at a high level, The first is to regularly participate in community-organized events with a level of opinion coming in, followed by often assisting communities or organizations with a high level of opinion, Third place is accepted by people in the community who live with a high level of opinion, And fourth, there is a group of friends in the community to meet and talk with a high level of opinion.

4. The opinions on the well-being of the elderly found that the overall opinion of the well-being of the elderly was at a high level, First of all, the current expenditure of Sufficient for Living has a high level of opinion, followed by the current need to receive additional occupational training to generate income, opinions are at a moderate level, Third place is currently still in the main occupation, opinion is moderate, And fourth, when sick, will have to pay for medical care by himself. Opinions are moderate.

5. The opinions on good physical condition on the needs of the elderly found that the overall good physical condition was at a high level, The first is a regular health check with a high level of opinion, followed by avoiding alcoholic beverages with a high level of opinion, Third place had a high level of self-esteem in their health satisfaction, And the fourth place has time to exercise, there is a high level of opinion.

6. The opinions of the self-determination towards the needs of the elderly found that the overall opinion of the self-determination was at a high level, The first is to decide to do things by myself. There is a high level of opinion, followed by being able to set things in daily life on their own with a high level of opinion, The third-place always followed what was intended even if others disagreed with a high level of opinion. And fourth, lack of independence in doing the activities that they want to do, there is a high level of opinion.

Recommendation

1. Suggestions from this research: Overall, the elderly consider that they would like to use the research results for relevant agencies to apply the research results to use in policy-making in the guidelines for improving the quality of life of the elderly by establishing a learning center to improve the quality of life of the elderly, including organizing appropriate activities for the development of the elderly

2. Recommendations for further research are as follows: (1) There should be a yearly survey of the opinions of the elderly to use the data to improve the research supporting factors to be effective in conducting research. (2) Should add questions that are relevant to the reality and meet the needs of personnel as much as possible.

References

- Andrews, F. M., & Withey, S. B. (1976). Social indicators of well-being America's perception of life quality. New York Plenum. doi10.1007/978-1-4684-2253-5.
- Chinanthuya, P. (1993) Quality of life of the elderly in the Din Daeng Elderly Social Club. Bangkok: Mahidol University.
- Community Development Department. (1991). A report on the results of a survey on basic information of the target villages 1991, the project to provide farming for the poor people in the degraded forest reserves of the northeastern region. Bangkok: Department of Community Development.



- Department of Local Administrative Promotion. (2005). Guide to the preparation of local development plans (strategic plans development of a three-year development plan and action plan). Bangkok: Department of Local Administration Promotion.
- Ebersole, P., & De Vore, G. (1995). Self-actualization, diversity, and meaning in life. *Journal of Social Behavior & Personality*, 10(1), 37–51.
- Ferrans, C. E., & Powers, M. J. (1992). Psychometric assessment of the quality-of-life index. *Research in Nursing & Health*, 15(1), 29–38.
- Fillenbaum, G. G. (1987). OARS Multidimensional Functional Assessment Questionnaire. In G. L. Maddox (Ed.), *The encyclopedia of aging* (pp. 496-497). New York: Springer.
- Janobrom, S. (1991). *Science of the elderly*. Bangkok : Chulalongkorn University.
- Kanthasaewee, N. (1988) *Quality of life for Thai society*. Documents for the National Seminar on Thai Society at Siam Bayshore Resort Pattaya, during 19-21 April.
- Khamhom, R., Jongsathitman, J., Vejayachai, A., Sanitwong Na Ayudhya, T., and Chintrakul, P., (1999). *Assessment of Social Welfare Service Projects to Improve the Quality of Life for the Elderly in Thailand*. Bangkok: Health Systems Research Institute (HSRI).
- Kompayak, J. (1992). *Practice behaviors to protect themselves from AIDS of professional nurses*. Faculty of Nursing: Mahidol University.
- Kongsuwan, D., and Rattanapong, W. (2011). *Population and world society*. Faculty of Social Sciences Chiang Rai Rajabhat University. [Online] from the source: https://www.baanjomyut.com/global_community/02_2.html (1 October 2017)
- Lalang, P. . (2013). *Logistics system and tourism development in the Gulf of Thailand (Royal Coast):A case study of Chumphon Province and its connected areas*. Bangkok : Government Infrastructure Database on Science and Technology, Ministry of Science and Technology.
- Leungamornlert, S. (1994). *Nursing care of chronic patients: important concepts for caring*. Khon kean: Khon Kaen Printing
- Miller, N. J., Besser, T. & Malshe, A. (2007). Strategic Networking among Small Business in Small US Communities. *International Small Business Journal*, 25(6), pp. 631-665.
- Nawajinda, A., and Piromthamsiri, K. (1991). *Satisfaction: The central variable for improving the quality of life of the elderly*. Research document, Department of Home Economics, Kasetsart University.
- Panichacheewakul, P. (1994) *The development of a tool for measuring the quality of life that is sahamitian for the elderly in rural areas*. Bangkok: Mahidol University.
- Peter, Paul J. and Jerry C. Olsen. (1990). *Consumer Behavior and Marketing Strategy*. 2 nd ed. Homewood : Richard D. Irwin.
- Saengsuwan, J. (2001). *Prevention of Accidents in the Elderly in Jianjit Saengsuwan and Panngam Phanachet"* (Editor), *Handbook of Elderly Care at Home* (pages 82-85). Khon Kaen: Khon Kaen Printing.
- Somboonprom, C. (1996) *Quality of life of the elderly in Phu Thai, So, Yo, Thai and Lao ethnic groups living in rural areas in Sakon Nakhon Province*. Khon Kaen: Khon Kaen University
- Srisa-ard, B. (2010). *Preliminary Research*. 8th edition, Bangkok: Suwiriyan.
- Tantiplachiva, K., and Tantiplachiva, K. (1985). *Health care in the elderly*. Bangkok: Arun printing.
- Wasikasin, W., Wasinarom, S., and Nonpattamadul, K. (2010). *general knowledge about social welfare and social work*. Bangkok : Thammasat University Press,
- WHO. (1985). *Energy and protein requirements: Report of a joint FAO/WHO/UNU expert consultation*. WHO Technical Report Series No. 724. Geneva.



- WHOQOL Group. (1996). What quality of life? The WHOQOL Group. World Health Organization Quality of Life Assessment. *World Health Forum*. 17(4):354-6.
- Wichawuth, C. et al. (2010). Review and assistance of Thai elderly knowledge 2002-2007. Bangkok: Foundation of Thai Gerontology Research and Development Institute.