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A Model for Designing a Long-term Care Program

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1. Introduction

   Japan is a “super-aging society.” Currently, more than 20% of its total population is above 65 years of age [1]. In response to the increasing social need for appropriate Elderly Care (long-term care) services, the “long-term care insurance system” was instituted in April 2000. Under this insurance system, care for the elderly is provided on the basis of a “long-term care program” designed by “care managers.” More than 14% of the elderly above 65 years of age were using this insurance system in 2002 [2]. It can be said, therefore, that care for the elderly is a national concern.

   However, a specific and defined methodology for designing a long-term care program has not been established yet. As a result, the quality of long-term care programs, and therefore the quality of Elderly Care has been dependent upon the particular experience or attitude of a care manager. It is necessary to establish appropriate processes to design a long-term care program according to the condition of an elderly person.

2. Previous Study

2.1 Process Model for Determining Elderly Care on ADL

   With respect to the background provided above, Kato et al. [3] proposed a “process model for determining Elderly Care on ADL (Activity for Daily Living [4]) items.” This process helps care managers help to determine the concrete content of care suited to the ability of an elderly person to perform each ADL item. In addition, Kato et al. [5] developed knowledge contents for ADL items required for the process model for determining Elderly Care. Using this model and the knowledge contents, we can determine the concrete content of care suited to the ability of an elderly person’s to perform each ADL item.

2.2 Issues Posed by Previous Studies

   Some issues were posed by previous studies. In this paper, we have focused on the following two issues.

   First, the model cannot be adapted to suit individual environmental needs because only the most basic environmental conditions have been included in the model.

   Second, it is difficult to determine which care services should be included in the care plans on the basis of the output of the model because care services are not associated with individual care options.

3. Purpose of this Study

   In this study, we present a model for designing a long-term care program. We interpret the “design of a long-term care program” as the “design of practicable measures that can satisfy the needs of an elderly person,” and we have designed an appropriate model accordingly. We have resolved the two issues posed by the previous studies and endeavored to visualize and build structured thinking processes for care managers.

   This study limits its scope to long-term care in terms of ADL items because an ADL is the most fundamental part of a person’s life.

   Chapter 4 of this article describes the core concept that forms the foundation for the design of the model, and Chapter 5 presents the designed model. Chapter 6 reports the initial validation of the proposed model.

4. Core Concepts

4.1 Basic Structure of the Designing Process for a Long-term Care Program
This study defines the process of designing a long-term care program as “a process that can be used to design practicable measures to satisfy the Care Needs of an elderly person” (Figure 1). This process consists of five phases as shown in Figure 1.

Phase 1: Assess the “Actual Condition” of an Elderly Person
Phase 2: Set a “Mode of Life” for the Elderly Person
Phase 3: Identify Care Needs (identify the needs of Elderly Care on the basis of the gap between the Actual Condition and the Mode of Life set)
Phase 4: Determine Elderly Care (determine Elderly Care as a measure to satisfy Care Needs)
Phase 5: Design a Long-term Care Program (design a program of long-term care as required)

4.2 Phase 1: Assess the Actual Condition of an Elderly Person
In Phase 1, we assess the Actual Condition of an elderly person.
An “Ability Element” is defined as a scale used to assess a person’s condition. The Actual Condition of a patient can be quantitatively expressed as a score for each Ability Element, which is referred to as “Actual Ability.” If the person uses any wearable supporting devices, we need to assess the ability of the person separately for cases where devices were worn and those where they were not worn.

4.3 Phase 2: Set a Mode of Life for the Elderly Person
In Phase 2, we assume an example Mode of Life, which a person may want to realize. It is necessary to consider the functional design and condition of the concerned post-discharge residence, as well as the available human and physical resources, among other aspects.
We assume an example Mode of Life by determining how the person realizes each ADL item. In general, there are multiple ways to achieve each ADL item. To express the variety of means for the achievement of an ADL item, the ADL needs to be divided into more basic “Element Actions.” Then, each ADL is expressed as a “Realization Pattern,” which is a combination of multiple Element Actions, based on which environmental conditions are determined. In this way, a Mode of Life for the elderly person can be established precisely.

4.4 Phase 3: Identify Care Needs
In Phase 3, we identify an elderly person’s needs for long-term care.
The ability required for of a patient to perform an ADL in the manner expressed in the Mode of Life is referred to as “Required Ability.” For each Element Action, which is included in the Realization Pattern set in Phase 2 for each ADL item, ability gaps are identified by comparing the Actual Ability assessed in Phase 1 with the Required Ability determined by the Element Action. These gaps represent Care Needs.
4.5 Phase 4: Determine Elderly Care
In Phase 4, we determine a feasible method to satisfy an elderly person’s Care Needs. These methods are classified into two types. One method is “Decreasing Required Ability,” which can be achieved by improving the environmental conditions, using supporting devices, and providing assistance. The other method is “Improving Actual Ability,” which can be achieved by rehabilitation training, or by the use of wearable supporting devices (e.g., eyeglasses, acoustic aids).

Practicable measures are selected from multiple Elderly Care options capable of fulfilling the ability gaps with respect to each Element Action for which Care Needs are identified. For each Ability Element, practicable Elderly Care items are determined by comparing the Actual Ability assessed in Phase 1 and with the Ability Required for Care.

Finally, we evaluate the feasibility of each method.

4.6 Phase 5: Design a Long-term Care Program
In Phase 5, based on the Elderly Care items determined in Phase 4, we design a long-term care program for the elderly person.

The long-term care program is designed by determining the frequency and timeline for the implementation of Elderly Care and the person (family or service provider) in charge. In the design of the program, some kind of coordination process should be introduced if there are multiple Elderly Care items that become redundant in terms of their output.

5. Logical Model and Implementation System for Designing Long-term Care Programs

5.1 Structure of the Logical Model and Implementation System
We propose a logical model in this chapter, on the basis of the core concepts explained in Chapter 4, that can be used to design a long-term care program for an elderly person. Figure 2 illustrates the logical model and the implementation system.

The logical model as a whole defines a methodology for designing a long-term care program. The model is composed of three layers that have four hierarchical components, namely, “Framework,” “Method,” “Knowledge Structure,” and “Knowledge Content.”

The implementation system designed on the basis of the logical model has two components: 1) “Procedure,” which is optimized on the basis of the Framework, Method, and Knowledge Structure, and 2) the “Knowledge Base,” which is specifically established on the basis of the Knowledge Structure. This system supports the implementation of the methodology specified by the logical model.

![Figure 2: Structure of the Logical Model and Implementation System](image)

5.2 Framework
Figure 3 shows the established Framework. A Framework is defined as “the design of a long-term care program,” and it shows all the elements that need to be considered as well as the relationships between them.
As shown in Figure 3, the Framework illustrates the elements of the core concept described in Chapter 4 as well as their relationships.

5.3 Method and Knowledge Structure

Table 1 and Figure 4 show the Method (partial) and the Knowledge Structure, respectively. The Method computes the various functions (information conversion) that can be used to find a final solution, while the Knowledge Structure indicates the structure of knowledge used to implement the Method.

In the Method, there are five phases composed of 11 functions. To implement the Method, it is essential to use the Knowledge Structure shown in Figure 4. The Knowledge Contents developed on the basis of this Knowledge Structure will be converted into six Knowledge Bases of the implementation system, namely, the Assessment Sheet, the Home/Facility Information Sheet, the Actual Ability Calculation Formula, the Realization Pattern List, the Table of Required Ability for Element Action, and the Table of Required Ability for Care.

![Figure 3: Framework](image)

### Table 1: Method

<table>
<thead>
<tr>
<th>Function</th>
<th>Outline of Function</th>
<th>Required Structured Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1 Evaluate Person’s Condition</td>
<td>Evaluate person’s condition</td>
<td>Assessment Sheet</td>
</tr>
<tr>
<td>1-2 Determine Actual Ability</td>
<td>Determine Actual Ability on the basis of the results of 1-1</td>
<td>Actual Ability Calculation Formula</td>
</tr>
<tr>
<td>2-1 Evaluate Home/Facility Environment</td>
<td>Evaluate home/facility environment, where the person will live</td>
<td>Table of Home/Facility Information</td>
</tr>
<tr>
<td>2-2 Reflect Home/Facility Environment</td>
<td>limit selectable Mode of Life on the basis of the results of 2-1</td>
<td>Table of Limitation to Mode of Life (included in Table of Home/Facility Information)</td>
</tr>
<tr>
<td>2-3 Set Mode of Life</td>
<td>Set (Multiple) Modes of Life for the person on the basis of the results of 2-2</td>
<td>List of Realization Pattern</td>
</tr>
<tr>
<td>3-1 Identify Care Needs</td>
<td>Identify person’s care needs as gaps between Required Ability for (Multiple) Modes of Life set in 2-3 and Actual Ability determined in 1-2</td>
<td>Table of Required Ability for Element Action</td>
</tr>
<tr>
<td>4-1 Evaluate Elderly Care Options</td>
<td>Evaluate practicability of elderly care options to meet the person’s care needs identified in 3-1</td>
<td>Table of Required Ability for Elderly Care</td>
</tr>
<tr>
<td>4-2 Determine Elderly Care</td>
<td>Select elderly care from the elderly care options found practicable in 4-1</td>
<td>Elderly Care Services Table (incorporated into Elderly Care List)</td>
</tr>
<tr>
<td>4-3 Determine Elderly Care Services</td>
<td>Determine elderly care services to implement elderly care selected in 4-2</td>
<td>Elderly Care Services Table (incorporated into Elderly Care List)</td>
</tr>
<tr>
<td>5-1 Determine Mode of Life</td>
<td>Determine Mode of Life from (Multiple) Mode of Life options set in 2-3</td>
<td>Elderly Care Services Table (incorporated into Elderly Care List)</td>
</tr>
<tr>
<td>5-2 Design Long-term Care Program</td>
<td>Determine person in charge and specific timeline of the elderly care based on the results of 5-1</td>
<td>(Design Item (PIC, Timeline etc.))</td>
</tr>
</tbody>
</table>
5.4 Knowledge Contents

Knowledge Contents are specific contents developed using the Knowledge Structure. In this study, we developed Knowledge Contents in collaboration with care managers, doctors, nurses, and social workers in
the Ohme Area. For example, the developed “Table of Required Ability for Element Actions” contains 125 element actions and an organized Required Ability list created using 32 Ability Elements.

In the development process, we applied the Knowledge Contents for twelve actual cases that were being handled by the concerned professionals, and modified them by comparing the output of the model to the actual situations in those cases.

By using this process of development, we could compile the Knowledge Contents accurately.

5.5 Implementation System

Figure 5 shows the Procedure and Knowledgebase in the implementation system and a flowchart describing the implementation of the methodology specified by the logical model. In this study, we developed a specific application for the implementation system using Excel and VBA. The methodology specified by the logical model can be executed on this application.

6. Application of the Logical Model

6.1 Method of Logical Model Application

In an attempt to perform initial validation of the proposed logical model, one of the authors (Kato) held a workshop together with five care managers (two newly recruited care managers, two experienced care managers, and one advising care manager). In this workshop, Kato and the therapists developed a long-term care program for two actual cases. The actual cases were in the charge of the advising care manager. The other care managers and Kato had no prior knowledge about these cases.

Kato and the four care managers were divided into three groups, namely, Groups A, B, and C. A newly recruited therapist and an experienced care manager were included in both Groups A and B. Kato was the only member of Group C. Group A did not use the logical model and carried out all the steps manually, while Group B used a format that reflected the three components of the logical model, namely, the Framework, the Method, and the Knowledge Structure. In other words, the format used by the care managers of Group B did not reflect the use of the Knowledge Contents. Group C used the entire implementation system containing every component of the logical model. Every participant, out of the five participants, independently designed a long-term care program for each of the two cases.

The logical model was evaluated for three evaluation indicators; completeness, definiteness and accuracy, through discussions among all the participants of the workshop by comparing the outputs of the three groups with the actual situation of the cases provided by the advising care manager.

6.2 Results of the Logical Model Application

As the results of evaluation for three evaluation indicators, the overall outputs of Group C were the best, followed by the outputs of Group B and then Group A, in that order. The outputs of Group B, which used the format representing the Framework, the Method, and the Knowledge Structure, were found to be better than those of Group A, which did not use the logical model at all. Further, the outputs of Group C, which used the entire implementation system, were better than the outputs of Group B.

When examining some parts of the outputs, however, the ranking order mentioned above, namely, Group C, Group B, and Group A, was not necessarily valid. A comparison between Group A and Group B revealed that some outputs of Group A were better than the corresponding outputs of Group B. The overall outputs of Group C were of a higher quality because Group C used the Knowledge Base built using the implementation system. Group C, however, failed to present some outputs which Groups A and B were able to produce.

When the newly recruited care manager and the experienced care manager from the same group were compared to each other, some outputs of the newly recruited care manager were found to be better than the corresponding outputs of the experienced care manager.

7. Discussions and Future Plans

7.1 Initial Validation of the Logical Model

The overall results of the workshop described in Chapter 6, i.e., Group A < Group B < Group C, suggest that the logical model is valid.
The care managers of Group B were able to effectively utilize their experience and expertise because they used the format reflecting the Framework, the Method, and the Knowledge Structure defined in the logical model. As a result, Group B was able to generate higher quality outputs compared to Group A. With regard to the areas in which Group A performed better than Group B, it is concluded that the experience and expertise of the therapists from Group A in those areas was superior to that of the therapists from Group B.

The outputs of Group C were of a higher quality because they used the Knowledge Base built using the implementation system. However, Group C failed to present some outputs that Groups A and B were able to produce. The Knowledge Contents used in this workshop were developed with the help of a limited number of professionals. The quality of the Knowledge Contents needs to be improved for future studies.

7.2 Significance of the Logical model

This study regards the design of a long-term care program as “the design of practicable measures to satisfy an elderly person’s needs,” and has developed a model for the design process. The core concept and elements in the Framework of this model are designed specifically for long-term care programs. By being generalized to some extent, however, this model can serve as a basis for a common model that can be used to “design practicable measures to satisfy some needs that are expressed as gaps between actual conditions and assumed conditions.” We plan to attempt the application of this model to various issues and the optimization of the model such that it can handle each individual issue.

7.3 Future Issues

We will need further consideration about the acknowledgment ability elements. Study on these abilities, i.e., individualized functions, is also under research in this specialized field. In the future, we will endeavor to develop proper indicators (ability elements) and identify the relationships between acknowledgment ability elements and element actions. Once this issue is solved, we believe that it will be possible to precisely estimate the required time for providing elderly care to a target client and to conduct a benchmark test for the current long-term care insurance system.

In this study, we developed the Knowledgebase by structuring the technical knowledge obtained from a specific group of medical/welfare professionals. Therefore, it is possible that the knowledge base could take a different view had another group of medical/welfare professionals had been consulted. In addition, a portion of the knowledge base could depend upon culture and group values.

In the future, we will need to consider these issues in other groups of medical/welfare professionals and make further verifications to develop a standard Knowledgebase.

7.4 Integration the Proposed Model into PCAPS-IMT

To ensure quality healthcare, Iizuka et al. [6] proposed a system known as the PCAPS-IMT (patient condition adaptive path system). The distinguishing feature of this system is that it adapts to the individual patient’s particular conditions. PCAPS-IMT consists of two tools: The clinical process chart encompasses the overall flow of clinical judgments and treatments that can be considered for a type of disease, consisting of clinical unit processes, and the unit sheet specifies a set of treatments, tests, observations, and other clinical treatments to be conducted in a unit clinical process to manage the total activities by the clinical team.

To obtain a satisfactory performance with this system, it is necessary to correctly understand the patient’s specific conditions. Therefore, we consider that it is possible to integrate the process model for determining elderly care into the PCAPS-IMT as an evaluation model for patient scenarios. We especially consider it to be applicable during periods of convalescence, where the degree of dependence upon nursing is critical. Accordingly, we will consider applying our model in such situations.

8. Conclusion

In this study, we have developed a logical model composed of a Framework, a Method, a Knowledge Structure, and Knowledge Content that can be used to design an appropriate long-term care program. On the basis of the logical model, we also established the implementation system using Excel and VBA. By using the proposed logical model and implementation system, it is possible to efficiently and effectively design a long-term care program suited to the Mode of Life set for an elderly person.
To promote sustainable growth in society, it is essential to meet the social needs associated with the long-term care of the elderly. This study is expected to contribute considerably in the efforts to ensure long-term care for the elderly and the improvement of the quality of such care.

Acknowledgements
This study was supported by a grant from Japan Ministry of Education, Culture, Sports, Science and Technology (Shogo Kato, No. 21710146).
This study was supported by care managers, doctors, nurses and social workers in Ohme Area. Special thanks are extended to them for their great contribution to this study.

References