System Dynamics Modeling for Long Term Care Policy

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Abstract

Rising long-term care cost due to increase in senior population is a serious issue that concerns many public policy makers in the U.S. Many states and local governments have come up with different policies in order to tackle the problem, and one of the policies that recently gained much support is a single point of entry system. The single point of entry is a place where people in need of long term care visit, have their needs assessed, and obtain information about different long term care service options. The supporters argue that by implementing the point of entry system, it is possible to reduce the total long term care cost by directing many potential institutional care recipients to better-fitted home and community based care.

This paper is about a system dynamics model built for a government agency that is about to propose the policy to key decision makers. The modeling process and insights gained from the model will be discussed in this paper.

Key words

Healthcare, senior, consulting, public policy, simulation

Introduction

The U.S. senior population is expected to rise sharply over the next decades, and the rising long term care cost is a serious issue that concerns many public policy makers. State and local governments come up with different policies in order to tackle the problem, and one of the policies that gained much support recently is "single point of entry (SPOE)" system.

The single point of entry is a place where people who require long term care visit, have their needs assessed, and obtain information about service options that are appropriate and available for them. The policy assumes that many people who need long term care do not have much information about variety of services they can get, especially about home and community based care. Many people who will actually be better off by receiving home and community based care enter institutional care facilities such as nursing homes, because institutional care is more widely known. The supporters of the policy argue that by implementing the single point of entry policy, it is possible to reduce long term care cost by directing many potential institutional care recipients to better-fitted home and community based care.

This paper is about a system dynamics model built for a state agency that is about to propose the policy to key decision makers. The state agency requested a group of system

dynamics modelers to build a model that enables them to advocate the single point of entry policy to other policy makers. The modeling involved frequent interaction between the client agency and the modelers, and this paper will discuss the details of model development process and the insights gained from the modeling process. The greatest huddle in the project was the difference in the model purpose defined by the clients and the modelers. The difference led the modelers to consider modeler's role in a consulting setting when clients are working in a highly complex and political decision making environment. This client-modeler difference will also be discussed in this paper.

Problem Definition

State of Goodwill Office for Gerontology (SGOG)[1] is a state government agency that plans and coordinates services related to long-term care. Its' mission is to create an environment that results in healthier senior citizens by designing and implementing efficient and high quality long term care system.

The U.S. Bureau of the Census (Day, 1996) estimates the percentage of the population aged 65 and older will increase from 12 percent in year 2000, to 20 percent by year 2030. In addition, the percentage of the most needy groups, those aged 85 and older, will increase from 1.6 percent of the population in 2000, to 2.4 percent in 2030. Center for Medicare and Medicaid Services (2000) projects the national health expenditures will increase from $1,424 billion in 2001 to $2,640 billion by 2010, and their share of Gross Domestic Product (GDP) will increase from 14 percent in 2001 to 16.8 percent in 2010. The data also shows that public share of the health care expenditures, such as Medicare and Medicaid, has been rising over the past decades and expected to rise in the future. In 2002, 43 percent of the total health care expenditures are covered by public funds. Like other states in the U.S., State of Goodwill has been experiencing rising demand for long-term care services that are expected to overwhelm the financial capacity of the current system.

One source of the major inefficiency in the current long-term care system is multiple and fragmented points of entry into the system. The system is complex, and people often make their decisions based on limited information about what types of long-term care are available for them. The following citations from internal literature provided by SGOG suggest a typical long-term care entry case.

> *"What long term care services you receive largely depends on the door you enter first. If you have a friend in a nursing home, it becomes your nursing home. You happen to live near a nursing home and that becomes the service you get, because you don't have any other information source."*

> *"The provision of long term care has evolved over the years in response to available funding stream, consequently its design and operation has been driven by the requirements of the funding streams, not by the needs of the consumer requiring long term care services."*

SGOG believes that the current system creates inappropriateness in the service, which means that there is a disparity between the services people require and the services people receive. More specifically, they believe that many people currently in institutional care facilities

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[1] For the discussions in this paper, a fictional name is used to protect confidentiality of the client.

such as nursing homes and hospitals are not in the level of impairment that require such intensive care. SGOG believes those less impaired institutional care clients would be better off by receiving home and community based care, because it better suits their needs and it gives them independence. Why, then, do these individuals purchase the expensive services provided by institutions when they do not require such care? SGOG posits four potential reasons.

First, people do not have sufficient knowledge about the array of long-term care services available to them. SGOG argues that individuals often do not seek the preferred type of care because they do not know such services exist. This is particularly true for home and community based programs. Unlike institutional care facilities that actively market their services, the dissemination of information for home and community based care is limited. When people become impaired and require long-term care, they often think first of nursing homes. Without sufficient information about home and community based care, institutional care becomes the point of entry for many individuals regardless of the level of assistance they require.

Second, some consumers obtain an assessment of their health needs before they receive long-term care services. However, the assessors often have interests in institutional facilities and the results of the assessments can be highly biased. Such assessments exaggerate an individual's need in order to attract more people to their facilities.

Third, the costs of long-term care can be easily shifted to the public. "Spending-down" to Medicaid is an increasing concern as individuals often waste large amounts of money for services they do not need. Consumers of institutional care often face large out-of-pocket expenses, and once the institutional care recipients can no longer afford the service, Medicaid and other public funding sources assume responsibility of the cost. Therefore, the high costs of institutional care do not deter individuals from seeking institutional care. Unfortunately, publicly funded insurance programs, such as Medicaid, cover only a few community-based services; though the costs for home and community based care dwarf those of institutional care, many people do not perceive an incentive to seek home and community based care.

Finally, many seniors depend on their family or friends for the care they need rather than seeking a formal type of long-term care services. However, burn out of the family or friend caregiver leads to the seniors' entry into institutional care facilities. Home and community based care can alleviate their burn out, but because the caregivers lack information about home and community based services, institutional care becomes their alternative.

Single Point of Entry Policy

In order to overcome the current inefficiency of the long-term care system, SGOG proposed the Single Point of Entry (SPOE) policy. The SPOE is a place where people enter once they become in need of long-term care. According to SGOG, the SPOE would offer a host of 'consumer specific functions and interventions' to provide the consumer with a 'complete and unbiased explanation of all available options for care in their community.' The SPOE would assist individuals in the selection of long term care by matching the consumer's needs and preferences with the most appropriate and cost effective services that are provided in the least restrictive settings.

The two main goal of SPOE would be to enhance appropriateness of long term care services and to reduce cost of long term care by directing some potential institutional care clients towards better fitted home and community based care.

Policy and System Dynamics Model

SGOG wanted a system dynamics model to examine the implications of the SPOE program in different counties in State of Goodwill. For six months, the authors had bi-weekly meetings with the client agency. The initial meetings were devoted to defining the problem and explaining the various programs, agencies and interests within the long-term care system.

The model was the outcome of a group modeling process (Richardson and Andersen, 1995). The modeler team consisted of one *facilitator*, two *modelers/reflectors*, and one *process coach*. Usually one of the modelers served as a *recorder*. From the client team, there was a *gatekeeper* who advocated the modeling process to the client group and identified key stakeholders for the modelers (Andersen and Richardson, 1997).

SGOG introduced problems they perceived within current system; dialogue between the modelers and the client group ensured a mutual understanding of the problems and the proposed policy. The following meetings were devoted to presentation of system dynamics model developed from the previous discussion. With feedback from the client group, the modelers updated and modified the model(s) for subsequent meetings. This feedback-update process continued until the model structure met the expectations of the client.

The primary purpose of the system dynamics model was to create a policy-supporting tool in a highly political arena. The client group had a strong commitment to the proposed policy, and they were highly aware of the fact that the SPOE policy may get derailed by the opposition from interest groups or other political actors. SGOG was in a position to convince political leaders of the benefits of the SPOE policy, and win a policy war against the competitive stakeholders within the long-term care market who are often sensitive to new programs and legislations. The modelers, however, saw more value of the system dynamics model in policy analysis tool. The modelers tried to use the model to expand the client perspectives by highlighting unintended consequences and underlying assumptions of the policy.

Underlying Assumptions of SPOE Policy

During the problem definition and the modeling process, the modelers pointed out some of the underlying assumptions held by the client group.

First, the policy assumes that people inappropriately getting institutional care outnumber people inappropriately *not* getting institutional care. However, there was no data to support the inappropriateness in the system. Without data on people's actual long term care need and the services they receive, it could be possible that the SPOE end up with higher institutional care demand than in the current system, if people in the current system have not been getting the needed institutional care due to various reasons including financial factor.

Second, the policy assumes that the SPOE has minor or no affect on the cost structure within service facilities. If the SPOE leads institutions to receive clients with higher level of impairment than in the current system, it is possible that the per capita cost incurred by institutional care may rise. Combined with failure of meeting the first assumption, this can lead SPOE to generate higher health care cost than in the current system. It is also possible to imagine that the SPOE delays people's entry into institutional care until their impairment is aggravated to critical level, which could have been prevented by early institutionalization, leading to costlier service.

Third, the policy assumes that people's satisfaction is decreased when they are over-cared. Would people prefer home and community care to institutional care if the former better fits to their need? What if there are other attraction factors in institutional care?

Forth, the policy assumes that people will voluntarily enter the SPOE once it is implemented. People may appreciate the SPOE as a useful information resource as SGOG hopes for, but it may also be possible that people regard the SPOE as another layer of bureaucracy.

Finally, the policy assumes that there is enough caregiver capacity in the long-term care system to fulfill any demand changes generated by the SPOE policy. The SPOE policy is likely to increase demand for home and community based care, but if there is no caregiver capacity to meet the demand, the policy will not produce much benefit.

While the modelers constantly brought the clients' attention back to above issues, the clients wanted to proceed with the modeling given the assumptions were true. The clients' position was understandable, because any investment required to create the assumed environment would be made only after the SPOE policy gain political support.

Modeling Process

1. Definition of Key Terms

The key terminologies are defined in the early stage of the modeling in order to facilitate the communication as follows:

Institutional Care (IC): Comprised mainly of skilled nursing facilities, IC facilities provide 24-hour care for those with severe long-term health problems. As a result, institutional care is provided to the consumer at great expense. The institutional setting of skilled nursing facilities tend to limit patients' ability to live independently and are considered a last resort for long term care.

Home and Community Based Care (HCBC): The home and community based care sector aggregates the largest number of services. HCBC includes those who receive paid medical and personal care services of any kind, including local volunteer support. Programs such as meals on wheels to private duty nurses are considered HCBC. With IC, HCBC constitute the formal long-term care, which is paid by either public or private funds.

Family Care (FC): It is estimated that informal family care provides roughly 80 percent of all long-term care services. An individual may receive family care in one of two ways. First, the caregiver may "check-up" on an individual in need yet who maintains independent residence. Second, the needy individual may cohabitate with the caregiver. For this model, individuals in family care receive no paid services or organized volunteer aid of any kind, and caregiving is solely provided by family or friends.

People Waiting for IC/HCBC: Unlike FC, people must wait for a certain length of time before they receive IC or HCBC. Two factors create the waiting line. First, unlike FC, IC and HCBC requires administrative processes that delay people's entrance into the service. Second, the service provided in IC and HCBC is restricted by the capacity. People can only enter IC or HCBC when there is a spot available and if not, people continue to wait until there is a vacancy.

2. Conceptual Model

After the first few meetings with the client group, the modelers built a conceptual map of the long-term care system. (See Figure 1.) The main issues described in the diagram are:

- Population dynamics
- Caregiving capacity
- Finance
- Appropriateness of service
- Health status

- Quality of long-term care
- Migration effect, etc.

Figure 1. Conceptual Model
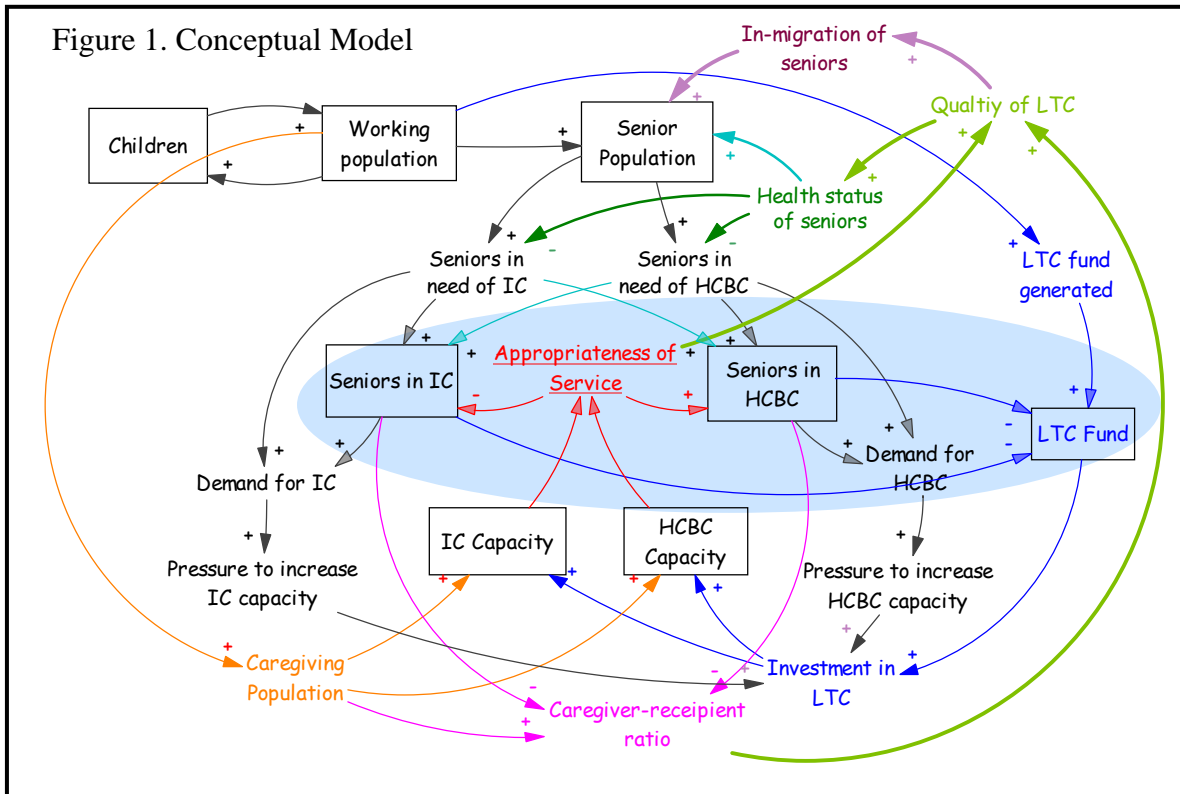
While the discussion with the client group generated a rich picture of the long-term care system, the clients made it clear that they would like to limit the model boundary to appropriateness of service and finance issues (the area shaded in Figure 1). The clients regarded the factors that cannot be controlled by their organization as exogenous factors, even if they were linked to the controllable factors through feedback system. However, the modelers insisted that in order to study the policy effects in the systems perspective, it was necessary to include some of the "exogenous" factors within the feedback loop.

3. Aging Chain Model

The first formal simulation model developed from the conceptual map was the Aging Chain Model shown in Figure 2. The model depicts how population moves from one stock of age group to the next as they get older, and how some of them become in need of long term care while others become caregivers in the system. The stocks represent people in each age cohort. Each year, people flow into an age group from the younger age group or from births. People flow out of a cohort because of death or by moving to the next age group. The age group "18-49" and "50-59" are the potential caregiving population, and some fraction of this population actually provides care. The need for long-term care is generated mostly by the people in the age group of "50-59", "60-85", and "85+". As individuals age, they become more likely to require long-term care. The aging chain calculates the proportion of those in need of long-term care to those who provide long-term care.

The Aging Chain Model had two purposes. One, the modeler used the model to introduce to the client group what system dynamics model does in terms of structure and behavior. The modelers presented various simulation runs with different parameters and it was an effective way to demonstrate the basics of system dynamics model.

Second, the modeler used the model to elicit feedback discussion from the client group. The client group had been describing problems fragmentally, and in order to find out various cause-effect relationships within the system, it was necessary to guide the discussion to the direction that would clarify the system structure. The modelers deliberately went to a meeting with the Aging Chain Model that ends with the '*ratio of need to support*' in order to ask the client group what happens if the ratio becomes out of balance (See Figure 3). The modelers expected the client group to come up with various ramifications of caregiver population being less than the needy population. However, the discussion was not successful, because the caregiving capacity was not the issue the client group was interested. It was clearly within the boundary of the clients' mental model, since the capacity issue frequently emerged in the clients' description of long term care problems, but they did not want to include it in the model because it was not something they can control. The client group wanted to examine the effect of SPOE policy apart from the pressure and influences that fall outside the policy's reach.

In order to accurately represent the problems with the current system of long-term care and to gauge the effective on any long-term care policy, SGOG should consider the pressures created by supply shortages.

Figure 2. Aging Chain Model

Figure 3.

Ratio of Need to Support

Ratio of Need to Support : Base ————————————————————— Dmnl
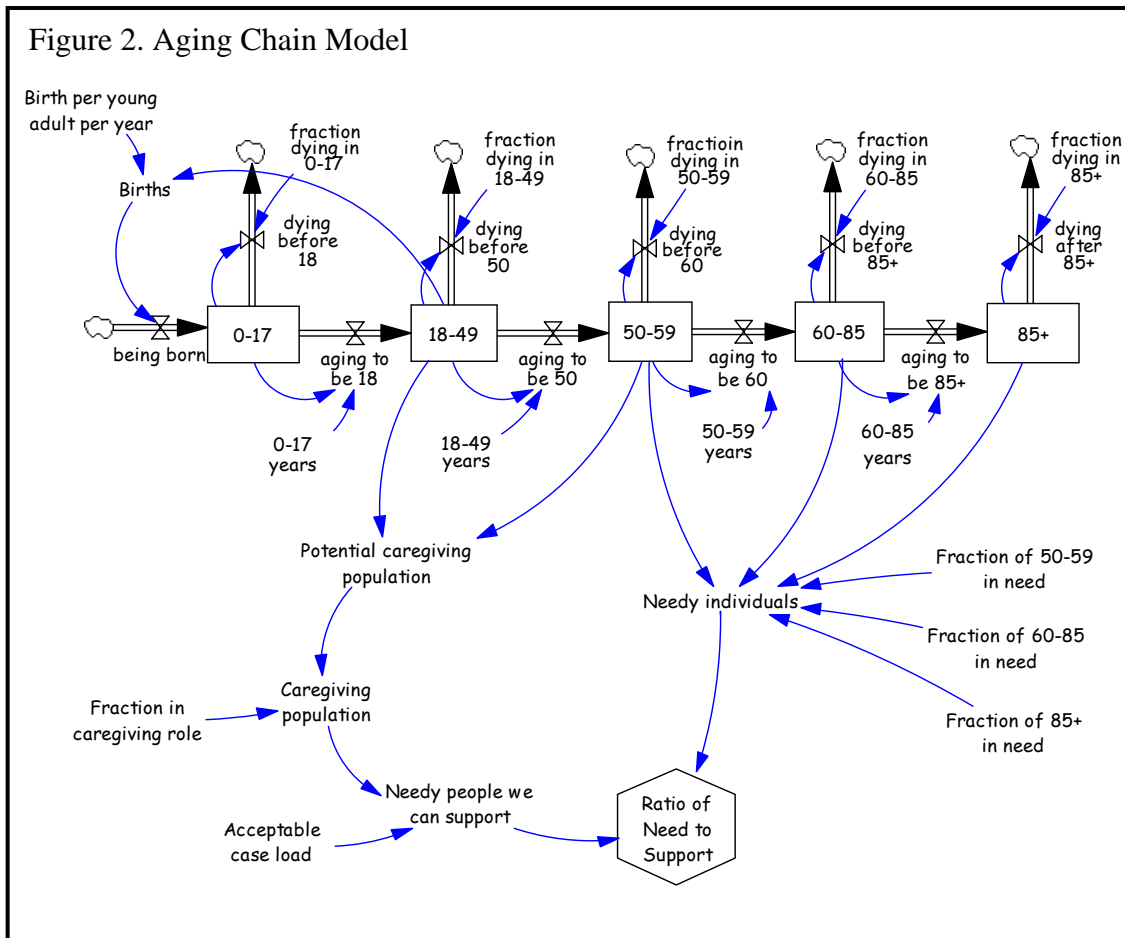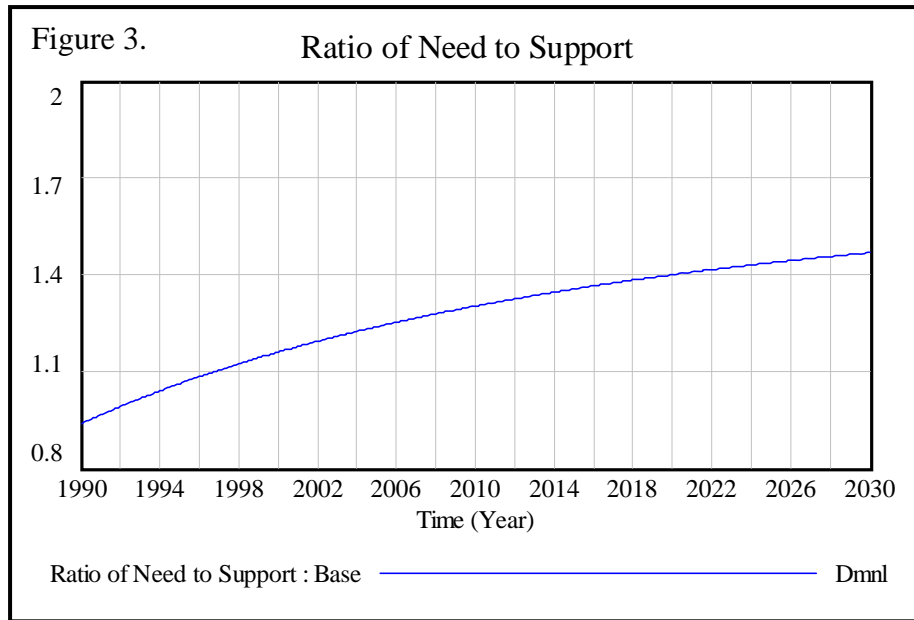
4. SPOE Model

The modelers soon discovered the aging chain alone could not adequately represent the long-term care system as described by SGOG. To better capture the system, an extensive stock and flow diagram was created to represent how an individual enters and moves through the system of long-term care.

The attributes of an individual in need, such as age, general health status, income, insurance coverage, current living status, and availability of community support can be used to estimate ones entry and transition within the long-term care system. However, this data was either unavailable or unreliable at the stage.

The model depicts a generic county in SGOG, with a population of 150,000. The time frame of the model spans 40 years, from 1990 to 2030. The model tracks how people enter the long-term care system and move between IC, FC, and HCBC. As the SPOE policy extends its role in the system, the number of people in IC decreases and that in HCBC increases. Changes in the enrollments for each type of service influence public and private expenditures on long term care. To capture the dynamics of the long-term care system according to SGOG's assumptions, a simple stock and flow diagram was devised to distribute people entering the system both with and without the SPOE.

SGOG failed to provide the modeler with data to run the model. The modelers tried to use the best estimation possible. While the model behavior still provides insights without the data, the hard data collected from the real world can make the simulation much more interesting by producing outcomes with realistic numbers.

## SPOE Model Structures[2]

1. Current Non-SPOE System

The Non-SPOE structure captures consumers' entrance into and movement within the long-term care system (See Figure 4). In the current system, when people become in need of long-term care, they make a decision to enter IC, FC, or HCBC. This model does not consider

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[2] Please refer to the attached model for details of model formulation.

the factors that influence the consumers' choice of service. The model acknowledges that the majority of people in need of long-term care enter FC, utilization of IC is higher than the actual need, and the remaining population receives HCBC.

The population decreases slightly over time, and the fraction of the population becoming needy each year rises, representing the increasing proportion of the population in need for the NYS. The death rates are relatively higher for people in IC and HCBC, because people with higher levels of impairment are more likely to receive IC or HCBC rather than FC.
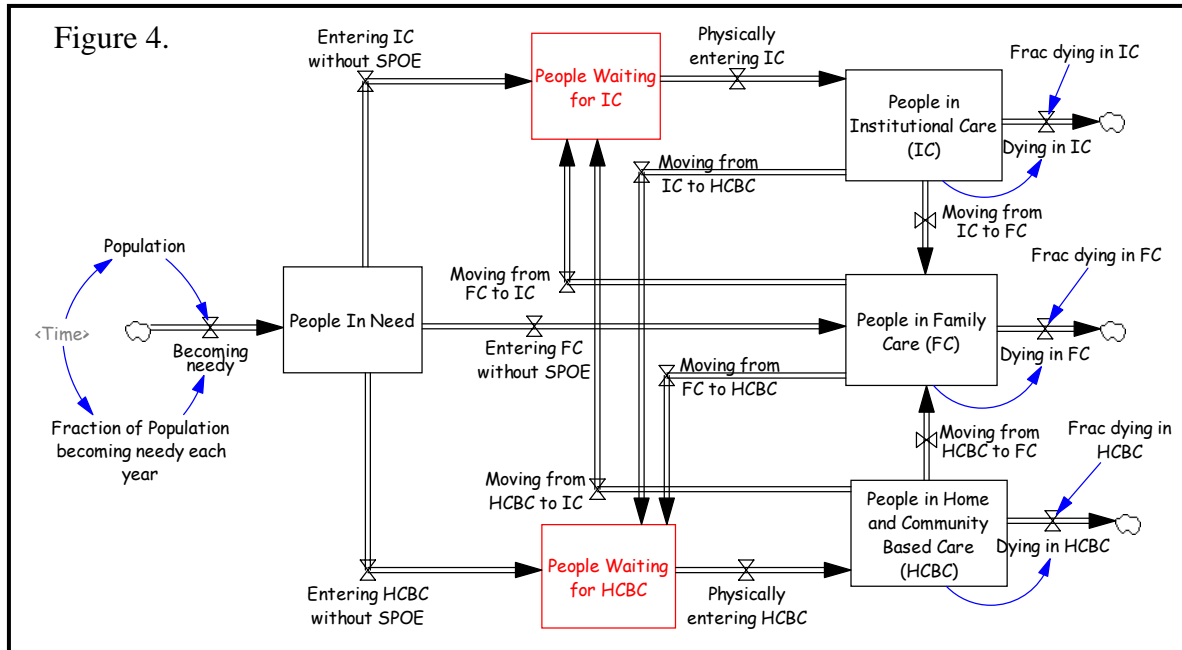
Figure 4.

2. SPOE System
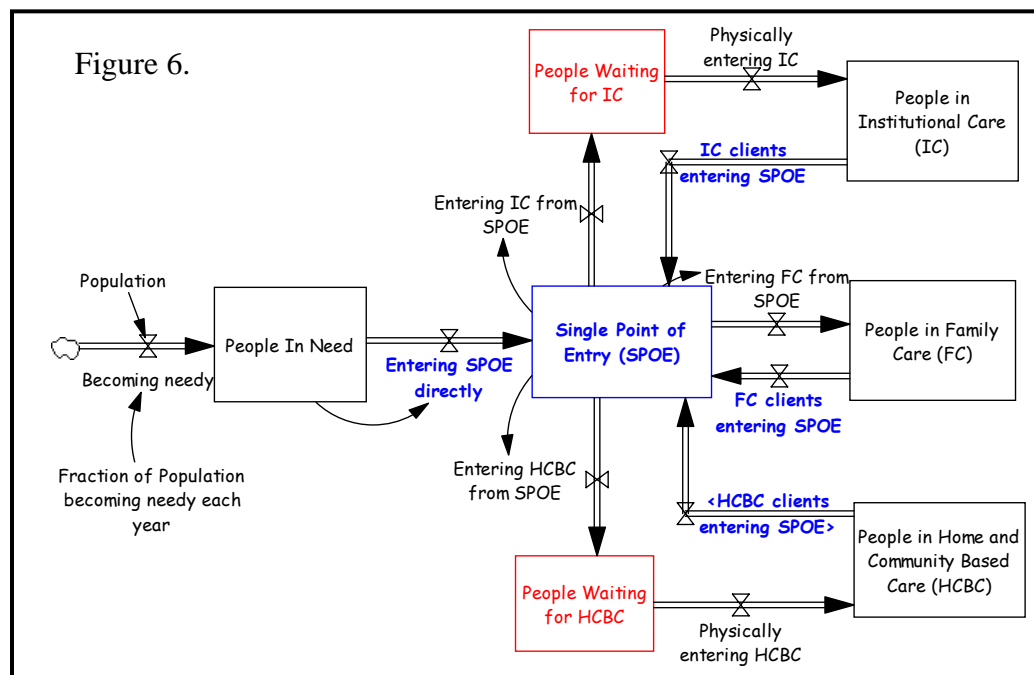
Figure 6.

In the SPOE system, people in need 'enter' the SPOE before they enter any type of long-term care services (See Figure 6). In the SPOE, individuals receive assistance and an unbiased determination of their long-term care needs. Due to the interventions of the SPOE, a larger fraction of people enters HCBC and a smaller fraction of people enters IC when compared to the non-SPOE system. The fractional changes are based on assumptions made by SGOG.

In the SPOE system, people already receiving LTC services may also enter the SPOE when they desire a change in service. The fraction of the total number of people seeking relocation in long-term care service entering the SPOE depends on the visibility of the SPOE policy and the penetration of SPOE clients in the system. SGOG assumes that people who have had contact with the SPOE are likely to come back to the SPOE when they need a change in service.

Even in the SPOE world, the non-SPOE system still exists. The SPOE policy can encourage more people to enter the SPOE, but it cannot prohibit people from finding long-term care services without the SPOE. Therefore, the SPOE system and the non-SPOE system will co-exist even with the SPOE policy. Only when the SPOE canvassing efforts reach everyone in need and in the long-term care system or new legislation is passed that requires mandatory SPOE contacts, will the SPOE system operate without the non-SPOE system.

3. Distribution of People in the SPOE vs. Non-SPOE World

This structure shows how people in need are distributed among IC, FC, and HCBC in both the SPOE and the non-SPOE systems (Figure 7). The fraction entering IC/FC/HCBC from/without SPOE reflects the assumption of SGOG that the SPOE would direct more people toward HCBC and less people to IC compared to the non-SPOE system.

The policy 'lever' is the 'fraction in need entering SPOE.' As a larger fraction of people enter the SPOE, the number of people directly entering services decreases.
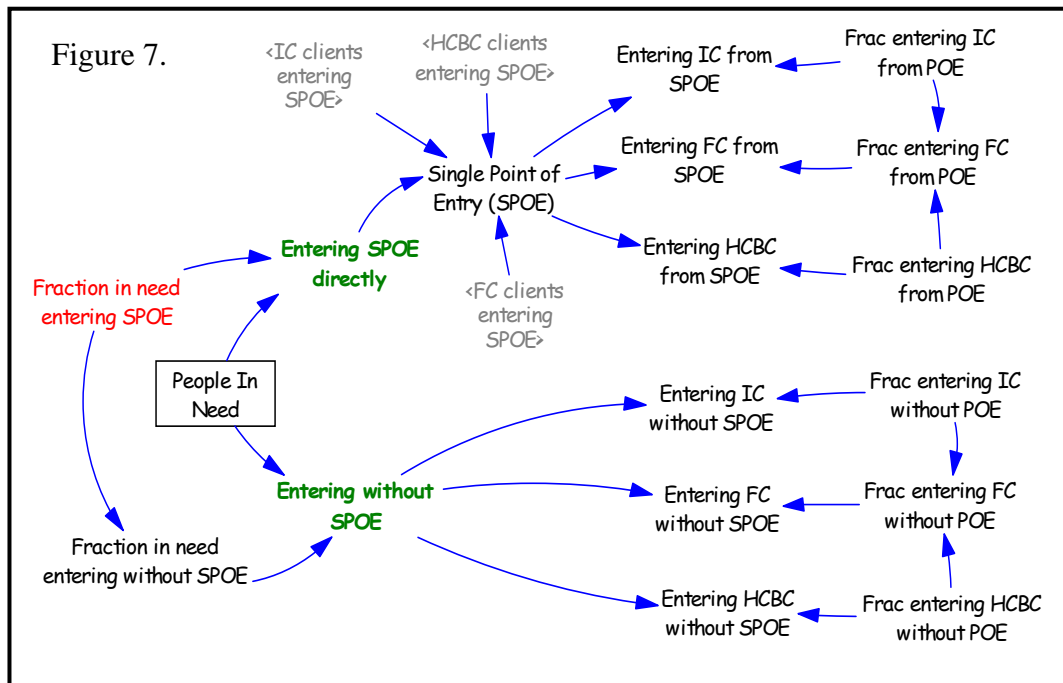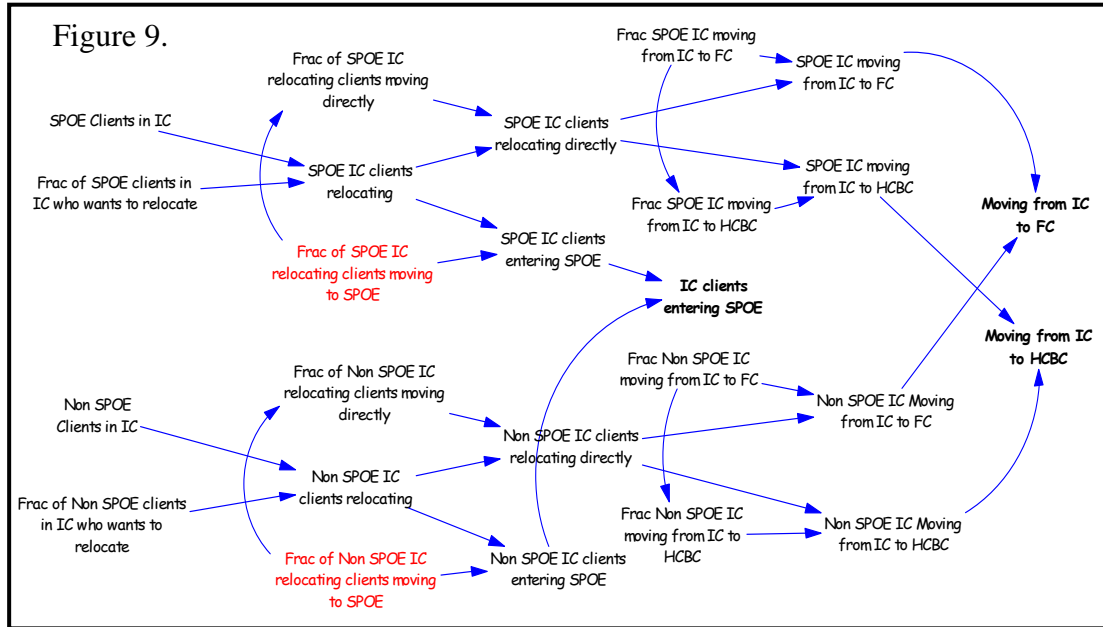

Figure 7.

4. Coflow for SPOE and Non-SPOE Clients

This structure differentiates the SPOE clients from the non-SPOE clients in each service sector (See Figure 8). The distinction is important because an individual who has experience with the SPOE may choose a different type of long-term care service than if they did not have contact with the SPOE. According to the assumption that the SPOE enables people to receive services that fit their needs, SPOE clients in one type of service are less likely than non-SPOE clients to pack their things to move to another type of service sector as they are receiving the preferred type of care. SPOE clients change services only from changes in their preferences.
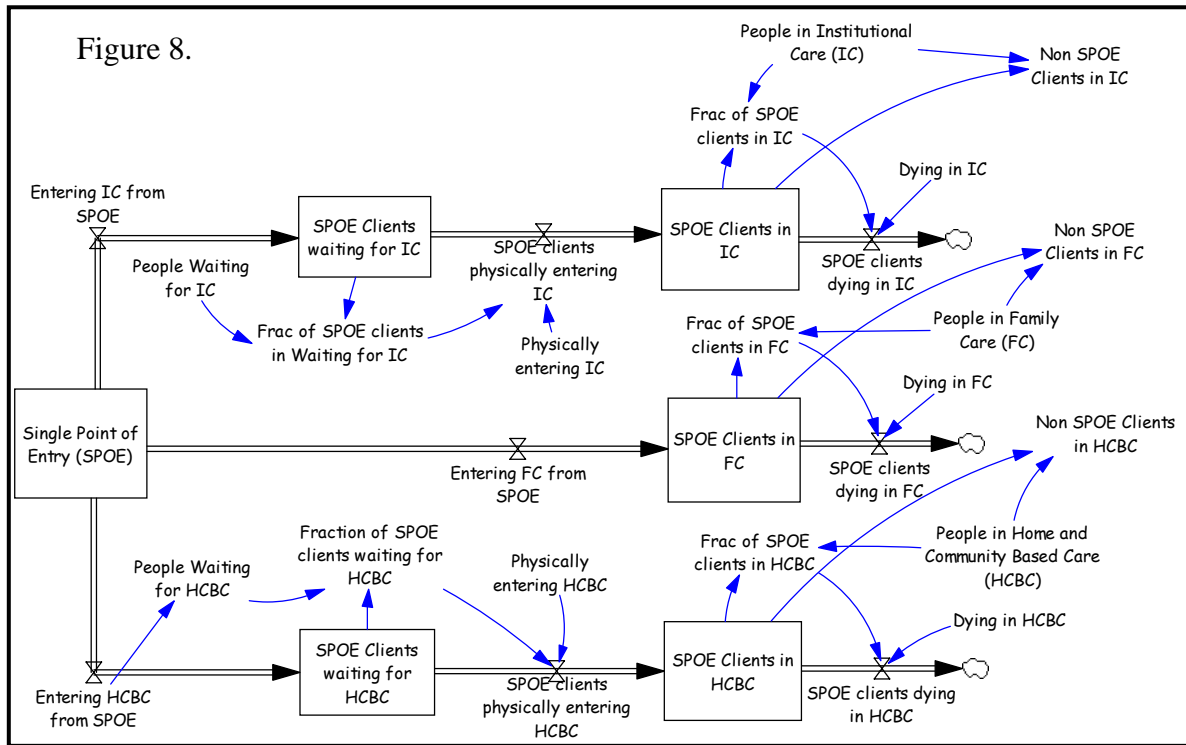

Figure 8.

5. Relocation

Figure 9.

The following three structures show how SPOE and non-SPOE clients transition between IC, FC, and HCBC. The example shown in Figure 9 is relocation of IC clients.

6. Entering after Waiting

As previously noted, the model assumes, under normal conditions, people wait for a certain amount of time before they enter IC or HCBC, and this waiting time increases as the capacity utilization of IC or HCBC increases (See Figure 10). Capacity utilization affects the rate at which people enter IC and HCBC from the waiting line. If there is no available capacity, the entrance into the IC or the HCBC halts.

Figure 10.
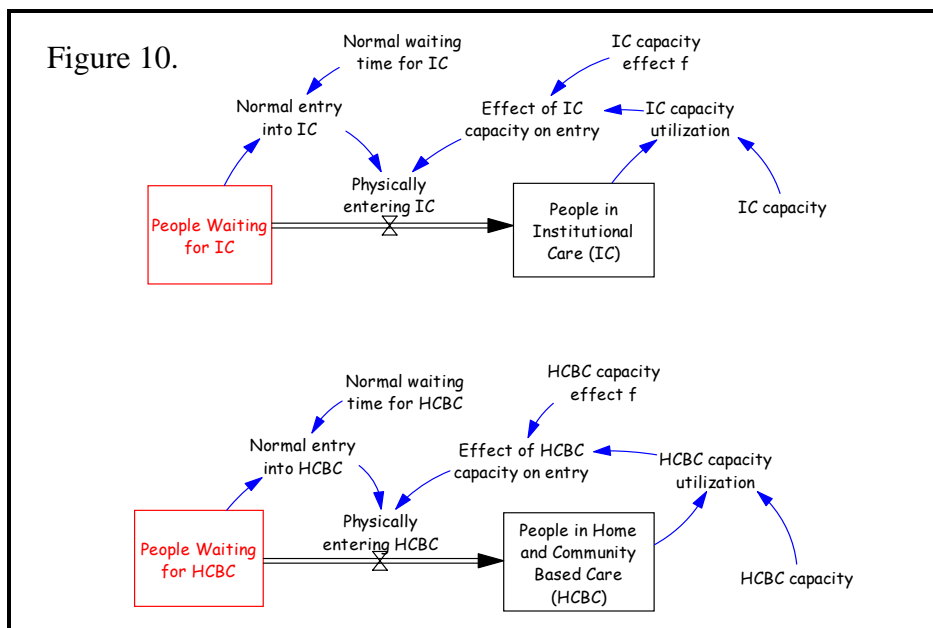
The IC capacity and the HCBC capacity are artificially set to constants that are too large to limit the entrance. SGOG wanted to have this fictional capacity to fully appreciate the effect of the SPOE policy without the interference of constraints outside the realm of the policy. However, in reality, the IC capacity and

12

the HCBC capacity are likely to adjust to demand and other pressures; during the adjustment process, shortages of IC and HCBC capacity are likely occur.

The normal waiting time is longer for IC than for HCBC because the administrative time required for the entrance is usually longer for IC. Recall, the total time an individual waits includes both administrative and capacity delays, the current long-term care system suggests the total time in which an individual waits for HCBS greatly exceeds that of IC because of constraints in capacity, not from administrative delays.

7. Long-term Care Expenditure

The structure in Figure 11 calculates total long-term care (LTC) costs. The average cost per client for each service is multiplied by the number of clients to produce the total cost of each type of service. The average cost is highest for IC services, and nominal for FC services. There is no data indicating the average cost per FC client because those in FC do not receive paid services. For the purposes of the model, the estimated opportunity cost of the FC caregiver is used as the average cost per FC client.

LTC costs also accrue from people waiting for LTC services because the people who are waiting for IC must be in either FC or HCBC. Similarly, people waiting for HCBC must be in either FC or IC while they wait. The average cost per waiting client is therefore estimated as some amount less than the average cost per IC client and the average cost per HCBC client.

The total cost incurred by each service sector is divided into the cost covered by private funds and the cost covered by public funds. All costs incurred by the FC sector are covered by private funds. The estimated SPOE operational cost is included within the total LTC cost to the public.
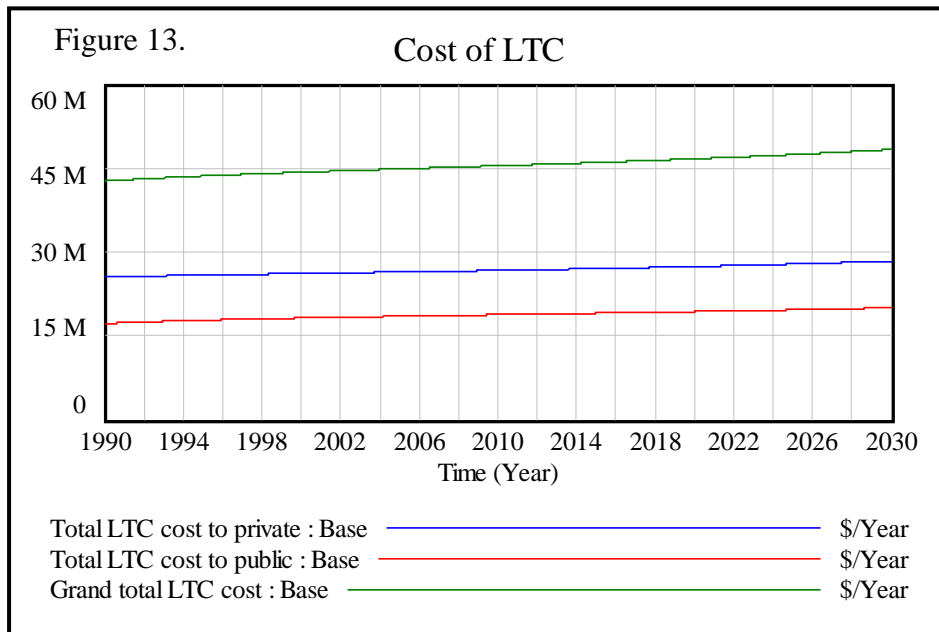

Figure 11.

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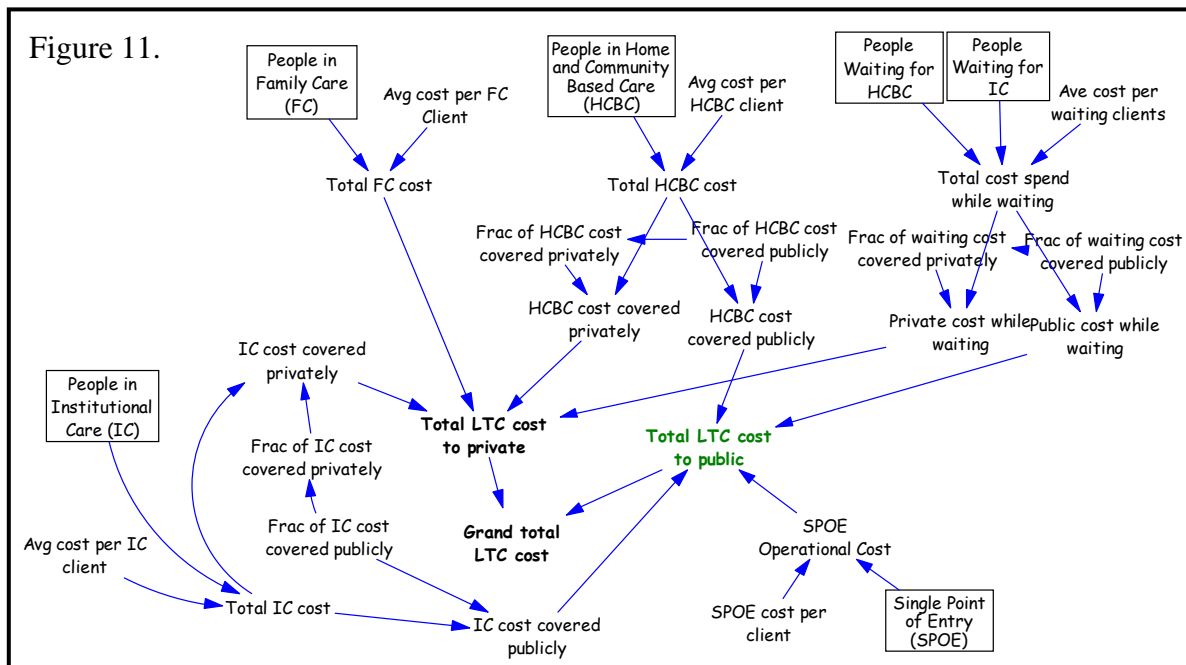
SPOE MODEL BEHAVIORS

1. Base Run

Figure 12 shows distribution of people in the current system. Due to increasing senior population, the long-term care clients are generally in increasing trend.

Figure 12. Where People Are
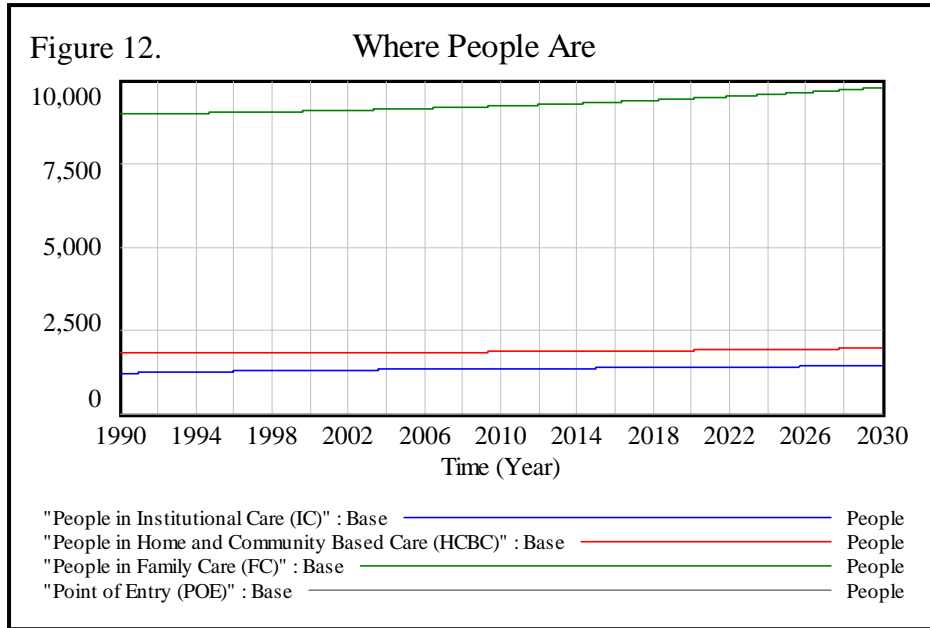
Accordingly with the increasing senior population, the long term care costs are in upward trend (See Figure 13).

Figure 13. Cost of LTC

2. SPOE Run

As the SPOE policy takes effect, the number of people in IC declines and the numbers of people in HCBC and in FC increase. (See Figure 14 and 15.) The blue schedule shows SPOE takes full effect (100 percent of total long-term care clients), and the red and green schedules respectively show that the SPOE entrance constitutes 50 percent and 20 percent of total long-term care entry.
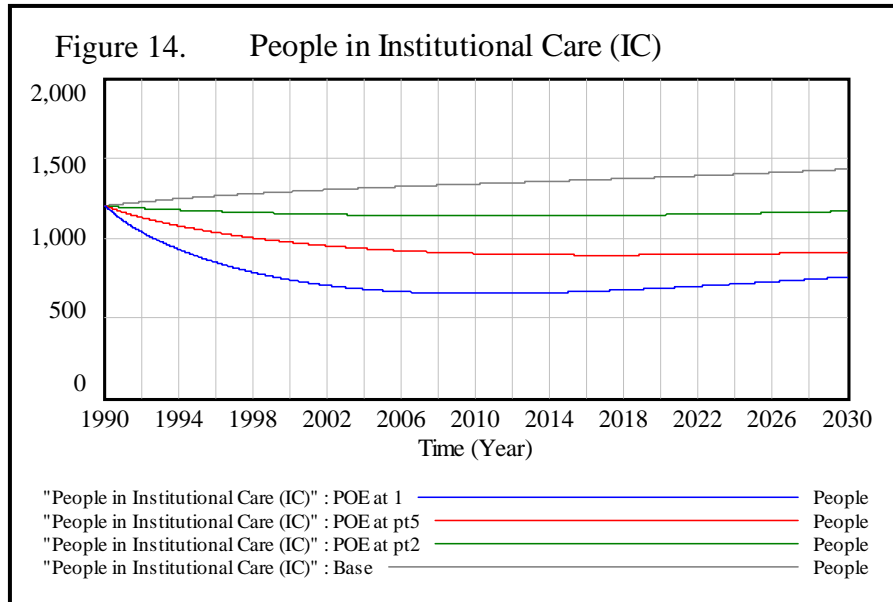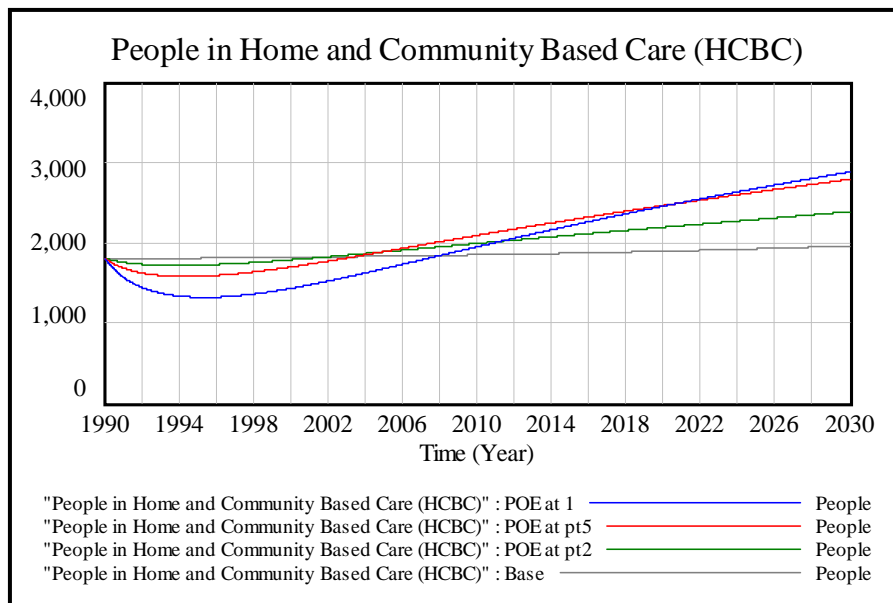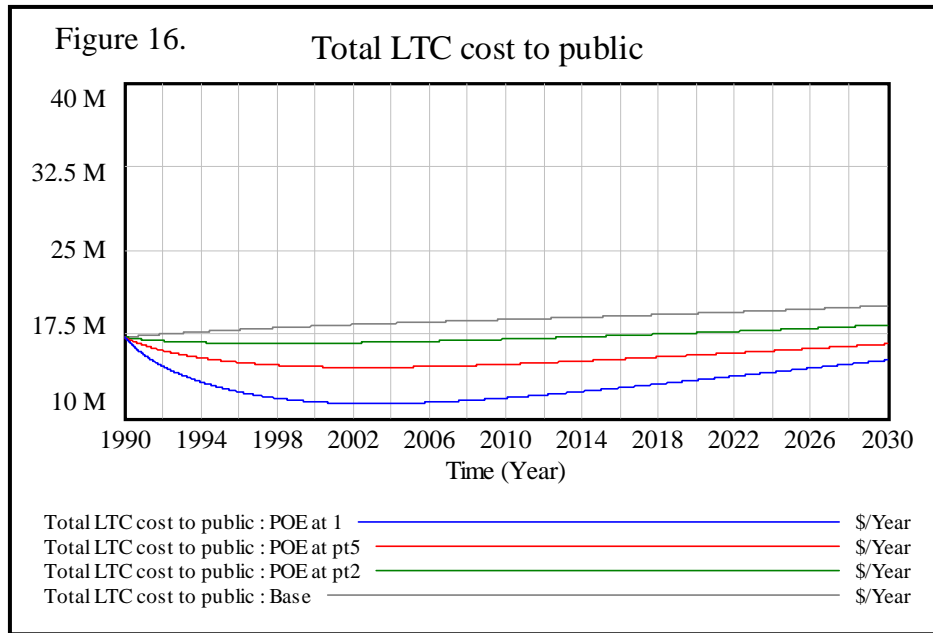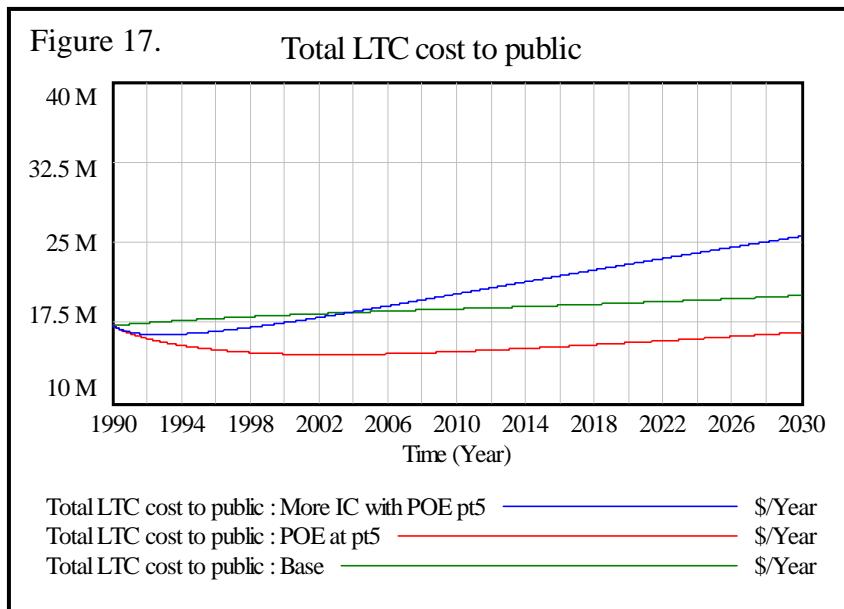
Figure 14. People in Institutional Care (IC)

Figure 15.

People in Home and Community Based Care (HCBC)

Figure 16 shows extent of public long term care cost saving due to the SPOE policy.

Figure 16.

Total LTC cost to public

Total LTC cost to public : POE at 1 — $/Year
Total LTC cost to public : POE at pt5 — $/Year
Total LTC cost to public : POE at pt2 — $/Year
Total LTC cost to public : Base — $/Year

The model behavior replicates SGOG's expected effect of the SPOE policy, because the model regards the assumptions underlying the model as true. However, the modelers felt that the real value of system dynamics model lies in dealing with the effects of the policy in systems perspective, and in order to do that, it was necessary to test the SPOE policy under situations when the assumptions fail to hold. Therefore, the modelers generated some scenario runs to see what happens if some of the SGOG's assumptions do not hold.

3. Scenario Run I

Figure 17.

Total LTC cost to public

Total LTC cost to public : More IC with POE pt5 — $/Year
Total LTC cost to public : POE at pt5 — $/Year
Total LTC cost to public : Base — $/Year

What happens if the number of people inappropriately getting IC is smaller than the number of people inappropriately not getting IC? In other words, what if the SPOE better identifies people's need, and as a result, finds out that there are many people in HCBC or FC who need to be cared by IC?

In order to run the simulation, the fraction of people entering IC without SPOE was set to a lower value than the fraction entering IC with SPOE. Also,

the fraction of people relocating from HCBC and FC to IC was set to a greater value with SPOE than without SPOE.

The result is shown in Figure 17. The SPOE policy results in higher long-term care cost than the non-SPOE system. If SGOG had provided the modeler with better data set, the model can actually show the extent of this effect quite precisely.

4. Scenario Run II

What if the SPOE fails to attract people? In other words, what if people regard the SPOE as another layer of bureaucracy rather than a helpful government service, and continue to enter the long-term care system without the SPOE?

In order to test the scenario, a new structure was added to the original model to take fixed cost of SPOE implementation into consideration (See Figure 18). Also the SPOE entrance rate was set to a low level.

With real data, the new structure can reveal what level of SPOE utilization is necessary to bring the targeted long-term care cost saving. Even with the estimated data, the model run reveals that it is necessary to assure some level of SPOE utilization if the policy is to succeed in cost saving (See Figure 19).

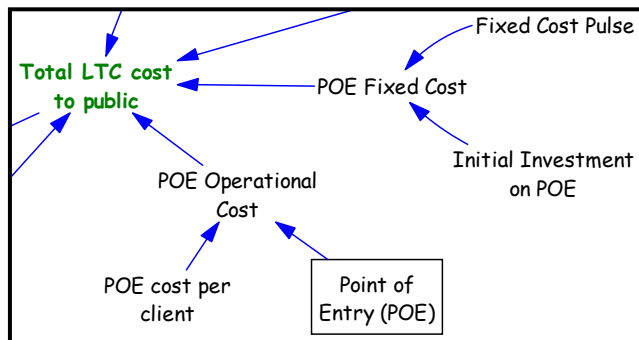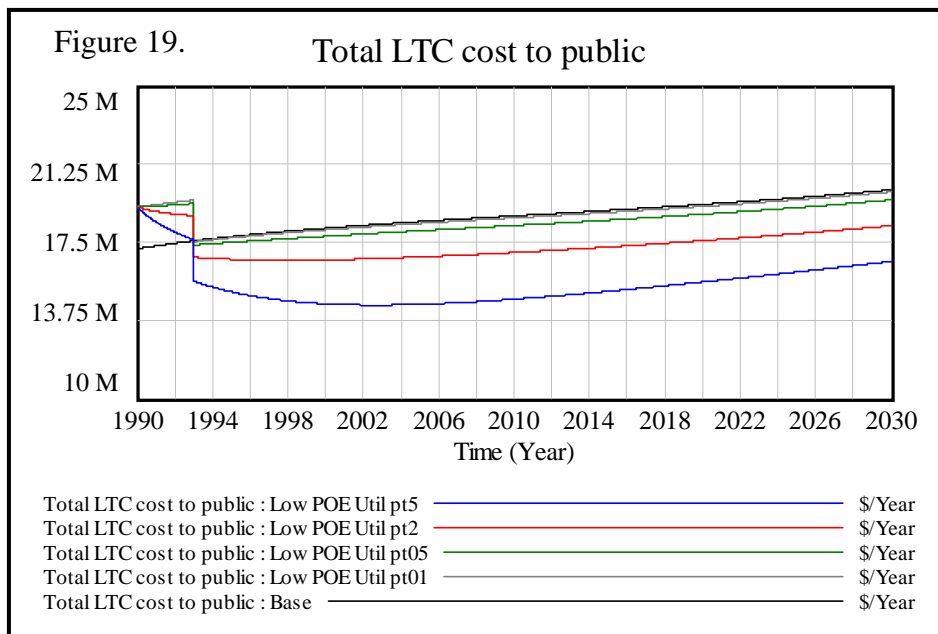Figure 18. Fixed Cost Formulation

Figure 19.

Total LTC cost to public

5. Scenario Run III

What if the SPOE successfully guides people away from IC to HCBC, but HCBC lacks caregiver capacity? In order to run the scenario, HCBC capacity was set to meet only the level of HCBC demand before the SPOE implementation. The HCBC capacity does not adjust to meet any changes in HCBC demand.

The result is shown in Figure 20. It clearly shows that people starts to build up in waiting line for HCBC. Do policy makers want this to happen? What are the side effects of extended waiting line? Negative public opinion, inefficiency in the system, and deteriorating senior health status may be a few of the side effects.

Figure 20. People Waiting for HCBC
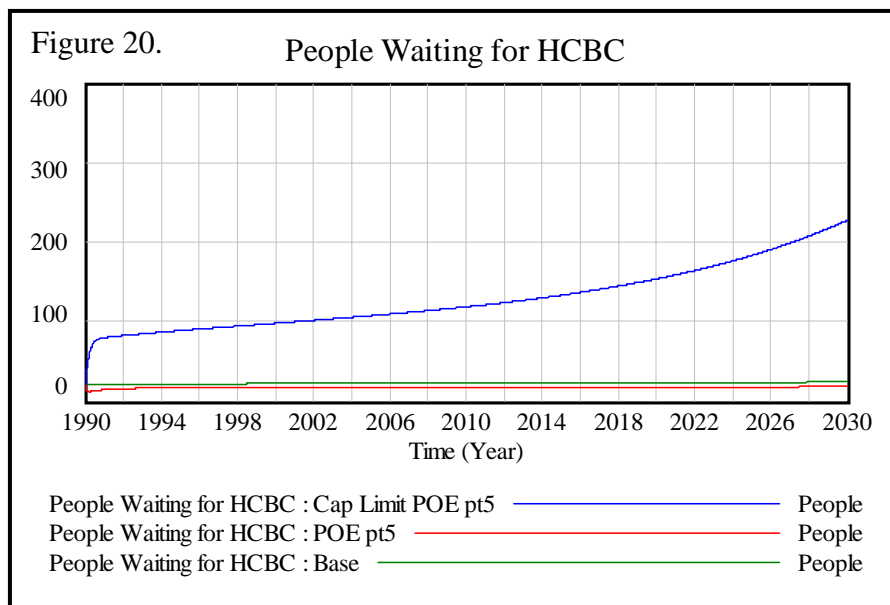
Model Implications and Recommendations

The model scenario runs clearly show the SPOE policy will succeed only under certain conditions. Without sufficient caregiver capacity or high SPOE utilization rate, the effort of SGOG will not be fruitful. In other words, the success of SPOE is highly dependent on resource availability and inter-organizational cooperation. In addition, the model shows that SGOG need to assess its assumptions more closely if it wants to minimize unexpected policy outcomes. Especially, the model clarified what data SGOG should collect in order to support the SPOE policy. Some of the required data are:

- Percentage of people inappropriately placed in IC/HCBC/FC
- Dollar prediction of SPOE investment
- Long-term care cost coverage ratio
- Number of people entering/exiting IC/HCBC/FC each year
- People's motivation behind choosing IC/HCBC apart from their impairment level

Model Limitations and Possible Improvement

The success of the SPOE model is yet to be determined, as the model remains incomplete due to the lack of usable data. The model is a powerful presentation tool in that it vividly shows the flow of people in the system and its effects on the cost. However, the model has several limitations.

First, the model is short of vigorous validation due to insufficient data.

Second, the structure of the model failed to include all the feedback loops relevant to the context in which the SPOE operates, and limited itself to a policy-advocating tool. The modelers tried to overcome the limitation by running various scenario runs to highlight the possible weaknesses of the policy. However, in this particular consulting setting, the modelers and clients were looking for different values in the model.

There are some possible model improvement points. First, the model can implement the policy starting at year 2005 rather than 1990 which is more realistic approach. Second, the model can incorporate changes in caregiving cost in IC and HCBC due to client redistribution by the SPOE policy. In other words, if IC receives more number of highly impaired people after the implementation of SPOE, it can lead to higher IC cost per person. Third, the model can include other factors, such as insurance coverage, income, and family size which have significant influence in the long-term care system.

Conclusion

Building a system dynamics model for a client that works in a highly political environment poses some problems for modelers. It can easily lead to frustration in both parties of clients and modelers, because they are looking for different values in a model.

In order to describe the policy in a complex system, SGOG found it more appropriate to study the policy effect holding other factors in the system constant. SGOG's position is more than reasonable, because those 'other factors' are the things that the agency cannot influence and should be negotiated at another level of government once the policy itself gains some positive support.

On the other hand, system dynamics modeling pays much attention on ways in which policy and other things in the system interact and influence each other. That is what feedback loop is all about. Therefore, while the SGOG was looking for feedback loops that can support the policy, the modelers tried to explore various feedback loops that can positively or negatively influence the policy outcome.

We believe that we use system dynamics models to better understand the reality, and therefore we are policy analysts and not policy advocates. Then what is a modeler's role in a consulting situation that is highly political and that clients come with predetermined solution to a problem? This is a difficult question to answer. However it is a problem that needs to be studied more closely, because as system dynamics modelers we come across these situations more than often. After all, building a desirable client-modeler relationship is as important as building a good model. This is a lesson the modelers learnt from the SGOG consulting case.

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