

A prediction of the geriatric specialists for the elderly in Iran: a dynamic system

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Abstract: Maintaining and upgrading the quality of the elderly's lives depends on the goal of services, choosing both an appropriate strategy and a suitable method for assessing and estimating the human capital needed for the elderly in the future. Presenting a dynamic system model for predicting the amount of geriatric specialist's proportional with the population of the elderly from 2009 to 2025. At first a general study was done in libraries on the elderly. Afterwards data gathering and building structures for determining the amount of geriatric specialists was done considering the effective factors on this subject. Finally by using the cause and effect diagrams, the flow accumulation diagrams were determined and the model's equation were determined in the Vensim software version 5. After simulating the results: from 2005 until 2025 the population of the elderly in Iran has an extremely steep growth and is predicted to reach 7 million people. This amount is about 8% of the entire population. The amount of students who had started to study geriatrics from the years 2009 until 2012 had been announced 6 students. According to the results from simulating, the amount of students who will study geriatrics until 2025 will be about 485 students. The geriatrics specialists who gave services to the elderly in 2009 were only 4. It can be said that the average growth of this group each year was 1.26%. This means by 2025 the population of geriatric specialists will be about 283 specialists. This number of specialists is only able to give services to 9% of the elderly. At the end of the study it was summarized that if the rate of the students of geriatrics grows up to 50% by 2025 the number of geriatrics will reach about 2800 in the whole country which is a standard rate in this area. This model shows that, for in order to give service to the elderly, the numbers of students who study geriatrics have to have a 50% growth by 2025. On the other hand, a program needs to be presented to compensate the shortages of the geriatrics specialists. Finally in can be said that if the present condition goes on, we will need to recruit these specialists from other countries.

Key words: *Elderly; Dynamic System; Predict; Geriatrics specialist*

1. Introduction

The first and maybe the most important stage in planning and developing human capital in health areas is predicting and estimating human capital for the future. Planning for human capital includes determining and allocating an appropriate number of physicians with suitable specialties in suitable places and at the suitable time (Barber, Conzalez, Valcarce, l 2010). On the other hand, health manpower is considered as a core in all health systems (Weiner, 2014). This is why preparing human capital in health systems is an extremely logistic and complicated action. Nowadays unreliable conditions and in national scales long term planning is needed (Sibbald, Shen, McBride, 2004). In the past four basic approaches were used in order to predict the required human capital which was: 1) the ratio

of healthcare workers to the population, which is the simplest approach. 2) Supply and demand approach. In this approach the future needs are estimated by the present use of services. 3) service-goal approach. In this approach goal setting for production and offering specific are converted to standard efficiencies. 4) Health and service needs approach. In this approach the future needs for healthcare workers are predicted according to the populations needs to health services (WHO, 2004a, WHO, 2004 b). None of the mentioned approaches are used separately in order to plan for human capital in healthcare services. This is also true in countries such as Australia (Joyce 2004, Tess 2005, Warwick, 2000), Canada (Mable, 2001; Newton, 1998; Tyrrell, 1999; Lome, 2007), Germany, France, Holland and England who have a large history and great experiences in regards to planning based on needs. In Australia, analyzing the condition of human capitals in order to determine the future

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requirements of human capitals is mainly based on variables such as the growth of population, social and technological changes, a combination of skills and individuals' performance (WHO ,2004a,WHO, 2004 b).

In a dynamic system, prediction for dentists in Thailand which was done by Adom Panich for a period from 1995 to 2015, results revealed that in 1995 the number of required dentists would be 6164 and in 2015 would be 11970. The ratio between dentists and people in 2015 would be 1: 5813. As a result in this specific case the need of people for dentists in 2015 will decrease up to 75%. In another prediction of physicians which was done in Spain in 2010, results revealed that the average growth of specialists in only 2% and by 2025 will reach up to 14.3%. This shows that they will face shortages of specialists (Barber, Conzalez, Valcarcel, 2010).

On the other hand, in the beginning of the 21st country the life expectancy index went beyond 66 years of age and every year 1.7% was added to the world population. However this growth for 65 year olds and over 65 year olds is higher than 2.5% (mirzai and ghahfarokhi, 2007).

So, one of the most important demographic characteristics in the past few decades is increasing life expectancy in the elderly of Iran (rizzo and seidman, 2011). It is clear that with respect to the physiologic changes of the elderly, their natural capacities start to decline. This means that the elderly need much more healthcare services compared to the younger (Committee on the Future Health Care Workforce for Older Americans, 2008). The health condition of an elderly is the result of the interaction between his/her natural elderly condition, diseases and the disabilities that are the consequence of diseases and other dangerous factors such as drug consumptions, inappropriate diet, immobility and so on. Other than these factors the risk of suffering from diseases is much higher in the elderly (Brossoie, 2010).

Educating and training manpower with respect to the needs of the elderly is facing extreme shortages, especially for long term treatments (Buchan, 2006). Geriatrics specialists are usually busy studying, diagnosing and curing the elderly. These specialists consider the social and sociological factors in regards to the elderly (Brossoie, 2010). Given the needs of the elderly for geriatrics specialists (every 2500 elderly one specialist) (Kanani and Hosseini, 2011), there is a growing need for geriatrics specialists for the coming future. In this study, the dynamic system approach for predicting geriatrics specialists in Iran's health systems by 2025 was used. In this model, by simulating and studying the effects of the variable on each other we tried to estimate the geriatrics specialists in Iran by 2025.

2. Dynamic system and predicting human capitals in health systems

The dynamic system was firstly presented by Forrester in the mid-1950s (Forrester, 1987). The

dynamic system refers to dynamic and nonlinear concepts in social systems. It also emphasis the interactions between the variables of the system. Dynamic systems emphasis Meta systemic relations and considers the dependent variable dimensions in casual diagrams as the basis of dynamic systems (Hamidzadeh, 2000). All around the world dynamic systems are used for planning (Roy and Koul, 2009) and predicting human capital in healthcare systems (Chung et al., 2010). Researchers such as Jantsch in 1972-1973, Khoong, Caine and Parker in 1996 and Martino in 1980 mentioned the advantages of dynamic systems as mathematical methods for predicting human capital.

There are four complicated levels in predicting human capitals. The steps of predicting human capital start from very simple discussions and end up in extremely complicated computer systems. Some predicting methods have quantitative natures and others have qualitative natures. Some famous predicting methods are:

1) Predicting based on zero, 2) Bottom to top methods, 3) Using predicting variables, 4) Regression analysis (Jazani, 1996).

In order to have an efficient evaluation of human capitals in health areas we should act extremely technically. The most important features which should be paid attention to are: effectiveness, efficiency, responsibility and also the needs of other people and sources should be considered as subsidiary factors for services (Tomblin et al., 2009). Another issue depends on future needs. This means understanding the present condition of human capital is a basic term for having a precise prediction (Dussault, Buchan, Sermeus, 2010).

3. Present situation in Iran

According to the field studies carried out and also according to the statistics gained from the human resource office of the ministry of Health only 6 students (men) were busy studying geriatrics in 2009. In 2013 statistics showed 4 students (3 women and 1 man). It can be also said that between the years 2009 until 2013, 4 people (3 women and 1 man) were busy giving services in the field of geriatrics.

4. Materials and Methods

In this study, the dynamic system method and the causal ring shaped diagrams were used. These diagrams have variables for cause and effects (Forrester, 1987). For quantitative analysis for dynamic systems, accumulated flow diagrams were used. In these diagrams two variables were used: accumulation variables which revealed the systems conditions such as the number of geriatric specialists and the flow variables which revealed the rate of accumulation such as the growth rate of the students studying geriatric. For studying the present conditions, the needed data were gathered from the ministry of health and were analyzed by the Vensim

PLE software version 1989-2011. The credibility of the model was checked through structure tests and parameter analysis. Parameter analysis was done by using the output of the models charts and was finally compared with the real conditions. The period for gathering data from the elderly was from 2005 to 2025 and the period for gathering statistics from the military of health was from 2009 to 2025.

5. The causal loop diagram predicting the geriatric specialists in Iran

As shown in the causal loop system Fig.1 three feedbacks are seen in this system which is separately described below:

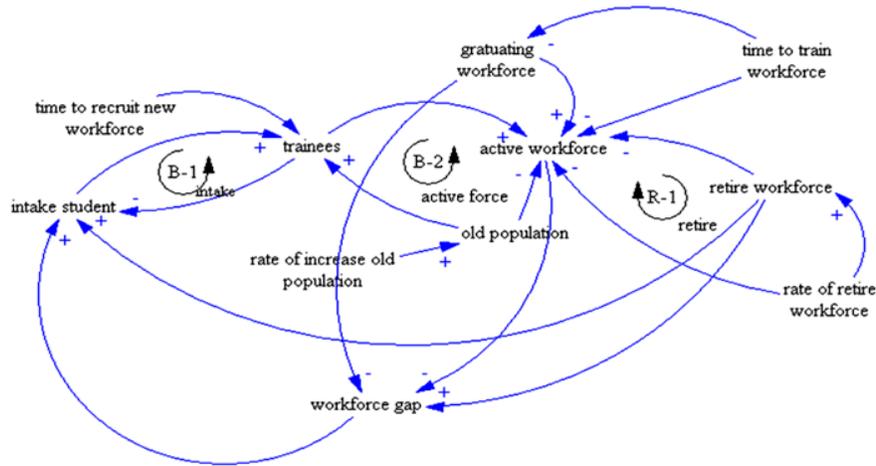


Fig. 1: Causal loop diagram for geriatric specialists in Iran

Loop (B-1): Negative feedback loop_ this means any change in the number of students who start to study geriatrics has an effect on the number of students who graduate from this course and finally has a negative effect on the market which has a great need to this specialty.

Loop (B-2): Negative feedback loop_ this means any change in the number of students studying geriatrics has an effect on the human capital in the society.

Loop (R-1): Positive feedback loop_ this means any change in the rate of retirement and the time of retirement has an effect on the human capital in the society. On the other hand, the retirement factor has an effect on the students who start studying geriatrics.

6. Stock and flow diagram

Stock and flow diagrams are used as a countable dynamic structure for causal loops. In these study students (Fig.2), human capitals, retired workforce and the elderly population who were over 60 were considered as accumulated variables. In this method, the number of students studying geriatrics in the whole country was obtained from the statistics office if the military of health. Also, the number of students who had graduated from this course and the retired workforce were obtained from the human resource office of the ministry of health. The statistics of the elderly population over 60 were obtained from the statistical yearbook.

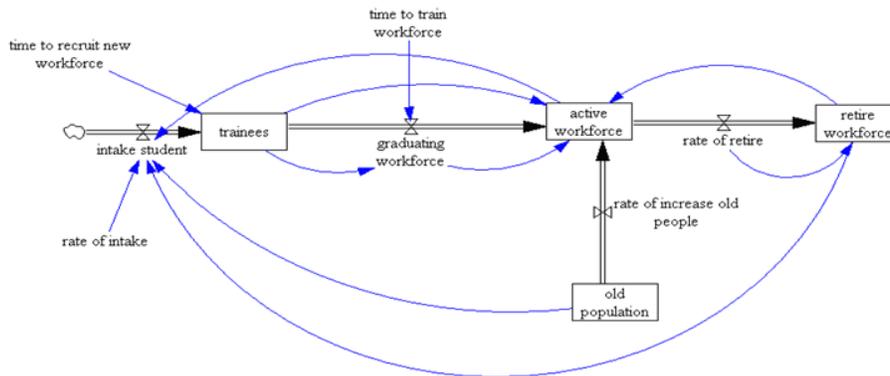


Fig. 2: Stock and flow diagram of geriatric specialists

7. Results

After drawing a mental model of the prediction model of the geriatric specialists in Iran, the results of the simulation variables are as follows:

According to the statistics of the statistical center of Iran from 2005 to 2013 and also according to the statistics of the office of the United Nations of Iran, the population of the elderly in Iran is growing. In this study, the elderly populations were those over 60 years. According to the results, it is shown in chart 1 that during 2005 to 2025 the population of the elderly in Iran has had a steep growth and has reached 7 million people. This population has assigned more than 8% of the whole population of Iran. This means by 2025, Iran has become an elder country. According to results in 2009, 6 students (men) were busy studying geriatrics. As shown in chart 2, if the present growth process of the geriatric specialists (trainees) which has a rate about 1.5% continues, the population of the students studying geriatrics would reach something about 485 students by 2025. As shown in chart 3 (active workforce) and according to the data gathered from the ministry of health, only 4 geriatric specialists existed in 2009. This group has an average growth of 1.26% per year. It is predicted that by 2025 the number of geriatric specialists will reach 283 specialists. This amount can give service to only 10% of the elderly of the society.

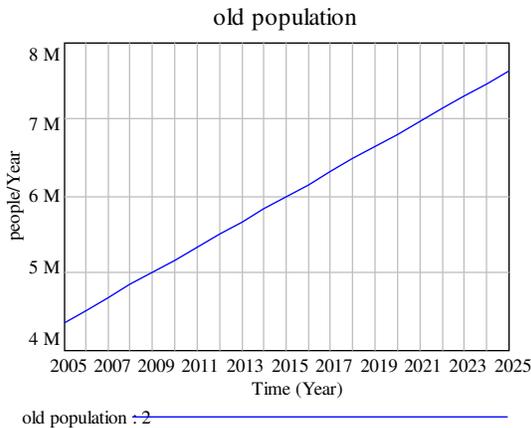


Chart 1: The development rate of the elderly population in Iran

8. Political analysis

In this section, the sequence of changes made to create different policies is reproduced. Policy analysis is commonly used as a tool in system dynamics. In the policy analysis, results of the system behaviors in different situation were analyzed before implementation. Encouraged by this

Finding, three policies were analyzed relative to a base run situation, with focus on the rate of active workforce and its dynamic effect on the active workforce until 2025. These policies According to

chart 4 in the first scenario (continuing current trend), an average growth of 1.26% is seen in this group. It is predicted that by 2025 the number of geriatric specialists will reach 283 specialists. This amount can give service to only 10% of the elderly of the society. The second scenario is considered as the most ideal condition.

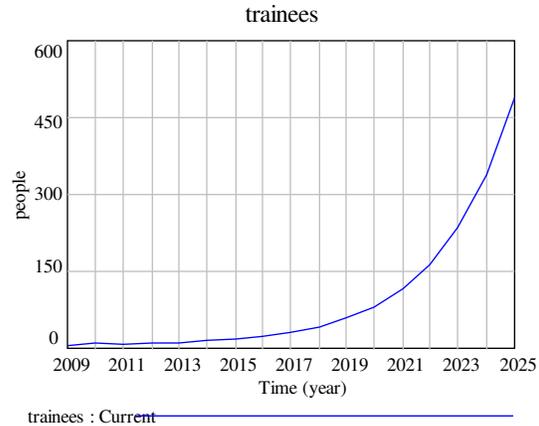


Chart 2: The development rate of geriatric specialist who are educating.

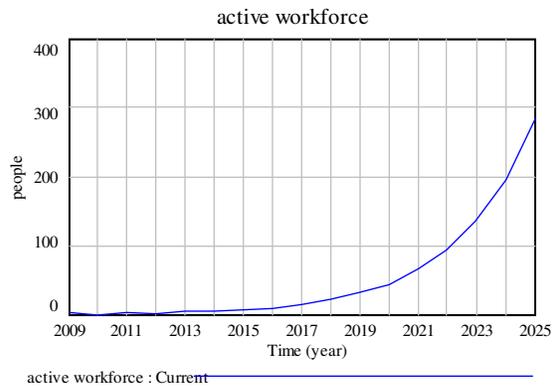


Chart 3: The development rate of active workforce (geriatric specialists existed)

In this scenario if the growth rate of the students increases up to 50%, by 2025 we will have 2800 geriatric specialists. In this condition we can give service to all the elderly of the society. In the third scenario, which is the worst condition, the growth rate of the students is extremely poor (0.26%). In this scenario the number of human capital in 2025 will be 161. This number can only give service to 5% of the elderly which is something about 350000 elderly. It is predicted that in the future years we will probably encounter some problems in health centers when facing the elderly.

Policy one: active workforce: increase rate %1.26(continuation of current situation)

Policy two: active workforce: increase rate: %50(best)

Policy three: active workforce: increase rate: %0.26(worst)

9. Discussion and conclusion

In order to predict and estimate the number of geriatric specialists a dynamic system model was used in this study. The most important advantage of the dynamic system model is about the parameters which should be considered by policy makers.

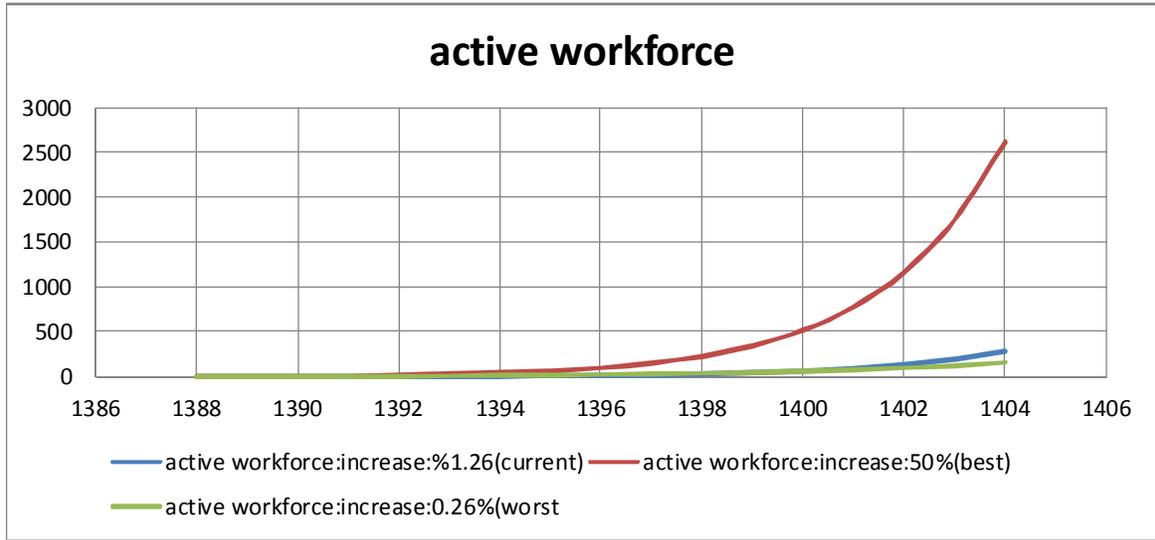


Chart 4: The behavior of variable of the model in policy analysis

According to the data gathered from the United Nations office in Iran, the elderly population in Iran is increasing. Unfortunately as results reveal, there is no precise planning for controlling this situation and no precise demands of the aged people in the future has not been recognized yet. As United Nations data shows, by 2050 the elderly population of developing countries such as Iran, Saudi Arabia, Kuwait and China will reach from 739,000,000 to 2000000000(World Population Prospects, 2009).

It can be also resulted that as the elderly population will increase in the future years, we will definitely face a decrease in the total population growth. This means the number of human resource will effectively decrease. This is while the elderly population will increasingly need healthcare services. Also, as seen in the gathered data, in 2009 only 6 students (men) had started studying geriatrics. This number decreased in 2013 to 4 students (3 women and 1 man). It was also observed that only 4 people were busy giving service to the elderly in 2013. All these results reveal that we are facing huge shortages in this field in our society.

In a study conducted by Kanani and Hussein (2011), a prediction was carried out using the David Foot method in order to predict the number of required geriatric specialists. Results revealed that 2000 geriatric specialists are needed in our society. From 2010 to 2020 another 1000, from 2020 to 2030 another 1500, from 2030 to 2040 another 2000 and from 2040 to 2050 another 3000 geriatric specialists should be added to this number. The results of Kanani and Hussani's study are in line with this study and show that with the current growth rates of the elderly, we will definitely face problems for elderly healthcare services by 2025.

In another research conducted in New Zealand in 2011(Dussault,2011), results revealed that considering the growth rate of the elderly population, by 2026 this country will need 100% growth in the number of geriatric specialists in order to give services to this group. The method of this study was also a dynamic system, and is in line with our results. Both results show a great need to educate specialists, in order to give service to the elderly.

In another study conducted in Miniuka during 2007-2011 results revealed that there are very few educated man force in the field of geriatrics. So the results of the above mentioned study confirms the results of this study regarding the lack of educated human resource in this area (CMDHB Workforce Development Committee, 2008).

As the elderly population of America is increasing, this country is also facing shortages in geriatric specialists. According to studies only 1% of physicians and nurses are busy giving service to the elderly. In a study conducted in 1987 it was predicted that by 2020 six to seven thousand geriatric specialists, will be required. Unfortunately up to now only 4% of the predication has turned out true. According to statistics by 2030, 3.5 million specialists will be required in this field (Committee on the Future Health Care Workforce for Older Americans, 2008). By comparing the results of the U.S.A, Japan and mentioned study and the present study it can be concluded that Iran will also face big shortages in regards to geriatric specialists in the coming future.

This model can be used in other studies in the future in order to predict geriatric specialist. This model can be used along with other models in order

to have a more precise prediction of the future of geriatric.

Acknowledgments

Hereby the authors thank the Ministry of Health and Education.

Author's Contributions

All authors were involved in the study design, data analysis and result interpretation. All authors confirmed the final draft before submission.

Finding/Support

This study was part of Ph.D. dissertation which was support by Islamic Azad University, Sciences and Research Branch of Tehran, Iran.

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