

Study of Nurses Manpower Planning in Korea: Its Implication for Policy Making

Hyeoun-Ae Park, PhD, MSN, RN¹, Eunyoung Choi, PhD²

Purpose. The purpose of this study was to project supply and demand for registered nurses to the year 2015 and to make recommendations regarding nurse manpower planning for the 21st century in Korea.

Methods. The supply of nurses was predicted using a baseline projection and demographic methods. The demand for nurses was forecasted by the derivative method.

Results. Projections indicate there will be an oversupply of nurses based on the current productivity. However, there will be under-supply if predictions are based on the standard for nursing staff established by the medical law and the optimal productivity derived by the patient classification system.

Conclusion. Korea needs more practicing nurses. One way to increase the number of practicing nurses is to increase the number of graduates. However, considering the low retention rate of nurses, a better way to solve the nurse shortage problem is to develop strategies to recruit and retain nurses.

Key Words: Nurse manpower planning; Supply projection; Demand projection

INTRODUCTION

The demand for health care in the Republic of Korea has increased with continuing socioeconomic development, improvement of the living standards, and the introduction of a national health insurance system in 1989. To meet this rising demand a major concern is providing an adequate number of health care professionals. Nurses are very important to health care because they constitute the largest group of health care workers who give direct patient care. Also, as the emphasis of health care changes from the cure of diseases to health promotion, nurses will fill an increasingly important role. Thus, it is necessary to project how many nurses will be needed to meet the demand.

At first glance, the large number of unemployed nurses and nurses' low employment rate (60%) in the Republic

of Korea suggests an oversupply of nurses. Parts of the country, however, are experiencing a shortage of nurses in clinical areas. Maldistribution of nurses is therefore a problem, especially within some geographical areas and work places (Ministry of Health and Welfare (MOHW), 1997). Geographically more than 96% of nurses are working in urban areas, and more than 75% of nurses are working in clinical areas. National nurse manpower planning is necessary to solve these problems and to seek ways to better utilize nurses.

BACKGROUND

There are two nursing educational systems in Korea: A three-year diploma program and a four-year education program. As of December 1997 there were 64 junior colleges (three-year diploma programs) and 48 universities with nursing programs (Korean Nurses Association,

1. Associate Professor, College of Nursing, Seoul National University, Seoul, Korea
2. Lecturer, Department of Statistics, Ewha Women's University, Seoul, Korea
Corresponding author: Hyeoun-Ae Park, PhD, RN, College of Nursing, Seoul National University
28 Yongon-dong Chongno-gu, Seoul 110-799, Korea
Tel: 822-740-8827 Fax: 822-765-4103 E-mail: hapark@plaza.snu.ac.kr
Received June 10, 2001 ; Accepted December 21, 2001

1998). The total enrollment was 11,660 (Korean Nurses Association, 1998). As of December 1997 there were 133,946 licensed nurses (MOHW, 1998) and about 120,000 nurses available (Park, 1999) after taking losses into account. Licensure for nursing in Korea is life-long. According to various data sources, there were 67,140 nurses employed in South Korea, which represents 60 percent of the total number of nurses available as of December 1996.

Song et al. (1986) and Kim et al. (1991) forecasted the nurse manpower in preparation for the sixth and seventh 5-year Planning for Socioeconomic Development in Korea. Since then, three significant changes have taken place. First, in 1989 the Korean government introduced the national health insurance system, which has brought changes in utilization patterns of health care services. The national health insurance system consists of four different programs: Industrial Workers Program, Government and Private School Employees Program, Self-employed Program, and Medical Aid Program. These four programs cover nearly 100% of the population. Second, there have been changes in government policy to lower the number of beneficiaries of the Medical Aid Program and transfer those who are not eligible to the Self-employed Program. Third, during the past five years 20 new three-year diploma programs and 25 new four-year education programs have opened, which has resulted in an increased number of nursing students.

Because of these important changes, a new study on nursing workforce was needed. The present research was undertaken to project the supply of and demand for registered nurses until the year 2015.

PURPOSE

The purpose of this article is to: (a) determine if the supply of nurses will meet the demand for nurses in Korea, and (b) suggest ways to recruit and retain nurses. These findings will assist nursing leaders and government strategists to conduct advance planning so that Korea has enough nurses.

METHODS

1. Supply analysis and projection

Three major components make up the supply of nurses: current supply, future increments, and projected losses.

The current supply has two sub-components: (a) nurses who are currently employed in the health sector and (b) nurses who are unemployed, or engaged in activities other than nursing. Future increments generally include new graduates, persons who transfer from other occupations into nursing, and repatriation of nurses from abroad. For this study only new graduates within the country were considered because the number of transfer and repatriation is very minimal. Projected losses include deaths, emigrations, and retirees.

To determine the current supply of nurses, an analysis was done of the number of individuals who have become nurses and who have left nursing since introduction of the national licensing examinations in 1914 to the present. Future increments were analyzed by examining the total number of students enrolled in nurses' education programs, the number of graduates, the number of applicants to take the national licensing examination, and the number of licenses issued.

Projected losses were determined by analyzing the deaths, retirements, and emigrations of licensed nurses. The lack of information on emigration made it difficult to accurately assess the number of nurses who had left the country. Based on findings by Song et al. (1986), the number of emigrants up to 1984 was assumed to be 9,895. After 1985, emigrants were estimated by using the number of newly licensed nurses and the estimated emigration rate of 0.012 based on the telephone survey of 10 educational institutions by the authors. The number of deaths was estimated by constructing a proxy life table for nurses based on the Korean Female Population Life Table (National Statistical Office, 1995). Finally, the number of retirees was estimated by assuming those nurses older than 60 years of age were retired based on the civil workers retirement age.

The supply of nurses was predicted using a baseline projection (Bui Dang Ha Doan, 1981) assuming that the current age structure of nurses will be maintained. Using a demographic method developed by Horbach (1979), the age specific future supply of nurses was predicted by using the age structure of input and output of nurses into the health care delivery system. The supply projection for each five-year interval up to the year 2015 was estimated on the basis of the past trend of nurses' increments and losses prior to 1996. Nursing supply was projected using the following computational form (Table 1).

2. Demand analysis and projection

Demand for nurses was analyzed by examining the current status of employment in different areas of nursing, past trends of health care services, and nurse productivity. Due to the lack of a reliable data source, the employment status of nurses was assessed from a variety of sources. The demand for nurses in clinical areas was predicted using a derivative method (Bui Dang Ha Doan, 1981), where health workforce demand is derived from estimates of the demand for health care services. The number of nurses required in the clinical area was computed using the demand for health care services (utilization of health care services) and nurse productivity.

Utilization can be described with two indices: ambulatory care and inpatient care. The index for ambulatory care is the number of visits by patients to an ambulatory care unit, while the index for inpatient care is the number of days of hospital stay. In this study, statistics from the national medical insurance system were utilized for

estimating the demand for health care (Korean Medical Insurance Co., 1990- 97). The coverage rate of the medical insurance programs in the Republic of Korea is close to 100 percent; thus, projected utilization rate of the population covered by medical insurance can be regarded as that of the total population. Health care services utilization of the four national health insurance programs is estimated using a nonlinear regression model with the square root of the year as an independent variable, with an assumption that increased health care services will be saturated as the year progresses. The health care services utilization rates from 1990 to 1997 were analyzed using a regression model (Table 2).

The total number of days of hospital stay and visits was computed by multiplying estimated health care services utilization rate with the projected number of beneficiaries from each insurance program. The number of beneficiaries from each insurance program was estimated by the coverage ratio for each insurance program

Table 1. Computational Formula for Nurse Supply Projection

Computational Form	Contents
$T(n) = T(n-1) + G(n) - L(n)$	$T(n)$ is number of available nurses at year n $T(n-1)$ is number of available nurses at year $(n-1)$ $G(n)$ is number of newly licensed nurses at year n $L(n)$ is number of losses at year n
$G(n) = \{E(n) + F(n-1) \times RR\} \times SR$	$E(n)$ is number of expected graduates at year n $F(n-1)$ is number of applicants who failed the license exam for year $(n-1)$ RR is average reapplication rate for the license exam from '94 - '98, 1.028 was used SR is average success rate for the license exam from '94 - '98 0.925 was used
$L(n) = D(n) + E(n) + R(n)$	$D(n)$ is number of estimated deaths at year n $E(n)$ is number of estimated emigrants at year n $R(n)$ is number of estimated retirees at year n

Table 2. Regression Analysis of Health Care Services Utilization by Insurance Program

Insurance Program	Regression model = $a + b \sqrt{\text{year}-1989} + e$			
	Data available	Estimates of a	Estimates of b	R ²
Inpatient				
Industrial workers	1990 - 97	0.5046	0.0712	0.8881
Government and Private school Employees	1990 - 97	0.5712	0.0934	0.9087
Self employed	1990 - 97	0.4916	0.1326	0.9417
Medical Aid	1992 - 97	-0.5878	2.2874	0.9073
Ambulatory patient				
Industrial workers	1990 - 97	6.0961	1.1333	0.8411
Government and Private school Employees	1990 - 97	6.8732	1.1552	0.7794
Self employed	1990 - 97	4.7268	1.4821	0.8958
Medical Aid	1992 - 97	3.8144	2.7053	0.8704

multiplied by the total number of population projections from the National Statistical Office (1996). The coverage ratio was assumed constant.

Nurse productivity can be defined as the number of patients attended by a nurse per day. It is desirable to limit the maximum number of patients attended by a nurse per day because an overload of work affects the quality of care provided. According to a survey done by Chang (1991a), only 16 percent of surveyed health care institutions met the standard prescribed by medical law. A recent study estimated the time needed for different classes of patients (Chang, 1991b; Park, Joe, Park, & Han, 1995).

For this study, three different indices of nurse productivity: (a) current productivity from the patients' survey by MOHW (1994): 5.0 for inpatients or 60 for ambulatory patients; (b) productivity prescribed by medical law: 2.5 for inpatients or 30 for ambulatory patients; and (c) optimal productivity based on a patient classification system: 1.5 for inpatients and 40 for ambulatory patients were used to project the demand for nurses. The underlying assumption for the number of nurse working days in a year is 265 days.

The demand for nurses in non-clinical areas was estimated using different criteria. For example, the demand

for nurses in the public health sector was computed based upon recommended staffing patterns for health centers and health sub-centers. The demand for school health was computed based on the number of schools expected, excluding schools with less than one class per grade according to the Educational Standard. The nurses needed for occupational health was computed using the number of industrial units expected and the Industrial Security and Health Law. The demand for nursing faculty in educational institutions was computed based on the Educational Standard for Colleges and Universities established by government mandate, with an assumption that the number of student enrollments in 1998 will be maintained to year 2015. The demand for nurses in administration, research, health insurance, social welfare, and military services was estimated using a nonlinear regression model with the square root of the year as an independent variable.

RESULTS

1. Supply Analysis and Projection

Based upon current enrollments, the expected number of newly licensed nurses per year is projected to be 10,533 in the year 2000 and stabilize at 11,301 from

Table 3. Projected Supply of Available Nurses

Year	Cumulative Number of Licensed Nurses	Cumulative Losses				Available Nurses
		Emigrants	Deaths	Retirees	Subtotal	
1996	133,946	10,844	2,310	2,829	15,983	111,963
2000	161,850	11,176	3,213	3,827	18,216	143,634
2005	218,002	11,842	5,397	6,756	23,995	194,007
2010	274,507	12,512	8,811	12,342	33,665	240,842
2015	331,012	13,182	14,061	21,435	48,678	282,334

Table 4. Projected Utilization of Health Care Services for Different Medical Insurance Programs

Class/Insurance Program	2000	2005	2010	2015
Inpatient (Total number of hospital day)				
Industrial Workers	13,013,359	14,411,246	15,630,216	16,662,132
Government and Private School Employees	4,470,472	4,981,671	5,429,290	5,810,269
Self Employed	21,934,297	24,804,773	27,716,584	30,060,159
Medical Aid	10,511,452	13,875,822	16,830,557	19,444,903
Total	49,929,580	58,073,512	65,606,647	71,977,463
Ambulatory patient (Total number of visits)				
Industrial Workers	173,117,372	194,017,897	212,352,752	228,031,362
Government and Private School Employees	54,314,387	60,598,287	66,097,836	70,792,552
Self Employed	227,076,727	228,605,534	290,454,269	316,227,626
Medical Aid	19,986,904	24,261,321	27,994,604	31,238,022
Total	474,495,389	537,483,039	596,899,461	646,289,562

2004 to 2015. The projected number of supply of nurses until the year 2015 is shown in Table 3. For licensed nurses, 331,012 are projected as needed, but only 282,334 nurses are projected to be available when attrition projections are applied.

2. Demand analysis and projection

Demand for nurses in clinical areas was analyzed in terms of previous health care services utilization as well as nurse productivity. The projected utilization rates of different medical insurance programs are given in Table 4. The number of hospital stay for the participants in the Self-employed Insurance Programs was projected to be higher than that of the Government and Private School Employees Insurance Programs. This finding is plausible due to aging of the population covered by the Self-employed Insurance Programs. Beneficiaries of the Industrial Workers, the Government and Private School Employees Programs will become beneficiaries of the Self-employed Medical Insurance Programs once they retire from the industrial sector, government and private school.

Table 5. Projected Demand for Nurses

Area	2000	2005	2010	2015
Clinical Area				
Present Productivity	86,893	99,858	111,947	122,099
Medical Law, standard	135,050	155,266	174,110	189,939
Optimal Productivity	170,372	196,802	221,359	242,046
Non -Clinical Area				
Public Sector	4,737	4,737	4,737	4,737
School Health	7,563	7,537	7,519	7,505
Industrial Health	7,553	7,873	8,104	8,286
Training Institution	1,633	1,633	1,633	1,633
Administration/Research	596	723	831	925
Health Insurance	636	695	744	787
Social Welfare and Services	1,120	1,221	1,307	1,382
Total	23,838	24,419	24,875	25,255

Table 6. Comparison of Nurse Supply with Demand

Area	2000	2005	2010	2015
Supply				
Available	143,634	194,007	240,842	282,334
Active*	86,180	116,404	144,505	169,400
Demand				
Present productivity	110,731	124,277	136,822	147,354
Medical Law	158,888	179,685	198,985	215,194
Optimal productivity	194,210	221,221	246,234	267,301

*Number of Available Nurses x Employment Rate of Year 1996 (0.60)

The demand for nurses to year 2015 in clinical areas was computed by dividing the projected total amount of health care services utilization by aforementioned three different indices of nurse productivity (See Table 5). The projected demand for nurses in non-clinical areas is 25,255 in the year 2015(See Table 5).

A summary of the supply and demand projections for nurses up to year 2015 is given in Table 6. These projections indicate that the relationship between the supply of nurses and the demand for services is determined in large part by nurse productivity. According to nursing workforce supply and population projections, the ratio of the general population to nurses decreases from 372 in 1985 to 187 by 2015, which is very close to the nursing workforce ratio in the advanced countries (WHO, 1995).

DISCUSSION AND CONCLUSION

According to the present productivity criteria, an over-supply of nurses is projected from 2010. However, the present productivity standard does not allow nurses enough time to provide quality care as pointed out by Chang (1991). Thus, nurses become dissatisfied with work and leave nursing (Kim, 1994). This increased turnover rate lowers the quality of nursing care again. According to Mills and Blaesing (2000) problem of work-related dissatisfaction in nursing when there is a shortage of nurses is found in many countries.

According to the optimal productivity criteria, an under-supply of nurses is projected. However, this projection might not be realistic, given limited health resources in Korea. There is no indication that additional money will be spent on nursing so that the nurse/patient ratio improves. Thus, demand projection for quality nursing care targeted at maintaining nurses at the level prescribed in the Medical Law is more useful.

If Korean health institutions observe the productivity criteria of the Medical Law the supply of available nurses will be slightly over the demand. However, if the future demand based on Medical Law is compared to the number of projected active nurses, that is, the number of nurses projected to be employed in the health sector with the employment rate of year 1996 (60%), there will be a shortage of nurses in the future. The nursing shortage can be remedied in three ways: (a) increasing enrollment in education programs, (b) retaining employed nurses, and c) recruiting inactive, unemployed

nurses into the workforce. Given the fact that the nursing retention rate was only 60 percent in 1996, retaining employed nurses and recruiting inactive and unemployed nurses back to the workplace is less expensive than increasing enrollment in nursing schools. These results indicate that with retaining employed nurses and effective recruitment of unemployed nurses, the current supply of nurses may be adequate to meet future demands.

According to a survey done in 1997 by the Korean Clinical Nurses Association, factors that cause nurses to leave nursing are: family circumstances, child bearing, and child care. Many European countries and the US have nursing shortage problem too, but reasons for the shortage are low pay, a heavy workload, and shift work, which is slightly different from Korea (William, 1999; Mills and Blaesing, 2000). In order to retain and recruit nurses efforts should be made to accommodate these situations by arranging child care, flexible working time or part time work schedules, and special hours to accommodate family requirements. Improved benefits, including salaries and educational grants, are also essential.

The findings of this study are limited by the number of assumptions that we used for our projections, for example, stable enrollments, retirement age and stable age structure. Utilization of a nursing personnel mix could also affect the projections of this study. In Korea small hospitals and clinics tend to hire nurses' aides rather than registered nurses to save money. However, questions about quality of care arise. Analyses are needed to determine whether one registered nurse or several nurse aides are more effective and provide greater utility. Additional cost analysis based on the nursing personnel mix is also needed.

In summary, this research was conducted to project the supply of and demand for nurses in Korea. The findings provide suggestions for analyzing nursing personnel management and planning for the future of health care in the Republic of Korea. This study will provide health care planners and public and private decision-makers with information about the present number of nurses and the needs in the future. Furthermore, this approach will provide the policy makers in the Ministries of Health and Welfare, and Education with information that must be considered in determining the number of students to be admitted to nursing programs.

Acknowledgements

The authors would like to thank Mariah Snyder and Miriam Cameron for their editorial contribution.

References

- Chang, H.S. (1991). *Measurement of nursing workload based on patient's demand for nursing care demand in a tertiary hospital*. MS Thesis submitted to Seoul National University.
- Chang, H.S. (1991). *Computation of optimal productivity based on patient classification*. Korean Clinical Nurses Association.
- Bui Dang Ha Doan. (1981). Projection of supply and requirements of health manpower with particular reference to primary health care manpower. *World Health Statistics Quarterly*, 34(2), 74-90.
- Horbach L. (1979). Techniques for computation of demographic projections of health manpower. *World Health Statistics Quarterly*, 32(2), 106-114.
- Kim, E.S., Cho, W.J., Cho W.H., Lee, C.Y., Ko, I.S., Jee, S.H., Chung, N.S., & Shon, T.Y. (1991). *Long term and short term public health manpower planning - nurses, nurse aides, pharmacists, medical technicians*. Korea Institute of Health and Social Affairs.
- Kim, Y.M. (1994). *A Study on the intention and behavior of nurse turnover*. MS Thesis submitted to Seoul National University.
- Korean Clinical Nurses Association. (1997). *Annual report of 1997*. Korean Clinical Nurses Association
- Korea Medical Insurance Corporation (KMIC). (1998). *Statistics on medical aid*. Korean Medical Insurance Corporation
- Korean Nurses Association. (1998). *Survey of nursing education*. Korean Nurses Association.
- Mills, A.C., & Blaesing, S.L. (2000). A lesson from the last nursing shortage: the influence of work value on career satisfaction with nursing. *Journal of Nursing Administration*, 30(6), 309-315
- Ministry of Education. (1998). *Yearbook of educational statistics*. Ministry of Education.
- Ministry of Health and Welfare. (1994). *1992 Survey for inpatients and ambulatory patients*. Ministry of Health and Welfare.
- Ministry of Health and Welfare. (1980-1998). *Yearbook of health and welfare statistics*. Ministry of Health and Welfare.
- National Federation of Medical Insurance. (1990~1997). *Medical insurance statistical yearbook*. National Federation of Medical Insurance.
- National Statistical Office. (1995). *Year of 1995 life table*. National Statistical Office.
- National Statistical Office. (1996). *Projection of future population*. National Statistical Office.
- Park, H.A. (1999). Research on nursing manpower demand and supply projection, *The Korean Nurse*, 38(1), 51-70.
- Park, J.H., Joe, H., Park, H.A. & Han, H.R. (1995). Measurement of the nursing workload by patient classification system in a secondary hospital. *Journal of Korean Academic Society for Nursing Management*, 1(1), 132-145.
- Song, K.H., Kim, S.C., & Kim, Y.I. (1986). *Research on long-term planning of health manpower*, Korea Institute for Population and Health.
- Williams, S. (1999). Crises on the European front. *Nursing Standard*, 13(33), 22-23.
- WHO. (1995). *1994 World Health Statistics Annual*. WHO.