

Nursing Demand Projections

Introduction and Executive Summary

This report was prepared for the Tennessee Healthcare Consortium on Nursing. The report shows demand for Registered Nurses in Tennessee involved in patient care in a variety of practice areas. Nursing demand is forecasted for the years 1999 – 2020.

The base model used was the Nurse Demand Based Requirements Forecasting Model, produced by the Division of Nursing, Bureau of Health Professions, Health Resources and Services Administration, U.S. Dept. of Health and Human Services.¹ The model used 1991 data to predict the demand for nurses from 1991-2020. In this study, the data was updated using the most recent data sources to result in the most accurate demand forecast possible.

The data shows that the need for registered nurses rises from 33,000 in 1999 up to about 46,000 in 2020, an increase of over 38%. The demand for registered nurses in the hospital setting rises by 28%, or over 6,000 FTEs. Complete results are shown in Table 3.

There are two significant limitations to the model. First, the demand for registered nurses in non-patient care areas (i.e., insurance, administration) is not projected. The second limitation is that the model cannot take into account the rapidly changing environment of healthcare (*see discussion on home health care in the results section*), so unforeseen changes may alter the need for nursing personnel, especially over the longer term.

Overall, this forecast, which uses an accepted forecasting model and the most recent valid data available, provides a well grounded, realistic estimation of the number of registered nurses needed in Tennessee over the next two decades.

¹ The computer based model, software, and documentation is available from the National Technical Information Service, Springfield, VA 22151. <http://www.ntis.gov>.

Methodology

Nurse Demand Based Requirements Forecasting Model

The Division of Nursing of the Bureau of Health Professions began modeling nursing demand in the early 1970's. Several iterations of demand models and analyses were presented over the next two and a half decades. The Nursing Demand Based Requirements Forecasting Model (NDBRFM), completed in 1997, builds upon previous models and incorporates their advances as well as new innovations in computer technology.

The NDBRFM is a PC computer based software program that calculates the demand for nurses. The program comes with 1991 data for each state² and the ability to run projections and reports 'out of the box' with the packaged data. One of the goals of the NDBRFM project was to allow users the ability to change the baseline data and run new projections based upon the updated information.

NDBRFM Analytical Procedure

At its most basic level, the NDBRFM model predicts the demand for nurses based on the state population, the per capita demand for health services, and the utilization per service of the services supported by nursing personnel.³ The model breaks down nursing demand into thirteen categories:

Short-term hospital inpatient	Home Health Care
Short-term hospital outpatient	Occupational Health Care
Short-term hospital emergency room	School Health
Long-term/Psychiatric/Other hospital	Public Health
Nursing Homes	Nursing Education Programs
Board and Care Homes	Other Nursing Employment
Ambulatory Care (non-institutional)	

The demand for each category of nurses is influenced by demographic and socioeconomic forces of the population it serves. The user may input various scenarios by changing the data in the input files. However, the user cannot change the analytic

² Although the baseline year was 1991, different data sources had different years of collection, from 1989-1995. Original data sources include: AHA Annual Survey of Hospitals; U.S. Census Population Survey (and projections); National Health Interview Survey; National Ambulatory Medical Survey; National Health Provider Inventory; Bureau of Economic Analysis, Regional Projections; CBO, Economic Outlooks; National League for Nursing, Educational Program Statistics; Division of Nursing, Educational Projections.

³ A complete description of the analytical model is available in the manual that accompanies the software.

process used by the program that manipulates the input files and produces the projections.

NDBRFM Model Input Files

The purpose of this report was to update the input files for the NDBRFM with the most recent data available, then run the model and produce projections for the next twenty years. In each case, 1999 was moved to the first position in the file, so the baseline for the projections was 1999. The following describes the process and data used to replace the input data in various input files.

Population File

Population files were updated using U.S. Census Bureau projections for Tennessee. The projections began with 1999 data. The data are broken out by age group, sex, and year.

Benchmark Service File

The benchmark service data files contained information for utilization by health care sector. For benchmark service data files, information was substituted from current data. Short term and other hospital utilization was determined for 1999 from the Joint Annual Report of Hospitals. Likewise, home health and nursing home data were gathered from their respective Joint Annual Reports for the most recent year.

Updated data on primary care, Obstetrical/Gynecological, and non-primary care ambulatory visits was not available on a state by state basis. The National Ambulatory Medical Care Survey: 1998 Summary⁴ was used to calculate the percent increase from 1991 to 1998 data for the U.S. for these visits. This percent increase was applied to the Tennessee 1991 figures to estimate the value for 1998. School health visits, occupational health visits, and public health visits were not available for Tennessee. The projections to 1999 for the number of visits created by the model using the 1991 data were used for 1999.

Nurse Manpower Data File

Updated nursing manpower information came from a number of sources. The Joint Annual Report of Hospitals was used for short-term and other hospital

⁴ Advance Data, No. 315, July 19, 2000. [National Ambulatory Medical Care Survey: 1998 Summary](#)

information⁵. The breakdown of nurses by department (inpatient, outpatient, and emergency) was required by the model, but not available in the Joint Annual Report. So the ratio of departmental RNs to total RNs from the model data for the 1991 data was applied to the 1999 data to approximate the number of RNs in each department.

The Joint Annual report of Nursing homes was used for nursing home RNs, LPNs and nursing assistants. The Joint Annual Report of Home Health Agencies was also used for home health categories of nursing.

The final source of data was the March 2001 License file for RNs and LPNs. This file was used for other areas of nursing employment, including Board and Care homes, Ambulatory care, Occupational, Student, and Public Health. Nurses that reported working part-time were counted as half a full time employee. The other patient care category included nurses reporting as private duty and hospice.

Table 1. Data Sources for Nursing Manpower Files*

<u>Area</u>	<u>RNs</u>	<u>LPNs</u>	<u>Nursing Assistants</u>	
ST Hospital- IP ST Hospital- OP ST Hospital- ED	19,413 1,327 664	4,591	7,177	Joint Annual Report data. A breakdown by department was not available, so the ratios in the original file were used to estimate the number of RNs working in each department
Psych/LT/Other Hospitals	1,170	401	1,332	Joint Annual Report data.
Nursing Homes	2,420	5,343	13,390	Joint Annual Report data.
Board and Care Homes	88	269	330	Nursing License file for RNs and LPNs. The model's 1991 numbers were used for NAs.
Ambulatory Care	3,565			Nursing License file. Includes RNs reported in ambulatory care and physician's offices.
Home Health	1,858	775	61	Joint Annual Report Data.
Occupational Health	756			Nursing License file for RNs.
Student Health	415			Nursing License file for RNs.
Public Health	957			Nursing License file for RNs.
Nursing Education	579			Nursing License file for RNs.
Other Care	412			Nursing License file for RNs. Includes Private Duty and Hospice.

*Areas with blanks (Public Health LPNs, for example) were not needed by the model.

⁵ The Tennessee nurse license files did not distinguish between short-term, long-term, and psychiatric hospitals. Using Joint Annual Report data allowed for the distinctions required in the model.

Other Files

There were several other input files used by the model. Most of these were left unchanged, except for moving the 1999 projections up to the base year position, if there was a projection. One such file was a change limit file, which limited the amount the model could increase or decrease the number of nurses needed in one year. Another file estimated the per capita utilization rate based on the General Services Demand Model, a previous study of utilization.

The Tennessee State Projection Data file #2 contained socio-economic data and projections which were poorly documented or beyond the scope of this project.⁶ The 1999 projections were moved up to the 1991 position. Although the impact of these factors was minor since the increases from year to year were negligible or non-existent, updated sources for the data would have resulted in a stronger study.⁷

Building the Model

Once all the data files were updated with new data and the starting year for all the data was set to the 1999 year, the model was started and the output files were produced. For comparative purposes, the original model was also run.

⁶ For example, one of the data points was the percentage of those employed who are working in the manufacturing industries, 1991-2020. Another was the percent change in real per capita income relative to that of the previous year. The initial data in this file showed no or small increases in the values, which would result in little impact on the final projections.

⁷ One exception was the managed care index, which was undocumented, but predicted a four-fold increase over a twenty-year period.

Results

Table 2 shows the overall demand for registered nurses over the period 1999-2020. Table 3 shows results by practice area. Overall, a steady increase is seen in the demand for nurses, although some areas were more notable than others.

Figure 1 shows the total percent increase for each practice area over the entire study period. Figures 2-4 show the percent of RNs in each practice area for the years 1999, 2010, and 2020. Table 4 presents the percentages for all years. Table 5 shows the percent increase each year. The steady increase in demand is fueled by increases in population and other factors such as per capita utilization and demographic characteristics. The results for each sector are analyzed individually.

One major shortcoming of the study was that the model did not look at the demand for non-patient care RNs. Insurance, administrative, and other positions outside of patient care utilize 24% of RNs in Tennessee. The question of whether this percentage will be increasing or decreasing in the future remains to be answered.

Table 2. Percent increase in demand for Tennessee RNs, 2000-2020

<u>Year</u>	<u>Percent Change</u>	<u>Year</u>	<u>Percent Change</u>
2000	1.81%	2011	1.29%
2001	1.59%	2012	1.70%
2002	1.48%	2013	1.36%
2003	1.45%	2014	1.36%
2004	1.42%	2015	1.39%
2005	1.43%	2016	1.33%
2006	1.91%	2017	1.35%
2007	1.90%	2018	1.30%
2008	2.00%	2019	1.41%
2009	1.79%	2020	1.50%
2010	1.67%		

Short Term Hospitals

Figure 5 shows data for the growth in short term hospital RN demand. The data closely follow the results that were seen using the original data model for the period 1991-2000. However, a slightly greater demand is shown during the later years of the projections.

The updated data did not have breakouts by inpatient, outpatient, and emergency room RNs, so approximations were used. Overall, however, the numbers represent the total number of short term hospital employed RNs. Another shortcoming of the study was that it used a managed care index (and projections of that index) as a variable in determining the demand for RNs in short term hospitals. The index was not defined, so it could not be updated with current data and projections.

Long Term, Psychiatric, and Other Hospitals

Figure 6 shows data for the growth in long term, psychiatric, and other hospitals. The updated data used for the study was a great improvement over the data in the original dataset. The original data overestimated the number of RNs in these hospitals by about three thousand FTEs. The new data corrects for this problem by using actual number of RNs in this setting.

The data show about a two percent increase each year through 2005, then a slower growth rate. The logic behind the model assumes that as the population's longevity increases less long-term hospital care and more acute care will be needed. Thus, as the population over 65 increases, the rate of growth in the demand for RNs in the long term and psychiatric hospital setting does not increase as rapidly.

Nursing Homes

The demand for RNs in the nursing home setting shows a steady percentage increase each year of between 7 and 8.2 percent. The factors included in the analysis of the demand for nursing are population, financial outlook of the population, and health care coverage. A graph of the data is presented in Figure 7.

Board and Care

RNs in board and care homes were included in the study, but the authors of the study stated that a coherent model could not be constructed, resulting in only nominal changes to the RN demand over the period studied. Figure 8 shows data for this area. With increases in assisted living facilities and homes for the aged, an increase in the demand for board and care nurses in Tennessee should be expected.

Ambulatory Care (non-institutional)

Graphic data for ambulatory care RN demand is presented in Figure 9. Ambulatory care shows the greatest regular percentage increase (averaging over 9%). Population and age seem to be the greatest factors in the rise.

Home Health Agencies

The data for home health agencies, like the data for long-term, psychiatric, and other hospitals, was reduced from the study's 1991 estimates. During the 1980's and early 1990's, home health care was booming due to payment rates by Medicare and other payers. In the mid and late 1990's, payment and services were more restrictive, resulting in lower utilization of RNs and a decreased number of home health visits.

However, home health RN's showed the steepest increase across the projection years. Some of this is due to an increase in aging among the population and a move to treat patients in the least restrictive, lowest cost setting, but there may be a factor built into the model that causes the perceived demand for RNs to rise at a more rapid rate than would be expected under current reimbursement and utilization guidelines. The data is presented graphically in Figure 10.

Occupational Health, School Health, Public Health, Nursing Education, and Other

The data for these three areas was only updated as to the number of RNs in 1999. In other areas, the utilization of the services was also updated. A small, but steady increase in each of these areas is seen over the study period. Results are presented graphically in figures 11-15.

Table 3. Tennessee RN Demand, 1999 –2020

Year	Hospitals				Nursing Homes	Board and Care	Ambulatory Care	Home Health	Occupational Health	School Health	Public Health	Nursing Education	Other Care	Total
	Short Term General IP	Short Term General OP	Short Term General ER	Long Term, Psychiatric, Other										
1999	19,413	1,327	664	1,170	2,420	88	3,293	1,858	693	415	957	579	415	33,292
2000	19,684	1,358	686	1,201	2,471	89	3,362	1,930	705	418	971	585	435	33,895
2001	19,906	1,379	716	1,229	2,514	91	3,423	2,005	726	421	982	588	454	34,434
2002	20,114	1,412	741	1,256	2,555	92	3,481	2,082	738	423	991	584	474	34,943
2003	20,324	1,444	763	1,282	2,599	93	3,537	2,166	750	425	999	574	494	35,450
2004	20,523	1,475	786	1,308	2,644	94	3,590	2,251	763	426	1,004	575	515	35,954
2005	20,713	1,506	810	1,334	2,689	96	3,642	2,340	775	427	1,008	593	535	36,468
2006	21,011	1,525	835	1,356	2,754	98	3,687	2,495	799	426	1,021	601	556	37,164
2007	21,325	1,555	858	1,379	2,818	99	3,729	2,658	814	426	1,032	601	576	37,870
2008	21,692	1,582	880	1,400	2,885	102	3,767	2,838	832	424	1,039	591	597	38,629
2009	21,989	1,610	904	1,421	2,944	105	3,801	3,013	848	422	1,047	598	617	39,319
2010	22,226	1,637	926	1,442	3,004	107	3,834	3,198	863	419	1,056	624	638	39,974
2011	22,368	1,651	960	1,461	3,051	109	3,860	3,384	880	416	1,065	628	657	40,490
2012	22,708	1,669	968	1,479	3,141	114	3,887	3,535	906	414	1,059	621	676	41,177
2013	22,979	1,687	977	1,498	3,221	118	3,912	3,654	929	412	1,057	597	694	41,735
2014	23,239	1,705	985	1,517	3,293	122	3,936	3,775	951	412	1,056	599	711	42,301
2015	23,498	1,724	993	1,535	3,365	126	3,959	3,898	973	412	1,055	622	728	42,888
2016	23,755	1,743	1,002	1,554	3,440	129	3,980	4,028	995	412	1,061	617	743	43,459
2017	24,032	1,758	1,010	1,573	3,515	134	4,002	4,173	1,018	414	1,057	603	758	44,047
2018	24,303	1,769	1,020	1,591	3,588	138	4,022	4,343	1,041	416	1,053	562	772	44,618
2019	24,592	1,780	1,029	1,610	3,662	143	4,042	4,508	1,065	419	1,048	564	786	45,248
2020	24,890	1,790	1,038	1,628	3,750	147	4,060	4,673	1,089	421	1,043	600	799	45,928

Table 4. Percent change from previous year in Tennessee RNs by practice area, 2000 – 2020

Year	Hospitals													
	Short Term General IP	Short Term General OP	Short Term General ER	Short Term General, All	Long Term, Psychiatric, Other	Nursing Homes	Board and Care	Ambulatory Care	Home Health	Occupational Health	School Health	Public Health	Nursing Education	Other Care
2000	1.40%	2.34%	3.31%	1.51%	2.65%	2.11%	1.14%	2.10%	3.88%	1.73%	0.72%	1.46%	1.04%	4.82%
2001	1.13%	1.55%	4.37%	1.26%	2.33%	1.74%	2.25%	1.81%	3.89%	2.98%	0.72%	1.13%	0.51%	4.37%
2002	1.04%	2.39%	3.49%	1.21%	2.20%	1.63%	1.10%	1.69%	3.84%	1.65%	0.48%	0.92%	-0.68%	4.41%
2003	1.04%	2.27%	2.97%	1.19%	2.07%	1.72%	1.09%	1.61%	4.03%	1.63%	0.47%	0.81%	-1.71%	4.22%
2004	0.98%	2.15%	3.01%	1.12%	2.03%	1.73%	1.08%	1.50%	3.92%	1.73%	0.24%	0.50%	0.17%	4.25%
2005	0.93%	2.10%	3.05%	1.08%	1.99%	1.70%	2.13%	1.45%	3.95%	1.57%	0.23%	0.40%	3.13%	3.88%
2006	1.44%	1.26%	3.09%	1.49%	1.65%	2.42%	2.08%	1.24%	6.62%	3.10%	-0.23%	1.29%	1.35%	3.93%
2007	1.49%	1.97%	2.75%	1.57%	1.70%	2.32%	1.02%	1.14%	6.53%	1.88%	0.00%	1.08%	0.00%	3.60%
2008	1.72%	1.74%	2.56%	1.75%	1.52%	2.38%	3.03%	1.02%	6.77%	2.21%	-0.47%	0.68%	-1.66%	3.65%
2009	1.37%	1.77%	2.73%	1.44%	1.50%	2.05%	2.94%	0.90%	6.17%	1.92%	-0.47%	0.77%	1.18%	3.35%
2010	1.08%	1.68%	2.43%	1.17%	1.48%	2.04%	1.90%	0.87%	6.14%	1.77%	-0.71%	0.86%	4.35%	3.40%
2011	0.64%	0.86%	3.67%	0.77%	1.32%	1.56%	1.87%	0.68%	5.82%	1.97%	-0.72%	0.85%	0.64%	2.98%
2012	1.52%	1.09%	0.83%	1.47%	1.23%	2.95%	4.59%	0.70%	4.46%	2.95%	-0.48%	-0.56%	-1.11%	2.89%
2013	1.19%	1.08%	0.93%	1.18%	1.28%	2.55%	3.51%	0.64%	3.37%	2.54%	-0.48%	-0.19%	-3.86%	2.66%
2014	1.13%	1.07%	0.82%	1.12%	1.27%	2.24%	3.39%	0.61%	3.31%	2.37%	0.00%	-0.09%	0.34%	2.45%
2015	1.11%	1.11%	0.81%	1.10%	1.19%	2.19%	3.28%	0.58%	3.26%	2.31%	0.00%	-0.09%	3.84%	2.39%
2016	1.09%	1.10%	0.91%	1.09%	1.24%	2.23%	2.38%	0.53%	3.34%	2.26%	0.00%	0.57%	-0.80%	2.06%
2017	1.17%	0.86%	0.80%	1.13%	1.22%	2.18%	3.88%	0.55%	3.60%	2.31%	0.49%	-0.38%	-2.27%	2.02%
2018	1.13%	0.63%	0.99%	1.09%	1.14%	2.08%	2.99%	0.50%	4.07%	2.26%	0.48%	-0.38%	-6.80%	1.85%
2019	1.19%	0.62%	0.88%	1.14%	1.19%	2.06%	3.62%	0.50%	3.80%	2.31%	0.72%	-0.47%	0.36%	1.81%
2020	1.21%	0.56%	0.87%	1.16%	1.12%	2.40%	2.80%	0.45%	3.66%	2.25%	0.48%	-0.48%	6.38%	1.65%

Table 5. Tennessee RNs, percent by practice area, 1999 –2020

Year	Hospitals				Nursing Homes	Board and Care	Ambulatory Care	Home Health	Occupational Health	School Health	Public Health	Nursing Education	Other Care
	Short Term General IP	Short Term General OP	Short Term General ER	Long Term, Psychiatric, Other									
1999	58.3%	4.0%	2.0%	3.5%	7.3%	0.3%	9.9%	5.6%	2.1%	1.2%	2.9%	1.7%	1.2%
2000	58.1%	4.0%	2.0%	3.5%	7.3%	0.3%	9.9%	5.7%	2.1%	1.2%	2.9%	1.7%	1.3%
2001	57.8%	4.0%	2.1%	3.6%	7.3%	0.3%	9.9%	5.8%	2.1%	1.2%	2.9%	1.7%	1.3%
2002	57.6%	4.0%	2.1%	3.6%	7.3%	0.3%	10.0%	6.0%	2.1%	1.2%	2.8%	1.7%	1.4%
2003	57.3%	4.1%	2.2%	3.6%	7.3%	0.3%	10.0%	6.1%	2.1%	1.2%	2.8%	1.6%	1.4%
2004	57.1%	4.1%	2.2%	3.6%	7.4%	0.3%	10.0%	6.3%	2.1%	1.2%	2.8%	1.6%	1.4%
2005	56.8%	4.1%	2.2%	3.7%	7.4%	0.3%	10.0%	6.4%	2.1%	1.2%	2.8%	1.6%	1.5%
2006	56.5%	4.1%	2.2%	3.6%	7.4%	0.3%	9.9%	6.7%	2.1%	1.1%	2.7%	1.6%	1.5%
2007	56.3%	4.1%	2.3%	3.6%	7.4%	0.3%	9.8%	7.0%	2.1%	1.1%	2.7%	1.6%	1.5%
2008	56.2%	4.1%	2.3%	3.6%	7.5%	0.3%	9.8%	7.3%	2.2%	1.1%	2.7%	1.5%	1.5%
2009	55.9%	4.1%	2.3%	3.6%	7.5%	0.3%	9.7%	7.7%	2.2%	1.1%	2.7%	1.5%	1.6%
2010	55.6%	4.1%	2.3%	3.6%	7.5%	0.3%	9.6%	8.0%	2.2%	1.0%	2.6%	1.6%	1.6%
2011	55.2%	4.1%	2.4%	3.6%	7.5%	0.3%	9.5%	8.4%	2.2%	1.0%	2.6%	1.6%	1.6%
2012	55.1%	4.1%	2.4%	3.6%	7.6%	0.3%	9.4%	8.6%	2.2%	1.0%	2.6%	1.5%	1.6%
2013	55.1%	4.0%	2.3%	3.6%	7.7%	0.3%	9.4%	8.8%	2.2%	1.0%	2.5%	1.4%	1.7%
2014	54.9%	4.0%	2.3%	3.6%	7.8%	0.3%	9.3%	8.9%	2.2%	1.0%	2.5%	1.4%	1.7%
2015	54.8%	4.0%	2.3%	3.6%	7.8%	0.3%	9.2%	9.1%	2.3%	1.0%	2.5%	1.5%	1.7%
2016	54.7%	4.0%	2.3%	3.6%	7.9%	0.3%	9.2%	9.3%	2.3%	0.9%	2.4%	1.4%	1.7%
2017	54.6%	4.0%	2.3%	3.6%	8.0%	0.3%	9.1%	9.5%	2.3%	0.9%	2.4%	1.4%	1.7%
2018	54.5%	4.0%	2.3%	3.6%	8.0%	0.3%	9.0%	9.7%	2.3%	0.9%	2.4%	1.3%	1.7%
2019	54.3%	3.9%	2.3%	3.6%	8.1%	0.3%	8.9%	10.0%	2.4%	0.9%	2.3%	1.2%	1.7%
2020	54.2%	3.9%	2.3%	3.5%	8.2%	0.3%	8.8%	10.2%	2.4%	0.9%	2.3%	1.3%	1.7%

Figure 1. Total percent change in nursing by practice area from 1999-2020

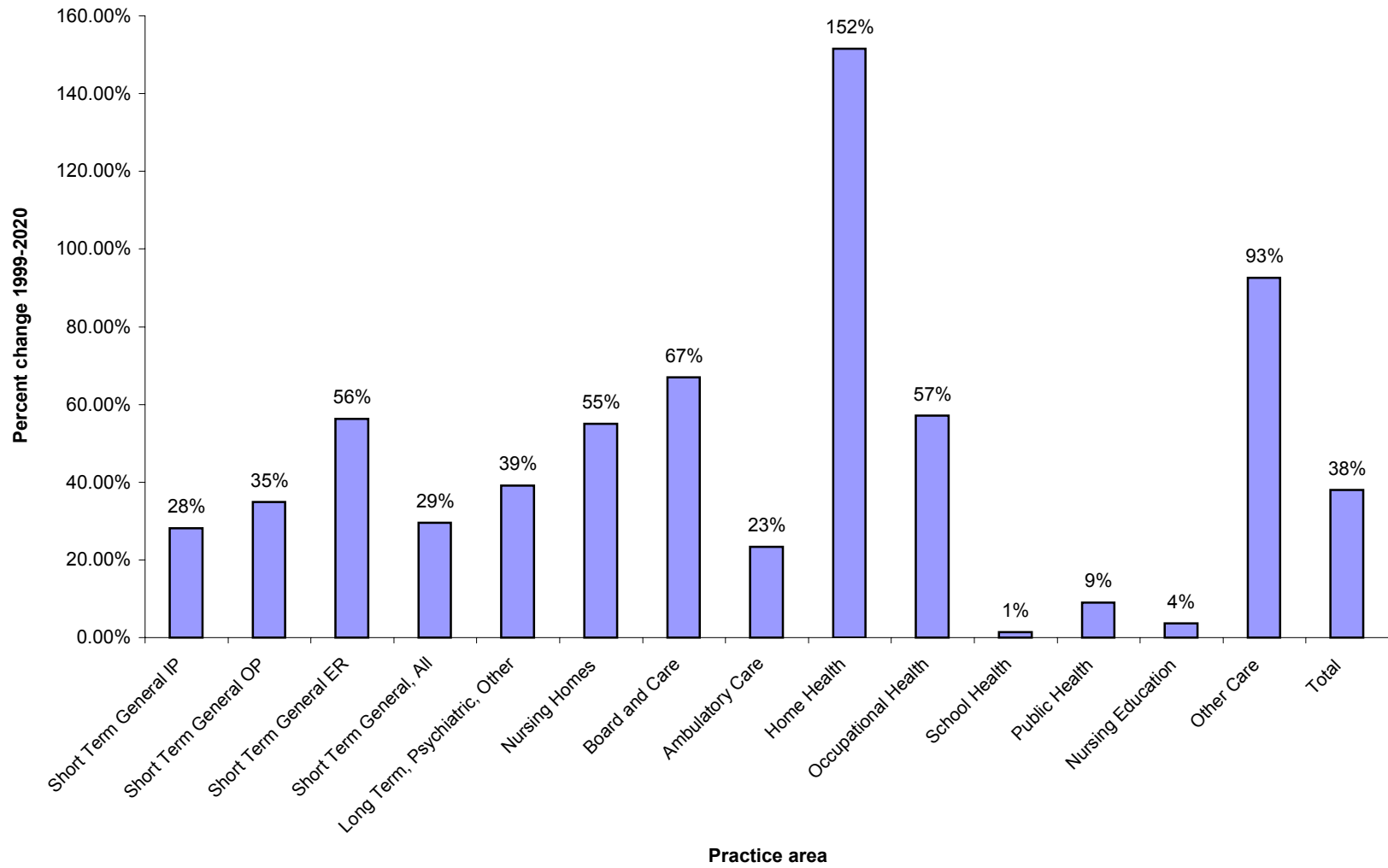


Figure 2. Percent of RNs by practice area, 1999

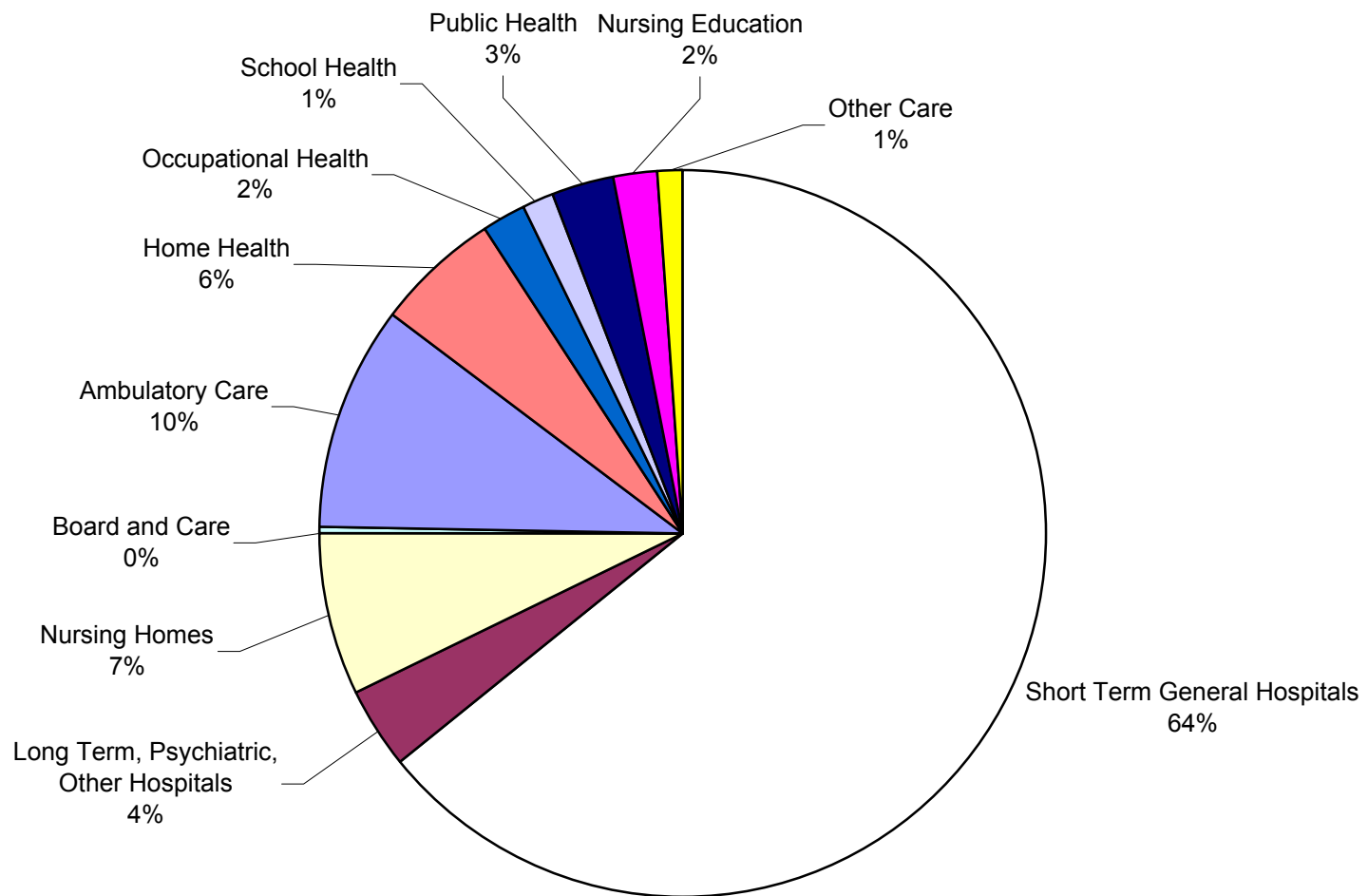


Figure 3. Percent of RNs by practice area, 2010

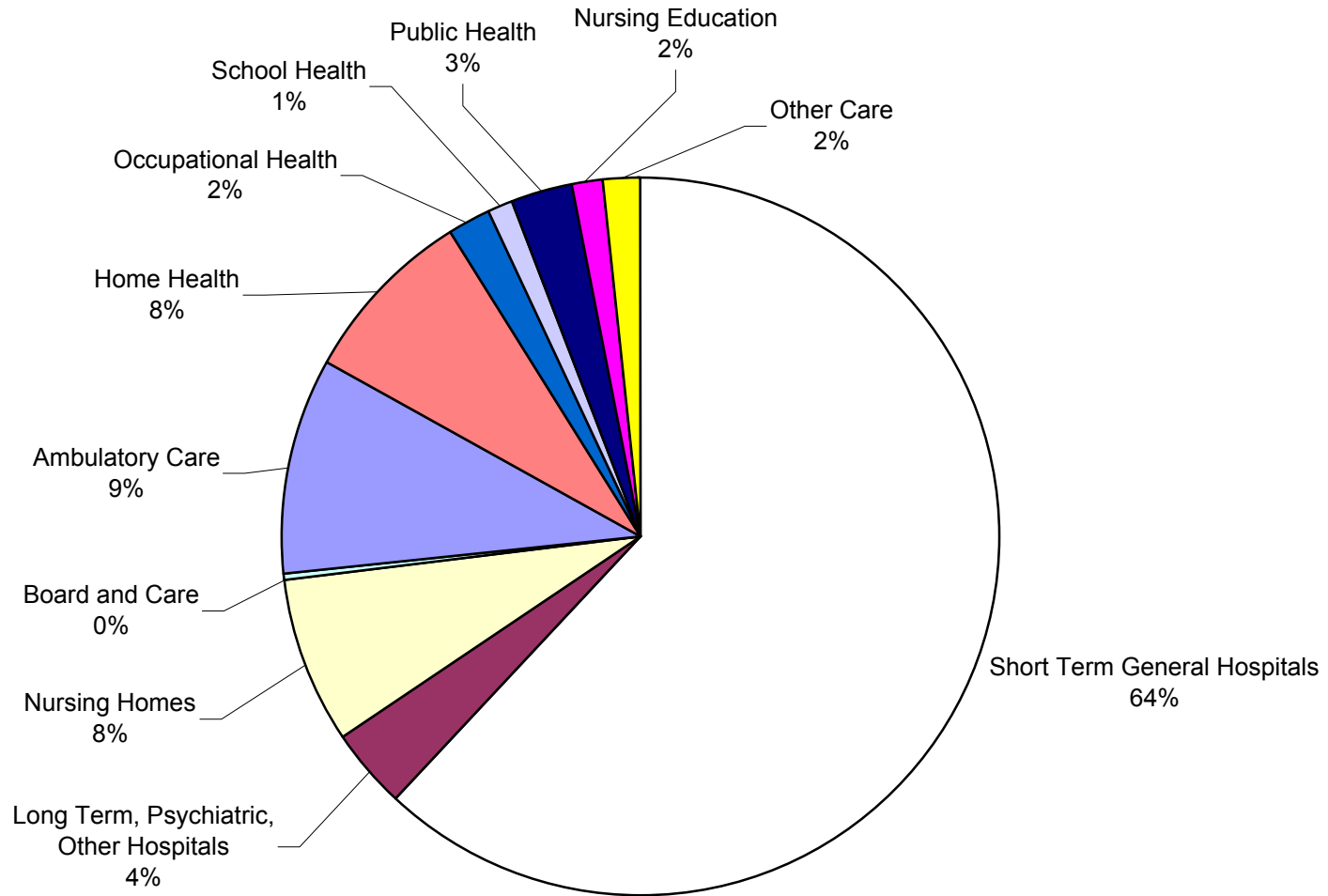


Figure 4. Percent of RNs by practice area, 2020

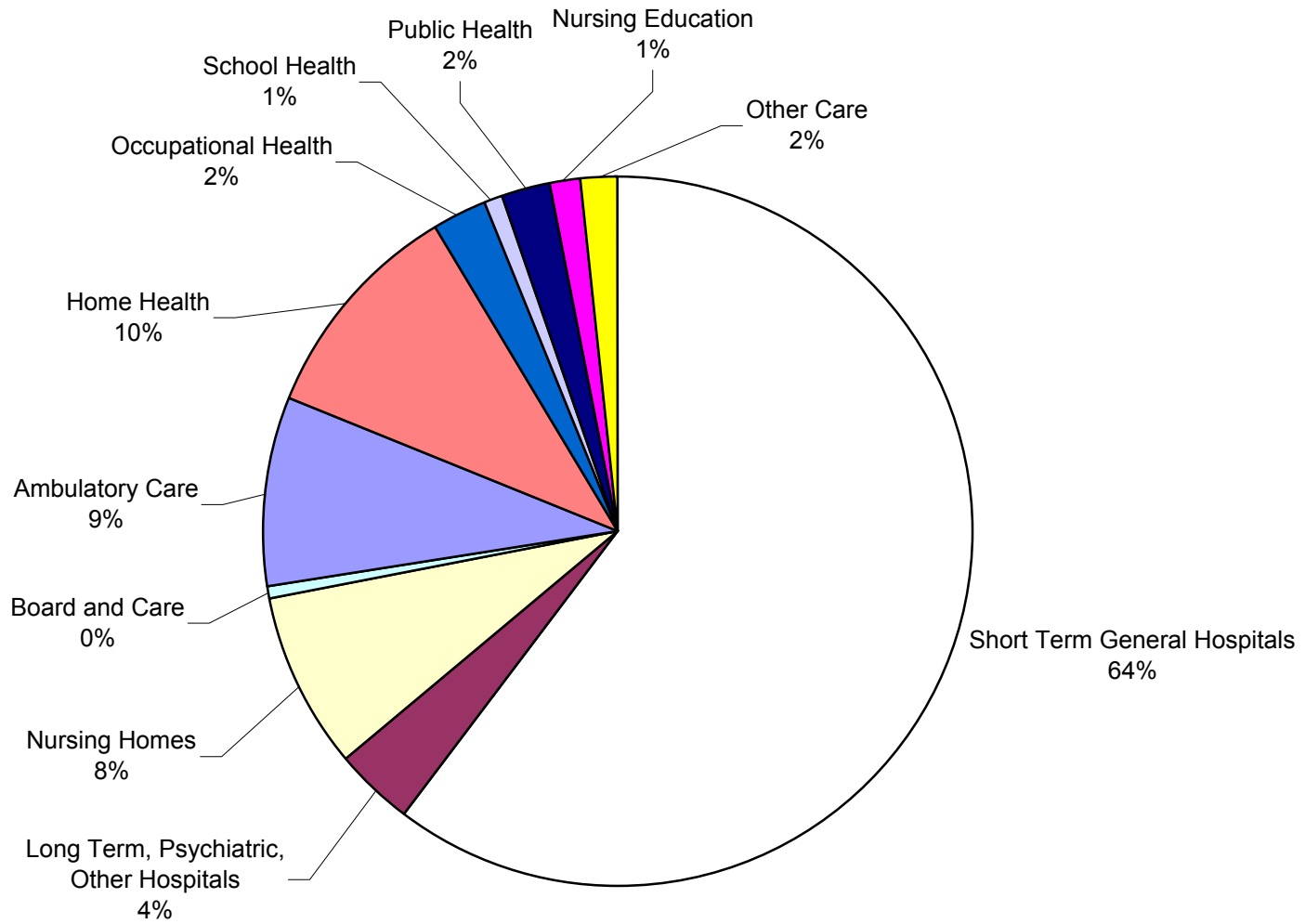


Figure 5. Short term hospital RN demand, 1999-2020



Figure 6. Psychiatric hospital RN demand, 1999-2020

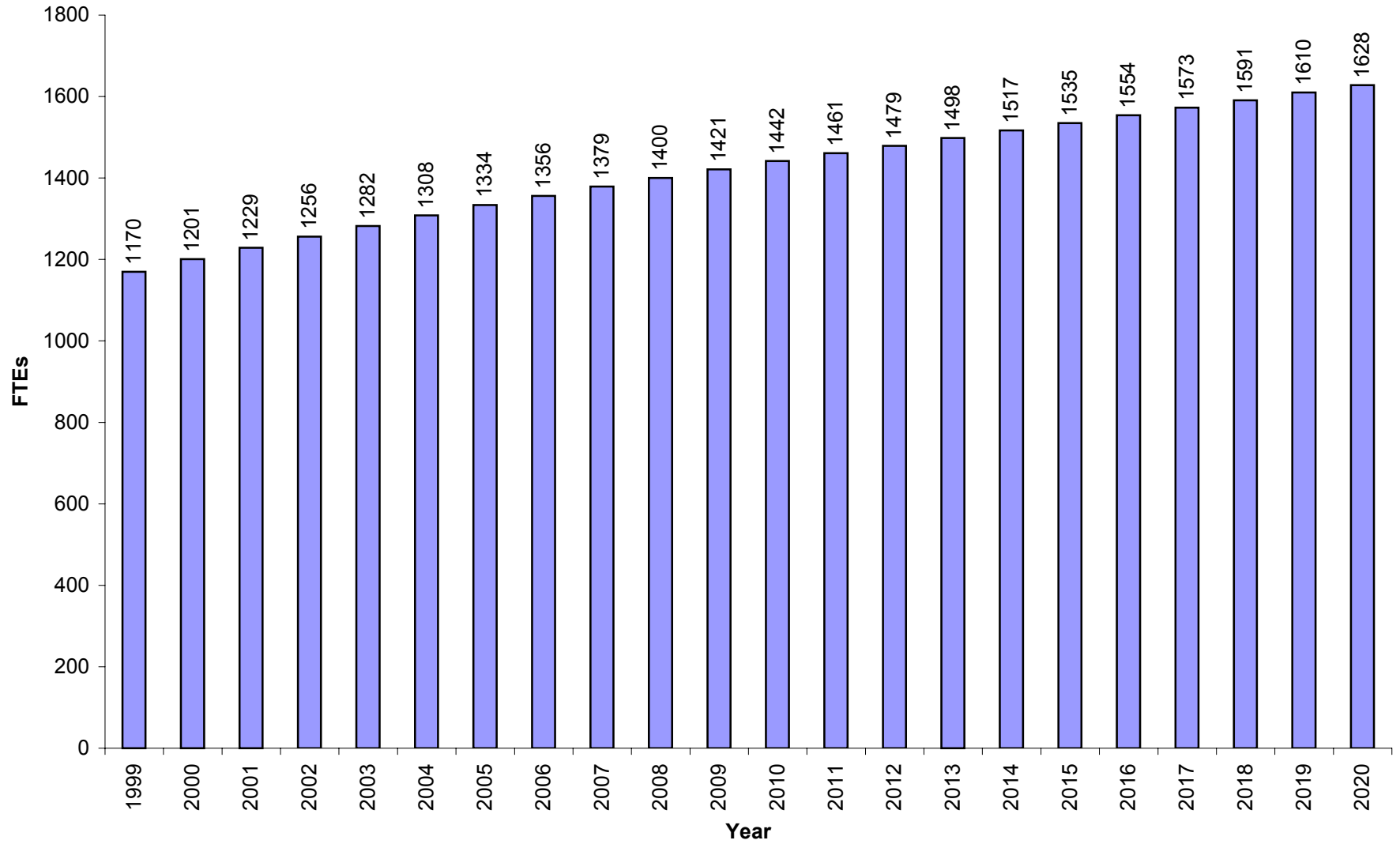


Figure 7. Nursing home RN demand, 1999-2020

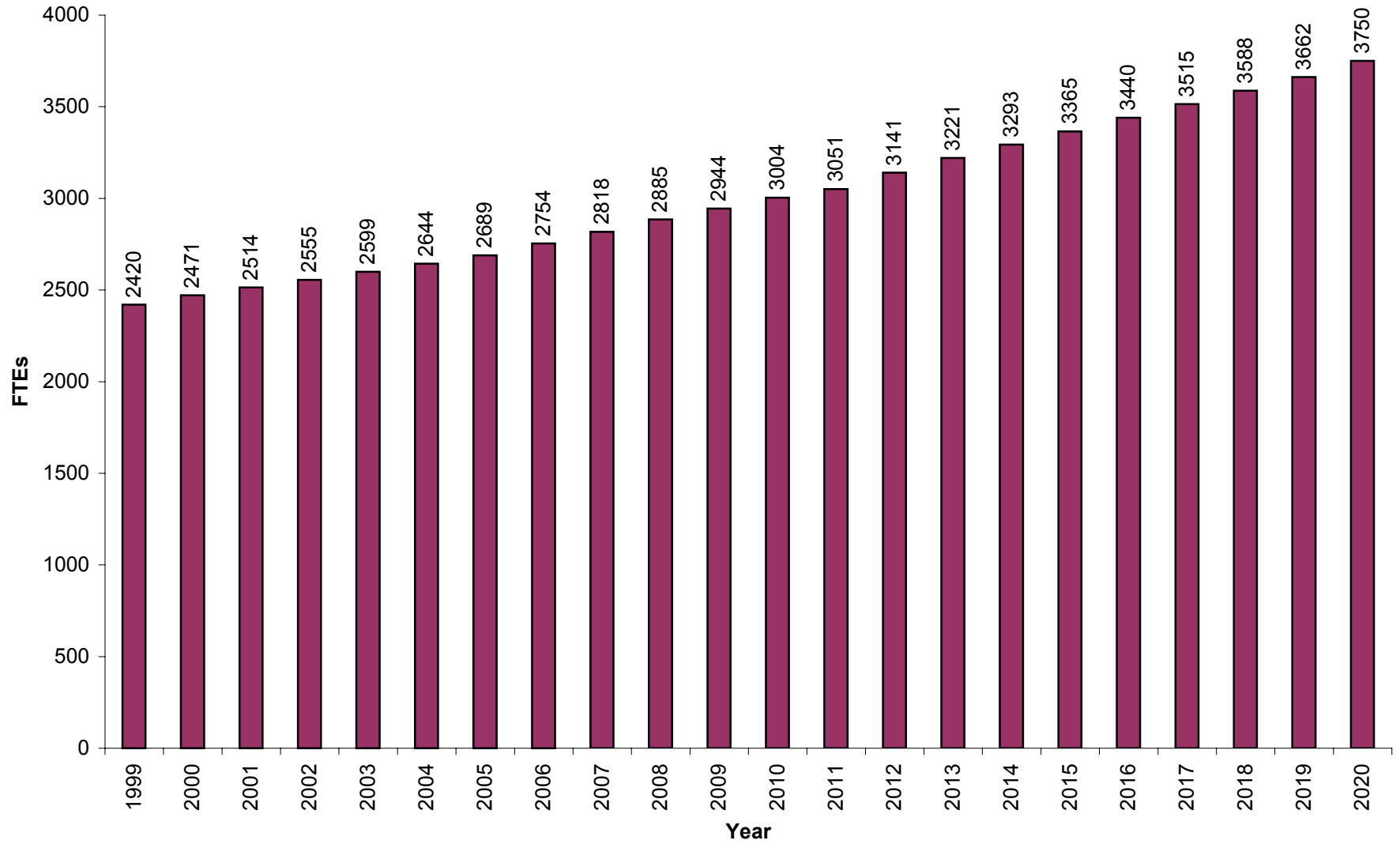


Figure 8. Board and Care RN demand, 1999-2020

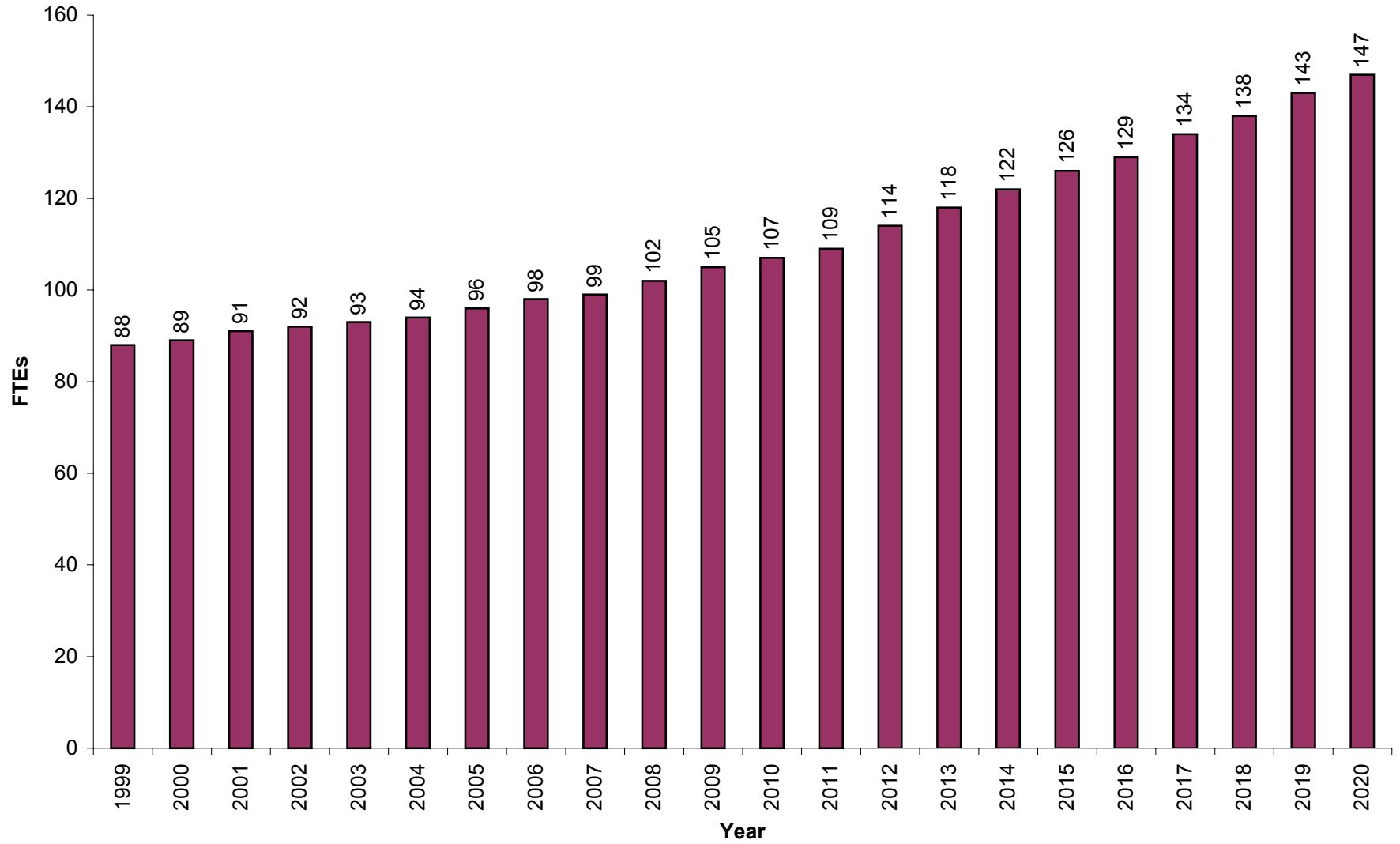


Figure 9. Ambulatory Care RN demand, 1999-2020

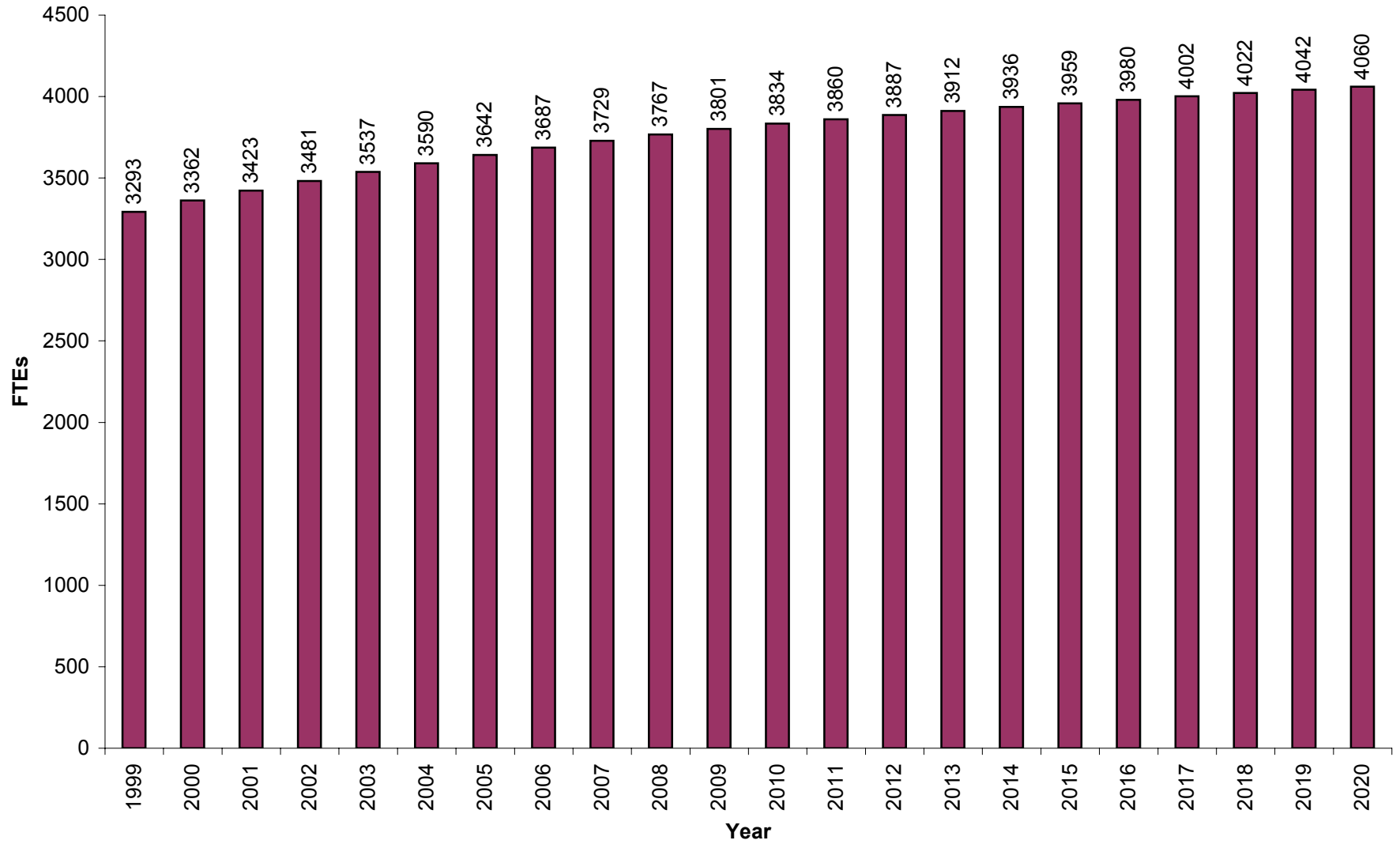


Figure 10. Home Health Care RN demand, 1999-2020

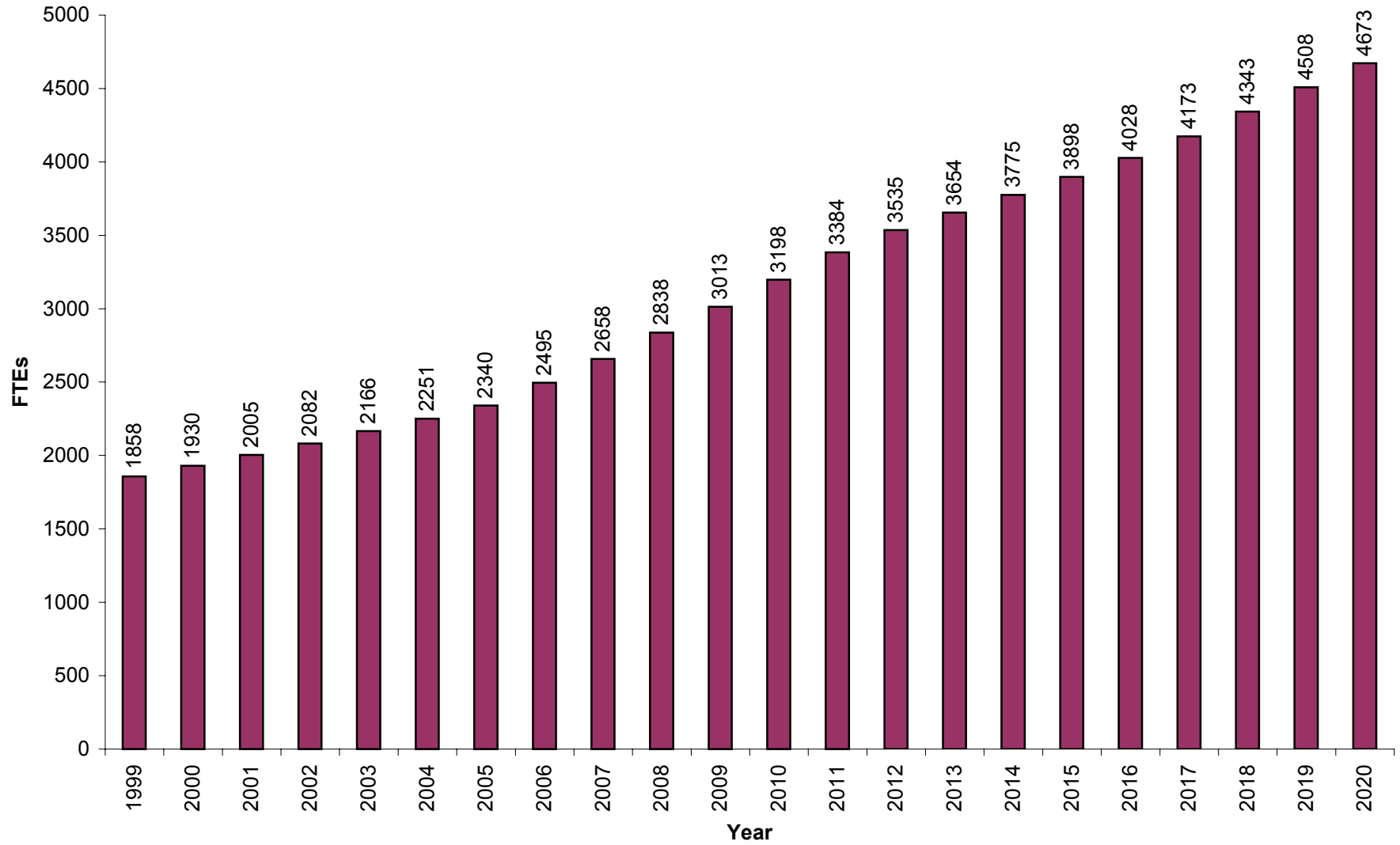


Figure 11. Occupational Health Care RN demand, 1999-2020

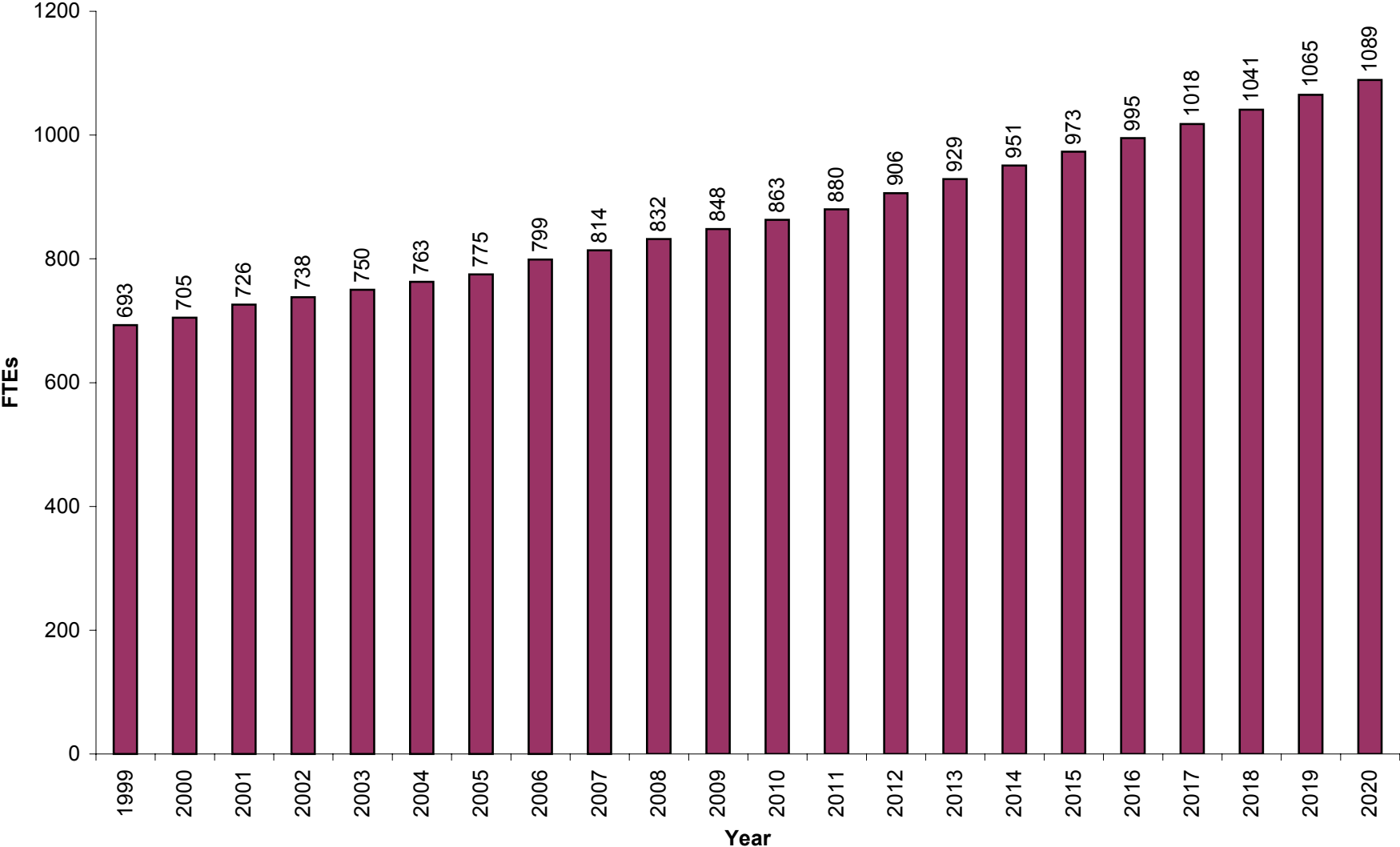


Figure 12. School Health Care RN demand, 1999-2020

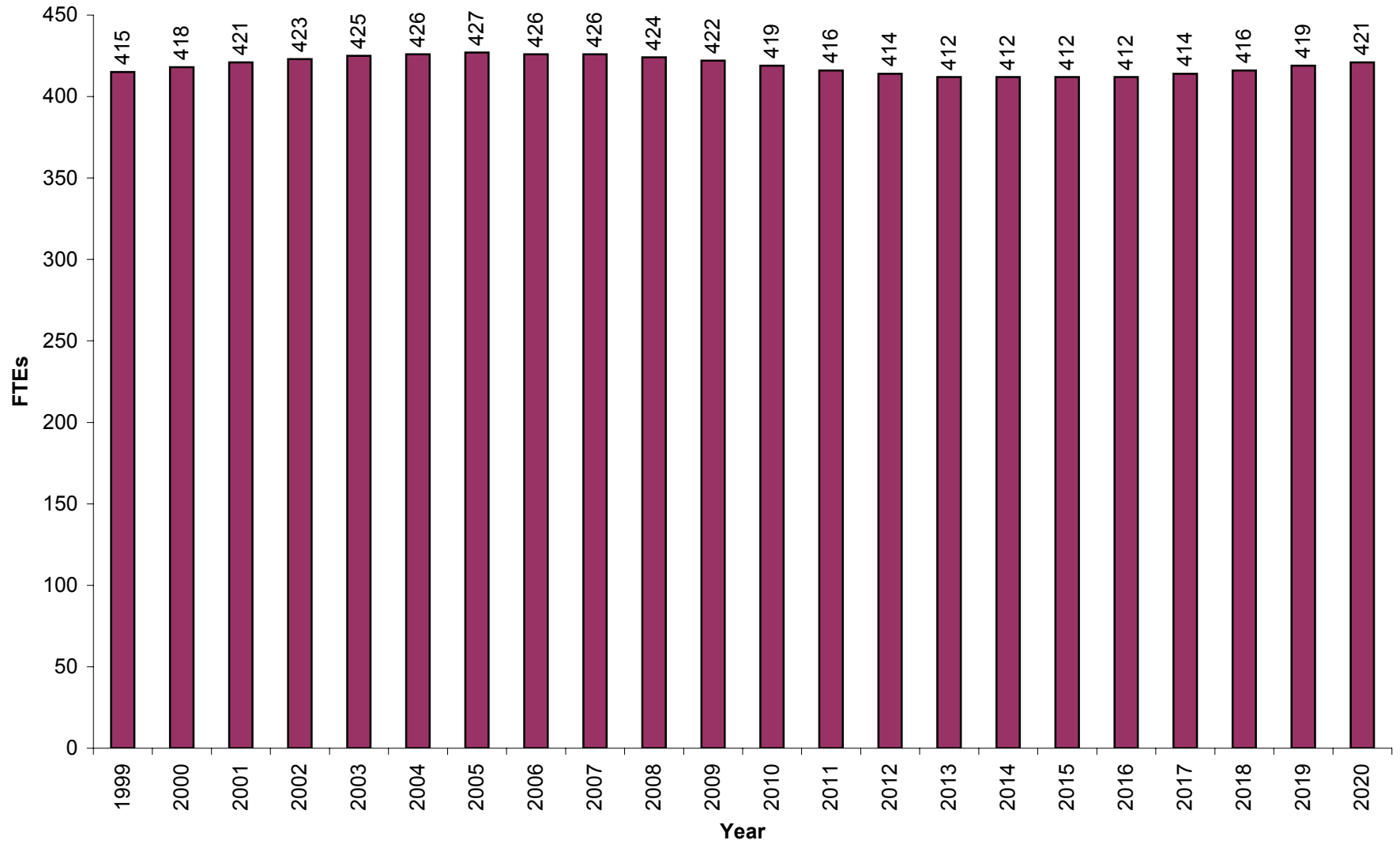


Figure 13. Public Health Care RN demand, 1999-2020

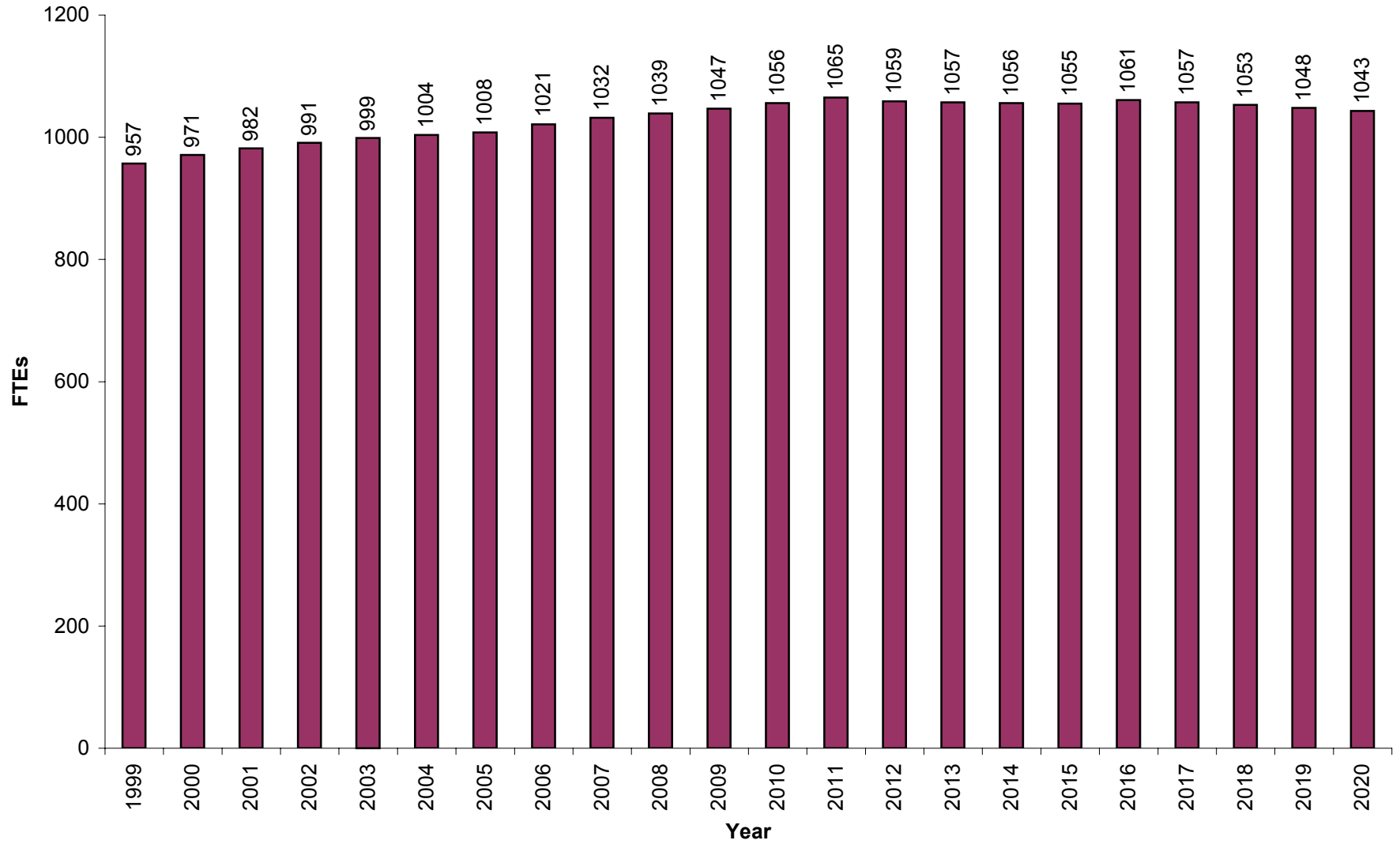


Figure 14. Nursing education RN demand, 1999-2020

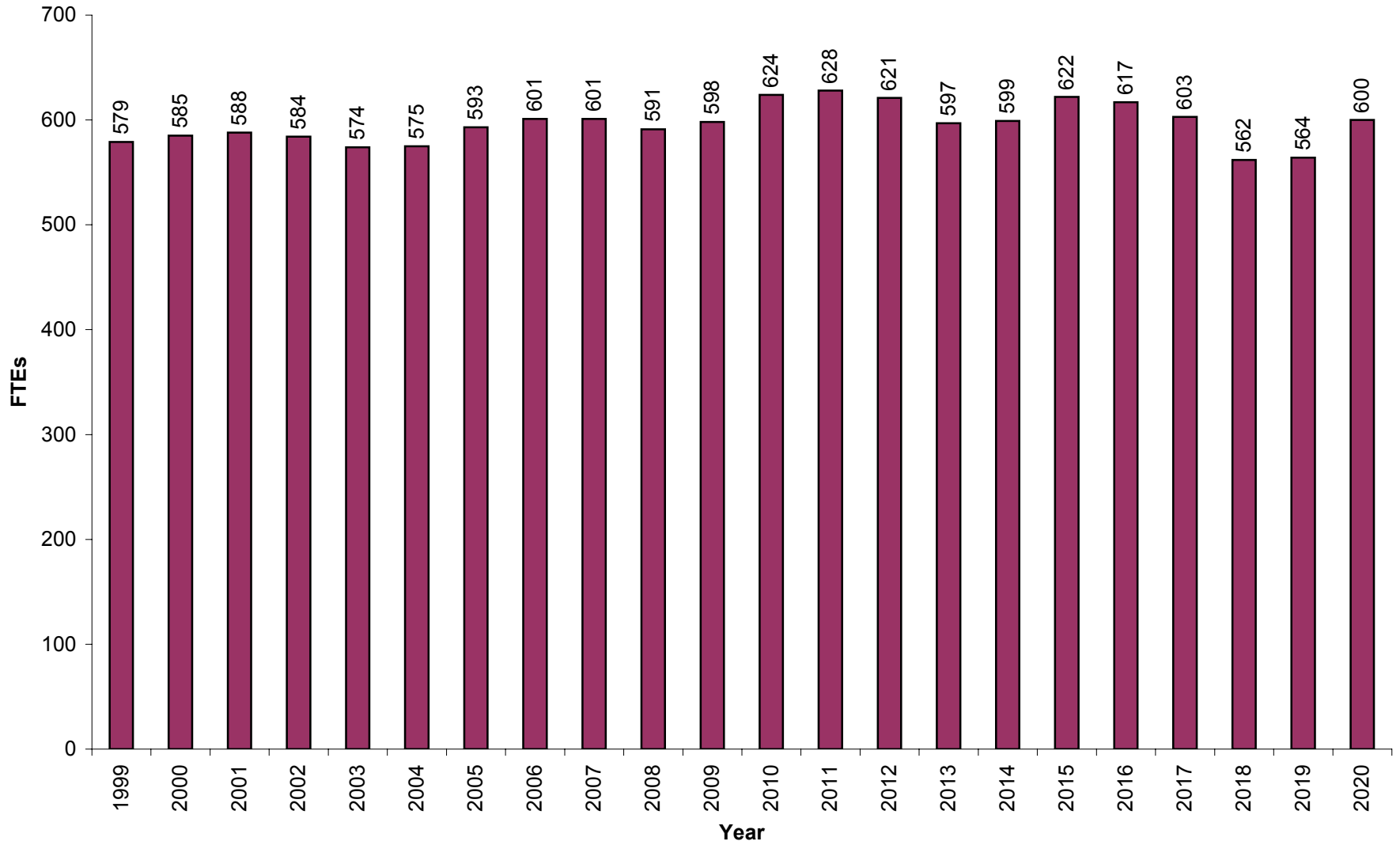


Figure 15. Other care RN demand, 1999-2020

