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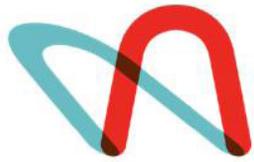
Louisiana's Multi-Regional Statewide Nursing Workforce Forecasting Model

Technical Report
2013

Project Acknowledgements

Louisiana's Multi-Regional Statewide Nursing Workforce Forecasting Model
Executive Summary

The Louisiana Center for Nursing (LCN), a division of the Louisiana State Board of Nursing (LSBN), received funding from the Louisiana Health Works Commission (LHWC) and LSBN in 2012 to develop a nursing workforce forecasting model. The Forecasting Model will be used to predict nursing workforce supply and demand for Registered Nurses (RNs), Advanced Practice Registered Nurses (APRNs), and Licensed Practical Nurses (LPNs). This Forecasting Model provides a more precise way of assisting policymakers, nurse leaders, and nurse educators in their efforts to plan and prepare a future nursing workforce for decades to come. The model incorporates a number of data sets including population demographics, economic conditions, level of patient care mix (acute and long-term care), as well as the current nursing workforce supply and demand.

The Northeast Ohio Nursing Initiative (NEONI) Forecasting Model was used as a template for Louisiana's Multi-Regional Statewide Nursing Workforce Forecasting Model. The NEONI Group, composed of Dr. Craig Moore, economist, and private consultant, Dr. Patricia Cirillo, statistician and President of Cypress Research Group in Northeast Ohio, and Lisa Anderson, MSN, RN, Vice President with the Center for Health Affairs in Cleveland, OH, in collaboration with Dr. Cynthia Bienemy, Director for the Louisiana Center for Nursing, developed Louisiana's Multi-Regional Statewide Nursing Workforce Forecasting Model. The NEONI Forecaster, although a very dynamic forecasting tool, is currently limited to 17 counties within Northeast Ohio, whereas, Louisiana's Multi-Regional Statewide Nursing Workforce Forecasting Model is believed to be the only nursing workforce forecasting model that has the ability to predict supply and demand for RNs, APRNs, and LPNs at both the **regional** and **statewide** level, and **identify gaps (either a shortage or a surplus)** through the year 2020.

In recognition that population, technological advances in health care, regulatory changes which impact healthcare, and other market forces will vary unpredictably in the next seven years, the model is not static, it is dynamic. That is, a number of key assumptions regarding the future of healthcare and changes in the nursing workforce can be easily changed in the model to provide a range of future forecasts. Used in this way, the model becomes a policy tool that can help identify the most effective way to manage any anticipated shortages in the availability of nurses.

Nursing Supply and Demand Forecast

If the current conditions remain constant, that is, if the population demographics, number and type of nurse workforce, level of exporting care to patients outside of the region, and the level of demand for care by the population (intensity factors) remain the same, the current forecast shows that there will be large regional differences in shortages and surpluses across Louisiana for RNs, APRNs, and LPNs.

Major Findings

Registered Nurses (RNs)

- Nearly 60 percent of RNs are employed in Louisiana hospitals.
- Almost 10 percent of RNs in Louisiana are unemployed or choose not to work.
- A **statewide shortage** for RNs is expected to continue through 2016. In 2017, the supply of RNs will just meet the demand until 2020 based on current conditions.*
- 2013 shows a shortage of full-time equivalent (FTE) RNs (41,397 supply) compared to demand (44,472) and varies significantly by region.
- Shortages will exist through 2020 for RNs in the following regions: Baton Rouge, Lafayette, and New Orleans.
- There will be a surplus of RNs in Alexandria, Houma, and Lake Charles through 2020.
    *Changes in health care policy/health care reform, patient care delivery, nurse intensity, or population shift will affect demand for RNs, APRNs, and LPNs

Advanced Practice Registered Nurses (APRNs)

- The demand for APRNs (FTEs) in 2013 was estimated at 5,282, with a supply of 3,959, leaving a gap of 1,323 FTEs. The ultimate size of this gap over the next decade will depend on the changing patterns of APRN utilization and healthcare policy as we go forward.
- Based on the current intensity (nurse-to-healthcare-unit ratio) for APRNs in Louisiana and a growth rate of 4% annually for APRNs in both the inpatient and ambulatory care settings, the demand for APRNs will be almost 7,000 FTEs by 2020. If, state-wide, the number of new APRNs entering the workforce remains at about 10% (the recent rate in Louisiana), the state-wide shortage of APRNs will continue at its current level until 2020.
- There will be a demand for APRNs through 2020 in the following regions: Baton Rouge, Lafayette, New Orleans, and Shreveport.

Licensed Practical Nurses (LPNs)

- The majority of LPNs are employed in long-term care facilities (5,411) and hospitals (4,569).
- About 10 percent of LPNs are unemployed.
- The LPN ratio of nurses to patients is much higher in Louisiana hospitals, especially rural facilities, than other states in the country.
- There will be a shortage of LPNs through 2020 in the following regions: Baton Rouge, New Orleans, and Houma.
- A surplus in the number of FTE LPNs will extend through 2020 in Alexandria, Lafayette, and Monroe.
- Statewide, the demand for LPNs will extend through 2013. Beginning in 2014 and extending through 2020, the supply of LPNs will just meet the demand.

Recommendations:

- Present the forecasting model to stakeholders across the state to share how the model can be used by educators, nursing administrators, healthcare facilities, and legislators for strategic planning, workforce planning, and policy development.
- Update the Multi-Regional Statewide Nursing Workforce Forecasting Model each year using the most current licensure renewal data (nursing supply) and education capacity data.
- Seek funding to:
  - Develop comprehensive regional profiles of the current supply, demand, and education capacity for RNs, APRNs, and LPNs for the eight regional labor market areas in Louisiana
  - Validate and modify the assumptions in the Forecasting Model based on the findings obtained from the regional analysis of the 2013-2014 nursing supply, education capacity, demand, and new graduate data
  - Predict nursing supply and demand through 2020 at the regional and statewide level using the updated Louisiana Multi-Regional Statewide Nursing Workforce Forecasting Model
  - Use Geographic Information System (GIS) Mapping to visually illustrate regional and state-wide nursing workforce profiles
  - Develop recommendations for workforce development and strategic planning for each region and the state as a whole based on 'what if' scenarios generated by the Louisiana Multi-Regional Statewide Nursing Workforce Forecasting Model.

The Louisiana Multi-Regional Statewide Nursing Workforce Forecasting Model

The Louisiana Nursing Workforce Forecasting Model is a tool that provides a benchmark forecast of the need for **registered nurses** (RNs), **advanced practice registered nurses** (APRNs), and **licensed practical nurses** (LPNs), through the year 2020. The model is designed to provide forecasts for RNs, APRNs, and LPNs, both at the state level, and at the regional level. Louisiana's eight Regional Labor Market Areas (RLMAs) were used for forecasting at the regional level.

The model estimates both the future **demand** for health care services to be provided by nurses and the **supply** of nurses available to meet that demand. The model contrasts the supply and demand for RNs, APRNs, and LPNs within each region and for the entire state, and identifies gaps (either a shortage or a surplus) from 2013 through the year 2020.

Demand for Nurses – Supply of Nurses= Shortage or Surplus of Nurses

In recognition that population, technological advances in health care, regulatory changes which impact healthcare, and other market forces will vary unpredictably in the next seven years, the model is not static, it is dynamic. That is, a number of key assumptions regarding the future of healthcare and changes in the nursing workforce can be easily changed in each model to provide a range of future forecasts. Used in this way, the models become policy tools that can help identify the most effective way to manage any anticipated shortages in the availability of nurses.

The model is a manifestation of the examination of the relationships of various factors (statistical variables) related to both the supply and demand for nurses in Louisiana. This report describes the sources of data which served as input into the models, how the data relate to both the supply and demand, and assumptions used in the modeling and output process.

Healthcare Settings

A core piece of the model relies on the number of nurses required to care for patients within various settings also known as the 'intensity factor'. Because the 'intensity factor' varies tremendously by healthcare setting, the model separates the demand for nurses by setting. The various settings delineated in the model are:

- Hospital Inpatient Care
- Emergency Department
- Ambulatory Care
- Nursing Facilities/Nursing Homes
- Home Health
- Community Health
- Public Health
- Nursing Education
- Other – healthcare related settings other than the eight settings listed above.

The Regions

An essential first step in developing the forecasting model was determining the best regional division for the state. This was done using information such as commuter patterns for nurses working in the region, industry clusters that characterize the region, and major exports of products and services. After considering alternative boundaries and the need for comparability, Louisiana's eight Regional Labor Market Areas (RLMAs) were selected as the regions that would be used to develop the models. Users of the model can therefore focus on a single region alone, as the data input for each region was specific to that region.

A map and definition of each region based on Parish is shown below.

Eight Regions for the Nursing Workforce Forecasting Model – State of Louisiana

Parishes in Regions:
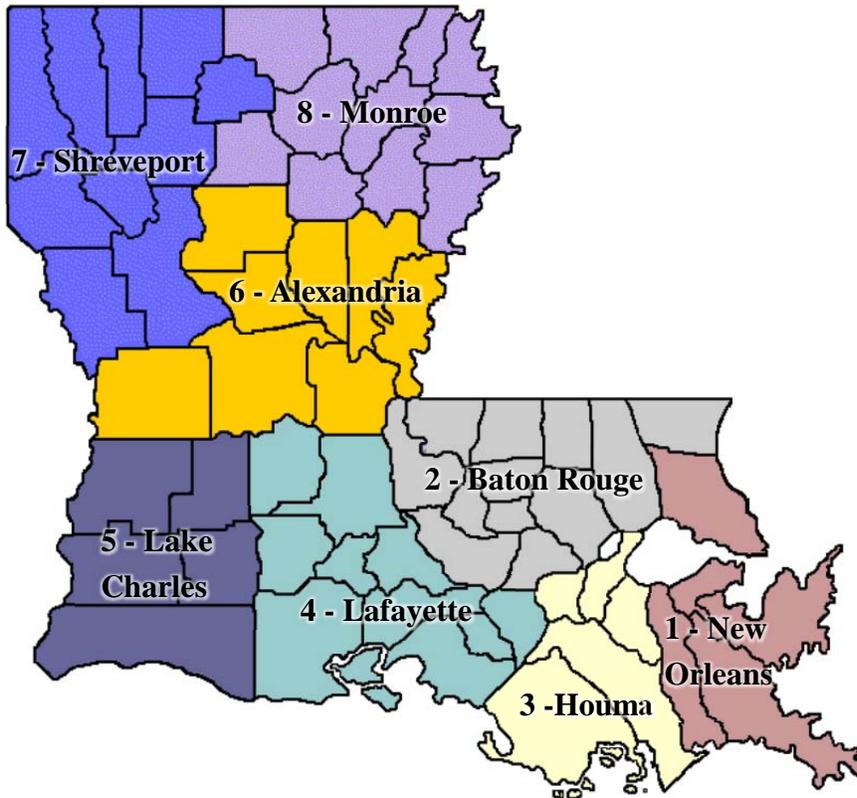
1 - New Orleans: Jefferson, Orleans, Plaquemines, St. Bernard, St. Charles, St. James, St. John the Baptist, St. Tammany

2 - Baton Rouge: Ascension, East Baton Rouge, East Feliciana, Iberville, Livingston, Pointe Coupee, St. Helena, Tangipahoa, Washington, West Baton Rouge, West Feliciana

3 - Houma: Assumption, Lafourche, Terrebonne

4 - Lafayette: Acadia, Evangeline, Iberia, Lafayette, St. Landry, St. Martin, St. Mary, Vermilion

5 - Lake Charles: Allen, Beauregard, Calcasieu, Cameron, Jefferson Davis

6 - Alexandria: Avoyelles, Catahoula, Concordia, Grant, LaSalle, Rapides, Vernon, Winn

7 - Shreveport: Bienville, Bossier, Caddo, Claiborne, DeSoto, Lincoln, Natchitoches, Red River, Sabine, Webster

8 – Monroe: Caldwell, East Carroll, Franklin, Jackson, Madison, Morehouse, Ouachita, Richland, Tensas, Union, West Carrol[1]

Adapted from the Louisiana Workforce Commission RLMAs
http://www.laworks.net/Downloads/lmi/RLMAsDefined.pdf

Model Structure

Each model has two components: the **demand for healthcare** provided by nurses and the **supply of nurses** available to provide that care. The overall model for each nurse type (RNs, APRNs, and LPNs) is comprised of nine separate Excel spreadsheets. Each regional model 'stands alone' (the data which drives the model's components are contained within each file). The state model is dynamic with each of the regional models; changes to a regional model's assumptions are reflected in the state model for each nurse type.

The Demand Model

The demand side of the model marries three general pieces of information:
- population demographics, in particular the size of the population;
- the amount of healthcare (by setting) required by the population; and,
- the number of nurses required to provide each 'unit' of healthcare, which is described below.

Population Demographics

The population in each of the regions in the state is analyzed by **age**, **gender**, and **degree of urbanization** because these three factors are highly related to the utilization of healthcare. The analysis is done at the Parish level and population projections are made through the year 2020 using the 2010 decennial census figures by age and gender for each Parish as the basis for demographic projections forward[2]. A standard cohort survival model was used that aged the population each year and applied standard survival rates from the U.S. Department of Health and Human Services, Centers for Disease Control[3]. New births were estimated using the birth rates per 1,000 females between the ages of 15 and 44 in each Parish from Louisiana state data. The population projections were then aggregated to the regional level and placed into nine age groups: 0 to 4, 5 to 14, 15 to 17, 18 to 24, 25 to 44, 45 to 64, 65 to 74, 75 to 84, and 85+ by gender. They were further divided into "Urban Parishes" and "Rural and Suburban Parishes" within each region. Parishes which contained the major metro area for that region were considered "urban." All others were considered "non-urban." The projections assume no net population migration.

The age categories are based on the Health Resources Service Administration's (HRSA) national model[4]. They were found to be the break points where the demand for health care changed significantly with age (see Appendix A).

Amount of Healthcare Required By a Population

The demand for healthcare for each age/gender/degree of urbanization population sector is determined by marrying the population size for each sector with its anticipated use of healthcare ("demand for nurses"). These are known and calculated for each population sector within each of the following healthcare settings:

1. Inpatient Care measured in patient days
2. Emergency Department Visits
3. Ambulatory Visits
4. Nursing Facilities measured in resident days
5. Home Health Visits
6. Community Health measured in nurses per 10,000 population
7. Public Health measured in nurses per 10,000 population
8. Nursing Education measured in nurses per 10,000 population
9. Other – healthcare related settings other than the eight settings listed above per 10,000 population.

The link between demographics and the demand in each of the healthcare settings in each model is used by applying a set of expected number of units (inpatient days, visits, etc.) of healthcare per 1,000 persons in a particular category of age, gender, and degree of urbanization. The demand figures for each setting come from a variety of sources compiled and analyzed by HRSA. Each of these is outlined below.

Healthcare "Units" by Population Subsegments

Below are the data used to estimate the amount of healthcare "units" required by a population of a set size (generally, 1,000) in a set period of time (generally one year). The sources vary by healthcare setting and are based on national data which dates from 2005-2007. It is important to note that the intensity factors used in the models can be easily modified to reflect any new information gained regarding 2013 intensity factors, or future impacts on intensity factors.

Table 1. Inpatient Days, Per 1,000 People, Per Year

	Female		Male	
Age	*Urban*	*Non-Urban*	*Urban*	*Non-Urban*
0-4	1030	466	1084	509
5-17	97	42	84	30
18-24	435	337	168	68
25-44	477	271	287	137
45-64	637	343	726	296
65-74	1614	791	1627	820
75-84	2366	1559	2883	1504
85+	4299	3548	5089	2633

Estimates of inpatient days were taken from the **2005 Nationwide Inpatient Sample**[a] divided by Census Bureau population estimates (Table 1). They were compared with figures from the **American Hospital Association**[b] and adjusted by using a scalar that brought the two sets of figures into alignment in the aggregate.

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Table 2. Emergency Visits, Per 1,000 People Per Year

| | Female | | Male | |
Age	**Urban**	**Non-Urban**	**Urban**	**Non-Urban**
0-4	645	496	703	605
5-17	294	278	307	275
18-24	594	614	404	397
25-44	451	409	378	307
45-64	333	260	295	214
65-74	370	311	367	367
75-84	499	424	509	470
85+	807	689	1081	772

Estimates of annual emergency visits per 1,000 people were made from the **2005 National Hospital Ambulatory Medical Care Survey[c]** divided by Census Bureau population estimates (Table 2). Again, a comparison with data from the **American Hospital Association[b]** was made and a scalar applied to align the aggregate figures.

Table 3. Ambulatory Visits, Per 1,000 People Per Year

| | Female | | Male | |
Age	**Urban**	**Non-Urban**	**Urban**	**Non-Urban**
0-4	4510	3849	5020	4624
5-17	2236	1650	2300	1712
18-24	2743	2044	1151	886
25-44	3685	2249	2017	1697
45-64	5046	3391	3741	2566
65-74	7961	4945	6403	5350
75-84	8031	7088	8072	5662
85+	7516	8093	9716	5361

Estimates from the **2005 National Hospital Ambulatory Medical Care Survey[c]** for outpatient care and the **National Ambulatory Medical Care Survey[d]** were divided by Census Bureau estimates to determine the annual ambulatory visits per 1,000 persons. These rates increase very rapidly with age as shown in Table 3).

Table 4. Number of Persons in Nursing Homes, Per 1,000 People Per Year

| | Female | | Male | |
Age	**Urban**	**Non-Urban**	**Urban**	**Non-Urban**
0-44	0.5	0.2	0.6	0.2
45-64	1.9	1.2	2.4	0.9
65-74	11.5	5.1	9.7	3.5
75-84	44.9	22.3	30.5	13.9
85+	222.9	123.5	112.2	40.2

Estimates from the **National Nursing Home Survey[e]** divided by Census Bureau population figures produced point-in-time estimates of the number of persons in nursing homes per 1,000 people (Table 4).

Table 5. Number of Home Health Visits, Per 1,000 People Per Year

Age	Female		Male	
	Urban	Non-Urban	Urban	Non-Urban
0-17	379	211	512	824
18-44	881	1048	424	278
45-64	1898	519	815	2834
65-74	6185	6426	2675	5247
75-84	13895	11063	6179	11818
85+	25093	24665	15238	21705

Home Health visits were estimated from the **2005 Medical Expenditure Panel Survey**[f]. Utilization patterns are again, highly correlated with age (Table 5).

Figures for Public Health, Community Health, Nursing Education, and nurses employed in other non-health care jobs were estimated using the 2012 annual nurse registration data[5,6] from Louisiana and the 2010 census figures.

The Number of Nurses Required to Provide each 'Unit' of Healthcare: Intensity Factors

Once the projected demand was determined in each setting, that information was used to estimate the number of nurses required to meet that demand. This was done by applying an *intensity factor,* which is simply a nurse-to-healthcare-unit ratio, where the number of nurses is expressed as a Full-Time Equivalent (FTE) and the healthcare unit is measured for each healthcare setting (e.g., inpatient days for acute care settings).

The intensity factors were determined by using the actual ratio of nurses working in each healthcare setting in 2012 taken from state nurse licensure data (RN, APRN, and LPN) to the estimated demand for that year (2012). That is, it is known how many nurses were working in various settings in 2012, and how many "units" of care were provided in various settings in 2012. This provides the number of nurses measured in FTEs in each healthcare setting. These were then added together at the regional level to determine the statewide total need for nurses in each year.

> *Intensity Factor =*
>
> *Number of Nurses Working In Setting*
> _____
> *Amount of Care Provided in Setting*

Intensity factors were estimated at the national level by HRSA for each of the healthcare settings in 2004[4]. The figures from HRSA have been used here to make sure the intensity factors estimated based on the current nurse licensure data from Louisiana are reasonable (Table 6). For example, the total FTE nurses working inpatient care involving hospital patients in Louisiana in 2012[a] were divided into the estimated annual demand per 1,000 patient days of care across the state. The result was 6.91 as the intensity factor for 2012 for that setting. The HRSA estimate for the U.S. in 2004 for inpatient care was 6.2 and projected to be 7.17 in 2010. Thus, the estimated intensity factor for inpatient care in Louisiana for 2012 seems quite reasonable given how close it is to the national HRSA figure.

Calculations were done for each healthcare setting and for each type of nurse. The following table shows the benchmark intensity factors used in each of the models based on the healthcare setting and the type of nurse. Note that part of the utility of the model is that users may change these intensity factors; the figures below are the 'baseline' or starting point for 2013.

Table 6. Intensity Factors Based on 2012 Nurse Registration Data

Setting	RN	LPN	APRN
Ambulatory Care	0.24	0.23	0.11
Community Health	1.77	0.42	0.03
Emergency Visits	1.00	n/a	0.05
Home Health	0.36	0.23	0.001
Inpatient	6.91	1.97	0.72
Nursing Education	3.11	n/a	0.17
Nursing Facilities	0.06	0.19	0.002
Public Health	1.12	0.42	0.03

Adjustments to Demand

There are a few final adjustments to the forecast for demand for healthcare in each region. First, for inpatient days, there are some regions where patients travel to another region for surgery or other complex treatment. For Houma, Alexandria, Lake Charles, and Monroe, an adjustment is made to reduce inpatient demand by 10 to 15 percent. In New Orleans, Baton Rouge, Lafayette, and Shreveport, there is an export factor added to demand to account for the inflow of these patients from the other four regions[7]. Further, it is clear that when the same intensity factor is applied across all regions the number of nurses needed in inpatient care is not consistent with the statewide percentage of the nurse workforce working in inpatient care. In the large metropolitan areas like New Orleans, Baton Rouge, Lafayette, and Shreveport, the intensity factor for LPNs is lower than in Alexandria, Monroe, Houma, and Lake Charles, where the data indicates that more LPNs are used in inpatient care and the intensity factors are higher than the state average. The initial intensity factors based on the state average have been calibrated to bring the number of nurses working in inpatient care in each region in line with the expected number based on the licensure data.

User Adjustment to Demand

As aforementioned, many of the baseline assumptions in the model can be modified in order to see changes in demand or supply (and therefore, the gap between the two). One of those changeable assumptions is **the percent of patients coming from outside the region for treatment** regardless of where they come from such as another region, state, or anywhere else. This allows for the estimation of change in nurse supply/demand based on scenarios such as a large health system strategic plan which calls for the expansion of services to a larger market and expects to draw patients from outside of the region. The impact of their strategic plan can be seen using the model and plans for changes in the nurse workforce can be anticipated and managed.

Another changeable assumption is the migration of older households that may move into the region. Current population studies for the state do not show a large influx of older people at this time, but this could change as the economy continues to rebound. However given how sensitive the need for healthcare is based on age, any unexpected change in the number of older citizens would have a direct impact on the amount of healthcare needed.

The Supply Model

The supply side of the model is based on the number of nurses working in each region by their age. It marries three pieces of information in each region:

- the number of newly licensed nurses (RNs, APRNs, and LPNs);
- the demographics of the nurse workforce (in particular, age); and
- the work patterns of the nurse workforce (in particular, the number of hours worked).

Number of Newly Licensed Nurses

Information on the nurse workforce was obtained through examination of the early 2013 nurse (RN, APRN, and LPN) licensure renewal data[5,6]. It is assumed that these figures from the beginning of 2013 reflect the nurse workforce at the end of 2012 because most of the graduates from nursing programs in 2012 will have passed their licensure exams and will have found jobs. In the licensure renewal process, nurses provide their age, their licensure level (RN, APRN, or LPN), the setting in which they work, their home zip code, and the zip code of their employer.

Beginning with the nurse licensure renewal data in early 2013, the number of nurses is projected out through 2020. The number of nurses expected in each year is adjusted by the number of hours worked given their age using the hours worked reported in the nurse licensure data by age. This estimates the supply of nurses measured in FTEs.

Nurse Demographics (Age)

Each model has a "Master Supply" section that contains the number of nurses in each year from 2010 projected through 2020. The key data are from the latest 2013 licensure renewal data. The supply is broken down into the number of nurses (RNs, APRNs, and LPNs - each have their own models) by age from 22 years through 75 years in one-year increments. The number of nurses is converted to FTEs based on their age and work setting (historical data shows how many hours nurses tend to work based on their age and work setting).

Aging the Nurse Workforce

Once the number of nurses in each age category is established, they are progressed to the next oldest year to project the number in the future, accounting for any expected changes in work patterns (hours-worked) based on age. Those who are 75 years are assumed to be fully retired in the year they reach age 76. This is done for each year to 2020. The number of nurses is converted to FTEs using the method described above. This gives a reasonable idea of the number

of FTEs available in each region and statewide by type of nurse through 2020 based on the current number of licensed nurses.

As each age group of nurses becomes older, the number of FTEs generated by that group decreases and more nurses are retired. This leaves potential job openings for new nurses as long as there is projected demand in the region. The model allows us to replace those nurses with a specific number of newly licensed nurses. Based on nurse licensure data in 2012, the state currently injects 2,600 newly licensed RNs into the state supply, 350 APRNs, and 1,100 LPNs. These are all newly licensed nurses in Louisiana, regardless of where they were educated.

It is helpful to understand how the current supply of nurses in the state is distributed and how much longer they are likely to work. See Appendix B for further discussion on this topic.

Nurse Work Patterns

For RNs, the hours worked for all nurses currently working was analyzed by their age statewide[5]. A statistical relationship was identified that explains about 97% of the variation in hours worked by their age. This is a very strong relationship and provides an estimate of the expected hours worked for each age. That number of hours is then divided by 40 hours per week as the benchmark for a full-time nurse. The resulting percent is then multiplied times the number of nurses in each age category to estimate the FTEs available. Below is a graph that shows the relationship between age and hours worked for RNs and the equation that was used (Figure 1). The dependent variable, y, is hours worked per week. The horizontal axis (x) is the age that begins at 20 and ends at just less than 80.

Figure 1. Number of Hours Worked, RNs, By Age
Model Fitting

$$y = -0.0006x^3 + 0.0753x^2 - 3.0109x + 76.638$$
$$R^2 = 0.9688$$
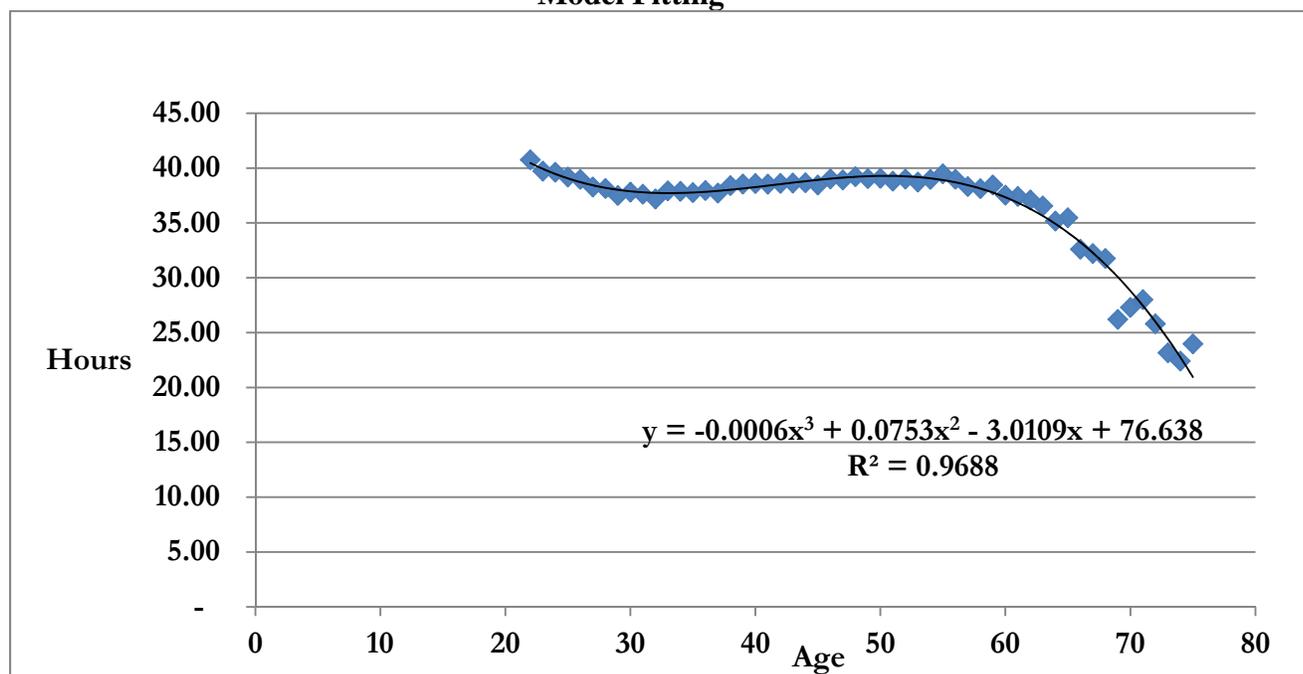
Note: Demonstration of the strength of the relationship between the age of RNs and hours worked.

As the age of current RN workforce progresses in the model, an estimate can be made of the total number of hours nurses will be working by that workforce in that point in time which is defined as an FTE nurse. This can be achieved by exploiting the very close relationship of the age of the nurse and the hours worked. That is, the number of nurses in FTEs that will be working each year can be predicted based on their current ages because it is known how many hours they will work in the future based on their age. Figure 1 demonstrates the strength of the relationship between the age of RNs and hours worked.

For LPNs, the licensure data[6] does not include hours worked per week. To make this estimate, the newly released "*The U.S. Nursing Workforce: Trends in Supply and Education*"[g] report from HRSA was reviewed. The study includes estimates of average hours per week worked by both RNs and LPNs by age category based on Census data from 2010 and the American Community Survey (ACS) from 2008 through 2010[h]. The estimates from analysis of Louisiana data and the Census analysis are almost identical for RN data. The LPN relationship shows that LPNs tend to work more hours per week after the age of 60 than RNs. The hours worked prior to that age are about the same as for RNs. Therefore, in the Louisiana LPN models, an adjustment was made to the hours worked as a percent of full-time based on the HRSA relationship described above. These data are divided by 40 hours per week and the resulting ratio is then used to convert the number of nurses to FTEs.

For APRNs the same analysis was done as for RNs[5]. The age range of APRNs begins at age 25 rather than age 20, because they have more years in training and experience prior to becoming licensed as an APRN. The chart and relationship below shows the estimated hours worked per week by age (Figure 2). In general it shows higher levels of hours worked during middle age than RNs and the hours fall off more slowly after age 60. There is also more variation across APRNs as they get older. Thus, the relationship explains about 83% of the variation in hours worked based on age.

Figure 2. Number of Hours Worked, APRNs, By Age
Model Fitting

$$y = -0.02x^2 + 0.8397x + 33.833$$
$$R^2 = 0.8255$$
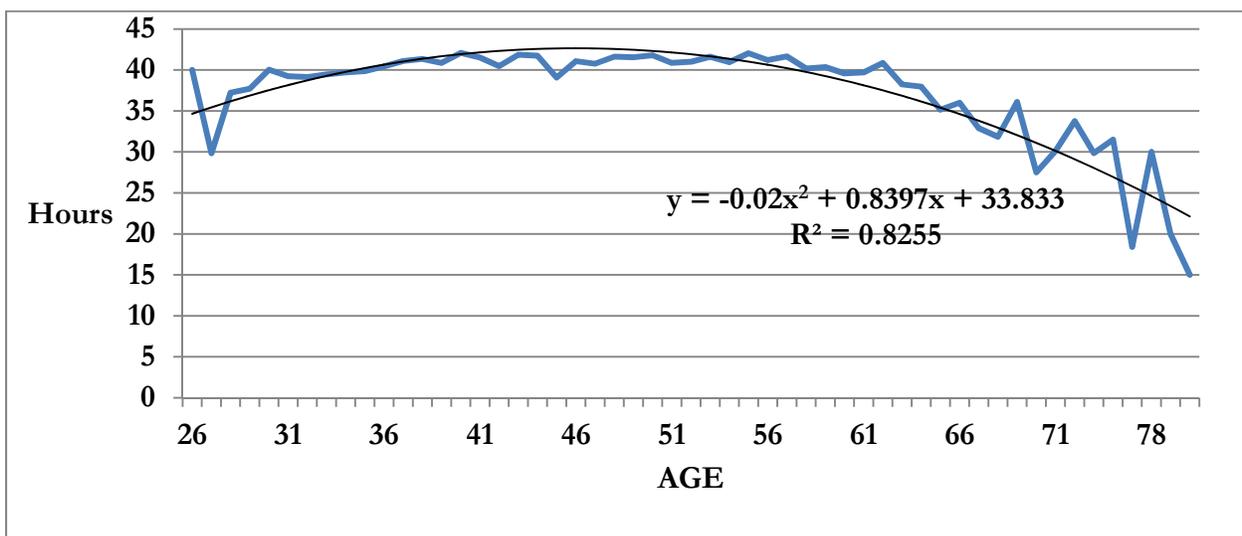
Note: The chart shows the relationship between age of APRNs and hours worked per week.

Using these relationships, the expected hours per week were divided by 40 to estimate the FTEs for APRNs based on their age and that ratio was used to convert APRNs to FTEs in each model.

Nursing Workforce and FTEs

<u>RNs</u>

The number of FTEs is significantly lower than the number of licensed nurses. This is not only because a number of licensed nurses work part-time, but also because only 88% of licensed nurses are actively working full-time or part-time in nursing. The rest are out of the active labor force because of retirement, family obligations, return to school, unemployment, being employed in a field outside of nursing, or seeking a job outside of nursing. Further, there are nurses who are active in administrative positions, involved in research, or in a job that is outside the major healthcare settings listed such as working as a school nurse or as a consultant. The following table shows a detailed breakdown of licensed RNs by employment category and indicates which are in the forecasting model (shown in gray) and those that are not.

Table 7. Louisiana RNs, 2012

Setting*	Number of RNs	Proportion of Total
Academic Setting	997	1.9%
Ambulatory Care	3,533	6.8%
Community Health	812	1.6%
Home Health	3,383	6.6%
Hospital	30,091	58.3%
Nursing Home/Extended Care/Assisted Living	1,694	3.3%
Public Health	515	1.0%
Other-Health Related	4,604	8.9%
Licensed RNs Employed in the Model:	**45,629**	88.5%
Adjustment to FTEs in the models reduce this figure to:	39,016	--
Unemployed looking for a job as a nurse - unemployed/active RN workforce	**1,562**	3.0%
Active RN Workforce	**47,191**	91.5%
Unemployed not seeking work as a nurse	2,628	5.1%
Retired RNs	615	1.2%
Working in nursing only as a volunteer	188	0.4%
Subtotal: Unemployed Licensed RNs Choosing Not to Work	**3,431**	6.7%
Other-Non-Healthcare-Related RNs working	963	1.9%
Total Licensed RNs	**51,585**	100.0%

*Self-reported in annual registration data, 2012.

As the table above shows, the Louisiana workforce model includes about 88% of licensed RNs[5]. Further, those who are unemployed and looking for a nursing job are part of the workforce. The rest either choose not to work, or are working in a non-healthcare-related job. This converts to just over 39,000 FTEs for the number of RNs working because of (1) their age distribution and (2) the 5,213 (11.4% of the RNs employed) who work part-time.

APRNs

As shown in Table 8, there are 4,133 licensed APRNs in the state[5]. A little more than 41% of employed APRNs work in an array of ambulatory and community settings and a little over 40% work in the hospital. Approximately 85% of the APRNs were working full-time and 15% were working part-time. The number of employed APRNs (full-time and part-time) were converted to FTEs. Unemployment or choosing not to work is just about 3% while APRNs working in a role other than healthcare is less than 1%.

The demand for APRNs is expected to grow as shortages are anticipated in the primary care workforce and changes in provider reimbursement are expected to create demand for more cost-efficient primary care providers (Appendix C).

Table 8. Louisiana APRNs, 2012

Setting*	Number of APRNs	Proportion of Total
College Student Health Clinic	16	0.4%
Emergency Department	86	2.1%
HIV/AIDS Clinic	7	0.2%
Hospital	1,664	40.3%
Medicine Clinic	25	0.6%
Nursing Home	57	1.4%
Outpatient Clinic	653	15.8%
Pediatric Clinic	60	1.5%
Physician Office	425	10.3%
Private Clinic	193	4.7%
Rural Clinic	205	5.0%
School Clinic	47	1.1%
School of Nursing	78	1.9%
Urban Clinic	19	0.5%
Women's Health Clinic	37	0.9%
Other – Health Related	292	7.1%
Unknown	99	2.4%
Licensed APRNs Employed in Healthcare Settings in the Model:	**3,963**	95.9%
Adjustment to FTEs in the models reduce this figure to:	3,609	
Unemployed looking for a job as a nurse - unemployed/active APRN workforce	**63**	1.5%
Active APRN Workforce	**4,026**	97.4%
Unemployed not seeking work as a nurse	51	1.2%
Retired APRNs	10	0.2%
Working in nursing only as a volunteer	10	0.2%
Subtotal: Unemployed Licensed APRNs Choosing Not to Work	**71**	1.7%
Other-Non-Healthcare-Related APRNs working	36	0.9%
Total Licensed APRNs	**4,133**	100.0%

*Self-reported in annual registration data, 2012. The APRN data are not part of the previous RN data table and were calculated separately.

LPNs

The LPN workforce is distributed across healthcare settings and other categories differently[6]. Table 9 shows a breakdown of the LPN workforce statewide. LPNs have a much higher unemployment rate than RNs. Another difference is that one of the categories used in the LPN licensure data to identify what type of job they are doing is called "Agency/Contract". A breakdown of the LPNs in this category is shown in the last rows of the table and these numbers have been allocated to the appropriate healthcare settings. Also, there are no LPNs working in Emergency Departments or in Nursing Education. LPNs are much more concentrated in Nursing Facilities and Ambulatory Treatment such as clinics and doctors' offices. Louisiana has a higher intensity factor for LPNs in hospitals doing inpatient care than most other states, suggesting Louisiana hospitals employ more LPNs proportionately than the national average.

Table 9. Louisiana LPNs, 2012

Setting*	Number of LPNs	Proportion of Total
Academic Setting	-	0%
Ambulatory Care	3,401	16.3%
Community Health	193	0.9%
Home Health	2,146	10.3%
Hospital	4,569	21.9%
Nursing Home	5,411	25.9%
Public Health	193	0.9%
Other Health Related	2,414	11.6%
Unemployed	**2,069**	9.9%
Total LPNs in Workforce Model	**20,396**	97.7%
Adjustment to FTEs in the models reduce this figure to:	19,838	
Choosing not to work	**51**	0.2%
Other-Non- Healthcare-Related LPNs working	**425**	2.0%
Total Licensed LPNs	**20,872**	100.0%

There were 551 LPNs who reported 'Agency/Contract' as their work setting. They were allocated into the settings above as such: Hospital (175); Nursing Home (62); Home Health (122); Ambulatory Care/Office (42); Other (150).

*Self-reported in the registration data.

Another important point is that the LPN licensure data is based on the region of residence and not on the region of employment. This is due to differences in data captured in the LPN licensure renewal process. With regard to 2013 registrations, work location for all LPNs was not available (this information was available for RNs and APRNs). Therefore, the regional models for LPNs are based on where the nurses live, not work. Hence, it is not possible to accurately allocate where (what region) LPNs work, nor accurately remove those LPNs from the regions based on unemployment rates for LPNs. This is discussed further in the next section (Updating the Supply Forecast). The end result is that **the LPN models, unlike the RN and APRN models, include those nurses who are unemployed and looking for work in healthcare.** So,

it is important when using the models to remember that the supply figures in the RN and APRN models do not include the reservoir of nurses looking for work in healthcare. In the case of RNs this is about 3% and for APRNs it is about 1.5%. The supply figures in the LPN models, on the other hand, already include these nurses. Thus when there is a surplus of LPNs in a region, part of that surplus includes unemployed nurses.

Updating the Supply Forecast

The Louisiana Multi-Regional Statewide Nursing Workforce Forecasting Model is designed so that baseline data for each year can be replaced with the most recent nurse licensure data. That way, any real changes to the size or type of the nurse work force will be reflected in the model going forward to 2020.

Each year when the new licensure data[5,6] becomes available, the models will be updated. This will be done by taking the number of nurses in each region by their age and entering it into the prior year. Again, this is because the number of licensed nurses at the beginning of the year is used as the figure for the number at the end of the prior year. Performing this function is a simple operation in Excel. So, for example, in early 2014 when the new licensure renewal data for nurses is available, the number in each region by each year of age is inserted over the figures for 2013 and the models will automatically reforecast the change in supply. Any nurses who do not renew their license are automatically accounted for in the new licensure data.

It is important to understand why new graduates are entered into the model each year using the licensure information. Nurses entering the workforce are spread out across various age categories. One cannot assume that they are all in their early 20s or estimate how many are expected in each age group. This is especially true of APRNs. In 2012 there were 413 newly licensed APRNs and only 13% of them were between the age of 25 and 29. Almost half, 47%, were between 30 and 39 years old and the remaining 40% were 40 years and older. While RNs and LPNs are more concentrated in the lower age groups, they are also spread across a wide range of ages. Given the distribution of age in an *entering* cohort of nurses, it is impossible to assign them to their proper age group for each future year in each model. Figure 3 shows the age distribution of RNs at the time of obtaining their first license. Further, there is no way of predicting which region they will become employed in. This is the reason the models are updated with the licensure renewal data each year. The new data indicates the current age distribution of the workforce by the region they are employed in and any new nurses are placed in the appropriate age category and region.

Figure 3. Age of RNs at Initial Licensure, 2012
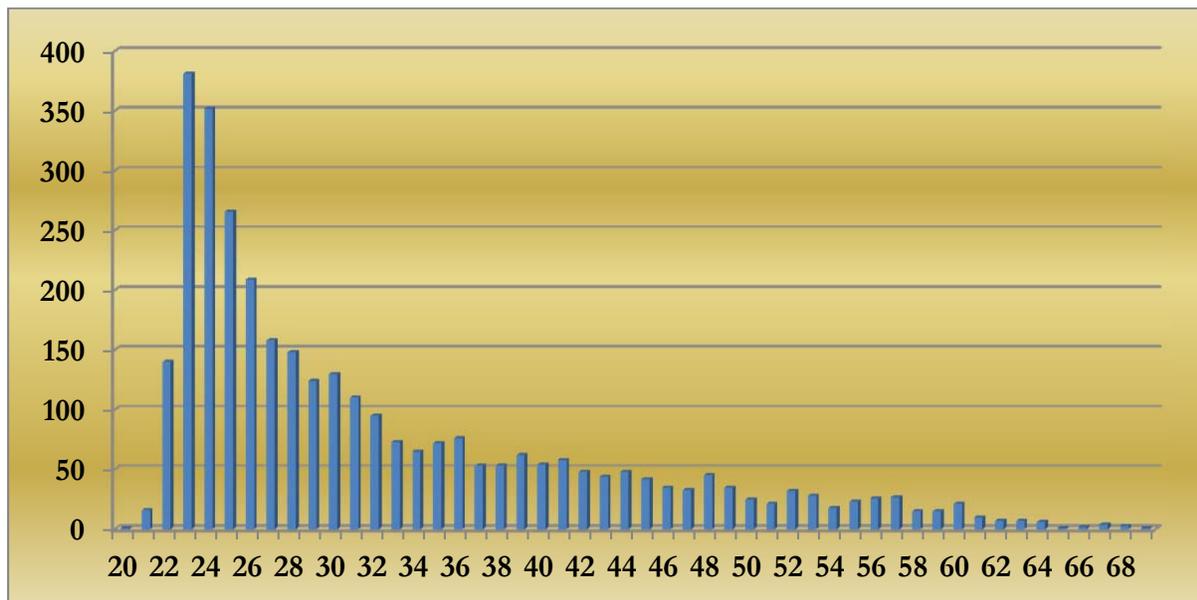
Note: Age distribution of RNs at the time of initial licensure.

By design, the models present nurse forecasts by region. However, there is no way to estimate where newly licensed nurses will choose to work (either by setting and/or region). The number of newly licensed nurses that are in each region is known by residence, but what is not known is where they will choose to work. For RNs and APRNs, this is not a problem because the regional designation used for each nurse is based on where they are actually employed rather than where they reside (that is, there is no need to estimate where they work based on where they reside; where they work is known). This eliminates several other potential problems which are known to be true:

1. A significant number of nurses live in one region and work in another,
2. Some nurses live outside the state and are licensed and work in Louisiana,
3. Some new nurses give various addresses depending on where they went to college and when they took their licensure exam.

For LPNs the licensure data does not identify where the nurses' primary job is located [6]. This raises a problem due to nurses commuting between regions. To adjust regional supply figures, a matrix showing where a large sample of LPNs (n = 9,470)[6] live and work was generated (Table 10). The commuting patterns for the sample of LPNs were compared to the commuting patterns of RNs between regions and the two were very similar[5].

Table 10. Louisiana, Commuting Matrix of LPNs

Residence Region	Work Region							
	New Orleans	Baton Rouge	Houma	Lafayette	Lake Charles	Alexandria	Shreveport	Monroe
New Orleans	95.4%	3.4%	0.6%	0.1%	0.1%	0.0%	0.1%	0.1%
Baton Rouge	8.9%	89.6%	0.3%	0.5%	0.1%	0.4%	0.0%	0.3%
Houma	7.5%	6.3%	82.8%	3.4%	0.0%	0.0%	0.0%	0.0%
Lafayette	1.1%	1.4%	0.8%	92.9%	2.4%	0.9%	0.2%	0.2%
Lake Charles	0.3%	0.7%	0.3%	5.0%	88.8%	4.2%	0.4%	0.3%
Alexandria	0.6%	2.2%	0.2%	3.1%	2.6%	85.4%	2.5%	3.3%
Shreveport	0.2%	0.1%	0.0%	0.3%	0.1%	1.0%	94.9%	3.5%
Monroe	0.2%	0.1%	0.1%	0.4%	0.1%	2.4%	6.7%	90.0%

Note: Matrix showing where LPNs live and work.

The rows in the table indicate where the sample of LPNs live and the columns indicate where they work. The main diagonal in grey shows the percent of LPNs that both live and work in the same region. So, for example, while 95.4% of LPNs both live and work in New Orleans, 8.9% commute in from Baton Rouge, and 7.5% come from Houma. When the nurses commuting from all the other regions are added and those who commute from New Orleans to other regions are taken out, the net result is that New Orleans has 14.1% more LPNs working there than are living there.

These figures are used in each regional LPN model to either increase the total FTEs available or reduce the number of FTEs available depending on whether the region has a net inflow or outflow of nurses. This adjusted supply is then compared with regional demand to identify the number of job openings in each year for LPNs in each region and across the state. In sum, the commuting patterns of LPNs are used to adjust the number of LPNs *working* in a region as compared to where they *reside*.

Comparing Supply and Demand

Once the demand for healthcare is estimated for each health care setting, it is used to create a profile of the FTE nurses needed in each year. There is a separate table and tab in each regional model that breaks down demand into healthcare categories. The total demand is then added across all healthcare settings for each year. The supply of FTE nurses available in each region is then compared to the demand. The total demand and supply of nurses is measured in FTEs. The supply of nurses in each year is subtracted from demand to show the number of estimated unfilled FTEs.

There is a set of eight regional models for each level of nursing workforce. There is also a statewide model for each level of nurse that automatically polls the regional models and aggregates supply and demand.

The state model for each type of nurse determines the supply of nurses by taking the total FTEs for each year in each regional model and summing them. This sets a baseline of the existing nurse workforce that is presently in place and adjusts it as nurses get older and work less hours. The estimated annual additional FTEs from new licensees and those recruited from outside of the region are added to the baseline supply in each year from each regional model. Thus, the total supply of nurse FTEs is estimated statewide in each year to 2020.

The model also includes a figure which shows the estimated unfilled FTEs for each region in each year across the state. That is, the tables and graphs in the statewide models identify where the greatest need will be for the nurses joining the workforce in each year.

Major Findings:

If the current conditions remain constant, that is, if the population demographics, number and type of nurse workforce, level of exporting care to patients outside of the region, and the level of demand for care by the population (intensity factors) remain the same, the current forecast shows that there will be large regional differences in shortages and surpluses across Louisiana for RNs, APRNs, and LPNs.*

*For the purposes of this report, a surplus is considered to be anything exceeding 5% of the annual demand. The numerical cut-off for balancing supply and demand will need to be determined by each region.

Registered Nurses (RNs)

- Nearly 60 percent of RNs are employed in Louisiana hospitals.
- Almost 10 percent of RNs in Louisiana are unemployed or choose not to work.
- A **statewide shortage** for RNs is expected to continue through 2016. In 2017, the supply of RNs will just meet the demand until 2020 based on current conditions.*
- 2013 shows a shortage of full-time equivalent (FTE) RNs (41,397 supply) compared to demand (44,472) and varies significantly by region.
- Shortages will exist through 2020 for RNs in the following regions: Baton Rouge, Lafayette, and New Orleans.
- There will be a surplus of RNs in Alexandria, Houma, and Lake Charles through 2020.
    - **Changes in health care policy/health care reform, patient care delivery, nurse intensity, or population shift will affect demand for RNs, APRNs, and LPNs*

Advanced Practice Registered Nurses (APRNs)

- The demand for APRNs (FTEs) in 2013 was estimated at 5,282, with a supply of 3,959, leaving a gap of 1,323 FTEs. The ultimate size of this gap over the next decade will depend on the changing patterns of APRN utilization and healthcare policy as we go forward.
- Based on the current intensity (nurse-to-healthcare-unit ratio) for APRNs in Louisiana and a growth rate of 4% annually for APRNs in both the inpatient and ambulatory care settings, the demand for APRNs will be almost 7,000 FTEs by 2020. If, state-wide, the number of new APRNs entering the workforce remains at about 10% (the recent rate in Louisiana), the state-wide shortage of APRNs will continue at its current level until 2020.
- There will be a demand for APRNs through 2020 in the following regions: Baton Rouge, Lafayette, New Orleans, and Shreveport.

Licensed Practical Nurses (LPNs)

- The majority of LPNs are employed in long-term care facilities (5,411) and hospitals (4,569).
- About 10 percent of LPNs are unemployed.
- The LPN ratio of nurses to patients is much higher in Louisiana hospitals, especially rural facilities, than other states in the country.
- There will be a shortage of LPNs through 2020 in the following regions: Baton Rouge, New Orleans, and Houma.
- A surplus in the number of FTE LPNs will extend through 2020 in Alexandria, Lafayette, and Monroe.
- Statewide, the demand for LPNs will extend through 2013. Beginning in 2014 and extending through 2020, the supply of LPNs will just meet the demand.

Regional and Statewide Nursing Workforce Forecasts for Louisiana
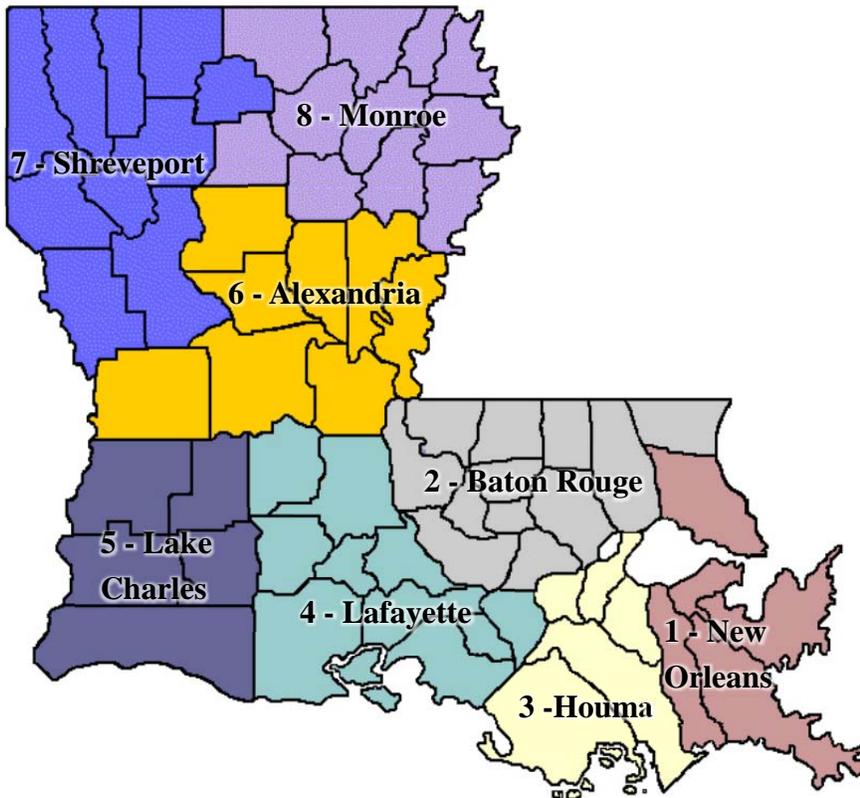
Forecasts represent predictions based on the current conditions. Changes in health policy, patient care delivery, nurse intensity, or population shift, and implementation of all, or components of the Affordable Care Act, will affect demand for RNs, APRNs, and LPNs in Louisiana.

Forecasts by Regional Labor Market Area (RLMA):

Region 1 (New Orleans RLMA): Jefferson, Orleans, Plaquemines, St. Bernard, St. Charles, St. James, St. John the Baptist, St. Tammany Parishes

Forecast

    RNs – There will be a demand for RNs through 2020

    APRNs – There will be a demand for APRNs through 2020

    LPNs – There will be a demand for LPNs through 2020

Region 2 (Baton Rouge RLMA): Ascension, East Baton Rouge, East Feliciana, Iberville, Livingston, Pointe Coupee, St. Helena, Tangipahoa, Washington, West Baton Rouge, West Feliciana Parishes

Forecast

    RNs – There will be a demand for RNs through 2020

    APRNs – There will be a demand for APRNs through 2020

    LPNs – There will be a demand for LPNs through 2020

Region 3 (Houma RLMA): Assumption, Lafourche, Terrebonne Parishes

Forecast
> **RNs** – There will be a surplus of RNs through 2020
> **APRNs** – There will be a demand for APRNs through 2016. Beginning in 2017 and extending through 2020, supply will just meet the demand for APRNs.
> **LPNs** – There will be a demand for LPNs through 2020

Region 4 (Lafayette RLMA): Acadia, Evangeline, Iberia, Lafayette, St. Landry, St. Martin, St. Mary, Vermilion Parishes

Forecast
> **RNs** – There will be a demand for RNs through 2020
> **APRNs** – There will be a demand for APRNs through 2020
> **LPNs** – The supply of LPNs will exceed the demand through 2020

Region 5 (Lake Charles RLMA): Allen, Beauregard, Calcasieu, Cameron, Jefferson Davis Parishes

Forecast
> **RNs** – A surplus for RNs will begin in 2013 and extend through 2020.
> **APRNs** – There will be a demand for APRNs through 2017. Beginning in 2018, the supply of APRNs will just meet the demand through 2020.
> **LPNs** – There will be a surplus of LPNs through 2016, followed by a closing of the gap between supply and demand beginning in 2017, subsequently leading to a demand for LPNs in 2018 which will extend through 2020.

Region 6 (Alexandria RLMA): Avoyelles, Catahoula, Concordia, Grant, LaSalle, Rapides, Vernon, Winn Parishes

Forecast
> **RNs** – There will be a surplus of RNs through 2020.
> **APRNs** – The supply of APRNs just meets demand through 2013. Beginning in 2014 the supply of APRNs will exceed demand through 2016. In 2017 the gap between supply and demand will begin to close leading to a demand for APRNs in 2018 extending through 2020.
> **LPNs** – There will be a surplus of LPNs through 2020.

Region 7 (Shreveport RLMA): Bienville, Bossier, Caddo, Claiborne, DeSoto, Lincoln, Natchitoches, Red River, Sabine, Webster Parishes

Forecast
> **RNs** – Beginning in 2013, the supply of RNs will just meet demand through 2014. There will be a surplus of RNs in 2015 which will extend through 2020.
> **APRNs** – The demand for APRNs will exceed supply through 2020.
> **LPNs** – Supply will just about meet the demand for LPNs through 2014, but beginning in 2015 the demand for LPNs will exceed the supply through 2020

Region 8 (Monroe RLMA): Caldwell, East Carroll, Franklin, Jackson, Madison, Morehouse, Ouachita, Richland, Tensas, Union, West Carroll Parishes

Forecast

      RNs – In 2013, the supply of RNs will just meet demand. There will be a surplus of RNs beginning in 2014 extending through 2020.

      APRNs – For APRNs, supply will exceed demand beginning in 2013 continuing through 2020.

      LPNs – A surplus of LPNs is predicted to extend through 2020.

Statewide:

Forecast

      RNs – There will be a demand for RNs through 2016. The gap between supply and demand will begin to close in 2017, at which time the supply will just meet the demand for RNs through 2020 based on current conditions.

      APRNs – There will be a statewide demand for APRNs through 2020.

      LPNs – The demand for LPNs will extend through 2013. Beginning in 2014 and extending through 2020, the supply of LPNs will just meet the demand.

References and Primary Data Sources

1. Louisiana Health Works Commission Regional Labor Market Area Map
   http://www.laworks.net/Downloads/lmi/RLMAsDefined.pdf

2. The 2010 Decennial Census of Population for Louisiana, population characteristic including age, and gender by Parish, U.S. Department of Commerce, Bureau of the Census, Washington, DC.

3. Data from The Centers for Disease Control and Prevention, National Center for Health Statistics mortality data and US Census Bureau population data, 2007.

4. The *HRSA Nursing Supply Model: Updated Technical Report and User Guide*. Report prepared for the Bureau of Health Professions, Health Resources and Services Administration, April 2009.

5. Licensure Renewal registration data for RNs and APRNs from the Louisiana State Board of Nursing for 2012 and 2013.

6. Licensure Renewal data for LPNs from the Louisiana State Board of Practical Nurse Examiners for 2012 and 2013.

7. Louisiana Health Information Network (LHIN) 2009 Louisiana State Inpatient Database, a service of ShareCor that brings together the data collection efforts of Louisiana healthcare facilities, the Louisiana Hospital Association, the Metropolitan Hospital Council of New Orleans, Thomson Reuters, and public and private data and technology organizations to create a statewide information resource of patient-level health care data.   This data enables research on a broad range of health policy issues, including cost and quality of health services, medical practice patterns, access to health care programs, and outcomes of treatments.

Secondary Data Sources not Directly Relied Upon for Estimates

a. The 2005 Nationwide Inpatient Sample (NIS) - one of a family of databases and software tools developed as part of the Healthcare Cost and Utilization Project (HCUP), a Federal-State Industry partnership sponsored by the Agency for Healthcare Research and Quality (AHRQ). The NIS is the largest nationwide all-payer hospital inpatient care database in the U.S. Each year the NIS contains data from approximately eight million hospital stays – all discharge records from approximately 1,000 hospitals selected from HCUP State Inpatient Databases (SID) data. For a complete description of the survey, see "HCUP, Design of the Nationwide Inpatient Sample (NIS), 2005", June 13, 2007, Healthcare Cost and Utilization Project, Agency for Healthcare Research and Quality, 540 Gaither Road, Rockville, MD 20850.

b. American Hospital Association Annual Survey, an annual survey of hospitals in the United States and associated territories, produces an Annual Survey Database. This

database includes data elements containing demographic, utilization, financial, and other hospital characteristics of interest to health care researchers. For a full description, see "Overview of the HCUP American Hospital Association, Annual Survey SAS® Databases 1987-2010", December 9, 2011.

c. National Hospital Ambulatory Medical Care Survey (NHAMCS) is a national survey designed to collect data on the utilization and provision of ambulatory care services in hospital emergency and outpatient departments. Findings are based on a national sample of visits to the emergency departments and outpatient departments of non-institutional general and short-stay hospitals. For a full description see www.cdc.gov/nchs/ahcd.htm

d. National Ambulatory Medical Care Survey (NAMCS) is a national survey designed to meet the need for objective, reliable information about the provision and use of ambulatory medical care services in the United States. Findings are based on a sample of visits to non-federal employed office-based physicians who are primarily engaged in direct care. For a full description see www.cdc.gov/nchs/ahcd.htm

e. National Nursing Home Survey (NHHS) is a continuing series of national sample surveys of nursing homes, their residents and their staff. For a full description see www.cdc.gov/nchs/nnhs.htm

f. Medical Expenditure Panel Survey (MEPS) is a set of large-scale surveys of families and individuals and their medical providers, and employers across the United States which is conducted annually. For a full description see www.ahrq.gov/resear/data/mes/index/html

g. "*The U.S. Nursing Workforce: Trends in Supply and Education*", Health Resources and Services Administration, Bureau of Health Professions, National Center for Health Workforce Analysis, April 2013.

h. 2008-2010 American Community Survey 3-Year Estimates is an annual survey of socioeconomic information every year covering more than 40 topics. The estimates are available in detailed tables for the nation, all 50 states, the District of Columbia, Puerto Rico, every congressional district, every metropolitan area, and all counties and places with populations of 20,000 or more.

i. Biviano MB, Tise S, Fritz, M, Spencer W, and Dall TM. (2007). "What is Behind HRSA's Projected U.S. Supply, Demand, and Shortages of Registered Nurses?"

j. The Nursing Demand Model: Development and Baseline Forecasts. Report prepared for the Bureau of Health Professions, Health Resources and Services Administration, September 2004.

k. *Louisiana State Board of Nursing 2011 Annual Report*

l. *Louisiana State Board of Nursing 2012 Annual Report*

m. *Nursing Workforce Demand Report*, Dr. Cynthia Bienemy, Louisiana Center for Nursing, March 2012.

n. University Medical Management Corporation*,* "Louisiana Market Overview", Kauffman Hall & Associates, draft power point presentation, March 16, 2012.
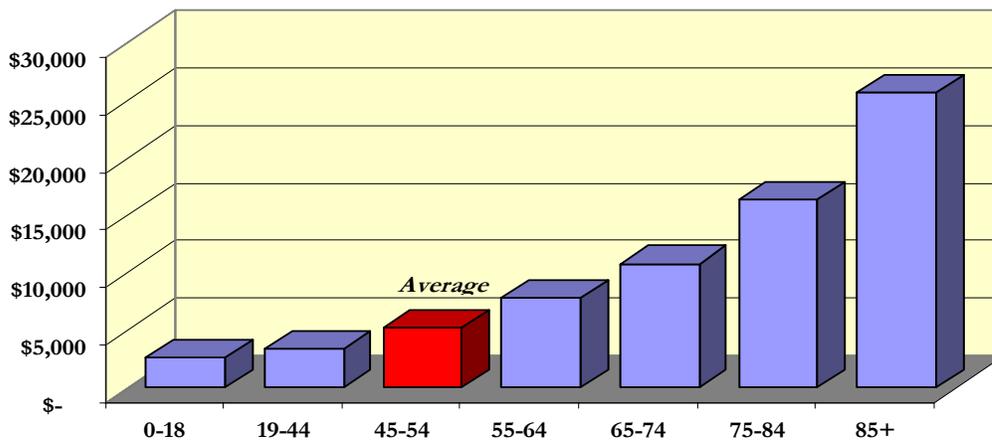
APPENDIX A

Demand for Health Care

The demand for health care increases geometrically with age. This can be easily illustrated by looking at the relative expenditures on healthcare by age group for the U.S. below:

Figure A1.

U.S. Per Capita Healthcare Expenditures

- People between 45 and 54 spend 2 times as much as someone under 19
- People between 55 and 64 spend 3 times as much as someone under 19
- People between 65 and 74 spend 4 times as much as someone under 19 or 2 times as much as someone between 45 and 54
- People between 75 and 84 spend 6 times as much as someone under 19 or 3 times as much as someone between 45 and 54
- People 85 and older spend almost 10 times as much as someone under 19 or 5 times as much as someone between 45 and 54

APPENDIX B

The following bar chart shows the breakdown of RNs by the year they were first licensed[5]. Most of the RNs in red and light blue will be retiring from the workforce by 2020 as they surpass 30 years of service. Replacing them in the face of increasing demand for health care as the population gets older will certainly be a challenge.

Figure B1. RN Workforce by Year of Initial License
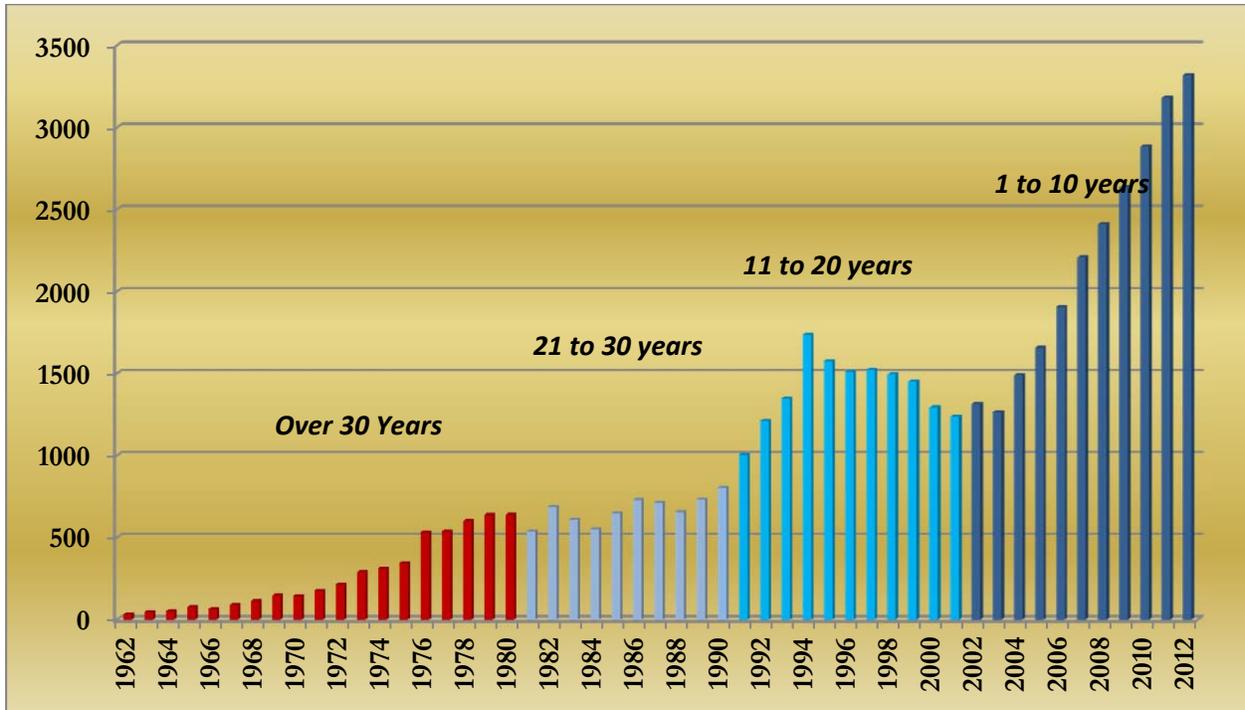
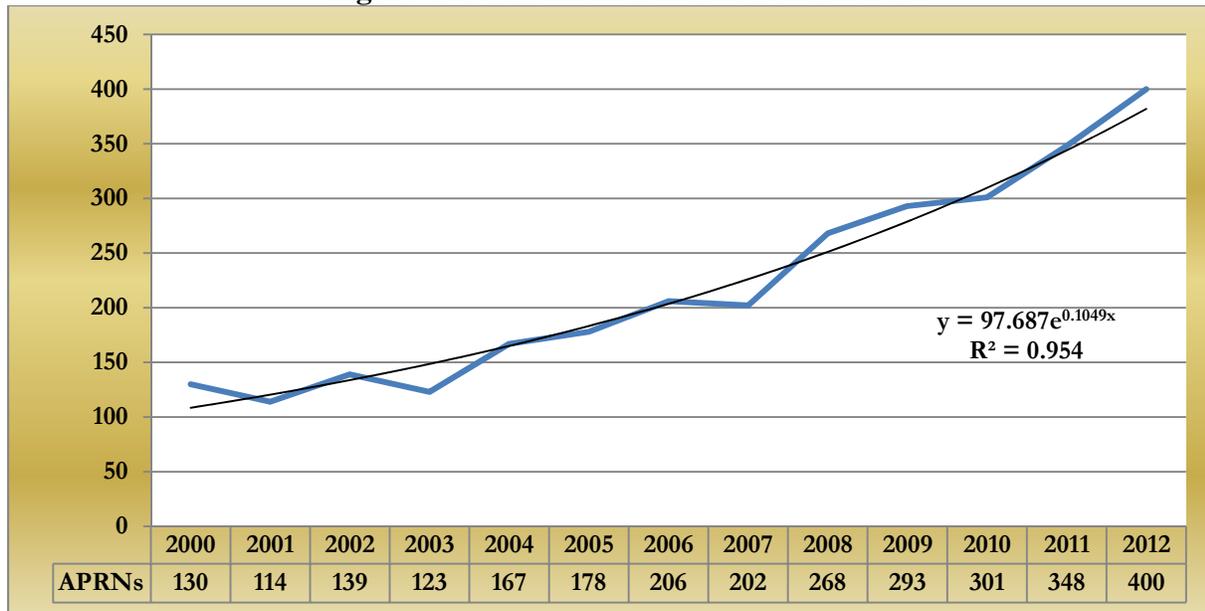Note: Breakdown of RNs by the year they were first licensed.

APPENDIX C

Explosive Growth in the Demand for APRNs

The role of nurses today is ever widening and the greatest change involves the use of Nurse Practitioners and Physician Assistants. In rural areas and core urban areas where health care is least affordable, APRNs are used to supplement the care given by primary care physicians.[1]

The growth in the demand for APRNs can be seen in the following chart that shows the exponential growth of newly licensed APRNs in Louisiana in the past 12 years[5]. The current annual number of newly licensed APRNs is about 350, but, this number has been growing at 10.8% a year. The unemployment rate for APRNs, based on 2012 licensure data, is only 1.5%. It is easy to see that as fast as these new nurses have entered the labor market they have found work. Based on this, an initial growth rate in the intensity factor was used for APRNs of 4% a year for inpatient care and 4% for outpatient care. These are the two health care settings where the vast majority of APRNs currently work according to the current registration data. This may be a very conservative figure given the obvious growth in demand in the recent past in the state. However, in the model itself the user can modify the growth rate assumption.

Figure C1. New APRNs Licensed Each Year

$$y = 97.687e^{0.1049x}$$
$$R^2 = 0.954$$

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
APRNs	130	114	139	123	167	178	206	202	268	293	301	348	400

Note: Growth of newly licensed APRNs in Louisiana in the past 12 years.

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[1]O'Grady, E. R., Hanson, C., Lugo, N. R., & Hodnicki, D. (2010). Unleashing the nation's nurse practitioners. *The Journal of Rural Health.* Retrieved on March 3, 2012 from http://m.eileenogrady.net/upload/Unleashing%20the%20%20Nation's%20Nurse%20Practitioners.pdf.