Wisconsin Registered Nurse Supply and Demand Forecasting: Results Report 2010-2035

"Health workforce data analysis (including collection) and forecasting is necessary to develop an effective response to the health workforce shortage threatening our most vulnerable communities. A healthy Wisconsin requires a sufficient, diverse, competent and sustainable health workforce."

Wisconsin Health Workforce Data Collaborative, 2009

ABSTRACT

The aging population is creating a unique set of challenges for the Health Care Industry. To put it simply, the baby-boom population is retiring, and there are not enough RNs entering the labor force to keep up with the increasing demand of the aging population. The Wisconsin Office of Economic Advisors expanded and improved an existing forecasting tool to project the future supply and demand of Registered Nurses (RNs) in Wisconsin. The Wisconsin Supply and Demand models have the capability to run policy scenarios. The base projections show that the supply of RNs will begin to flatten while demand for RNs will grow steadily. Under the current market conditions, the gap between supply and demand is expected to reach about 35% by 2035.

OVERVIEW

This report provides results and analysis of the Wisconsin registered nurses supply and demand forecasts. The gap between supply and demand is expected to be about 35% by 2035 under the current market conditions. This report does not attempt to recommend a final solution for closing the gap. Solving the problem is much better left in the hands of experts that are more in tune with the health care industry. The report entitled "Wisconsin Registered Nurse Supply and Demand Forecasting Model: Technical Report" (Walsh et al., 2011) has been published as a companion to this report to provide a detailed description of the forecasting models used to prepare the results.

The expected shortage of RNs should come as no surprise since Wisconsin's labor force is facing a great change as the baby-boom population begins to retire. The changes are inevitable, and economists at the Office of Economic Advisors (OEA) within the Wisconsin Department of Workforce Development (DWD) have already examined their effects in a paper entitled, "The Impact of Aging Population on Wisconsin's Labor Force" (Winters et al., 2009). As stated in the paper, the effects of the shifting demographics on Wisconsin's workforce cannot be overstated. However, health care faces a unique set of challenges due to the nature of this industry. Along with a decreasing labor supply, the aging population will increase the demand for health care. In other words, there are not enough RNs entering the labor force to keep up with the steadily retiring baby-boom population and increasing demand as the aging population will require more health care. Steps need to be taken to ensure high quality health care in the future.

The Office of Economic Advisors is working with other Wisconsin Health Workforce Data Collaborative (Data Collaborative) members to provide a "Collaborative Response to the Growing Wisconsin Health Workforce Crisis" project. One of this project's goals calls for the expansion of the existing

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The Office of Economic Advisors (OEA) is more than just data. OEA is a group of economists and analysts charged with identifying, analyzing, interpreting, and projecting workforce trends. As a part of the Department of Workforce Development, OEA assists public and private sector partners to better understand the effects of trends on the state's employment and economic growth.

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forecasting tool for registered nurses (RNs) in Wisconsin.

It is essential to stress why state specific supply and demand models are needed for RNs when the Bureau of Labor Statistics (BLS) already requires ten-year employment projections for all occupations. One reason is that BLS employment projections estimate the number of jobs rather than the number of workers. Also, the BLS employment projections do not estimate the demand or supply in the strict economic sense of these words. For any given wage, it is not known how many jobs employers would really want to provide. Likewise, it is not known how many people would want to work for any given wage. The BLS projections only indicate the number of jobs that will actually be filled in the projected year. As a result, BLS projections estimate the number of job openings assuming the market is in equilibrium, which refers to a balance between supply and demand of workers.

The Health Resources and Services Administration (HRSA), an agency of the U.S. Department of Health and Human Services, released a study in 2004 that projected RN supply and demand for the nation and all 50 states. The HRSA projections gave a basic overview of the Wisconsin's future nursing shortage. However, the state specific projections relied on a small sample size of nurses and used national health care usage rates to project demand. Due to these limitations, a Wisconsin specific long-term supply and demand forecasting model (the Wisconsin Model) was designed to more precisely quantify the supply-demand balance of nurses in the state.

Using the HRSA forecasting model as a guide, the Wisconsin Model was originally developed by DWD's health care policy analyst and OEA economists in 2007. However, the robustness of the supply and demand forecasts were limited by inadequate data. Since then, the 2010 RN License Renewal Survey (the RN Survey) was launched thanks to legislation on the state level. Data from the survey was used to expanded and improved the Wisconsin Model, which allowed for enhanced supply and demand projections of RNs in Wisconsin through 2035.

Despite the fact that the HRSA model was used as a guide for the design, the Wisconsin Model deviates from the HRSA model in several major ways.

First, the HRSA supply model is a "stock and flow" model. This design requires estimates of inflows to and outflows from the RN labor market to project supply. Other states, including Texas, Nebraska, North Dakota, California, and Florida, use this methodology to project RN supply. Similar methodologies are used for other models including HRSA's Physician Supply Model. The "stock and flow" methodology provides accurate and reliable projections if all of the data elements are present and measured correctly.

By comparison, the supply-side of the Wisconsin Model requires fewer data elements because it uses changing demographics and overall population growth to implicitly capture all the factors influencing supply. The supply-side refers to the number RNs in the labor market. Another advantage of the Wisconsin Model approach is easily adaptable to other occupations. To project supply, the only required data elements are the age distribution of an occupation's workforce, the total number of workers in the workforce, and population projections by age. On the demand-side, the Wisconsin Model deviates from the HRSA model by using Wisconsin specific or region specific data available, to project the demand for RNs. The demand-side refers to the number of nurses that are needed to meet the health care future needs of the population.

Another unique feature of the Wisconsin Model is that it allows users to generate forecasts based on their own assumptions about the future of the nursing workforce, as well as to estimate impacts of various policy interventions. This feature is captured through the scenario models. The base models provide forecasts under the assumption that the current market conditions remain constant over time, while the scenario models allow for changes to the model's underlying assumptions. Policymakers will be able to use this model as a tool when considering which steps to take to minimize the anticipated shortage of RNs.

Additionally, the two models differ in their equilibrium assumptions. HRSA made the assumption that the supply of RNs equaled the demand for RNs in 1996. The Wisconsin Model has a greater flexibility. Its base case assumes balance between supply and demand in 2010, but users can challenge this equilibrium assumption. Flexibility is important because there is currently no data to definitively determine the RN equilibrium conditions in the state. Supply and demand balance is a difficult concept to quantify even with available data. For example, there are many differing opinions on the appropriate staffing intensity to provide quality care for patients. Employer-based surveys asking about current unmet RN demand are needed to estimate the current gap between supply and demand.

The year 2010 was chosen as the base equilibrium condition based on the subject's literature and qualitative opinions of expert partners from the Data Collaborative. The ability to change the equilibrium conditions makes forecasting results less dependent on this assumption.

Finally, the Wisconsin Model improved HRSA's method of projecting nurse educators. The HRSA model projects demand for educators by using a ratio of all other RNs to educators in the base period. The Wisconsin Model projects demand for educators based on demand for RNs in a future period since it takes time to educate, train, and license a nurse.

Overall, the Wisconsin Model is unique in its versatility and ease of use. Changes to the supply base case can be made by altering the factors that influence supply. These factors are the number of new graduates, labor force participation, retirement, and net migration. Changes to the demand base case can be made by altering the overall RN demanded-to-population ratio or the ratio for any of the employment settings. Changes to the demand ratio come from changes in health care usage or staffing intensity rates.

The Wisconsin Model allows users to generate their own forecasts by changing factors that influence supply or demand in any combination. This versatility is important, because a combination of policies will need to be considered to alleviate the anticipated health care workforce gap. The Wisconsin Model allows for quick and easy multivariate sensitivity analysis. For example, policymakers might consider taking steps to increase nursing educational capacity and invest in technology designed to improve the efficiency of nurses. The anticipated impact of such policies can easily be estimated through this tool. Policy makers and stakeholders can use the Wisconsin Model to perform multiple scenarios while making important decisions.

RN Forecasting Models: The Wisconsin Model

A more detailed description of methods and assumptions is provided in "Wisconsin Registered Nurse Supply and Demand Forecasting Model: Technical Report" (Walsh et al., 2011).

The Wisconsin supply and demand models rely on changing age demographics and the overall population growth as the major driving forces. The supply and demand models both have base and scenario versions: Base Supply Model, Scenario Supply Model, Base Demand Model, and Scenario Demand Model. Additionally, each model has four sub-models:

- Broad Nursing Workforce, Head Count RNs
- Broad Nursing Workforce, FTE[1] RNs
- Direct Patient Care, Head Count RNs
- Direct Patient Care, FTE[1] RNs

[1] FTE = Full-Time Equivalent

The Base Supply Model uses a constant ratio of RNs to the total population in each age group to project the future supply of RNs. The Scenario Supply Model lets users change the ratios by changing the factors that influence supply. (See "Supply Model: Scenario" on page 4.)

The Base Demand Model relies on constant nurse staffing intensity and health care usage by age and by employment setting to project the future demand for RNs. The Scenario Demand Model allows users to change either the overall base demand or the base demand in any of the employment settings. (See "Demand Model: Scenario" on page 4.)

Both base models assume that the nursing labor market was in equilibrium in 2010. However, this assumption can be challenged in the scenario models.

The quality of the theoretical design provides confidence in the model's result. Quality data sources, highlighted by the 2010 RN Survey, were used throughout the forecasting model. A total of 77,701 RNs renewed their Wisconsin license in 2010. 77,553, or 99.8%, responded to the survey. Additionally, the population estimates and projections used in the model are subject to strict quality standards. Also, state or regional level health care usage data was used to forecast demand. Other projection models apply national data to the state level. As a result, the demand projections more accurately capture the unique characteristics of the state's population. The base projection models reflect the composition of the workforce under the assumption that factors effecting supply and demand will not change in the future. As with any model, error increases from the short-term (2015) to the long-term (2035) as the population becomes more susceptible to unpredictable events.

I. SUPPLY MODEL

1. Supply Model: Base

The primary driving forces for the base supply projections are changing demographics and population growth. These forces implicitly capture all current RN inflows and outflows. The base supply projections are prepared based on the assumption that the 2010 RN-to-population ratios in each age group will remain constant going forward. This assumption is made since the historic data on the RN workforce is currently limited.

The RN-to-population ratios are calculated by comparing the number of nurses (head count or FTE) in an age group by gender to the general population for that age group. The following thirteen age groups are used in the Wisconsin Model:

(20-24) (25-29) (30-34) (35-39) (40-44) (45-49) (50-54) (55-59) (60-64) (65-69) (70-74) (75-79) (80 & Above)

Wisconsin population estimates for the year 2009 were provided by the Wisconsin Department of Health Services (DHS), population projections by age for every projected period (2015, 2020, 2025, 2030, and 2035) come from the Wisconsin Department of Administration (DOA), and the number of nurses (head count and FTE) in 2009 was counted from the RN Survey.

For the purposes of this and other forecasting reports, the year 2010 was used as the base year for all models. While conducted in early 2010, the RN Survey contains data pertaining to nurses' current situation as well as their situation during the calendar year 2009. Additionally, July 1, 2009 was used as a point-in-time population estimates for the state of Wisconsin.

2. Supply Model: Scenario

As presented in the previous section, the Base Supply Model uses a constant ratio of registered nurses to the total population for each age group and gender to project the future supply of RNs. The numbers of RNs are projected for every fifth year through 2035 by multiplying the ratio observed in 2010 by the projected population for a given year. The base model does not allow for policy scenario analyses since all factors that effect supply are implicitly captured but not isolated.

The Scenario Supply Model identifies and isolates four factors that influence supply. This allows model users to determine the effects of changes to specific factors on the overall RN supply.

The Scenario Supply Model does not allow users to change the overall RN-to-population ratio. This is because all changes to supply can be attributed to changes in the isolated factors that influence supply. The isolated factors that influence supply are:

- Change in new graduates
- Change in labor force participation
- Change in retirement pattern
- Change in net migration (in minus out)

The main goal of policymakers might be to increase the overall supply of RNs. Individual policies to increase supply can be simulated by changing one or more of the factors that influence supply.

II. DEMAND MODEL

1. Demand Model: Base

The Base Demand Model relies on two data elements: 1) nurse staffing intensity and 2) health care usage by employment setting by age. Both elements are held constant, which means aging population and overall population growth are the only driving forces for the Base Demand Model. The employment settings used in the HRSA Model were used as a guide for categorizing health care usage. Demand projections were made using the best obtainable data, and Wisconsin specific or regional data was used in all settings. The data inputs for the Base Demand Model are explained in detail in the technical report.

Overall, quality projections were made based on the best available data. Future demand projections can be improved by creating and improving methods of data collection for health care usage by employment setting and by age.

2. Demand Model: Scenario

The Scenario Demand Model allows users to change overall base demand and base demand in any of the settings in any of the six periods between 2010 and 2035. Most supply and demand models need to make assumptions for equilibrium conditions. The Base Demand Model assumes the labor market for registered nurses was in equilibrium in 2010. However, this assumption can be challenged in the Scenario Demand Model. The Scenario Demand Model allows users to change the following settings: Nursing Homes and Extended Care, Home Health Care, Inpatient Care, Emergency Care, Ambulatory Surgeries in Hospitals, Ambulatory Care, Public Health Care, Other, and Nurse Educators.

Base demand projections are used to calculate a RNs demanded-to-population ratio for each employment settings. Changes to base demand are made through percent changes to the RN demanded to population ratios. Changes can be made to any of the individual settings or to the overall demand. After a new demand total is calculated through a change in the overall demand, the model recalculates demand in each of the individual settings based on the proportion

of total nurses demanded in the setting prior to the change to overall demand.

III. BASE CASE RESULTS

The supply and demand of registered nurses was projected for the Broad Nursing Workforce, Head Count Model (Figure 1 and Table 1), Broad Nursing Workforce, FTE Model (Figure 2 and Table 2), Direct Patient Care, Head Count Model (Figure 3 and Table 3), and Direct Patient Care, FTE Model (Figure 4 and Table 4).

Regardless of the model, the forecasts show that demand for nurses will continue to rise while supply is expected to flatten after 2015. Rapidly increasing demand and flat supply is caused by changing population demographics. To put it simply, the baby-boom population is retiring, and there are not enough RNs entering the labor force to keep up with the increasing demand of the aging population. The projected shortage of RNs by 2035 for the four models varies between a high of 36.6% and a low of 34.4%.

All four models were necessary to meet the varying needs of potential health care data users even though the trends are very similar between the models. Those more concerned with nurses' role in the overall health care industry will find the Broad Nursing Workforce projections more useful. Those more specifically interested in nurses that are interacting with patients will find more utility in the Direct Patient Care projections. Head Count and FTE projections were generated because some areas of workforce planning require an estimate of the workers needed while other areas need an estimate of hours worked.

The base projections provide a baseline for the labor market trend. It is important to reiterate that these projections are based on a current snap shot of the RN labor force. The projections are based on the assumption that the factors influencing supply and demand remain constant over time. Implicit upon this assumption is that health care demand increases with age. The baseline projections quantity and support the hypothesis that the nursing industry faces a pending shortage.

The projection results become more meaningful when examined in conjunction with the baby-boom generation. Immediately following World War II, the United States and much of the western world experienced an explosive increase in birth rates. Approximately 80 million babies were born in the U.S.

Figure 1: RN Supply and Demand Projections: Wisconsin, 2010-2035
(Base Case, Head Count, Broad Nursing Workforce)

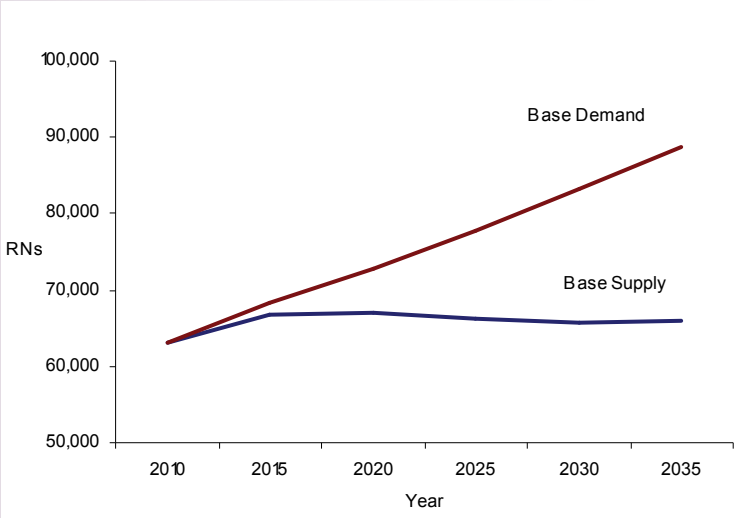


Table 1: Projected RN Supply, Demand, and Gap in Wisconsin, 2010-2035
(Base Case, Head Count, Broad Nursing Workforce)

Results	2010	2015	2020	2025	2030	2035
Base Supply	62,962	66,664	67,143	66,267	65,657	66,019
Base Demand	62,962	68,338	72,733	77,776	83,291	88,722
Gap	0	-1,675	-5,589	-11,508	-17,633	-22,703
Percent Gap	0.0 %	-2.5 %	-8.3 %	-17.4 %	-26.9 %	-34.4 %

during the period known as the "baby boom" (Winters, et al.). Baby boomers are defined as those born between the years 1946 and 1964. This means the oldest boomer turned 65 in 2011 and the youngest boomer will turn 65 in 2029. The 2010 RN model provides a snap shot of the RN labor market at the beginning of a labor market exodus. The effects of this historic event can be seen in the flat supply growth projections. Using 65 as a guide for estimating retirement, it is safe to say that the majority of baby boomers will still be active in the labor market by 2015. This explains the expected increase in supply growth between 2010 and 2015. However, supply growth flattens after 2015 and actually becomes negative as a larger share of baby boomers leave the workforce after 2015.

Zero supply growth is not unique to the RN workforce. However, rapidly increasing demand for health care is a unique phenomenon. The accelerated demand growth is caused by a sharp increase in demand for health care services due to an aging population. As a reference, Wisconsin's population as a whole is expected to grow by a little over 17% between 2010 and 2035. All four models project demand for RNs to grow by over 40% during the same time frame. This should not be a major surprise given the demographic characteristics of the population. As baby boomers age, they will use more health care. It will be a challenge for the health care industry as a whole to keep up with the increased demand for services caused by that concentration of aging population.

Additionally, the age demographics will change. The demographic shift will cause changes in the average number of hours worked per nurse over time. Average hours worked per RN can be calculated by comparing the FTE models to the head count models. The average nurse in the Broad Nursing Workforce worked 1,652 hours in the base year. Average annual hours worked are expected to decline as the workforce ages. Hours worked will decline every year of the model until 2030 when average hours bottoms out at 1,626 hours per year. The decline represents a 1.6% reduction in hours worked per nurse. Average hours worked per RN in the Direct Patient Care workforce are expected to decline by 1.3% over the same time period. Average hours worked will rebound slightly for both workforces by 2035.

Figure 2: RN Supply and Demand Projections: Wisconsin, 2010-2035
(Base Case, FTE, Broad Nursing Workforce)

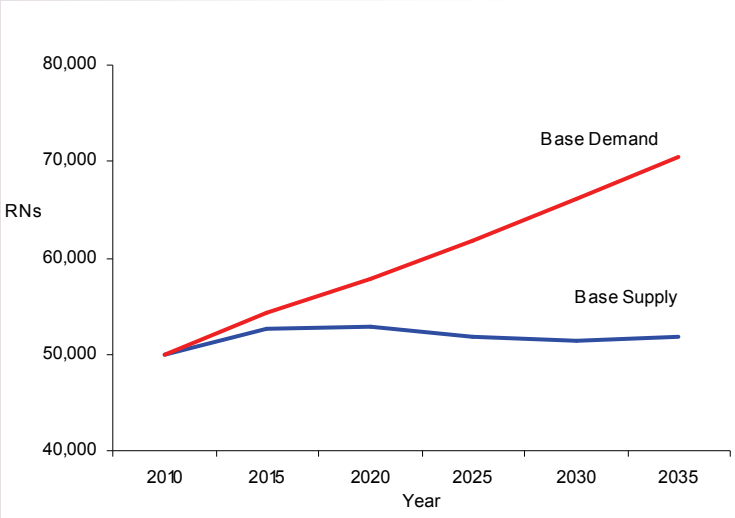


Table 2: Projected RN Supply, Demand, and Gap in Wisconsin, 2010-2035
(Base Case, FTE, Broad Nursing Workforce)

Results	2010	2015	2020	2025	2030	2035
Base Supply	50,019	52,702	52,766	51,826	51,324	51,771
Base Demand	50,019	54,300	57,795	61,786	66,132	70,382
Gap	0	-1,598	-5,029	-9,960	-14,807	-18,611
Percent Gap	0.0%	-3.0%	-9.5%	-19.2%	-28.9%	-35.9%

Figure 3: RN Supply and Demand Projections: Wisconsin, 2010-2035
(Base Case, Head Count, Direct Patient Care)

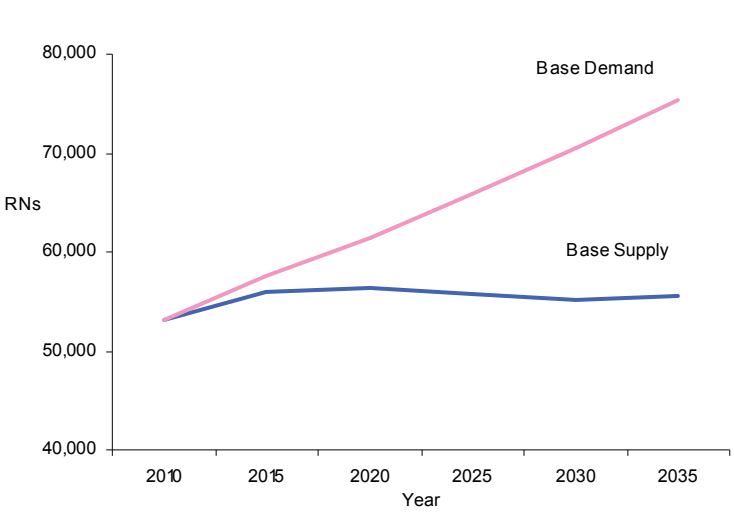


Table 3: Projected RN Supply, Demand, and Gap in Wisconsin, 2010-2035
(Base Case, Head Count, Direct Patient Care)

Results	2010	2015	2020	2025	2030	2035
Base Supply	53,036	56,060	56,424	55,705	55,228	55,539
Base Demand	53,036	57,663	61,438	65,790	70,570	75,270
Gap	0	-1,603	-5,014	-10,085	-15,342	-19,731
Percent Gap	0.0%	-2.9%	-8.9%	-18.1%	-27.8%	-35.5%

Figure 4: RN Supply and Demand Projections: Wisconsin, 2010-2035
(Base Case, FTE, Direct Patient Care)

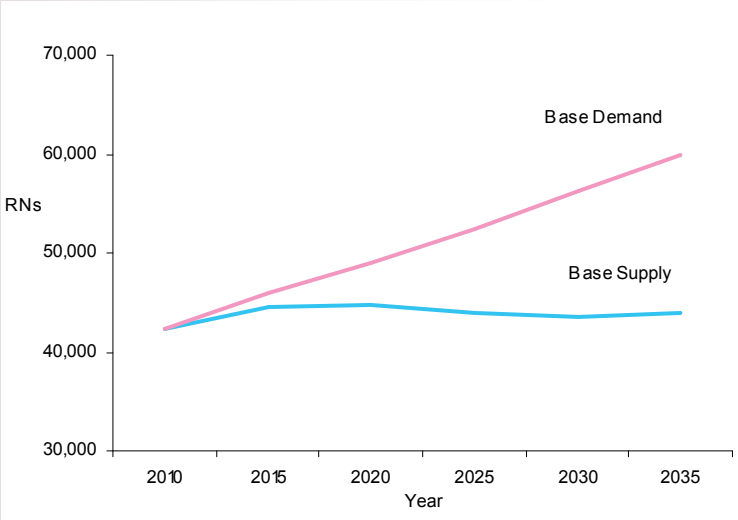


Table 4: Projected RN Supply, Demand, and Gap in Wisconsin, 2010-2035
(Base Case, FTE, Direct Patient Care)

Results	2010	2015	2020	2025	2030	2035
Base Supply	42,362	44,596	44,666	43,927	43,542	43,900
Base Demand	42,362	46,049	49,062	52,513	56,279	59,955
Gap	0	-1,453	-4,396	-8,587	-12,737	-16,054
Percent Gap	0.0%	-3.3%	-9.8%	-19.5%	-29.3%	-36.6%

IV. SCENARIO ANALYSIS

The scenarios included in this report are primarily intended to demonstrate the capabilities of the model. The capabilities of the model are best portrayed by using relevant scenarios. Stakeholders in the project were solicited to make sure the scenarios accurately assessed possible directions of the industry.

The model has the flexibility to run scenarios that are determined by external factors and by policies that can be changed. Scenarios determined by external factors include laws and policies that have already been passed but not implemented, budget changes, and changes that affect labor market behaviors. Scenarios that can be changed are plausible policy interventions. These scenarios could include increasing the physical space available for educating RNs or implementing new technology into daily practice. The model projects the result of the scenario, which allows for sensitivity analysis. Policymakers can determine the effectiveness of a policy, which potentially allows for a cost-benefit analysis.

The model allows for three types of scenarios: "plateau" scenarios, "interval" scenarios, and "single-period" scenarios. "Plateau" scenarios are changes to the base that become the new standard throughout the rest of the model. "Interval" scenarios incorporate variations in the change to a factor that influences supply or demand from period to period. "Single-period" scenarios are a one period change in the factors. After the period, the factors return to base conditions. Any nurses that were added to supply filter through the remainder of the model under the base conditions.

Project partners were consulted to identify relevant scenarios regarding the industry. The scenarios were broken in to four categories based on collaborative input from project stakeholders:

- Educational Capacity
- The Uninsured and Public Insurance Programs
- Health Care Utilization and Scope of Work
- The Economy

Additionally, a scenario that combines multiple changes was added. This scenario is intended to demonstrate the model's ability to accommodate and measure multiple changes simultaneously. The ten scenarios are briefly summarized in Table 5, and full result are included in the following pages.

The model projects changes to supply and demand under each scenario. The strength of the tool is its versatility and flexibility. A scenario can either isolate a single change or estimate the effects of multiple changes. A limitation of the model is that it does not take patient outcomes or quality of care into consideration. Policymakers should do a separate analysis of a scenario's effects on patient outcomes and quality of care before implementing the policy.

Table 5: Summary of Scenarios

Category	Number	Summary	Notable Result
Educational Capacity	1.1	Graduation trends continue to increase at their current rate.	Gap decreases from -8.3% to -5.5% in 2020.
Educational Capacity	1.2	Educational capacity increases at a rate that keeps the supply and demand of nurses in balance.	Shortage eliminated.
Educational Capacity	1.3	Unrepresented groups of the population graduate from RN degree programs at the same rate as other groups.	Gap decreases from -8.3% to -0.3% in 2020.
The Uninsured and Public Insurance Programs	2.1	The entire population is insured.	The model starts with a 4% shortage in 2010.
The Uninsured and Public Insurance Programs	2.2	Public insurance programs eliminate some unnecessary health care services.	Gap decreases from -8.3% to -4.0% in 2020.
The Uninsured and Public Insurance Programs	2.3	Changes to Medicare and Social Security programs change retirement behaviors.	Minimal increase in supply.
Health Care Utilization and Scope of Work	3.1	RNs increase their scope of practice.	Increase in supply and demand
Health Care Utilization and Scope of Work	3.2	Individuals improve self-management.	Small reduction in demand
The Economy	4.1	The economy returns to prerecession conditions.	Gap increases from -8.3% to -15.2% in 2020
Combination	5.1	The net effect of a combination of unrelated changes.	Increase in supply and demand

Scenario 1: Educational Capacity

Scenario 1.1

Labor supply for specific occupations is closely linked to the capacity of in-state educational programs that train workers. Educational capacity is in a constant state of change as some programs add capacity and others decrease capacity. For example, UW-Madison and Viterbo University are currently undergoing major expansions to nursing facilities while other programs have expressed the intent to reduce the number of seats for nursing students.

Historical graduation trends can be tracked through National Council Licensure Examinations (NCLEX) statistics. The data indicates that RN graduation has been increasing at a rate of about 150 RNs per year since 2005 (NCSBN, 2011). Increased graduation is the result of policy interventions. Continued efforts will need to be made to increase graduation at the current rate. The trend was not incorporated into the base model because incorporating the trend might give the impression that graduation would increase without continued policy efforts.

For this scenario, continued efforts to expand educational capacity allows graduation to rise at its current rate. One hundred and fifty more RN graduates per year equates to an additional seven hundred and fifty graduates per five year period.

Model: Broad Nursing Workforce, Head Count: Scenario Supply and Demand

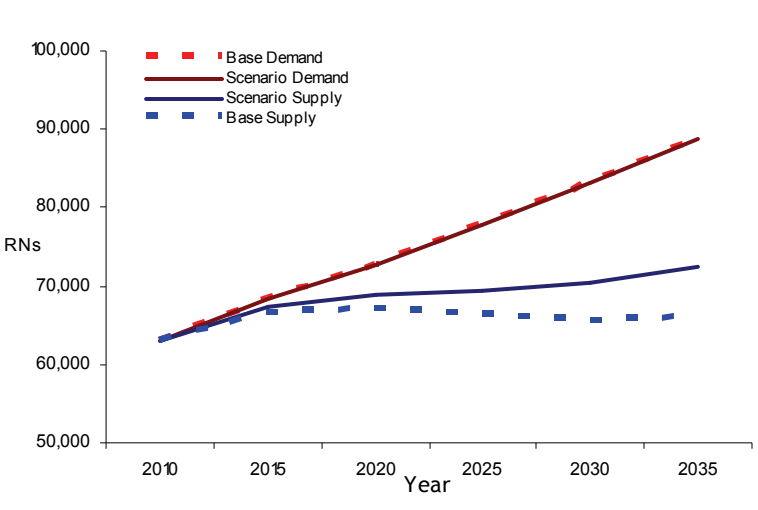
Table 6: Scenario 1.1 Percent Change to Base Supply Factors

	2010	2015	2020	2025	2030	2035
Graduation Ratio	0.0%	23.9%	53.3%	81.6%	108.0%	131.0%

Table 7: Scenario 1.1

Results	2010	2015	2020	2025	2030	2035
Scenario Supply	62,962	67,339	68,960	69,474	70,422	72,446
Scenario Demand	62,962	68,338	72,733	77,776	83,291	88,722
Scenario Gap	0	-999	-3,773	-8,302	-12,869	-16,276
Scenario % Gap	0.0%	-1.5%	-5.5%	-11.9%	-18.3%	-22.5%
Base Gap	0	-1,675	-5,589	-11,508	-17,633	-22,703
Base % Gap	0.0%	-2.5%	-8.3%	-17.4%	-26.9%	-34.4%

Figure 5: Scenario 1.1 Projected RN Supply and Demand



Scenario 1.2

Increasing RN graduation is usually one of the first things that comes to mind when thinking of ways to close a shortage. This scenario assumes that there are no constraints on Wisconsin's educational capacity, and educational programs produce enough nurses to keep the supply of RNs equal to the demand of RNs through 2035.

Model: Broad Nursing Workforce, Head Count: Scenario Supply and Demand

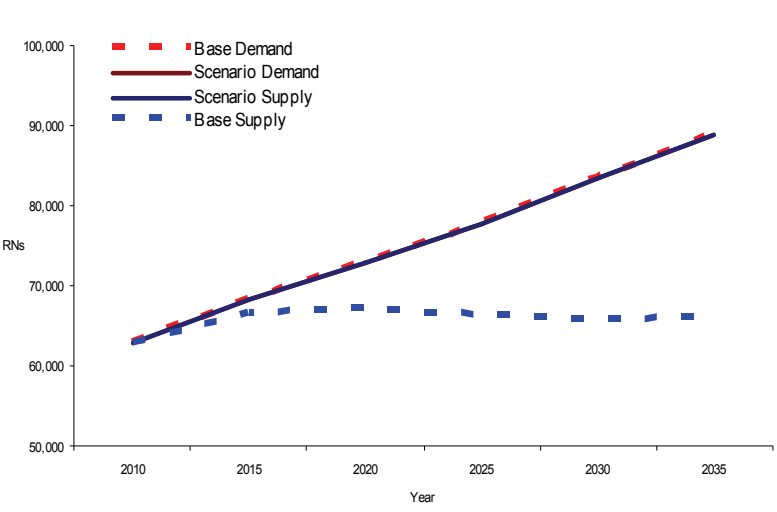
Table 8: Scenario 1.2 Percent Change to Base Supply Factors

	2010	2015	2020	2025	2030	2035
Graduation Ratio	0.0%	59.4%	171.3%	312.0%	410.8%	450.1%

Table 9: Scenario 1.2

Results	2010	2015	2020	2025	2030	2035
Scenario Supply	62,962	68,338	72,733	77,776	83,291	88,722
Scenario Demand	62,962	68,338	72,733	77,776	83,291	88,722
Scenario Gap	0	0	0	0	0	0
Scenario % Gap	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Base Gap	0	-1,675	-5,589	-11,508	-17,633	-22,703
Base % Gap	0.0%	-2.5%	-8.3%	-17.4%	-26.9%	-34.4%

Figure 6: Figure 1.2 Projected RN Supply and Demand



Scenario 1.3

Underrepresented sections of the population could provide an untapped pool of potential nurses. In this scenario, we assume there are no constraints on educational capacity. The number of graduates will increase so the total ratio of RN Graduates to the population in each age group matches the ratio of non-Hispanic white female RN Graduates to the non-Hispanic white female population in each age group.

Model: Broad Nursing Workforce, Head Count: Scenario Supply and Demand

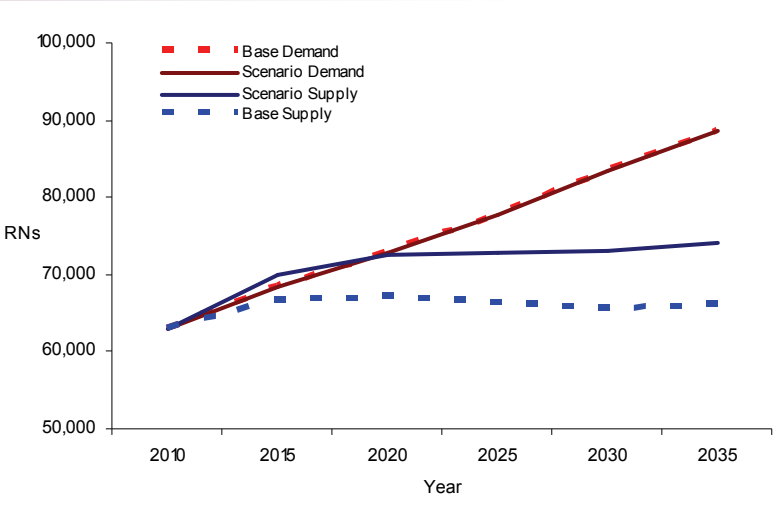
Table 10: Scenario 1.3 Percent Change to Base Supply Factors

	2010	2015	2020	2025	2030	2035
Graduation Ratio	0.0%	119.2%	132.8%	130.8%	126.2%	122.7%

Table 11: Scenario 1.3

Results	2010	2015	2020	2025	2030	2035
Scenario Supply	62,962	70,027	72,515	72,833	73,024	74,020
Scenario Demand	62,962	68,338	72,733	77,776	83,291	88,722
Scenario Gap	0	1,689	-218	-4,943	-10,267	-14,702
Scenario % Gap	0.0%	2.4%	-0.3%	-6.8%	-14.1%	-19.9%
Base Gap	0	-1,675	-5,589	-11,508	-17,633	-22,703
Base % Gap	0.0%	-2.5%	-8.3%	-17.4%	-26.9%	-34.4%

Figure 7: Scenario 1.3 Projected RN Supply and Demand



Scenario 2: The Uninsured and Public Insurance Programs

Scenario 2.1

The demand projections are based on current utilization rates. This implicitly captures differing usage pattern between the insured and the uninsured. Arguments have been made that demand is better conceptualized by estimating usage as if everyone had equal access to health care. This assumes that the entire population uses health care at the same rate as the insured population. This assumes that the entire population uses health care at the same rate as the insured population.

Ninety-one percent of Wisconsin residents were covered under some form of health insurance in 2009 (Wisconsin Department of Health Services, 2009). Insured people use about 45% more health care than uninsured people (Hadley and Holahan, 2004). This scenario calculates demand under the hypothetical assumption that the uninsured population had the same access to health care as the insured population. The result is a 4% increase in demand for RNs.

Model: Broad Nursing Workforce, FTE: Scenario Supply and Demand

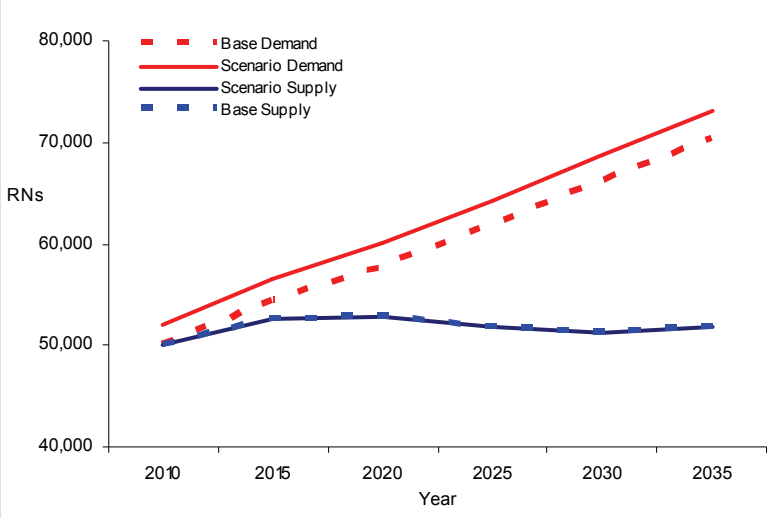
Table 12: Scenario 2.1 Percent Change to Base Demand Factors

	2010	2015	2020	2025	2030	2035
Total	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%

Table 13: Scenario 2.1

Results	2010	2015	2020	2025	2030	2035
Scenario Supply	50,019	52,702	52,766	51,826	51,324	51,771
Scenario Demand	52,020	56,472	60,106	64,258	68,777	73,134
Scenario Gap	-2,001	-3,770	-7,341	-12,432	-17,453	-21,363
Scenario % Gap	-4.0%	-7.2%	-13.9%	-24.0%	-34.0%	-41.3%
Base Gap	0	-1,598	-5,029	-9,960	-14,807	-18,611
Base % Gap	0.0%	-3.0%	-9.5%	-19.2%	-28.9%	-35.9%

Figure 8: Scenario 2.1 Projected RN Supply and Demand



Scenario 2.2

The health care industry was examined as it currently stands to make demand projections. This method includes the imperfections that exist within the system and doesn't take future policy changes into consideration. A Congressional Budget Office (CBO) report suggested that roughly 30% of Medicare's costs could be eliminated without negatively affecting health outcomes (CBO, 2008). This is consistent with a study of U.S. physicians that found that 20.0%-33.3% of services are unnecessary (Weiner, 2004). There are numerous reasons that unnecessary health care exists in the system. Some of the reasons cited for unnecessary medical services include duplicative tests and a pay-for-service system that compensates health care providers for procedures regardless of necessity. It is probably unrealistic to consider eliminating all unnecessary health care services. However, unnecessary health care services could be reduced by changing the standard practices in the industry.

This scenario will focus specifically on Medicare and Medicaid. Medicare and Medicaid makes up about 30% of total health care spending (CBO, 2007). Starting in 2015, stricter practice review processes are expected to cut unnecessary health care usage in Medicare and Medicaid in half.

Model: Direct Patient Care, Head Count: Scenario Supply and Demand

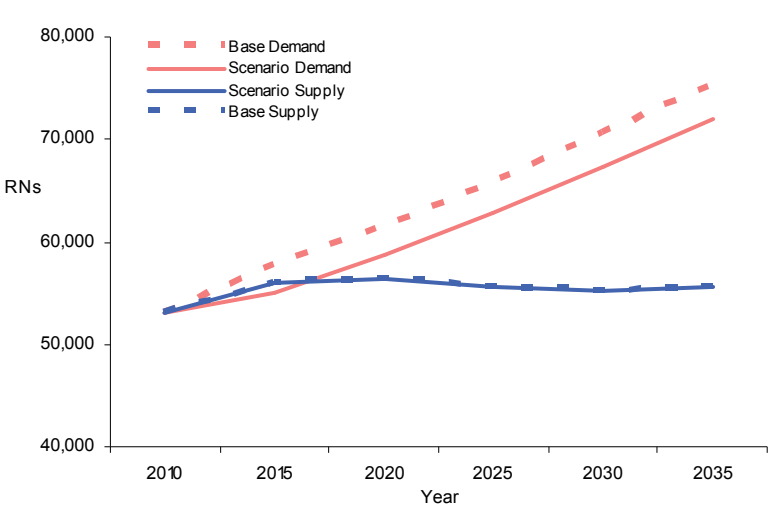
Table 14: Scenario 2.2 Percent Change to Base Demand Factors

	2010	2015	2020	2025	2030	2035
Total	0.0%	-4.5%	-4.5%	-4.5%	-4.5%	-4.5%

Table 15: Scenario 2.2

Results	2010	2015	2020	2025	2030	2035
Scenario Supply	53,036	56,060	56,424	55,705	55,228	55,539
Scenario Demand	53,013	55,068	58,674	62,830	67,395	71,914
Scenario Gap	23	991	-2,249	-7,125	-12,166	-16,375
Scenario % Gap	0.0%	1.8%	-4.0%	-12.8%	-22.0%	-29.5%
Base Gap	0	-1,603	-5,014	-10,085	-15,342	-19,731
Base % Gap	0.0%	-2.9%	-8.9%	-18.1%	-27.8%	-35.5%

Figure 9: Scenario 2.2 Projected RN Supply and Demand



Scenario 2.3

This scenario assumes that Medicare and Social Security reform changes the minimum age for receiving benefits to 67 after 2020. This will cause nurses to postpone retirement by five years on average starting in 2020. As a result, the supply of nurses will increase starting in 2020. The change to the retirement ratio is caused by the changing age distribution of the population. This scenario assumes that demand for nurses will remain constant even though usage rates might differ between Medicare recipients and those in the same age group that do not receive Medicare.

Model: Broad Nursing Workforce, Head Count: Scenario Supply and Demand

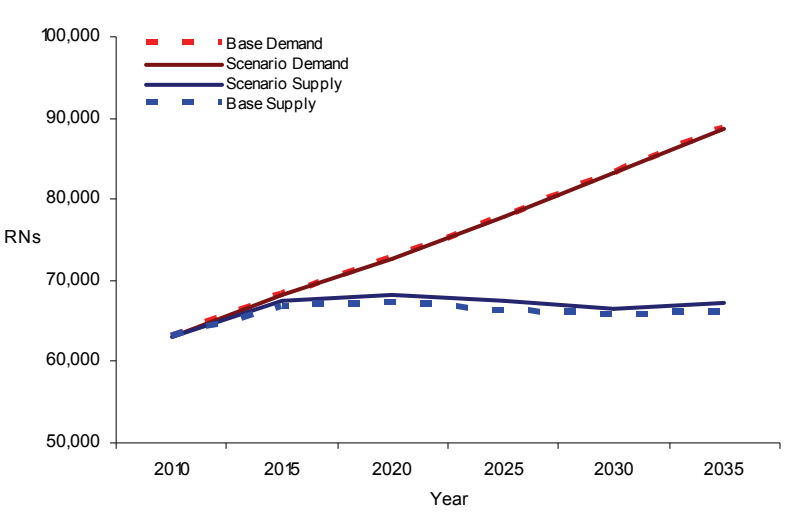
Table 16: Scenario 2.3 Percent Change to Base Supply Factors

	2010	2015	2020	2025	2030	2035
Retirement Ratio	0.0%	-17.1%	-13.6%	-8.7%	-3.4%	-10.9%

Table 17: Scenario 2.3

Results	2010	2015	2020	2025	2030	2035
Scenario Supply	62,962	67,452	68,292	67,447	66,564	67,148
Scenario Demand	62,962	68,338	72,733	77,776	83,291	88,722
Scenario Gap	0	-886	-4,440	-10,329	-16,727	-21,574
Scenario % Gap	0.0%	-1.3%	-6.5%	-15.3%	-25.1%	-32.1%
Base Gap	0	-1,675	-5,589	-11,508	-17,633	-22,703
Base % Gap	0.0%	-2.5%	-8.3%	-17.4%	-26.9%	-34.4%

Figure 10: Scenario 2.3 Projected RN Supply and Demand



Scenario 3: Health Care Utilization and Scope of Work

Scenario 3.1

The Institute of Medicine released a report titled "The future of Nursing: Leading Change, Advancing Health" in 2010. One of the recommendations in the report suggests that nurses practice to the full extent of their education and training. According to the report, legal and structural barriers currently stand in the way of achieving this recommendation.

This scenario assumes that the scope of practice steadily increases for nurses. Demand will increase as nurses are asked to do more. Also, supply will increase as nurses are compensated for the increasing scope of practice. Demand for RNs increases by 1% per year starting in 2015 as the use of nurses in place of other health care professionals increases. Also, RNs receive a 5% raise in real wages per period as their job duties change. The increased pay causes the graduation rate to increase by 4% per period and the labor force participation rate increases by 1.5% (HRSA, 2004).

Model: Direct Patient Care, Head Count: Scenario Supply and Demand

Table 18: Scenario 3.1 Percent Change to Base Supply Factors

	2010	2015	2020	2025	2030	2035
Graduation Ratio	0.0%	4.0%	8.0%	12.0%	16.0%	20.0%
Participation Ratio	0.0%	1.5%	3.0%	4.5%	6.0%	7.5%

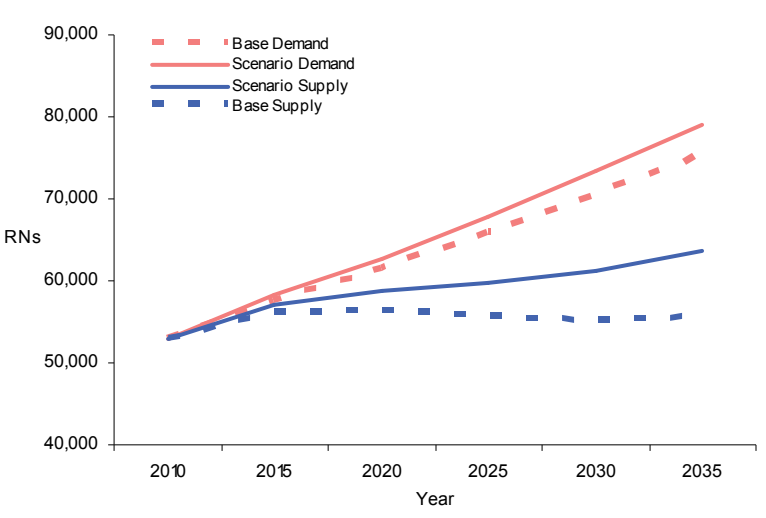
Table 19: Scenario 3.1 Percent Change to Base Demand Factors

	2010	2015	2020	2025	2030	2035
Total	0.0%	1.0%	2.0%	3.0%	4.0%	5.0%

Table 20: Scenario 3.1

Results	2010	2015	2020	2025	2030	2035
Scenario Supply	53,036	57,006	58,806	59,802	61,249	63,709
Scenario Demand	53,041	58,245	62,673	67,770	73,400	78,998
Scenario Gap	-5	-1,239	-3,867	-7,968	-12,150	-15,289
Scenario % Gap	0.0%	-2.2%	-6.6%	-13.3%	-19.8%	-24.0%
Base Gap	0	-1,603	-5,014	-10,085	-15,342	-19,731
Base % Gap	0.0%	-2.9%	-8.9%	-18.1%	-27.8%	-35.5%

Figure 11: Scenario 3.1 Projected RN Supply and Demand



Scenario 3.2

One way to reduce the demand for nurses is to decrease the need for health care services. Various studies have shown overall health care usage can be decreased by improving individual self-management.

Methods of increasing self-managed care have effectively reduced ambulatory visits by 17% (Vickery, et al., 1983). In this scenario, 25% extra nurses are needed in the public health setting in 2025 to effectively coordinate a self-managed care plan that decreases ambulatory care demand by 17%.

***Model*:** Broad Nursing Workforce, FTE: Scenario Supply and Demand

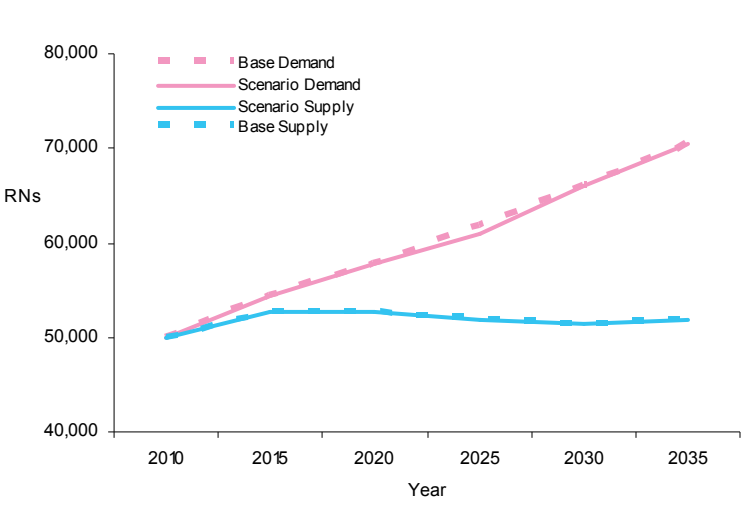
Table 21: Scenario 3.2 Percent Change to Base Demand Factors

	2010	2015	2020	2025	2030	2035
Ambulatory Care	0.0%	0.0%	0.0%	-17.0%	0.0%	0.0%
Public Health	0	0.0%	0.0%	25.0%	0.0%	0.0%

Table 22: Scenario 3.2

Results	2010	2015	2020	2025	2030	2035
Scenario Supply	50,019	52,702	52,766	51,826	51,324	51,771
Scenario Demand	50,019	54,300	57,775	60,888	66,132	70,382
Scenario Gap	0	-1,598	-5,010	-9,063	-14,807	-18,611
Scenario % Gap	0.0%	-3.0%	-9.5%	-17.5%	-28.9%	-35.9%
Base Gap	0	-1,598	-5,029	-9,960	-14,807	-18,611
Base % Gap	0.0%	-3.0%	-9.5%	-19.2%	-28.9%	-35.9%

Figure 12: Scenario 3.2 Projected RN Supply and



Scenario 4: Economy

Scenario 4.1

The 2010 RN survey data and health care usage data were collected in the immediate aftermath of the country's deepest recession in the post World War II era. Employment of FTE RN's typically increases faster during recessions than expansions due to increasing labor force participation rates. One study suggests that participation rates increase by about 1.3 percentage points during recessions (Buerhaus et al., 2009). Additionally, fewer health care services are used during recessions because some people postpone non-critical procedures until the economy becomes more stable. Health care expenditures during the recession were about 1% lower than anticipated based on historical trends (Centers for Medicare & Medicaid Services).

For this scenario, participation rates return to pre-recession levels and decrease by 1.3 percentage points in every period through the model starting in 2015 since the survey was taken during a recession. Demand will increase by 1% starting in 2015.

Model: Direct Patient Care, FTE: Scenario Supply and Demand

Table 23: Scenario 4.1 Percent Change to Base Supply Factors

	2010	2015	2020	2025	2030	2035
Participation Ratio	0.0%	-2.4%	-2.4%	-2.5%	-2.5%	-2.5%

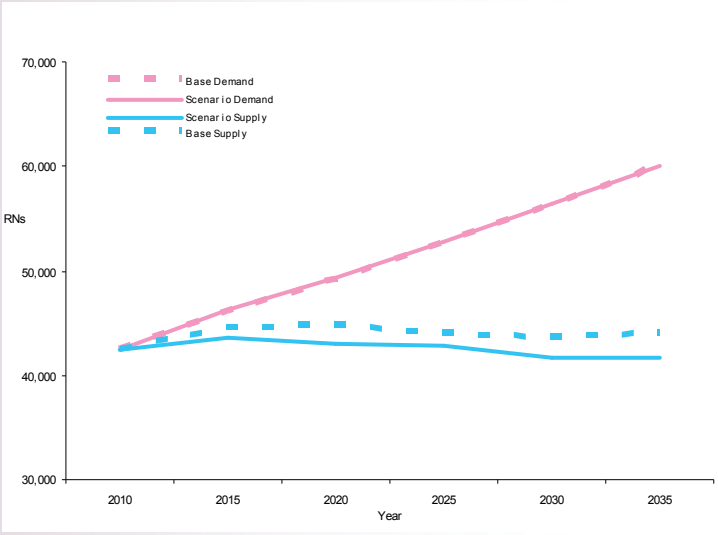
Table 24: Scenario 3.1 Percent Change to Base Demand Factors

	2010	2015	2020	2025	2030	2035
Total	0.0%	1.0%	1.0%	1.0%	1.0%	1.0%

Table 25: Scenario 4.1

Results	2010	2015	2020	2025	2030	2035
Scenario Supply	42,362	43,521	43,027	41,921	41,270	41,413
Scenario Demand	42,367	46,510	49,553	53,038	56,842	60,547
Scenario Gap	-5	-2,989	-6,525	-11,118	-15,571	-19,134
Scenario % Gap	0.0%	-6.9%	-15.2%	-26.5%	-37.7%	-46.2%
Base Gap	0	-1,453	-4,396	-8,587	-12,737	-16,054
Base % Gap	0.0%	-3.3%	-9.8%	-19.5%	-29.3%	-36.6%

Figure 13: Scenario 4.1 Projected RN Supply and Demand



Scenario 5: Combination

Scenario 5.1

This scenario estimates the overall effects of unrelated factors to demonstrate the model's ability to incorporate multiple changes simultaneously. The following changes are incorporated:

- Everyone in Wisconsin is insured by 2015. Demand for nurses increases by 4% through the remainder of the model.
- A one time push to recruit nurses into the state increases net migration by 400% in 2025
- RNs receive a 5% increase in real wages per period as their job duties change. The increased pay causes graduation to increase by 4% per period and labor force participation increases by 1.5%.
- Emergency room visits decline by 10%, and Ambulatory care demand increases by 9%.
- Declining home prices makes shifts demand from nursing homes to home health care. Nursing home demand declines by 15% and home health demand increases by 9%.
- Improved ergonomic conditions allow nurses to postpone retirement by 5 years.

Model: Direct Patient Care, FTE: Scenario Supply and Demand

Table 26: Scenario 5.1 Percent Change to Base Supply Factors

	2010	2015	2020	2025	2030	2035
Graduation Ratio	0.0%	4.0%	8.0%	12.0%	16.0%	20.0%
Participation Ratio	0.0%	1.5%	3.0%	4.5%	6.0%	7.5%
Retirement Ratio	0.0%	-17.1%	-13.6%	-8.7%	-3.4%	-10.9%
Net Migration Ratio	0.0%	0.0%	0.0%	400.0%	0.0%	0.0%

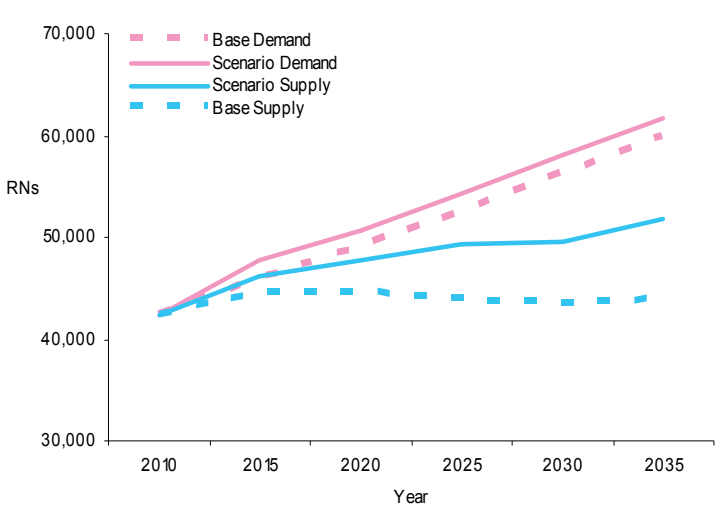
Table 27: Scenario 5.1 Percent Change to Base Demand Factors

	2010	2015	2020	2025	2030	2035
Nursing Home/ Extended Care	0.0%	-15.0%	-15.0%	-15.0%	-15.0%	-15.0%
Home Health	0.0%	9.0%	9.0%	9.0%	9.0%	9.0%
Emergency	0.0%	-10.0%	-10.0%	-10.0%	-10.0%	-10.0%
Ambulatory Care	0.0%	9.0%	9.0%	9.0%	9.0%	9.0%
Total	0.0%	4.0%	4.0%	4.0%	4.0%	4.0%

Table 28: Scenario 5.1

Results	2010	2015	2020	2025	2030	2035
Scenario Supply	42,362	46,134	47,695	49,237	49,618	51,749
Scenario Demand	42,380	47,665	50,783	54,321	58,125	61,756
Scenario Gap	-19	-1,531	-3,088	-5,085	-8,507	-10,006
Scenario % Gap	0.0%	-3.3%	-6.5%	-10.3%	-17.1%	-19.3%
Base Gap	0	-1,453	-4,396	-8,587	-12,737	-16,054
Base % Gap	0.0%	-3.3%	-9.8%	-19.5%	-29.3%	-36.6%

Figure 14: Scenario 5.1 Projected RN Supply and Demand



V. CONCLUSION

The future cannot be predicted with absolute accuracy, and the Wisconsin Model, like any other model, is not without limitations. However, decision makers were essentially in the dark in regards to the future of the RN workforce prior to the RN license renewal survey and the forecasting model. The model does not completely illuminate the future outlook of the RN workforce, but it does provide decision makers with the equivalent of a flashlight to look at the future of the workforce.

Registered nurses make up the largest occupation in the health care industry. Therefore, any improvements in the nursing labor force would undoubtedly benefit the health care industry as a whole. However, the problems facing the RN workforce are not unique to the occupation. In fact, the health care industry faces the same challenges. Other occupations within the industry, such as physicians and nursing assistants, need to be examined to get a more complete picture of the industry's long-term outlook. This potentially adds value to the Wisconsin Model because it is very applicable to other occupations. Base supply estimates can be made for any occupation if the size and age distribution of the workforce is known.

There is a great deal of strength in the theoretical design of the model. However, the strengths would be problematic without quality data. The 2010 License Renewal Survey provided one of the most robust data sets for the nursing work force in the country. It is referred to as a "survey", but it is more accurately described as a census since all nurses were required to complete it. This all inclusive data source was essential for populating both the supply and demand models. The technical report identifies areas in which data collection could be improved on the demand side. Even with the limitations, the data used was more robust than other studies from around the country that relied on national health care usage rates to project state specific demand.

The quality of the data inputs is complemented by the model's flexibility. The model allows for a change to one factor or multiple factors simultaneously. Isolating a single factor provides a lot of value for sensitivity analysis. Decision makers can use the model to estimate the effect of a policy and determine whether or not the costs outweigh the benefits. The model can also be used to compare possible policy interventions and determine which is the most effective. However, the ultimate solution will almost certainly not come from a single policy change. The model can be used to analyze the effects of multiple policies that could be implemented in conjunction with one another. Such scenarios could aim to increase nursing supply while also decreasing the overall demand for nurses.

The ability to change the equilibrium assumption adds to the flexibility and versatility of the model. Data does not exist to determine whether or not RN supply and demand are currently in balance. Employer based surveys could be used to get a better idea of the balance between supply and demand. However, proper staffing intensities for ideal patient outcomes will always be a hotly debated topic even if data becomes available. In reality, there probably cannot be a consensus on equilibrium in a labor market such as nursing because there will always be disagreement on most ideal staffing intensities for various settings. The built-in capability to change the equilibrium assumption allows for analysis based on the each individual user's definition of "equilibrium".

The capabilities of the Wisconsin RN Model are best demonstrated by using realistic policy scenarios. None of the example scenarios take a very big bite out of the RN shortage. This inevitably leads to a question of what can be done to completely close the shortage. The answer to the question is not in this report. Solving the problem is much better left in the hands of experts that are more in tune with the health care industry. The Wisconsin Model provides those experts with a valuable tool that can be used to help analyze possible solutions. Longitudinal data could lead to enhancements in future generations of the model. Subsequent models could possibly incorporate variables such as geography, education level, and perhaps even patient outcomes. Continued efforts to maintain and improve the model will increase the power of the "flashlight" available to decision makers as they develop plans to close the rapidly approaching, perhaps existing, shortage.

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REFERENCES

Buerhaus, Peter I., David I. Auerbach, Douglas O. Staiger, "The Recent Surge in Nurse Employment: Causes and Implications," 2009, http://www.healthstaff.org/documents/surgeinnurseemployment.pdf.

Centers for Medicare & Medicaid Services, Office of the Actuary, National Health Statistics Group; U.S. Department of Commerce, Bureau of Economic Analysis; and U.S. Bureau of the Census, *National Health Care Expenditure Data,* https://www.cms.gov/NationalHealthExpendData/02_NationalHealthAccountsHistorical.asp.

Congressional Budget Office. Opportunities to Increase Efficiency in Health Care (June 2008).

Congressional Budget Office. The long-Term Outlook for Health Care spending (November 2007).

Hadley, Jack and John Holahan, "The Cost of Care for the Uninsured: What Do We Spend, Who Pays, and What Would Full Coverage Add to Medical Spending?," 2004, http://www.kff.org/uninsured/upload/The-Cost-of-Care-for-the-Uninsured-What-Do-We-Spend-Who-Pays-and-What-Would-Full-Coverage-Add-to-Medical-Spending.pdf.

Health Resources and Services Administration (HRSA). "What is Behind HRSA's Projected Supply, Demand, and Shortage of Registered Nurses?," 2004.

National Council of State Board of Nursing (NCSBN). "NXLEX Examination Pass Rates." NCSBN. 2011. Web. https://www.ncsbn.org/1237.htm

State and County Age-Sex Population Projections, 2000-2035, Wisconsin Department of Administration, Demographic Services.

Vickery, D.M. et al., "Effect of Self-Care Education Program on Medical Visits," *Journal of the American Medical Association* 250, no. 21 (1983): 2952–2956

Walsh, Thomas, Victoria Udalova, and Dennis Winters, "Wisconsin Registered Nurse Supply and Demand Forecasting Model: Technical Report," 2011, http://dwd.wisconsin.gov/oea/rn_forecasting/Technical_Report.pdf.

Weiner JP. "Prepaid Group Practice Staffing and U.S. Physician Supply: Lessons for Workforce Policy," Health Affairs. Available at http://content.healthaffairs.org/content/suppl/2004/02/04/hlthaff.w4.43v1.DC1. February 2004.

Winters, Dennis, Beverly Gehrke, Eric Grosso, and Victoria Udalova, "Impact of Population Aging on Wisconsin's Labor Force," 2009, http://dwd.wisconsin.gov/oea/contact_us/Dennis/impact_of_aging_population_paper.pdf.

Wisconsin County and DHS Region Level Population Estimates, Wisconsin Department of Health Services, Office of Health Informatics, Karl Pearson.

Wisconsin Department of Health Services, Division of Public Health, Office of Health Informatics. Wisconsin Health Insurance Coverage, 2009 (P-45369-09). October 2010.