

2018 Supply and Demand Projections Technical Report

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Introduction and Projection Limitations

An imbalance between the supply and demand of nurses may be characterized in three ways. First, the supply of nurses may exceed demand. This can result in high unemployment rates and low wages. The second imbalance may be a misdistribution of nurses. This has been apparent in North Dakota in that the majority of nurses are in large population centers and more rural counties have insufficient nurses. The third imbalance, a nursing shortage, occurs when there are not enough nurses to meet demand. Current and predicted shortages are determined by comparing the supply of nurses and the demand for nurses and projecting this comparison into the future. The resulting projections are estimates based on assumptions and several cautions are necessary when interpreting them.

Long-term demand projections have been developed by Job Service North Dakota and are recalculated for all occupations every two years. The projections are based on selected national and state factors along with historical trends that are used to indicate what is likely to happen in the future based on population, labor force, productivity and economic output growth. They include a number of assumptions. For more information regarding data limitations and interpretation notes see the most recent demand projection report at Job Service ND: https://www.ndworkforceintelligence.com/admin/gsipub/htmlarea/uploads/lmi_LTproj2026.pdf .

Supply projections are based on historical trends and estimates of nurses over the last twenty-six years. Several adjustments have been made to take into account increases in licensure population due to exams and endorsement, decreases in licensure population due to lapsed licenses, unemployment, continued licensure during retirement, volunteer and per diem work and nurses licensed in ND and employed out-of-state. The supply projections are making several important assumptions: 1) the future nurse population in the next ten years will retain the same age and retirement demographics as the last twenty-six years, 2) the addition of new nurses through exam (new graduates) or endorsement (new nurses from other states) will continue at the same rate as the average from the last 26 years, 3) the percentage of unemployed, retired, per diem and out-of-state nurses will remain at the same average as the last five years. The supply model does not take into account the potential for increased demand of nurses with changed in health insurance regulation or increased utilization of nurses in care coordination models. Projections are statewide estimates and may not reflect city or county level shortages.

Workforce supply projections were calculated by modifying a model from Oregon's Nursing Shortage: A Public Health Crisis in the Making (2001) and was utilized in a [2003 Nursing Supply and Demand Projections Study](#) (Moulton, 2003) and recalculated several times over the next several years. The model involves calculating the supply of nurses over multiple years and using averages to predicting future supply. The original model was modified by adjusting supply numbers by estimates of the percentage of nurses that are unemployed and retired but still retaining license. Substantial refinement of the model occurred in 2013, as the projection model underwent a validation process. This included meeting with Job Service North Dakota to determine the parameters utilized in demand projections in order to better match our supply projections with their demand projections. In addition, this model was distributed, and input gathered from the Forum of State Nursing Workforce Centers Research Committee which includes lead researchers from nursing workforce centers across the United States. A draft of this model was also presented to the Partners Investing in Nursing group which includes a wide variety of stakeholders. The 2017 and 2018 projection model include the addition of an adjustment for the number of nurses licensed in ND but that are employed out-of-state and a simplification of future year supply estimates.

Table 1: RN/APRN Historical Trend Data 1990-2016

Year	Total # Licensed (1)	New License by Exam (2)	New License by Endorsement (3)	Predicted Total (4)	Percentage of non-renewed licenses adjustment 6.05% (5)	Licensed in ND but employed out-of-state adjustment- 23.44% (6)	Not employed adjustment - 11.58% (7)	Predicted Total with Adjustments (8)	Net Annual Change (9)
1990-1991	7,056	152	168						
1991-1992	7,116	195	125	7,376	446	1,729	854	4,347	
1992-1993	7,373	234	179	7,529	456	1,765	872	4,437	90
1993-1994	7,587	315	123	7,811	473	1,831	905	4,603	166
1994-1995	7,673	306	100	7,993	484	1,874	926	4,710	107
1995-1996	7,910	290	170	8,133	492	1,906	942	4,793	83
1996-1997	8,205	274	286	8,470	512	1,985	981	4,991	199
1997-1998	8,296	297	167	8,669	524	2,032	1,004	5,109	117
1998-1999	8,308	287	132	8,715	527	2,043	1,009	5,136	27
1999-2000	8,273	249	126	8,683	525	2,035	1,005	5,117	(19)
2000-2001	8,271	219	141	8,633	522	2,024	1,000	5,087	(29)
2001-2002	8,392	222	257	8,750	529	2,051	1,013	5,156	69
2002-2003	8,505	257	174	8,823	534	2,068	1,022	5,199	43
2003-2004	8,711	261	239	9,005	545	2,111	1,043	5,307	107
2004-2005	8,618	318	210	9,239	559	2,166	1,070	5,445	138
2005-2006	8,804	426	232	9,276	561	2,174	1,074	5,466	22
2006-2007	9,122	460	249	9,513	576	2,230	1,102	5,606	140
2007-2008	9,634	542	332	9,996	605	2,343	1,158	5,891	285
2008-2009	9,975	542	262	10,438	631	2,447	1,209	6,151	260
2009-2010	10,736	601	550	11,126	673	2,608	1,288	6,557	405
2010-2011	11,431	557	625	11,918	721	2,794	1,380	7,023	467
2011-2012	12,219	616	722	12,769	773	2,993	1,479	7,525	501
2012-2013	12,810	590	726	13,535	819	3,173	1,567	7,976	451
2013-2014	13,349	574	763	14,147	856	3,316	1,638	8,337	361
2014-2015	13,464	614	812	14,775	894	3,463	1,711	8,707	370
2015-2016	14,268	637	723	14,824	897	3,475	1,717	8,736	29
26 Year Average	9,466	386	331	10,006	605.35	2,345.37	1,159	5,896.44	182.88
10 Year Average	11,701	573.3	576.40	12304.10	744.40	2884.08	1424.81	7250.81	326.94
5 Year Average	13,222	606.2	749.20	14010.00	847.61	3283.94	1622.36	8256.09	342.50

(1) Number licensed from [North Dakota Board of Nursing Annual Report](#) years 1990 - 2016.

(2) New license by exam is the number of licenses that were issued to nurses taking the NCLEX examination and is from North Dakota Board of Nursing Annual Report years 1990-2016.

(3) New license by endorsement is the number of licenses that were issued to nurses by endorsement and is from North Dakota Board of Nursing Annual Report years 1990-2016.

(4) Predicted total is the number of licensed nurses from the previous year plus nurses licensed by endorsement and by examination.

(5) Percentage of non-renewal licenses is the number of RN and APRN non-renewed licenses divided by total numbers of licenses from 2011-2016.

2011- 2012	2012- 2013	2013- 2014	2014- 2015	2015- 2016	Average
4.97%	6.20%	5.89%	5.82%	7.36%	6.05%

(6) Licensed in ND but employed out-of-state adjustment is based on the average percentage of nurses that are licensed but indicate that they are employed out-of-state from North Dakota Board of Nursing Annual Reports.

2011- 2012	2012- 2013	2013- 2014	2014- 2015	2015- 2016	Average
23.15%	22.77%	23.08%	23.89%	24.32%	23.44%

(7) Not employed adjustment is based on the percentage of nurses indicating that they are not employed, are a nursing volunteer, per diem or retired is the five-year average from North Dakota Board of Nursing Annual reports.

2011- 2012	2012- 2013	2013- 2014	2014- 2015	2015- 2016	Average
9.89%	10.32%	11.00%	11.37%	15.31%	11.58%

(8) Predicted Total with Adjustments is the predicted total minus the percentage of lapsed licenses, licensed but not employed in ND and not employed adjustments.

(9) Net Annual Change is the current year predicted total minus the previous year predicted total.

Table 2: Supply and Demand Projection Estimates

	Estimated 2016	Projected 2021	Projected 2026	Numeric Change
Projected Supply Based on 26 Year Average (Net Annual Change=182.88) (1)	8,736	9,650	10,565	1,829
Projected Supply Based on 10 Year Average (Net Annual Change=326.94) (1)	8,736	10,371	12,006	3,269
Projected Supply Based on 5 Year Average (Net Annual Change=342.50) (1)	8736	10,448.50	12,161	3,425
Projected Demand (2)	9,483	10,452	11,421	1,937
Decreased Demand -9.1% (3)	9483	9,501	10,382	
Increased Demand +9.1% (3)	9483	11,403	12,460	

(1) Estimated supply is the predicted total from 2015-2016 from table 1. Supply change is based on the 26-year, 10-year and 5-year average net annual change from table 1.

(2) Projected 2026 Supply utilizing changes from full implementation of ND Governors Nursing Shortage Task Force Plan. Strategies are projected to increase RN/APRN availability by 20% by 2026. The total annual increase by 2026 of 1,489.80 was added to the projected 2026 supply point in Figure 1.

(3) An average 9.1% relative standard error based on 2010-2016 is utilized to estimate variance due to factors outside demand projection modeling. Standard errors were calculated by Job Service of ND.

**Registered Nurses (includes NPs, Midwives, and CRNAs)
Demand Projection Relative Error 2010-2016**

	OES EMP	RELATIVE				
	OES EMP	STANDARD	90% CONFIDENCE			
YEAR	ESTIMATE	ERROR (%)	INTERVAL			LT PROJ
2010	6880	6.8	6131	7629		7128
2012	8390	15.4	6322	10458		7563
2014	8470	7.5	7455	9485		8188
2016	9340	6.6	8355	10325		8514
AVG		9.1				

Projections indicate a current shortage of RN/APRNs that will continue for the next 10 years based on long-term historical estimates.

In 2026, the state will need an additional 856 RNs/APRNs in order to meet demand.

However, based on the past 5 and 10 years supply trends, the shortage will continue until 2021 and continued support there will be an adequate supply after 2021. However, this supply is still below the greatest demand projection (See Figure 1) .

**Figure 1: Projected RN/APRN Supply and Demand
2016-2026**

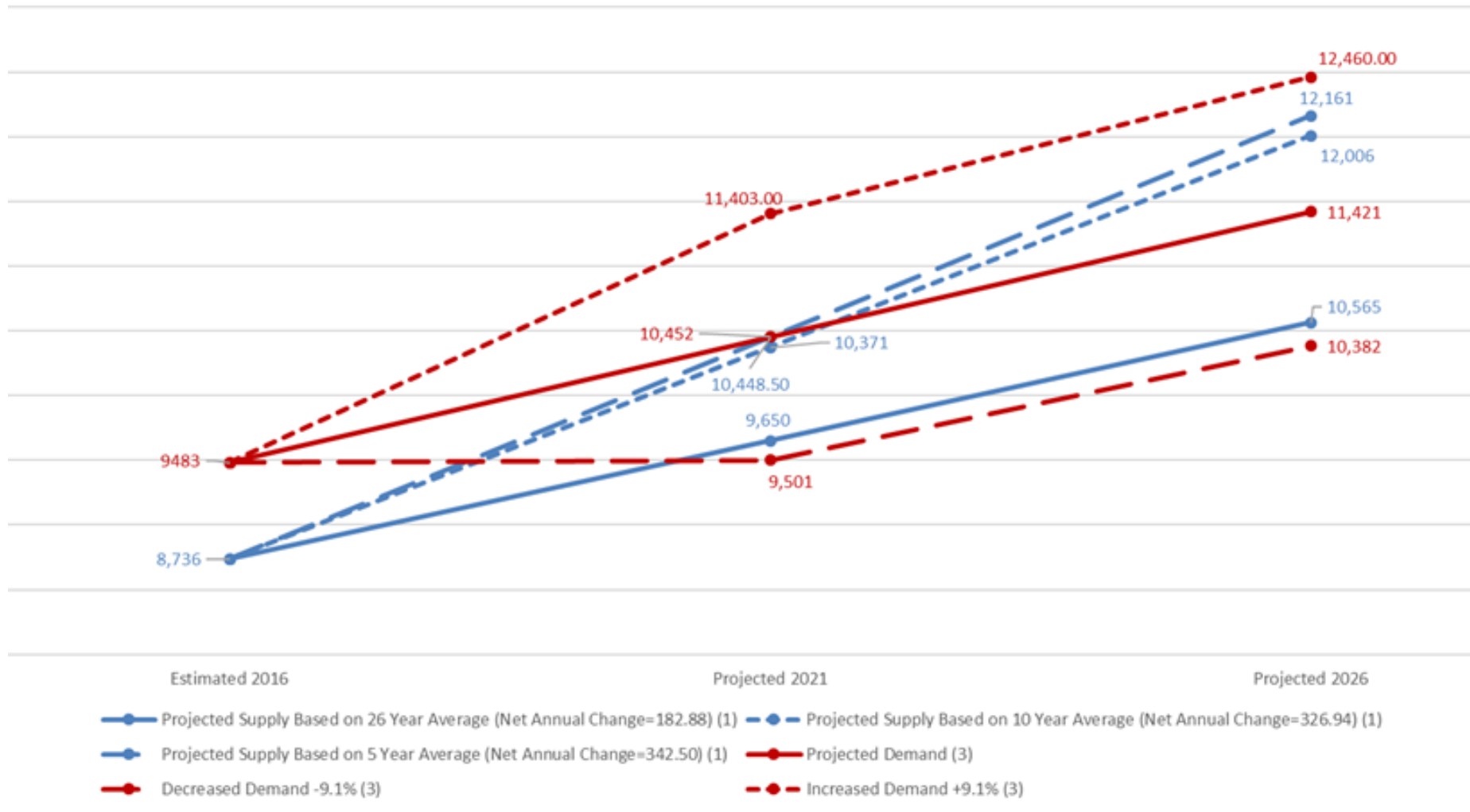


Table 3: LPN Historical Trend Data 1990-2016

Year	Total # Licensed (1)	New License by Exam (2)	New License by Endorsement (3)	Predicted Total (4)	Percentage of non-renewals licenses adjustment 11.96%(5)	Licensed in ND but employed out-of-state adjustment 15.71%(6)	Not employed Adjustment - 16.81% (7)	Predicted Total with Adjustments (8)	Net Annual Change (9)
1990-1991	2,981.00	63.00	38.00						
1991-1992	2,901.00	57.00	47.00	3,085.00	368.97	484.65	518.59	1,712.79	
1992-1993	2,977.00	93.00	37.00	3,031.00	362.51	476.17	509.51	1,682.81	(29.98)
1993-1994	3,021.00	113.00	20.00	3,110.00	371.96	488.58	522.79	1,726.67	43.86
1994-1995	3,019.00	89.00	17.00	3,127.00	373.99	491.25	525.65	1,736.11	9.44
1995-1996	3,047.00	116.00	20.00	3,155.00	377.34	495.65	530.36	1,751.66	15.55
1996-1997	3,115.00	124.00	28.00	3,199.00	382.60	502.56	537.75	1,776.08	24.43
1997-1998	3,162.00	118.00	24.00	3,257.00	389.54	511.67	547.50	1,808.29	32.20
1998-1999	3,197.00	158.00	19.00	3,339.00	399.34	524.56	561.29	1,853.81	45.53
1999-2000	3,193.00	116.00	18.00	3,331.00	398.39	523.30	559.94	1,849.37	(4.44)
2000-2001	3,200.00	161.00	20.00	3,374.00	403.53	530.06	567.17	1,873.24	23.87
2001-2002	3,179.00	130.00	61.00	3,391.00	405.56	532.73	570.03	1,882.68	9.44
2002-2003	3,244.00	196.00	51.00	3,426.00	409.75	538.22	575.91	1,902.12	19.43
2003-2004	3,356.00	177.00	88.00	3,509.00	419.68	551.26	589.86	1,948.20	46.08
2004-2005	3,434.00	203.00	63.00	3,622.00	433.19	569.02	608.86	2,010.93	62.74
2005-2006	3,485.00	346.00	79.00	3,859.00	461.54	606.25	648.70	2,142.52	131.58
2006-2007	3,594.00	289.00	82.00	3,856.00	461.18	605.78	648.19	2,140.85	(1.67)
2007-2008	3,634.00	284.00	88.00	3,966.00	474.33	623.06	666.68	2,201.92	61.07
2008-2009	3,647.00	287.00	58.00	3,979.00	475.89	625.10	668.87	2,209.14	7.22
2009-2010	3,661.00	306.00	78.00	4,031.00	482.11	633.27	677.61	2,238.01	28.87
2010-2011	3,667.00	289.00	90.00	4,040.00	483.18	634.68	679.12	2,243.01	5.00
2011-2012	3,694.00	273.00	139.00	4,079.00	487.85	640.81	685.68	2,264.66	21.65
2012-2013	3,744.00	341.00	141.00	4,176.00	499.45	656.05	701.99	2,318.52	53.85
2013-2014	3,752.00	296.00	137.00	4,177.00	499.57	656.21	702.15	2,319.07	0.56
2014-2015	3,797.00	272.00	146.00	4,170.00	498.73	655.11	700.98	2,315.18	(3.89)
2015-2016	3,567.00	287.00	119.00	4,203.00	502.68	660.29	706.52	2,333.51	18.32
26 year Average	3,356.46	199.38	65.69	3,619.68	432.91	568.65	608.47	2,009.65	25.86
10 year Average	3675.70	292.40	107.80	4067.70	486.50	639.03567	683.78	2258.39	19.10
5 Year Average	3710.80	293.80	136.40	4161.00	497.66	653.6931	699.46	2310.19	18.10

(1) Number licensed from [North Dakota Board of Nursing Annual Report](#) years 1990-2016.

(2) New license by exam is the number of licenses that were issued to nurses taking the NCLEX examination and is from North Dakota Board of Nursing Annual Report years 1990-2016.

(3) New license by endorsement is the number of licenses that were issued to nurses by endorsement and is from North Dakota Board of Nursing Annual Report years 1990-2016.

(4) Predicted total is the number of licensed nurses from the previous year plus nurses licensed by endorsement and by examination.

(5) Percentage of non-renewed licenses is the number of LPN non-renewed licenses divided by total numbers of licenses from 2011-2016.

2011- 2012	2012- 2013	2013- 2014	2014- 2015	2015- 2016	Average
10.85%	12.07%	11.32%	10.84%	14.70%	11.96%

(6) Licensed in ND but employed out-of-state adjustment is based on the average percentage of nurses that are licensed but indicate that they are employed out-of-state.

2011- 2012	2012- 2013	2013- 2014	2014- 2015	2015- 2016	Average
14.59%	14.69%	15.76%	16.59%	16.90%	15.71%

(7) Not employed adjustment is based on the percentage of nurses indicating that they are not employed, are a nursing volunteer, per diem or retired is the five-year average from North Dakota Board of Nursing Annual reports

2011- 2012	2012- 2013	2013- 2014	2014- 2015	2015- 2016	Average
12.82%	17.17%	16.45%	16.43%	21.17%	16.81%

(8) Predicted Total with Adjustments is the predicted total minus the percentage of lapsed licenses, licensed but not employed in ND and not employed adjustments.

(9) Net Annual Change is the current year predicted total minus the previous year predicted total.

Table 4: LPN Supply and Demand Projection Estimates

	Estimated 2016	Projected 2021	Projected 2026	Numeric Change
Projected Supply Based on 26 Year Average (Net Annual Change=25.86) (1)	2,334	2,463	2,593	259
Projected Supply Based on 10 Year Average (Net Annual Change= 19.10) (1)	2,334	2429.5	2525	191
Projected Supply Based on 5 Year Average (Net Annual Change =18.10) (1)	2334	2424.5	2515	181
Projected Demand (2)	2,714	2,844	2,977	263
Decreased Demand -7.9% (3)	2,714	2,619	2,742	
Increased Demand +7.9% (3)	2,714	3,069	3,212	

(1) Estimated supply is the predicted total from 2015-2016 from table 3. Supply change is based on the 26-year, 10-year and 5-year average net annual change from table 1.

(2) Demand estimates and projected change are from the North Dakota Labor Market Information Center North Dakota Employment Projections 2016-2026 Available online at https://www.ndworkforceintelligence.com/admin/gsipub/htmlarea/uploads/lmi_LTproj2026.pdf.

(3) In the graph an average 7.9% relative standard error based on 2010-2016 is utilized to estimate variance due to factors outside demand projection modeling. Standard errors calculated by Job Service of ND.

Licensed Practical and Licensed Vocational Nurses

	OES EMP	RELATIVE	90% CONFIDENCE		
YEAR	ESTIMATE	STANDARD ERROR (%)	INTERVAL		LT PROJ
2010	3280	10.9	2707	3853	2718
2012	3280	8	2861	3699	2826
2014	3230	5.4	2952	3508	2842
2016	2670	7.4	2353	2987	3145
AVG		7.9			

Projections indicate a critical shortage of LPNs that will continue for the next 10 years based on long-term historical estimates (26 year, 10 year and 5 year) (see Figure 2).

In 2026, the state will need an additional 384 LPNs in order to meet demand.

