

Visual Impairment Among North Dakotans, 2005 Report

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FORWARD

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Regarding Comparisons to Previous Reports

In order to be more conservative, we have chosen to focus on prevalence rates based on clinical, measured visual impairment. Therefore, we developed our projections for this report based on the age-specific prevalence rates derived in The National Eye Institute Study (The Eye Diseases Prevalence Research Group 2004), noted in Table 4. Since this approach does differ from our previous projections (see Jacobsen and Rathge, 1997; Rathge, et. al., 1999), comparisons to previous reports should be made with caution. In addition, in this report we do not report gender-specific distributions or differentiate between institutionalized and non-institutionalized persons.

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INTRODUCTION

The purpose of the “Visual Impairment Among North Dakotans, 2005 Report” is to present estimates and projections of the number of people ages 15 and older in North Dakota who have a visual impairment, in 2000, 2010, and 2015. Visual impairment typically refers to a loss of vision to the extent that daily tasks are difficult or impossible to accomplish. This vision loss cannot be corrected to a normal level. In this report, the degree of visual impairment is described as either “low visual impairment” or “severe visual impairment.” The cause of visual impairment typically falls into two areas: poor visual acuity and poor visual field. Poor visual acuity refers to the fact that the eye does not see objects as clearly as usual. In contrast, poor visual field indicates that the eye cannot see as wide an area as usual and, therefore, a person must move their eyes or turn their head to adequately see.

The definitions we used to define visual impairment are consistent with those used by The Eye Diseases Prevalence Research Group (2004). Low visual impairment refers to visual acuity that is best corrected to a level between 20/40 and 20/200, or a visual field no worse than 20 degrees. This definition differs slightly from the definition used by the World Health Organization, which defines low visual impairment, also called “low vision,” as visual acuity between 20/70 and 20/400 (Centers for Disease Control and Prevention 2005). Severe visual impairment refers to visual acuity best corrected to 20/200 or worse, or a visual field of 20 degrees or less, a definition consistent with the World Health Organization.

The measure of visual acuity refers to a ratio of the distance a person sees relative to what a person with normal sight should see. For example, a person with a low visual impairment (e.g., visual acuity of 20/40) can see at 20 feet what someone with normal sight can see at 40 feet. Similarly, a person with a severe visual impairment (e.g., visual acuity of 20/200) can see at 20 feet what someone with normal sight can see at 200 feet. Visual field, or the amount of a person’s surroundings that they can see without moving their eyes, is measured in degrees similar to the arc of a circle. A normal visual field is about 160-170 degrees horizontally, or nearly half of a person’s total surroundings.

There are a variety of reasons for defining the severity of visual impairment. One common use is for establishing eligibility thresholds for education or federal programs. For example, “legal blindness” is a term used for those who have a visual acuity best corrected to 20/200 or worse, or a visual field of 20 degrees or less. “Legal blindness” is synonymous with severe visual impairment. “Blindness,” in contrast, is even more severe: a visual acuity best corrected to 20/400 or worse, or a visual field of 10 degrees or less (Centers for Disease Control and Prevention 2005).

The estimates and projections of the number of North Dakotans ages 15 and older with visual impairment were calculated using prevalence rates, described in more detail below. These rates were obtained through an extensive review of the scientific literature. In brief, we found a very consistent pattern of age-specific rates of visual impairment among studies in which participants’ vision was measured by researchers. Since these rates did not vary significantly by location, we felt confident in using them for our current estimates and future projections of visual impairment among North Dakotans.

STUDIES REVIEWED

A review of the scientific literature was conducted to examine the consistency of age-specific prevalence rates of visual impairment by severity. We will highlight the most relevant studies.

Beaver Dam Eye Study

This study was reported by Klein (1991) and conducted in Beaver Dam, Wisconsin. There were 4,926 participants in the study. Participants' vision was tested at Beaver Dam Hospital's special sight clinic. The respondents' vision was tested with their glasses or other corrective lens in order to determine "best corrected" level of vision. "Rates of visual acuity of 20/20 or better declined in both eyes with increasing age" (Klein 1991). Age was separated into four categories. However, for comparison purposes we computed a fifth category (55 and older). Noticeably higher rates of impairment were found with age. Results of the study are as follows:

Table 1. Percent of Population With Visual Impairment: Beaver Dam Eye Study

Best Corrected Level of Visual Impairment	Age				
	43 to 54	55 to 64	65 to 74	75 and Older	(55 and Older)
Mild Impairment (20/40-20/60)	0.6	0.5	4.3	15.1	9.7
Moderate Impairment (20/80-20/160)	0.1	0.2	0.4	4.0	2.0
Severe Impairment (20/200 and worse)	0.1	0.2	0.3	2.0	2.2

Beaver Dam Follow-up Study

A 5-year follow-up to the Beaver Dam Study supports the claim that as one ages, vision becomes worse. The sample of participants returning from the original study was 3,684. This study was conducted to check the change in visual acuity over the 5-year time span. "Over the 5-year period, vision became impaired in 2.9 percent of the population, and severely impaired in 0.3 percent of the population. ... People 75 years of age or older at baseline were 12.5 times more likely to have impaired vision, 9.7 times more likely to have doubling of the visual angle, and 78 times more likely to have severe visual impairment than people younger than 75 years of age at baseline" (Klein 1996). The only age group to show a clinically significant change in visual impairment over the 5-year period was the 75 and older category.

Baltimore Eye Study

This study took place in Baltimore, Maryland and was reported by Tielsch and colleagues (1990). The study had 5,300 participants. Participants were visually screened and their eyesight was measured accurately. Eyesight was noticeably worse in the older ages relative to the younger ages. Results of the study are as follows:

Table 2. Percent of Population With Visual Impairment: Baltimore Eye Study

Best Corrected Level of Visual Impairment	Age					
	40 to 49	50 to 59	60 to 69	70 to 79	80 and Older	(50 and Older)
Mild Impairment (20/40-20/60)	0.4	1.0	2.0	6.3	15.7	3.7
Moderate Impairment (20/80-20/160)	0.3	0.7	0.9	2.7	9.8	1.9
Severe Impairment (20/200 and worse)	1.0	0.8	1.4	2.3	11.1	2.2

U.S. Department of Health and Human Services Study

This national study was reported by Roberts and Ludford (1977). It was based on a national sample of 6,672 subjects between the ages of 4 and 74. The range of visual impairment evaluated was divided into 11 groupings from 20/10 or better to 20/400 and worse. The findings are as follows:

Table 3. Percent of Population With Visual Impairment: U.S. Department of Health and Human Services Study

Best Corrected Level of Visual Impairment	Age			
	45 to 54	55 to 64	65 to 74	(55 and Older)
Mild Impairment (20/40)	3.5	5.8	11.9	8.3
Moderate Impairment (20/60-20/180)	3.0	4.1	12.8	7.6
Severe Impairment (20/200 and worse)	0.2	0.6	1.3	1.6

National Eye Institute Study

This study was conducted by The Eye Diseases Prevalence Research Group (2004), a consortium of principal investigators. They produced prevalence estimates of blindness and low vision in people ages 40 and older based on a meta analysis of various standardized databases. They derived age-specific prevalence rates by combining the pooled rates using logistic regression. These pooled prevalence rates were then modeled to the U.S. population using Census 2000 data. This technique parallels a similar process used by the U.S. Census Bureau in their development of state and county-based visual impairment estimates using the 1990 Census (see McNeil 1977). The findings are as follows:

Table 4. Visual Impairment Among Adults 40 Years and Older in the United States: National Eye Institute Study

Age in Years	Legal Blindness (20/200 and worse)		Low Vision (20/40-20/200)		All Visually Impaired	
	Persons	Percent	Persons	Percent	Persons	Percent
40 to 49	51,000	0.1	80,000	0.2	131,000	0.3
50 to 59	45,000	0.1	102,000	0.3	147,000	0.4
60 to 69	59,000	0.3	176,000	0.9	235,000	1.2
70 to 79	134,000	0.8	471,000	3.0	605,000	3.8
80 and Older	648,000	7.0	1,532,000	16.7	2,180,000	23.7
Total	937,000	0.8	2,361,000	2.0	3,298,000	2.7

DISCUSSION

After careful review of the literature and examination of the most relevant prevalence rates, we concluded that there is a relatively consistent relationship between age and vision loss. The rate of visual impairment among U.S. residents is stable, at roughly 0.3 percent, for people under the age of 50. After the age of 50, however, the prevalence of visual impairment increases systematically with age. For those between the ages of 50 and 59, the rate increases modestly to approximately 0.4 percent. It jumps to 1.2 percent for individuals between the ages of 60 and 69. The rate of visual impairment more than triples to 3.8 percent for those in their 70s. For individuals 80 years of age and older, the level of visual impairment exceeds 23 percent. This dramatic increase in visual impairment by age is compelling, especially for a state like North Dakota where its resident population is older than the national average. Our review of the literature indicates that rates of visual impairment are similar by gender, thus we focused our analysis on the total population and did not report gender-specific distributions. We did not differentiate between institutionalized and non-institutionalized persons because our prevalence rates are for the total population.

The studies noted above reflect research in which participants' vision was actually measured, as opposed to participants' self-reported assessment of their vision. Prevalence rates reported by surveys in which participants rated their own visual impairment are much higher than the rates in the studies noted above, with the exception of the oldest participants. For example, results of the National Health Interview Survey (National Center for Health Statistics 2002) indicate that 6,151,000 (5.7 percent) adults 18 to 44, 7,135,000 (11.0 percent) adults 45 to 64, and 2,578,000 (14.5 percent) adults 65 to 74 report they have a visual impairment because they "have trouble seeing, when wearing glasses or contacts" or are "blind or unable to see at all." Among adults 75 and older, 3,205,000 (21.0 percent) reported vision problems, a prevalence rate similar to the studies reviewed above.

According to disability characteristics of persons 16 and older from the Housing and Household Economic Statistics Division of the U.S. Census Bureau (1990), 20,788 North Dakotans (4.5 percent) indicated they had "difficulty seeing words and letters in newspaper print" and an additional 3,084 (0.7 percent) indicated they were "unable to see words and letters in newspaper print." Both of these surveys reflect rates of self-reported visual impairment higher than studies in which visual impairment is actually measured.

METHODS

In order to be more conservative, we have chosen to focus on prevalence rates based on measured visual impairment. Therefore, we developed our projections based on the age-specific prevalence rates derived in The National Eye Institute Study (The Eye Diseases Prevalence Research Group 2004), noted in Table 4. Since this approach does differ from our previous projections (see Jacobsen and Rathge, 1997; Rathge, et. al., 1999), comparisons to previous reports should be made with caution.

The prevalence rates used in calculating visual impairment estimates and projections for North Dakota are divided into two categories. The first reflects the number of persons with a severe visual impairment (visual acuity of 20/200 or worse) while the second focuses on those with a low visual impairment (visual acuity between 20/40 and 20/200). We also report total visually impaired which is the combined total of these two categories.

The analysis was conducted in two steps. First, we applied age-specific prevalence rates (see Table 5) to the state's population as reported in Census 2000. Next, we applied the rates to age-specific population projections for 2010 and 2015 for each county published by the North Dakota State Data Center (see Rathge, et. al., 2002). The population projections were modeled using a standard cohort-survival technique with Census 2000 data as a baseline and 3-year trend lines for age-specific mortality, fertility, and migration.

Table 5. Age-Specific Prevalence Rates of Visual Impairment

Age in Years	Severe Visual Impairment	Low Visual Impairment	Total Visual Impairment
15 to 49	0.1	0.2	0.3
50 to 59	0.1	0.3	0.4
60 to 69	0.3	0.9	1.2
70 to 79	0.8	3.0	3.8
80 and Older	7.0	16.7	23.7

LIMITATIONS

The data in this report are calculated using national prevalence rates and are based on the assumption that these rates accurately reflect the profile in North Dakota. In addition, we are using prevalence rates based on measured visual impairment, not self-reported visual impairment. **Prevalence rates based on measured visual impairment are more conservative and result in more conservative figures of the number of North Dakotans who are visually impaired than presented in previous reports.** Finally, we are using population projections that assume age-specific fertility, mortality, and migration rates will remain constant and follow historical trends. Although the limitations noted are reasonable, it is wise to use these figures of visual impairment with caution. They should be used as one tool among others in policy and decision making.

FINDINGS

North Dakotans Ages 15 and Older

An estimated 10,396 North Dakotans ages 15 and older had visual impairment in 2000 (see Table 6). This number is expected to increase by 38 percent over the next 10 years and reach 14,335 by the year 2015. The largest numbers of North Dakotans with visual impairment are found in Cass, Burleigh, Ward, Grand Forks, and Stutsman counties, following county population trends overall (see Figure 1). However, the counties with the highest proportion of residents with visual impairment are several of North Dakota's more rural and more sparsely populated counties (see Figure 2). While only two counties were estimated to have 4 percent or more of their population experiencing visual impairment in 2000, that number is expected to increase to 20 counties by 2015.

Low visual impairment is defined as those persons with a visual acuity level best corrected to between 20/40 and 20/200, or a visual field no worse than 20 degrees, experienced broadly as having difficulty seeing words and letters in newspaper print with their glasses or other corrective lens. Nearly three-fourths (72 percent) of all persons with visual impairment have low visual impairment. An estimated 7,460 residents in North Dakota ages 15 and older had low visual impairment in 2000. The number of residents in the state with low visual impairment is expected to reach 10,283 by the year 2015.

Severe visual impairment is defined as those persons with a visual acuity level (the vision best corrected using glasses or other corrective lens) at 20/200 or worse or a visual field of 20 degrees or less. It is estimated that 2,936 residents in North Dakota ages 15 and older had severe visual impairment in 2000 (see Table 6), meaning they could not see words or letters in newspaper print with their glasses or other corrective lens and were considered "legally blind." It is expected that this number will surpass 4,000 people by the year 2015. The largest numbers of North Dakotans with severe visual impairment in 2000 were found in Cass, Burleigh, Ward, and Grand Forks counties, following county population trends overall (see Figure 3). However, the counties with the highest proportion of residents with severe visual impairment are several of North Dakota's more rural and more sparsely populated counties (see Figure 4). In five counties in 2000, an estimated one in 100 residents had severe visual impairment. By 2015, one in 100 residents will have severe visual impairment in 33 counties.

North Dakotans Ages 15 to 49

The proportion of residents in the state between the ages of 15 and 49 is expected to decline slightly over the next 10 years. Since this age group has a fairly constant rate of visual impairment, our estimates indicate that there will be a modest decline in the number of North Dakotans between the ages of 15 and 49 who have a visual impairment over the next 10 years. We estimated that 978 residents in this age group had a visual impairment in 2000 and this number is expected to drop to 828 by the year 2015 (see Table 7). The number of residents in the state between 15 and 49 who were "legally blind" (i.e., had severe visual impairment) is expected to drop from 327 in 2000 to 277 by 2015. Similarly, the number of residents in this age category with a low visual impairment is expected to decline from 651 in 2000 to 551 by 2015.

North Dakotans Ages 50 to 59

The trailing edge of the baby boom generation will be moving into their 50s over the next 10 years. As a result, the number of North Dakotans between the ages of 50 and 59 is expected to increase by nearly 35 percent or by approximately 23,350 people by 2015 (see Table 8). This means that the number of residents with visual impairment in this age category will also expand markedly rising from 263 in 2000 to 359 by the year 2015. Those with a severe visual impairment is expected to jump from 62 in 2000 to 90 by the year 2015.

North Dakotans Ages 60 to 69

The largest segment of the baby boom generation was born in the early 1950s. This cohort of baby boomers will be entering their 60s over the next 10 years, thus dramatically expanding the number of people in this age group. For example, in North Dakota, the number of residents 60 to 69 years of age will increase by more than 59 percent between 2000 and 2015, growing by over 28,000 people (see Table 9). This means the number of residents with visual impairment in the state in this age group will also expand dramatically, climbing from 573 in 2000 to 910 by the year 2015. It is expected that those with a severe visual impairment will reach 230 by 2015.

North Dakotans Ages 70 to 79

Residents who will be entering their 70s between now and 2015 were born during the Depression years prior to World War II. The devastated national economy at the time dramatically curbed the number of children that people opted to have during this period. This low birth period, combined with the current outmigration of residents in this age cohort from North Dakota, results in an expectation of only modest growth for this age group over the next 10 years. Our estimates suggest that residents in this age group will expand by 7,611 people (see Table 10). As a result, the number of visually impaired in this age group is expected to grow only modestly from 1,593 in 2000 to 1,878 by 2015. The number who are legally blind in this age group is expected to expand by 64 residents during this time period.

North Dakotans Ages 80 and Older

One of the fastest growing age groups in North Dakota are those 80 years of age and older. Our estimates indicate that this cohort is expected to increase by more than 48 percent between 2000 and 2015. This means an additional 14,210 residents will be 80 years of age or older in 2015 relative to 2000. Since this is the age group with the highest prevalence for visual impairment, their numbers will rise rapidly. For example, in 2000, slightly fewer than 7,000 residents 80 years of age and older had a visual impairment; 2,068 had a severe impairment (see Table 11, Figure 5). It is expected that by the year 2015, 10,360 North Dakotans 80 years of age and older will be visually impaired and 3,059 will be legally blind. In 2000, the proportion of North Dakotans with visual impairment who are ages 80 and older was at least three-fourths in six counties (see Figure 6). By 2015, at least three-fourths of residents with visual impairment will be ages 80 and older in 34 counties.

Table 6. Visual Impairment Among North Dakotans Ages 15 and Older: 2000, 2010, and 2015

Area	North Dakotans Ages 15 and Older											
	2000 Estimates				2010 Projections				2015 Projections			
	Total	Visual Impairment			Total	Visual Impairment			Total	Visual Impairment		
		Total	Severe	Low		Total	Severe	Low		Total	Severe	Low
North Dakota	512,354	10,396	2,936	7,460	529,259	13,011	3,683	9,328	534,641	14,335	4,052	10,283
Adams	2,123	70	20	50	1,899	72	20	52	1,782	75	21	54
Barnes	9,691	266	74	192	9,761	308	87	221	9,765	336	95	241
Benson	4,906	99	28	71	5,322	125	36	89	5,421	138	40	98
Billings	731	14	4	10	684	19	4	15	626	20	5	15
Bottineau	5,910	168	47	121	5,761	200	56	144	5,591	215	60	155
Bowman	2,640	77	21	56	2,724	98	28	70	2,657	107	31	76
Burke	1,886	54	15	39	1,656	55	16	39	1,528	54	15	39
Burleigh	55,501	926	262	664	59,108	1,100	310	790	60,789	1,227	345	882
Cass	99,143	1,360	387	973	112,911	2,049	580	1,469	119,974	2,389	673	1,716
Cavalier	3,906	116	33	83	3,465	127	36	91	3,250	137	40	97
Dickey	4,652	147	43	104	4,462	147	42	105	4,381	163	47	116
Divide	1,934	78	22	56	1,619	85	24	61	1,432	85	24	61
Dunn	2,819	67	19	48	2,647	76	21	55	2,562	83	24	59
Eddy	2,238	72	20	52	2,232	95	26	69	2,173	106	29	77
Emmons	3,472	110	32	78	3,426	156	44	112	3,322	171	49	122
Foster	2,967	83	23	60	2,946	108	31	77	2,830	122	35	87
Golden Valley	1,534	48	14	34	1,474	52	15	37	1,435	54	15	39
Grand Forks	53,124	746	213	533	55,338	939	268	671	55,806	1,008	289	719
Grant	2,348	77	21	56	1,950	86	24	62	1,764	89	25	64
Griggs	2,279	78	23	55	2,012	95	27	68	1,866	94	27	67
Hettinger	2,225	69	18	51	1,906	81	22	59	1,728	86	24	62
Kidder	2,270	65	18	47	2,004	79	22	57	1,855	87	25	62
LaMoure	3,835	110	32	78	3,650	133	38	95	3,472	143	41	102
Logan	1,889	63	17	46	1,722	84	24	60	1,673	89	25	64
McHenry	4,887	142	40	102	4,813	157	44	113	4,781	180	50	130
McIntosh	2,876	127	35	92	2,613	155	44	111	2,491	168	48	120
McKenzie	4,335	104	29	75	4,249	124	36	88	4,120	144	41	103
McLean	7,621	209	59	150	7,444	261	75	186	7,338	290	80	210
Mercer	6,712	136	38	98	6,559	186	52	134	6,226	215	60	155
Morton	19,872	380	107	273	22,534	544	155	389	23,793	642	181	461
Mountrail	5,143	135	39	96	5,260	143	40	103	5,280	155	44	111
Nelson	3,107	109	30	79	3,162	151	43	108	3,106	156	45	111
Oliver	1,646	28	8	20	1,587	37	11	26	1,535	41	11	30
Pembina	6,948	180	50	130	6,873	221	62	159	6,762	229	65	164
Pierce	3,812	124	34	90	3,851	160	47	113	3,813	167	48	119
Ramsey	9,640	258	73	185	9,558	305	87	218	9,381	322	91	231
Ransom	4,709	138	39	99	4,804	183	52	131	4,878	204	59	145
Renville	2,153	61	17	44	1,996	69	19	50	1,918	73	21	52
Richland	14,431	315	90	225	14,454	389	111	278	14,397	417	119	298
Rolette	9,566	140	40	100	10,598	192	54	138	10,726	236	64	172
Sargent	3,418	74	21	53	3,478	91	26	65	3,456	93	27	66
Sheridan	1,429	41	12	29	1,307	51	15	36	1,221	52	14	38
Sioux	2,693	22	7	15	2,999	29	8	21	3,038	34	8	26
Slope	632	11	2	9	577	15	4	11	542	18	4	14
Stark	18,007	386	108	278	18,439	460	130	330	18,411	506	143	363
Steele	1,783	39	11	28	1,770	53	15	38	1,760	56	16	40
Stutsman	17,899	415	116	299	17,721	557	158	399	17,609	609	172	437
Towner	2,332	75	21	54	2,100	79	22	57	2,061	77	22	55
Traill	6,785	189	54	135	6,615	206	57	149	6,598	212	60	152
Walsh	9,945	264	73	191	9,260	269	77	192	8,905	273	76	197
Ward	46,019	831	235	596	45,267	984	277	707	44,853	1,083	307	776
Wells	4,201	141	41	100	3,959	168	48	120	3,776	183	52	131
Williams	15,730	359	101	258	14,733	403	113	290	14,184	422	120	302

Please Note: These data are calculated using clinical, measured prevalence rates which are more conservative than rates based on self-reported visual impairment. Comparisons with previous projections should be made with caution.

Table 7. Visual Impairment Among North Dakotans Ages 15 to 49: 2000, 2010, and 2015

Area	North Dakotans Ages 15 to 49											
	2000 Estimates				2010 Projections				2015 Projections			
	Total	Visual Impairment			Total	Visual Impairment			Total	Visual Impairment		
		Total	Severe	Low		Total	Severe	Low		Total	Severe	Low
North Dakota	326,448	978	327	651	293,304	879	294	585	275,391	828	277	551
Adams	1,014	3	1	2	768	2	1	1	634	2	1	1
Barnes	5,492	16	5	11	4,481	13	4	9	4,127	12	4	8
Benson	3,030	9	3	6	3,162	9	3	6	3,065	9	3	6
Billings	429	1	0	1	304	1	0	1	227	1	0	1
Bottineau	3,095	9	3	6	2,368	7	2	5	1,910	6	2	4
Bowman	1,419	4	1	3	1,292	4	1	3	1,120	3	1	2
Burke	854	3	1	2	672	2	1	1	552	2	1	1
Burleigh	36,721	110	37	73	34,026	102	34	68	32,523	98	33	65
Cass	72,079	216	72	144	68,993	207	69	138	68,039	204	68	136
Cavalier	1,867	6	2	4	1,355	4	1	3	1,125	3	1	2
Dickey	2,528	8	3	5	2,117	6	2	4	1,971	6	2	4
Divide	810	2	1	1	565	2	1	1	377	1	0	1
Dunn	1,570	5	2	3	1,148	3	1	2	964	3	1	2
Eddy	1,135	3	1	2	852	3	1	2	666	2	1	1
Emmons	1,606	5	2	3	1,326	4	1	3	1,046	3	1	2
Foster	1,606	5	2	3	1,347	4	1	3	1,060	3	1	2
Golden Valley	828	2	1	1	650	2	1	1	560	2	1	1
Grand Forks	39,076	117	39	78	38,320	115	38	77	37,553	113	38	75
Grant	1,096	3	1	2	722	2	1	1	576	2	1	1
Griggs	1,105	3	1	2	783	2	1	1	637	2	1	1
Hettinger	1,024	3	1	2	668	2	1	1	500	2	1	1
Kidder	1,148	3	1	2	789	2	1	1	602	2	1	1
LaMoure	1,949	6	2	4	1,487	4	1	3	1,176	4	1	3
Logan	833	2	1	1	676	2	1	1	611	2	1	1
McHenry	2,559	8	3	5	2,214	7	2	5	2,004	6	2	4
McIntosh	1,150	3	1	2	855	3	1	2	711	2	1	1
McKenzie	2,480	7	2	5	2,015	6	2	4	1,734	5	2	3
McLean	3,969	12	4	8	2,817	8	3	5	2,364	7	2	5
Mercer	4,103	12	4	8	3,118	9	3	6	2,468	7	2	5
Morton	12,494	37	12	25	11,684	35	12	23	11,105	33	11	22
Mountrail	2,891	9	3	6	2,563	8	3	5	2,374	7	2	5
Nelson	1,389	4	1	3	1,191	4	1	3	1,044	3	1	2
Oliver	949	3	1	2	714	2	1	1	625	2	1	1
Pembina	3,862	12	4	8	3,148	9	3	6	2,747	8	3	5
Pierce	1,965	6	2	4	1,720	5	2	3	1,473	4	1	3
Ramsey	5,556	17	6	11	4,731	14	5	9	4,156	12	4	8
Ransom	2,587	8	3	5	2,165	6	2	4	1,977	6	2	4
Renville	1,120	3	1	2	924	3	1	2	834	3	1	2
Richland	9,428	28	9	19	7,906	24	8	16	7,234	22	7	15
Rolette	6,529	20	7	13	6,276	19	6	13	5,485	16	5	11
Sargent	1,914	6	2	4	1,767	5	2	3	1,658	5	2	3
Sheridan	626	2	1	1	507	2	1	1	456	1	0	1
Sioux	2,025	6	2	4	2,147	6	2	4	2,013	6	2	4
Slope	363	1	0	1	240	1	0	1	196	1	0	1
Stark	11,274	34	11	23	10,052	30	10	20	9,305	28	9	19
Steele	947	3	1	2	854	3	1	2	797	2	1	1
Stutsman	10,660	32	11	21	9,024	27	9	18	8,300	25	8	17
Towner	1,174	4	1	3	900	3	1	2	837	3	1	2
Traill	3,928	12	4	8	3,269	10	3	7	2,985	9	3	6
Walsh	5,524	17	6	11	4,535	14	5	9	3,949	12	4	8
Ward	31,269	94	31	63	28,205	85	28	57	27,202	82	27	55
Wells	1,992	6	2	4	1,560	5	2	3	1,219	4	1	3
Williams	9,407	28	9	19	7,332	22	7	15	6,518	20	7	13

Please Note: These data are calculated using clinical, measured prevalence rates which are more conservative than rates based on self-reported visual impairment. Comparisons with previous projections should be made with caution.

Table 8. Visual Impairment Among North Dakotans Ages 50 to 59: 2000, 2010, and 2015

Area	North Dakotans Ages 50 to 59											
	2000 Estimates				2010 Projections				2015 Projections			
	Total	Visual Impairment			Total	Visual Impairment			Total	Visual Impairment		
		Total	Severe	Low		Total	Severe	Low		Total	Severe	Low
North Dakota	66,921	263	62	201	91,818	370	91	279	90,272	359	90	269
Adams	330	1	0	1	345	1	0	1	308	1	0	1
Barnes	1,327	5	1	4	1,894	8	2	6	1,615	6	2	4
Benson	678	3	1	2	760	3	1	2	796	3	1	2
Billings	118	0	0	0	169	1	0	1	152	1	0	1
Bottineau	946	4	1	3	1,159	5	1	4	1,100	4	1	3
Bowman	373	1	0	1	517	2	1	1	522	2	1	1
Burke	338	1	0	1	309	1	0	1	302	1	0	1
Burleigh	7,614	30	8	22	11,630	47	12	35	11,994	48	12	36
Cass	11,559	46	12	34	19,188	77	19	58	19,668	79	20	59
Cavalier	633	3	1	2	666	3	1	2	586	2	1	1
Dickey	630	3	1	2	763	3	1	2	664	3	1	2
Divide	311	1	0	1	263	1	0	1	267	1	0	1
Dunn	439	2	0	2	565	2	1	1	509	2	1	1
Eddy	292	1	0	1	468	2	0	2	459	2	0	2
Emmons	500	2	1	1	571	2	1	1	650	3	1	2
Foster	368	1	0	1	527	2	1	1	606	2	1	1
Golden Valley	203	1	0	1	296	1	0	1	282	1	0	1
Grand Forks	5,821	23	6	17	7,133	29	7	22	6,923	28	7	21
Grant	384	2	0	2	352	1	0	1	286	1	0	1
Griggs	349	1	0	1	409	2	0	2	363	1	0	1
Hettinger	350	1	0	1	365	1	0	1	309	1	0	1
Kidder	317	1	0	1	412	2	0	2	401	2	0	2
LaMoure	529	2	1	1	743	3	1	2	745	3	1	2
Logan	276	1	0	1	251	1	0	1	255	1	0	1
McHenry	709	3	1	2	827	3	1	2	823	3	1	2
McIntosh	346	1	0	1	375	2	0	2	378	2	0	2
McKenzie	711	3	1	2	801	3	1	2	726	3	1	2
McLean	1,286	5	1	4	1,657	7	2	5	1,436	6	1	5
Mercer	1,060	4	1	3	1,437	6	1	5	1,398	6	1	5
Morton	2,734	11	3	8	4,617	18	5	13	4,827	19	5	14
Mountrail	782	3	1	2	1,022	4	1	3	948	4	1	3
Nelson	465	2	0	2	552	2	1	1	529	2	1	1
Oliver	315	1	0	1	367	1	0	1	303	1	0	1
Pembina	1,029	4	1	3	1,388	6	1	5	1,336	5	1	4
Pierce	484	2	0	2	699	3	1	2	777	3	1	2
Ramsey	1,337	5	1	4	1,708	7	2	5	1,715	7	2	5
Ransom	631	3	1	2	866	3	1	2	831	3	1	2
Renville	308	1	0	1	343	1	0	1	315	1	0	1
Richland	1,634	7	2	5	2,708	11	3	8	2,579	10	3	7
Rolette	1,252	5	1	4	1,757	7	2	5	2,052	8	2	6
Sargent	542	2	1	1	597	2	1	1	553	2	1	1
Sheridan	241	1	0	1	245	1	0	1	205	1	0	1
Sioux	339	1	0	1	389	2	0	2	475	2	0	2
Slope	83	0	0	0	151	1	0	1	126	1	0	1
Stark	2,335	9	2	7	3,161	13	3	10	3,037	12	3	9
Steele	273	1	0	1	310	1	0	1	314	1	0	1
Stutsman	2,456	10	2	8	2,930	12	3	9	2,828	11	3	8
Towner	360	1	0	1	407	2	0	2	402	2	0	2
Traill	900	4	1	3	1,252	5	1	4	1,262	5	1	4
Walsh	1,465	6	1	5	1,685	7	2	5	1,637	7	2	5
Ward	5,369	21	5	16	6,161	25	6	19	5,334	21	5	16
Wells	598	2	1	1	754	3	1	2	813	3	1	2
Williams	2,192	9	2	7	2,897	12	3	9	2,551	10	3	7

Please Note: These data are calculated using clinical, measured prevalence rates which are more conservative than rates based on self-reported visual impairment. Comparisons with previous projections should be made with caution.

Table 9. Visual Impairment Among North Dakotans Ages 60 to 69: 2000, 2010, and 2015

Area	North Dakotans Ages 60 to 69											
	2000 Estimates				2010 Projections				2015 Projections			
	Total	Visual Impairment			Total	Visual Impairment			Total	Visual Impairment		
		Total	Severe	Low		Total	Severe	Low		Total	Severe	Low
North Dakota	47,649	573	147	426	60,341	721	184	537	75,821	910	230	680
Adams	289	3	1	2	275	3	1	2	323	4	1	3
Barnes	1,057	13	3	10	1,338	16	4	12	1,723	21	5	16
Benson	502	6	2	4	599	7	2	5	663	8	2	6
Billings	75	1	0	1	98	1	0	1	127	2	0	2
Bottineau	683	8	2	6	929	11	3	8	1,120	13	3	10
Bowman	308	4	1	3	302	4	1	3	363	4	1	3
Burke	281	3	1	2	305	4	1	3	328	4	1	3
Burleigh	4,902	59	15	44	6,286	75	19	56	8,254	99	25	74
Cass	6,699	80	20	60	12,081	145	36	109	16,956	203	51	152
Cavalier	596	7	2	5	541	6	2	4	607	7	2	5
Dickey	537	6	2	4	580	7	2	5	636	8	2	6
Divide	270	3	1	2	240	3	1	2	240	3	1	2
Dunn	342	4	1	3	405	5	1	4	510	6	2	4
Eddy	281	3	1	2	291	3	1	2	386	5	1	4
Emmons	522	6	2	4	484	6	1	5	523	6	2	4
Foster	397	5	1	4	331	4	1	3	400	5	1	4
Golden Valley	170	2	1	1	184	2	1	1	231	3	1	2
Grand Forks	3,471	42	10	32	4,425	53	13	40	5,346	64	16	48
Grant	322	4	1	3	318	4	1	3	328	4	1	3
Griggs	258	3	1	2	261	3	1	2	324	4	1	3
Hettinger	342	4	1	3	303	4	1	3	343	4	1	3
Kidder	317	4	1	3	251	3	1	2	291	3	1	2
LaMoure	524	6	2	4	507	6	2	4	615	7	2	5
Logan	303	4	1	3	256	3	1	2	243	3	1	2
McHenry	648	8	2	6	643	8	2	6	723	9	2	7
McIntosh	473	6	1	5	350	4	1	3	353	4	1	3
McKenzie	475	6	1	5	603	7	2	5	678	8	2	6
McLean	907	11	3	8	1,267	15	4	11	1,563	19	5	14
Mercer	626	8	2	6	808	10	2	8	969	12	3	9
Morton	1,918	23	6	17	2,649	32	8	24	3,673	44	11	33
Mountrail	563	7	2	5	701	8	2	6	866	10	3	7
Nelson	439	5	1	4	450	5	1	4	534	6	2	4
Oliver	169	2	1	1	266	3	1	2	333	4	1	3
Pembina	754	9	2	7	948	11	3	8	1,221	15	4	11
Pierce	470	6	1	5	430	5	1	4	529	6	2	4
Ramsey	972	12	3	9	1,241	15	4	11	1,465	18	4	14
Ransom	511	6	2	4	617	7	2	5	785	9	2	7
Renville	293	4	1	3	258	3	1	2	303	4	1	3
Richland	1,241	15	4	11	1,490	18	4	14	2,033	24	6	18
Rolette	863	10	3	7	1,223	15	4	11	1,491	18	4	14
Sargent	384	5	1	4	455	5	1	4	500	6	2	4
Sheridan	224	3	1	2	205	2	1	1	209	3	1	2
Sioux	184	2	1	1	278	3	1	2	310	4	1	3
Slope	105	1	0	1	65	1	0	1	107	1	0	1
Stark	1,747	21	5	16	2,187	26	7	19	2,711	33	8	25
Steele	247	3	1	2	235	3	1	2	257	3	1	2
Stutsman	1,807	22	5	17	2,180	26	7	19	2,478	30	7	23
Towner	274	3	1	2	310	4	1	3	347	4	1	3
Traill	667	8	2	6	807	10	2	8	977	12	3	9
Walsh	1,116	13	3	10	1,272	15	4	11	1,492	18	4	14
Ward	3,882	47	12	35	4,461	54	13	41	5,185	62	16	46
Wells	603	7	2	5	524	6	2	4	590	7	2	5
Williams	1,639	20	5	15	1,828	22	5	17	2,259	27	7	20

Please Note: These data are calculated using clinical, measured prevalence rates which are more conservative than rates based on self-reported visual impairment. Comparisons with previous projections should be made with caution.

Table 10. Visual Impairment Among North Dakotans Ages 70 to 79: 2000, 2010, and 2015

Area	North Dakotans Ages 70 to 79											
	2000 Estimates				2010 Projections				2015 Projections			
	Total	Visual Impairment			Total	Visual Impairment			Total	Visual Impairment		
		Total	Severe	Low		Total	Severe	Low		Total	Severe	Low
North Dakota	41,844	1,593	332	1,261	44,322	1,685	351	1,334	49,455	1,878	396	1,482
Adams	267	10	2	8	280	11	2	9	278	11	2	9
Barnes	998	38	8	30	1,078	41	9	32	1,246	47	10	37
Benson	423	16	3	13	420	16	3	13	473	18	4	14
Billings	70	3	1	2	54	2	0	2	63	2	1	1
Bottineau	671	25	5	20	664	25	5	20	775	29	6	23
Bowman	303	12	2	10	290	11	2	9	285	11	2	9
Burke	258	10	2	8	201	8	2	6	179	7	1	6
Burleigh	3,809	145	30	115	4,133	157	33	124	4,612	175	37	138
Cass	5,373	204	43	161	6,925	263	55	208	8,675	330	69	261
Cavalier	466	18	4	14	501	19	4	15	480	18	4	14
Dickey	487	19	4	15	535	20	4	16	588	22	5	17
Divide	287	11	2	9	260	10	2	8	252	10	2	8
Dunn	274	10	2	8	299	11	2	9	331	13	3	10
Eddy	306	12	2	10	303	12	2	10	304	12	2	10
Emmons	521	20	4	16	521	20	4	16	513	19	4	15
Foster	347	13	3	10	389	15	3	12	345	13	3	10
Golden Valley	179	7	1	6	169	6	1	5	187	7	1	6
Grand Forks	2,832	108	23	85	2,774	105	22	83	3,089	117	25	92
Grant	308	12	2	10	266	10	2	8	272	10	2	8
Griggs	316	12	3	9	226	9	2	7	210	8	2	6
Hettinger	303	12	2	10	310	12	2	10	291	11	2	9
Kidder	293	11	2	9	294	11	2	9	267	10	2	8
LaMoure	508	19	4	15	482	18	4	14	467	18	4	14
Logan	286	11	2	9	254	10	2	8	257	10	2	8
McHenry	541	21	4	17	643	24	5	19	655	25	5	20
McIntosh	492	19	4	15	496	19	4	15	446	17	4	13
McKenzie	358	14	3	11	447	17	4	13	528	20	4	16
McLean	824	31	7	24	866	33	7	26	1,056	40	8	32
Mercer	541	21	4	17	613	23	5	18	704	27	6	21
Morton	1,691	64	14	50	1,962	75	16	59	2,243	85	18	67
Mountrail	499	19	4	15	542	21	4	17	627	24	5	19
Nelson	478	18	4	14	449	17	4	13	464	18	4	14
Oliver	142	5	1	4	129	5	1	4	156	6	1	5
Pembina	770	29	6	23	678	26	5	21	730	28	6	22
Pierce	509	19	4	15	452	17	4	13	458	17	4	13
Ramsey	984	37	8	29	888	34	7	27	1,003	38	8	30
Ransom	560	21	4	17	536	20	4	16	591	22	5	17
Renville	245	9	2	7	252	10	2	8	228	9	2	7
Richland	1,202	46	10	36	1,109	42	9	33	1,220	46	10	36
Rolette	573	22	5	17	841	32	7	25	1,050	40	8	32
Sargent	383	15	3	12	391	15	3	12	484	18	4	14
Sheridan	222	8	2	6	184	7	1	6	182	7	1	6
Sioux	106	4	1	3	130	5	1	4	176	7	1	6
Slope	50	2	0	2	84	3	1	2	58	2	0	2
Stark	1,542	59	12	47	1,655	63	13	50	1,821	69	15	54
Steele	215	8	2	6	211	8	2	6	214	8	2	6
Stutsman	1,783	68	14	54	1,796	68	14	54	2,035	77	16	61
Towner	288	11	2	9	222	8	2	6	224	9	2	7
Traill	708	27	6	21	625	24	5	19	697	26	6	20
Walsh	1,048	40	8	32	938	36	8	28	993	38	8	30
Ward	3,187	121	25	96	3,549	135	28	107	3,878	147	31	116
Wells	570	22	5	17	560	21	4	17	525	20	4	16
Williams	1,448	55	12	43	1,446	55	12	43	1,570	60	13	47

Please Note: These data are calculated using clinical, measured prevalence rates which are more conservative than rates based on self-reported visual impairment. Comparisons with previous projections should be made with caution.

Table 11. Visual Impairment Among North Dakotans Ages 80 and Older: 2000, 2010, and 2015

Area	North Dakotans Ages 80 and Older											
	2000 Estimates				2010 Projections				2015 Projections			
	Total	Visual Impairment			Total	Visual Impairment			Total	Visual Impairment		
		Total	Severe	Low		Total	Severe	Low		Total	Severe	Low
North Dakota	29,492	6,989	2,068	4,921	39,474	9,356	2,763	6,593	43,702	10,360	3,059	7,301
Adams	223	53	16	37	231	55	16	39	239	57	17	40
Barnes	817	194	57	137	970	230	68	162	1,054	250	74	176
Benson	273	65	19	46	381	90	27	63	424	100	30	70
Billings	39	9	3	6	59	14	4	10	57	14	4	10
Bottineau	515	122	36	86	641	152	45	107	686	163	48	115
Bowman	237	56	17	39	323	77	23	54	367	87	26	61
Burke	155	37	11	26	169	40	12	28	167	40	12	28
Burleigh	2,455	582	172	410	3,033	719	212	507	3,406	807	238	569
Cass	3,433	814	240	574	5,724	1,357	401	956	6,636	1,573	465	1,108
Cavalier	344	82	24	58	402	95	28	67	452	107	32	75
Dickey	470	111	33	78	467	111	33	78	522	124	37	87
Divide	256	61	18	43	291	69	20	49	296	70	21	49
Dunn	194	46	14	32	230	55	16	39	248	59	17	42
Eddy	224	53	16	37	318	75	22	53	358	85	25	60
Emmons	323	77	23	54	524	124	37	87	590	140	41	99
Foster	249	59	17	42	352	83	25	58	419	99	29	70
Golden Valley	154	36	11	25	175	41	12	29	175	41	12	29
Grand Forks	1,924	456	135	321	2,686	637	188	449	2,895	686	203	483
Grant	238	56	17	39	292	69	20	49	302	72	21	51
Griggs	251	59	18	41	333	79	23	56	332	79	23	56
Hettinger	206	49	14	35	260	62	18	44	285	68	20	48
Kidder	195	46	14	32	258	61	18	43	294	70	21	49
LaMoure	325	77	23	54	431	102	30	72	469	111	33	78
Logan	191	45	13	32	285	68	20	48	307	73	21	52
McHenry	430	102	30	72	486	115	34	81	576	137	40	97
McIntosh	415	98	29	69	537	127	38	89	603	143	42	101
McKenzie	311	74	22	52	383	91	27	64	454	108	32	76
McLean	635	150	44	106	837	198	59	139	919	218	64	154
Mercer	382	91	27	64	583	138	41	97	687	163	48	115
Morton	1,035	245	72	173	1,622	384	114	270	1,945	461	136	325
Mountrail	408	97	29	68	432	102	30	72	465	110	33	77
Nelson	336	80	24	56	520	123	36	87	535	127	37	90
Oliver	71	17	5	12	111	26	8	18	118	28	8	20
Pembina	533	126	37	89	711	169	50	119	728	173	51	122
Pierce	384	91	27	64	550	130	39	91	576	137	40	97
Ramsey	791	187	55	132	990	235	69	166	1,042	247	73	174
Ransom	420	100	29	71	620	147	43	104	694	164	49	115
Renville	187	44	13	31	219	52	15	37	238	56	17	39
Richland	926	219	65	154	1,241	294	87	207	1,331	315	93	222
Rolette	349	83	24	59	501	119	35	84	648	154	45	109
Sargent	195	46	14	32	268	64	19	45	261	62	18	44
Sheridan	116	27	8	19	166	39	12	27	169	40	12	28
Sioux	39	9	3	6	55	13	4	9	64	15	4	11
Slope	31	7	2	5	37	9	3	6	55	13	4	9
Stark	1,109	263	78	185	1,384	328	97	231	1,537	364	108	256
Steele	101	24	7	17	160	38	11	27	178	42	12	30
Stutsman	1,193	283	84	199	1,791	424	125	299	1,968	466	138	328
Towner	236	56	17	39	261	62	18	44	251	59	18	41
Traill	582	138	41	97	662	157	46	111	677	160	47	113
Walsh	792	188	55	133	830	197	58	139	834	198	58	140
Ward	2,312	548	162	386	2,891	685	202	483	3,254	771	228	543
Wells	438	104	31	73	561	133	39	94	629	149	44	105
Williams	1,044	247	73	174	1,230	292	86	206	1,286	305	90	215

Please Note: These data are calculated using clinical, measured prevalence rates which are more conservative than rates based on self-reported visual impairment. Comparisons with previous projections should be made with caution.

Figure 1. Total Visual Impairment Among North Dakotans Ages 15 and Older: 2000, 2010, and 2015

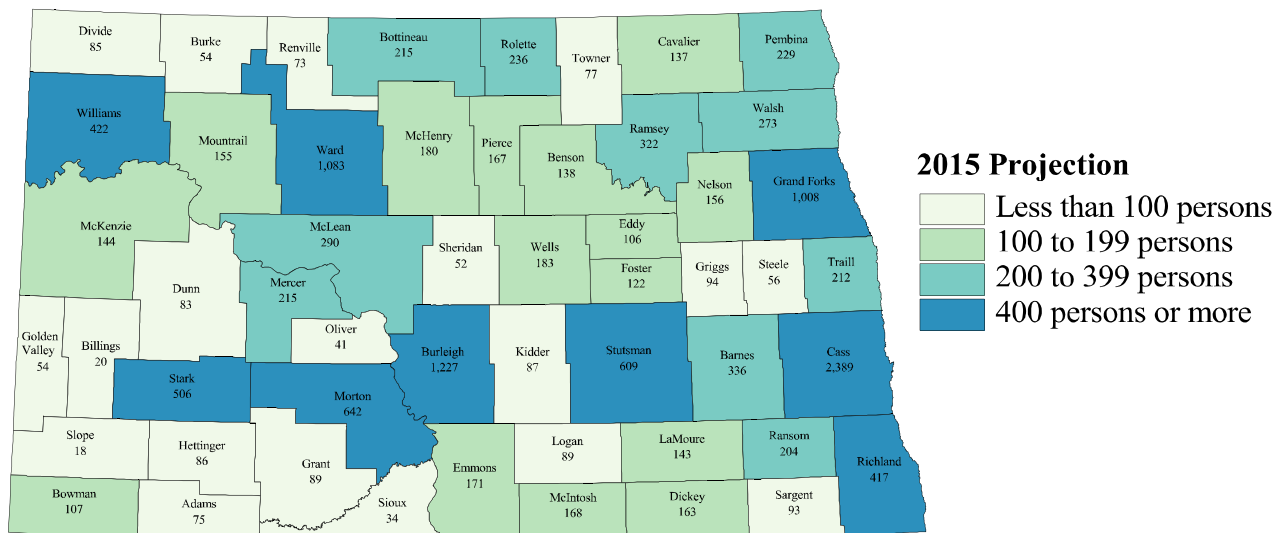
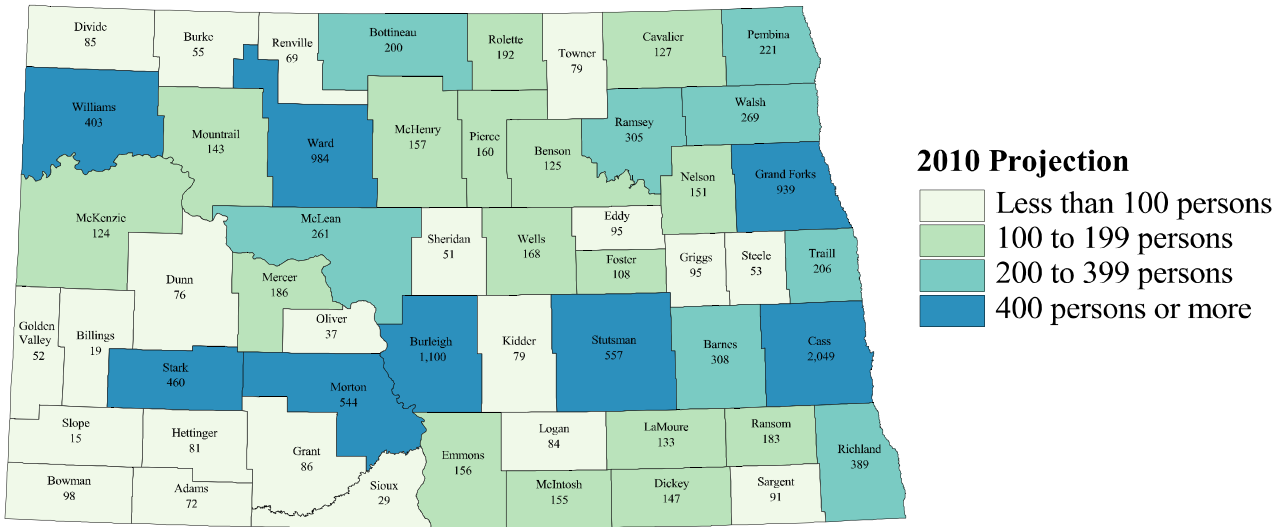
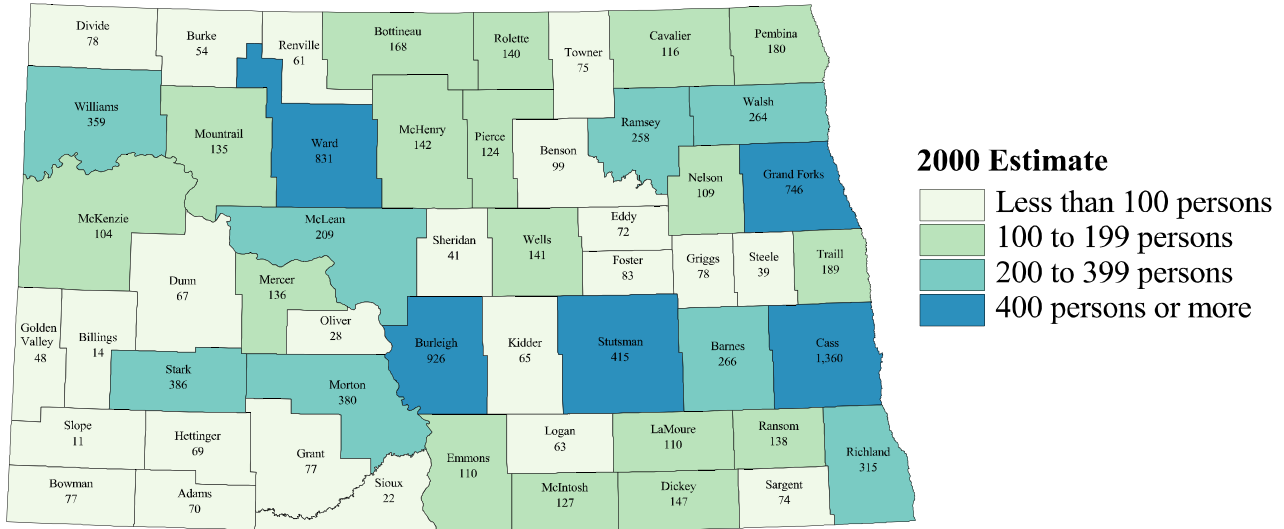


Figure 2. Total Visual Impairment Among North Dakotans Ages 15 and Older as a Percent of Total Persons Ages 15 and Older: 2000, 2010, and 2015

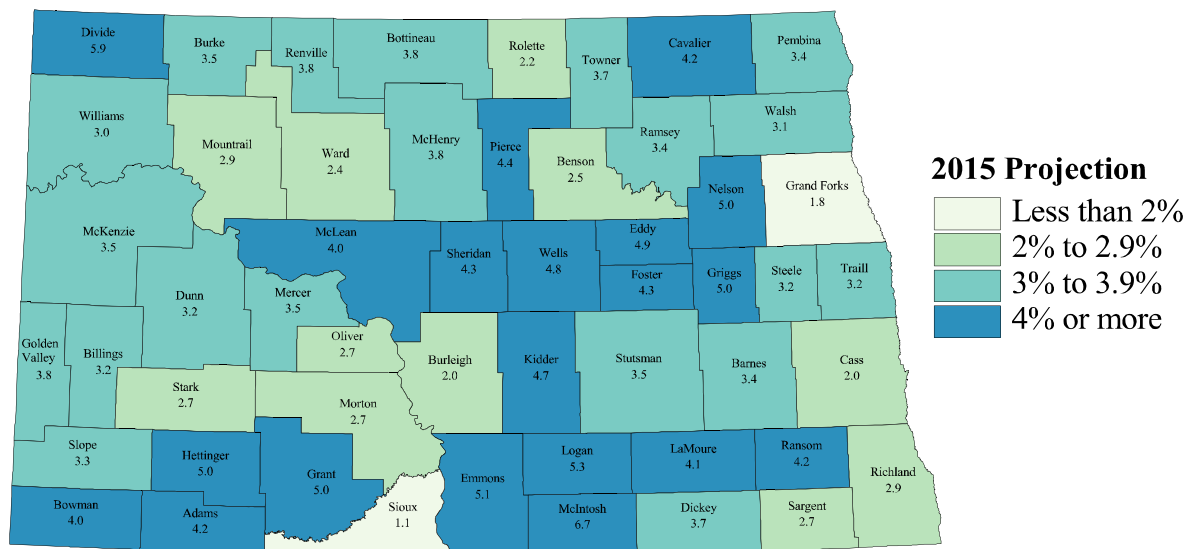
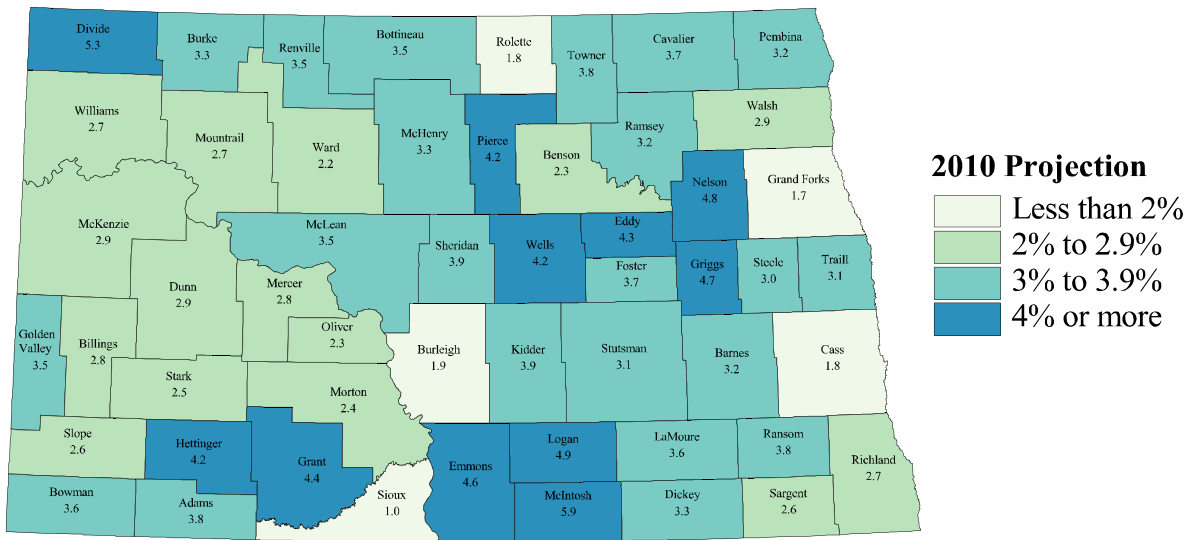
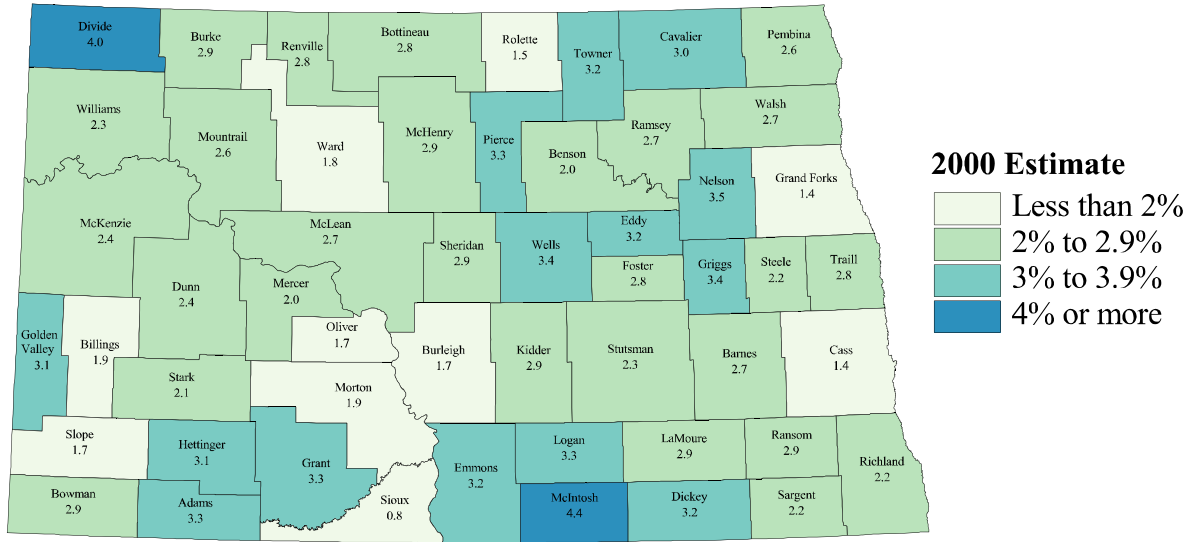


Figure 3. Severe Visual Impairment Among North Dakotans Ages 15 and Older: 2000, 2010, and 2015

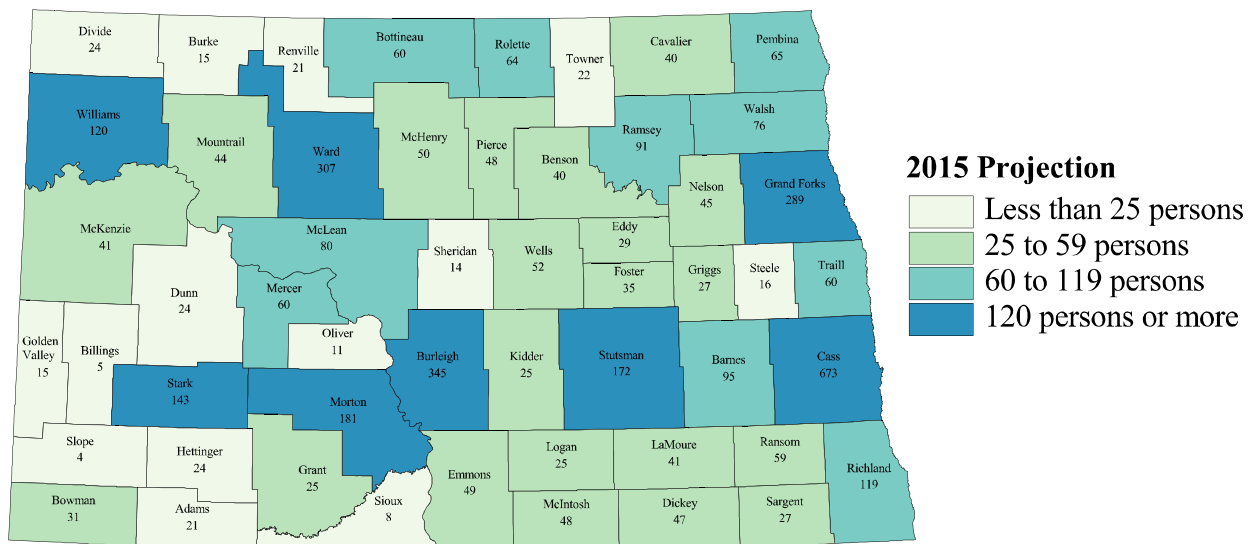
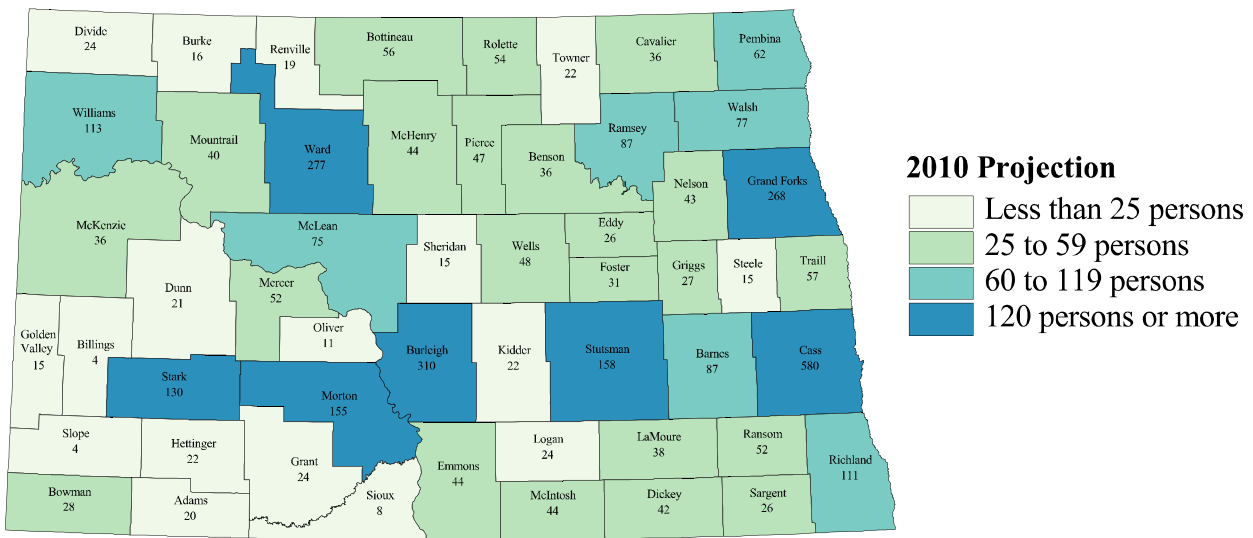
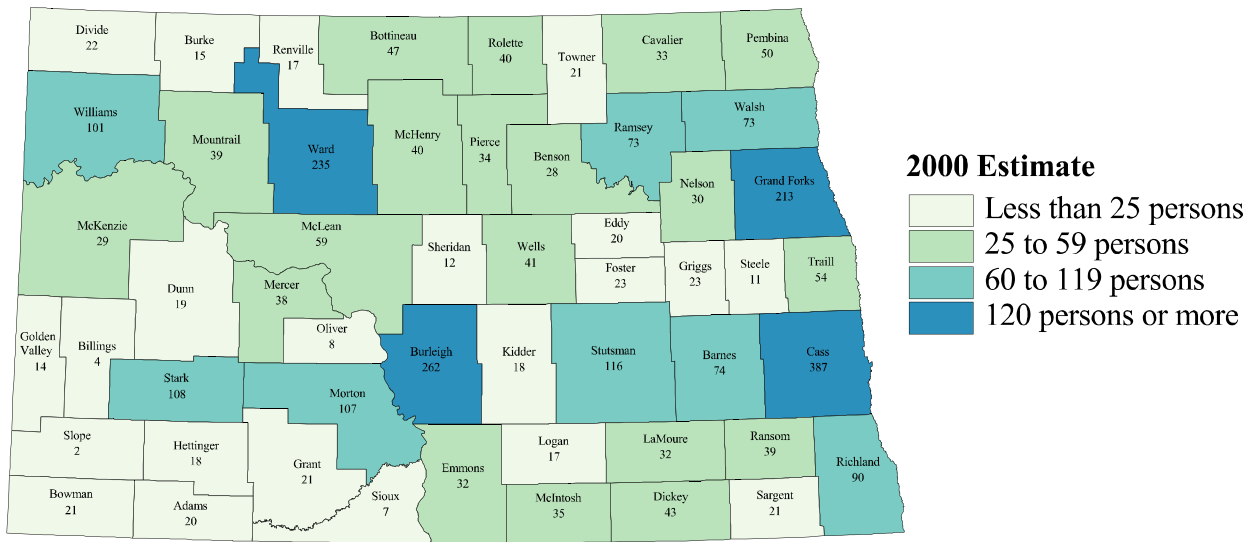


Figure 4. Severe Visual Impairment Among North Dakotans Ages 15 and Older as a Percent of Total Persons Ages 15 and Older: 2000, 2010, and 2015

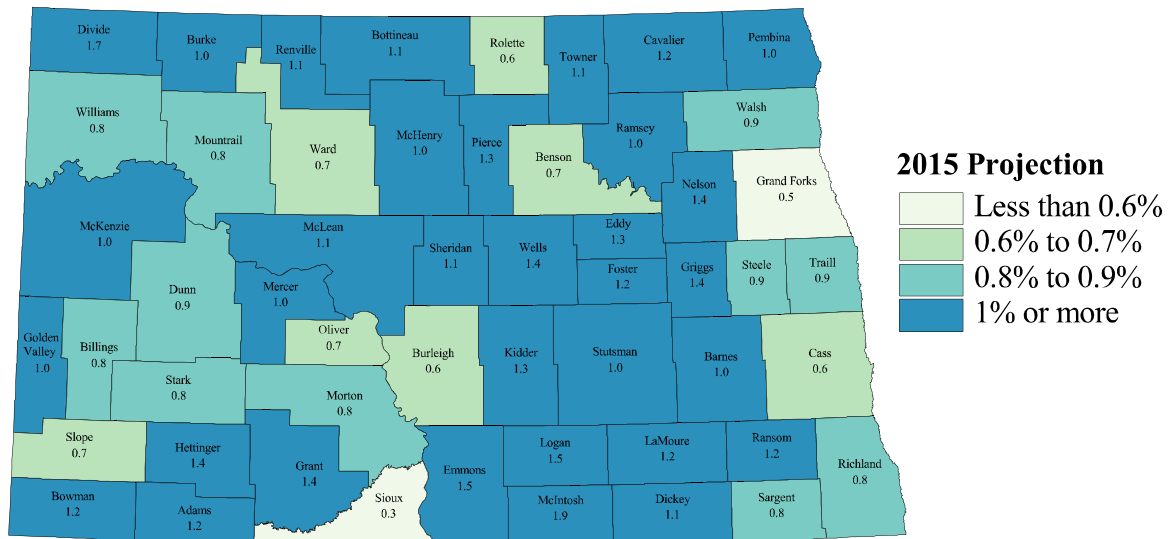
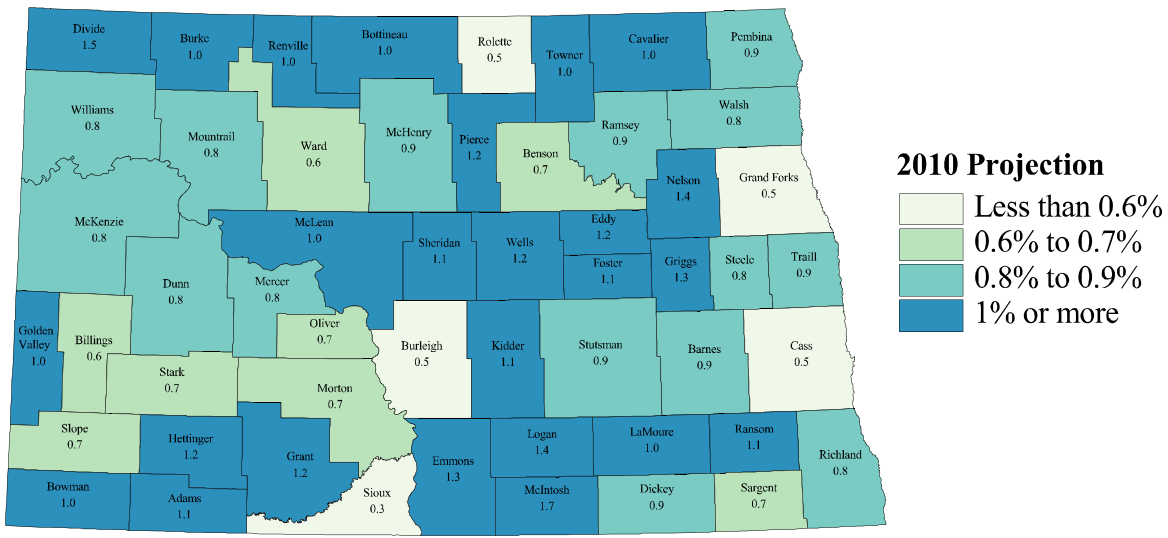
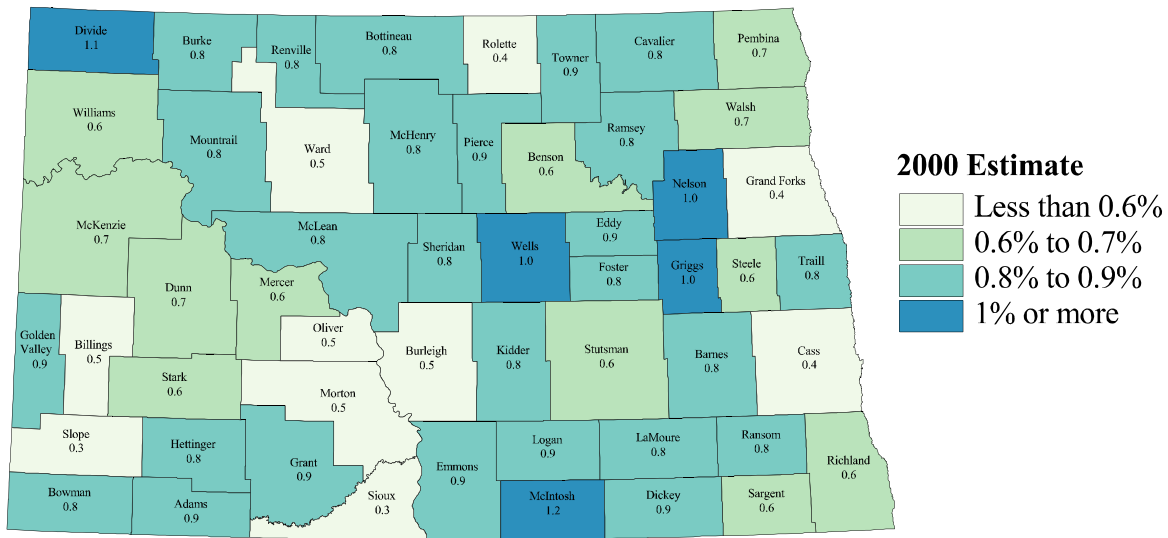


Figure 5. Total Visual Impairment Among North Dakotans Ages 80 and Older: 2000, 2010, and 2015

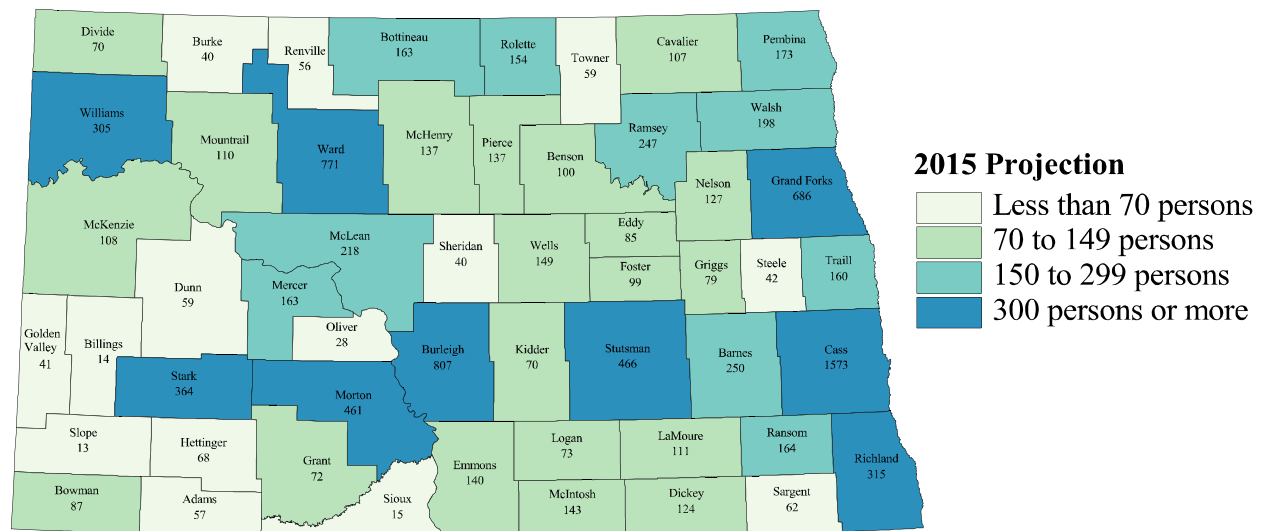
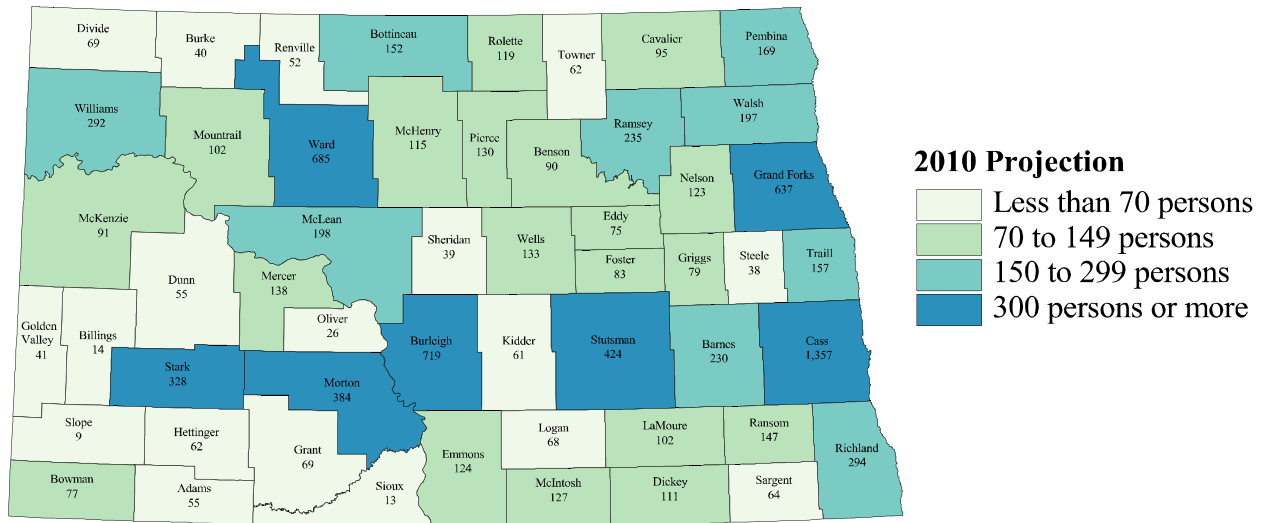
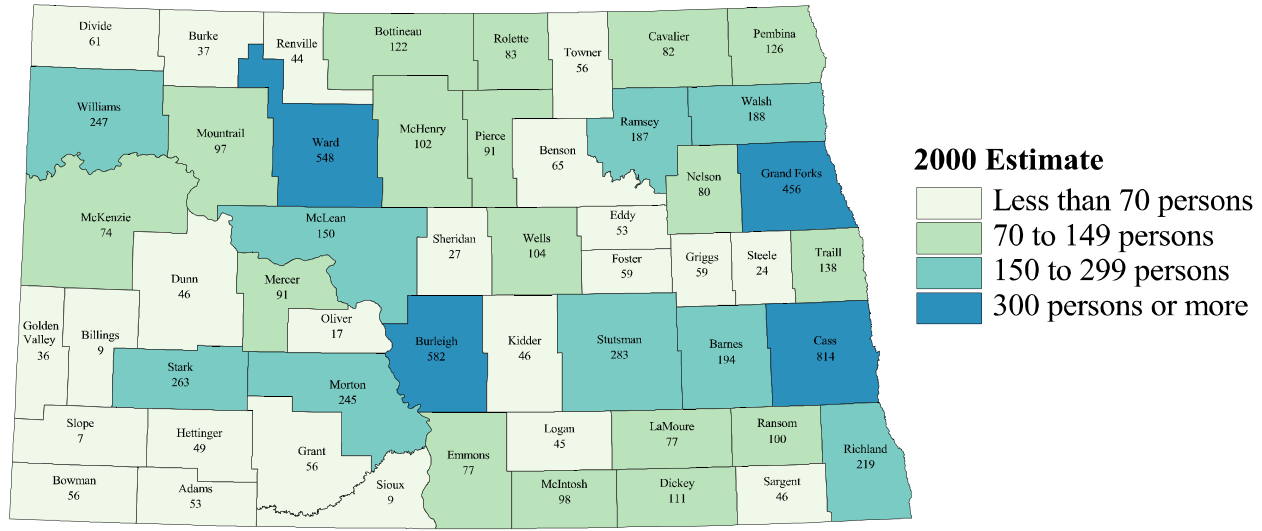
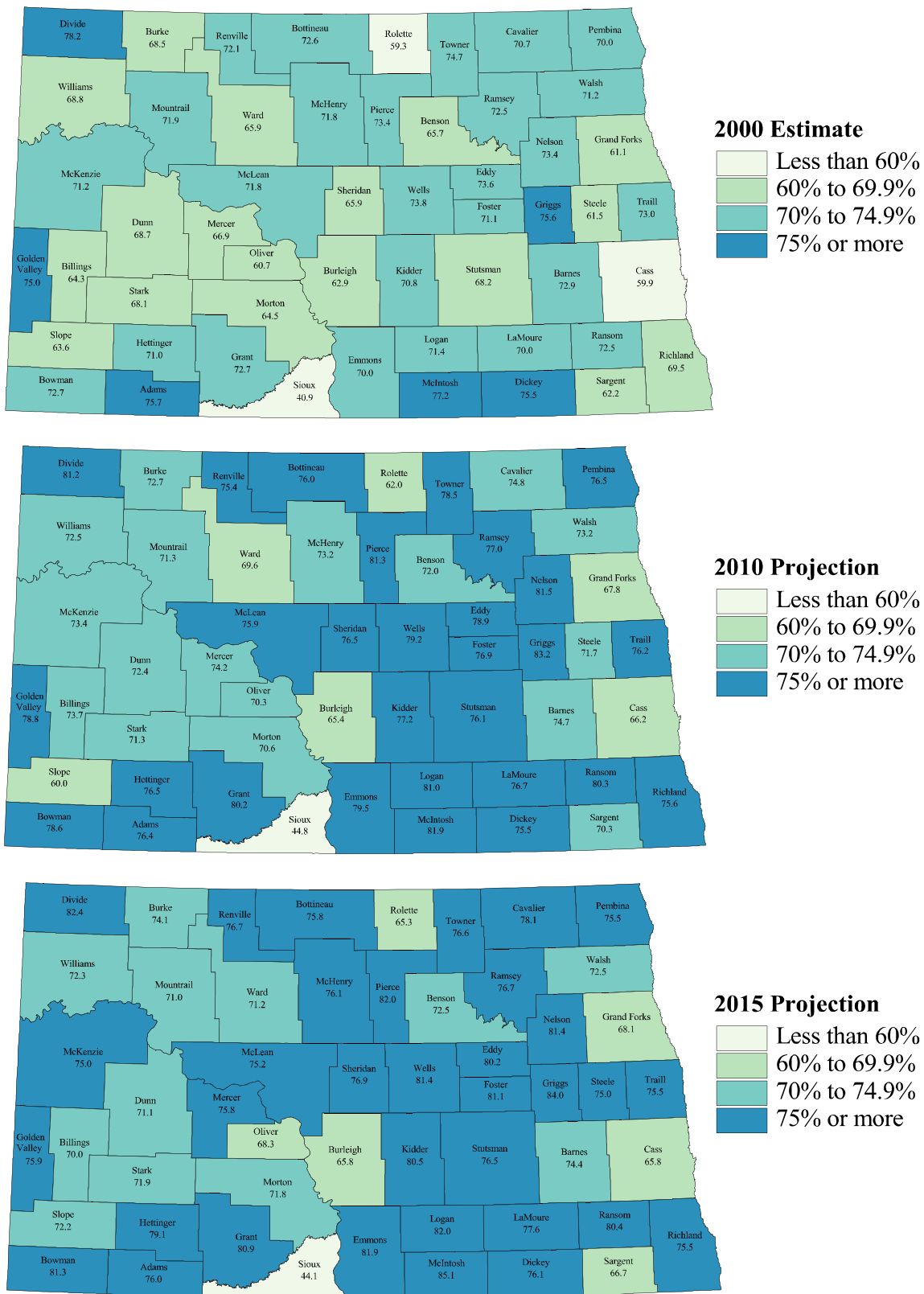


Figure 6. Total Visual Impairment Among North Dakotans Ages 80 and Older as a Percent of Total Visual Impairment Among North Dakotans Ages 15 and Older: 2000, 2010, and 2015



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