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Access to care and melanoma incidence and mortality in Nebraska

Natalia Trinidad

MPH- Epidemiology

Abstract:

The purpose of this study is to determine incidence and mortality of melanoma across all counties in Nebraska in the context of access to primary care providers and dermatologists. Crude and age-adjusted incidence rates of melanoma from 2001-2016 by county were calculated for the following year intervals: 2001-2005, 2006-2010, 2011-2016. Variables for melanoma cases were obtained from the Nebraska Cancer Registry and included the case's zip code at diagnosis, race, ethnicity, sex, age at diagnosis, year, cancer site, vital status, stage of disease, and the ICD-O code for the cancer type. Crude and age-adjusted mortality rates were calculated for the year intervals 2001-2005, 2006-2010, and 2011-2016 by county using the 2000 US standard population. The variables on the number of primary care providers and address of practice were obtained from the University of Nebraska, College of Public Health, Health Professions Tracking Service. The number of primary care providers/dermatologist to population ratios were determined for each county for the year 2016. Shortage areas for primary care providers/dermatologists were determined by calculating the ratio of primary care providers/dermatologists for each county in Nebraska. The results of this study will guide the UNMC Dermatology Department as to which counties in Nebraska to focus on with regard to its melanoma skin cancer prevention efforts in Nebraska and help guide its telemedicine program in Nebraska.

Chapter 1: Introduction

Research questions: What was the incidence and mortality of melanoma in Nebraska from 2001-2016? What is the number of primary care providers/dermatologists in each county in Nebraska for the year 2016?

Specific Aims:

1. Quantify the incidence and mortality of melanoma in every county in Nebraska for the years 2001-2016.

    a. Determine the crude and age-adjusted incidence and mortality rates of melanoma for the time intervals 2001-2005, 2006-2010, and 2011-2016 in every county in Nebraska.

        i. Crude and age-adjusted incidence rates for melanoma for the following time intervals 2001-2005, 2006-2010, and 2011-2016 were calculated for each county using the variables obtained from the Nebraska Cancer Registry.

        ii. Crude and age-adjusted mortality rates for melanoma for the following time intervals 2001-2005, 2006-2010, and 2011-2016 were calculated for each county using the variables obtained from the Nebraska Cancer Registry.

2. Quantify the number of primary care providers/dermatologists in every county in Nebraska for the year 2016 (coincides with the latest data on incidence and mortality made available by the Nebraska Cancer Registry)

    a. Determine the number of primary care providers/dermatologists in each county in Nebraska for the year 2016.

        i. Determine the primary care providers/dermatologists to population ratios in each county in Nebraska.

3. Determine in which counties in Nebraska there is limited access to primary care providers/dermatologists for melanoma.

    a. Identify counties with a low ratio of primary care providers/dermatologist to population in Nebraska. The recommendations provided by American Medical Association on the number of primary care providers per 100,000 people and by the American Professors of Dermatology that recommends 4.0 dermatologists per 100,000 people.

        i. The variables on primary care providers/dermatologists were obtained from the Nebraska Health Professions Tracking Service (HPTS) and population estimates were obtained from the US Census Bureau population numbers.

Significance:

The results of this research study will determine in which counties there has been an increase in incidence and mortality in Nebraska for the years 2100-2016. We also want to investigate the relationship between primary care provider/dermatologist to population ratios in each Nebraska county for the year 2016. The results of this study will guide the outreach efforts of the UNMC dermatology department.

Chapter 2: Background and Literature Review

Description of the problem:

Nebraska does not meet the recommendations for the number of dermatologists needed per 100,000 people. Currently there is one dermatologist for every 52,000 people, the recommended number is one dermatologist for every 25,000 or 30,000 people by the American Professors of Dermatology or 4.0 dermatologist per 100,000 people (Glazier et al., 2017). Increasing the number of primary care providers and more specifically dermatologists is imperative given that there has been an increase in incidence of melanoma in Nebraska from

15.2 per 100,000 in 2001 to 25.6 per 100,000 in the year 2015 (Centers for Disease Control and Prevention [CDC], 2019). Prevention and early diagnosis of melanoma may decrease mortality of the disease so it will be helpful to know which counties in Nebraska have seen an increase in incidence since 2001. The results of this study will provide more information as to which counties in Nebraska have seen a greater increase in incidence and mortality within the past fifteen years of data that is available from the Nebraska Cancer Registry. This study will also quantify the number of primary care providers/dermatologists that are available in each county so that shortage areas can be identified. The UNMC Dermatology Department will use this information to guide its outreach efforts in rural areas in Nebraska.

Scientific Background:

Epidemiology of Melanoma in the US and Nebraska

The incidence of melanoma has increased in the past 30 years in the US from 16.6 new cases per 100,000 in 1996 to 22.7 new cases per 100,000 in 2016 (Siegel, Miller, & Jamal, 2016; National Cancer Institute, 2019a), and it is estimated that 96,480 Americans will be diagnosed with melanoma in 2019. In terms of mortality, the rates have remained steady from 1996 to 2016, rates per 100,000 were 2.8 and 2.2 respectively and it is estimated that there will be 7,230 melanoma related deaths in 2019 (Siegal, Miller, & Jamal, 2016; Glazer et al., 2016). However, Apalla et al. (2017) projected that the incidence rate will continue to increase in the US, UK, Sweden, and Norway until at least the year 2022. Currently the lifetime risk for being diagnosed with invasive melanoma or in situ melanoma in the US in 2019 is 1 in 27 for men and 1 in 40 for women. Melanoma is more common among Whites than other ethnic groups, as Caucasians have an overall lifetime risk of 2.4% compared to 0.1% in Blacks and 0.5% in Hispanics (Apalla et al., 2017). The risk of melanoma also increases with age, with an average age of diagnosis of 63 and a 3.5 times higher incidence among males 75 years of age or older (Siegel, Miller, & Jamal, 2016; Apalla et al., 2017). The age-adjusted incidence rate of

melanoma in Nebraska during the years 2011-2015 was 22.1 per 100,000 and mortality was 3.0 per 100,000 compared to the overall US incidence of 20.7 per 100,000 and a mortality of 2.7 per 100,000 (Nebraska Department of Health and Human Services/Cancer Registry, 2015).

Primary care physicians and dermatologists in the United States and Nebraska

Since the passage of the Affordable Care Act (ACA) in 2014, there has been an increase in the use of cancer preventative services and access to cancer treatment (American Society of Clinical Oncology, 2015); however, in rural areas access to primary care providers and dermatologists is limited (Aneja, Aneja & Bordeaux, 2012). The recommended number of primary care providers is 89.4 per 100,000 people by the American Medical Association (Locum Tenens Staffing Firm, 2012). The Association of American Medical Colleges [AAMC] (2019) has reported that there is an increase of physician shortages in the United States; especially in rural areas. This is due to an increase in the demand of for primary care physicians and dermatologists due to the aging population and population growth (AAMC, 2019). It is estimated that the U.S. population for those 65 years of age and older will increase by 48% by the year 2032 (AAMC, 2019).

In terms of dermatology, there has been an increase in the density of dermatologists in the US in the past decade. However, the current density of dermatologists in the US is 3.4 per 100,000 although the recommended density is 4 per 100,000 population (Glazer et al., 2017). This issue of scarcity of dermatologists is compounded by increased need for dermatologic services. This increased demand is due in part to the rising rates in skin cancer and other skin diseases (Glazer et al., 2017). Given the increase in incidence of melanoma, access to care when diagnosed with melanoma is important since survival rates fall if the disease is diagnosed in its late stages (Tripp et al., 2016). The five-year relative survival rate for melanoma for the time-period 2008 to 2014 was 93% (Siegel, Miller, & Jamal, 2016). The survival rate is high compared to other cancers; however, survival rates decrease as the disease is diagnosed in its

later stages. The five-year survival rate for melanoma diagnosed at the localized stage it is 98% but for melanoma diagnosed at the distant stage, the five-year survival rate decreases to 23%. An increase in dermatologist density has been associated with lower melanoma mortality rates and an improved diagnosis of skin disease (Glazer and Rigel, 2017); therefore, increasing the number of dermatologists per 100,000 may decrease overall mortality rates.

In rural areas, there is an increased burden in access to high quality care where there is a shortage of providers. While dermatologist density has increased in the past decade in the United States, dermatologists are unevenly distributed in terms of geography leaving some areas in the US underserved (Glazer and Rigel, 2017). The majority of dermatologists practice in dermatologist dense areas or in large academic medical centers; therefore, over 70% of section codes (3-digit zip code locations obtained from the U.S. Census Bureau) with at least 1 practicing dermatologist have less than the recommended 4 dermatologists for 100,000 people (Glazer et al., 2017). For people living in rural areas, getting proper treatment for melanoma means driving longer distances and a decrease in access to dermatologists and advanced treatments and technologies (American Society of Clinical Oncology, 2015).

In Nebraska, approximately 47% of residents live in rural areas and there is a shortage of providers in these areas especially dermatologists. Based on the map created by Glazer et al. (2017) some section codes in Nebraska don't have a single practicing dermatologist and the highest density of 3 to 4 dermatologists per 100,000 people are in the urban areas. To the best of our knowledge, incidence and mortality rates of melanoma in each county in Nebraska along with the number of primary care providers/dermatologists has not been quantified. The aim of this study is to be able to quantify these so it will help guide the UNMC Dermatology Department in its effort to increase access to care in rural Nebraska for melanoma patients.

Limitations and Gaps in the existing literature:

There is information on incidence and mortality for Nebraska; however, this study will include rates for three different time intervals 2001-2005, 2006-2010, and 2011-2016. Also, there is not a lot of information on incidence and mortality of the disease for each county in Nebraska. There is information available for number of providers/dermatologists in the US and where there are low density areas; however, there is limited data on the number of primary care providers/dermatologist for each county in Nebraska. The increase in incidence of melanoma in Nebraska has created a need for dermatologists or primary care providers that can diagnose the disease early or refer suspected cases to dermatologists; thus, early diagnosis and treatment will decrease mortality. The results of this study will provide information on which counties in Nebraska there is a need for primary care providers/dermatologists and where the incidence is highest so that the UNMC Dermatology Department can increase its prevention efforts for the disease.

Rationale:

The purpose of the study is to calculate crude rates and age-adjusted incidence and mortality rates of melanoma by county for the years 2001-2016 in Nebraska. The ratio of primary care providers/dermatologists in each county in Nebraska for the year 2016 will also be investigated to determine where there are shortage areas based on the recommendations set by the American Professors of Dermatology and the American Medical Association.

Chapter 3: Data and Methods

Study Design:

The crude incidence and mortality rates as well as age-adjusted incidence and mortality rates were determined for each county in Nebraska for three-time intervals: 2001-2005, 2006-

2010, and 2011-2016. Age-adjusted incidence and mortality rates were only calculated for counties that had 20 or more cases for each time-interval.

Setting and Study Population:

All melanoma cases in Nebraska for the years 2001-2016. All primary care providers and dermatologists for the year 2016 in Nebraska.

Data Sources:

The dataset for all cases of melanoma in Nebraska for the years 2001-2016 were obtained from the Nebraska Department of Health and Human Services/Nebraska Cancer Registry. The dataset for providers was obtained from the Nebraska Health Professions Tracking Service.

Variables:

The variables for all melanoma cases for the years 2001-2016 were obtained from the Nebraska Department of Health and Human Services/Nebraska Cancer Registry. The following variables were included for each case: Zip code of the case at the time of diagnosis, race, ethnicity, sex, age, year, ICD-O-3 typography code for skin melanoma, vital status, stage of the disease, and subtype of melanoma skin cancer. The county populations for the years 2001-2016 were obtained from the 2000-2010 County Characteristics Intercensal Population Estimates, U.S. Census Bureau, Population Division that were released on October 2012 and from the 7/1/2018 County Characteristics Resident Population Estimates, U.S. Census Bureau, Population Division that were released on June 2019. The variables obtained from both datasets were the following: year, age group, and resident population estimates for all Nebraska counties for each year from 2001 to 2016. The age groups were the following: Age 0, age 1 to 4 years, age 5 to 9 years, age 10 to 14 years, age 15 to 19 years, age 20 to 24 years, age 25 to

29 years, age 30 to 34 years, age 35 to 39 years, age 40 to 44 years, age 45 to 49 years, age 50 to 54 years, age 55 to 59 years, age 60 to 64 years, age 65 to 69 years, age 70 to 74 years, age 75 to 79 years, age 70 to 84 years, and age 85 years and older.

The variables for providers were obtained from the Nebraska Health Professions Tracking Service for the year 2016. The following variables were included for each provider: year, profession, primary specialty, clinic name of practice, clinic address, and county clinic is located.

Calculations for Incidence and Mortality

Crude incidence and mortality rates were calculated by determining the number of cases for each county for the three-time intervals (2001-2005, 2006-2010, and 2011-2016). The total number of cases or deaths for each time interval was then divided by the population of the county for all of the years included in the timer interval and multiplied by 100,000. Age-adjusted rates for incidence and mortality for counties that had 20 or more cases were calculated for the following periods: 2001-2005, 2006-2010, and 2011-2016. The population numbers for each age group and county were obtained from the US Census Bureau, Population Division. The 2000 US Standard Population obtained from the US Census Bureau was used to calculate the age-adjusted rates. For cases less than 20, rates were not calculated since a statistically significant rate cannot be determined. See Appendix A for the formulas used to calculate crude and age-adjusted rates as well as the weights for each age group for the 2000 US Standard Population.

The Number of Providers/Dermatologists per 100,000 population

The number of providers for each county in Nebraska was obtained from the Nebraska Health Professions Tracking Service and included the following specialties: family medicine, general practice, internal medicine, dermatology, and dermatopathology per county. The total

number of primary care providers or dermatologists was then divided by the total population of the county for the year 2016 and then multiplied by 100,000. The recommendation by the American Medical Association gives a ratio of the number of providers per 100,000 people; therefore, all ratios on the number of providers and dermatologists were per 100,000 people.

Chapter 4: Results

Demographic Characteristics for Melanoma Cases

There were 9,690 cases of melanoma in Nebraska from the years 2001-2016. 54.6% were males and 45.4 % were females. The mean age for all cases was 60.7 with a standard deviation of 16.9. In terms of race and ethnicity, the majority were White (89.3%) and Non-Hispanic (99.4%). These findings are consistent with the literature in that melanoma of the skin rates are higher among Non-Hispanic whites, men, and those over the age of 60. For this time frame, there were cases as young as one year of age that were diagnosed with melanoma and this finding is also in accordance with the literature in that melanoma of the skin is not uncommon to be diagnosed in people under the age of 30. **See Table 1.0.** For the given time frame, there were 2,256 deaths from melanoma of the skin and 7, 439 new cases. For stage at diagnosis, 36.7% of the cases were diagnosed with melanoma in situ, 47.6% with localized melanoma, 5.5% with regional, and 3.0% with distant. **See Table 2.0.**

Table 1.0 Demographic Characteristics of all Melanoma Cases

Variable	N (%)
Gender	
Male	5,295 (54.6)
Femaie	4,400 (45.4)
Race	
White	8,661 (89.3)
Black	11 (0.1)
Other	26 (0.3)
Uknown	997 (10.3)
Ethnicity	
Non-Hispanic	9,634 (99.4)
Hispanic	54 (0.6)
Not specified	7 (0.0)
	Mean (STD)
Age	60.7 (16.9)

Table 2.0 Melanoma Characteristics for all Cases

Variable	N (%)
Vital Status	
Death	2,256 (23.3)
Alive	7,439 (76.7)
Stage at Diagnosis	
In situ	3,240 (36.7%)
Localized	4,199 (47.6%)
Regional	487 (5.5%)
Distant	264 (3.0%)
Unknown/Unstaged	640 (7.2%)

Incidence and Mortality for 2001-2005, 2006-2010, and 2011-2016 for each County in Nebraska

Crude incidence rates of melanoma of the skin did increase for 84 of the 93 counties in Nebraska from the first time-interval (2001-2005) to the third time-interval (2011-2016). There was a large variation in the crude incidence rates for all counties in Nebraska within the time-intervals. There were some counties with a 0.0 per 100,000 and the highest was 61.7 per 100,000 for the time-interval 2001-2005. For the 2006-2010 time-interval the lowest rate was 0.0 per 100,000 and the highest rate was 70.9 per 100,000. For the time interval 2011-2016 the lowest rate was 0.0 per 100,000 and the highest was 104.4 per 100,000. **See table 3.0** for crude incidence rates for each county and all time-intervals in Nebraska.

Crude mortality rates did increase for 17 of the 93 counties in Nebraska from the first time-interval (2001-2005) to the third time-interval (2011-2016). Crude mortality rates also varied within each time-interval. The lowest crude mortality rate was 0.0 per 100,000 people for the time-interval 2001-2005 and the highest rate was 47.0 per 100,000 people. For the 2006 to 2010 time-interval the range was 0.0 to 39.3 per 100,000 people. This shows a slight decrease in crude mortality rates; however, for the time-interval 2011-2016 the rates were 0.0 to 41.8 per 100,000 people. Based on the calculated crude mortality rates, there has been a decrease in mortality of melanoma of the skin from the initial time-interval of 2001-2005 to the 2011-2016 time-interval in Nebraska since the crude mortality rates decreased for 64 of the 93 counties in Nebraska. **See table 4.0** for crude mortality rates for all counties and all time-intervals in Nebraska.

Table 3.0 Melanoma Incidence in Nebraska
Number of Cases, Crude Rates, and Age-adjusted Rates, by County of Residence
Years 2001-2005, 2006-2010, and 2011-2016

| | 2001-2005 | | | 2006-2010 | | | 2011-2016 | | |
	# Cases	Crude Rates	Rates	# Cases	Crude Rates	Rates	# Cases	Crude Rates	Rates
Nebraska	1345	15.5	15.5	1919	21.3	20.8	4175	37.2	34.4
County									
Adams	27	17.5	16.7	30	19.3	18.0	84	44.5	41.4
Antelope	4	11.2	ND	7	20.8	ND	19	48.9	ND
Arthur	1	47.0	ND	1	44.2	ND	0	0.0	0.0
Banner	0	0.0	0.0	2	57.1	ND	1	24.3	ND
Blaine	0	0.0	0.0	1	42.2	ND	1	34.7	ND
Boone	1	3.4	ND	14	50.4	ND	15	46.5	ND
Box Butte	9	15.4	ND	18	31.7	ND	26	38.4	35.4
Boyd	1	8.7	ND	1	9.5	ND	4	32.9	ND
Brown	4	23.2	ND	1	6.3	ND	10	55.4	ND
Buffalo	20	9.2	10.0	24	10.6	11.0	101	35.0	35.8
Burt	4	10.8	ND	12	34.5	ND	13	32.8	ND
Butler	7	16.1	ND	7	16.7	ND	13	26.5	ND
Cass	20	16.1	15.2	28	22.2	20.0	75	49.3	42.0
Cedar	10	21.4	ND	8	18.0	ND	21	40.6	11.6
Chase	4	19.9	ND	5	25.5	ND	7	29.4	ND
Cherry	0	0.0	ND	2	6.9	ND	8	23.1	ND
Cheyenne	12	24.0	ND	16	31.8	ND	23	38.1	32.4
Clay	3	8.8	ND	12	36.6	ND	25	65.9	48.6
Colfax	3	5.8	ND	6	11.8	ND	18	28.2	ND
Cuming	5	10.2	ND	6	13.0	ND	21	38.7	27.5
Custer	5	8.8	ND	8	14.5	ND	29	44.6	33.3
Dakota	10	9.8	ND	6	5.8	ND	32	25.9	26.0
Dawes	7	15.3	ND	7	15.3	ND	23	42.4	40.1
Dawson	7	5.8	ND	12	9.9	ND	31	21.5	18.9
Deuel	1	9.8	ND	3	30.6	ND	3	26.0	ND
Dixon	4	13.3	ND	7	23.3	ND	17	48.6	ND
Dodge	25	13.8	13.9	22	12.0	10.6	56	25.5	22.1
Douglas	331	13.9	14.2	537	21.3	21.9	1, 276	39.4	46.0
Dundy	1	9.3	ND	6	59.8	ND	8	70.4	ND
Fillmore	8	25.3	ND	11	37.0	ND	14	41.2	ND
Franklin	0	0.0	ND	5	31.0	ND	8	43.3	ND
Frontier	2	13.3	ND	2	14.2	ND	2	12.4	ND
Furnas	4	15.5	ND	8	32.4	ND	14	48.2	ND
Gage	19	16.5	ND	24	21.2	21.2	42	32.3	15.5
Garden	1	8.9	ND	3	29.3	ND	5	42.7	ND
Garfield	6	61.7	ND	1	10.0	ND	7	58.2	ND
Gosper	0	0.0	0.0	1	9.7	ND	12	98.8	ND

Grant	1	28.4	ND	0	0.0	0.0	2	52.2	ND
Greeley	4	30.1	ND	3	23.6	ND	9	60.8	ND
Hall	33	12.2	12.0	38	13.4	12.5	131	36.0	33.8
Hamilton	5	10.7	ND	8	17.5	ND	24	43.9	36.6
Harlan	2	10.9	ND	2	11.6	ND	13	62.8	ND
Hayes	0	0.0	0.0	0	0.0	0.0	1	18.1	ND
Hitchcock	7	46.0	ND	2	13.7	ND	8	46.5	ND
Holt	11	19.9	ND	13	24.8	ND	35	56.4	39.5
Hooker	0	0.0	0.0	0	0.0	0.0	1	23.2	ND
Howard	1	3.1	ND	5	15.9	ND	18	47.3	ND
Jefferson	10	24.5	ND	10	25.9	ND	14	31.6	ND
Johnson	2	8.0	ND	4	15.4	ND	11	35.2	ND
Kearney	1	2.9	ND	4	12.2	ND	15	38.2	ND
Keith	4	9.3	ND	6	14.4	ND	13	26.5	ND
Keya Paha	0	0.0	0.0	3	70.9	ND	5	104.4	ND
Kimball	6	30.1	ND	2	10.5	ND	6	26.8	ND
Knox	5	11.0	ND	15	34.2	ND	19	37.2	ND
Lancaster	260	19.9	21.1	344	24.6	25.5	558	31.0	31.3
Lincoln	23	13.2	12.2	25	13.8	13.9	49	22.8	18.5
Logan	0	0.0	0.0	0	0.0	0.0	4	85.3	ND
Loup	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Madison	21	11.8	12.5	58	33.4	34.9	120	57.0	49.0
McPherson	1	37.4	ND	0	0.0	0.0	0	0.0	0.0
Merrick	5	12.5	ND	7	18.0	ND	20	42.7	33.6
Morrill	8	30.7	ND	6	23.7	ND	13	44.0	ND
Nance	3	15.4	ND	2	10.7	ND	6	27.7	ND
Nemaha	9	24.7	ND	10	27.6	ND	10	23.5	ND
Nuckolls	8	32.9	ND	10	43.6	ND	20	76.4	48.1
Otoe	15	19.3	ND	12	15.2	ND	12	12.7	ND
Pawnee	1	6.8	ND	3	21.7	ND	5	30.4	ND
Perkins	1	6.4	ND	4	26.8	ND	3	17.2	ND
Phelps	3	6.3	ND	12	26.0	ND	18	32.7	ND
Pierce	8	21.1	ND	10	27.4	ND	19	44.1	ND
Platte	30	19.4	19.5	38	24.0	23.6	54	27.5	24.6
Polk	3	10.9	ND	10	37.0	ND	6	19.0	ND
Red Willow	7	12.3	ND	11	19.9	ND	22	33.5	24.5
Richardson	5	11.1	ND	4	9.5	ND	15	30.7	ND
Rock	0	0.0	0.0	2	25.9	ND	3	34.8	ND
Saline	20	28.3	30.4	12	17.0	ND	29	33.8	31.9
Sarpy	121	18.2	19.8	169	22.2	24.3	424	41.5	43.0
Saunders	15	14.9	ND	16	15.6	ND	44	35.1	30.0

County								
Scotts Bluff	47	25.8	23.7	61	33.4	29.4	83	37.8	32.0
Seward	14	16.9	ND	27	32.5	32.9	34	33.4	27.6
Sheridan	4	13.6	ND	6	21.7	ND	8	25.3	ND
Sherman	3	18.5	ND	2	12.7	ND	9	49.1	ND
Sioux	0	0.0	0.0	0	0.0	0.0	3	38.3	ND
Stanton	2	6.2	ND	4	12.9	ND	14	38.5	ND
Thayer	8	28.4	ND	9	34.2	ND	14	45.3	ND
Thomas	0	0.0	0.0	0	0.0	0.0	2	47.3	ND
Thurston	4	11.4	ND	2	5.8	ND	6	14.3	ND
Valley	1	4.4	ND	1	4.7	ND	13	51.6	ND
Washington	15	15.4	ND	26	25.8	23.5	64	53.4	44.8
Wayne	4	8.3	ND	15	31.3	ND	19	33.6	ND
Webster	3	15.2	ND	5	26.2	ND	11	50.1	ND
Wheeler	0	0.0	0.0	0	0.0	0.0	2	42.0	ND
York	11	15.5	ND	14	20.2	ND	48	57.9	44.8

Table 4.0 Melanoma Mortality in Nebraska
Number of Deaths, Crude Rates, and Age-adjusted Rates by County of Residence
Years 2001-2005, 2006-2010, and 2011-2016

| | 2001-2005 | | | 2006-2010 | | | 2011-2016 | | |
	# Deaths	Crude Rates	Rates	# Deaths	Crude Rates	Rates	# Deaths	Crude Rates	Rates
Nebraska	863	9.9	9.3	758	8.4	7.6	635	5.7	4.8
County									
Adams	22	14.3	12.2	22	14.1	11.9	19	10.1	ND
Antelope	4	11.2	ND	8	23.7	ND	3	7.7	ND
Arthur	1	47.0	ND	0	0.0	0.0	0	0.0	0.0
Banner	0	0.0	0.0	1	28.6	ND	0	0.0	0.0
Blaine	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Boone	4	13.5	ND	1	3.6	ND	3	9.3	ND
Box Butte	6	10.2	ND	7	12.3	ND	5	7.4	ND
Boyd	0	0.0	0.0	1	9.5	ND	3	24.7	ND
Brown	3	17.4	ND	0	0.0	0.0	0	0.0	0.0
Buffalo	17	7.9	ND	11	4.8	ND	24	8.3	6.7
Burt	6	16.2	ND	6	17.2	ND	4	10.1	ND
Butler	5	11.5	ND	8	19.1	ND	4	8.2	ND
Cass	12	9.7	ND	12	9.5	ND	11	7.2	ND
Cedar	6	12.9	ND	4	9.0	ND	7	13.5	ND
Chase	3	14.9	ND	1	5.1	ND	1	4.2	ND
Cherry	1	0.0	ND	2	6.9	ND	1	2.9	ND
Cheyenne	1	2.0	ND	4	8.0	ND	0	0.0	0.0
Clay	2	5.9	ND	7	21.4	ND	3	7.9	ND
Colfax	9	17.3	ND	6	11.8	ND	1	1.6	ND
Cuming	11	22.4	ND	2	4.3	ND	3	5.5	ND
Custer	7	12.3	ND	6	10.9	ND	7	10.8	ND
Dakota	8	7.9	ND	5	4.8	ND	7	5.7	ND
Dawes	6	13.1	ND	4	8.7	ND	4	7.4	ND
Dawson	8	6.6	ND	10	8.2	ND	6	4.2	ND
Deuel	1	9.8	ND	0	0.0	0.0	0	0.0	0.0
Dixon	5	16.6	ND	8	26.7	ND	0	0.0	0.0
Dodge	17	9.4	ND	8	4.4	ND	11	5.0	ND
Douglas	181	7.6	8.5	179	7.1	7.9	154	4.8	4.9
Dundy	0	0.0	0.0	3	29.9	ND	0	0.0	0.0
Fillmore	3	9.5	ND	5	16.8	ND	2	5.9	ND
Franklin	1	5.8	ND	0	0.0	0.0	0	0.0	0.0
Frontier	0	0.0	0.0	1	7.1	ND	0	0.0	0.0
Furnas	6	23.2	ND	6	24.3	ND	3	10.3	ND
Gage	13	11.3	ND	13	11.5	ND	3	2.3	ND
Garden	1	8.9	ND	1	9.8	ND	2	17.1	ND
Garfield	0	0.0	0.0	1	10.0	ND	1	8.3	ND
Gosper	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Grant	1	28.4	ND	3	0.0	ND	1	26.1	ND

Greeley	3	22.6	ND	1	7.9	ND	0	0.0	0.0
Hall	26	9.6	8.7	11	3.9	ND	35	9.6	8.4
Hamilton	4	8.6	ND	0	0.0	0.0	3	5.5	ND
Harlan	2	10.9	ND	3	17.3	ND	4	19.3	ND
Hayes	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Hitchcock	1	6.6	ND	2	13.7	ND	3	17.5	ND
Holt	6	10.8	ND	9	17.2	ND	4	6.4	ND
Hooker	0	0.0	0.0	1	0.0	ND	0	0.0	0.0
Howard	7	21.7	ND	1	3.2	ND	4	10.5	ND
Jefferson	5	12.2	ND	5	13.0	ND	3	6.8	ND
Johnson	3	11.9	ND	1	3.8	ND	3	9.6	ND
Kearney	3	8.8	ND	4	12.2	ND	5	12.7	ND
Keith	2	4.7	ND	1	2.4	ND	2	4.1	ND
Keya Paha	0	0.0	0.0	0	0.0	0.0	2	41.8	ND
Kimball	1	5.0	ND	2	10.5	ND	1	4.5	ND
Knox	3	6.6	ND	8	18.3	ND	4	7.8	ND
Lancaster	150	11.5	13.2	109	7.8	8.8	88	4.9	5.0
Lincoln	17	9.7	ND	13	7.2	ND	11	5.1	ND
Logan	0	0.0	0.0	0	0.0	0.0	1	0.0	ND
Loup	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Madison	23	12.9	10.7	14	8.1	ND	12	5.7	ND
McPherson	1	37.4	ND	0	0.0	0.0	1	32.4	ND
Merrick	1	2.5	ND	2	5.1	ND	4	8.5	ND
Morrill	4	15.4	ND	3	11.8	ND	2	6.8	ND
Nance	4	20.6	ND	3	16.0	ND	0	0.0	0.0
Nemaha	5	13.7	ND	5	13.8	ND	0	0.0	0.0
Nuckolls	5	20.5	ND	9	39.3	ND	4	15.3	ND
Otoe	7	9.0	ND	8	10.2	ND	7	7.4	ND
Pawnee	3	20.4	ND	2	14.5	ND	1	6.1	ND
Perkins	3	19.2	ND	4	26.8	ND	0	0.0	0.0
Phelps	9	18.8	ND	5	10.8	ND	1	1.8	ND
Pierce	5	13.2	ND	3	8.2	ND	0	0.0	0.0
Platte	11	7.1	ND	15	9.5	ND	8	4.1	ND
Polk	3	10.9	ND	4	14.8	ND	0	0.0	0.0
Red Willow	3	5.3	ND	8	14.5	ND	4	6.1	ND
Richardson	11	24.4	ND	3	7.1	ND	4	8.2	ND
Rock	2	0.0	ND	0	0.0	0.0	2	23.2	ND
Saline	7	9.9	ND	9	12.8	ND	6	7.0	ND
Sarpy	49	7.4	10.5	49	6.4	9.8	38	3.7	4.5
Saunders	9	8.9	ND	11	10.7	ND	7	5.6	ND
Scotts Bluff	46	25.3	19.1	19	10.4	ND	24	10.9	7.1

County									
Seward	5	6.0	ND	6	7.2	ND	11	10.8	ND
Sheridan	6	20.4	ND	2	7.2	ND	4	12.7	ND
Sherman	3	18.5	ND	1	6.4	ND	2	10.9	ND
Sioux	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Stanton	3	9.4	ND	1	3.2	ND	2	5.5	ND
Thayer	5	17.7	ND	8	30.4	ND	3	9.7	ND
Thomas	0	0.0	0.0	0	0.0	0.0	1	0.0	ND
Thurston	4	11.4	ND	1	2.9	ND	0	0.0	0.0
Valley	4	17.7	ND	6	28.0	ND	3	11.9	ND
Washington	8	8.2	ND	9	8.9	ND	7	5.8	ND
Wayne	2	4.1	ND	6	12.5	ND	1	1.8	ND
Webster	4	20.2	ND	5	26.2	ND	1	4.6	ND
Wheeler	0	0.0	0.0	1	0.0	ND	1	21.0	ND
York	4	5.6	ND	7	10.1	ND	7	8.4	ND

Initially the age-adjusted incidence and mortality rates for all counties that had over 20 cases for the three time-intervals were calculated. However, only 13 counties of the 93 had more than 20 new cases for all three time-intervals and only 5 of the 93 counties had more than 20 deaths for the initial time interval of 2001-2005 and for the final time interval of 2011-2016. Age-adjusted incidence rates were calculated for the following counties: Adams, Buffalo, Cass, Dodge, Douglas, Hall, Lancaster, Lincoln, Madison, Platte, Saline, Sarpy, and Scotts Bluff. For age-adjusted incidence rates, they all increase from the first time-interval to the third time-interval. For the age-adjusted mortality rates, they all decreased from the first time-interval to the third-time interval. Age-adjusted mortality rates were calculated for the following counties: Douglas, Hall, Lancaster, Sarpy, and Scotts Bluff. **See table 3.0 and 4.0** for age-adjusted incidence and mortality rates for the counties that had more than 20 cases. The low number of counties with more than 20 cases to calculate age-adjusted rates limited our findings because a comparison could not be made for all counties in Nebraska. Age-adjusted rates are recommended to reduce the potential confounding of age by using the same standard population when comparing age-adjusted rates.

Access to primary care providers and dermatologists in Nebraska for the year 2016

For the year 2016, there were a total of 1,309 primary care providers in Nebraska and 43 dermatologists. The ratio of primary care providers for the year was 68.9 per 100,000 people and for dermatologists it was 2.3 per 100,000 people. Both of these ratios are below the recommended ratios set by the American Medical Association and the American Professors of Dermatology. The American Medical Association recommends a ratio of 89.4 primary care providers per 100,000 people and the American Professors of Dermatology recommend 4.0 dermatologists per 100,000 people. 19 counties in Nebraska had a ratio of 0.0 of primary care providers per 100,000. There was a large variation in the ratio of primary care providers for all counties, the lowest ratio was 0.0 primary care providers per 100,000 to 173.0 per 100,000. For the year 2016, only 6 of the 93 counties in Nebraska had practicing dermatologists and they are counties with large population numbers. The counties with practicing dermatologists were: Buffalo, Douglas, Hall, Lancaster, Lincoln, and Scotts Bluff. **See Table 5.0**.

Table 5.0 Ratio of Primary Care Providers/Dermatologists in Nebraska for the year 2016

County	Number of Dermatologists	Number of Providers	Number of providers per 100,000 population	Number of dermatologists per 10,000 population
Adams	0	20	63.2	0.0
Antelope	0	3	47.3	0.0
Arthur	0	0	0.0	0.0
Banner	0	0	0.0	0.0
Blaine	0	0	0.0	0.0
Boone	0	8	150.0	0.0
Box Butte	0	3	26.8	0.0
Boyd	0	3	151.9	0.0
Brown	0	3	100.7	0.0
Buffalo	2	34	69.1	4.1
Burt	0	1	15.3	0.0
Butler	0	5	62.5	0.0

Cass	0	3	11.7	0.0
Cedar	0	3	34.9	0.0
Chase	0	3	76.7	0.0
Cherry	0	2	34.3	0.0
Cheyenne	0	4	39.8	0.0
Clay	0	1	16.3	0.0
Colfax	0	5	46.5	0.0
Cuming	0	6	67.0	0.0
Custer	0	6	55.4	0.0
Dakota	0	7	34.5	0.0
Dawes	0	6	67.4	0.0
Dawson	0	17	71.5	0.0
Deuel	0	0	0.0	0.0
Dixon	0	1	17.4	0.0
Dodge	0	15	40.9	0.0
Douglas	25	597	107.5	4.5
Dundy	0	2	110.5	0.0
Fillmore	0	3	53.4	0.0
Franklin	0	1	33.4	0.0
Frontier	0	0	0.0	0.0
Furnas	0	3	63.0	0.0
Gage	0	10	46.3	0.0
Garden	0	1	52.4	0.0
Garfield	0	1	50.2	0.0
Gosper	0	0	0.0	0.0
Grant	0	0	0.0	0.0
Greeley	0	0	0.0	0.0
Hall	2	39	63.4	3.3
Hamilton	0	6	65.5	0.0
Harlan	0	2	57.9	0.0
Hayes	0	0	0.0	0.0
Hitchcock	0	0	0.0	0.0
Holt	0	10	97.8	0.0
Hooker	0	1	146.4	0.0
Howard	0	4	62.4	0.0
Jefferson	0	4	55.8	0.0
Johnson	0	4	76.7	0.0
Kearney	0	3	45.7	0.0
Keith	0	4	49.4	0.0
Keya Paha	0	0	0.0	0.0

Kimball	0	1	27.2	0.0
Knox	0	5	58.9	0.0
Lancaster	10	178	57.3	3.2
Lincoln	2	22	62.0	5.6
Logan	0	0	0.0	0.0
Loup	0	0	0.0	0.0
McPherson	0	0	0.0	0.0
Madison	0	23	65.6	0.0
Merrick	0	4	51.1	0.0
Morrill	0	2	41.1	0.0
Nance	0	1	28.1	0.0
Nemaha	0	5	71.7	0.0
Nuckolls	0	3	70.4	0.0
Otoe	0	8	50.2	0.0
Pawnee	0	2	74.1	0.0
Perkins	0	4	138.0	0.0
Phelps	0	6	65.3	0.0
Pierce	0	1	14.0	0.0
Platte	0	13	39.4	0.0
Polk	0	2	38.4	0.0
Red Willow	0	9	173.0	0.0
Richardson	0	3	37.5	0.0
Rock	0	0	0.0	0.0
Saline	0	9	63.3	0.0
Sarpy	0	76	42.6	0.0
Saunders	0	5	23.8	0.0
Scotts Bluff	2	19	52.2	5.5
Seward	0	11	64.3	0.0
Sheridan	0	2	38.2	0.0
Sherman	0	0	0.0	0.0
Sioux	0	0	0.0	0.0
Stanton	0	0	0.0	0.0
Thayer	0	4	78.8	0.0
Thomas	0	0	0.0	0.0
Thurston	0	11	154.0	0.0
Valley	0	6	142.9	0.0
Washington	0	5	24.7	0.0
Wayne	0	3	31.9	0.0
Webster	0	3	84.1	0.0
Wheeler	0	0	0.0	0.0

York	0	9	65.5	0.0
Total in NE	43	1309	68.9	2.3

Chapter 5: Discussion

Based on the calculated crude incidence rates, there has been an increase in melanoma of the skin in Nebraska overall and in the majority of the counties (84 of 93). These findings are in accordance with the overall increase in incidence of melanoma in the United States (Siegel, Miller & Jamal, 2016; National Cancer Institute, 2019a.). Mortality rates in Nebraska for the two-year intervals did not increase as much from 2001-2005 to 2011-2016. There was a decrease in mortality of melanoma in Nebraska which is inconsistent with mortality rates observed in the in the United States that have remained steady (Siegel, Miller, & Jamal, 2016; Glazer at al., 2016). However, Glazer et al. (2016) put forth the hypothesis that the steady mortality may be due to a lag in deaths since incidence rates have just started to increase at a much higher rate; therefore, there may not an actual decrease in mortality. To determine whether or not this is true, crude or age-adjusted mortality rates need to be calculated for the next time interval of 2016-2020 once this data becomes available.

The results of this study will guide the UNMC Dermatology Department in its melanoma prevention and outreach efforts in Nebraska. The incidence rates are useful because it is imperative to know where it is increasing in order to focus prevention strategies in these areas such as early screening. This study also shows the counties that have no primary care providers and dermatologists available; thus, this indicates where there is a shortage of primary care providers and dermatologists. This is important to know since the UNMC Dermatology Department is also working on establishing a Teledermatology program to address the shortage of dermatologists in rural areas. These results also show that there needs to be an increase in the number of primary care providers; thus, there is a need for strategies to address this issue.

Limitations

There are some limitations to this study. Age-adjusted rates for all counties were not calculated given that the majority had less than 20 cases for each time interval. Since melanoma of the skin is more prevalent among those 60 years of age and older, these age-adjusted rates would have been better to use for comparison. Since the number of cases were low at the county level, another way to have conducted this analysis is to look at the difference in incidence and mortality by urban/rural designation. Since there were number of cases with an age of diagnose of 18 and younger, pediatricians should have been included in the number of primary care providers for the year 2016.

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Appendix A: Calculations for Crude rates and age-adjusted rates

The rate in the area of study (county, state) was computed for each age group noted in the table below by dividing the number of events (new cases/deaths) in that age group by the estimated population of the same age group in that area and then multiplying by a constant of 100,000. The following standard populations were used to calculate age-adjusted rates for each county and time interval that had over 20 cases.

Age	U.S. 2000 Standard Populations	Age distribution of Standard Pop
00 years	3,794,901	0.013818
01-04 years	15,191,619	0.055316
05-09 years	19,919,840	0.072532
10-14 years	20,056,779	0.073031
15-19 years	19,819,518	0.072167
20-24 years	18,257,225	0.066478
25-29 years	17,722,067	0.064530
30-34 years	19,511,370	0.071045
35-39 years	22,179,956	0.080762
40-44 years	22,479,229	0.081852
45-49 years	19,805,793	0.072117
50-54 years	17,224,359	0.062718
55-59 years	13,307,234	0.048454
60-64 years	10,654,272	0.038794
65-69 years	9,409,940	0.034264
70-74 years	8,725,574	0.031772
75-79 years	7,414,559	0.026998
80-84 years	4,900,234	0.017843
85+ years	4,259,173	0.015509
All ages	274,633,642	1.000000

Primary Care Providers/Dermatologists to Population Ratios Calculations

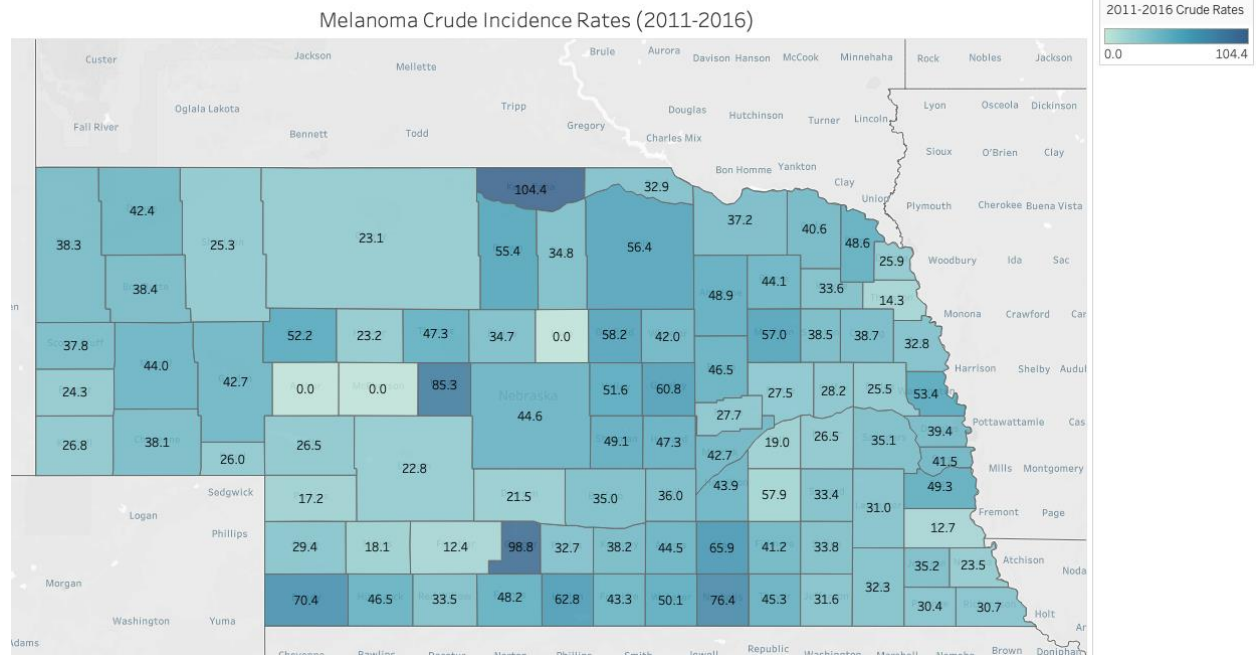(The number of health workers at a given time in a given county / Total population for county) * 10,000)
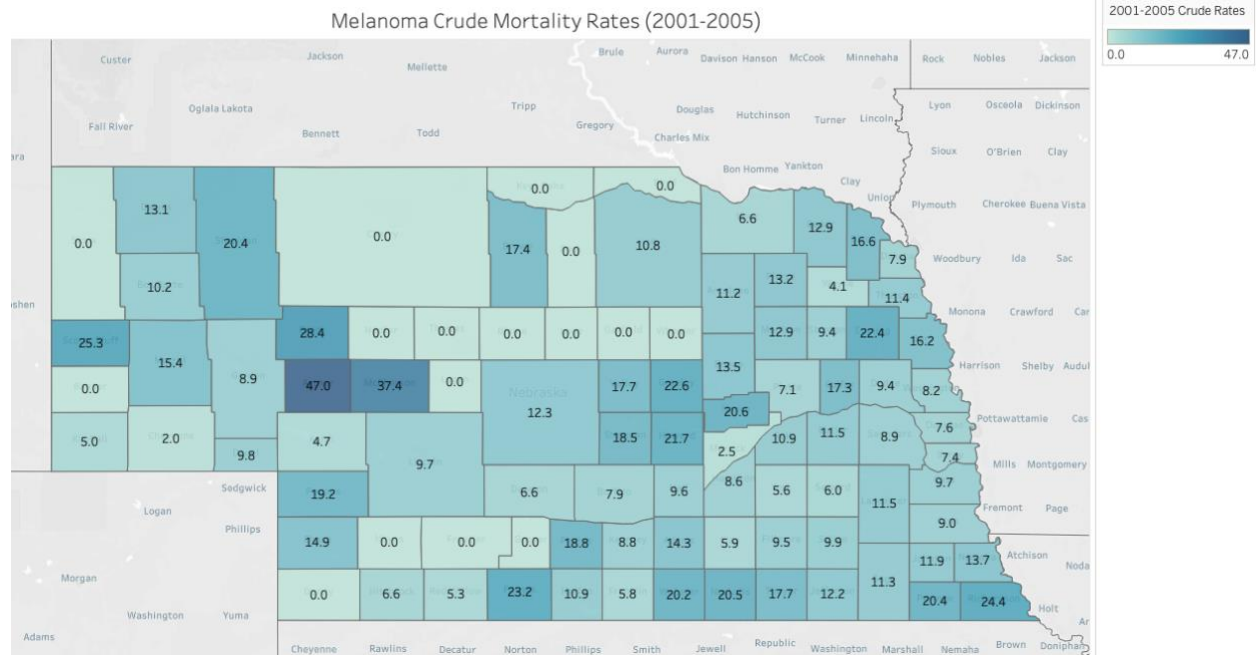
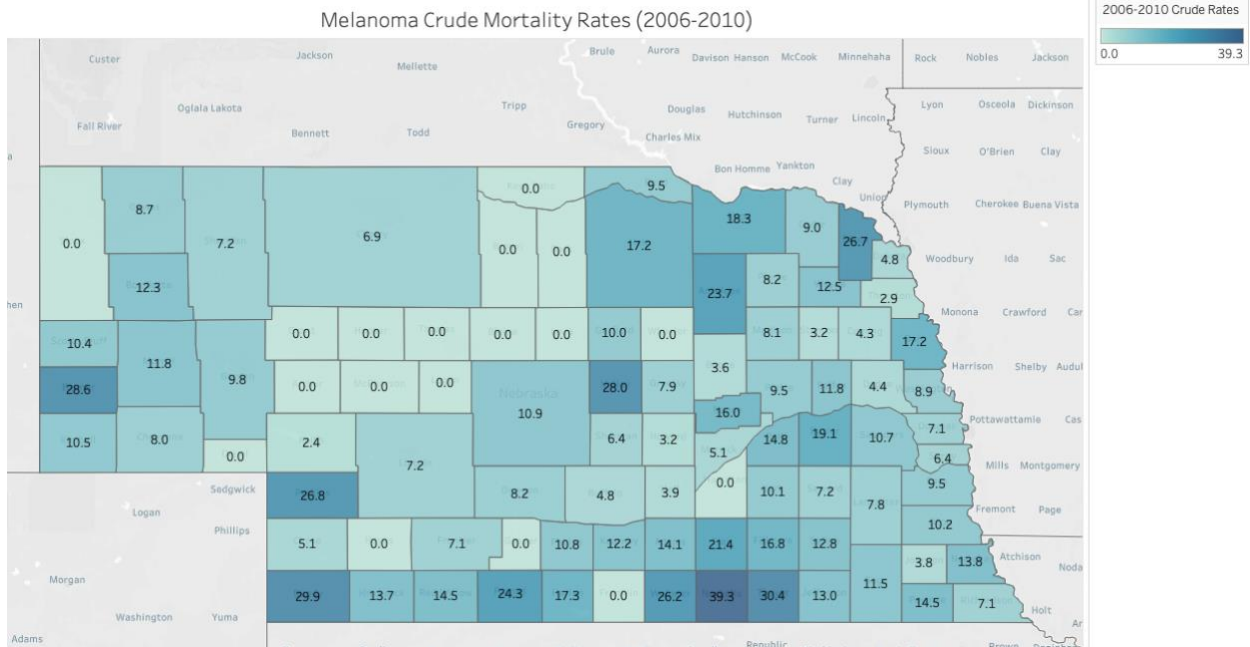**Appendix B. Figures for Crude Incidence and Mortality Rates in Nebraska**

Figure 1.0

Melanoma Crude Incidence Rates (2001-2005)

Figure 2.0

Melanoma Crude Incidence Rates (2006-2010)

Figure 3.0

Melanoma Crude Incidence Rates (2011-2016)

Figure 4.0

Melanoma Crude Mortality Rates (2001-2005)

Figure 5.0

Melanoma Crude Mortality Rates (2006-2010)

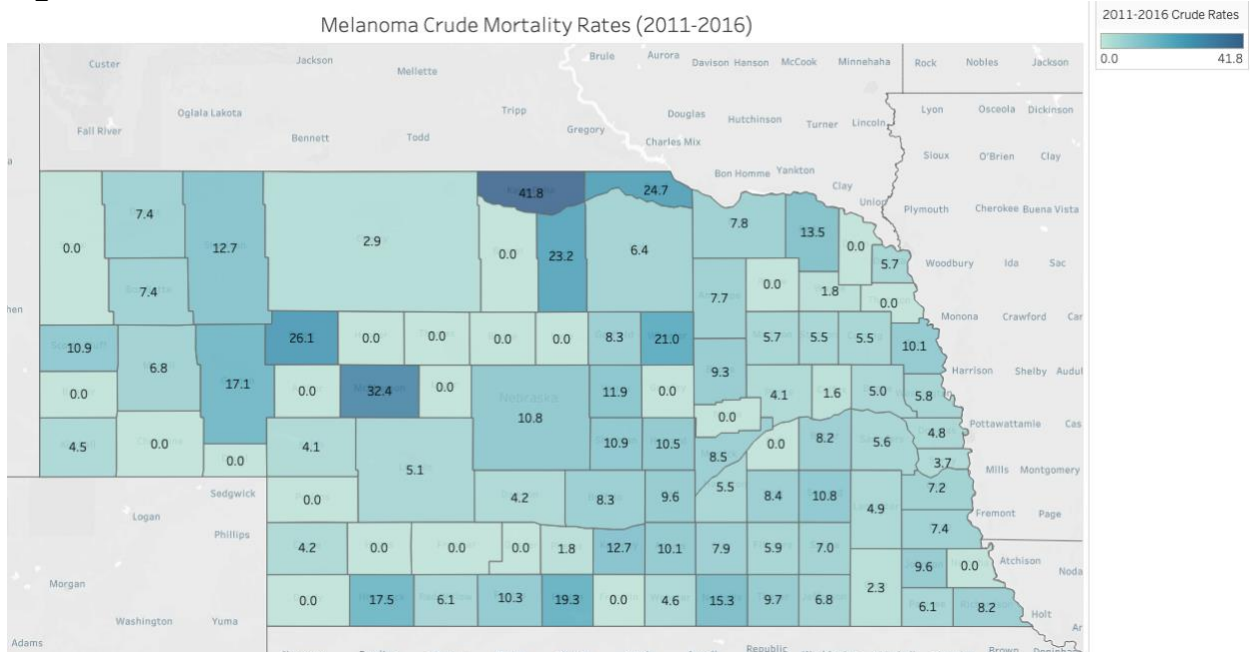**Figure 6.0**

Melanoma Crude Mortality Rates (2011-2016)

Appendix C: Figures for Primary Care Providers and Dermatologists in Nebraska for the year 2016

Figure 7.0

Number of Primary Care Providers per 100,000 people in Nebraska for the year 2016
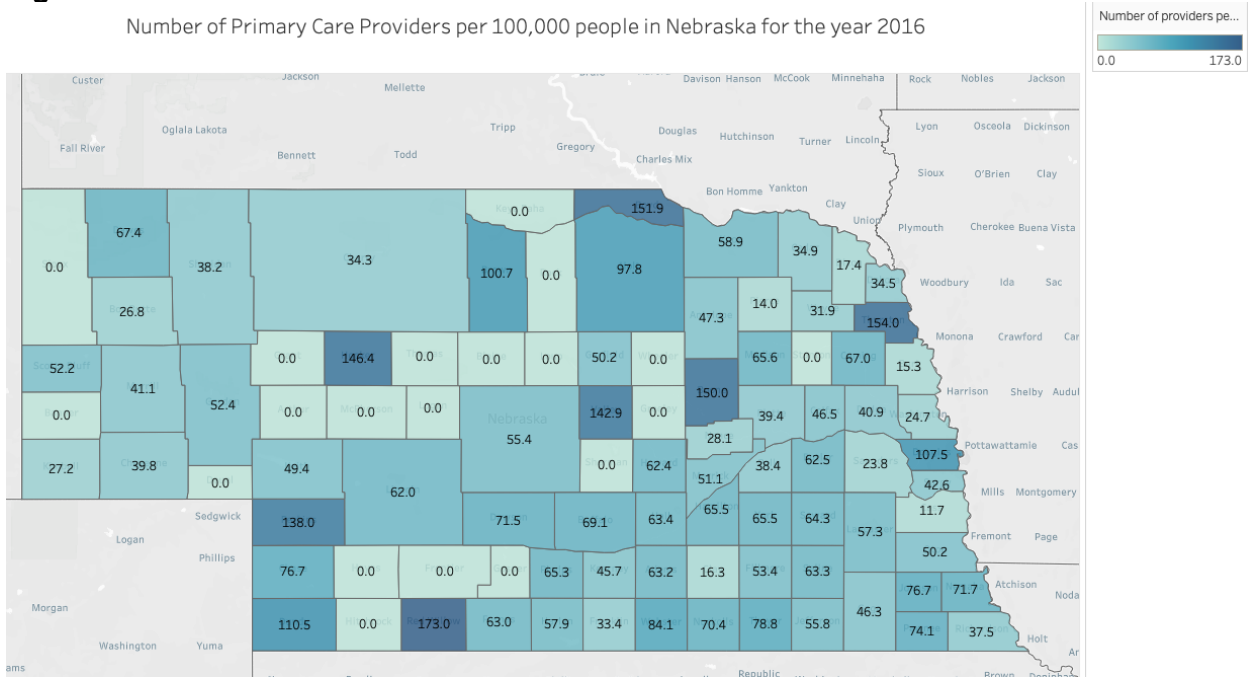
Figure 8.0

Number of Dermatologists per 100,000 people for the year 2016 in Nebraska