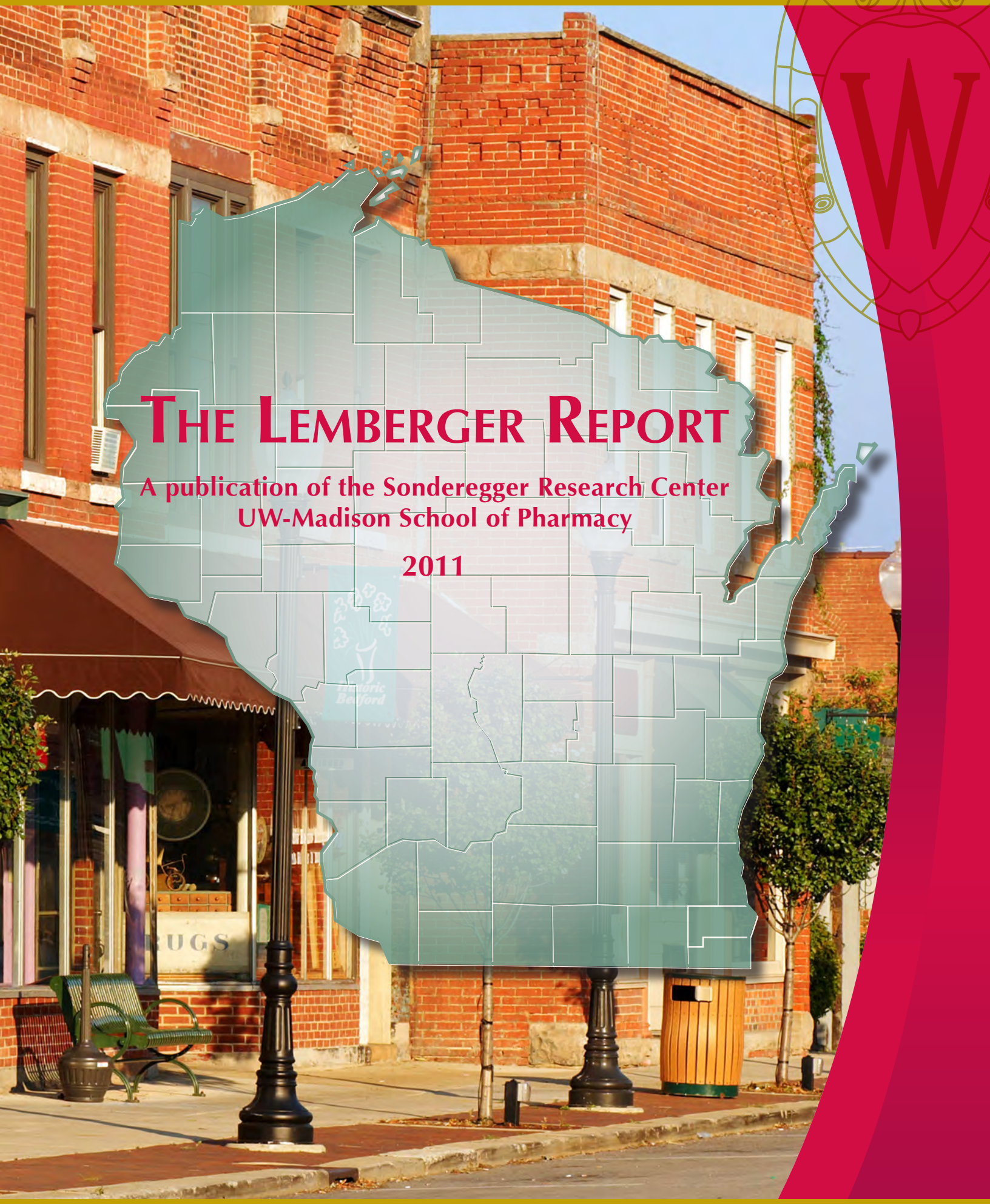

The Lemberger Report

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UW-Madison School of Pharmacy

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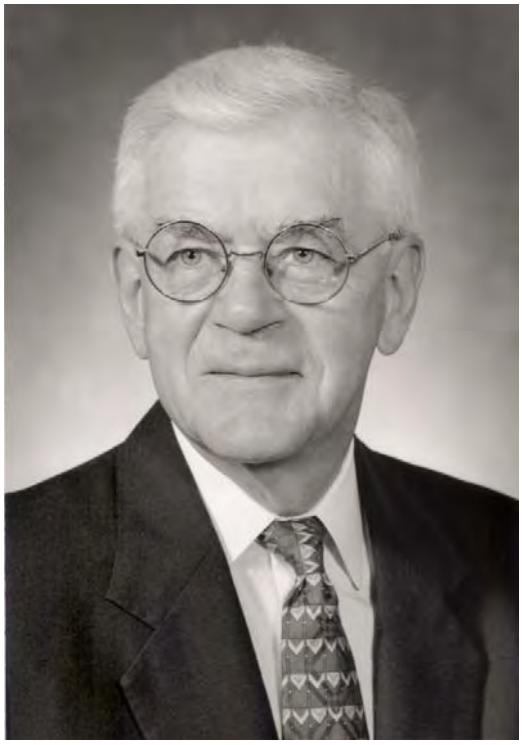


August P. Lemberger, PhD

With this inaugural Lemberger Report, the Faculty and Staff of the Sonderegger Research Center pay tribute to UW School of Pharmacy Professor and Dean Emeritus "Gus" Lemberger. Dean Lemberger believed that the social sciences in pharmacy were critical to identify and address evolving pharmacy related issues and health needs in the state of Wisconsin. To that end he worked with the Rennebohm Foundation to establish the Sonderegger Research Center (SRC) in 1985. Dr. Lemberger was a mentor, role model, and leader for pharmacy students, practitioners, and colleagues. SRC faculty and staff remember and honor his warmth, integrity and vision for the future.

Pharmacy and the Health of Wisconsin's Population

The Lemberger Report was initiated to provide information and insights related to pharmacy and public health in Wisconsin. It is our intention to contribute to the well-being of the state in keeping with the *Wisconsin Idea*. A key aspect of our approach is to undertake systematic collection and analysis of existing health services data with an eye toward pharmacy. By highlighting data and research results on an ongoing basis, we hope the report will contribute to perspective on the state of the State with regard to pharmacy and provide trends and insights for policy and practice.

In this inaugural Report, we focus on providing some initial insights about both health need and capacity related to pharmacy now. This report offers a view of population health needs reflected in hospital discharge data, particularly needs that ambulatory setting pharmacists can help to address. This report also provides information relevant to pharmacy and pharmacist capacity to meet these needs now and as Wisconsin's population ages.

Wisconsin's counties vary substantially in health needs, proximity to health professions and the age of their population. These county differences pose a challenge regarding how best to respond to unmet health needs and more specifically how pharmacy as part of the inter-professional health team can help address the state's health needs effectively.

By offering a baseline description we hope to promote discussion of future health and work force agendas to tailor resources and provider capacity for different regions in the state.

To accomplish the goal of providing perspective on need and capacity, the report is organized to include analyses related to two primary questions:

1. How do hospital discharge diagnoses relevant to ambulatory pharmacy vary by county?

2. How does accessibility to pharmacies and pharmacists vary by county?

I. Hospital Discharge Patterns by County

Hospitalizations for ambulatory care sensitive conditions (ACSCs) are a health care utilization measure that has been used by many federal, state, and local research sectors to examine access to primary health care and community area resource needs.[1,2] ACSCs are defined as "diagnoses for which timely and effective outpatient care can help to reduce the risks of hospitalization by either preventing the onset of an illness or condition, controlling an acute episodic illness or condition, or managing a chronic disease or condition."[3,4] Appropriate drug therapy and medication use often are central to treating acute and chronic conditions, thus placing pharmacists in a potentially key position to influence these hospitalizations. In these analyses, we examine ACSC hospital discharge patterns by county for a subset of diagnostic categories that are especially relevant to pharmacists' roles in medication therapy management in ambulatory care settings. Understanding the occurrence of these ACSCs may help to target future pharmacy services in high need areas.

Data and methods

Hospitalization records were drawn from the 2009 Wisconsin State Inpatient Databases (SID) developed as part of the Healthcare Cost and Utilization Project (HCUP).[5] HCUP is sponsored by the Agency for Healthcare Research and Quality (AHRQ) and is a family of health care databases and related software tools developed

through Federal-State-Industry partnerships. The Wisconsin SID contains all hospital admission record abstracts for the state. The unit of analysis is the hospital discharge, not the individual patient; if a patient is discharged multiple times throughout a year, each discharge is counted in the summary.

Although some hospital admissions are for 'out of area' patients, most are for individuals residing in the communities where the hospital is located. Consequently, local ambulatory care pharmacies and pharmacists would influence ACSCs via the medications and medication-related services they provide.

Pharmacy-related ACSCs were identified using AHRQ's Prevention Quality Indicators (PQIs).[6] The PQIs are a set of measures using ICD-9-CM codes in hospital administration records to identify hospital admissions that suggest the hospitalization could have been prevented through high-quality outpatient care. Using the PQI measures, eight ACSCs were identified: asthma, bacterial pneumonia, chronic obstructive pulmonary disease (COPD), congestive heart failure (CHF), diabetes long-term complications, diabetes short-term complications, uncontrolled diabetes, and hypertension (HTN). Seven of the eight ACSCs identified are chronic diseases that can be and often are managed to a large extent in an outpatient setting and for which medications are prominent as part of patients' primary care. One additional pharmacy-related ACSC, bacterial pneumonia, relates to prevention services.

For each ACSC, the number of hospitalization discharges was divided by the county population figure and then multiplied by 100,000.

Hospitalizations for the targeted ACSCs are not stand-alone measures of health care needs. The indicators should not be interpreted as measures of a county's health; they are not adjusted for risk factors that vary by county. The rates are derived from raw numbers of discharges; variability reflects differences in absolute need in counties. The rates provide a unique approach and starting point for identifying geographic areas that can benefit from pharmacy's presence and potentially increased involvement as part of patients' health care teams.

Overall significant findings:

In 2009, there were over 47,000 hospitalizations in Wisconsin due to the eight Ambulatory Care Sensitive Conditions (ACSCs) targeted for our analyses. **Table 1** presents the number of 2009 Wisconsin adult hospital discharge events by the targeted subset of ACSCs. All hospitalization events due to these ACSCs varied by age group. Not surprisingly, hospitalizations were highest for older adults (65+ years); nearly two-thirds of all hospitalizations were for older adults. Hospitalizations for diabetes short-term complications were an exception where hospitalizations were more prevalent in the younger age groups relative to their older counterparts.

The frequency of bacterial pneumonia and congestive heart failure hospitalizations stand out. Nearly two thirds of all the ACSC hospitalizations analyzed were due to bacterial pneumonia and congestive heart failure. For older adults (65+ years) there was approximately three times the rate of hospitalizations in these two condition categories compared to the other age groups combined. Pharmacists have the potential to address both of these areas through their expanding immunization roles and their medication therapy management programs to enhance patient skills to manage their medications more effectively.

Because bacterial pneumonia and CHF were the most prominent ACSCs, they also were examined on a per county basis. Observed hospitalization rates in 2009 using the principal diagnoses of bacterial pneumonia and CHF were

Table 1. Wisconsin 2009 Adult Hospitalization Events for Pharmacy- Related Ambulatory Care Sensitive Conditions by Age Groups

Pharmacy-related ACSC	All Adults, 18+ years	Age Groups		
		18-44 years	45-64 years	65+ years
Asthma	3,802	1,059	1,545	1,198
Bacterial Pneumonia	14,582	1,368	3,363	9,851
COPD	6,881	182	1,869	4,830
CHF	14,818	396	2,563	11,859
DM Long-term Complications	3,688	560	1,538	1,590
DM Short-term Complications	2,220	1,349	676	195
Diabetes Uncontrolled	430	102	181	147
HTN	1,539	223	545	771
Totals	**47,960**	**5,239**	**12,280**	**30,441**

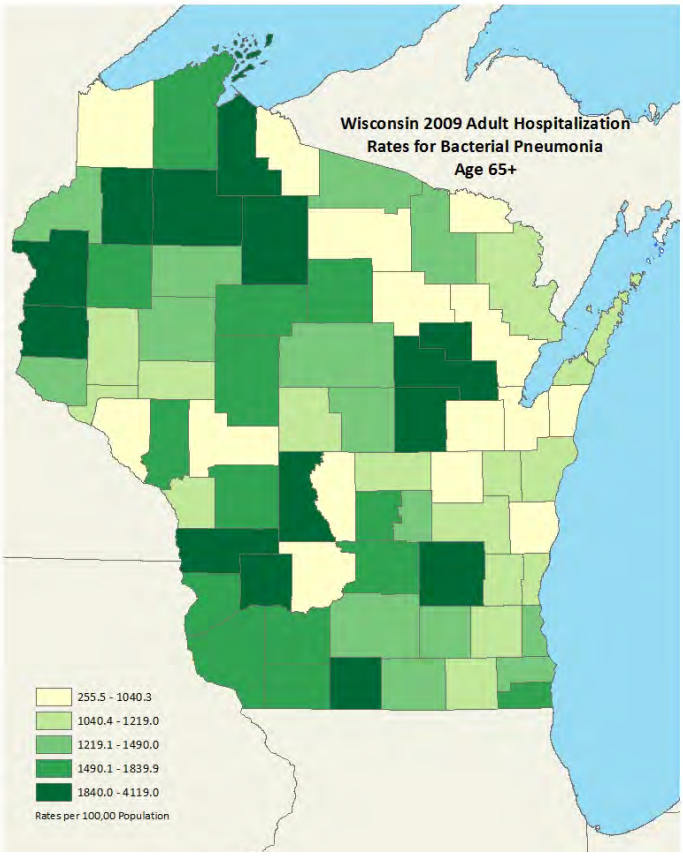
ACSC, Ambulatory care sensitive condition; COPD, Chronic obstructive pulmonary disease; CHF, Congestive Heart Failure; DM, Diabetes Mellitus; HTN, Hypertension.

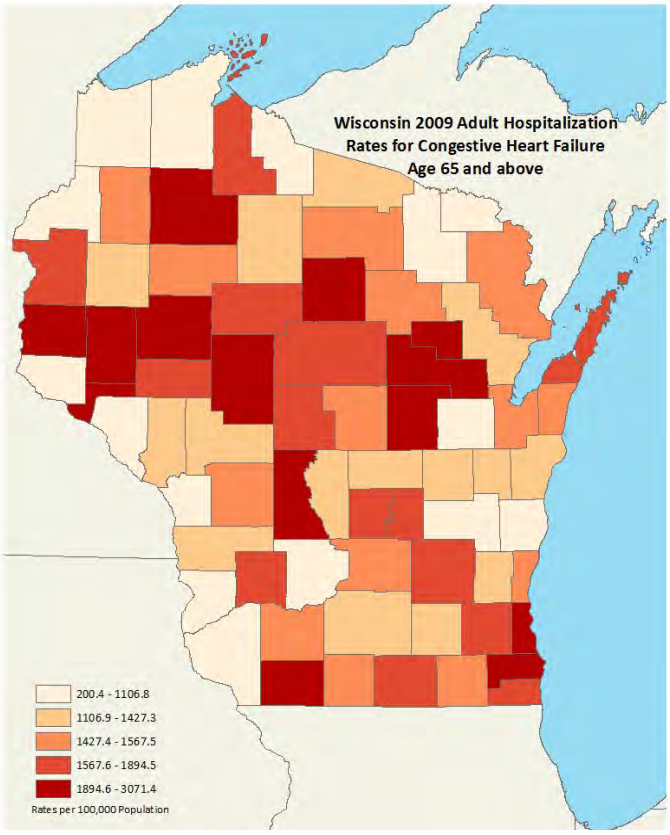
calculated for all adults in each Wisconsin county (per 100,000 people) and then stratified by age group (18-44, 45-64, and 65+ years).

The rates for all counties and age groups are shown in **Appendix A** (for bacterial pneumonia) and **Appendix B** (for CHF). For CHF, there was a ten-fold difference in the overall rate between the highest and lowest county rates and rates varied by county for all the age groups. Often, the highest per county rates overall were influenced by very high rates among elders. As might be expected, hospitalization rates significantly increased for older adults (65+ years).

Results for the older adult population, age 65+ are highlighted in **Figure 1**. Some overlap occurs in counties with high hospitalization rates for both of these conditions.

Figure 1. Wisconsin Hospitalization Rates among Adults Age 65 and Above for Bacterial Pneumonia and Congestive Heart Failure, 2009

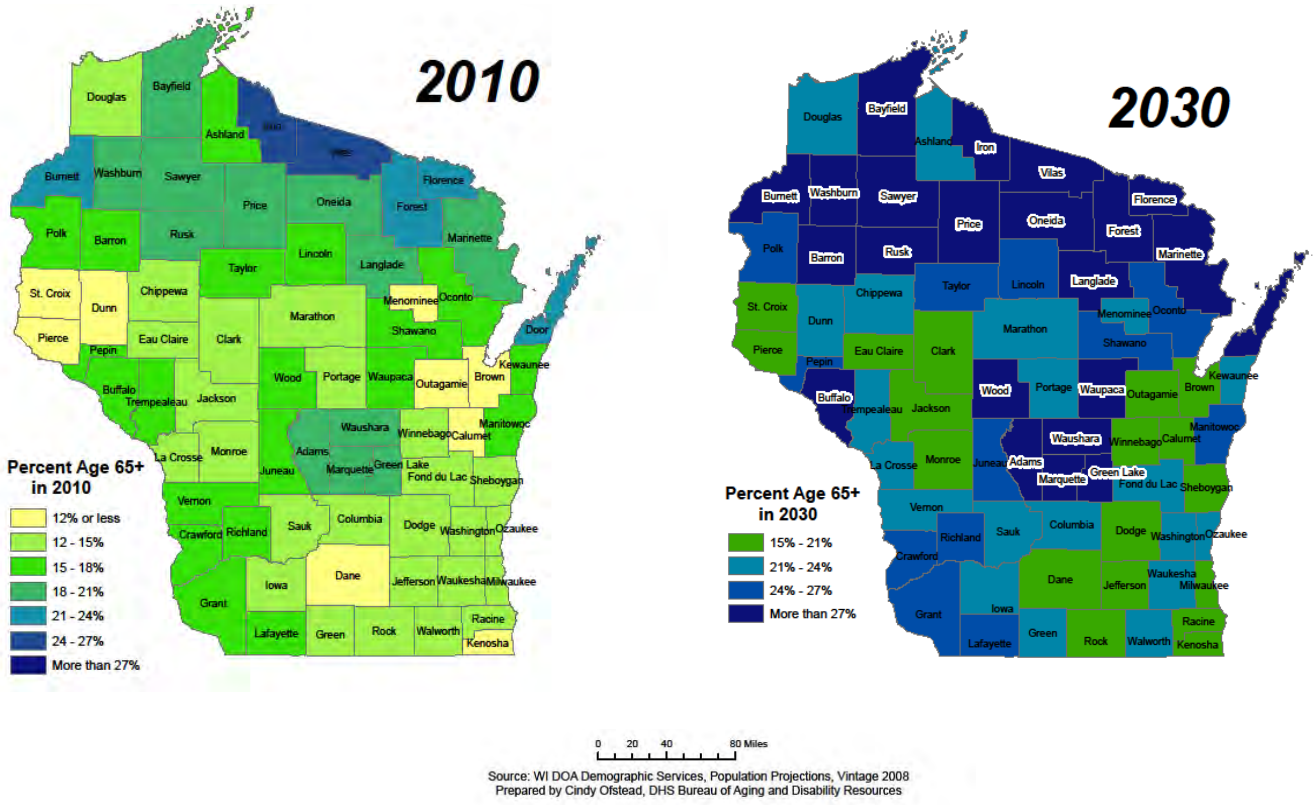




Since these two prominent ACSCs are related to age, it is useful to consider how the elderly population is distributed in the state and how that distribution may change in the future.

The maps in **Figure 2** display the distribution of Wisconsin's population 65+ years of age in 2010 and the projected distribution in 2030. The striking increase in older adults poses serious questions about the increasing need for care in the state and how best to respond to this need. The aging of Wisconsin, is especially relevant to pharmacy given older adults have increasing chronic comorbidities and complicated medication regimens.

Figure 2. Wisconsin Population Age 65+, 2010 and 2030



Although pharmacists have the potential to be one of the most accessible health care professionals to provide medication therapy management relevant to conditions prevalent in elders, availability barriers may prevent patients from seeking care from a pharmacist in certain regions.[4] This is particularly salient if availability to other primary care is limited as well.

It will be critical to project the need for ambulatory pharmacy care to supplement health shortage areas for primary care given the population demographics projected for older adults 20 years from now.

II. Pharmacy Accessibility by County

Ambulatory Care Pharmacies. The aging of Wisconsin has profound implications for health care capacity needs. Ambulatory pharmacies are a critical component of the health care system. They not only offer medication access points for many in the community, but they also can serve as hubs for medication therapy management (MTM) services, self-care advice about non-prescription medications, and immunization programs.[7-9] For the purposes of this report, ambulatory pharmacy refers to all pharmacy settings serving patients on an out-patient basis such as community retail pharmacies, clinic pharmacies, hospital outpatient clinics and dispensaries.

Two measures of potential access to health care include the number of patients per pharmacy and travel times to health care facilities. Examining how counties differ in the number of Wisconsinites per licensed ambulatory care pharmacy and their average drive time to a pharmacy can help identify possible geographic areas of pharmacy access deficiency as well as identify areas of saturation.

Data and Methods

An inventory of unique pharmacy sites operating in the state was derived from a listing of all licensed pharmacies in Wisconsin obtained from the Department of Safety and Professional Services (DSPS). For some pharmacies, the listing included multiple entries with the same or similar name for a single street address. We removed duplicate address entries to result in the inventory of unique pharmacy sites and considered these as a pharmacy. We categorized the pharmacies based on name recognition to represent pharmacy setting types, such as independent retail, chain retail, hospital, long-term care, etc. In cases where multiple entries appeared on the DSPS list reflecting what might be considered 'combination' pharmacies (e.g., an independent retail pharmacy with long-term care pharmacy at the same site, or a hospital with inpatient and outpatient departments), we categorized the pharmacy based on whether it would or could serve ambulatory patients and relied on that main distinction for our analyses focused on ambulatory care pharmacy capacity. We assigned each pharmacy to a county based on a zip code to county matching file.

To assess drive time to pharmacies, the inventory of pharmacy sites, with street addresses was linked with 2010 census data by staff at the UW Applied Population Laboratory, using GIS mapping. We specified 20 minutes as the drive time criterion for mapping state residents to the nearest pharmacy.

Table 2 presents the number of Wisconsinites per licensed ambulatory care pharmacy by county. The total number of ambulatory care pharmacies in Wisconsin for 2011 was 1,012. This represents 79.6% of all pharmacy sites operating in the state (including 128 institutional, hospital pharmacies, 39 long-term-care pharmacies, 19 infusion pharmacies, and 74 other specialty pharmacies such as compounding, veterinary, and others).

Older adults (65+ years) are highlighted as a separate category because this population generally has a higher chronic disease burden relative to their younger counterparts[10,11] and subsequently consume a large majority of all prescribed medications.[12] For the total population, the number of Wisconsinites per ambulatory care pharmacy by county ranged from 3,202 to 15,737. The number of older adults per ambulatory care pharmacy by county ranged from 437 to 2,833.

Table 2. Number of Wisconsinites per Licensed Ambulatory Care Pharmacy by County, Overall and Age 65+, 2011

County	Total Population	Number of Ambulatory Care Pharmacies	Total Population per Each Ambulatory Care Pharmacy*	County	Total Population 65+ Years	65+ Years Population per Each Ambulatory Care Pharmacy*
Forest	9,605	3	3202.0	Menominee	437	437.0
Ashland	16,181	5	3236.2	Dane	48,449	489.4
Oneida	35,930	11	3266.4	Ashland	2,518	503.6
Crawford	16,731	5	3346.2	La Crosse	14,621	504.2
Barron	45,591	13	3507.0	Crawford	2,883	576.6
Price	14,214	4	3553.5	Sauk	8,910	594.0
Vilas	21,496	6	3582.7	Pepin	1,255	627.5
Rusk	14,367	4	3591.8	Milwaukee	109,505	633.0
Pepin	7,293	2	3646.5	Barron	8,260	635.4
Marinette	41,968	11	3815.3	Columbia	8,289	637.6
La Crosse	113,679	29	3920.0	Kewaunee	3,239	647.8
Sauk	58,922	15	3928.1	Brown	28,167	655.0
Kewaunee	20,315	5	4063.0	Rusk	2,736	684.0
Sawyer	16,939	4	4234.8	Polk	6,848	684.8
Columbia	55,170	13	4243.8	Portage	8,248	687.3
Polk	44,252	10	4425.2	Forest	2,078	692.7
Grant	48,965	11	4451.4	St Croix	8,336	694.7
Menominee	4,513	1	4513.0	Eau Claire	12,733	707.4
Green Lake	18,472	4	4618.0	Walworth	13,446	707.7
Trempealeau	27,754	6	4625.7	Ozaukee	12,866	714.8
Ozaukee	86,311	18	4795.1	Grant	7,945	722.3
Taylor	19,222	4	4805.5	Oneida	7,968	724.4
Lincoln	29,404	6	4900.7	Price	2,906	726.5
Dane	491,357	99	4963.2	Kenosha	18,362	734.5
Jackson	19,886	4	4971.5	Dunn	5,205	743.6
Green	36,110	7	5158.6	Jackson	2,980	745.0
Waupaca	51,665	10	5166.5	Rock	21,606	745.0
Juneau	26,451	5	5290.2	Marinette	8,208	746.2
Walworth	100,593	19	5294.4	Outagamie	21,675	747.4
Burnett	15,884	3	5294.7	Winnebago	20,975	749.1
Monroe	43,760	8	5470.0	Monroe	5,997	749.6
Chippewa	60,609	11	5509.9	Washington	17,309	752.6
Rock	160,155	29	5522.6	Chippewa	8,322	756.5
Eau Claire	99,409	18	5522.7	Jefferson	10,594	756.7
Milwaukee	959,521	173	5546.4	Trempealeau	4,543	757.2
Washburn	16,666	3	5555.3	Green	5,361	765.9
Door	27,815	5	5563.0	Taylor	3,106	776.5
Washington	130,681	23	5681.8	Calumet	4,835	805.8
Brown	247,319	43	5751.6	Iowa	3,229	807.3
Portage	69,176	12	5764.7	Pierce	4,121	824.2
Jefferson	80,833	14	5773.8	Sawyer	3,321	830.3
Winnebago	163,370	28	5834.6	Racine	25,585	852.8
Vernon	29,324	5	5864.8	Sheboygan	16,332	859.6
Iowa	23,498	4	5874.5	Fond Du Lac	14,679	863.5
Fond Du Lac	100,070	17	5886.5	Juneau	4,405	881.0
Richland	17,848	3	5949.3	Dodge	12,335	881.1
Sheboygan	114,560	19	6029.5	Green Lake	3,534	883.5

County	Total Population	Number of Ambulatory Care Pharmacies	Total Population per Each Ambulatory Care Pharmacy*	County	Total Population 65+ Years	65+ Years Population per Each Ambulatory Care Pharmacy*
Iron	6,078	1	6078.0	Waupaca	8,839	883.9
Outagamie	177,155	29	6108.8	Lincoln	5,452	908.7
Dunn	42,968	7	6138.3	Marathon	18,545	927.3
Wood	73,932	12	6161.0	Vilas	5,598	933.0
Manitowoc	80,583	13	6198.7	Douglas	6,654	950.6
Dodge	87,335	14	6238.2	Vernon	4,831	966.2
Douglas	44,274	7	6324.9	Manitowoc	13,062	1004.8
Marathon	131,612	20	6580.6	Richland	3,103	1034.3
Kenosha	165,382	25	6615.3	Waukesha	55,072	1079.8
Langlade	20,008	3	6669.3	Wood	13,143	1095.3
Racine	200,601	30	6686.7	Burnett	3,510	1170.0
Buffalo	13,425	2	6712.5	Buffalo	2,359	1179.5
Shawano	41,166	6	6861.0	Washburn	3,557	1185.7
St Croix	83,351	12	6945.9	Shawano	7,314	1219.0
Marquette	14,727	2	7363.5	Door	6,142	1228.4
Calumet	44,739	6	7456.5	Clark	5,272	1318.0
Waukesha	383,154	51	7512.8	Langlade	3,966	1322.0
Pierce	40,081	5	8016.2	Oconto	5,869	1467.3
Waushara	24,606	3	8202.0	Iron	1,497	1497.0
Clark	33,426	4	8356.5	Marquette	3,052	1526.0
Oconto	37,149	4	9287.3	Waushara	4,624	1541.3
Adams	20088	2	10044.0	Adams	4,339	2169.5
Bayfield	14,789	1	14789.0	Lafayette	2,465	2465.0
Lafayette	15,737	1	15737.0	Bayfield	2,833	2833.0
Florence	4,554	0	**	Florence	919	**

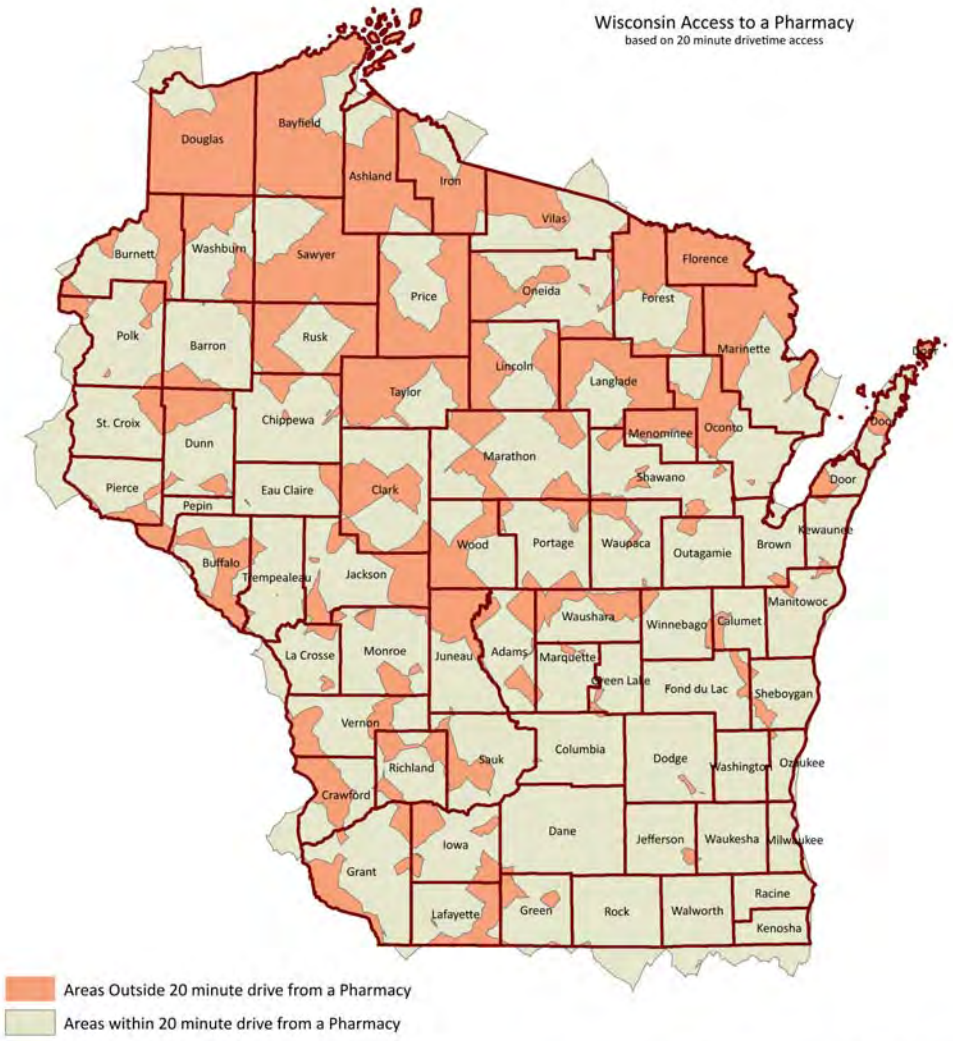
* The population per each ambulatory care pharmacy was calculated by using the county's population divided by number of ambulatory care pharmacies in the county.

** Florence County does not have an ambulatory care pharmacy.

The population to pharmacy ratios provide one perspective of access, and they are affected by both county population and pharmacy prevalence in the county. A less populace county with one or a few pharmacies might have an apparent low ratio, but access challenges may still occur for residents.

A visual depiction of drive time to a pharmacy is shown in **Figure 3**. A drive time of 30 minutes or more has been used as one factor in designating shortage areas for primary care physicians. In our analysis, we applied a more stringent criterion, 20 minutes; this represents 40 minutes round trip travel time to visit a pharmacy. The darker areas in **Figure 3** indicate that patrons must drive 20 minutes or more one way to reach an ambulatory pharmacy. As can be seen from the map, longer drive times to an ambulatory pharmacy tend to occur in rural areas. Some of these areas also have higher percentages of older adults in their total population which will increase by 2030.

Figure 3. 20-Minute Driving Time to Ambulatory Pharmacies



	Total Population	White	Black	Hispanic	Asian	American Indian	Age 65 and Over
Beyond 20 Minute Access	179,708	171,613	1,303	3,185	847	4,614	74,456
State Totals	5,686,986	4,786,483	385,167	363,189	148,605	75,495	773,314

III. Pharmacist Accessibility by County

As projections are readied for how the state will handle health needs of Wisconsin's population as it ages, it is important to examine pharmacist work force characteristics and what they mean for accessibility even now, particularly in counties with a larger proportion of older adults. The availability of *pharmacists* in counties can highlight variability in the human pharmacist resources available to meet the health needs of citizens.

Data and Methods

A listing of licensed pharmacists was obtained from the Wisconsin Department of Safety and Professional Services. The listing was restricted to pharmacists with a Wisconsin address (residence) on file and county was assigned based on zip code to county matching file. The

age and gender mix of pharmacists across counties was of interest because they are associated with hours worked and contribution to the workforce. Gender was provided for many pharmacists in the listing and where not available it was based on name recognition (with 11 undetermined categorized as males). Age was estimated for each pharmacist based on the date of first licensure reported in the pharmacist listing from the State. Assuming an age of 24 when first licensed, the years accumulated since the year of first licensure was added to 24 as an estimate of current pharmacist age.

The number of pharmacists in a county is a raw measure of pharmacist availability, and main basis for pharmacist capacity in this report. In an attempt to refine the measure of pharmacist capacity we derived an estimate of the number of hours a pharmacist contributes to the workforce. Data from the 2009 Biennial Wisconsin Pharmacist Compensation Survey[15] were used to build a prediction model with gender and age as factors contributing to the total number of hours worked per year. The prediction model was applied for each pharmacist in the state, to estimate the total hours worked by each pharmacist and thus available pharmacist hours per county.

The State listing did not include setting, so focus on ambulatory pharmacists is not possible; pharmacists and pharmacist hours per county provide a preliminary baseline to identify varying capacity throughout the state.

Overall significant findings:

Table 3 gives a breakdown of the number of pharmacists that reside in each county, along with other characteristic data. Although there can be some slippage in the rates of pharmacists per county due to work commutes that cross county lines, the pharmacist counts per county give a baseline measure of pharmacist availability.

Each county was home to at least one pharmacist. As might be expected, more pharmacists lived in more populous counties. Overall, 36 percent of all the pharmacists in the state live in Milwaukee County or a contiguous county and another 17 percent of the state's pharmacists live in Dane County (where the average age and percent male pharmacists are among the lowest).

The pharmacists in the two counties with only one pharmacist each were at or near retirement age, making those counties the top two with respect to average pharmacist age in the county. If those pharmacists retire, the counties could be at risk of having no pharmacist capacity in the county.

Table 3. Pharmacist Characteristics by County

County	Number of Pharmacists	Percent of Pharmacists Who Are Male	Average Estimated Pharmacist Age	Average Pharmacist Hours/Year	Population per Pharmacist	Population Age >65 per Pharmacist	Total Pharmacist Hours per Capita
ADAMS	2	50.0	52.0	1819.6	10,044	2,170	0.181
ASHLAND	9	44.4	44.7	1913.7	1,798	280	1.064
BARRON	43	67.4	46.9	1980.7	1,060	192	1.868
BAYFIELD	18	66.7	51.2	1872.0	822	157	2.278
BROWN	217	55.3	44.5	1915.2	1,140	130	1.680
BUFFALO	10	90.0	51.9	1833.2	1,343	236	1.366
BURNETT	5	100.0	52.6	2070.1	3,177	702	0.652
CALUMET	10	40.0	44.1	1765.9	4,474	484	0.395
CHIPPEWA	44	50.0	47.8	1905.7	1,377	189	1.383
CLARK	15	66.7	54.0	1857.3	2,228	351	0.833
COLUMBIA	45	55.6	47.6	1862.3	1,226	184	1.519
CRAWFORD	7	57.1	45.9	1897.7	2,390	412	0.794
DANE	916	43.1	40.7	1940.4	536	53	3.617
DODGE	41	56.1	46.2	1951.6	2,130	301	0.916
DOOR	23	56.5	51.8	1889.6	1,209	267	1.562
DOUGLAS	20	95.0	52.5	1925.2	2,214	333	0.870
DUNN	20	65.0	46.6	1947.8	2,148	260	0.907
EAU CLAIRE	120	58.3	43.9	1951.9	828	106	2.356
FLORENCE	1	100.0	67.0	1637.2	4,554	919	0.360
FOND DU LAC	62	51.6	43.8	1921.4	1,614	237	1.190
FOREST	6	50.0	53.2	1903.9	1,601	346	1.189
GRANT	30	56.7	47.0	1930.1	1,632	265	1.183
GREEN	43	48.8	44.7	1814.2	840	125	2.160
GREEN LAKE	14	71.4	49.1	1930.4	1,319	252	1.463
IOWA	20	55.0	42.6	1922.2	1,175	161	1.636
IRON	2	50.0	48.5	1747.8	3,039	749	0.575
JACKSON	11	27.3	40.4	1874.1	1,808	271	1.037
JEFFERSON	51	51.0	49.1	1841.8	1,585	208	1.162
JUNEAU	14	64.3	49.5	1949.8	1,889	315	1.032
KENOSHA	103	48.5	40.4	1933.6	1,606	178	1.204
KEWAUNEE	14	71.4	50.9	1772.8	1,451	231	1.222
LA CROSSE	140	57.9	40.5	1970.8	812	104	2.427
LAFAYETTE	7	57.1	38.6	2023.8	2,248	352	0.900
LANGLADE	12	66.7	54.2	1712.8	1,667	331	1.027
LINCOLN	30	76.7	49.8	1920.5	980	182	1.959
MANITOWOC	56	69.6	47.6	1914.4	1,439	233	1.330
MARATHON	118	46.6	44.6	1875.1	1,115	157	1.681
MARINETTE	35	71.4	40.4	2037.5	1,199	235	1.699
MARQUETTE	5	80.0	53.4	1657.4	2,945	610	0.563
MENOMINEE	1	0.0	62.0	1929.7	4,513	437	0.428
MILWAUKEE	738	54.7	42.9	1943.2	1,300	148	1.495
MONROE	28	60.7	49.2	1947.0	1,563	214	1.246

County	Number of Pharmacists	Percent of Pharmacists Who Are Male	Average Estimated Pharmacist Age	Average Pharmacist Hours/Year	Population per Pharmacist	Population Age >65 per Pharmacist	Total Pharmacist Hours per Capita
OCONTO	15	66.7	51.5	1890.5	2,477	391	0.763
ONEIDA	51	72.5	50.4	1931.0	705	156	2.741
OUTAGAMIE	180	51.7	42.1	1968.0	984	120	2.000
OZAUKEE	126	63.5	49.3	1895.7	685	102	2.767
PEPIN	5	60.0	46.8	1965.5	1,459	251	1.348
PIERCE	24	41.7	44.2	1913.3	1,670	172	1.146
POLK	32	75.0	52.0	1923.5	1,383	214	1.391
PORTAGE	56	67.9	43.6	1945.7	1,235	147	1.575
PRICE	14	71.4	56.5	1741.4	1,015	208	1.715
RACINE	153	54.9	47.0	1871.3	1,311	167	1.427
RICHLAND	9	77.8	52.6	1921.1	1,983	345	0.969
ROCK	89	50.6	43.6	1902.7	1,799	243	1.057
RUSK	10	70.0	55.3	1826.2	1,437	274	1.271
SAINT CROIX	57	33.3	40.4	1896.4	1,462	146	1.297
SAUK	47	48.9	48.3	1847.9	1,254	190	1.474
SAWYER	18	61.1	42.1	1960.7	941	185	2.084
SHAWANO	25	56.0	44.8	1906.7	1,647	293	1.158
SHEBOYGAN	74	60.8	48.7	1884.6	1,548	221	1.217
TAYLOR	10	70.0	44.2	2089.8	1,922	311	1.087
TREMPEALEAU	12	41.7	46.6	1877.9	2,313	379	0.812
VERNON	25	52.0	41.7	1932.5	1,173	193	1.648
VILAS	23	65.2	50.5	1864.9	935	243	1.995
WALWORTH	61	62.3	46.9	1954.1	1,649	220	1.185
WASHBURN	11	54.5	50.7	1912.4	1,515	323	1.262
WASHINGTON	132	56.8	45.5	1936.5	990	131	1.956
WAUKESHA	802	51.4	44.6	1933.9	478	69	4.048
WAUPACA	35	65.7	51.5	1882.6	1,476	253	1.275
WAUSHARA	5	80.0	44.8	1997.4	4,921	925	0.406
WINNEBAGO	119	49.6	44.6	1927.4	1,373	176	1.404
WOOD	95	47.4	42.7	1918.3	778	138	2.465
State Average		59.5	47.6	1900.4	1,786	295	1.408

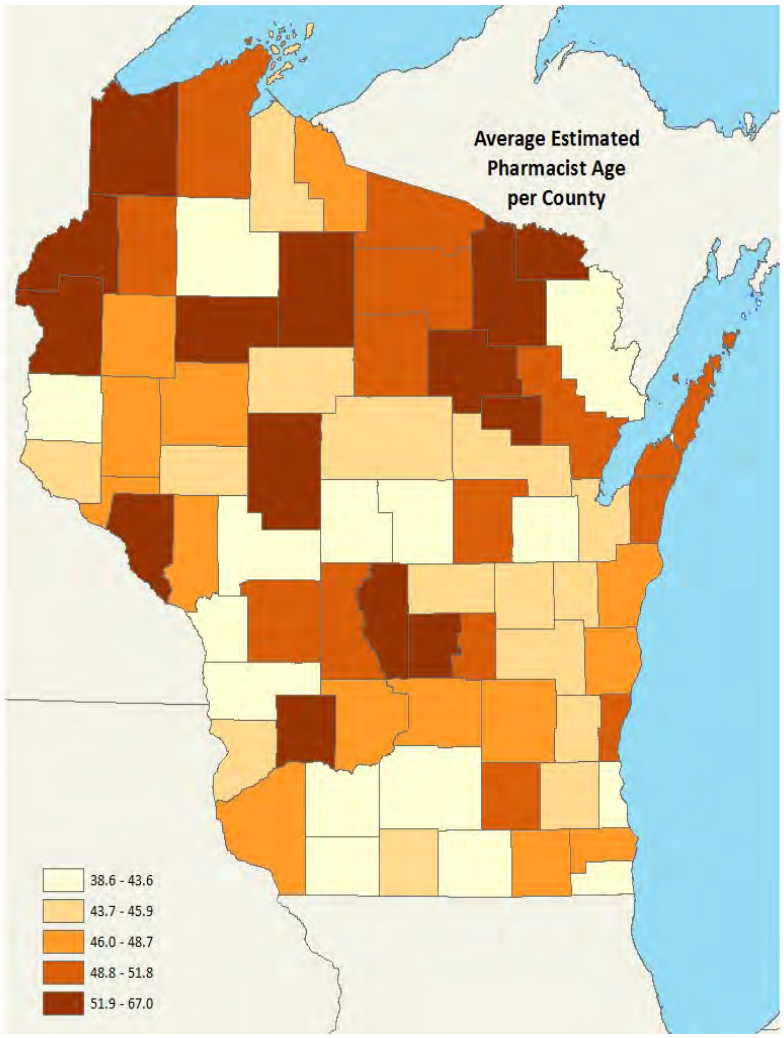
Perspective on the age distribution of pharmacists across counties and where 'graying' of the pharmacist population exists are shown in **Figure 4** where the estimated average of pharmacists in each county is depicted. Interestingly, there seems to be correlation between pharmacist and county population ages.

The estimated average hours per year worked by pharmacists varied somewhat across counties. Both the number of pharmacists and the work hours per year contributed to the ratios of available total hours of pharmacist time per capita across counties. Although not all pharmacists provide direct patient care in their employment, the hours worked estimates give a sense of the pharmacist capacity in the

counties and how that varies in regions and counties.

The average population to pharmacist ratio for the ten counties with the highest rates was nearly six times the average ratio for the ten counties with the lowest rates. For the 65+ population to pharmacist ratios the discrepancy was even greater; there was over a seven-fold difference between the average ratio for the ten highest and lowest ranking counties. A similar pattern resulted for the available pharmacist hours per capita across the counties, with closely corresponding hours per 65+ population capacity rates (65+ rates not shown in Table). These measures reflect substantial capacity differences across the state. Assuming similar needs among populations across counties, the ranges of population to pharmacist and pharmacist hours per capita suggest potential disparities are present in areas of the state.

Figure 4. Average Pharmacist Age by County



Summary and Implications

This inaugural Lemberger Report offers some baseline indicators of population health needs relevant to pharmacy. In the context of the Wisconsin population's anticipated aging, questions will arise about how best to meet the increasing health needs of our population. How can preventable hospitalizations be averted? What configuration and access to ambulatory care will be needed 20 years from now? Our analyses also raise some questions of what the capacity of pharmacy and pharmacists should be to meet the need for reducing hospital discharges for ambulatory care sensitive conditions.

AHRQ's Prevention Quality Indicators (PQIs) [6] of hospital admissions that might have been prevented through high-quality outpatient care offered useful insights. Using these indicators, the report presents perspective on *pharmacy* and *pharmacist* capacity by county. Taken together, we can see both gaps and opportunities for pharmacy to help address health needs of the Wisconsin population.

For example, the findings regarding hospitalizations for bacterial pneumonia and congestive heart failure (CHF) suggest pharmacists could play increased roles in an interdisciplinary approach for improving health in older adults especially. Ambulatory pharmacists already have expanded their influenza immunization training and roles. Thus it is logical to explore the possibility of expanding ambulatory pharmacist roles in offering pneumonia immunizations further. Congestive heart failure represents an area where medication consultation and assistance in preparing patients and caregivers to manage complex medication regimens builds on the training and accessibility of ambulatory pharmacists. With the aging of Wisconsin's population, inter-professional collaboration of ambulatory pharmacists in monitoring and helping older adults with CHF deserves attention. This has implications for our health profession education to offer more inter-professional training.

Analysis of the county differences in this area suggests some counties are particularly in need of greater attention to how inter-professional care can be offered to address these health needs. System and policy level interventions may be needed to improve communication and coordination of care across health care sites and professions to reduce preventable hospitalizations and better serve patients with ACSCs.

Given anticipated aging of Wisconsin's population over the next decade, there is a need to consider pharmacy work force distribution issues. It is clear that some counties have lower ambulatory *pharmacy* to population ratios and 20 minute or more drive times to ambulatory pharmacies. Similarly, some have much poorer *pharmacist* to population ratios. Some of the counties with few pharmacists also have the oldest pharmacists and are at risk of losing pharmacists altogether as these pharmacists approach retirement age. Other counties do not have these issues. The disparity in pharmacy and pharmacist distribution suggests that more consideration of barriers and incentives affecting the education, recruitment, location, and retention of pharmacists in underserved areas is needed. This is particularly true for the parts of Wisconsin already designated as health profession shortage areas for primary care physicians.

Generating this report revealed a need for improved methods to collect pharmacist specific data. While identifying the location of ambulatory *pharmacies* is straightforward, information on individual *pharmacist* capacity relevant to ambulatory care was less direct and therefore less complete. To improve these data, one approach would be to collect a core set of

variables from pharmacists every two years at the time of their relicensure. Examples would be work setting and hours worked, similar to what occurs for nurses in Wisconsin. This would allow greater accuracy in tracking and anticipating workforce distribution.

Looking ahead to future Lemberger Reports, we anticipate continuing to track these and other health and pharmacist trends to examine county disparities and explore their implications for potential interventions. We will overlay these with the Health Professional Shortage Areas in Primary Care presented in **Appendix C.** As more data become available about demographic trends as well as needs, this will inform revised projections. The Sonderegger Research Center will continue working on these and other issues collaboratively with our Wisconsin Pharmacy Practice Enhancement and Action Research Link (Pearl Rx) Network and other providers and researchers around the state as we seek to improve the health of Wisconsin.

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Appendix A: Wisconsin 2009 Adult Hospitalization Rates for Bacterial Pneumonia by County and Age

County name	Rates per 100,000 population*			
	All Adults, 18+ years	Age Groups		
		18-44 years	45-64 years	65+ years
Adams	353.3	69.9	271.2	852.7
Ashland	612.1	110.4	246.4	2343.1
Barron	554.5	72.3	308.6	1767.6
Bayfield	492.4	25.9	151.2	1764.9
Brown	173.2	41.1	126.9	724.3
Buffalo	201.0	50.1	73.2	678.3
Burnett	536.4	193.8	287.0	1310.5
Calumet	211.0	45.0	89.4	1054.8
Chippewa	369.6	42.6	228.3	1490.0
Clark	569.7	142.5	279.1	1839.9
Columbia	416.8	49.8	269.2	1508.0
Crawford	494.5	40.8	213.2	1769.0
Dane	265.8	52.3	196.2	1403.5
Dodge	464.5	82.9	262.4	1840.3
Door	408.0	85.9	217.2	1074.6
Douglas	114.2	19.0	159.2	255.5
Dunn	286.0	42.9	288.8	1152.7
Eau Claire	268.8	35.1	183.5	1209.5
Florence	79.2	0.0	0.0	326.4
Fond du Lac	300.8	40.3	196.4	1117.2
Forest	675.9	144.5	667.2	1395.6
Grant	450.6	44.4	260.7	1674.0
Green	582.1	130.8	206.5	2294.3
Green Lake	467.7	137.8	175.1	1414.8
Iowa	353.0	26.5	127.4	1610.4
Iron	136.8	65.5	47.8	334.0
Jackson	303.0	14.6	264.8	1040.3
Jefferson	391.9	77.6	295.1	1472.5
Juneau	679.3	115.8	375.7	2315.6
Kenosha	386.1	77.3	319.6	1584.8
Kewaunee	204.1	62.1	116.7	648.3
La Crosse	245.8	36.2	162.6	1080.6
Lafayette	496.1	63.9	274.8	1744.4
Langlade	278.6	53.1	129.6	832.1
Lincoln	607.2	175.7	359.5	1687.5
Manitowoc	317.1	67.0	185.2	1048.8
Marathon	336.2	58.4	206.2	1261.8
Marinette	375.7	132.6	181.0	1047.8
Marquette	529.0	101.8	168.7	1638.3
Menominee	967.3	379.5	510.2	4119.0
Milwaukee	337.8	90.1	302.8	1269.3
Monroe	411.1	119.5	214.4	1500.8
Oconto	240.8	35.2	118.2	886.0
Oneida	329.5	84.5	125.0	928.7
Outagamie	238.4	48.9	152.2	996.5
Ozaukee	259.9	31.0	94.4	1072.6
Pepin	318.5	45.2	137.4	1115.5
Pierce	252.9	23.6	170.1	1407.4
Polk	533.8	79.3	269.0	1971.4
Portage	250.6	34.9	142.8	1236.7
Price	626.8	166.7	240.9	1858.2

County name	Rates per 100,000 population*			
	All Adults, 18+ years	Age Groups		
		18-44 years	45-64 years	65+ years
Racine	343.9	68.3	219.4	1360.2
Richland	562.7	72.6	266.9	1933.6
Rock	363.8	83.2	284.4	1254.3
Rusk	413.6	25.2	158.3	1388.9
St. Croix	351.3	128.1	192.7	2087.3
Sauk	535.7	201.0	125.5	639.7
Sawyer	648.1	111.7	302.3	2770.2
Shawano	387.8	56.8	488.8	2037.2
Sheboygan	261.2	83.5	82.8	1004.2
Taylor	366.9	33.6	70.6	1545.4
Trempealeau	446.6	70.0	214.2	1562.8
Vernon	581.3	83.3	237.1	2049.3
Vilas	618.0	234.9	394.8	1250.4
Walworth	308.6	54.0	216.3	1197.4
Washburn	730.4	68.6	430.0	1996.1
Washington	312.2	69.0	180.3	1219.0
Waukesha	291.5	47.6	147.6	1131.2
Waupaca	606.8	57.6	230.9	2240.1
Waushara	380.9	53.8	236.0	1146.2
Winnebago	257.7	52.4	220.8	967.8
Wood	390.6	84.4	272.0	1110.9

*The number of bacterial pneumonia hospitalization discharges was divided by the county population figure and then multiplied by 100,000. Rates were not risk-adjusted.
Population estimates were provided by the US Census Bureau.

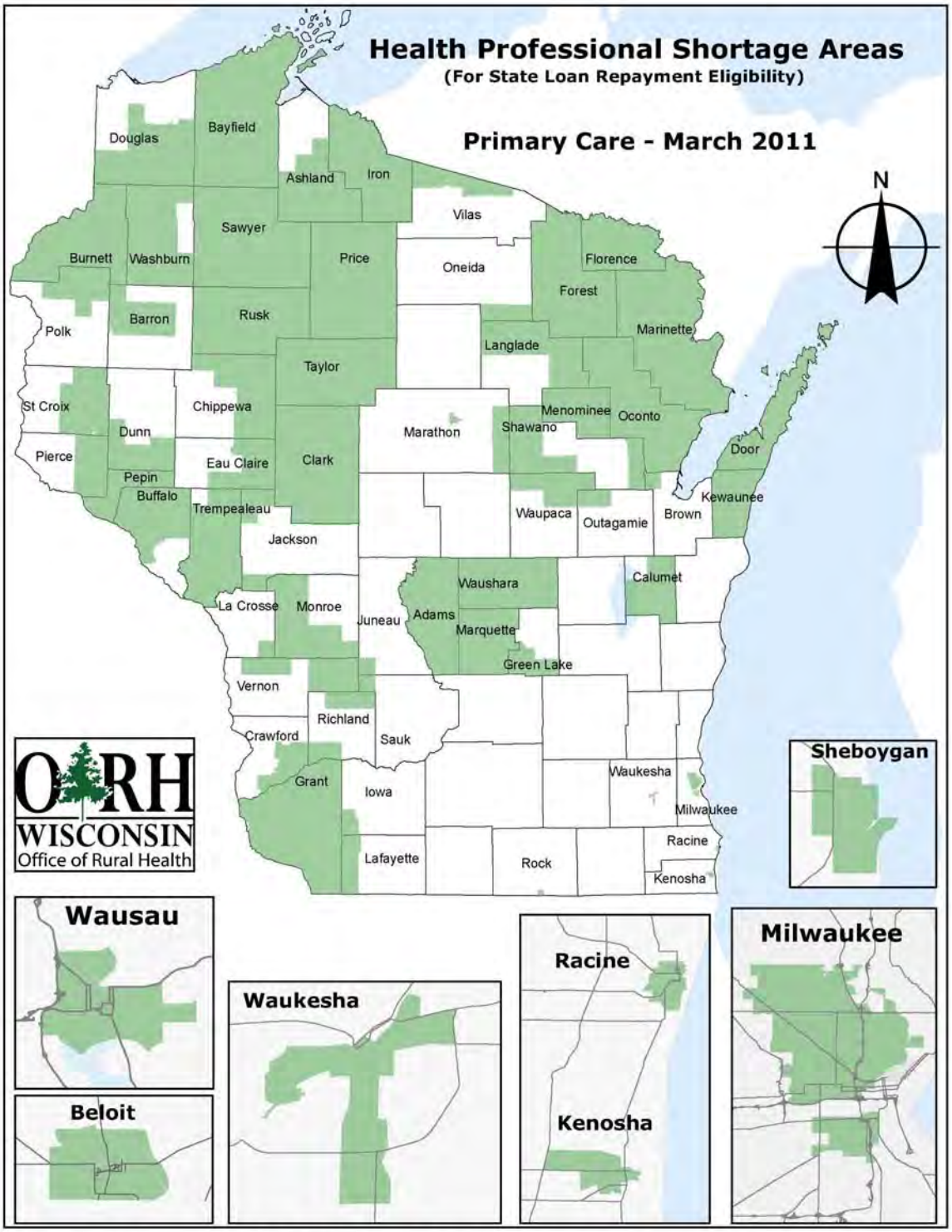
Appendix B: Wisconsin 2009 Adult Hospitalization Rates for Congestive Heart Failure by County and Age

County name	Rates per 100,000 population*			
	All Adults, 18+ years	Age Groups		
		18-44 years	45-64 years	65+ years
Adams	335.3	0.0	75.3	1175.4
Ashland	338.2	0.0	44.8	1588.6
Barron	338.8	0.0	51.4	1380.1
Bayfield	267.0	0.0	75.6	988.4
Brown	259.6	14.8	96.0	1459.2
Buffalo	239.3	25.1	146.4	763.0
Burnett	326.5	0.0	76.5	1082.6
Calumet	226.3	12.8	65.1	1323.7
Chippewa	429.8	0.0	128.8	2138.9
Clark	540.2	10.2	139.5	2181.3
Columbia	344.2	5.5	128.5	1508.0
Crawford	231.8	20.4	77.5	867.2
Dane	205.2	8.7	121.8	1300.3
Dodge	341.8	19.1	96.9	1653.8
Door	526.5	14.3	144.8	1709.5
Douglas	54.2	0.0	8.0	270.5
Dunn	329.8	10.7	96.3	1940.4
Eau Claire	296.6	7.0	123.8	1586.4
Florence	52.8	0.0	0.0	217.6
Fond du Lac	236.2	11.5	89.3	1049.1
Forest	357.9	0.0	148.3	1106.8
Grant	204.6	0.0	110.6	818.1
Green	331.1	0.0	84.5	1529.6
Green Lake	411.9	19.7	17.5	1612.9
Iowa	319.4	13.2	113.2	1486.5
Iron	97.7	0.0	95.6	200.4
Jackson	283.7	0.0	53.0	1375.8
Jefferson	279.4	10.1	131.7	1340.4
Juneau	462.5	0.0	129.6	1952.3
Kenosha	331.8	19.3	186.6	1726.4
Kewaunee	325.3	15.5	33.4	1481.9
La Crosse	196.9	6.4	99.0	998.6
Lafayette	538.2	0.0	317.1	1987.8
Langlade	481.2	17.7	275.3	1462.4
Lincoln	533.0	11.7	157.3	1962.6
Manitowoc	350.6	7.9	144.0	1401.0
Marathon	396.3	13.5	130.3	1844.2
Marinette	456.2	41.4	181.0	1510.7
Marquette	469.2	0.0	84.4	1671.0
Menominee	533.7	0.0	306.1	2974.8
Milwaukee	462.1	49.5	411.9	1997.2
Monroe	324.5	0.0	90.7	1567.5
Oconto	302.7	8.8	84.5	1312.0
Oneida	468.8	21.1	125.0	1518.6
Outagamie	204.8	3.1	70.8	1102.7
Ozaukee	321.9	7.8	87.1	1453.4
Pepin	530.9	0.0	45.8	2310.8
Pierce	142.3	0.0	37.8	994.9
Polk	369.5	21.6	74.7	1650.1
Portage	241.5	10.5	60.4	1442.8
Price	383.0	0.0	140.5	1273.2
Racine	531.4	48.0	318.5	2302.1

County name	Rates per 100,000 population*			
	All Adults, 18+ years	Age Groups		
		18-44 years	45-64 years	65+ years
Richland	432.9	0.0	95.3	1772.5
Rock	375.3	49.6	177.2	1619.9
Rusk	395.6	0.0	67.8	1498.5
St. Croix	297.9	10.2	94.1	1931.4
Sauk	53.1	22.3	11.9	235.7
Sawyer	916.3	16.0	337.8	3071.4
Shawano	753.5	2.6	278.1	2802.8
Sheboygan	127.8	6.4	27.6	618.4
Taylor	455.2	67.3	158.8	1738.6
Trempealeau	313.5	0.0	126.0	1232.7
Vernon	327.6	0.0	142.2	1221.3
Vilas	533.7	0.0	239.7	1393.4
Walworth	302.2	10.8	139.3	1435.4
Washburn	436.7	0.0	112.2	1461.9
Washington	245.9	6.9	100.5	1172.8
Waukesha	362.7	10.9	118.1	1654.2
Waupaca	481.9	6.4	96.2	2002.5
Waushara	391.1	13.4	131.1	1427.3
Winnebago	265.5	7.7	123.2	1354.0
Wood	505.7	17.8	170.6	1894.5

*The number of congestive heart failure hospitalization discharges was divided by the county population figure and then multiplied by 100,000. Rates were not risk-adjusted.

Appendix C. Wisconsin Health Professional Shortage Areas, March 2011



This Primary Care HPSA map is valid as of March, 2011. The map illustrates the general location of shortage areas eligible for state loan repayment; please see the WI Primary Care Office web site (http://dhs.wisconsin.gov/health/primarycare/ShortageDesignation.htm) for more detailed information on shortage areas and associated benefits.

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Maps of the Wisconsin population age 65+ for 2010 and 2030 were provided by Cindy Ofstead, Wisconsin Department of Health Services, Division of Long Term Care, using population projections from the Wisconsin Department of Administration, Demographic Services Center.

The map showing Health Professional Shortage Areas as of March 2011 (Appendix C) was provided by the Wisconsin Office on Rural Health. http://worh.org/

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