Show Me the Nursing Shortage: Location Matters in Missouri Nursing Shortage

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Background: Across the United States, data show that nursing shortages exist in many parts of the country. **Purpose:** This descriptive research study seeks to identify nursing shortage and nurse age differences by county in Missouri and aims to determine whether the distribution of nurses is even across rural and urban areas. **Methods:** Using nursing workforce data based on licensed nurses, geographic mapping was performed to show nurse distribution and age cohorts at the county level in Missouri. The number of nurses per 10,000 residents was the ratio used to show nursing population density by county. **Results:** Eleven metropolitan, 4 micropolitan, and 12 rural counties had the lowest ratio of nurses to 10,000 population at 18 to 49. By comparison, 2 metropolitan, 2 micropolitan, and 0 rural areas had the highest ratio at 198 to 327. There were several counties in which 42% to 58% of nurses were older than 54 years. **Conclusion:** There is a disparity in both the number of nurses and the age of nurses in metropolitan, micropolitan, and rural areas. Understanding the factors that contribute to differential nurse practice patterns by geographic regions in states such as Missouri is essential to inform nursing policy and craft workforce solutions.

Keywords: Nursing workforce, nursing workforce solutions, nurse staffing, public policy

In 2017, the U.S. Department of Health and Human Services (HHS) published *Supply and Demand Projections of the Nursing Workforce 2014–2030* (HHS et al., 2017). The report asserts that nurses tend to practice where they are educated and trained, that the nursing shortage is not equal across states, and that Missouri will have a 22.8% surplus of nurses by 2030 (HHS et al., 2017). However, although the HHS report projects an overall surplus of nurses in Missouri, some areas of the state are likely to still experience a nursing shortage, particularly rural areas. In fact, the Missouri State Board of Nursing (MSBN; 2021) has already begun to observe this trend, with lower rates of nurses in rural versus urban parts of the state. The purpose of this article is to evaluate the distribution of nurses and nurse characteristics to identify differences between counties. Such data can help policy makers improve patient access to nursing care.

Literature Review

Numerous studies demonstrate that patient safety and health outcomes are directly related to nurse staffing (Brooks Carthon et al., 2019; Cho et al., 2008; Kane et al., 2007; Needleman et al., 2002). A lower ratio of nurses to patients has been linked to increased mortality rates, longer hospital stays, increased complications, and disparities in quality of care as well as disparities in access to healthcare (Brooks Carthon et al., 2019; Needleman et al., 2011). Having sufficient nurse staffing can play a critical role in patient safety; thus, it stands to reason that the overall number of nurses can impact nurse-patient ratios. Laseter et al. (2020) argued that this link is not direct given the general misconception regarding broader U.S. nursing shortages, and they identified some strategies states have already adopted to alleviate local nursing shortfalls. Specifically, they noted that 34 states have adopted the Nurse Licensure Compact, which enables nurses to practice across state lines via a multistate nurse license.

Furthermore, research has shown that the distribution of nurses is not even across rural and urban areas. Globally, about half of the population lives in rural areas, but these areas are served by only 38% of the total nursing workforce (World Health Organization, 2010). Recent workforce data from Missouri illustrate this imbalance at the local level. In 2020, the rate of nurses per 10,000 residents working in rural Missouri counties was just 77 compared to 118 in micropolitan counties and 156 in metropolitan counties (MSBN, 2021). The U.S. Health Resources and Services Administration (HRSA) designates health professional shortage areas (HPSAs) primarily based on a ratio of population to providers (HRSA Health Workforce, 2021). Of Missouri's 114 counties, only one—Platte County—is not designated as an HPSA. In 16 counties, only part of the county is an HPSA; however, for the remaining counties, the entire areas are designated as HPSAs (HRSA, n.d.).

Congruence exists among many reports on factors driving the nursing shortage. These factors include the number of nurses at or near retirement age, a reduction in birth rates, aging populations, faculty shortages, lack of nursing program infrastructures

such as clinical sites, and high attrition rates in the nursing profession (American Association of Colleges of Nursing, 2020). An overall view of the nursing workforce can be found by reviewing current and past National Council of State Boards of Nursing (NCSBN) Environmental Scans. The NCSBN's Environmental Scan (NCSBN, 2021) supports the premise that the nursing workforce is aging and, thus, is getting closer to retirement age. It also highlights shortages of nursing faculty and nursing program infrastructure issues that continue to trouble the profession.

An assessment of the characteristics of regional nursing shortages is necessary to tailor policy recommendations based on these differences (Park & Yu, 2019). A one-size-fits-all approach is simply not effective. As the nursing shortage manifests differently by geographic locale, multidimensional solutions are required. The shortcomings of focusing on only one dimension of the nursing shortage and how that can lead to ineffective policy solutions is evident in South Korea. In this example, local officials focused solely on increasing the number of registered nurses (RNs) to address provider shortages. This led to an increase in the number of RNs but did not alleviate the dearth of rural nurses (Lee, 2019). New Zealand, by contrast, was more successful in addressing regional nursing shortages by implementing a new pay agreement and safe staffing protocols (Buchan & North, 2009). This effort resulted in steady increases in the number of nurses, increases in the number of applications to nursing programs, and decreases in nurses reporting difficulties finding employment. However, a new concern has emerged: nurses tend to leave the workforce. A 2014–2015 survey of RNs in New Zealand revealed that slightly more than 22% of respondents planned to leave the workforce as their financial circumstances improved (Moloney et al., 2018). These examples further underscore the need to tailor and constantly refine policy solutions meant to address nursing shortages. The issues involving nursing distribution are multidimensional and changing; thus, the solutions must also be multidimensional and constantly updated.

Several studies have also focused specifically on the characteristics of rural nurses and their motivations for continuing their employment in more remote areas. For example, Skillman et al. (2005) compared the characteristics of nurses in rural and urban areas and concluded that rural nurses have lower educational levels, commute farther, and make less money than their urban counterparts. Similarly, a 2012 study looked at rural nurses who lived in one area but commuted to either a different rural or an urban area to work (Skillman et al., 2012). The authors found that higher pay is a major factor for rural nurses deciding not to work in their own community (Skillman et al., 2012). Additionally, younger nurses were found to value their mobility and were more likely to live in rural areas but work in urban areas (Skillman et al., 2012). More recent evidence has shown that nurses in rural settings particularly value workplace culture, professional development opportunities, teamwork, and other community attributes (Fields et al., 2018; Smith et al., 2018).

In Missouri, policy makers need reliable data on nursing workforce supply and demand to make changes that will advance healthcare, improve Missouri's economic environment, and improve overall quality of life. This study aims to identify the differences in nursing that exist at the county level in Missouri to identify possible provider shortage areas. This descriptive analysis examines available nursing workforce data in Missouri to identify where nursing shortages might exist or have the potential to exist in the near future. The findings are used to offer potential policy solutions to address current and projected gaps in care.

Methods

Databases

The nurse licensure data in the MSBN's *2020 Missouri Nursing Workforce Report* is derived from two sources: the Missouri Division of Professional Registration Board of Nursing Registry (PR) and Nursys e-Notify (MSBN, 2021). The PR includes all nurses with an active (i.e., nonexpired) license in Missouri as of June 23, 2020. The Nursys database is a repository of license and disciplinary data maintained by NCSBN, and Nursys e-Notify is a free notification service that provides automated license updates administered by NCSBN.

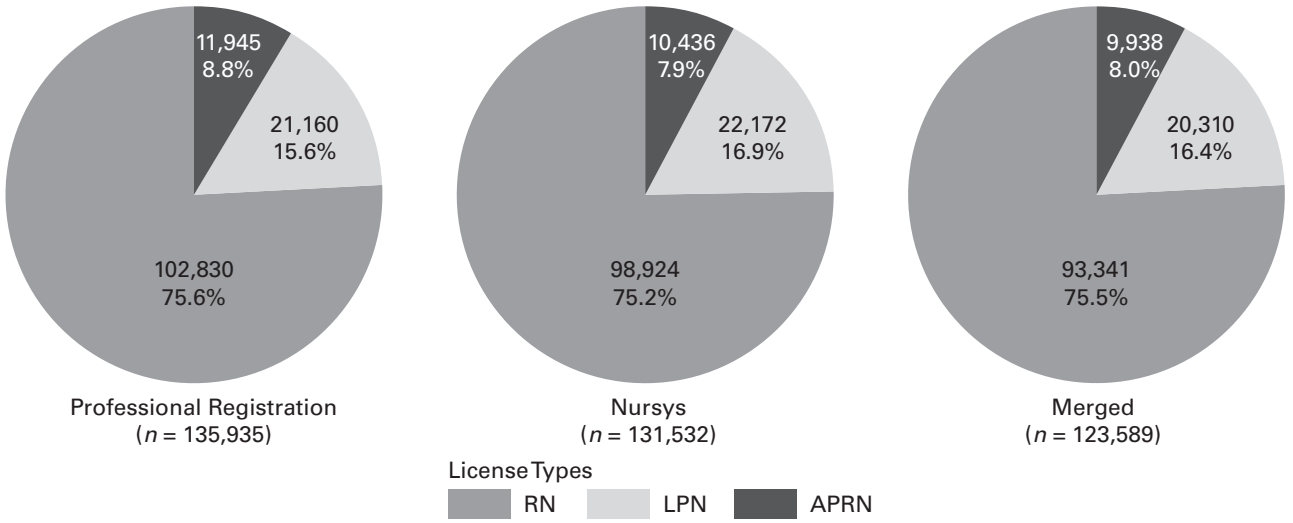
Nurses may enroll in Nursys e-Notify and provide workforce information. The workforce information includes education, employment location, setting, and employment status. Data in this study include nurses licensed in Missouri who enrolled in the Nursys e-Notify system between January 2018 and July 2020 (N = 131,532). During the 2019 license renewal period for RNs, Missouri required enrollment in the Nursys e-Notify service for the first time. The MSBN renewal rule regarding enrollment in Nursys e-Notify was amended to require a nurse to provide information related to practice and demographics. Because of this requirement, 94.1% of nurses licensed in Missouri are included in the Nursys dataset.

Sample

The MSBN provided a raw file with 148,423 entries to a research team at the University of Missouri-Columbia. The raw file included 12,488 duplicate entries. Duplicates typically occur when nurses advance to a new license type. For example, a nurse may have an original entry as an RN and another entry as an advanced practice registered nurse (APRN). The entry with the highest license type was retained for analysis, and the remaining duplicate entries were removed from the dataset, resulting in 135,935 unique nurses in the PR dataset. This study employed an iterative match strategy with nurses in the PR identified using license number, license type, first name, and birth year for a total of 120,864 matching records in Nursys e-Notify (Figure 1). The Missouri State Board of Nursing issues licenses every day. This merge allowed for a broader analysis of records that might be in

FIGURE 1

Number of Nurses in Missouri by License Type



Note. APRN = advanced practice registered nurse; RN = registered nurse; LPN = licensed practical nurse.

the PR but not yet in the Nursys database because the nurse had not yet enrolled in Nursys e-Notify.

Analysis

Means and standard deviations were calculated for continuous variables and proportions for categorical characteristics. Maps were used to show the distribution of nurses by type and characteristics at the county level. The Jenks natural breaks method was used within ArcGIS Pro (Esri) mapping software and presented in five categories. This method uses an algorithm to create categories that best group similar values in the merged dataset and maximize the differences between categories. The maps also indicate core-based statistical areas (CBSAs), which are geographic areas defined by the U.S. Office of Management and Budget. A CBSA includes one or more counties—or county-equivalents like the city of St. Louis—anchored by an urban center, plus the adjacent counties that are socioeconomically tied to the urban center by commuting. Metropolitan areas have an urban center with more than 50,000 residents, whereas Micropolitan areas have an urban center between 10,000 and 50,000 residents (U.S. Census Bureau, 2020). For this report, counties without a CBSA are defined as rural. The data include the employment zip codes for LPNs, RNs, and APRNs who reside in Missouri. All analyses were conducted using ArcGIS Pro mapping software.

Results

Geographic Distribution

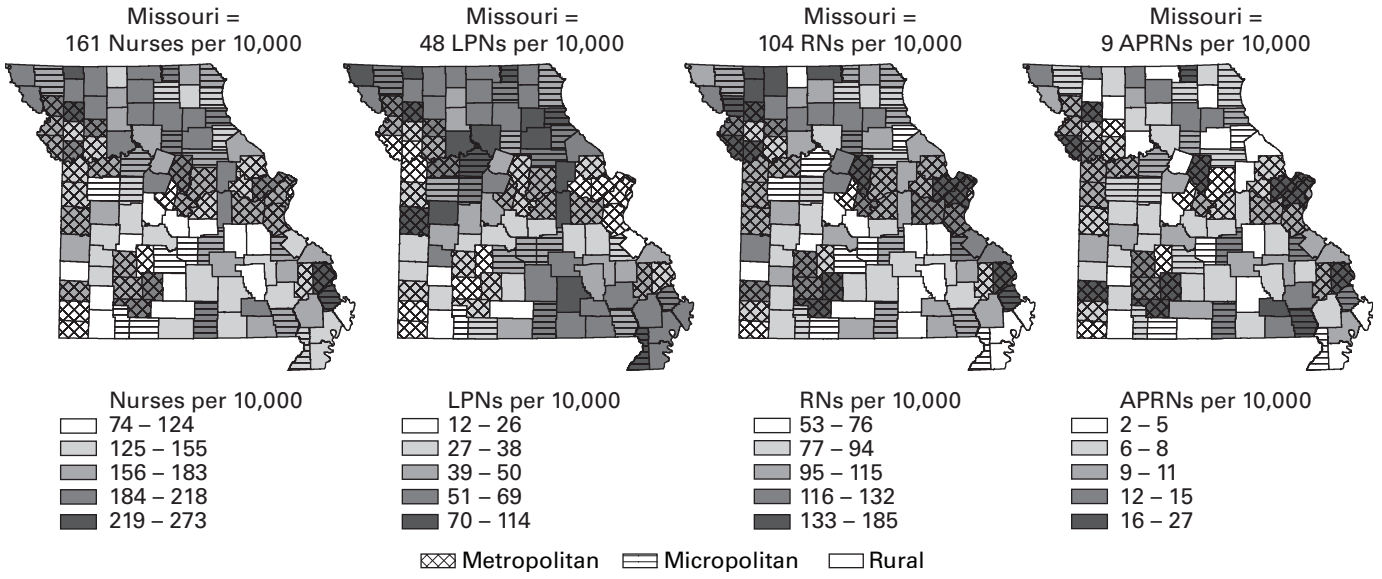
There appear to be fewer employment opportunities for licensed practical nurses (LPNs), RNs, and APRNs in rural areas than in metropolitan and micropolitan counties. The majority of all three groups of nurses both work and live in Missouri, including 14,953 LPNs, 64,349 RNs, and 7,446 APRNs. Those who live in Missouri but have an employment zip code outside Missouri are most likely to work in a border state (949 LPNs; 7,425 RNs, and 1,175 APRNs), particularly within the Kansas City and St. Louis metropolitan regions. There are a small number of each type of nurse with employment zip codes outside the border states, including 335 LPNs, 4,334 RNs, and 448 APRNs, potentially representing nurses who are on travel assignments. While all nurses licensed in Missouri are surveyed for their employment county, county of residence is only available for those living in Missouri (Figure 2). Eleven metropolitan, 4 micropolitan, and 12 rural counties had the lowest ratio of nurses to 10,000 population at 18 to 49. By comparison, 2 metropolitan, 2 micropolitan, and 0 rural areas had the highest ratio at 198 to 327 (Figure 3).

Age Distribution

In general, the nursing workforce is well distributed among age cohorts, and the median age of nurses in each license type is similar. The median age of LPNs and APRNs is 45 years and the median age of RNs is 47 years. The largest age cohort for both LPNs and APRNs is 35–44 years, while the largest cohort for RNs is 25–34 years. For each nursing type, age cohorts of 18–24, 25–34, 35–44, 45–54, 55–64, and > 65 were considered. Nearly 27% of the LPN group is in the 35–44 age cohort, 42% of LPNs range in age from 45 to 64, and 24% of the LPN population is younger than 35 years. A series of maps (Figure 4) show the concentrations of nurses older than 54 by county and thereby demonstrate where the nursing workforce is near retirement age across Missouri. In several counties, 42% to 58% of nurses were older than 54 years.

FIGURE 2

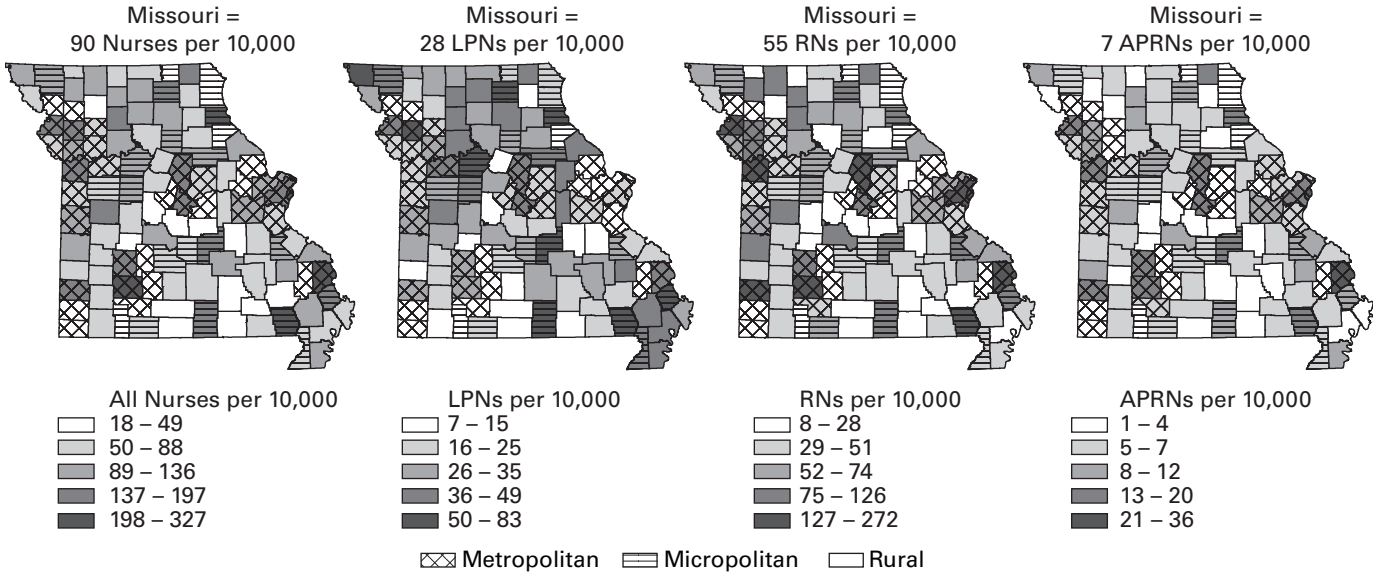
County of Nurse Residence With Core-Based Statistical Areas



Note. Created by the Center for Health Policy at the University of Missouri on March 8, 2021. From the Missouri Division of Professional Registration, 2020. LPN = licensed practical nurse; RN = registered nurse; APRN = advanced practice registered nurse.

FIGURE 3

County of Nurse Employment With Core-Based Statistical Areas

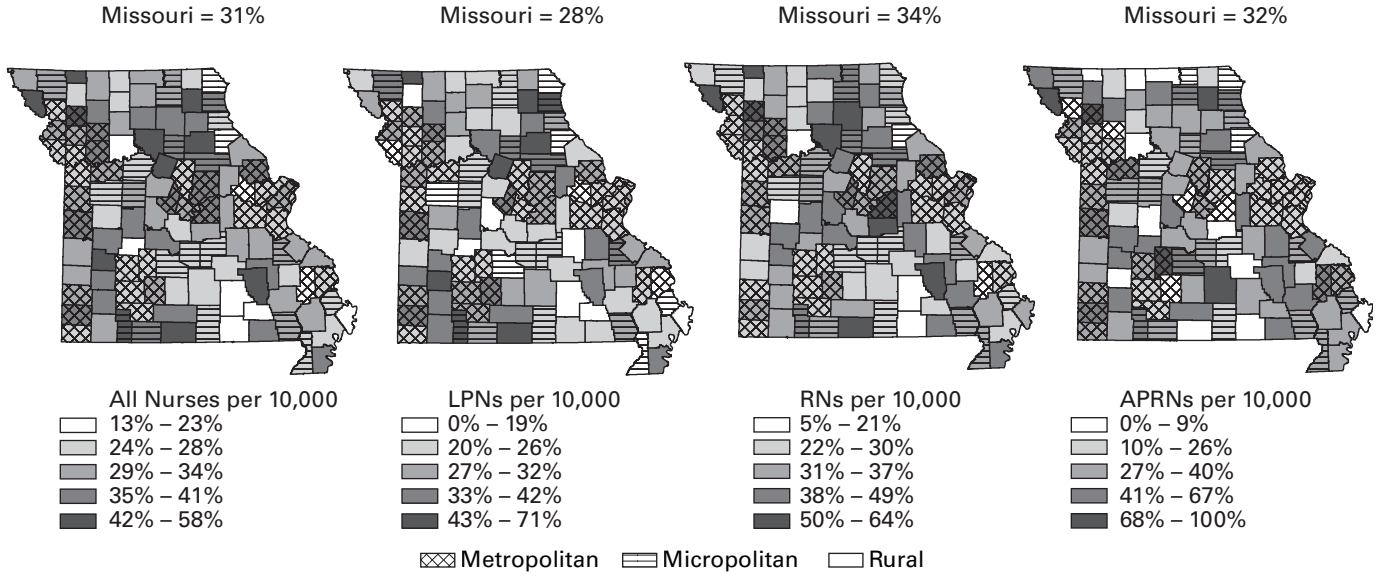


Note. Created by the Center for Health Policy at the University of Missouri on March 8, 2021. From Nursys, January 1, 2018, to June 22, 2020. LPN = licensed practical nurse; RN = registered nurse; APRN = advanced practice registered nurse.

Figure 5 shows that 30% of the overall RN population in Missouri is older than 54 years, while Figure 6 shows that 27% of the APRN population in Missouri is older than 54 years. Overall, 31% of all nurses, including RNs, LPNs, and APRNs in Missouri are older than 54 years. The geographic distribution of the nursing workforce by age is not evenly distributed. For all types of nursing licenses, rural counties are most likely to have a higher percentage of nurses in the older than 54 years category than Missouri's metropolitan and surrounding counties.

FIGURE 4

Percentage of Nurses Older Than 54 Years by County of Employment With Core-Based Statistical Areas



Note. Created by the Center for Health Policy at the University of Missouri on December 13, 2019. From Nursys, January 1, 2017, to August 29, 2019. LPN = licensed practical nurse; RN = registered nurse; APRN = advanced practice registered nurse.

Discussion

Of concern for the future of Missouri's RN workforce, almost one-third of practicing RNs (30.3% or 24,074) are older than 54 years and may be retired or considering retirement in the near future. This is consistent with the 2017 National Nursing Workforce Survey conducted by NCSBN, which revealed that more than 50% of LPNs and RNs are older than 50 years (Smiley et al., 2018). Furthermore, the data indicate that rural counties have lower rates of nurses per 10,000 residents than their metropolitan and micropolitan counterparts. This aligns with our knowledge of HPSAs (HRSA, 2021). This pattern is consistent for both the county of employment and the county of residence. A total of 19,448 nurses licensed in Missouri live outside of the State of Missouri. Based on data available for county of employment, it is likely that many of these nurses live in counties adjacent to Missouri (MSBN, 2021). Knowing nursing shortages are projected to intensify makes these discussions especially time sensitive (World Health Organization, 2013, 2015).

Across Missouri, rural areas have approximately 40% fewer nurses than their metropolitan counterparts; furthermore, fewer job opportunities may exist in remote areas. Considering that pay is one reason that nurses work outside their own communities and that nurses tend to practice where they were educated and trained (Skillman et al., 2012; HHS et al., 2017), one potential solution could be to educate nurses in the communities where the needs for nurses are greater. This notion can inform regulatory bodies and educational institutions when they are planning for new nursing education programs and when the need for targeted nursing program enrollments increase.

The workforce data show particular areas of concern in several counties, including DeKalb and Reynolds counties, because more than half of their nursing workforce is older than 54 years. Interestingly, these counties are dispersed intermittently across the state and not located in one particular region, but they are primarily rural. Specific focus will need to be given to these areas to ensure there is a not a significant shortfall of nurses when the nurses currently older than 54 years begin to retire. These counties need to be aware of these data to actively try to recruit nurses now rather than when the situation becomes more urgent.

Missouri law requires most APRNs to work in a collaborative practice with a physician. Regulations further require that APRNs and collaborating physicians be within 75 miles of one another. Correspondingly, the low number of nurses employed in rural counties often coincides with an overall shortage of healthcare providers, including hospitals, urgent care facilities, and other healthcare services, raising concerns related to the health trends of rural Missourians (MSBN, 2021).

Also, as previously noted, studies have suggested that pay, workplace culture, teamwork, and community are some factors that help retain rural nurses (Smith et al., 2018; Skillman et al., 2012). These studies touch on several important issues and show the need for legislatures, regulators, and individual counties to work together, particularly considering the current study confirmed the increasing ages and overall lower numbers of nurses currently present in rural areas. For example, legislation could help

FIGURE 5

Distribution of Registered Nurses (RNs) in Missouri by Age (*n* = 79,471)

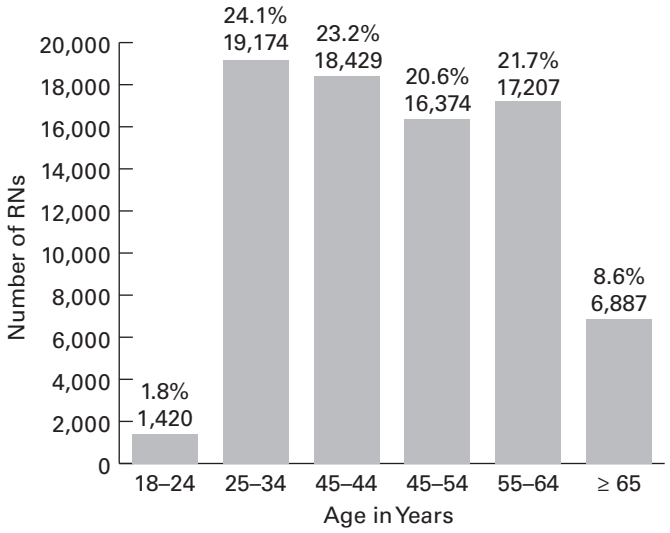
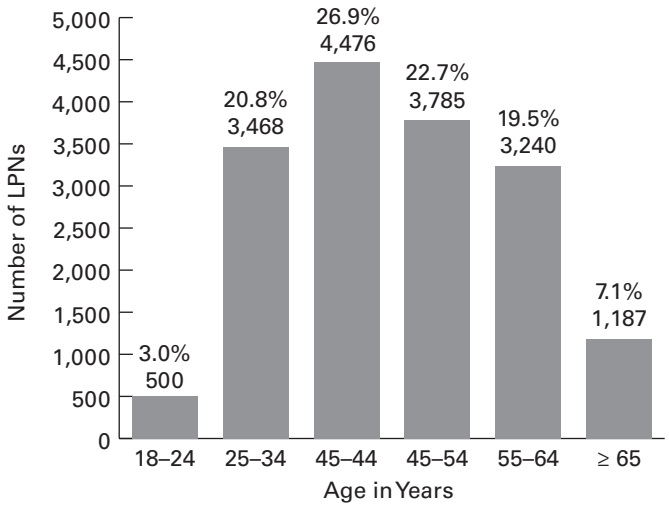


FIGURE 6

Distribution of Licensed Practical Nurses (LPNs) in Missouri by Age (*n* = 16,656)



provide funding to pay rural nurses higher wages, whereas regulators could work with rural schools to help increase the overall numbers of nurses. Hospitals and other private employers within those counties would then play critical roles in addressing workplace culture, community, and teamwork.

Identifying geographic shortages can assist nursing regulatory bodies, nursing education programs, and employers with developing education models that have the potential for alleviating the shortages. For example, in 2019, the MSBN approved an "earn while you learn" education model, which allows fourth-semester associate degree nursing students to earn wages while engaging in hands-on clinical learning through an apprenticeship model (MSBN, 2020b). That same year, the MSBN approved a partnership model between a rural nursing home with a severe nursing shortage and a nursing education program to allow the nursing home to increase the number of its own licensed nurses (MSBN, 2020a). A one-size-fits-all approach is not appropriate to solve the regional shortages, and as new education models are approved, these strategies must be evaluated for impact and long-term changes.

By examining the median age and age distribution of nurses in geographic areas, nursing regulators can examine solutions that might address future shortages. It stands to reason that, if nurses enter the profession at an earlier age, the average age of nurses would decrease. One such solution could be to offer dual enrollment courses with colleges. This solution could be helpful in lowering the average age of nurses, particularly in Missouri counties where a large portion of the nurses are older than 54 years. These counties will need a larger number of nurses than other counties in the coming years, and lowering the average age of nurses could help even out the number of nurses entering versus leaving the profession.

Limitations and Directions for Future Research

One important limitation to note is the staggered renewal cycles by license type. This means we lack a consistent picture of the entire Missouri nursing workforce—LPNs, RNs, and APRNs—at a single point in time, as nurses are required to respond to workforce questions only upon renewal. RN licenses expire on April 30 of every odd-numbered year, and LPN licenses expire on May 31 of every even-numbered year. APRNs are issued the authority to work through a recognition, not a license, which expires at the same time that the APRNs' national certification expires. Therefore, more research is warranted to determine if and how regulations that dictate license expirations impact the nursing shortage.

In addition, Missouri APRN regulation limits the number of APRNs a physician may collaborate with and requires APRNs to practice within 75 miles of their collaborating physicians. Although outside the scope of the current analysis, this presents another important line of inquiry. Future research should explore whether the lower rate of APRNs employed in rural Missouri counties (5 APRNs per 10,000 residents) compared to micropolitan (9 per 10,000 residents) and metropolitan (14 per 10,000 residents) counties has a direct correlation to the location of collaborating physicians. This investigation should include a direct comparison of the practice location of physicians with the practice location of APRNs, and it should consider whether regulations affect practice location.

Additionally, while this study is focused on Missouri, clearly limiting the generalizability of the results, little research on this topic using other states' workforce data analyses is currently available. Thus, this study may serve as a solid foundation for researchers to conduct workforce data analyses and explore possible geographic differences across other states.

Conclusion

Boards of nursing and policy makers are best positioned to fulfill their public protection mandates when they understand the dynamics of the nursing workforce. This workforce analysis indicates that Missouri has shortages in certain geographic areas of the state and provides its board of nursing with valuable information for targeting solutions. Solutions will need to focus on several strategies, including targeting geographic areas for supply increase, addressing work-life balance, and reducing regulatory barriers to practice.

For nursing regulatory bodies, simply approving more education programs or increasing student enrollments is not enough. Nursing regulatory bodies should promote innovation in how nurses are educated and support different education models.

This geographic workforce data analysis can be, and potentially should be, replicated to determine whether location matters in terms of nursing shortages in other states. Then, a multifaceted approach could be explored in an effort to achieve and retain a stable nursing workforce, tailored to and capable of meeting each state's healthcare needs. These approaches could be shared between states, allowing boards of nursing to learn from each other.

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