Certified Registered Nurse Anesthetists (CRNAs) work in practice models ranging from full scope (independent) to limited scope (dependent). Little is known about the influence of population density on CRNAs’ scope of practice (SOP) and job satisfaction in Arizona, an independent practice state. The objectives were to examine relationships between (1) SOP and population density and (2) job satisfaction and SOP. In this descriptive study, an 11-question survey was sent to CRNAs practicing in Arizona. A total of 515 surveys were distributed; 261 responses (50%) were received, and 230 respondents (46%) met inclusion criteria. Spearman rank-order correlation was used to analyze the relationship between SOP and population density and between SOP and job satisfaction. Rank biserial correlation was used to examine association between CRNAs’ SOP and geographic location. More than half the participants were male (54%), and 46% were female (age range, 27-75 years; years’ experience, 1-50 years). Population density had no association with SOP (P=.074). However, SOP and job satisfaction showed a positive correlation (P<.001). These findings suggest that removal of regulatory barriers to CRNAs’ SOP could decrease costs and increase access to care. Autonomy plays a clear role in job satisfaction, which may have implications for recruitment and retention.

Keywords: Anesthesiology, Certified Registered Nurse Anesthetist, independent practice, population density, scope of practice.
ner—the procedures, actions, and processes that a health-care practitioner is permitted to undertake in keeping with the terms of his or her professional license. The operational definition used for this study is the ability of the CRNA to perform independently all the skills required for their job as well as use independent decision making throughout the perioperative period. The SOP is limited to what the law allows in regard to specific education, experience, and specific demonstrated competency. Each jurisdiction has laws, licensing bodies, and regulations that describe requirements for education and training and define SOP. The scope of CRNAs’ practice is regulated by the state in which they are licensed. In Arizona, CRNAs are licensed independent practitioners who can work to the full scope of their licensure and education in any healthcare setting. However, SOP can be limited in any state at the facility level through bylaws and credentialing, specifically when a physician anesthesiologist is involved in patient care. This limitation has been identified as an issue with CRNA job satisfaction.

In 2017, Arizona had a population of 7,016,270 (Figure 1). Its population density was 61.7 persons per square mile. Arizona defines rural as (1) a county with a population below 400,000 persons or fewer than 1,000 persons per square mile according to the most recent US decennial census and (2) a census county division with fewer than 50,000 persons in a county with a population of 400,000 or more persons as determined by the most recent census. The state has 15 counties, 13 of which are defined as rural. As of 2017, there were 52,000 CRNAs in the United States, 515 of them in Arizona. Arizona is an independent practice state with no restrictions on CRNA SOP. Although CRNAs in Arizona enjoy full practice when not associated with a physician anesthesiologist involved in each patient’s care, it is not known how population density may influence CRNAs’ SOP or if job satisfaction is influenced by their SOP.

**Materials and Methods**

The purpose of this descriptive study was to examine the SOP of CRNAs based on population density and physician anesthesiologist involvement in practice in Arizona.
The objectives were twofold: (1) to examine CRNAs’ SOP in relation to population density and (2) to examine CRNAs’ job satisfaction in relation to their SOP.

• Setting and Participants. This study was performed by sending an electronic survey to all licensed and practicing CRNAs in the State of Arizona via email. Approval of the study was obtained from the institutional review board at the University of Alabama, where the author received his doctorate.

CRNAs currently practicing and residing in Arizona were eligible to participate in this study. Those who were retired, not living in the state, or currently not working as a CRNA were excluded. No compensation was provided to the participants. Email addresses were obtained from the Arizona Association of Nurse Anesthetists (AZANA). Qualtrics (Qualtrics), a health information protected software program, was used to send the survey via email to potential participants. It blinded each response to any identifying information.

• Procedure. An 11-question survey was developed and validated by 3 independent experts in the field of anesthesia and CRNA practice. The survey was entered into the Qualtrics software. The 515 email addresses obtained from the AZANA were entered into the software. The survey was deployed in August 2018 over a 30-day period. Reminder emails were sent every 7 days until the survey officially closed. Participants were required to provide written consent to participate before being able to continue with the survey as well as affirm that they lived and practiced in Arizona.

Demographic variables such as age, gender, years in practice, and practice ZIP code were obtained from each participant. Additional information included physician anesthesiologist involvement in practice, obstetric anesthesia practice, patient acuity in practice, and job satisfaction rating using a Likert scale. Involvement of physician anesthesiologists in practice was compared with population density, which was determined by calculating total population in a ZIP code recorded in the survey, then dividing it by the total square miles in that ZIP code. The mean (SD) population density (2,730.65 [2,393.85]) was then compared with the SOP recorded in those ZIP codes. Job satisfaction was also compared with involvement of physician anesthesiologists in practice to examine the influence, if any, on SOP.

• Data Analysis. Bivariate correlation analyses were used to examine the association between each set of variables to meet the objectives. To examine the association between CRNAs’ SOP and population density, the author calculated the Spearman rank-order correlation to determine the strength and direction of the relationship between 2 variables. The author chose the Spearman $\rho$ over the Pearson correlation coefficient because one of the variables was an ordinal-level measurement. To examine the association between SOP and geographic location, the author calculated a rank biserial correlation. Finally, the author chose an additional Spearman $\rho$ to analyze the association between the ordinal-level variables of CRNAs’ SOP and their level of job satisfaction. Before the analyses were conducted, the assumption of normality (using a Kolmogorov-Smirnov test), no extreme outliers (using a boxplot), and monotonic relationship (using a scatterplot) was conducted to ensure that there were no major assumption violations.

For all analyses, a $P$ value of .05 was set to determine statistical significance. Coefficients were reported for each analysis. Where appropriate, Cohen's conventions were used to guide interpretation of effect sizes, where

<table>
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<th>Characteristic</th>
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<th>Urban (n=145)</th>
<th>Rural (n=85)</th>
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<td>45.20 (11.27)</td>
<td>45.28 (10.71)</td>
<td>.96</td>
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<tr>
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<td>11.82 (11.61)</td>
<td>12.39 (9.80)</td>
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<td>97 (66.9)</td>
<td>68 (81.47)</td>
<td>.03</td>
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</tbody>
</table>

Table 1. Characteristics of CRNAs Participating in Survey
Abbreviations: CRNA, Certified Registered Nurse Anesthetist.

* Significant.
0.10 to 0.29 indicated a small relationship, 0.30 to 0.49 indicated a medium relationship, and 0.50 to 1.0 indicated a large relationship.

Results
The author distributed 515 surveys via email and received 261 responses (preliminary response rate, 51%). Four recipients declined participation, 18 either did not live or did not practice in Arizona, and 9 did not finish the survey (Table 1). Thus, the final response rate was 46% (230 of 497 eligible participants).

- **CRNA Characteristics in Arizona.** The sample consisted of 105 men (46%) and 125 women (54%), ranging in age from 27 to 75 years, with a mean (SD) age of 45.23 (11.04) years (see Table 1). Their years of experience ranged from 1 to 50 (mean [SD]=12.03 [10.99]). Sixty-two percent of respondents had a full SOP, and 38% did not due to artificial limitations imposed when working with physician anesthesiologists. One-third of those who did not have a full SOP in their primary practice worked part time in practices where they had a full SOP.

- Population density was coded in terms of geographic area (urban or rural) to further explain the sample. The definition of urban mirrored the US Census Bureau definition as areas with more than 1,000 persons per square mile; accordingly, areas with fewer than 1,000 persons per square mile were coded as rural. Thirty-seven percent (n=85) of CRNAs worked in rural areas, and 63% (n=145) worked in urban areas. Chi-square analyses, independent sample t tests, and Mann-Whitney U tests were conducted to examine if differences existed between CRNAs in urban and rural locations (see Table 1). There were no differences found in regard to gender, age, or years of experience. The author did find differences in regard to type of patient served. The patient’s ASA physical status score is based on the patient’s preexisting conditions and indicates anesthesia risk. The survey results indicate that rural CRNAs serve more patients with a physical status score of 4 than do CRNAs practicing in urban areas. The results also indicate that urban CRNAs serve more emergency patients, although neither of these differences was significant.

Overall, the CRNAs who participated in this study took care of every level of patient acuity and emergency cases. One hundred sixty-five respondents (71.7%) provided anesthesia care during emergency surgical procedures. Across all practice models, CRNAs provided anesthesia support during obstetric services such as cesarean delivery and labor epidural anesthesia 48.2% of the time compared with 52.7% for those working independently.

- **CRNA Scope of Practice and Population Density.** Results of the first correlation analysis revealed no association between the CRNAs’ geographic location or population density and their SOP (P=.074; Table 2). Survey responses indicated that 41% (n=95) of CRNAs did not work with physician anesthesiologists, 21% (n=47) had one who was available for consult but not involved in cases, and 38% (n=88) had one involved in every case.

- **CRNA Scope of Practice and Job Satisfaction.** Participants were asked to rate their job satisfaction from highly satisfied (5) to highly dissatisfied (1): 44% (n=102) were highly satisfied, 43% (n=98) were satisfied, 8% (n=18) were neither satisfied nor dissatisfied, 4% (n=8) were dissatisfied, and 2% (n=4) were highly dissatisfied (see Table 2). Results of the second bivariate correlation analysis (Spearman ρ) indicated a moderate to large positive association between CRNAs’ SOP and job satisfaction level (P<.001). As the CRNAs’ mean (SD) SOP increased (2.03 [0.89]), their level of satisfaction increased (4.88 [0.80]). Scope of practice explained 26.9% of the variance in the CRNAs’ job satisfaction.

Discussion
- **Scope of Practice/Autonomy.** To the author’s knowledge, this is the first study to examine the influence of population density on SOP and job satisfaction for CRNAs in...
Arizona. Scope of practice is a multifactorial concept that is complicated to define and measure but is often directly related to physician control.\textsuperscript{27} Scope of practice is not only related to a practitioner’s clinical capability from a licensure perspective but also can be affected by regulatory, statutory, and facility limitations. The requirement

\begin{figure}
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\includegraphics[width=\textwidth]{figure2}
\caption{Arizona CRNA Practice Models, Percentage}
\end{figure}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure3}
\caption{Percentage of Arizona CRNAs Who Work Full Time With Physician Anesthesiologists}
\end{figure}
for involvement of a supervising practitioner, in this case, a physician anesthesiologist, is associated with decreased SOP. In 40 states (including Arizona), nursing and medical licensing laws and regulations do not require physician supervision of CRNAs. It is well established that CRNAs are consistently the sole providers of anesthesia services in low-income, small-population-density areas. The current population density analysis revealed no association between CRNAs' geographic location and SOP (P=.074). Moreover, the author found no association between geographic location and satisfaction level (P=.063). Liao et al identified limited SOP in urban areas with a greater concentration of physician anesthesiologists. Other investigators demonstrated that 88% of CRNAs work in limited SOP models with physician anesthesiologists. This study author found that, in Arizona, only 38.5% of CRNAs work in similar models (Figure 2). Additionally, 37.7% of those working in restrictive models had other working arrangements in which they did not work with physician anesthesiologists at all (Figure 3).

The data from this survey indicate that, in Arizona, population density had no significant impact on SOP. This finding correlates with the finding that 61% of CRNAs in the state either do not work with physician anesthesiologists or do so in a limited manner. This observation helps to explain the variance between the national data indicating that 88% of CRNAs work with physician anesthesiologists in every case and the Arizona data demonstrating that population density has only minor significance on SOP.

- **Job Satisfaction.** Job satisfaction is the feeling of pleasure and achievement that one experiences in his or her job when the individual knows that the work is worth doing, or the degree to which one’s work gives an individual this feeling. Job satisfaction is a multifaceted concept, as individuals weigh contributing factors differently, such as the nature of their work as well as the influence of coworkers, supervisors, location, and remuneration. Previous studies found a mean job satisfaction rate for CRNAs ranging from 88% to 93%. Throughout the literature reviewed, one of the primary indicators of job satisfaction was SOP along with others such as location, pay, benefits, and treatment in the facility. In one AANA member survey, 21% of CRNAs cited SOP as a primary issue.

In this new survey of job satisfaction, the author found a moderate to large positive correlation between CRNAs' SOP related to physician anesthesiologists' involvement and job satisfaction level (P<.001). As CRNAs' SOP increased, their level of satisfaction increased significantly. The survey data indicate that CRNA job satisfaction relies heavily on their SOP. This single variable accounted for 26.9% of the variance in the CRNAs' job satisfaction. The author found no association between CRNAs' geographic location and job satisfaction level (P=.063), correlating with the finding that CRNAs in Arizona did not have a difference in SOP based on population density and that SOP was the primary indicator of job satisfaction. CRNAs have a full SOP everywhere in Arizona, and those who do have the greatest job satisfaction. Others studies also identified SOP as a significant indicator of job satisfaction and point to its influence on recruitment and retention.

- **Nurse Practitioner Data.** Scope of practice has been found to influence job satisfaction for NPs as well. A large amount of NP data demonstrates a direct link between job satisfaction and SOP. Han et al found that one of the highest scoring intrinsic factors contributing to job satisfaction was SOP. Other research groups found it was the element most significantly associated with NP job satisfaction. Hagan and Curtis also found it to be one of the primary factors in NP retention along with salary. Dunaway and Running demonstrated that Arizona, as a full SOP state for NPs, had higher satisfaction rates than restrictive states such as Nevada. Lyden et al analyzed 44 scale items individually and found that the item identified as most satisfying was SOP. They also found that NPs opened a practice primarily for SOP and because of practice restrictions. Athey and associates concluded that the removal of barriers at the policy and institutional levels, such as restrictive state laws and practice environments, to allow full SOP for NPs increases job satisfaction and increases access to care.

Multiple studies have shown an increase in both SOP and job satisfaction for NPs in rural areas. Recruitment and retention of NPs are strongly influenced by job satisfaction; autonomy has consistently been their best predictor. Sung-Heui found that rural NPs believed they performed to full SOP more often than NPs working in urban communities. Spetz et al reported that rural NPs were more likely to work in states with full SOP without supervision requirements. They also found that rural NPs worked to full SOP and were significantly less likely to leave that practice area, even though they often had higher patient volumes. Xue et al found that full SOP is directly associated with higher availability of NPs in rural areas.

The published NP data have some variation from the CRNA data reported in this study. The NP data show a significant correlation between SOP and rural areas, whereas the CRNA data from Arizona found a very small correlation between population density and SOP. It is also important to note that depending on the state, NPs may be required to bill “incident to” a physician and/or have a supervision or collaborative agreement. Although this is not required for NPs in Arizona, it is relevant to note the difference in their practice vs CRNAs.

- **Limitations.** This study was limited to Arizona and therefore regionalizes the dataset and the findings. The
survey methods also had limitations, as the findings represent a snapshot in time and do not demonstrate trends (unless ≥2 surveys are done at different times). Although the author made every effort to present the questions as clearly as possible, certain answer options might have been interpreted differently by respondents. Last, surveys rely on respondents to provide accurate and honest answers without the investigators having the ability to verify their accuracy or truthfulness. The tool was developed and reviewed by 3 doctoral-level experts in the anesthesia field. Although every effort was taken to generate a survey that was unbiased and generalizable, it was impossible to have a validated survey since no similar ones have been created. This, in and of itself, is a limitation.

Regarding the objectives, although other studies have demonstrated SOP/autonomy was a primary indicator of job satisfaction both for CRNAs and NPs, it is important to note that a multitude of factors can be very individualized (eg, age, experience, gender, location, benefits). These variables were not measured during this study, because the focus was on SOP/autonomy. Pertaining to the objective regarding SOP in relation to population density, this study relied on the 2010 US census data, the only complete dataset available at the time of the study. The population has likely changed in the years since that census, which could affect the outcome in an unpredictable manner. Additionally, the study focused on population density related to ZIP code, which appears to be the only study to do so.

**Implications.** Each state is likely to have factors that affect both objectives of the current study. Factors such as state laws, facility policies, and practice restrictions influence SOP and job satisfaction regardless of geographic location. One example is the difference between the percentages of CRNAs working with physician anesthesiologists in every case (88% nationally and 38% in Arizona).9 This observation might suggest that CRNAs who want to work independently are drawn to Arizona more than to other states or that the regulatory environment in Arizona is more conducive to this type of practice. Based on the significance of SOP on job satisfaction found in this and other studies, these results could be of assistance to employers for recruitment and retention of CRNAs. These findings present an opportunity for further study on the impact of these variables on both SOP and job satisfaction. Additionally, this study could be deployed nationally to determine results for each state in terms of the influence of population density on SOP and job satisfaction. Future studies could also analyze the impact of experience, gender, and age on CRNAs’ SOP in Arizona.

The implications of this study are farther reaching than CRNA practice in Arizona. They reinforce the need for other states to follow the National Academy of Medicine report15 and remove regulatory barriers to full SOP for advanced practice nurses, including CRNAs. As bending the cost curve of healthcare continues to be a priority, as the population continues to grow and age, and as access to care continues to be a problem, limiting the SOP of CRNAs will only exacerbate these issues.46,47 With job satisfaction tied to SOP, CRNAs will be attracted to and stay in states where they feel the SOP is least restricted. Conversely, it is likely that CRNAs will leave states and facilities that are most restrictive by requiring CRNAs to be supervised by a physician and limiting their SOP. This is a critical issue for patients needing care; it is also an issue for employers trying to recruit CRNAs to restrictive states. Employers’ costs are passed on to patients, hospitals, and taxpayers in the form of higher bills and premiums. Costs such as recruitment/retention bonuses, salary, and benefits will likely escalate to attract providers who may not stay at the end of their contracts, resulting in an expensive, cyclical shortage problem. Although this article did not study cost containment, further research should be done to determine if removing barriers to full SOP may help lower costs and increase access to care. Considering the 150-year history of anesthesia service and the robust evidence documenting the safety and cost-effectiveness of care provided by CRNAs, one can only speculate why some states continue to restrict CRNAs’ SOP.3-5,6-9,13,14,28,48

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