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TECHNICAL
REPORT

An Analysis of the Labor Markets for Anesthesiology

Lindsay Daugherty, Raquel Fonseca,
Krishna B. Kumar, Pierre-Carl Michaud

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Executive Summary

Anesthesiology is an important specialty within medicine and nursing. Several groups of highly skilled professionals are involved in the provision of anesthesia services in the United States. There are around 40,000 Anesthesiologists (ANs) and anesthesiology residents and 39,000 licensed Certified Registered Nurse Anesthetists (CRNAs) and student CRNAs in the United States, and they provide most anesthesiology services. Labor markets for highly skilled professionals, such as those for anesthesia professionals, can be very "thin," both because of natural limitations in the aptitude and ability in the population to undergo the rigorous study and training needed for practicing and because of the regulation of the supply of these professionals. These labor markets may not follow the precepts of "competitive" labor markets, in which wages are flexible enough to result in an equilibrium in which supply equals demand. In these markets, shortages or surpluses can occur. Shortages in this critical area of health care can lead to problems in the provision of health services.

In this report, we summarize a study we have conducted on the labor markets for ANs and CRNAs. The research questions that guide our study are as follows:

- What are characteristics of the AN and CRNA labor markets—their demographics, employment arrangements, compensation, and usage of time?
- How do these characteristics differ by geography and facility?
- What are their perceptions of and preferences for anesthesia technologies, and how do these depend on the above characteristics?
- Are these labor markets characterized by shortage or surplus?

Summary of Methodology

In our surveys, conducted in 2007, we gathered information about ANs and CRNAs on demographics, general employment (including compensation), time usage, preference for technology, and future plans. Questionnaires for these two surveys were developed in collaboration with the respective professional organizations, the American Society of Anesthesiologists (ASA) and the American Association for Nurse Anesthetists (AANA). These societies also generously made available their membership who could be reached electronically and requested to participate in the survey. While the ANs and CRNAs could be relied on to provide individually relevant data, they might be unable to provide data relevant for the entire facility or group with which they were affiliated. In order to gather information at this level—e.g., remuneration level, total number of procedures per day, number of ANs and CRNAs required per day,

waiting times—we surveyed directors of anesthesiology (ANDIRs). Unlike ANs and CRNAs, ANDIRs do not have a professional association on which to rely for contact information. Therefore, we relied on a stratified random sample we purchased from a vendor. Finally, since surgeons are typically the direct users of anesthesia services, we surveyed them to get broad details on AN and CRNA usage.

We use the data from these surveys to first characterize the AN and CRNA labor markets by demography, facilities, earnings, time usage, and preference for technology, focusing in particular on the regional heterogeneity that exists in these characteristics. In doing this, we go beyond summarizing statistics of the survey responses. We conduct statistical analysis to disentangle the source of heterogeneity—for instance, to examine whether the observed geographical variation is driven by the concentration of larger facilities in certain regions.

We then turn our attention to analyzing whether the AN and CRNA labor markets are characterized by shortage or surplus. We use three approaches of increasing completeness and complexity for this purpose:

- The surveys included several workforce-related questions, including the number of open positions, the need for extra professionals to handle the current volume of cases, and whether the provider's practice could handle more cases if additional staff could be hired. We use the responses to these questions to assess the existence and extent of shortage or surplus. While we use statistical techniques to validate responses (for instance, to examine whether ANs and CRNAs perceive similar shortages) and address confounding factors (for instance, to explore whether delays in procedures result from shortages of professionals or inefficiencies in scheduling), this approach can at best be used in conjunction with other methods to assess the state of the labor market. Shortage or surplus is an aggregate phenomenon, and individual responses go only so far in shedding light on it or in capturing the multiple dimensions of labor markets.
- We conduct a demand-based analysis (DBA), the most commonly employed method in workforce analysis, which is sometimes referred to as *noneconomic analysis* (see Lane and Gohmann, 1995). We sum up the supply of full-time equivalent (FTE) workers present in a particular state using national averages of clinical hours worked, which we gathered from our surveys (49 hours per week for ANs and 37 for CRNAs). We then calculate the demand based on the actual volume of services provided, which is then reexpressed in terms of FTEs using time taken per unit of service (e.g., procedure, patient), again based on national averages. While, nationally, these two quantities would have to be equal, within a state, demand could exceed supply, in which case there is a shortage; if supply exceeds demand, then there is a surplus. There is substantial variation in outcomes across states. Furthermore, the unit of variation in regulations regarding residency, education, licensing, and reimbursement mechanisms is the state. We therefore conduct our analysis at the state level, which appears to be the appropriate unit of analysis. If instead of using actual hours worked from our surveys, we use an arbitrarily fixed workweek (for instance, 40 hours per week, as used in other studies), then, even nationally, supply will not equal demand. However, as we discuss in Appendix H, the conclusion of a shortage or surplus is highly sensitive to the assumption used for the fixed workweek.
- Finally, we use an econometric (economic) analysis to estimate statewide supply and demand and, hence, shortage or surplus. Whereas the DBA approach ignores wages and relies only on the quantity of labor to draw inferences on shortage/surplus, the eco-

nomic approach relies on estimating the relationship between demand/supply and wages. Economic theory suggests that labor supply increases with wages while labor demand decreases with wages. In this view, a change in wages induces a behavioral response on the part of working professionals and their employers that noneconomic approaches, such as DBA, cannot capture. If wages fully adjust, the market will be in equilibrium—that is, supply will equal demand. However, as we discuss in greater detail in Chapters Two and Four, a disequilibrium model, in which rigidity of wages causes excess demand (shortage) or excess supply (surplus), might be more suitable to analyze the anesthesiology labor markets. We estimate such a model to infer shortage/surplus by state. This approach makes the most complete use of information available on wages and other factors that vary by state and could influence supply or demand (e.g., percentage of population over 65, health maintenance organization [HMO] penetration, capacity of medical facilities). Given this way of distinguishing supply from demand, the model is capable of providing estimates of shortage/surplus not only at the state level but also at the national level.

These three approaches have their own strengths and drawbacks, but each contributes to our understanding of how the labor markets for anesthesia providers function, and, together, they provide a range of estimates, which can be used to gauge the robustness of our conclusions. If we lean toward the economic approach, it is due to its more extensive use of information—for instance, on wages and institutions—than the noneconomic approach.

Summary of Results

Survey Findings

The surveys, conducted in 2007, were a rich source of information on various aspects of the CRNA and AN labor markets. We found that there is a great deal of heterogeneity in work arrangements for both types of professionals. Only around 40 percent of CRNAs and ANs are employed by a single group, and 40 percent by a single facility or hospital.[1] The rest work for multiple groups or facilities or are locum tenens.[2] ANs work more hours and make about twice as much as CRNAs. ANs spend a greater percentage of their time on general anesthesia, while CRNAs spend more time than ANs do on monitored anesthesia care (MAC).

There are clear urban/rural differences in the labor markets for anesthesiology. CRNAs and ANs are more likely to be employed by a facility in rural areas and, as we would expect, tend to work in smaller facilities. Rural facilities are more likely to employ CRNAs and less likely to employ ANs. CRNAs and ANs tend to work separately more often in rural areas than in urban ones as well. Both ANs and CRNAs make more money in rural areas, and rural CRNAs also work longer hours. Urban ANs and CRNAs spend more time on general anesthesia and less time on other types of anesthesia.

There are even more-pronounced *regional* differences in the practice of anesthesiology. In the Western United States, facilities in which ANs and CRNAs operate are generally smaller than facilities in other parts of the country, and many of those facilities do not use CRNAs.

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[1] *Groups* refers to physician or CRNA group practices and hospitals, and *facilities* includes university and nonuniversity hospitals, academic medical centers, ambulatory surgical centers, and office suites.

[2] A practitioner who temporarily takes the place of another.

ANs in the West are most likely to be employed by groups, while CRNAs in the West are least likely to be employed by groups. In this region, CRNAs and ANs tend to work separately from one another, and interactions between them are less frequent than in other regions. Where CRNAs work in the West, they tend to spend a relatively large percentage of their time in regional/spinal and obstetrical anesthesia compared to their counterparts in the rest of the country. Western CRNAs earn the most, while Western ANs earn the least.

The situation looks quite different in the Northeast. There, ANs and CRNAs tend to work in larger facilities than they do in the West. They are typically used in the same facilities and work more often on the same procedures. CRNAs in the Northeast spend more time in procedures, and a larger fraction of AN and CRNA procedures involve MAC. When we examine specific procedures, including colonoscopies and electrophysiology study (EPS) labs, preference for anesthesia providers over non–anesthesia providers is higher in the Northeast than in other regions. Northeastern CRNAs and ANs tend to work fewer hours and generally earn less than their colleagues in other parts of the country.

We also used our surveys to gather information on the technology preferences of anesthesia providers. Technology could be developed and used in anesthesiology to potentially ease any labor shortages; it is therefore important to understand how anesthesia providers feel about increased use of technology. Interestingly, we find that a majority of ANs and CRNAs across the country tend to prefer the adoption of more technology. CRNAs and ANs are most likely to prefer better technology in general anesthesia. ANs are less likely than CRNAs to want better technology for MAC and more likely than CRNAs to prefer better regional/spinal anesthesia technology. CRNAs and ANs are most likely to prefer better technology in patient monitoring and drug delivery over anesthesia machines and respirators/ventilators.

Again, we find geographical differences. Those in the Midwest are consistently less likely to prefer more technology than are those in the Northeast. However, the largest geographical differences are not in whether more technology was preferred but in which type of technology is preferred. Urban CRNAs are more likely to want better technology for anesthesia machines and patient monitoring, and urban ANs are more likely to want better technology for patient monitoring. Western CRNAs and ANs are also less likely to want more monitored anesthesia technology.

Analysis of Labor-Market Shortage/Surplus

As mentioned earlier, we use three methods to assess shortage/surplus in the labor market for anesthesia providers. Our survey-based approach, in which we directly questioned ANs, CRNAs, ANDIRs, and surgeons on various dimensions of shortage or surplus, yields a few interesting results. We find that a large number of ANs (47.4 percent) report that their "employer needs more ANs to meet current demand," and an even larger number of CRNAs report that their "employer needs more CRNAs to meet current demand" (79.1 percent). ANDIRs are also more likely than ANs to report needing more CRNAs to meet demand (29.1 percent versus 22.2 percent).

There is a statistically significant relationship between a CRNA or an AN reporting that there are "any open positions" in their primary employment arrangement and that their "employer needs more CRNAs/ANs to meet current demand." We find that CRNAs and ANs in the Northeast are significantly more likely to report open positions, particularly relative to the West, and CRNAs and ANs in urban areas are also significantly more likely to report open positions than are those in rural areas. The greatest evidence for a shortage of anesthesia pro-

viders is in the Northeast and in urban areas. Northeastern and urban CRNAs and ANs are most likely to report that their employer could handle more cases if they had more CRNAs/ANs. Interestingly, we find that urban CRNAs have not increased hours worked, despite indications of shortage.

This survey evidence is more suggestive than conclusive, which is the reason we conduct both a DBA and an economic analysis to further investigate shortages in these labor markets.

As mentioned already, in DBA, when we use the average clinical workweek gathered from our surveys to define FTE (49 hours for ANs and 37 for CRNAs) and our method for identifying supply and demand, we find that the national labor markets are (roughly) in equilibrium. However, there is wide variation in state-level estimates. We find that 25 states for ANs, and 19 for CRNAs, are in shortage. For ANs, the estimates range from a 36-percent surplus in Washington, D.C., to a shortage of 82 percent in Alabama. In absolute numbers, Florida, Alabama, and North Carolina exhibit the most shortage, and California, New York, and Massachusetts the most surplus. For CRNAs, the estimates range from a 38-percent surplus in South Dakota to a shortage of nearly the same percentage in Iowa. In terms of absolute numbers, Pennsylvania, Michigan, and Florida exhibit the most shortage, and Minnesota, North Carolina, and California the most surplus.

According to the economic approach, the current supply of ANs (FTE) would have to increase by 3,800 to meet U.S. demand, and the current supply of CRNAs (FTE) would have to increase by 1,282 to meet U.S. demand. We find that more than 54 percent of the states are experiencing a shortage of ANs, and more than 60 percent a shortage of CRNAs. Again, there are sizable variations across states. Delaware is seen to have a surplus of ANs of more than 26 percent, while Idaho has a shortage of more than 46 percent. Nevada has a surplus of CRNAs exceeding 53 percent, while New York has a shortage of nearly 28 percent.

The DBA and economic analysis agree in classifying states as experiencing shortage or surplus in only 44 percent of the cases for ANs, and in 52 percent of the states for CRNAs. States with high wages and income are more likely to be classified as facing shortage in the economic approach than in the noneconomic approach, presumably because the latter does not use any information other than the amount of labor. The survey-based approach of estimating shortage correlates well with the economic approach. Given its more complete use of available information, the economic approach might be more relevant for evaluating these labor markets.

The overall conclusion is that shortage of ANs and CRNAs is highly likely at the national level, with the survey approach providing hints of such a shortage and the economic analysis providing stronger confirmation.

Finally, to shed light on how the anesthesiology labor markets might evolve in the future, we use a simple linear projection of supply and demand to examine the evolution of both labor markets until 2020, starting at equilibrium. Using the clinical week averages from our surveys, average entry and exit rates from the recent past for both groups, and a growth rate in the demand for surgeries of around 1.6 percent between 1985 and 2004, we find a projected shortage of ANs by 2020, and an excess supply of CRNAs. However, there are scenarios in the entire range of parameter values we examine in which these situations reverse. These projections simply extrapolate the past and do not account for any changes in the future that might cause future trends to be different, such as changes in the rate of entry or exit from the profession, change in work practices, or an unexpected change in demand for anesthesia services.