

Results of the 2019 Survey on Perceptions of Vacancy and Turnover Among Perfusionists in the United States

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Abstract: A large number of recent publications and presentations have focused on impending workforce issues that surround the field of perfusion. Vacancy and turnover rates, which provide a picture of the current workforce status and serve as a benchmark for comparison with past and future equilibrium, have not been examined. The purpose of the 2019 Vacancy and Turnover study was to identify current staffing trends among a cohort of perfusionists in the United States, as well as the factors affecting these trends. A vacancy and turnover survey was conducted during January and February of 2019. The survey required participants to answer several questions designed to determine vacancy and turnover during the prior 1-year period. Questions related to the vacancy and turnover rates of perfusionists were reported with

descriptive statistics, including the means, medians, standard deviations, and range of scores. The study collected 502 responses, of which 484 met all inclusion criteria. Vacancy and turnover rates were analyzed by state, region, employer type, group size, and salary range. In summary, the vacancy rate for all perfusion groups in this survey was 12.3%, with a turnover rate of 14.7%. This investigation explores differences in vacancy and turnover among different subgroups based on state, region, employer, practice size, and salary range. Data from this study are presented as a guide to assist stakeholders in determining the best course of action with regards to staffing of perfusion services and how to plan for future needs. **Keywords:** perfusion, staffing, vacancy, turnover, workforce. *J Extra Corpor Technol. 2020;52:27–42*

INTRODUCTION

The purpose of the study was to identify current staffing trends among a cohort of perfusionists in the United States, as well as the factors affecting these trends. Current market signals point to a shortage of Certified Clinical Perfusionists (CCPs), but no data exist to quantify the gap. The United States Bureau of Labor Statistics does not track data regarding perfusionists (1). Using American Board of Cardiovascular Perfusion (ABCP) certification as a proxy, there are approximately 4,000 CCPs nationwide. Because of this small number, any changes in supply or demand, however minimal, can create far-reaching effects (2,3).

Data are required so that educational institutions can best meet the needs of patients without oversupplying a small market. Likewise, this data could allow hospitals to tailor their care delivery models and human resource strategies to expected market conditions. The specific problem this investigation was designed to address is the lack of data regarding the need for CCPs to fill vacant positions in the United States.

From 2013 to 2015, discussions about hiring and job opportunities on listservs appeared to increase, although this was anecdotal, and no specific data were available. Beginning in mid-2015, however, the term “shortage” was frequently used in social media postings and published literature. A large perfusion staffing company, Trident Health Resources, Inc., Dunedin, FL, used the term “shortage” to describe the number of CCPs in their published newsletter (no longer available online, but referenced here) (4). A search of PubMed and general internet web pages reveal that this was the first time since the 1980s that the current supply of clinicians in the United States was referred to as a shortage. More recently, published works in peer-reviewed journals began to refer to a shortage in

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perfusionists in the United States. In 2016, a validated, peer-reviewed salary survey was published and referenced a perfusion staffing shortage in many parts of the country (2). Later that same year, the nation's largest perfusion staffing company, Specialty Care, Inc., Nashville, TN, posted an opinion article by a prominent member of the profession. In the editorial, the current staffing situation was referred to as a "severe shortage" (5). In 2017, the ABCP published the results of a workforce survey. Although no data concerning staffing shortages were collected, the authors noted that the needs of the profession, along with changes CCPs are observing in day-to-day operations, require further study (3).

The supply and demand balance of the perfusion workforce is known to be subject to an extensive collection of influencing factors (2,3,6). Although the number of persons entering and leaving the field in a given interval will impact supply, demand is also highly subject to technological advances. In addition, population demographics and disease prevalence, along with workforce demographics, can generate somewhat predictable long-term changes in both supply and demand (7). These factors led the ABCP, in their 2017 report, to summarize that the field of cardiovascular perfusion may act as a constrained resource and that the uniqueness of the specialty, including training requirements, makes it one that is not easy to replicate (3).

In summary, no data exist on the current market status of perfusionists in the United States, outside of demographic surveys. As noted in the 2016 workforce study, no information exists regarding the number of vacant positions or hiring trends in the market (2). As such, several authors recommend this as an area in need of further investigation (2,3).

MATERIALS AND METHODS

A survey was designed with the assistance of subject matter experts, Doctorate of Health Administration faculty, and project committee members. This survey instrument was constructed to gather quantitative data for use in answering the following questions:

1. What are the perceptions of perfusionists in the United States regarding the vacancy and turnover rates in their profession?
2. What are the perceptions of perfusionists regarding factors affecting attrition rates in their profession?
3. What are the perceptions of perfusionists regarding what could be implemented to improve attrition rates in their profession, if this is perceived as an area to be addressed?
4. What are the variables associated with perfusion staffing vacancies and turnover in the United States?

Pilot testing of the survey allowed modification of the instrument so that content and clarity were well established. The project was granted exempt status by the

University of Mississippi Medical Center (UMMC) Institutional Review Board in January of 2019. Validity for questions other than those based on individual perceptions was anchored in standardized definitions of vacancy and turnover as has been established in the literature (8–11).

The survey was created and managed using Research Electronic Data Capture (REDCap) tools hosted at the UMMC. REDCap is a secure, web-based application designed to support data capture for research studies, providing: 1) an intuitive interface for validated data entry, 2) audit trails for tracking data manipulation and export procedures, 3) automated export procedures for seamless data downloads to common statistical packages, and 4) procedures for importing data from external sources (12). The data generated was password-protected and will be stored for 7 years after the conclusion of the project. This electronic, online survey design was chosen because of its low cost, rapid turnaround in data collection, and convenience.

The final survey instrument was distributed electronically to a cross-sectional sample through a variety of methods. A link to the survey was distributed via two professional listservs, Perfmail, hosted by perfusion.com, and Perflist, hosted by The American Society of Extracorporeal Technology (AmSECT), Chicago, IL. The survey link was also shared via the perfusion-centric website, circuitsurfers.com with the approval of the site owners. In addition, a link to the survey was posted online via social media platforms (perfusion.com Facebook page, AmSECT Facebook page, etc.) and online blog/discussion websites (amsect.org discussion forum and perfusion.com discussion forum).

Participation in the survey was strictly voluntary. Data collected through REDCap were sent anonymously to the principal investigator and were password-protected. No personal identifying information was collected from individuals. Information concerning the exact city or perfusion group was purposefully not specified in the survey because it could serve to identify participants.

The target population for the survey was perfusionists practicing in the United States during a 28-day window of January 30 through February 27 of 2019. Inclusion in survey participation was via a non-random convenience sample based on membership in, or access to, the referenced professional communication processes. Participation required self-identification as a practicing perfusionist in the United States, which is generally understood to be those individuals who provide cardiopulmonary bypass (CPB) to patients, during the 28-day survey window. An introduction to the survey included a statement indicating survey participation was voluntary and the decision to proceed constituted informed consent. The first survey question was designed to assure selection of the correct target population. The survey closed automatically if the participant did not answer that they were currently

practicing perfusion in the United States. The participants who answered “no” to this question saw a screen thanking them for participation. They were assigned a participant number, but their answers were not included in the study results.

Data from the completed survey was imported from REDCap into Statistical Package for Social Sciences. The absolute number of respondents was reported. The percentage of respondents who answered each question was also listed to determine response bias. Questions related to the vacancy and turnover rates of perfusionists were reported with descriptive statistics, including the means, medians, standard deviations, and range of scores. Vacancy and turnover rates were calculated by state (for all states with a response), U.S. Census Bureau region, by employer type, by salary range, and by group size. Queries with open-ended answers were categorized according to type and reported using descriptive statistics. Differences between categorical groups by state, region, employer, and size were examined using an analysis of variance (ANOVA). Differences between groups were examined using a least squares difference post hoc test. Significance was set at $p < .05$. Lei Zhang, PhD, MBA, professor of statistics at UMMC School of Nursing, reviewed the statistical methodology for appropriate application.

RESULTS

Demographics

A total of 502 surveys were submitted through the Redcap portal; 484 of the survey responses were complete and met the inclusion criteria. It is estimated that this number represents 10.9% of the target population identified (2,3,13,14). Not all questions were required to be answered. Therefore, all demographic data are presented with the number of participants providing a response to each question.

Figure 1 illustrates the responses for the question regarding primary state of practice. This graph illustrates that the survey respondents came from a geographically diverse pool of locations, with a total of 43 different states identified as the primary state of practice, as well as one U.S. territory. All 484 respondents who met the inclusion criteria provided a response to this question.

Figure 2 illustrates the responses for the survey question regarding employer type. All 484 eligible participants answered this question. This graph illustrates that the survey captured all employer types. The survey responses for employer type here are grossly similar to prior workforce and salary surveys (2,3,14).

Figure 3 illustrates the response for the survey question regarding the number of full-time equivalents (FTEs) in the participants group. This graph illustrates that the reported group size, identified as the number of FTEs, ranged from 1 (solo practitioner) to 37, with 32 different group sizes identified. When examining the group size, additional descriptive statistics were examined. The mean group size was 6.9 (rounded to 7), with a median of 5 and a mode of 3. The standard deviation of reported group size was 6.1, indicating that the majority of perfusionists work in groups of 1 to 13 perfusionists. The mean and median group sizes were skewed higher by a small number of very large group practices. Table 1 is a summary of the descriptive statistics for question 4.

The survey participants were also queried with regards to work status, with 95% indicating they were full-time and 5% indicating they were part-time or PRN. Of the respondents who answered, 37% indicated they were in a chief/director/supervisor role, with 63% indicating they were not.

The survey also had questions relating to annual compensation and the number of hours worked. These questions were included to help create a more robust understanding of the status of vacancies and turnover among perfusionists in the United States, as well as variables that might be associated with increased or decreased vacancies. For queries about the number of hours worked, answers were only recorded from those respondents who indicated they were full-time employees. The responses for annual compensation and number of hours worked are presented here first as a whole, and then categorized by staff and chief/director/supervisor.

Four hundred twenty-three respondents answered the salary question. Of these, 422 indicated they were full-time employees. The categorical results of their salary responses are presented in Figure 4. These data were then separated by staff vs. chief/director/supervisor. Of the 422 full-time respondents, 278 indicated they were not chief/directors/

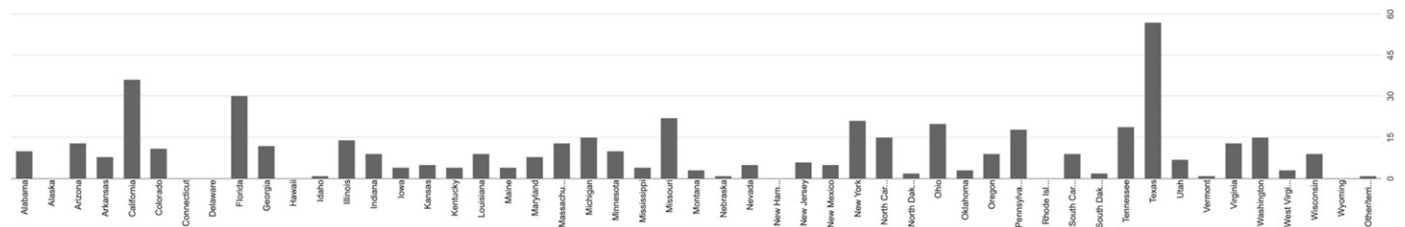


Figure 1. Number of responses by state of practice.

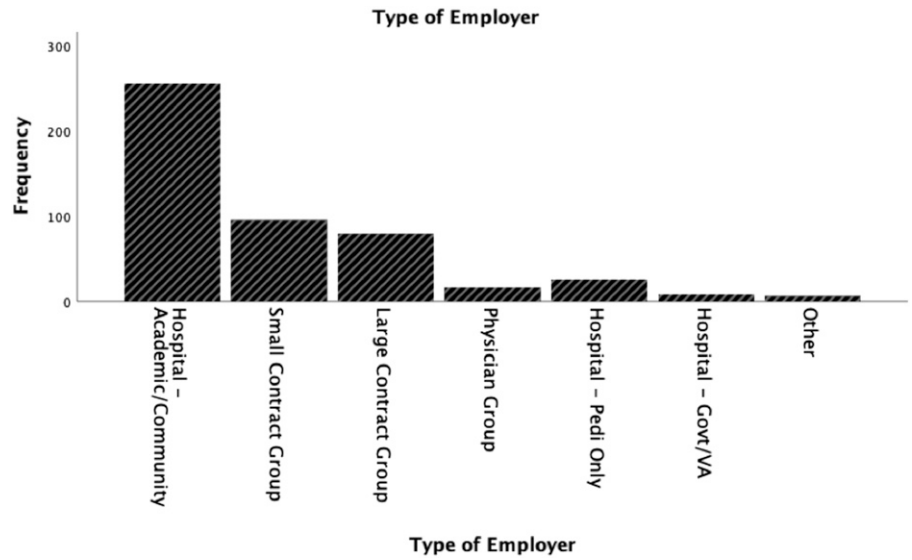


Figure 2. Number of responses by employer type.

supervisors and were grouped together as, and understood to be, staff perfusionists. The responses for this group are presented in Figure 5. The same analysis was undertaken with those respondents who specifically indicated they were chief/director/supervisors. This group included 145 responses. Figure 6 is a graphical representation of these answers and shows a substantial shift toward higher pay for those in this category when compared with staff perfusionists, or the population as an average.

For queries about the number of hours worked, answers were only recorded from those respondents who indicated they were full-time employees. The responses are

presented here first as a whole, then divided by staff and chief/director/supervisor. To make assessments easier and limit data entry error, the participants were allowed to select one answer from eight choices that included 5-hour increments. Of the 458 participants who were full-time employees, 455 answered this question. Figure 7 is a graphical representation of the average number of hours worked per week (for primary employer) for the entire group. Of the 455 who answered the question about the number of hours worked, 292 specifically indicated they were staff perfusionists. These staff perfusionist responses are presented in Figure 8. The remaining 162 respondents

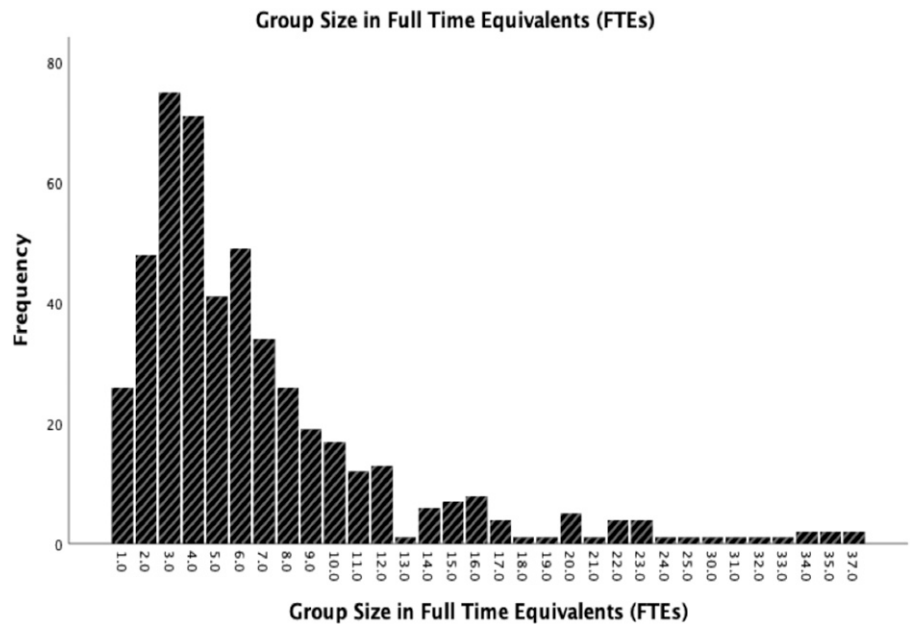


Figure 3. Number of responses by group size in FTEs.

Table 1. Group size in full-time equivalents (FTEs).

	Descriptive Statistics				
	N	Minimum	Maximum	Mean	Standard Deviation
Group size in FTEs	485	1.0	37.0	6.862	6.0732
Valid N (listwise)	485				

answered this question and indicated they were a chief/supervisor/director. Figure 9 is a graphical representation of the answers for chief/supervisor/directors.

Vacancy and Turnover Rates

The survey instrument asked respondents about their perception regarding the current number of vacancies they had within their group, as well as the number of open positions that had been filled in the previous 12 months. When divided by the number of budgeted positions, these variables represent the vacancy and turnover rates, respectively (8–11).

Four hundred eighty-one respondents answered both the questions determining the number of budgeted positions, as well as the number of current vacancies. Of the responses with vacancies, 24 indicated a vacancy rate at or above 100%. After consultation with the doctoral committee and the project statistician, the acceptable upper limit for vacancy rate was set at 87%. Responses with a reported vacancy rate above this number were not included in the analysis for this variable. This left 454 responses for analysis.

The vacancy rate for the sample ranged from zero to 86%. The average vacancy rate was 12.3%, with a standard deviation of 16.5%. The most common vacancy rates reported were zero (229 responses, 48%), 25% (29 responses, 6% of total), 33% (28 responses, 6% of total), and 17% (22 responses, 5% of total).

All 484 respondents answered both the question determining the number of budgeted positions, as well as the number of positions that had been filled during the prior 12 months. Of the responses that had one or more positions filled during the prior 12 months, 24 indicated turnover rates at or in excess of 100%. After consultation with the doctoral committee and the project statistician, the acceptable upper limit for the turnover rate was set at 99%. While turnover rates greater than 100% are possible, it was decided to omit these responses as they generally appeared to indicate the participant did not understand the initial question. Most of these respondents were also omitted in vacancy rate calculations, as they indicated vacancy rates at or equal to 100%. As such, responses with a reported turnover rate above this number were not included in the analysis for this variable.

The turnover rate for the sample ranged from zero to 83%. The average turnover rate was 14.7%, with a standard deviation of 17%. The most commonly recorded turnover rate was zero (194 responses, 41% of total), followed by 33% (38 responses, 8% of total), 25% (34 responses, 7% of total), 17% (27 responses, 6% of total), and 14% (24 responses, 5% of total). The turnover rates were calculated as a continuous variable and as such, a

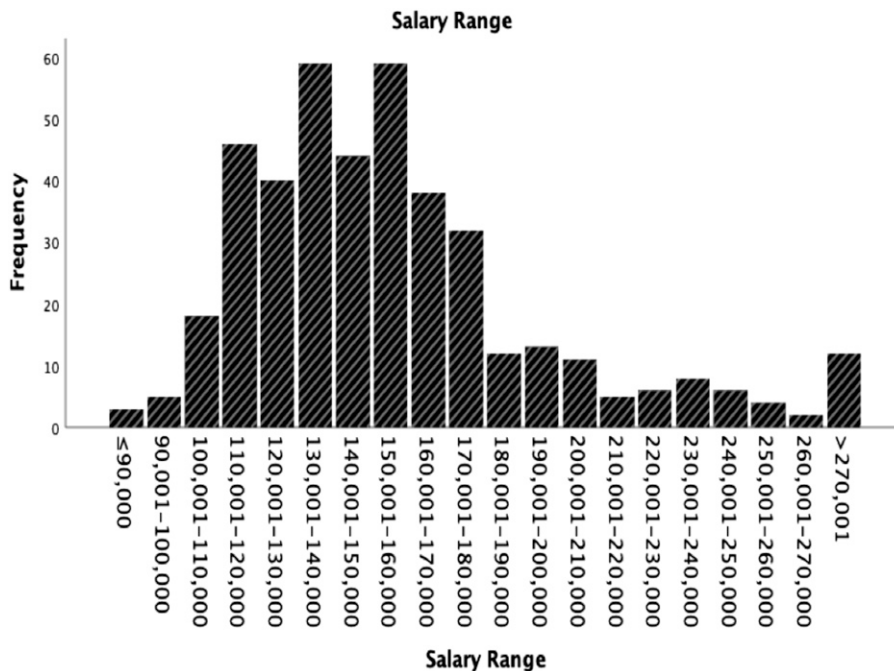
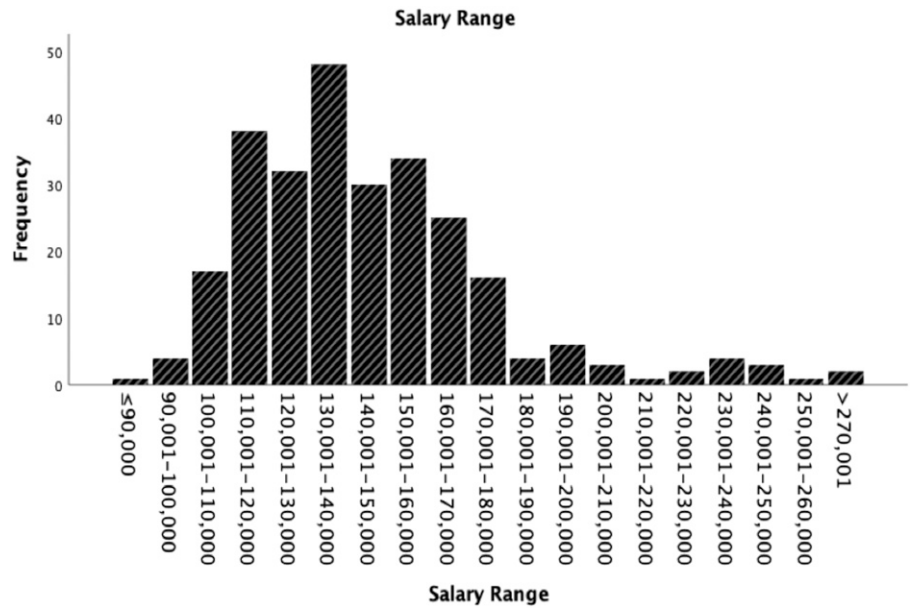


Figure 4. Number of responses by salary category for all respondents who indicated they were full-time employees.

Figure 5. Number of responses by salary category for respondents who indicated they were full-time staff perfusionists.



complete listing of discrete groups of answers is not presented here.

Factors Perceived to Effect Vacancy and Turnover

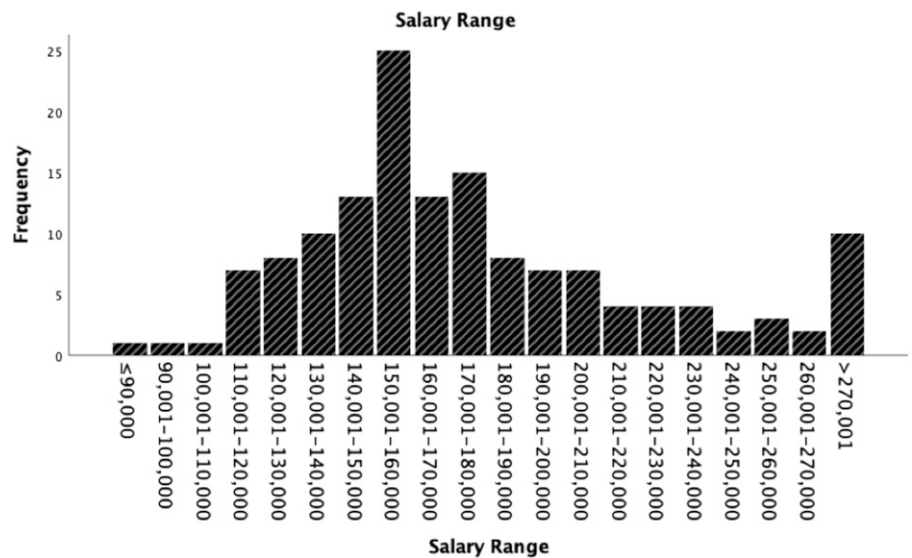
For the 227 respondents who indicated that they had one or more current vacancies with their group, branching logic in the survey led them to a question which asked them to identify the impact a variety of factors had on creating the vacancies. The answers were ranked according to the number of responses that indicated “some impact” or “high impact” for each factor. These results are shown graphically in Figure 10.

Of the 133 respondents who indicated “increased workload” had “some” or “high impact” in creating vacancies within their group, branching logic in the survey led them to a question which asked about the primary source of the expanded workload. One hundred thirty responses to this question were recorded. Figure 11 is a graphical representation of the responses to this query.

Factors Perceived to Decrease Vacancy and Turnover

For respondents who had no current vacancies in their group, branching logic in the survey instrument led them to a question which asked their opinion on the primary reason

Figure 6. Number of responses by salary category for respondents who indicated they were full-time chiefs/directors/supervisors.



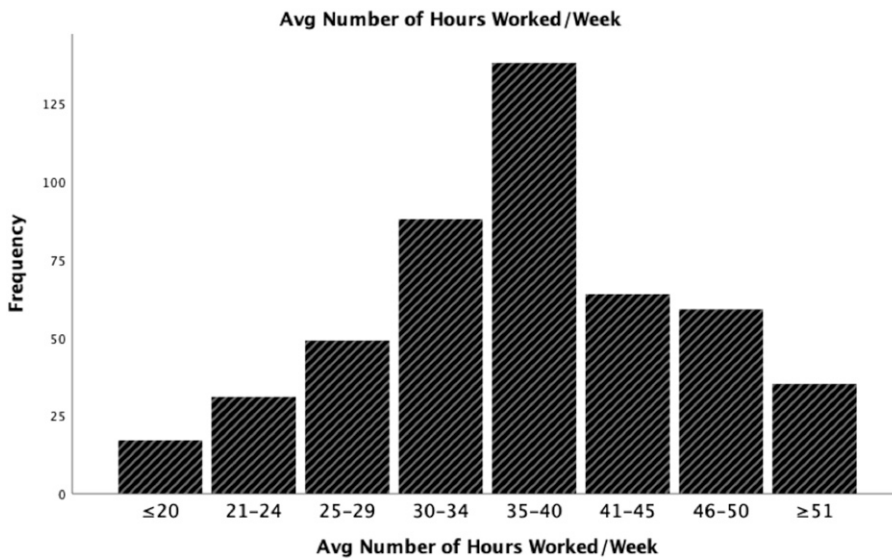


Figure 7. Number of responses by hours worked category for all respondents who indicated they were full-time employees.

they had been able to maintain full staffing. Figure 12 illustrates the responses to this question.

In a closely linked question, all survey participants had an opportunity to answer the question, “In your opinion, what is the best way to decrease the vacancy and turnover rates among perfusionists in the United States?” All 484 participants who met the inclusion criteria answered this question. Figure 13 is a graphical representation of the responses.

Participants were also asked, “In your opinion, what is the best way to keep those who are about to retire in the workforce longer?” As no published references existed for generating answer choices, this question had a free-text

answer. Of the 484 participants in the survey, 414 entered text in the box. The answers were reviewed and counted based on categorical content. Answers which included comments concerning conversions to part-time work, per diem, hourly, flexible schedules, job sharing, and set hours were included in the “flex work” category. Answers which included comments on decreasing, eliminating, or making call optional were included in the “decreased call” category. The “compensation category” included answers that suggested increased salary, healthcare benefits, or paid time off. The “balance category” included comments regarding a supportive work environment, including reasonable work expectations, quality management, and the

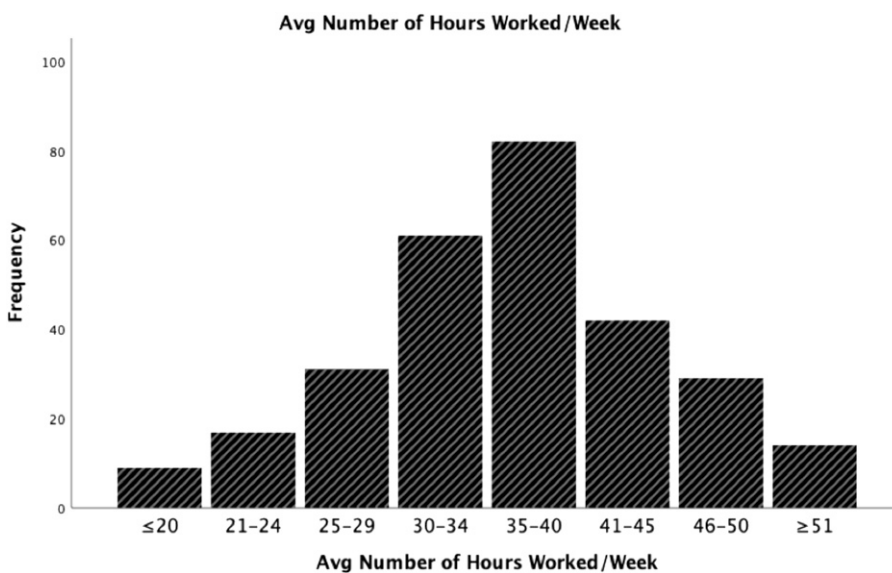
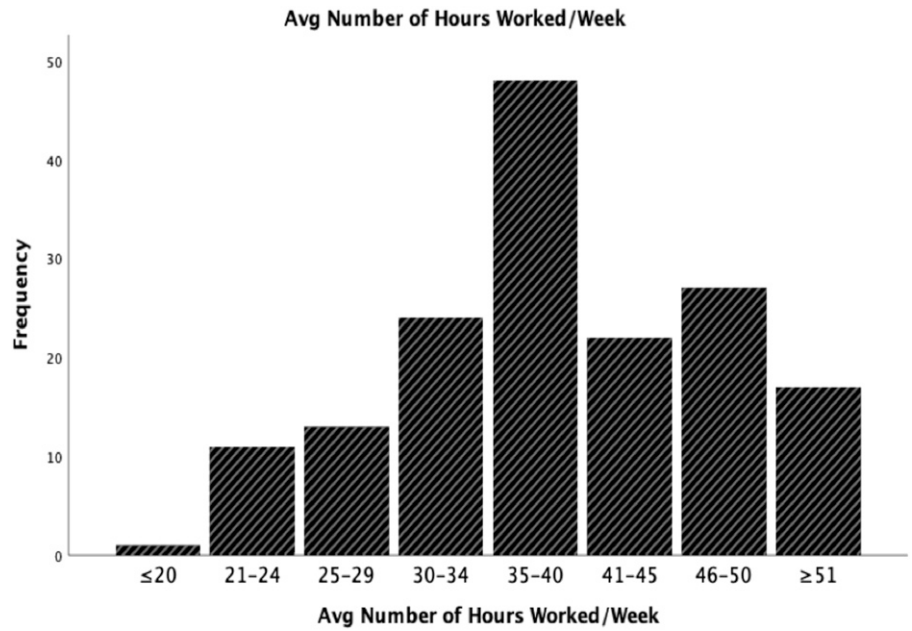


Figure 8. Number of responses by hours worked category for all respondents who indicated they were full-time staff perfusionists.

Figure 9. Number of responses by hours worked category for all respondents who indicated they were full-time chiefs/directors/supervisors.



absence of hostile surgeons/coworkers. Finally, the category of “other” was used to collect answers which were not well defined or mentioned less than five times each. Figure 14 shows the results of the review.

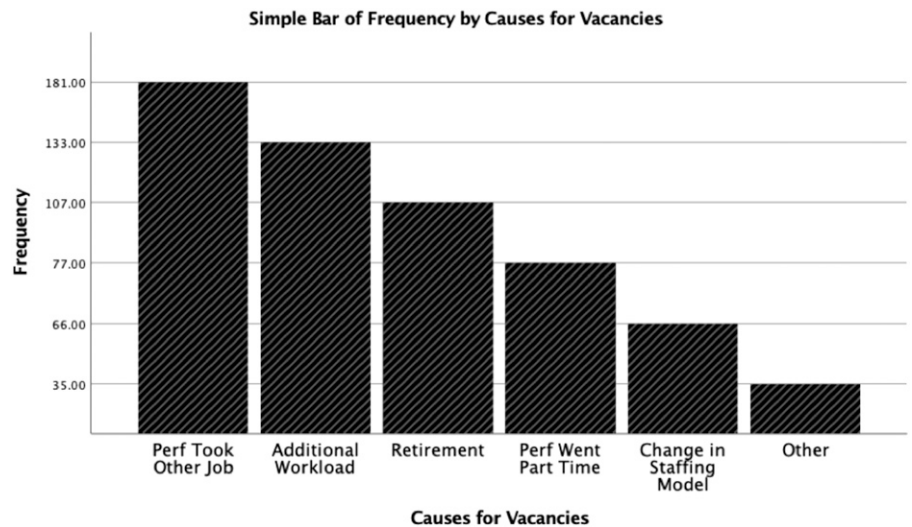
Variables Associated with Vacancies

Subgroup analysis was conducted to explore the vacancy rate in relation to the state of practice, employer type, pay category, and group size. Table 2 shows the vacancy rate by state, and the number of responses for each state for all states which had a response. An ANOVA was conducted to determine if there were differences in the vacancy rates between states. The significance for this analysis was .47,

indicating there were no statistically significant differences identified. Similar to previously published studies, the responses were grouped into the four U.S. Census Bureau data regions (2). After grouping, ANOVA was again conducted, and the *p*-value was found to be .89, indicating there were no statistically significant differences identified after grouping the states by U.S. Census Bureau data regions.

Figure 15 shows the mean vacancy rate by employer type. Further analysis of these results was performed using an ANOVA to determine if there were significant differences between the groups. The significance for this analysis was .01, indicating that significant differences exist. To

Figure 10. Number of responses by category who indicated each cause of vacancy had “some” or “high” impact.



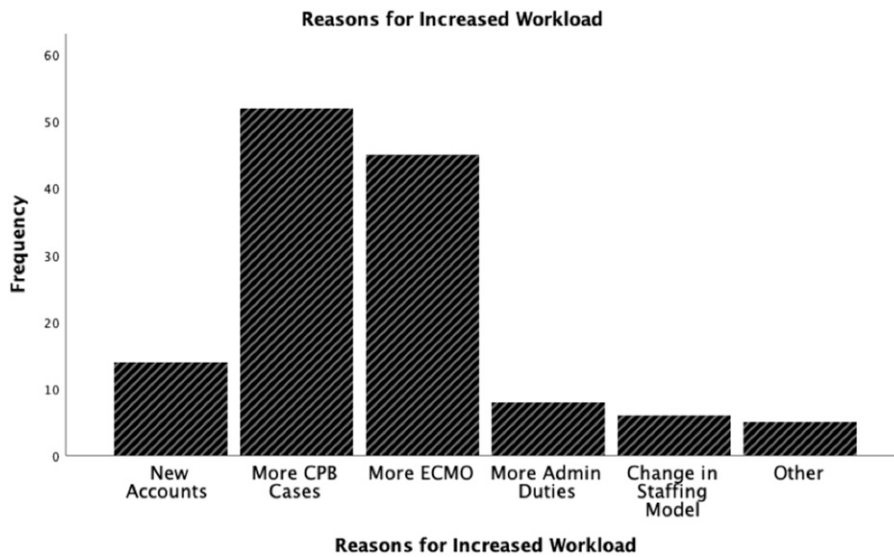


Figure 11. Source of expanded workload for respondents who indicated increased workload had an impact on creating vacancy.

determine which groups were significantly different, a least square difference post hoc test was undertaken. The results of this analysis indicate that significant differences exist between large contract groups and hospital employed, small contract group, and pediatric-only groups, with the large contract groups having slightly higher, but significantly different, vacancy rates (p -value < .05). Pediatric-only groups also had significantly lower vacancy rates than VA/government hospital groups and those groups categorized under “other” (p -value < .05).

Finally, the vacancy rate was examined by group size. Differences in this variable were examined using a one-way ANOVA. The results are presented in Table 3. This analysis revealed a p -value value of .84, indicating there

were no statistically significant differences in the vacancy rates between groups based on their size.

The vacancy rate was also analyzed by pay rate using categorical groups. An ANOVA analysis was conducted, which showed a p -value of .02, indicating there were significant differences in vacancy rates between groups. A post hoc test was not undertaken as the continuous nature of the vacancy variable created more than 50 groups for comparison, and several groups had an N of two or less. A mean vacancy rate for each group is presented below in Figure 16.

Strategies for Mitigation

With the understanding that the survey results may show a moderate or significant vacancy rate among perfusionists,

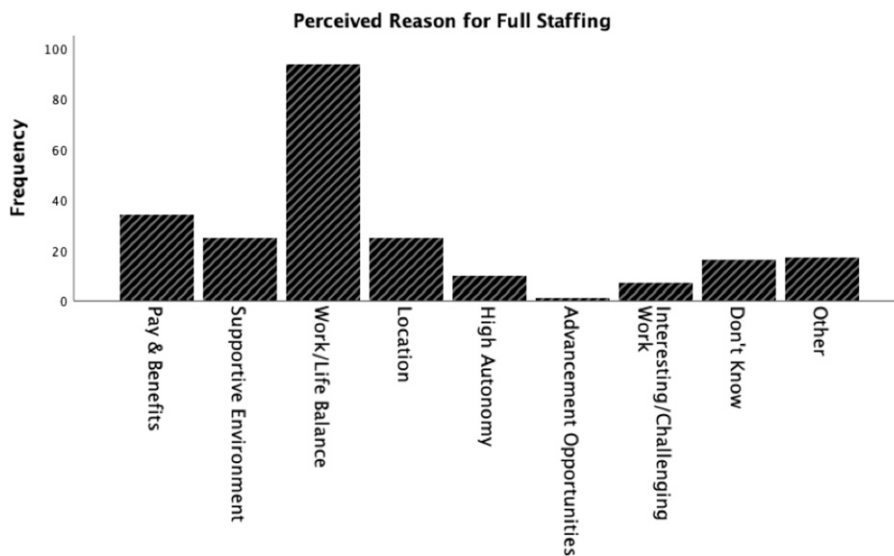
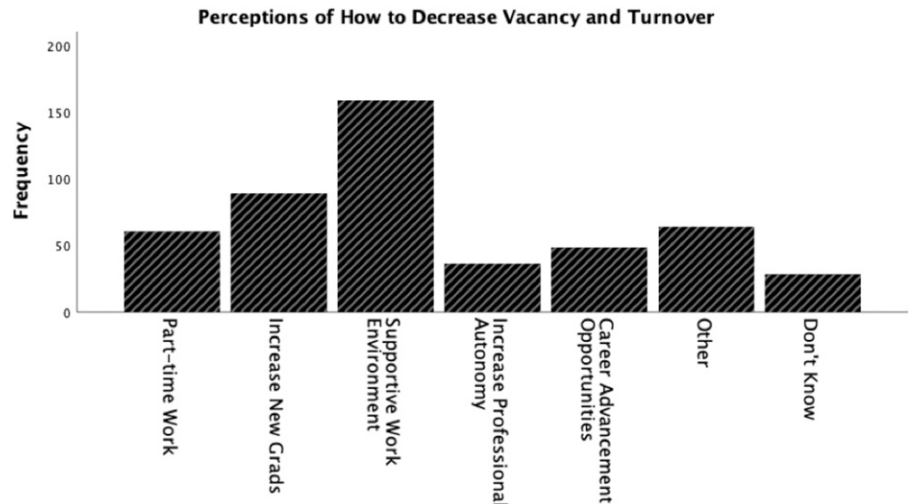


Figure 12. Primary cause of maintaining full staffing for respondents who indicated they had no current vacancies.

Figure 13. Number of responses by category for “best way to decrease vacancy and turnover.”



Perceptions of How to Decrease Vacancy and Turnover

participants were also asked questions regarding strategies they would consider using if they were unable to obtain a sufficient workforce to meet their needs.

The first question in this section asked what the perfusionists first strategy would be if they could not obtain an adequate workforce. Figure 17 illustrates the responses. Branching logic in the survey led several of the response selections from this question to a prompt asking for increased detail. One hundred and five respondents answered their first strategy would be “other” and these respondents were branched to a question in which they were asked to specify their answer in a free-text box. These answers were reviewed and counted based on categorical content. Of the respondents who were taken to this free-text box, 99 provided an answer. Some answers contained

content from more than one category. As such, the total number of tallies in all categorical responses is greater than the number of responses in total. The most common responses mentioned were as follows; attempt to hire temporary staffing (PRN, part-time, or locums [32 responses]), increase total compensation (including sign-on bonuses, additional vacation days, and higher salaries [30 responses]), work additional hours (voluntarily or involuntarily [17 responses]), provide temporary incentives (gap pay, retention bonuses, or comp time [8 responses]), and change staffing model (7 responses). An additional 15 categories were developed which had less than five responses each and are not included in this analysis.

The respondents who answered the initial question with “hand off some responsibilities to other healthcare

Figure 14. Number of responses by category for “best way to keep near-retirees in the workforce longer.”

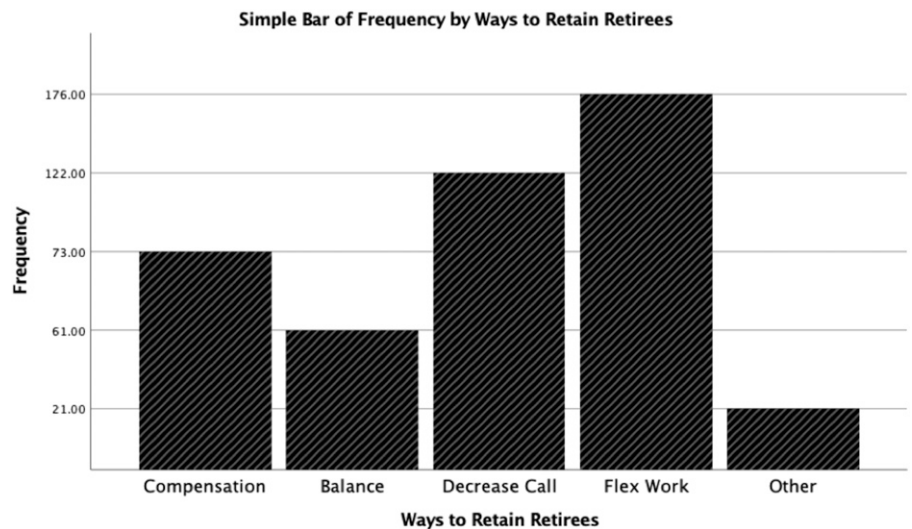


Table 2. Mean vacancy rate by state of practice.

State of Practice	Mean Rate	N
Alabama	.1469	10
Arizona	.0630	13
Arkansas	.0799	7
California	.1209	34
Colorado	.2381	10
Florida	.1318	26
Georgia	.0735	12
Idaho	.0000	1
Illinois	.1101	13
Indiana	.1893	7
Iowa	.2083	4
Kansas	.1667	3
Kentucky	.2167	4
Louisiana	.1042	8
Maine	.0000	4
Maryland	.2113	7
Massachusetts	.1363	12
Michigan	.0482	14
Minnesota	.2808	10
Mississippi	.2444	3
Missouri	.1276	21
Montana	.1667	3
Nebraska	.0000	1
Nevada	.2736	5
New Jersey	.0556	6
New Mexico	.3167	5
New York	.1703	20
North Carolina	.2015	14
North Dakota	.0000	2
Ohio	.0286	19
Oklahoma	.1944	3
Oregon	.0875	8
Pennsylvania	.1030	18
South Carolina	.0938	8
South Dakota	.1667	2
Tennessee	.0556	18
Texas	.1343	53
Utah	.0442	7
Vermont	.2500	1
Virginia	.1077	13
Washington	.1047	12
West Virginia	.1111	3
Wisconsin	.0000	9
Other/territory of the United States	.0000	1
Total	.1231	454

professionals” were asked to specify which responsibilities they would hand off in a free-text box. Of the 66 respondents who selected this choice, 49 entered a specific free-text answer. As before, these answers were reviewed and counted based on categorical content, with the number of categorical responses being greater than the number of responses in total. Six categories were established, and the responses were as follows: extracorporeal membrane oxygenation (ECMO) (45 responses), cell salvage/autotransfusion (27 responses), ventricular assist devices (12), intra-aortic balloon pump (6 responses), other (5 responses), and laboratory work (4 responses).

Respondents who answered the initial question with “host students” were led to a free-text box which asked, “If you do not currently host students, please specify the largest

obstacle you perceive to becoming a training site.” Of the 38 respondents who chose this option, 18 entered a specific free-text answer. Again, these answers were reviewed and counted based on categorical content, with the number of categorical responses being greater than the number of responses in total. Three categories were established, and the responses were as follows: difficulty in obtaining a contractual agreement with hospital and training program (6 responses), surgeon resistance (4 responses), and staff resistance (2 responses). An additional 4 categories were noted which had one entry each and are not included in this analysis.

DISCUSSION

Perfusionists play a small but critical role in healthcare in the United States. A shortage of perfusionists could lead not only to restricted access for cardiovascular surgery but also to interventional cardiology. The goal of this investigation was to explore a baseline understanding of the current status of perfusion services in the United States using perceptions of vacancy and turnover rates. These indicators help to assess the net effect of all variables impacting perfusion services. Specifically, both supply and demand impact these rates.

The study participants consisted of approximately 10.9% of the U.S. population of perfusionists and closely matched the geographic distribution of CCPs as reported by the ABCP (13). The survey participants were grossly similar to prior perfusion workforce studies in proportions of employer type (hospital, small group, large group, etc.), number of hours worked weekly, and percentage of respondents who were staff vs. chief/director (2,3,14,15).

The survey revealed a population-wide vacancy rate of 12.3% and a turnover rate of 14.7%. As a reference, literature for registered nurses has categorized vacancy rates as low ($\leq 4.1\%$), medium (4.2–11%), and high ($\geq 11.1\%$) (9). For registered nurses, vacancy rates in the high category were subjectively described by hospitals and healthcare workers as severe. Vacancy rates among nurses in excess of 10.2% have also been correlated with an increased risk of elimination of services, higher costs, and closed beds (16). A vacancy rate of 12.3% (revealed in this study) likely exceeds the nationwide vacancy rate of registered nurses at this time (17).

The turnover rates revealed here are somewhat lower than other healthcare related professions at the same vacancy rate (9,11). This may indicate that perfusionists are somewhat less prone to move from job to job, or, that turnover may yet increase.

Among the survey respondents, those who worked with large contract groups perceived a slightly higher, but statistically significant, vacancy rate than hospital employed, small contract group, or pediatric-only groups. Similarly,

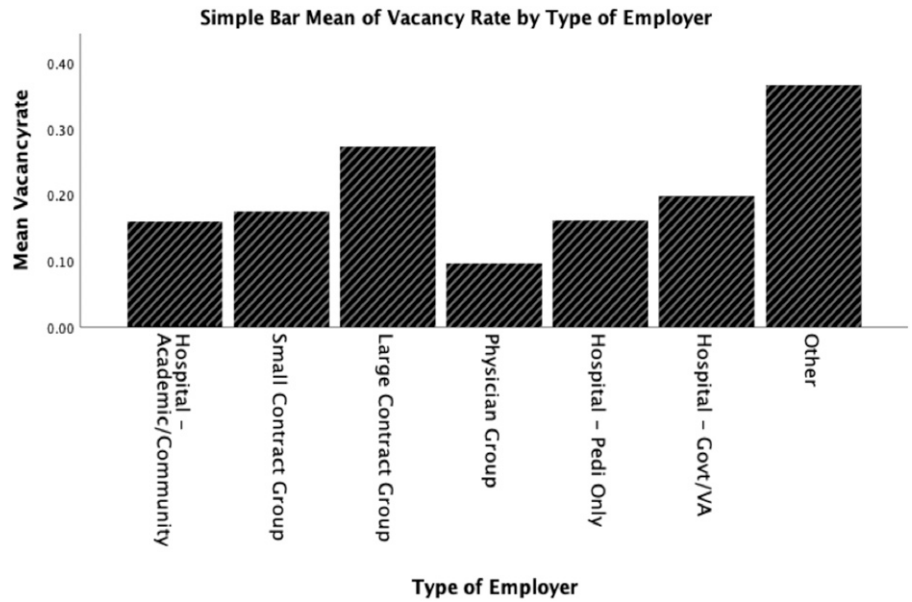


Figure 15. Mean vacancy rate by employer type.

pediatric-only groups perceived a statistically significant lower level of vacancy than VA/government hospital employees and perfusionists in the “other” employment group. For the population of participants, neither salary nor geographic proximity to perfusion training programs offered a protective effect against the mean vacancy rate.

The findings of this survey suggest the following: 1) vacancy in the sample is already at a level (12.3%) that would be considered high in other healthcare fields; 2) the primary factor in creating current vacancies is an increase in the clinical workload, not clinicians leaving the workforce; 3) if a large number of perfusionists retire in the near future, the vacancy rate is likely to increase; and 4) significant obstacles still exist to expanding clinician rotations for educational institutions.

Given these findings, hospitals, perfusionists, professional organizations, and educational institutions should prepare for increases in vacancy rates. A large number of perfusionists in this study suggested delaying or canceling surgery as a means of mitigating staffing shortages (20% of respondents, the third most common answer). To decrease the chances of this becoming a common obstacle to patient care, other strategies for mitigation should be investigated early to determine feasibility at the local level.

Limitations

The survey was designed with the assistance of subject matter experts, Doctorate of Healthcare Administration faculty, and project committee members. Pilot testing of the survey allowed modification of the instrument so that content and clarity were well established. The high response rate for questions indicates that there was little response bias

to individual questions. The small numbers of responses which needed to be removed from analysis further indicate the contextually sound nature of the instrument.

Nevertheless, a survey instrument distributed to a convenience sample, as in this study, has inherent limitations. The lack of randomized survey distribution means that there is no statistical technique which will allow the results of this study to be generalized to the entire population of perfusionists in the United States. Although previously published studies have claimed representation at lower participation rates, their method of data collection was not congruent with this assertion (2). Although the data and statistical relationships aggregated here hold true for the population of participants, it is left up to the individual reader to determine if they feel it is appropriate to apply these results to larger groups.

This survey is also the first of its kind to make assessments about vacancy, turnover, retention, and mitigation strategies for perfusionists. As a result, there were several questions in which no established criteria could be referenced to construct categorical answers. Where available, data from other healthcare fields were used.

Table 3. Vacancy rate by group size.

ANOVA					
Vacancy Rate					
	Sum of Squares	Df	Mean Square	F	p-Value
Between groups	.637	31	.021	.746	.839
Within groups	11.621	422	.028		
Total	12.258	453			

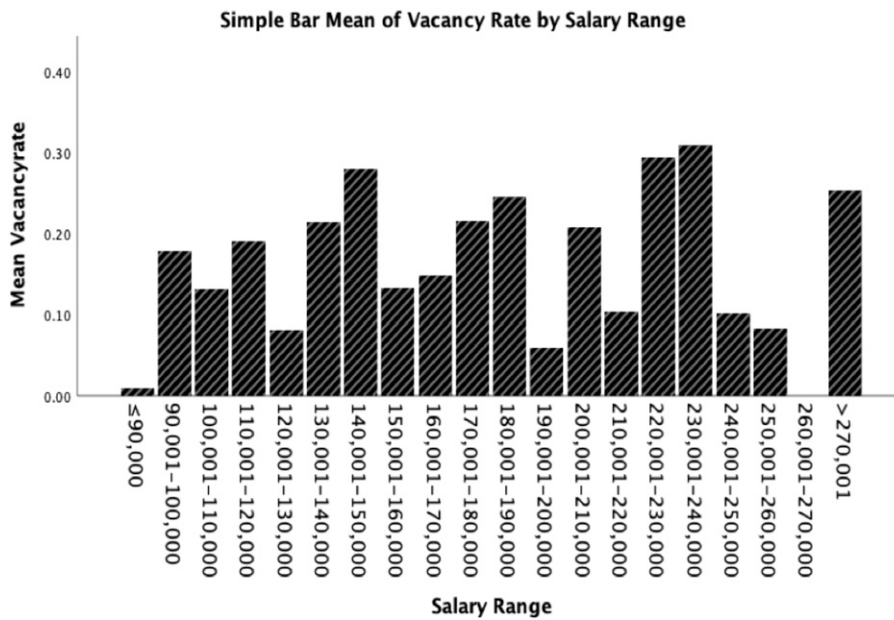


Figure 16. Mean vacancy rate by pay category.

The respondents generally appeared to follow a geographical distribution similar to 2018 ABCP data for home states of perfusionists (13). The home state of the author, however, appeared to have a disproportionate number of responses, possibly because of name recognition given the small absolute number of perfusionists and geographic proximity. Other demographic variables collected, such as the number of hours worked, employer type, and percentage of respondents who were staff vs. chief/director are generally similar to previous workforce studies (2,3,14,15). These comparisons lend credence to the study population but are not sufficient to generalize the survey results to the entire population of U.S. perfusionists.

Future Studies

An annual vacancy and turnover survey using a single-stage, random sampling method, and hosted by the ABCP, would be an obvious direction for future data collection to take. A survey of this design could produce a generalizable vacancy and turnover rate with an acceptable confidence interval using an *N* as low as 100, assuming negligible impact of non-certified and board-eligible new graduates (18,19). Another potential investigation could correlate these findings with subjective perceptions of staffing, as has been performed in other fields (9). This would assist in determining the ability of the profession to meet the needs of the healthcare industry.

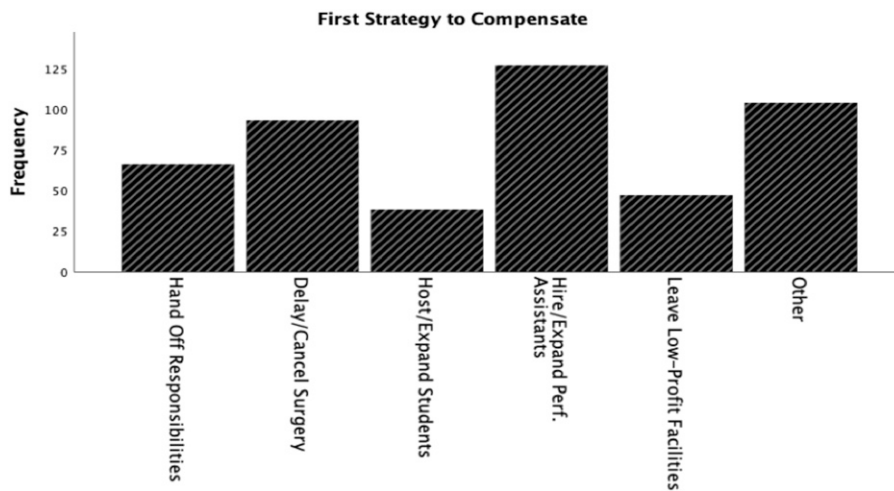


Figure 17. Number of responses by category for “first strategy if unable to obtain workforce.”

Although vacancy rates appear high, only 18% of survey participants felt that increasing the number of board-eligible new graduates was the best method for decreasing vacancy and turnover rates. In addition, the choice to host perfusion students, or expand the number hosted, was the least popular choice among respondents when asked what strategy they might use to mitigate staffing shortages. When combined, these answers appear to show a significant headwind to the expansion of clinical sites for perfusion training programs.

Data on the vacancy and turnover rates for facilities which host students could be collected and, if favorable, used to demonstrate the value of enrolling as a clinical site for a perfusion training program. This information should assist in overcoming barriers to the expansion of clinical affiliates, especially if the vacancy rate continues to increase.

Future studies could additionally attempt to determine why specific employer types had significantly different vacancy rates. The results of this study show that compensation, a likely answer, had no dose-dependent effect. Are pediatric programs establishing non-monetary factors that assist in decreasing vacancy and turnover rates? What are the differences between large and small contract groups that create significantly lower vacancy rates in the latter?

Summary

This study, although limited by the convenience sample design, has established a reference vacancy and turnover rate among a sizable portion (approximately 10.9%) of the U.S. population of perfusionists. These vacancy and turnover rates, 12.3% and 14.7%, respectively, would subjectively be considered “severe” in other healthcare professions and would be categorized in the highest strata of workforce shortages (8,9,11). The data collected suggest that the vacancy rate is primarily attributable to an increase in the demand for perfusion services, with a lower, but not insignificant, number of clinicians leaving the workforce. If other published predictions are accurate and barring any significant change in the number of board-eligible new graduates or a decrease in demand, the vacancy and turnover rates can reasonably be expected to increase. Analysis of the data has suggested that perfusionists in the United States will explore perfusion assistants to help bridge the gap in demand, as the concept of hosting students is not commonly considered and has noted obstacles. Employers who wish to find workforce participants to attenuate the impact of vacancies should look to flexible, non-call positions to help attract workers who may be considering retirement. Finally, the development of an annual vacancy and turnover survey, connected to ABCP recertification, could assist the profession in

creating an objective metric by which to guide future workforce training and needs.

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APPENDIX:

Survey Instrument

- (1) Are you a perfusionist who is currently practicing clinically in the United States?
A: ___ Yes ___ No) Are
- (2) In what state do you spend most of your time working as a perfusionist?
A: Respondent will be allowed to select 1 state from a drop-down list of states and U.S. territories.
- (3) When considering how you spend most of your time as a perfusionist, how would you define your employer?
A: Respondent will be allowed to select one of the below options.
 - ___ Hospital—academic or community
 - ___ Small contract group (≤25 CCPs)
 - ___ Large contract group (>25 CCPs)
 - ___ Physician group
 - ___ Hospital—pediatric/children only
 - ___ Hospital—government/veterans affairs
 - ___ Other
- (4) When considering the group of perfusionists you spend the most time working with clinically (i.e., perfusionists you would relieve from a CPB case or those with whom you would switch call coverage), how many full-time perfusionists would there be if any current vacant positions were filled?
A: The respondent will be allowed to select a single answer from a drop-down list that includes the numbers 1 through 37.
- (5) When considering the group of perfusionists you spend the most time working with clinically (i.e., perfusionists you would relieve from a CPB case or those with whom you would switch call coverage), how many vacant positions do you currently have for a full-time perfusionist?
A: The respondent will be allowed to select a single answer from a drop-down list that includes the numbers zero through 17.
- (6) When considering the vacant position(s) with your group, what is your perception regarding the impact that the following factors had in creating these vacancies?
A: The respondent will be allowed to rank a matrix of answers as outlined below.

(6B) Please explain your selection of “Other”

	High Impact	Some Impact	Little Impact	No Impact
Retirement of a perfusionist				
Perfusionist took a job with another group/location				
Perfusionist stepped down to part-time work				
Caseload expanded/new position				
Other				
I don't know				
Change in staffing model				

A: A free form text box which will be coded according to the category and reported with descriptive statistics.

(6C) When considering the positions which were opened because of expanded workload, please indicate the primary source of the expanded workload.

- A: ___ Acquired new accounts
 ___ Expansion of traditional workload (i.e., more CPB cases)
 ___ Expansion of ECMO workload
 ___ Expansion of administrative workload or non-CPB cases
 ___ Change in staffing (i.e., changed to two perfusionists per case or adopted $N + 1$ Model)
 ___ Other

(7) In your opinion, what is the primary reason you have been able to maintain full staffing in the current market? Respondents will be allowed to select one of the following.

- A: ___ Superior pay and benefits
 ___ Supportive work environment
 ___ Excellent work/life balance
 ___ Desirable location
 ___ High professional autonomy
 ___ Professional advancement opportunities
 ___ Interesting/challenging work
 ___ I don't know

(8) When considering the group of perfusionists you spend the most time working with clinically (i.e., perfusionists you would relieve from a CPB case or those with whom you would switch call coverage), how many full-time positions have you had open during the past 12 months that were filled?

- A: The respondent will be allowed to select a single answer from a drop-down list that includes the numbers zero through 26.
- (9) In your opinion, what is the best way to decrease the vacancy and turnover rates among perfusionists in the United States?
- A: Increase opportunities for part-time work
 Increase the number of board-eligible new graduates
 Create a more supportive work environment
 Increase professional autonomy
 Develop professional advancement opportunities
 Other
 I don't know
- (10) In your opinion, what is the best way to keep those who are about to retire in the workforce longer?
- A: Free-text box. Answers will be categorized into categories and reported using descriptive statistics.
- (11) In your opinion, if you were unable to obtain adequate staffing, what strategy would you employ first to compensate?
- A: Hand off some responsibilities to other healthcare providers (RNs, RRTs)
 Delay/cancel surgery
 Host students/expand student hosting
 Hire/expand perfusion assistants
 Pull out of some service locations
 Other
- (11B) Please specify "Other."
- A: Free-text box. Answers will be categorized into categories and reported using descriptive statistics.
- (11C) Please specify which responsibilities you would hand off.
- A: Free-text box. Answers will be categorized into categories and reported using descriptive statistics.
- (11D) If you do not currently host students, please indicate what you perceive to be the largest obstacle to doing so.
- A: Free-text box. Answers will be categorized into categories and reported using descriptive statistics.
- (12) When considering your group's practice, at what point would you be willing to employ some of the strategies listed above? (check all that apply)
- A: 10% vacancy rate
 25% vacancy rate
 50% vacancy rate
 Unable to hire a perfusionist for 6 or more months
 Unable to hire a perfusionist for 1 year or more
 Other
 Never
- (12B) Please specify other.
- A: Free-text box. Answers will be categorized into categories and reported using descriptive statistics.
- (13) Are you a full-time employee (i.e. not part-time or PRN)?
- A: Yes
 No
- (14) Are you a chief, director, or supervisor of other perfusionists?
- A: Yes
 No
- (15) (Optional) Please indicate your current annual cash compensation (including salary, bonus, overtime, supplemental, etc.) from your primary employer.
- A: Respondents will be allowed to choose one option from a list of $\leq 90,000$ through $\geq 270,001$, in \$10,000 increments.
- (16) When considering a normal week with your primary employer as a perfusionist, how many hours would you spend working?
- A: Respondents will be given a blank short answer box limited to two digits.