

Perfusion Recruitment Strategies Using Choice-Based Conjoint Analysis

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Abstract: Perfusionists are leaving the workforce in higher rates as baby-boomers retire, yet the volume of cases involving perfusion continues to increase. This change has resulted in a high-demand market with organizations competing for the same candidates. The purpose of this study was to use a choice-based conjoint (CBC) analysis to determine what attributes of employment opportunities are most important to perfusionists so hiring organizations are better equipped to produce employment offers specific to each candidate. The Sawtooth Software Discover program was used to create a CBC survey that was distributed to perfusionists. After a series of demographic questions, respondents chose between three employment offers that comprised eight attributes, each with three varying options. Completed surveys were analyzed using the Discover software, producing importance scores. Two hundred forty surveys were completed, 154 (64%) male and 86 (36%) female. Extracorporeal membrane oxygenation (ECMO) impact to the perfusionist and hours worked per week ranked most important, at

19.4% and 17.5%, respectively. A significant difference exists between ECMO impact to perfusionists and all other attributes. The least important attributes were annual continuing education funds and sign-on bonus/relocation, at 6.8% and 4.7%, respectively. Respondents in their 20s and 30s find the importance of ECMO impact to be significantly less important than those in their 50s. Perfusionists with a master's degree believe salary to be significantly more important than perfusionists with other types of perfusion education. Based on the respondents who completed this survey, the impact ECMO has on the perfusionist was the most significant job attribute. Offering large sign-on bonuses and relocation packages to entice new employees is not indicated as a viable way to satisfy perfusionists. Appropriate management of hours worked, days on call, and how ECMO impacts the perfusionists will be most impactful in recruitment of new employees. **Keywords:** choice-based conjoint, CBC analysis, recruitment, perfusion. *J Extra Corpor Technol. 2020;52:218–26*

The United States is experiencing an aging population, many of whom will require increased medical care for complex conditions, including cardiac conditions (1). With this increase in disease burden will come the need for a larger workforce to treat patients with complex medical conditions (1). It is predicted that there will be an additional 27 million Americans with hypertension, 8 million with coronary heart disease, and 3 million with heart failure between 2010 and 2030 (2). With the development of better technology for circuit components and clinician experience, extracorporeal life support (ECLS) outcomes have improved greatly.

The ECLS Organization (ELSO) reported 70% survival of ECLS and 55% survival to discharge or transfer in their July 2019 international summary for neonates, pediatrics, and adults combined (3). According to the ELSO registry, 150 centers reported 2,803 ECLS cases in 2008 compared with 420 centers reporting 12,644 ECLS cases in 2018. The development of simpler, compact ECLS machines has allowed more centers to begin offering this therapy. Perfusion-assisted cardiology procedures such as the transcatheter aortic valve replacement (TAVR), transcatheter aortic valve implantation (TAVI), and Watchman have created the need for hybrid operating room suites and staffing of such procedures. According to the Transcatheter Valve Therapy Registry, the TAVR procedural volume has increased from 4,627 in 2012 to 34,892 in 2016 (4). In addition, the Watchman device is considered the favored left atrial appendage closure device in the United States after obtaining the Food and Drug Administration approval in 2015 (5).

Over the last several years, there has been a significant shift in the staffing level of perfusionists across the United States.

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Perfusionists are leaving the workforce in higher rates as baby-boomers retire (6), yet the volume of cases involving perfusion continues to increase, as evidenced previously. With the increase in perfusion-supported procedures, the number of new graduates entering the workforce has not kept up with the demand for the highly specialized clinicians that perfusionists are. In 1994, there were 35 perfusion educational programs (7), yet only 17 programs exist in 2019. As evidenced by job postings on sites such as indeed.com, perfusion.com, and amsect.org, perfusionists seeking employment will find that opportunities exist across the United States. A recent search of job postings on these sites found more than 100 opportunities with increased salaries, sign-on bonuses, and other incentives to compete in a high-demand market. The U.S. Navy found themselves in a similar situation in 2000 when they were unable to meet their recruitment goals. They set out to fix the problem using a conjoint analysis to determine which components of an enlistment package were most valuable, what trade-offs existed in the packages, and what specific elements were most likely to help them reach their recruitment goals (8). Using the results of the conjoint analysis, they were able to prioritize components of their enlistment packages to attract the greatest number of recruits. Now, more than ever, it is critical for large and small organizations to understand the market and what perfusionists prioritize when seeking new employment.

The purpose of this study was to use a conjoint analysis to gain understanding of what attributes of employment opportunities are most important to perfusionists so that hiring organizations are better equipped to produce employment offers specific to perfusion candidates.

MATERIALS AND METHODS

Choice-based conjoint (CBC) is commonly used by researchers to study how people make choices (9). By presenting individuals with scenarios that contain multiple

alternatives to choose from, researchers can build models to determine the utilities, or preferences, based on the responses provided. The term conjoint comes from the words “considered jointly” because respondents must take into account all aspects of the options before making their choice. Conjoint analysis helps identify the combination of multiple attributes of a job opportunity that are most influential on the candidate’s choice or decision-making (10). Knowing what attributes are driving the decisions of the respondents allows researchers to then predict what future choices will be made using the information gathered.

Conducting a conjoint analysis requires software to program the different attributes and levels before administering the questions in a manner that will allow for abstraction of the data. Sawtooth Software awarded a grant to access their Discover software program online for purposes of this study. The design of the study comprised eight attributes, each with three levels to choose from. Three attributes were characterized as “Employment Package” options and five attributes were characterized as “Job Characteristics” (Table 1). The “Employment Package” category had both long-term and short-term attributes, such as base salary and sign-on bonus. It was predicted that perfusionists with different demographics would value long- versus short-term attributes differently. In the “Job Characteristics” category, all of the attributes represented long-term impacts to the perfusionist.

It was recognized early on that participation in the study would be at the discretion of the perfusionists receiving a link to the software study. Without monetary incentive to participate, it was crucial that the study not be too long that respondents quit before completion of the survey. In addition, the survey must be long enough to ensure adequate data were collected. Determination of the middle ground of not too long, not too short, was critical. SE computation built into the software provided a recommendation on the appropriate number of CBC questions and the number of levels per question. For example, if each question

Table 1. Attributes and levels for CBC questions.

| Attribute | Level 1 | Level 2 | Level 3 |
|------------------------------------|--------------------------------------|---|---|
| Employment package | | | |
| Base salary | 5% less than average | Average | 5% greater than average |
| Sign-on bonus + relocation (total) | \$15,000 | \$20,000 | \$25,000 |
| Continuing education funds | None | \$1,000 per year | \$2,000 per year |
| Job characteristics | | | |
| Hours worked per week | <30 | 30–40 | 40–50 |
| Worked hours past 4 pm or weekends | Seldom (two times or less per month) | Regularly (one time per week) | Frequently (two or more times per week) |
| Days on call per week | 0–2 | 3–4 | >4 |
| ECMO impact on perfusionists | No ECMO | ECMO initiations and interventions only | ECMO full coverage by perfusionists |
| Case mix | Cardiac only | Cardiac + cell savers | Cardiac + cell savers + HIPEC + transplants |

HIPEC, hyperthermic intraperitoneal extracorporeal circulation.

presented two scenarios for the respondent to choose from, then there would need to be more questions asked than if each question presented three scenarios for the respondent to choose from. Obtaining accurate preference scores depended on having the appropriate amount of data, which relied on the appropriate number of questions.

The next step was testing the survey, which comprised completing the survey multiple times in an attempt to expose deficiencies along the way. As an experienced perfusionist, unrealistic combinations of attribute levels in some of the scenarios were identified. For example, was it realistic to have a center with full extracorporeal membrane oxygenation (ECMO) coverage by perfusionists that seldom worked past 4 pm? At first glance, one might say no. However, what about the centers with full ECMO coverage that only do a few ECMO patients each year? Another unrealistic combination might be a transplant center where perfusionists seldom work past 4 pm—again, unrealistic at first glance. However, a center doing heart, liver, and lung transplants is very different from a center only transplanting a single organ. The software allows for “prohibitions” to be set to avoid unrealistic scenarios, but there are downsides to using this feature that eliminate certain combinations. Although it may seem counterintuitive, Sawtooth Software recommends showing respondents such unusual combinations because it leads to more precise

estimation of preference scores for each attribute level in the study (9). In addition, prohibitions lead to lower precision of preference scores, requiring an increase in the number of CBC questions that must be asked. Even with eight attributes and no prohibitions, the software recommendation was 25 CBC questions to meet statistical significance. Adding prohibitions was decided against to avoid increasing the number of questions asked and to avoid interjection of personal bias regarding what combinations were or were not unrealistic.

The final survey was ready for distribution and was composed of seven demographic questions, 25 CBC questions, and one optional open-ended space for comments. Baseline demographic questions categorized gender, age, type of perfusion education, level of experience, whether the respondent was American Board of Cardiovascular Perfusion (ABCP) certified, and if they had changed employment in the last 12 months or were considering new employment in the next 12 months. An example of the CBC questions that were presented to respondents can be viewed (Figure 1). After approval from the Institutional Review Board at the University of Nebraska Medical Center, the survey was distributed via Perflist, Perfmail, Perfusion.com, and personal emails to colleagues with a link to the Sawtooth Software site to begin the survey. Confidence about the precision of the

If presented with these 3 employment packages, which would you choose?

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| | 5% less than average | 5% greater than average | Average |
|---|---|---|------------------------------------|
| Base Salary | 5% less than average | 5% greater than average | Average |
| Sign on Bonus + Relocation (total) | \$20,000 | \$25,000 | \$15,000 |
| Annual Continuing Education Funds | None | \$1,000 per year | \$2,000 per year |
| Hours worked per week | 40-50 hours | Less than 30 hours | 30-40 hours |
| Days on Call Per Week | Greater than 4 days | 1-2 days | 3-4 days |
| Worked Hours Past 4pm or Weekends | Frequently (2 or more times per week) | Regularly (1 time per week) | Seldom (2 times or less per month) |
| Case Mix | Cardiac + Cell Saver + Transplant + HIPEC | Cardiac + Cell Saver | Cardiac Only |
| ECMO Impact to Perfusionist | Full ECMO coverage by perfusionists | ECMO initiations and interventions only | No ECMO |
| | Select | Select | Select |

Figure 1. Example of the CBC questions that were presented to respondents. HIPEC, hyperthermic intraperitoneal extracorporeal circulation.

Table 2. Demographic results.

| Demographic Results | | | | | | |
|--|----------------------------|----------------------|-------------------------------|------------------------|----------------------|--------------------|
| Gender | Male (n = 154) | Female (n = 86) | - | - | - | - |
| Age (years) | 20-29 (n = 30) | 30-39 (n = 41) | 40-49 (n = 50) | 50-59 (n = 72) | 60-69 (n = 43) | >70 (n = 4) |
| Type of perfusion education | Trained on the job (n = 9) | Certificate (n = 73) | Bachelor degree (n = 87) | Master degree (n = 71) | - | - |
| Level of perfusion experience | Student (n = 13) | 0-5 years (n = 25) | 6-10 years (n = 29) | 11-20 years (n = 48) | 21-30 years (n = 75) | >30 years (n = 50) |
| ABCP certified | Yes (n = 209) | No (n = 31) | - | - | - | - |
| Changed employment in the last 12 months | Yes (n = 33) | No (n = 206) | Prefer not to answer (n = 1) | - | - | - |
| Considering new employment in the next 12 months | Yes (n = 32) | No (n = 197) | Prefer not to answer (n = 11) | - | - | - |

part-worth utility weight is expressed in terms of a 95% confidence interval (CI). The 95% CI is calculated by taking the utility weight estimate plus or minus 1.96 SEs. This interval is commonly interpreted as follows: if we were to repeat the survey hundreds or thousands of times and computed a new CI each time based on our model, then the CIs would contain the true population mean 95% of the times (11).

RESULTS

Five hundred ninety-five respondents started the survey, and 240 surveys were completed in entirety. The design of a CBC survey requires that all questions be completed to maintain integrity of the survey, so the 240 completed surveys were used when computing data analysis. Demographics of respondents are available for viewing (Table 2). Of the respondents, 154 (64%) were male and 86 (36%) were female. This representation of male vs. female is consistent with original expectations based off the

2015–2016 survey conducted by Turnage et al. (6). The largest cohort of respondents were 50–59 years of age (30%), with the next three cohorts aged 40–49 years (21%), 30–39 years (18%), and 60–69 years (17%) (Figure 2). With respect to the type of perfusion education, the largest cohort of respondents had a bachelor’s degree (36%), with certificate and master’s degrees each at 30% of the cohort (Figure 3). The largest cohort of respondents had perfusion experience of 21–30 years (31%), with 72% of respondents having 11 years or greater of perfusion experience. The majority (87%) of respondents were ABCP certified. Of the respondents, 14% reported changing their primary place of employment in the last 12 months. When asked about future plans, 13% reported that they plan to change their primary place of employment in the next 12 months, whereas 5% preferred not to answer.

When looking at all-comers in terms of which attributes were most important, ECMO impact to the perfusionist and hours worked per week ranked most important, at 19.4% and 17.5%, respectively. Although no significant difference exists between those two attributes, a 95% CI

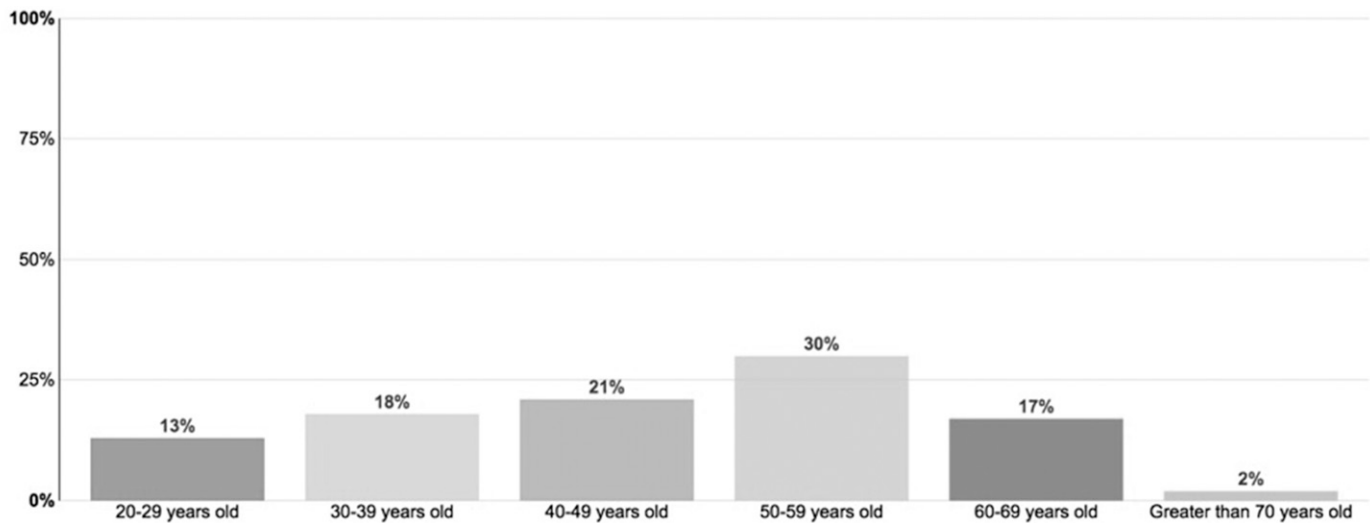


Figure 2. Age demographics of respondents, n = 240.

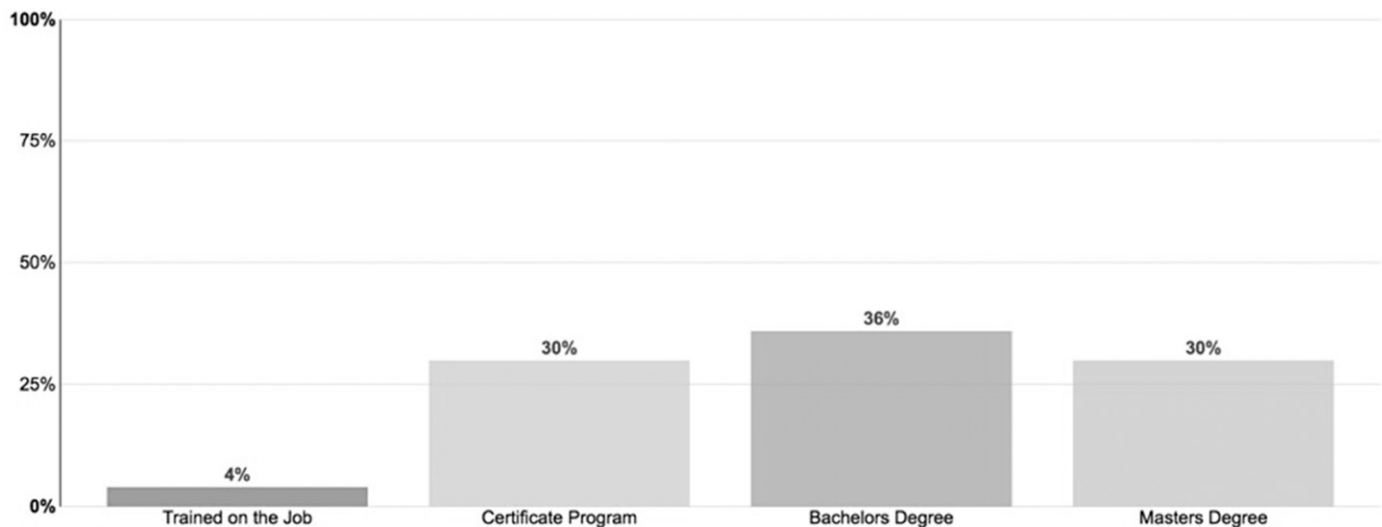


Figure 3. Type of perfusion education of respondents, n = 240.

would indicate a significant difference between ECMO impact to the perfusionist and all other attributes in the survey (Table 3). Days on call per week and base salary were ranked third and fourth most important, at 15.8% and 14.7%, respectively. A 95% CI exists between base salary and all other attributes other than days on call per week. The least important attributes were annual continuing education funds and sign on bonus/relocation, at 6.8% and 4.7%, respectively. A 95% CI exists between both of these attributes and all other attributes in the survey. Importances for all attributes can be viewed in the following text (Figure 4). Although male respondents find ECMO impact to be of highest importance (19.8%) and female respondents find hours worked per week to be most important (19.2%), there is no significant difference shown between genders (Table 4). When separated by age, the data indicates with a 95% CI that a significant difference exists between how respondents in their 20s and 30s rank the importance of ECMO impact on perfusionist when compared with those in their 50s (Table 5). Type of perfusion education shows with a 95% CI that a significant difference exists between importance of salary

when comparing perfusionists with a master's degree (18.28%) to perfusionists with a bachelor's degree (13.01%), certificate (13.33%), or those trained on the job (13.12%) (Figure 5). There was not a significant difference between perfusionists who reported changing their primary place of employment in the last 12 months and those who plan to change their primary place of employment in the next 12 months when compared with perfusionists who are in a steady place of employment. In addition, there was not a significant difference in those with or without ABCP certification. When comparing levels of experience, a 95% CI indicates that perfusionists with 21–30 years of experience find ECMO impact to the perfusionist more important when considering an employment opportunity than those with 0–5 years, 11–20 years, and greater than 30 years of experience.

DISCUSSION

The results of this survey provide insight into how different cohorts of perfusion candidates favor certain aspects

Table 3. Overall importance, CIs.

| Attribute | Importances (%) | SDs (%) | Lower 95% CI (%) | Upper 95% CI (%) |
|------------------------------------|-----------------|---------|------------------|------------------|
| Base salary | 14.67 | 9.80 | 13.43 | 15.91 |
| Sign-on bonus + relocation (total) | 4.69 | 4.38 | 4.14 | 5.25 |
| Annual continuing education funds | 6.77 | 6.31 | 5.97 | 7.57 |
| Hours worked per week | 17.50 | 10.36 | 16.19 | 18.81 |
| Days on call per week | 15.82 | 11.06 | 14.42 | 17.22 |
| Worked hours past 4 pm or weekends | 10.63 | 7.75 | 9.65 | 11.61 |
| Case mix | 10.48 | 8.68 | 9.39 | 11.58 |
| ECMO impact on perfusionists | 19.43 | 12.89 | 17.80 | 21.06 |

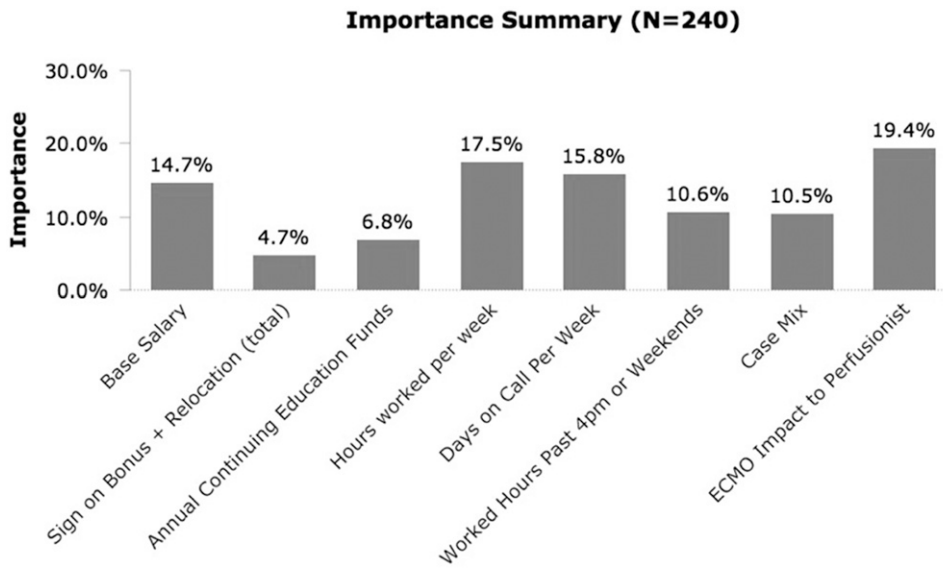


Figure 4. Importance summary, all respondents, n = 240.

of employment opportunities based on their individual demographics. Knowing that the ECMO impact to a perfusionist is the most important attribute of an employment offer, organizations can decide how they might address this for incoming candidates. For a large ECMO center, restructuring the perfusion department to include ECMO specialists may have a positive impact in their ability to recruit and retain perfusionists while still growing their ECMO program. Using ECMO specialists can prevent ECMO growth within an organization from increasing the hours worked per week and days on call per week for the perfusionists employed there. In addition, these data suggest that managing the hours worked per week and days on call per week will have more impact on recruitment and retention than simply increasing salaries among perfusionists. According to a study by Judge et al. (12), “although the notion that high pay leads to high levels of pay is not without debate...results suggest that pay level is only marginally related to satisfaction.” They go on to suggest that if an employee must choose, then individuals would be better off weighing other job attributes more heavily than pay (12). If salary alone does not keep an employee

satisfied, then in a unique profession such as perfusion, what does? The results of this survey show that work-life balance is more important than salary, bonuses, and relocation packages. Interestingly, perfusionists were not as concerned with working past 4 pm or on weekends as long as their overall hours worked per week were lower. This suggests that organizations that operate around the clock can still satisfy their employees by hiring more staff and distributing the overall hours among them. There was no significant difference among male and female perfusionists, something that may surprise some employers. With respect to age, the data show a significant difference between how respondents in their 20s and 30s rank the importance of ECMO impact to the perfusionist when compared with those in their 50s. Respondents in their 20s and 30s rank the importance of ECMO impact to the perfusionist as fourth overall, yet respondents in their 50s rank it first (Table 5). With many of the students graduating from perfusion schools in this age range, it will be important for employers to consider this information as they recruit new graduates. Full ECMO coverage by a perfusionist has a low utility score (-75.6) compared with no ECMO (35.4) or ECMO

Table 4. Importance summary, gender breakdown.

| Attribute | Male (n = 154) (%) | Female (n = 86) (%) | Total (n = 240) (%) |
|------------------------------------|--------------------|---------------------|---------------------|
| Base salary | 15.06 | 13.97 | 14.67 |
| Sign-on bonus + relocation (total) | 5.11 | 3.95 | 4.69 |
| Annual continuing education funds | 7.32 | 5.77 | 6.77 |
| Hours worked per week | 16.56 | 19.20 | 17.50 |
| Days on call per week | 15.58 | 16.26 | 15.82 |
| Worked hours past 4 pm or weekends | 10.16 | 11.47 | 10.63 |
| Case mix | 10.43 | 10.58 | 10.48 |
| ECMO impact on perfusionists | 19.79 | 18.80 | 19.43 |

Table 5. Importance summary, age breakdown.

| Attribute | Age 20-29 Years (n = 30) (%) | Age 30-39 Years (n = 41) (%) | Age 40-49 Years (n = 50) (%) | Age 50-59 Years (n = 72) (%) | Age 60-69 Years (n = 43) (%) | Older than 70 Years (n = 4) (%) | Total (n = 240) (%) |
|------------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|---------------------------------------|---------------------------|
| Base salary | 17.12 | 15.96 | 17.00 | 13.77 | 11.11 | 8.45 | 14.67 |
| Sign-on bonus + relocation (total) | 4.82 | 3.89 | 5.54 | 4.80 | 4.19 | 4.86 | 4.69 |
| Annual continuing education funds | 6.89 | 6.17 | 7.44 | 6.39 | 7.11 | 6.63 | 6.77 |
| Hours worked per week | 19.07 | 19.32 | 18.64 | 15.81 | 16.61 | 12.89 | 17.50 |
| Days on call per week | 17.44 | 17.20 | 14.15 | 15.70 | 15.93 | 11.54 | 15.82 |
| Worked hours past 4 pm or weekends | 8.93 | 13.53 | 9.20 | 9.54 | 11.91 | 17.22 | 10.63 |
| Case mix | 9.70 | 8.78 | 10.19 | 10.71 | 11.83 | 18.97 | 10.48 |
| ECMO impact on perfusionists | 16.03 | 15.15 | 17.84 | 23.27 | 21.30 | 19.44 | 19.43 |

initiations and interventions only (40.2), indicating that perfusionists find full ECMO coverage to be a job dissatisfier. Interestingly, initiations and interventions only are comparable to no ECMO at all with positive utility scores, indicating both to be job satisfiers (Figure 6). This is important again for employers as they determine the best way to manage a growing ECMO program. Interesting trends did emerge where statistical significance was not reached. Days on call per week are most important to respondents in their 20s and 30s at 17.4% and 17.2%, respectively. Respondents in their 30s also find hours worked past 4 pm or on weekends to be more important (13.5%) than respondents in their 20s (8.9%) or 40s (9.2%). With the average age of women with a college degree having their first child at the age of 30.3 years, these data may reflect the preferences for that cohort being more associated with having young children (13). In addition, base salary becomes less important as one ages, evidenced by 17.1% for

respondents in their 20s compared with 11.1% for respondents in their 60s. Perfusionists with a master’s degree placed significantly more importance on salary than their counterparts in the profession. This will be crucial for employers to consider as more perfusion schools are transitioning to master-level programs and more graduates are starting their careers with a master’s degree, and often times, more debt to show for it. Currently, many organizations have a salary range for perfusionists as a whole, not taking the level of education into consideration when hiring new employees. Survey results indicate that doing so will be a dissatisfier for master-trained perfusionists, making recruitment increasingly difficult if adjustments to salary ranges are not made. Perfusionists with 21–30 years of experience find ECMO impact to the perfusionist more important when considering an employment opportunity than those with 0–5 years, 11–20 years, and greater than 30 years of experience. It is interesting that the perfusionists



Figure 5. Importance summary, type of perfusion education, n = 240.

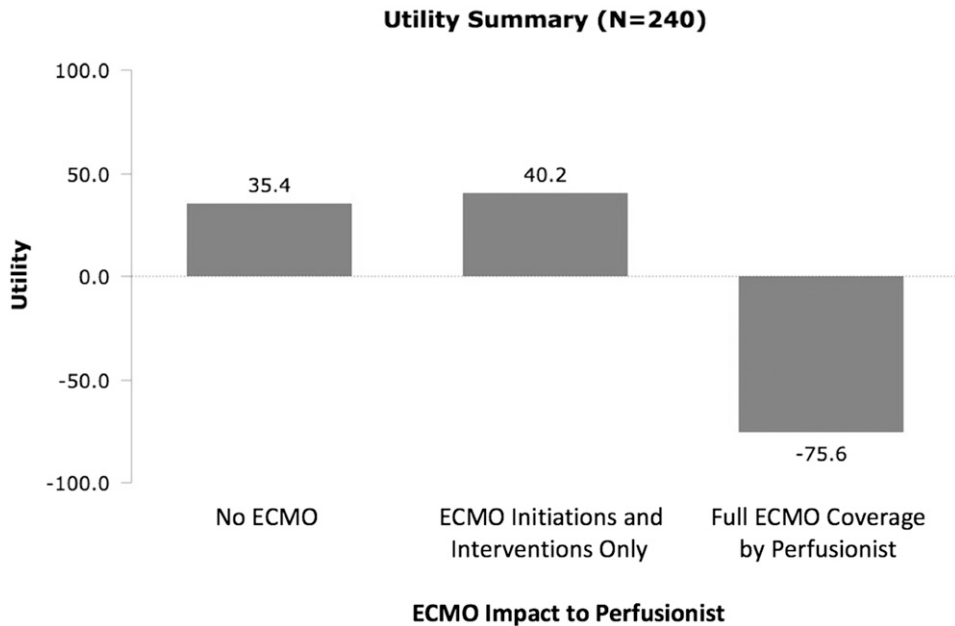


Figure 6. ECMO importance to perfusionist, utility score, n = 240.

with greater than 30 years of experience do not have similar results regarding the importance of ECMO impact to the perfusionist when compared with their slightly less experienced colleagues. Overall, a common theme of how ECMO impacts the perfusionist repeated itself throughout the survey results. There are 2.8 times more ECMO centers in 2019 than in 2008 (3), which indicates that job responsibilities for many perfusionists have likely changed in the past 10 years. The addition of an ECMO program has the ability to create tension within departments as roles and responsibilities change, hours increase, and work-life balance alters. Although not a focus of this study, it is interesting to note that continuous flow left ventricular assist device implants have increased by five times over the last 9 years with 421 implants in 2008 compared with 2,118 implants in 2017 (14). In addition, single-organ cardiac transplantations have increased from 2,163 transplants in 2008 to 3,408 transplants in 2018 (15). As technology grows in the field of advanced cardiac therapies, the role of a perfusionist will need to adapt as well. Offering large sign-on bonuses and relocation packages to entice new employees is not indicated as a viable way to satisfy perfusionists. Although salary is important, it came in as middle of the pack in terms of importance to perfusionists. Appropriate management of hours worked, days on call, and how ECMO impacts the perfusionists will be most impactful in recruitment of new employees. To accommodate these attributes of the profession, an increase in overall staff, whether it be with perfusionists, ECMO specialists, or a combination of the two, may be the best way to accomplish work-life balance. This will result in the need for more perfusionists and ECMO specialists to be

added to the workforce. The results of this survey show that CBC analysis can provide insight into what attributes of employment opportunities are most important to perfusionists. With this information, hiring organizations can be better equipped to produce employment offers specific to perfusion candidates.

As with any survey-based study, limitations do exist. The survey invitations went out via listservs, so it is impossible to know the denominator of who received the survey. With the anonymity of the survey, it is impossible to know that each respondent only completed the survey one time. In addition, the results are limited to individuals willing to complete the survey and therefore their interpretations and biases. Although we did our best to include as many factors that may influence an individual's job preference, it is impossible to predict all factors.

Future studies based from the results of this study might include isolating the top three to four attributes and drilling down into specifics surrounding each of those to gain better insight on perfusionist preferences. Including geographic location and exempt versus nonexempt may also provide valuable information for employers interested in using CBC analysis as a recruitment tool. In addition, by surveying their employees using CBC analysis software, individual organizations can gain an understanding of the preferences of their specific employees and use that information to maximize job satisfaction.

Overall, it is important for perfusion employers and potential employees alike to recognize that accepting a job offer is a multifactorial decision. No one employer or position is likely to have all the best attributes a perfusionist is looking for, so trade-offs are likely to occur.

Understanding the drivers behind these trade-offs is important for both sides of the recruitment process and can facilitate a successful relationship between employee and employer. CBC analysis is one tool that can provide insight that leads to successful recruitment and retention for perfusionists.

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