



Early effect of the COVID-19 pandemic on the North American cardiothoracic surgery job market

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Background: The present study aims to report the early effect of the coronavirus disease 2019 (COVID-19) pandemic on the cardiothoracic surgery job market in North America.

Methods: The Cardiothoracic Surgery Network (CTSNet) job market database was queried, and patterns from January to May for 2019 versus January to May 2020 were compared for trends in job postings and job seekers.

Results: Our study is comprised of 395 cardiothoracic surgery job postings, of which 98% were positions located in North America and 63% were academic. The negative impact of the pandemic on the cardiothoracic surgery job market was greatest in the cardiothoracic/cardiovascular combined subspecialty, followed by congenital and adult cardiac surgery, whereas general thoracic surgery experienced an increase in proportion of jobs available. Despite an increase in views per job posted in 2020 *vs.* 2019 (532 *vs.* 290), employer views of job seeker curriculum vitae declined over the same time period in 2020 (January, 380 views/month to May, 3 views/month) compared to 2019 (January, 100 views/month to May, 54 views/month).

Conclusions: An analysis of job postings from CTSNet suggests a decline in job availability in the North American cardiothoracic surgical job market following declaration of the pandemic with acknowledgement that there is month to month variability and a supply-demand mismatch. The COVID-19 pandemic has had an unprecedented impact on our field, and the ultimate consequences remain unknown.

Keywords: Cardiothoracic surgery workforce; job availability; job seeking; career development; workforce planning

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Introduction

The coronavirus disease 2019 (COVID-19) pandemic has had an unprecedented impact on healthcare with the ultimate consequences on our field yet unknown (1-4). At the peak of the pandemic, cardiothoracic surgical operations were deferred to conserve or redirect limited hospital resources and personnel, as well as to prevent nosocomial transmission per the Society of Thoracic Surgeons COVID-19 Taskforce and the Workforce for Adult Cardiac and Vascular Surgery (1).

At the first peak of the pandemic, COVID-19 had an impact on cardiothoracic surgery through the deferral and resultant decline in cardiothoracic surgery operative volume (5,6), coupled with the need to redeploy the healthcare workforce to the care of patients with COVID-19 (7-9). Prior studies have examined the evolution of the cardiothoracic surgery workforce (10), and job seeking behaviors of trainees (11), which have implications in workforce planning (12-14) as well as resultant interest and recruitment into the specialty (15-18).

Although it is assumed that the COVID-19 pandemic has resulted in decreased job availability with the deferral of cardiothoracic surgical procedures, the exact quantitative effect of the pandemic on the North American cardiothoracic surgery job market remains unknown. Current trends in the cardiothoracic surgery job market surrounding the pandemic may predict future trends in our workforce for subsequent healthcare crises. Furthermore, a clearer understanding of the impact of the pandemic on employment opportunities may assist trainees in planning their careers for the near future in terms of subspecialization or extended training.

The Cardiothoracic Surgery Network (CTSNet) is home to the largest online community of cardiothoracic surgeons in the world and is a comprehensive and heavily trafficked online source of information for cardiothoracic surgery. CTSNet is a not-for-profit organization overseen by the American Association for Thoracic Surgery, The Society of Thoracic Surgeons, and the European Association for Cardio-thoracic Surgery, with numerous other cardiothoracic surgery organizations from around the world involved in CTSNet as participating organizations (19). Among many key electronic resources, CTSNet offers profile pages for cardiothoracic surgeons and individuals associated with the specialty, job market database featuring a career center for the specialty, as well as a broad range of video and text-based educational resources for the

community.

Most cardiothoracic surgery job postings in North America ultimately get posted on CTSNet.org, providing a surrogate measurement for market demand. The CTSNet job market database provides the opportunity for employers to register and post available job opportunities. The database also provides the opportunity for job seekers to register, be notified of upcoming job opportunities, and post their curriculum vitae (CV).

The present study aims to report the early effect of the COVID-19 pandemic on the cardiothoracic surgery job market in North America utilizing data obtained from the CTSNet job market database.

Methods

Study design

The CTSNet job market database was queried at the beginning of June 2020 for all cardiothoracic surgical jobs posted, and patterns from January to May for 2019 versus 2020 were compared for trends in job postings and job seekers. Data regarding job views, job seeker registrations, and CV views were obtained. Subspecialty, position type, practice type, job duration, and emphasis on research as part of the job description were extracted from the job description provided. Only job postings for cardiothoracic surgeons are included in this analysis. The present study does not include patients or any unique identifiers, as such, IRB approval was not obtained. Data regarding location of registrants with CTSNet is based on the information entered by the user upon registration. The present study does not include patients or any unique identifiers, as such, IRB approval was not obtained.

Statistical analyses

Descriptive statistics were used to assess for patterns and trends in job postings from January to May for 2019 as compared to 2020. The normality of the sample was evaluated using the Kolmogorov-Smirnov Test, establishing non-normal distribution. Continuous variables are expressed as medians with the interquartile range (IQR). Categorical data were expressed as counts and percentages, and the percentage increase/decrease from 2019 to 2020 were analyzed. Statistical analyses were performed using SPSS software, version 23 (Chicago, Illinois, USA).

Results

CTSNet job market database demographics

There are 3,036 employers and 5,715 job seekers registered with the CTSNet jobs market database worldwide at the time of the study. At the time of submission, the CTSNet has a total membership of 47,622 worldwide, with 8,037 North American cardiothoracic surgeons registered as users of CTSNet.

Cardiothoracic surgery job posting characteristics

Our study is comprised of 395 total cardiothoracic surgery job postings from January to May for 2019 and January to May 2020. The majority of cardiothoracic surgery jobs posted were combined cardiothoracic/cardiovascular surgery positions which cover the scope of cardiac, thoracic, and/or vascular (58%), followed by thoracic surgery (22%), adult cardiac surgery (14%), and congenital surgery (6%). 90% of cardiothoracic surgery job postings were for faculty positions. The majority of cardiothoracic surgery jobs were posted for positions in North America (98%), of which there was broad geographic distribution across the country. Of jobs located in the USA, 29% of jobs were located in the Northeast, 24% in the South, 29% in the Midwest, and 19% in the West. There were 6 job postings from Canada. The remaining 2% of cardiothoracic surgery jobs posted were from Australia, China, Greece, Netherlands, New Zealand, and Saudi Arabia.

The majority of cardiothoracic surgery jobs were in academic practice (63%), with half including expectations for research as part of the job description (51%). Of jobs requiring research, the majority were research in one or more realms of the following, including clinical research (79%), followed by basic science (12%), translational research (9%), education (2%), and other (8%). Further characteristics of cardiothoracic surgery job postings, job views, and job seeker information stratified by year are shown in *Table 1*.

Change in cardiothoracic surgery job market with pandemic

There was an overall increase in cardiothoracic surgery job postings on the CTSNet jobs market database in the past year when comparing the number of jobs posted in the same time period of January to May in 2020 *vs.* 2019 (226 *vs.* 169 jobs) (*Table 1*). Temporal trends were seen, with job growth in a

month to month comparison of 2020 *vs.* 2019 at a minimum (+10%) during the month of March when COVID-19 was declared a pandemic and the largest (+110%) the month prior to COVID-19 being declared a pandemic (*Figure 1*).

Change in cardiothoracic surgery job market by subspecialty

The impact of the pandemic on the cardiothoracic surgery job market was greatest in the cardiothoracic/cardiovascular combined subspecialty (range, -25% to +1%), followed by congenital (range, -10% to +5%) and adult cardiac surgery (range, -5% to +10%), when comparing proportion of jobs available in each subspecialty at the same month in the previous year (*Figure 2*). In contrast, the general thoracic surgery subspecialty experienced an increase in availability of jobs in the 2020 season (range, +0% to +19%).

Change in cardiothoracic surgery job market by geographic region

Given that the majority of job postings were from the USA (97%), trends in cardiothoracic surgery job postings in the USA by geographic region were examined with differences in regional impact (*Figure 3*). The region in the USA with the greatest decrease in job availability was the Northeast region of -21%, whereas the greatest increase in job availability was seen in the Midwest region of +18% when compared to same month in the previous year.

Increase in cardiothoracic surgery job seeker activity

There was an overall increase in median views per job posted in the CTSNet jobs market database in the past year during the same time period of January to May in 2020 *vs.* 2019 (532 *vs.* 290 views per job) (*Table 1*). This trend in increase in median views per job posted persisted despite the pandemic (*Figure 4*). Employer views of job seeker CVs declined over the same time period in 2020 (January, 380 views/month to May, 3 views/month) compared to 2019 (January, 100 views/month to May, 54 views/month) (*Figure 5*). A graphical abstract of the effect of COVID-19 on the North American cardiothoracic surgery job market are shown in *Figure 6*.

Discussion

We demonstrate that there has been an overall increase in

Table 1 Characteristics of cardiothoracic surgery job posting on the Cardiothoracic Surgery Network (CTSNet)

Characteristic	January 2019 to May 2019 (n=169)	January 2020 to May 2020 (n=226)
Job subspecialty, n [%]		
Adult cardiac	21 [12]	35 [15]
Congenital	12 [7]	11 [5]
Thoracic	28 [17]	58 [26]
Cardiothoracic combined	108 [64]	122 [54]
Position type, n [%]		
Faculty	157 [93]	200 [88]
Fellowship	12 [7]	25 [11]
Other	0 [0]	1 [1]
Practice type, n [%]		
Academic	108 [64]	139 [62]
Community	61 [36]	82 [36]
Other	0 [0]	5 [2]
Job duration, n [%]		
Part-time	2 [1]	0 [0]
Full-time	167 [99]	226 [100]
Encourage research, n [%]		
Overall [yes]	77 [46]	123 [54]
Clinical	64 [83]	93 [76]
Translational	5 [6]	12 [10]
Basic science	8 [10]	16 [13]
Education	0 [0]	3 [2]
Other	5 [6]	11 [9]
Geographic region, n [%]		
USA	163 [96]	219 [97]
USA West	30 [18]	41 [19]
USA Midwest	43 [26]	66 [30]
USA South	37 [23]	54 [25]
USA Northeast	53 [33]	58 [26]
Canada	3 [2]	3 [1]
Other	3 [2]	4 [2]
Job posting attention, median [IQR]		
Views per Job	290 [192–465]	532 [375–571]

IQR, interquartile range; n, number; USA, United States of America.

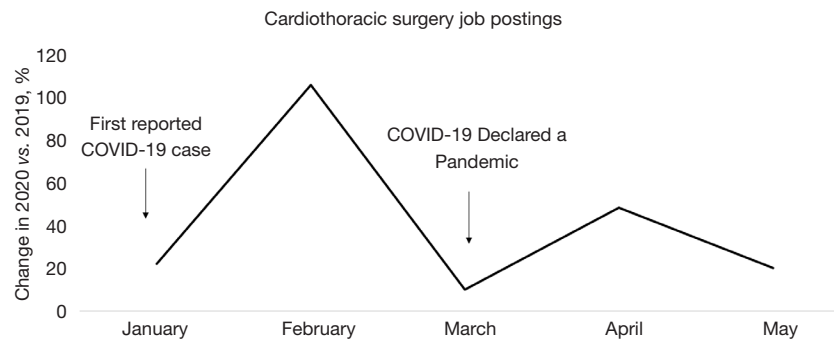


Figure 1 Percent change in 2020 vs. 2019 cardiothoracic surgery jobs posted in the CTSNet job market database. COVID-19, coronavirus disease 2019; CTSNet, Cardiothoracic Surgery Network.

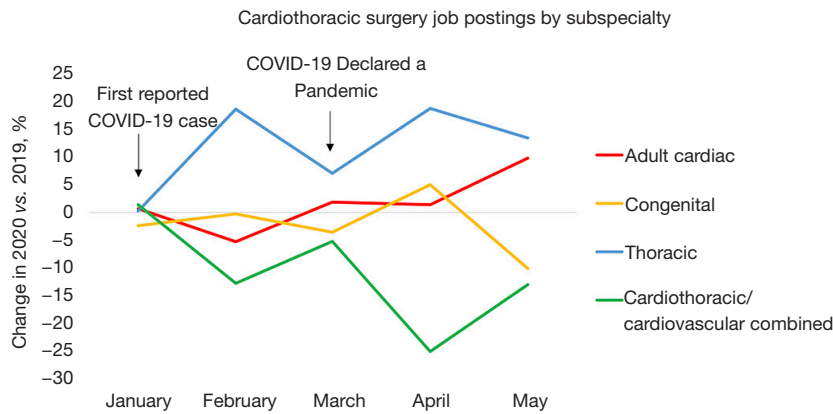


Figure 2 Percent change in 2020 vs. 2019 cardiothoracic surgery jobs by subspecialty that were posted in the CTSNet job market database. COVID-19, coronavirus disease 2019; CTSNet, Cardiothoracic Surgery Network.

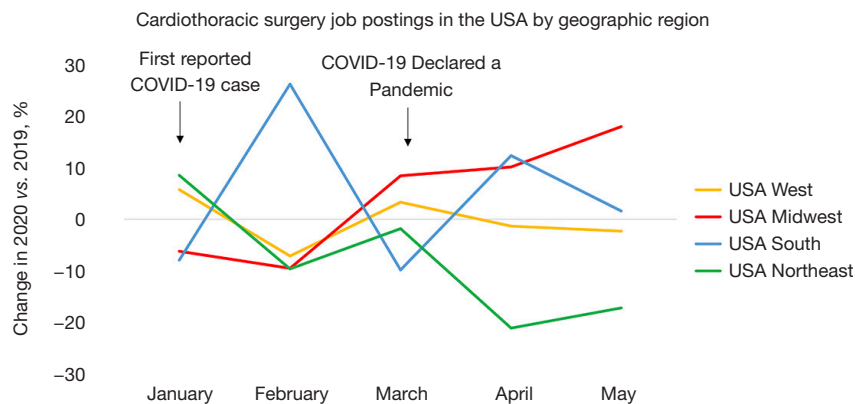


Figure 3 Change in 2020 vs. 2019 cardiothoracic surgery jobs by geographic region in the USA that were posted in the CTSNet job market database. COVID-19, coronavirus disease 2019; CTSNet, Cardiothoracic Surgery Network.

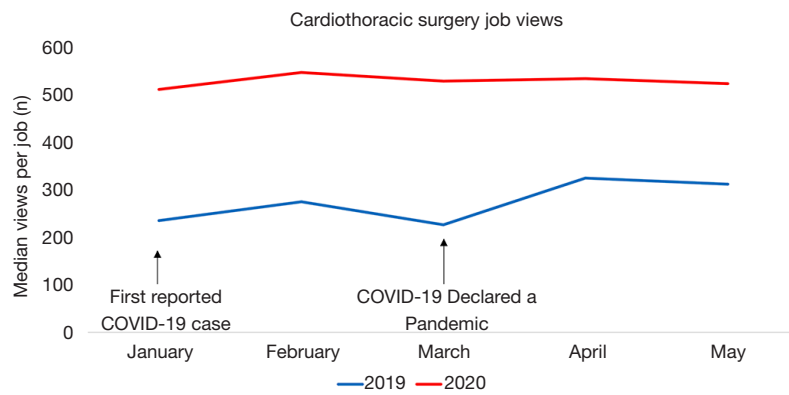


Figure 4 Trends in median number of views per cardiothoracic surgery job posting for jobs posted in the CTSNet job market database in 2020 (red) vs. 2019 (blue). COVID-19, coronavirus disease 2019; CTSNet, Cardiothoracic Surgery Network.

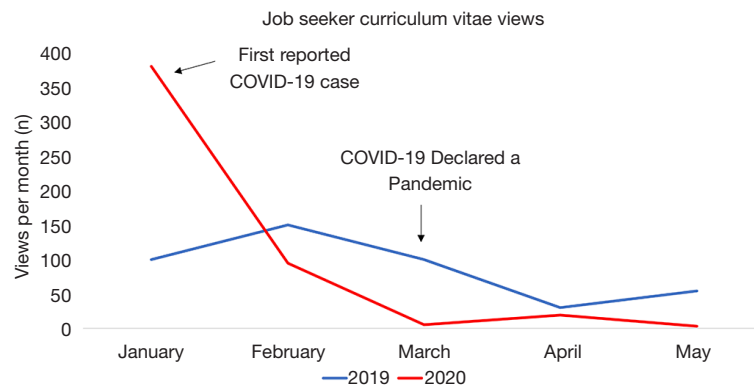


Figure 5 Trends in new cardiothoracic surgery job seeker curriculum vitae views per month in the CTSNet job market database in 2020 (red) vs. 2019 (blue). COVID-19, coronavirus disease 2019; CTSNet, Cardiothoracic Surgery Network.

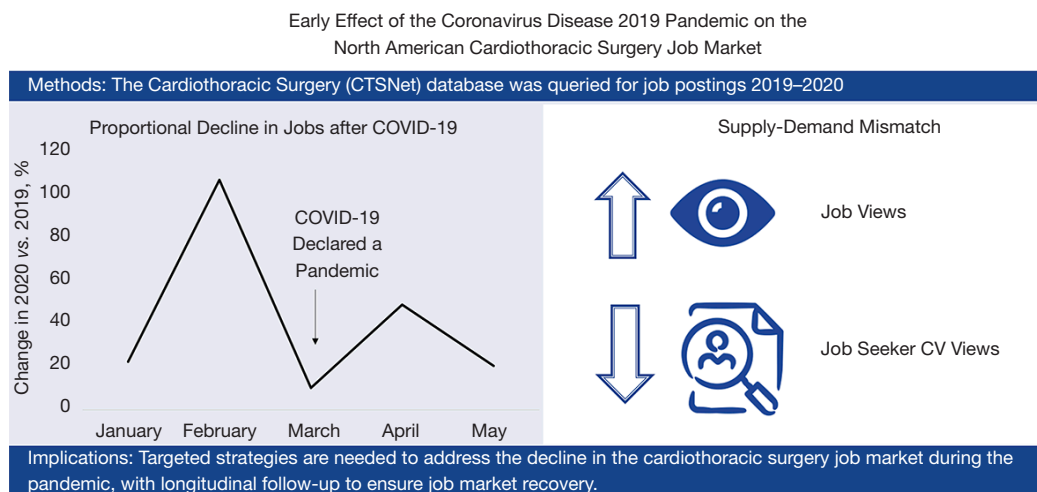


Figure 6 Graphical abstract of the early effect of the COVID-19 pandemic on the North American cardiothoracic surgery job market. COVID-19, coronavirus disease 2019.

cardiothoracic surgery job postings in 2020 compared to 2019, with the suggestion of a proportional decline in jobs available with a month to month comparison shortly after the start of the pandemic based on an analysis of the CTSNet job market database. It is important to acknowledge that there was month to month variability in this study, which may or may not be due to the COVID-19 pandemic. Subspecialties most affected with a decline in job availability were combined cardiothoracic/cardiovascular, followed by congenital and adult cardiac surgery, with general thoracic surgery experiencing a rise in job availability. There were regional differences in burden of impact in the USA for job availability with the Northeast region most affected and the Midwest region least affected, respectively. Furthermore, mismatch between demand and supply was demonstrated, in that there was an increase in views per job posted in 2020 *vs.* 2019, with a corresponding decrease in jobs and employer views of job seeker CVs.

Beyond survey data, use of e-technology and virtual job market database with quantitative data on job postings, login data and post views (20), can help provide a snapshot at the challenges facing cardiothoracic surgery job seekers at this critical point in time in history. Furthermore, comprehensive data on the cardiothoracic surgery workforce during the pandemic can help predict future trends in our workforce in preparation for subsequent waves of the pandemic and future healthcare crises.

The COVID-19 pandemic has challenged the landscape of cardiothoracic surgery education through diminished learning opportunities with deferral of operative cases, redeployment, delayed or cancellation of examinations, and concerns for adequacy of training (5,21,22). Understandably, the impact of the pandemic on our specialty varies by regional burden (5), which is a constantly moving target with different regions in different phases of the pandemic. Corroborating regional burden of COVID-19 with the New York State having been the epicenter of the pandemic during the period evaluated in our study (23), we demonstrate that the region of the USA with greatest decline in job availability was the Northeast region.

In terms of the trend toward reduction in jobs in the subspecialty of combined cardiothoracic/cardiovascular rather than the individual subspecialties of adult cardiac, congenital, and thoracic surgery, the reasons remain unknown. It is possible that this reflects the increasing subspecialization of our specialty into the respective adult cardiac, congenital, and thoracic surgical subspecialties consistent with what has been previously described (24,25).

Other possibilities include the fact that job availability varies year to year and this is simply a reflection of normal variations in the cardiothoracic surgical job market. It is also possible that job availability reflects the operative case volume available, which may vary by subspecialty, where oncologic surgery (primarily general thoracic surgery), may be less deferrable during the pandemic, than non-oncologic surgery (such as adult cardiac or congenital surgery) (4,26,27).

The imbalance between supply and demand in the cardiothoracic surgery workforce demonstrated in our study with the increase in median views per job corresponding with the decrease in jobs and employer views of job seeker CVs, may have downstream effects on the cardiothoracic surgery workforce. If more residents are required to extend training due to lack of employment (28), there may be concern of these graduates competing with new graduates in subsequent years for the limited availability of jobs. In addition, hypothetically, this may be perpetuated by the economic downturn prompting the delayed retirement of current practicing surgeons. The effect of the pandemic on the cardiothoracic surgery workforce, and documented concern regarding trends towards increased debt accrual and diminished job opportunities for trainees (29), may affect our specialty's recruitment efforts. Though importantly, this study examines all-comers for cardiothoracic surgery related job postings on CTSNet, and do not differentiate by jobs that seek new graduates, mid-career faculty, or senior leadership.

Specific for the trainees graduating during the pandemic and unable to find employment, targeted strategies and interventions are needed to address the decline in the cardiothoracic surgery job market during the COVID-19 pandemic to ensure the best and brightest of our workforce are able to attain meaningful employment. Previous reports (28,30) documenting the challenges of cardiothoracic surgery graduates seeking employment had identified potential strategies to address manpower issues in our specialty, some of which may be suitable in the current pandemic, including shared job positions, dedicated mentorship during the transition to practice, job splitting with a position in surgery and for example critical care, bolstering the mechanical circulatory support program, expansion of critical care and operating room capacity, and others.

Challenges during a pandemic exist for all and recognizing the setbacks thereof will provide an opportunity to formulate solutions for our specialty to adapt and rise

above. Ultimately, during this uncertain time, programs have a commitment to the personal as well as professional success of our future colleagues—to provide adequate mentorship to ensure they are able to gain meaningful employment. Ongoing monitoring of the cardiothoracic surgery job market to inform workforce forecasting are needed.

Limitations

Our study is subject to a number of limitations that must be considered in the interpretation of the data. Most importantly, there are many factors that affect job availability. Beyond the COVID-19 pandemic, other confounders for example seasonality may affect job availability and it was not possible to account for these in the present analysis. In our attempt to account for annual seasonal variations in the job market, the same month from 2020 was compared to 2019, with data presented month to month for greater transparency and clarity. We acknowledge that there were month to month variations in this study that may or may not be due to the COVID-19 pandemic, with trends that may have continued in the absence of a pandemic. It is important to recognize that our study only demonstrates trends over time in the job market, and is meant to be informative, transparent, objective, and hypothesis generating, to help initiate a discussion with the goal of generating strategies to limit the collateral damage of pandemic in the years ahead. Although we were able to demonstrate trends, we are not able to ascertain causation. The ever-evolving developments with the pandemic, as well as rapidly changing geographical hotspots, limits the assessment related to linkage of geographic mortality and the cardiothoracic surgery job market. As such, the goal of this study was to assess the effect of the first wave of the pandemic on the job market, which we hope, highlights and documents the response of our specialty to worldwide events and natural disasters, to better inform future trends in our workforce for subsequent healthcare crises. Second, job postings on CTSNet were used as a surrogate to examine job availability. As employers are not required to utilize CTSNet in recruitment efforts, it is possible that jobs available in cardiothoracic surgery were not posted on CTSNet and thus not captured in our analysis—underrepresenting the number of available jobs. Similarly, job seeker job views was used as a surrogate for job demand. It is possible that job views were higher overall in 2020 than 2019 due to increased time available by job seekers with surgery cancellations to view jobs during the

pandemic, or the increased job seeker activity can be due to the natural increase in CTSNet membership. Job seekers are not obligated to utilize CTSNet in their efforts to seek out jobs. As such, the database may not be representative of the population of job seekers. Job seekers are not required to upload their CVs for employers to view, therefore, data captured of CV views may also not be comprehensive. Additional limitations of the database are that granular data are not available for the employers and job seekers, and that it is based on the information supplied by the user upon registration. Furthermore, it is possible that individuals may have more than one profile if they registered for more than one account using a different email. Third, our study is limited to the time period examined, and the small number of jobs posted. In terms of geographic distributions, jobs posted on CTSNet were predominantly from North America, and specifically the USA. Therefore, despite analysis of the job market database, we were not able to capture and analyze jobs that were not posted on CTSNet and as such were excluded. Jobs posted may not be representative of jobs available internationally. Fourth, job seekers and job positions are heterogenous in career level and requirements and are meant to provide an overview of all cardiothoracic surgery jobs posted in the database. Lastly, our study is a snapshot of a rapidly evolving situation affecting heterogenous populations and regions with variable responses due to the pandemic's impact, with month to month variability that may or may not be due to the COVID-19 pandemic. It is possible that this study could have under or even overestimated the true job market early in the pandemic given a lag in response of the job market in response to worldwide events. Longitudinal follow-up to track the road to job market recovery is needed.

Conclusions

The present study provides information regarding the North American cardiothoracic surgical job market response to the COVID-19 pandemic. Analysis of job postings from CTSNet suggests a decline in cardiothoracic surgery job availability shortly after the pandemic was declared with the acknowledgement that there is month to month variability that may or may not be due to the pandemic, with differences in subspecialty and geographic impact. Longitudinal follow-up to track the disparity in supply and demand in job market recovery is needed. The COVID-19 pandemic has had an unprecedented impact on our field, and the ultimate consequences remains unknown.

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Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at <https://jtd.amegroups.com/article/view/10.21037/jtd-22-320/coif>). The following authors serve on the leadership board of CTSNet: JGYL is Resident Editor, CJ is Managing Editor, ER is Web Coordinator, Grahame Rush is Executive Director, JD, POM, MBA, and TCN are Associate Editors. MBA serves as an unpaid editorial board member of *Journal of Thoracic Disease*. The other authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The present study does not include patients or any unique identifiers, as such, IRB approval was not obtained.

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