

1 **Impact of COVID-19 on the Society for Vascular Surgery Vascular Quality Initiative**
2 **Venous Procedure Registries (Varicose Vein and Inferior Vena Cava Filter)**

3

4 Ashorne K. Mahenthiran, BA^a, Jay P. Natarajan, BS^b, Daniel J. Bertges, MD^c, Kristopher M.
5 Huffman, MS^d, Jens Eldrup-Jorgensen, MD, FACS^e, Gary W. Lemmon, MD, FACS^f

6

7

8

9 From: Feinberg School of Medicine, Northwestern University, Chicago, IL^a, College of
10 Medicine, Northeast Ohio Medical University, Rootstown, OH^b, Division of Vascular Surgery,
11 University of Vermont Medical Center, Burlington, Vt^c, Director of Analytics, SVS PSO,
12 Rosemont, Il^d, Division of Vascular and Endovascular Surgery, Maine Medical Center, Portland,
13 Me^e, Division of Vascular Surgery, Indiana University, Indianapolis, In^f

14

15

16 Correspondence: Gary W Lemmon, MD, FACS

17

Professor Vascular Surgery

18

Indiana University School of Medicine

19

1801 N Senate Boulevard, D-3500

20

Indianapolis, Indiana 46202

21

Email: gwlemmon@iupui.edu

22

Phone: 317-962-2300

23

This is the author's manuscript of the article published in final edited form as:

Mahenthiran, A. K., Natarajan, J. P., Bertges, D. J., Huffman, K. M., Eldrup-Jorgensen, J., & Lemmon, G. W. (2021). Impact of COVID-19 on the Society for Vascular Surgery Vascular Quality Initiative Venous Procedure Registries (Varicose Vein and Inferior Vena Cava Filter). *Journal of Vascular Surgery: Venous and Lymphatic Disorders*. <https://doi.org/10.1016/j.jvsv.2021.01.002>

1 Keywords: Covid-19, physician survey, VQI venous registry, clinical practice shift

2

3

4

5

6

7

8

9

10

11

12

13

14

15 **ARTICLE HIGHLIGHTS**

16

17 **Type of Research:** SVS PSO survey of clinical practice

18 effects due to coronavirus, Covid-19 pandemic.

19 Retrospective review of VQI venous registry volume

20 between 1st Quarter of 2019 and 2020.

21

22 **Key Findings:** Seventy four percent of respondents

23 adopted a restrictive pandemic operating policy to urgent

1 and emergent procedures. One half of surgeons
2 continued in hospital 'time sensitive' elective procedures
3 despite policy shift. A five-fold reduction in VQI venous
4 (VV + IVCF) procedural volume was noted in 1st Quarter
5 of 2020 with Data Manager re-assignment/furlough and
6 case volume decline contributing. Survey questions
7 omitted ambulatory practice change impact.

8
9 **Take home Message:** VQI venous case volume activity
10 and registry data entry was sharply reduced during the
11 initial phase of the Covid-19 pandemic as many vascular
12 surgeons adopted a restrictive policy on vascular
13 procedures. Ambulatory venous practice decreased
14 significantly.

15
16

17

18 Table of Contents Summary

19 SVS PSO surveys of VQI Data Managers and Physicians
20 assessed policy changes in response to the coronavirus
21 pandemic. Registry volume entry for 1st Quarter of 2020
22 was compared to historical 2019 levels.

23 **Abstract**

1
2 In response to the pandemic, an abrupt pivot of VQI physician members away from standard
3 clinical practice to a restrictive phase of emergent and urgent vascular procedures occurred. The
4 Society for Vascular Surgery Patient Safety Organization queried both data managers and
5 physicians in May 2020. Approximately three fourths (74%) of physicians adopted restrictive
6 operating policies for urgent and emergent cases only, while one half proceeded with 'time
7 sensitive' elective cases as urgent. Data manager case entry was negatively affected by both low
8 case volumes and staffing due to re-assignment or furlough. Venous registry volumes were
9 reduced five-fold in 1st Quarter of 2020 compared to a similar period in 2019.
10 The consequences of delaying vascular procedures for ambulatory venous practice remain
11 unknown with increased morbidity likely. Challenges to determine venous thromboembolism
12 mortality impact exist given difficulty in verifying 'in home and extended care facility' deaths.
13 Further ramifications of a pandemic shutdown will likely be amplified if postponement of
14 elective vascular care extends beyond a short window of time. It will be important to monitor
15 disease progression and case severity as a result of policy shifts adopted locally in response to
16 pandemic surges.

17

18 **Impact of COVID-19 on the Society for Vascular Surgery Vascular Quality Initiative**

19 **Venous Procedure Registries (Varicose Vein and Inferior Vena Cava Filter)**

20

21 **Introduction**

22 The coronavirus pandemic has altered our personal and professional lives in ways that were
23 inconceivable only months ago. As the coronavirus (SARs-Co-V2, herein listed as Covid-19)

1 spread across the United States, health care workers found themselves on the front lines of the
2 battle for their patients and, in many cases, their personal well-being and survival.¹

3 On March 13th, the American College of Surgeons issued a recommendation to “review all
4 scheduled elective procedures with a plan to minimize, postpone, or cancel electively scheduled
5 operations.”² On March 14th, Dr. Jerome Brown, the Surgeon General of the United States
6 reiterated this plea with a tweet “Hospital & healthcare systems, PLEASE CONSIDER
7 STOPPING ELECTIVE PROCEDURES until we can #FlattenTheCurve!”³

8 The vascular surgery community quickly responded to these dramatic events. As a result, the
9 Society for Vascular Surgery Vascular (SVS) Patient Safety Organization (PSO) Vascular
10 Quality Initiative (VQI) noted a precipitous decline in registry volumes. The SVS PSO
11 conducted two surveys early in the pandemic to assess changes in practice. We first surveyed
12 VQI data managers to discern pandemic impact on workflow and queried the historical volume
13 of the M2S registry. Second, we surveyed VQI physicians about practice changes altered in
14 response to the pandemic. We report the findings and discuss the implications in this practice
15 management study.

16 **The status quo disrupted**

17 Prior to the Covid-19 pandemic, physicians treating vascular disease regularly performed a
18 variety of procedures that were elective, urgent, and emergent in nature. Routine elective venous
19 procedures included varicose vein removal, saphenous vein ablation for reflux,
20 mechanical/thrombolytic treatment of venous thromboembolism, venous stenting and IVC filter
21 insertion or removal. Combined with non-elective arterial disease, urgent and emergent cases for
22 venous thromboembolism and vascular trauma comprise approximately 30-50% of an active

1 vascular surgery practice case mix.⁴ Many practitioners who focus on venous pathology dedicate
2 the majority of their case volume to ambulatory venous disease treatment.
3 The coronavirus pandemic disrupted this status quo threatening the timeliness and efficiency of
4 care. Physicians were confronted with the dilemma of potential Covid-19 exposure to patients by
5 bringing them into a hospital or office setting. This influenced physicians to rethink potential
6 exposure and utilization of hospital resources possibly needed for Covid-19 related admissions.⁵
7 Outpatient vascular services and office-based laboratories providing diagnostic and therapeutic
8 services were also dramatically affected and most apparent for elective venous disease treatment
9 primarily residing in the outpatient arena. In a global survey by Ng *et. al.*, 86.9% of vascular
10 surgeons stated that their outpatient services were either suspended or downscaled in response to
11 the pandemic.⁶ With little to no preparation, clinical practice for vascular surgeons had to shift
12 away from preferred face-to-face interactions and adopt a “only if your life (or limb) depends on
13 it” policy for direct patient contact. Postoperative follow up care and chronic disease
14 management evolved rapidly through “remote” medicine. Examples of these include
15 telemedicine through phone calls, video chats, and interactions via the electronic medical record.
16 This rapid pivot in vascular practice management has only been possible due to advances in
17 technology and internet access.

18 **A change in practice**

19 During the Society for Vascular Surgery’s webinar conducted on March 27th, Dr. Benjamin
20 Starnes clearly and passionately stated “the ultimate role of the surgeon in a pandemic is to help
21 grow hospital capacity by not operating...” to “preserve space, staff and stuff (personal protective
22 equipment).”⁷ Vascular surgeons across the nation responded to this “call to inaction” by
23 developing triage plans for elective, urgent and emergency procedures.^{8,9} Surgeons and trainees

1 were called upon to serve in a variety of new roles to combat the pandemic. The abrupt shutdown
2 of elective surgery in all forms allowed hospitals and health care systems to draw up capacity
3 and formulate surge plans in anticipation of an influx of patients with Covid-19.¹⁰

4 **Real time data of survey of Data Managers**

5 To determine pandemic impact on VQI workflow, we conducted a survey of VQI centers sent
6 5/8/2020 and closed 6/15/2020 from over 220 VQI data managers summarized in (Appendix A).

- 7 • The majority reported that hospital staff, as opposed to contracted vendors, were
8 responsible for data collection.
- 9 • At the time of the survey in early May, almost 10% of centers restricted procedures to
10 emergencies only, while over 90% of centers performed urgent and emergent operations.
11 Forty per cent of centers continued to perform elective procedures with minimal volume
12 reduction. Elective cases were scheduled to resume between May 11-24 (53%) and
13 between May 25-June7 (13%) of centers. One quarter (26%) of centers were unable to
14 provide a definitive time for restarting elective procedures.
- 15 • 75% of abstractors were not furloughed or reassigned. Thirty percent of respondents
16 reported having lower case volumes at the time of the survey.
- 17 • Variation in the methods for long term follow-up (LTFU) was noted. A third of centers
18 responded that they were continuing to do face-to-face follow-up with the remainder
19 adjusting their follow ups to phone contact, phone/video calls or electronic medical
20 record review. Twelve percent of the respondents stated that follow-up was currently not
21 possible.

22 **Survey of VQI member physicians**

1 To assess the effect on practice, we conducted a 7-question survey of VQI physicians sent
2 6/2/2020 and closed 7/20/2020 (Appendix B). The response from over 100 physicians is
3 summarized here:

- 4 • A variety of non-mutually exclusive sources were used to guide pandemic change in
5 operating policy; institutional (61%), societal guidelines (51%) and Center for Disease
6 Control (CDC)/Center for Medicare Services (CMS) guidelines (30%)
- 7 • The majority (74%) reported Operating Policy shift to urgent and emergent cases with
8 14% restricting to emergency procedures only. Despite this, one half of respondents
9 performed 'Elective' procedures while restrictive policies were in place due to perceived
10 need. Urgent cases were interpreted as both symptomatic and 'time sensitive' elective
11 cases as mentioned below
- 12 • Elective procedures considered time sensitive primarily encompassed dialysis access (de
13 novo 48%, dysfunctional access 72%, asymptomatic (often with larger size criteria) AAA
14 repair (41%) and PVI for threatened grafts (61%)
- 15 • The majority of centers conducted mandatory COVID-19 testing prior to surgery (79%);
16 11% reserved testing for symptomatic patients only.
- 17 • A shift to delay repair to a larger size aneurysm was noted in over one quarter of the
18 respondents.
- 19 • The survey did not include questions directed at ambulatory venous practice

20 In response to the pandemic, the SVS VQI noted precipitous global declines in all registries
21 including varicose veins (VV) and inferior vena cava filter (IVC) placement as shown in Figure
22 1. Operations for VV and IVC registries were compared on a week-by-week basis to 1st quarter
23 of 2019 in Figure 2. Individually, the VV registry noted a greater decline than did IVC registry

1 volumes by a factor of 6.2 to 1.8 reduction, respectively, (Table 1). Combining VV and IVC
2 volumes, a nearly 5-fold reduction in average weekly venous procedures were recorded from
3 weeks 6-9 to weeks 10-13 in 2020 (149 to 77.75, 47.8% decrease) when compared to the same
4 period in 2019 (160.25 to 145.75, 9.0% decrease). Geographic differences of the highest
5 performing regional groups from East and West Coast and Midwest demonstrated nearly
6 identical curves to registry volume decline as shown in Figure 3. While delay in data entry may
7 explain part of this decline, such delay would not account for the nearly 5-fold decrease in
8 average 2020 weekly venous procedural volumes when compared to 1st quarters of both 2018
9 and 2019. We attribute a significant part of the decline to procedural shutdown across registries
10 for this period. This is supported by over 75% of data managers being ‘not re-assigned or
11 furloughed’ and given reduced case volumes, likely had sufficient time for case entry.
12 Our abbreviated survey did not inquire about ambulatory practice revisions or in office-based
13 laboratory (OBL’s) performance. Thus, the full impact on venous practice cannot be fully
14 assessed. Given the unprecedented shutdown to all non-essential services nationally, it is
15 reasonable to surmise that ambulatory treatment of venous disorders lessened significantly, as we
16 continue to hear anecdotally of ongoing treatment of acute thrombophlebitis, infected venous
17 ulcers and other urgent conditions (JEJ).

18 The downstream secondary effects of suspending operations are unknown. Approximately 20%
19 of venous disorders require emergent treatment (thrombolysis, IVC filter insertion/removal,
20 thrombectomy) requiring hospitalization. Most can still be performed percutaneously and
21 contribute to a reduced procedural length of stay. Increased usage of outpatient low molecular
22 weight heparin injection/oral anticoagulant drug medication in place of inpatient continuous
23 intravenous heparin infusions can also reduce inpatient bed utilization.

1 **Covid-19 and peripheral venous complications**

2 Recent research has demonstrated the coronavirus's ability to produce thrombotic complications
3 due to the cytokine storm triggering a systemic immune response.¹¹ As a result, infected patients
4 are at higher risk of developing a hypercoagulable state with arterial and venous thrombosis.
5 Excessive inflammation, platelet activation, endothelial dysfunction, and stasis have been
6 postulated as mechanisms.¹² Venous thromboembolic events appear more common than arterial
7 thromboembolism yet few vascular beds have been spared.¹³⁻¹⁶ Going forward, vascular surgeons
8 will need to assess both a patient's response to a venous procedure but also if prior or current
9 Covid-19 infection has altered coagulation. Unknown dilemmas such as proper timing to safely
10 perform a venous ablation in patients who have contracted Covid-19 yet are clinically
11 asymptomatic are not presently clear. It is becoming apparent that Covid-19's hypercoagulable
12 duration may extend beyond acute hospitalization and into the convalescent stage, thus
13 anticoagulation may need extended beyond current accepted guidelines. The SVS VQI is
14 partnering with the Vascular Surgery Covid-19 Collaborative (VASCC) to learn more about the
15 long-term impact on vascular patients.¹⁷ The VQI has incorporated variables in all procedural
16 registries by late August-early September 2020 on Covid-19 status, infection history and impact
17 for ongoing monitoring at time of procedure and at long term follow up.

18 Of concern, are the unknown number of patients who may delay treatment for health issues due
19 to fear of contracting Covid-19 by seeking medical attention. Emergency department visits for
20 acute cardiac events have had a notable decline during the pandemic while a reciprocal rise in 'at
21 home' deaths have been reported.¹⁸⁻¹⁹ The health care impact of Covid-19 will need to take into
22 account indirect collateral morbidity and mortality rates due to patient reluctance or refusal to
23 seek timely medical attention.²⁰⁻²¹

1 Invariably, as health care systems look ahead to a return to the business of medicine, guidelines
2 have been developed for a return to operating.¹⁰ Hospitals and surgeons may adapt to elective
3 procedure backlogs and clinic visits in any number of ways including longer weekday hours or
4 weekend surgery.

5 The present analysis is limited by the subjective nature of an elective survey and our attempt to
6 correlate these results with actual workload volumes in the VQI procedure driven registry.

7 Attributing a nearly 5-fold difference in venous case volume drop to lack of data entry alone
8 should be viewed with caution as events surrounding responses to the Covid-19 crises is clearly
9 multifactorial, noting that 40% of centers continued elective work during this time. Changes in
10 data manager workflow and long-term follow-up will need to be considered for future quality
11 reporting and VQI clinical research studies. Survey questions were also directed primarily to the
12 inpatient setting with an emphasis on arterial procedures and thus did not completely capture
13 ambulatory venous changes in surgical centers and OBL's. Given survey focus, we also cannot
14 comment on indications or results of venous procedures performed during this time. That will
15 require ongoing analysis of center specific data.

16 While we analyzed geographic regions by coastal and Midwest locations, we cannot determine
17 regional distribution to the survey responses at the center level. VQI centers are in all 50 states.
18 Each geographic location demonstrated similar rates of decline following mid-March indicating
19 the national shutdown affected regions equally. We were unable to determine on a more
20 granular level the impact on individual centers. A more detailed reporting of regional
21 differences in practice variation during pandemic restrictions will require further trend analysis
22 near the end of 2020, not available at the time of this manuscript. Given the uncertain future
23 over the coming one to two years, the US healthcare system will face ongoing challenges. The

1 authors expect these challenges to be unevenly distributed over place and time given variations
2 in state and local guidelines for practice restrictions. Localized outbreaks with clusters of
3 infection or a resurgence of epidemics may necessitate a similar regional response with a
4 reduction in elective surgery.

5 Research into the ramifications of the coronavirus pandemic on all facets of vascular care will
6 help us provide the best care to our patients. Venous treatment delays may lead to progression of
7 thrombotic disease, embolization, or worsen morbidity of post-phlebotic limbs. Vascular
8 surgeon's partnership with public health experts and epidemiologists to study the pandemic
9 impact and our response to the public health crisis should be ongoing. Most importantly, we
10 must look for new and innovative ways to practice in what will likely be a "new abnormal."

11 **Conclusions**

12 The vascular surgery community response to the global Covid-19 pandemic during the national
13 shutdown resulted in a dramatic reduction in elective case volumes with most practitioners
14 performing emergency and select urgent procedures only. A 5-fold reduction in venous registry
15 case volumes was noted when compared to the same period in 2019. The potential impact of
16 delaying treatment on vascular disease remains unknown and will require further analysis. The
17 VQI is moving forward with regional virtual meetings that will provide a forum for study,
18 reflection, communication, and discussion.

19 **References**

- 20 1. National Center for Immunization and Respiratory Diseases. Cases in the U.S. Centers
21 for Disease Control and Prevention. [https://www.cdc.gov/coronavirus/2019-ncov/cases-
updates/cases-in-us.html](https://www.cdc.gov/coronavirus/2019-ncov/cases-
22 updates/cases-in-us.html). Published June 11, 2020. Accessed June 24, 2020.

- 1 2. American College of Surgeons. COVID-19: Recommendations for Management of
2 Elective Surgical Procedures. ACS: COVID-19 and Surgery.
3 <https://www.facs.org/covid-19/clinical-guidance/elective-surgery>. Published March 13,
4 2020. Accessed June 24, 2020.
- 5 3. Brown, Jerome (@Surgeon_General) “Hospital & healthcare systems, PLEASE
6 CONSIDER STOPPING ELECTIVE PROCEDURES until we can #FlattenTheCurve! “
7 March 14, 2020, 8:14 am. Tweet.
- 8 4. American College of Surgeons. COVID-19 Guidelines for Triage of Vascular Surgery
9 Patients. ACS: COVID-19 and Surgery. [https://www.facs.org/covid-19/clinical-](https://www.facs.org/covid-19/clinical-guidance/elective-case/vascular-surgery)
10 guidance/elective-case/vascular-surgery. Published March 24, 2020. Accessed June 24,
11 2020.
- 12 5. Al-Jabir A, Kerwan A, Nicola M, Zaid A, Mehdi K, Sohrabi C et al. Impact of the
13 Coronavirus (COVID-19) pandemic on surgical practice - Part 2 (surgical prioritisation)
14 [published online ahead of print, 2020 May 12]. *Int J Surg*. 2020;79:233-248.
15 doi:10.1016/j.ijvsu.2020.05.002
- 16 6. Ng JJ, Ho P, Dharmaraj RB, Wong JCL, Choong AMTL. The global impact of COVID-
17 19 on vascular surgical services. *J Vasc Surg*. 2020;71(6):2182-2183.e1.
18 doi:10.1016/j.jvs.2020.03.024
- 19 7. Lumsden A, Hodgson K, Irshad A, Forbes TL, Starnes BW, McDevitt D, Slaw KM,
20 Dalman RL, Schneider DB. *Early Vascular Surgeon Experiences with COVID-19 (Kim*
21 *Hodgson, MD & Alan Lumsden, MD) March 27, 2020.* [YouTube]. United States:
22 Society for Vascular Surgery; 2020.

- 1 8. Society for Vascular Surgery. COVID-19 Resources for Members. Society for Vascular
2 Surgery. <https://vascular.org/news-advocacy/covid-19-resources>. Published 2020.
3 Accessed June 24, 2020.
- 4 9. CMS News and Media Group. Press release CMS Releases Recommendations on Adult
5 Elective Surgeries, Non-Essential Medical, Surgical, and Dental Procedures During
6 COVID-19 Response. CMS Releases Recommendations on Adult Elective Surgeries,
7 Non-Essential Medical, Surgical, and Dental Procedures During COVID-19 Response.
8 [https://www.cms.gov/newsroom/press-releases/cms-releases-recommendations-adult-](https://www.cms.gov/newsroom/press-releases/cms-releases-recommendations-adult-elective-surgeries-non-essential-medical-surgical-and-dental)
9 [elective-surgeries-non-essential-medical-surgical-and-dental](https://www.cms.gov/newsroom/press-releases/cms-releases-recommendations-adult-elective-surgeries-non-essential-medical-surgical-and-dental). Published March 18, 2020.
10 Accessed June 24, 2020.
- 11 10. American College of Surgeons. Joint Statement: Roadmap for Resuming Elective
12 Surgery after COVID-19 Pandemic. ACS: COVID-19 and Surgery.
13 <https://www.facs.org/covid-19/clinical-guidance/roadmap-elective-surgery>. Published
14 April 17, 2020. Accessed June 24, 2020.
- 15 11. Gralinski LE, Baric RS. Molecular pathology of emerging coronavirus infections. *J*
16 *Pathol.* 2015;235(2):185-195. doi:10.1002/path.4454
- 17 12. Bikdeli B, Madhavan MV, Jimenez D, Chuich T, Dreyfus I, Driggin E et al. COVID-19
18 and Thrombotic or Thromboembolic Disease: Implications for Prevention,
19 Antithrombotic Therapy, and Follow-Up: JACC State-of-the-Art Review. *J Am Coll*
20 *Cardiol.* 2020;75(23):2950-2973. doi:10.1016/j.jacc.2020.04.031
- 21 13. Teo KC, Leung WCY, Wong YK, Liu R, Chan A, Choi O et al. Delays in Stroke Onset
22 to Hospital Arrival Time During COVID-19. *Stroke.* 2020;51(7):2228-2231.
23 doi:10.1161/STROKEAHA.120.030105

- 1 14. Kashi M, Jacquin A, Dakhil B, Zaimi R, Mahe E, Tella E et al. Severe arterial
2 thrombosis associated with Covid-19 infection. *Thromb Res.* 2020;192:75-77.
3 doi:10.1016/j.thromres.2020.05.025
- 4 15. Mestres G, Puigmacià R, Blanco C, Yugueros X, Esturrica M, Riambau V. Risk of
5 peripheral arterial thrombosis in COVID-19 [published online ahead of print, 2020 May
6 7]. *J Vasc Surg.* 2020; S0741-5214(20)31074-0. doi:10.1016/j.jvs.2020.04.477
- 7 16. Gomez-Arbelaez D, Ibarra-Sanchez G, Garcia-Gutierrez A, Comanges-Yeboles A,
8 Ansuategui-Vicente M, Gonzalez-Fajardo JA. COVID-19-Related Aortic Thrombosis:
9 A Report of Four Cases [published online ahead of print, 2020 May 29]. *Ann Vasc Surg.*
10 2020;S0890 5096(20)30438-6. doi:10.1016/j.avsg.2020.05.031
- 11 17. [https://medschool.cuanschutz.edu/surgery/specialties/vascular/research/vascular-](https://medschool.cuanschutz.edu/surgery/specialties/vascular/research/vascular-surgery-covid-19-collaborative/vascc)
12 [surgery-covid-19-collaborative/vascc](https://medschool.cuanschutz.edu/surgery/specialties/vascular/research/vascular-surgery-covid-19-collaborative/vascc) Accessed 7/27/2020.
- 13 18. Marijon E, Karam N, Jost D, Perrot D, Frattini B, Derkenne C et al. Out-of-hospital
14 cardiac arrest during the COVID-19 pandemic in Paris, France: a population-based,
15 observational study [published online ahead of print, 2020 May 27]. *Lancet Public*
16 *Health.* 2020;S2468-2667(20)30117-1. doi:10.1016/S2468-2667(20)30117-1
- 17 19. Teo KC, Leung WCY, Wong YK, Liu R, Chan A, Choi O et al. Delays in Stroke Onset
18 to Hospital Arrival Time During COVID-19. *Stroke.* 2020;51(7):2228-2231.
19 doi:10.1161/STROKEAHA.120.030105
- 20 20. Lodigiani C, Iapichino G, Carenzo L, Cecconi M, Ferrazzi P, Sebastian T et al. Venous
21 and arterial thromboembolic complications in COVID-19 patients admitted to an
22 academic hospital in Milan, Italy. *Thromb Res.* 2020;191:9-14.
23 doi:10.1016/j.thromres.2020.04.024

- 1 21. Bhatt AS, Moscone A, McElrath EE, Varshney A, Claggett B, Bhatt D et al. Declines in
2 Hospitalizations for Acute Cardiovascular Conditions During the COVID-19 Pandemic:
3 A Multicenter Tertiary Care Experience [published online ahead of print, 2020 May 21].
4 *J Am Coll Cardiol.* 2020;76(3):280-288. doi:10.1016/j.jacc.2020.05.038

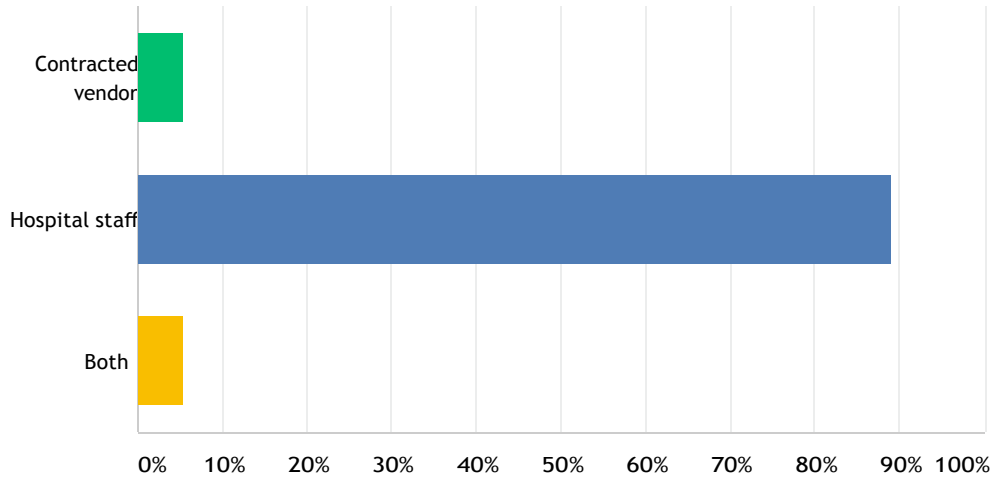
5

6

COVID Survey (Data Managers)

Q1 Who collects data at your facility?

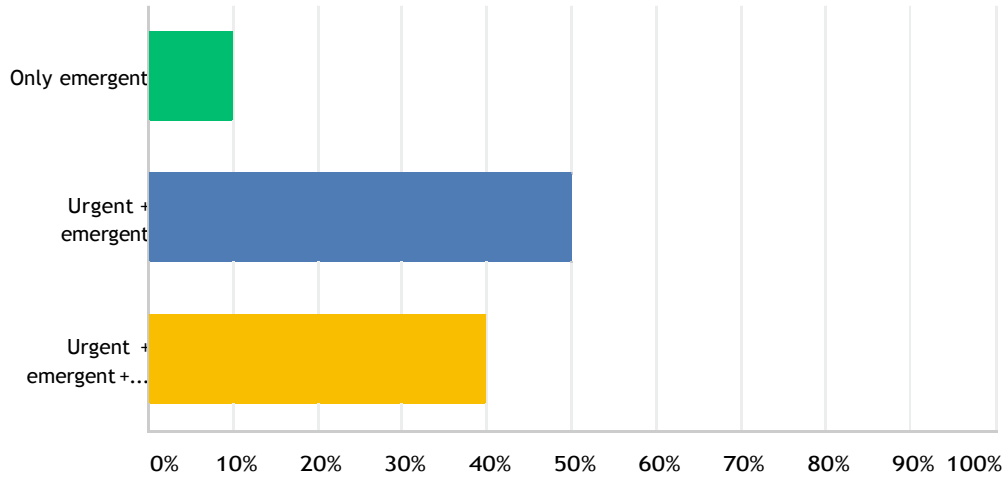
Answered: 221 Skipped: 4



ANSWER CHOICES	RESPONSES
Contracted vendor	5.43% 12
Hospital staff	89.14% 197
Both	5.43% 12
TOTAL	221

Q2 Are you currently performing elective procedures?

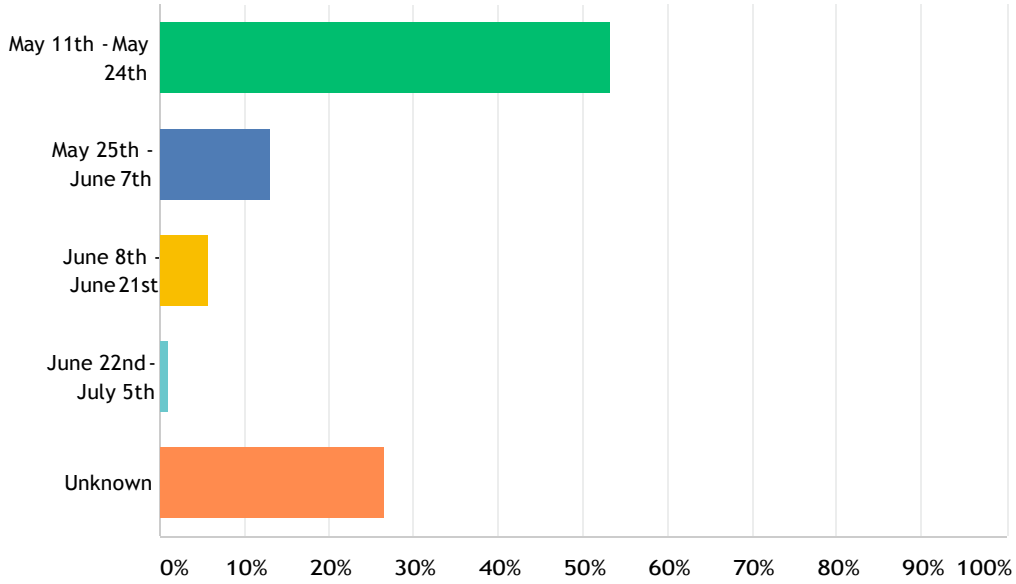
Answered: 225 Skipped: 0



ANSWER CHOICES	RESPONSES	
Only emergent	9.33%	21
Urgent + emergent	50.67%	114
Urgent + emergent + elective	40.00%	90
TOTAL		225

Q3 When are elective procedures scheduled to start?

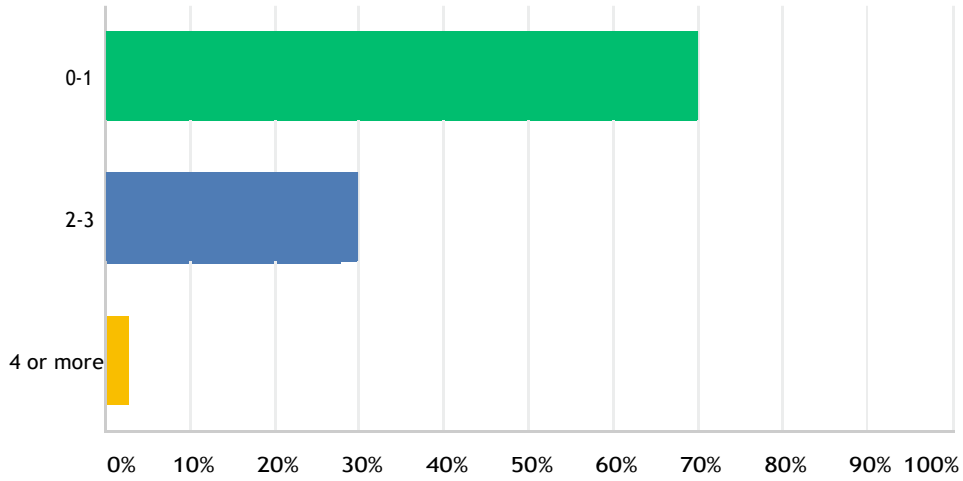
Answered: 204 Skipped: 21



ANSWER CHOICES	RESPONSES	
May 11th - May 24th	53.43%	109
May 25th - June 7th	13.24%	27
June 8th - June 21st	5.88%	12
June 22nd - July 5th	0.98%	2
Unknown	26.47%	54
TOTAL		204

Q4 How many employed VQI abstractors do you have at your center?

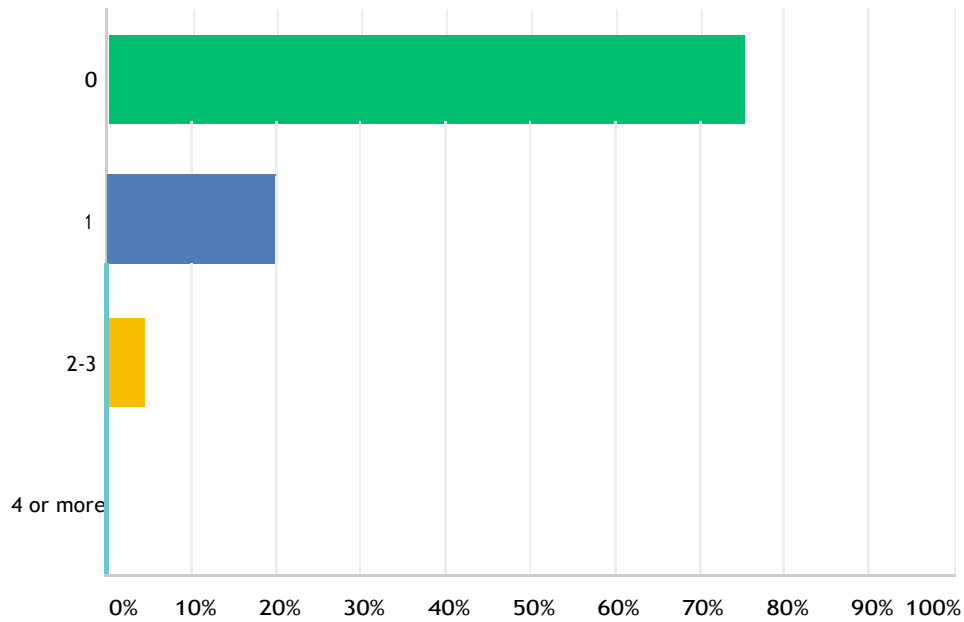
Answered: 223 Skipped: 2



ANSWER CHOICES	RESPONSES
0-1	69.51% 155
2-3	27.80% 62
4 or more	2.69% 6
TOTAL	223

Q5 How many of your employed VQI abstractors been re-deployed?

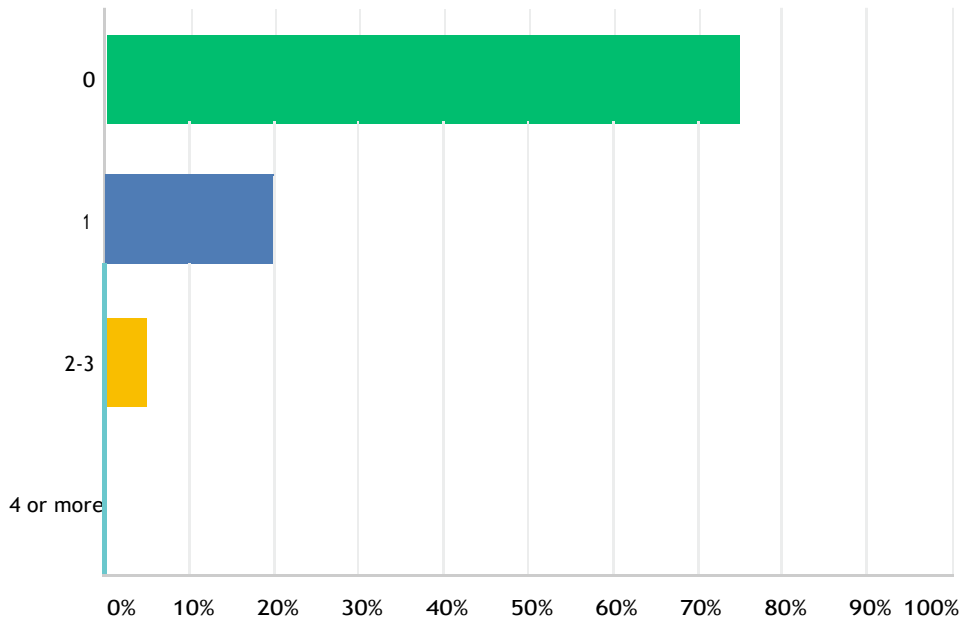
Answered: 223 Skipped: 2



ANSWER CHOICES	RESPONSES	
0	75.34%	168
1	19.73%	44
2-3	4.48%	10
4 or more	0.45%	1
TOTAL		223

Q6 How many of your employed VQI abstractors been furloughed?

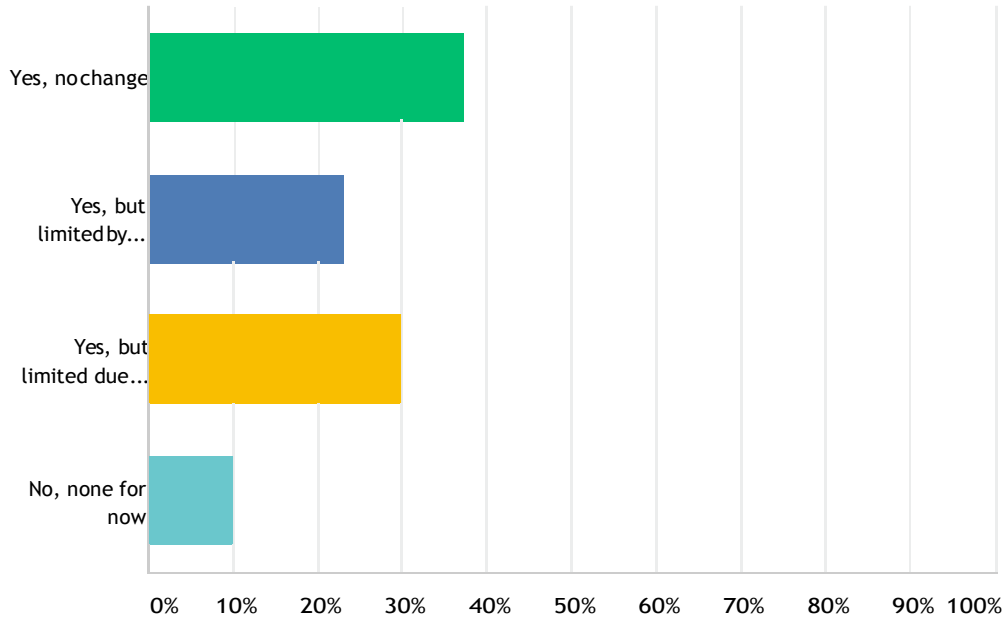
Answered: 224 Skipped: 1



ANSWER CHOICES	RESPONSES	
0	75.00%	168
1	19.64%	44
2-3	4.91%	11
4 or more	0.45%	1
TOTAL		224

Q7 Are you still abstracting current procedures?

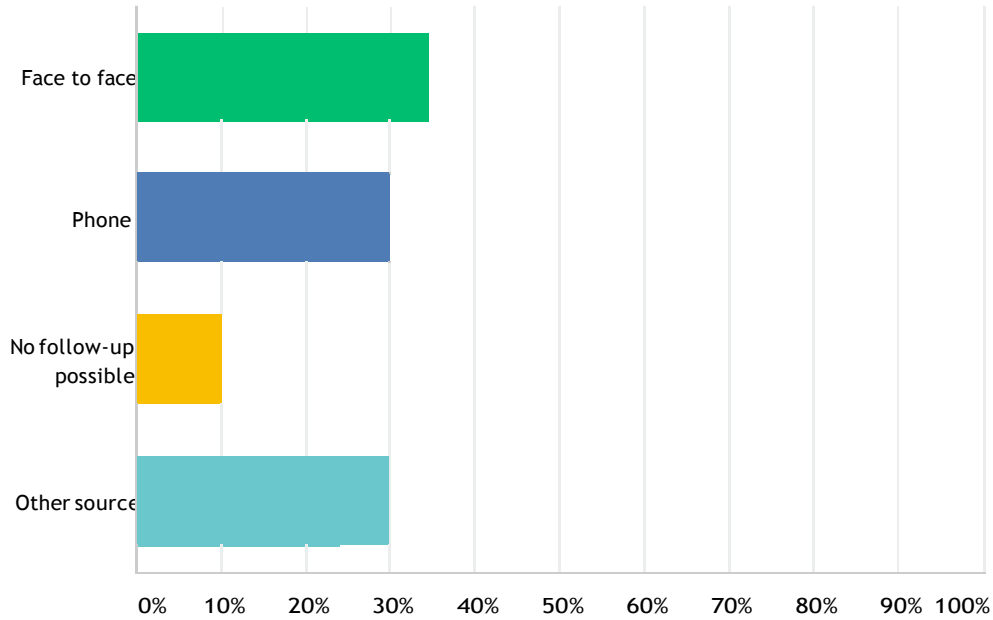
Answered: 225 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes, no change	37.33%	84
Yes, but limited by staffing	23.11%	52
Yes, but limited due to low case volume	29.78%	67
No, none for now	9.78%	22
TOTAL		225

Q8 What is your current process to collect LTFU between 9-21 months?

Answered: 220 Skipped: 5



ANSWER CHOICES	RESPONSES	
Face to face	34.55%	76
Phone	30.45%	67
No follow-up possible	10.91%	24
Other source	24.09%	53
TOTAL		220

COVID Survey (Data Managers)

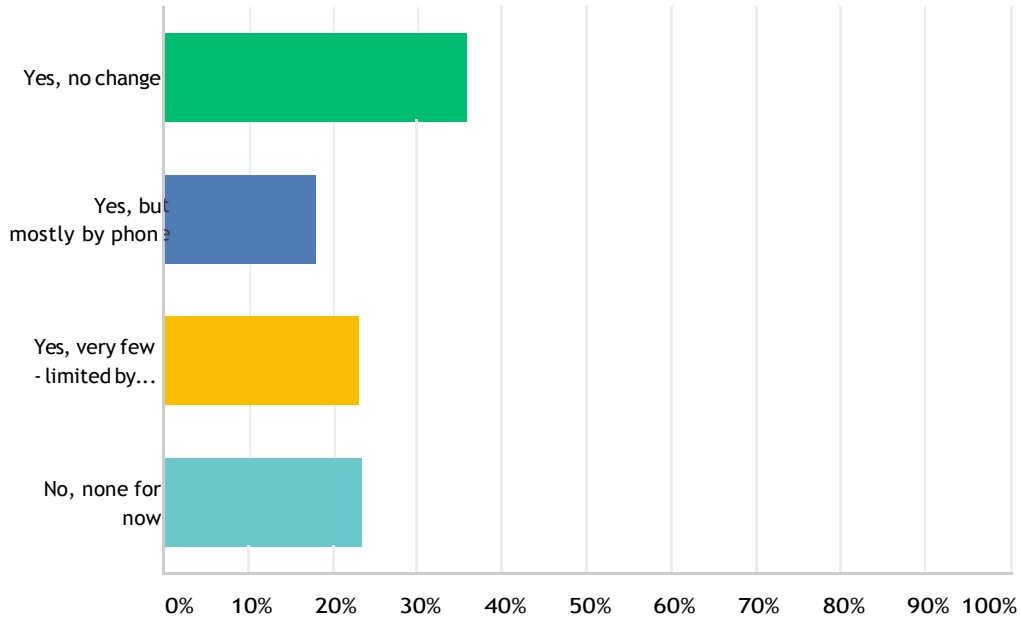
#	LIST OTHER SOURCE(S)	DATE
1	clinic	6/5/2020 12:24 PM
2	Per office records. Virtual visits.	6/5/2020 12:15 PM
3	Lot's of the office visits were canceled and some patient does not want to come back, the follow up rate is lower...	6/5/2020 11:05 AM
4	e records	6/5/2020 11:01 AM
5	Medical records	6/5/2020 10:59 AM
6	televisit	6/5/2020 10:59 AM
7	currently majority telehealth	5/26/2020 10:26 AM
8	phone but it wouldnt let me choose more than one / and internet if i think pt. is deceased	5/20/2020 9:04 AM
9	any combination of these sources are used to capture follow up data, email, phone calls, medical records search	5/18/2020 2:02 PM
10	collect from EMR	5/18/2020 10:04 AM
11	Epic	5/15/2020 9:49 AM
12	EMR review	5/14/2020 11:44 AM
13	EPIC	5/13/2020 12:21 PM
14	Currently pursue followup in MD office records but not active due to office reduction in force and office visits	5/13/2020 10:39 AM
15	Medical record	5/13/2020 8:11 AM
16	TELEMEDICINE OR FACE TO FACE	5/12/2020 8:45 AM
17	chart and care everywhere. We also call pts and PCP's	5/11/2020 4:38 PM
18	Clinic medical record	5/11/2020 3:54 PM
19	EMR	5/11/2020 2:09 PM
20	Medical records review	5/11/2020 12:46 PM
21	LTFU completed by physician office	5/11/2020 6:07 AM
22	havent though about it	5/10/2020 2:53 PM
23	Office visit records in EPIC	5/9/2020 4:17 PM
24	Unknown - currently clinic as far as I know	5/9/2020 9:06 AM
25	telehealth	5/9/2020 6:09 AM
26	Clinic is closed but will reopen soon	5/8/2020 4:00 PM
27	video visits	5/8/2020 3:35 PM
28	Telehealth	5/8/2020 3:24 PM
29	Telehealth with videoconferencing	5/8/2020 2:52 PM
30	EMR and phone calls	5/8/2020 1:40 PM
31	use all available sources	5/8/2020 1:39 PM
32	we try to use all tools available to us however very problematic at times (clinic visits, EMR, some will have no F/U)	5/8/2020 1:32 PM
33	We just started seeing patients in office again. Previously had been phone encounters.	5/8/2020 1:10 PM
34	unknown	5/8/2020 1:04 PM
35	unknown	5/8/2020 1:04 PM

COVID Survey (Data Managers)

36	Medical Records of face to face appointments or telehealth appts.	5/8/2020 1:03 PM
37	electronic records	5/8/2020 12:59 PM
38	We pull the data from the shared EMR. As long as patient's have given authorization, we can access at least parts of the EMR from health systems across our region.	5/8/2020 12:43 PM
39	Medical Record	5/8/2020 12:30 PM
40	situational	5/8/2020 12:30 PM
41	As we are new to VQI it is not time for follow-up	5/8/2020 12:27 PM
42	combination of phone, face to face, other source. Imaging is just more difficult	5/8/2020 12:24 PM
43	most have been rescheduled-some will fall out of 21 months	5/8/2020 12:18 PM
44	Tele med and others have been rescheduled and with rescheduling are likely to fall out of 9-21 months.	5/8/2020 12:18 PM
45	Electronic Health Records	5/8/2020 12:16 PM
46	EHR review.	5/8/2020 12:16 PM
47	limited as only one abstractor who has been furloughed	5/8/2020 12:16 PM
48	Telehealth and finding notes that qualify in the medical record	5/8/2020 12:15 PM
49	abstract through chart review after visit	5/8/2020 12:14 PM
50	other physician contact within 9-21 months	5/8/2020 12:12 PM
51	We will accept documentation of telehealth visits with surgeon's office or documentation in the medical record if they have been hospitalized within the 9-21 months	5/8/2020 12:10 PM
52	electronic medical record review	5/8/2020 12:10 PM
53	Medical record documentation	5/8/2020 12:09 PM
54	video	5/8/2020 12:09 PM

Q9 Are you still abstracting LTFU?

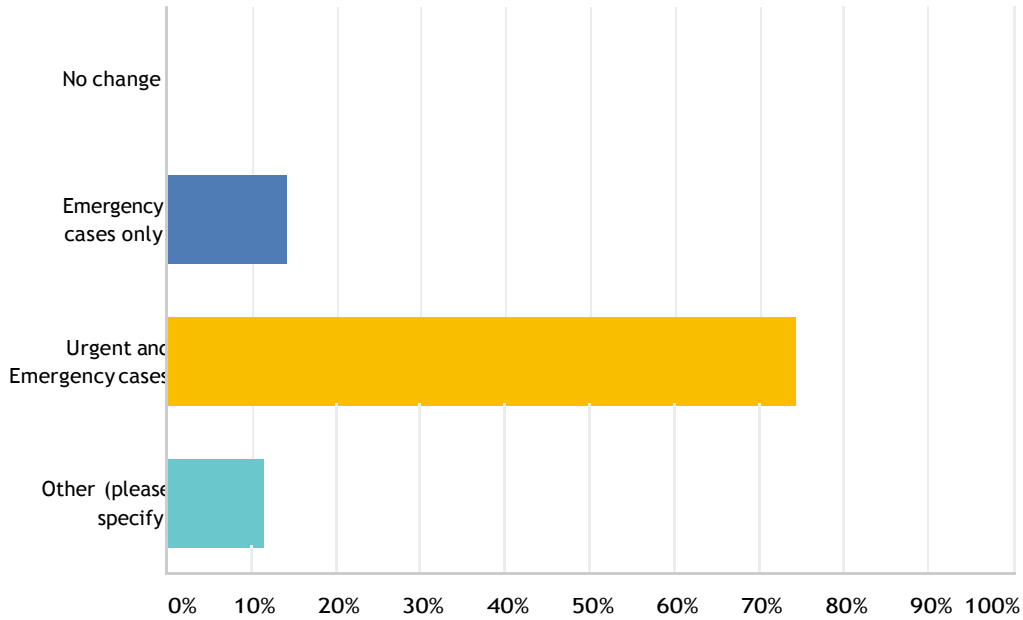
Answered: 218 Skipped: 7



ANSWER CHOICES	RESPONSES	
Yes, no change	35.78%	78
Yes, but mostly by phone	17.89%	39
Yes, very few - limited by staffing	22.94%	50
No, none for now	23.39%	51
TOTAL		218

Q1 Describe Operating Policy change (if any) as a response to the COVID-19 pandemic:

Answered: 105 Skipped: 0



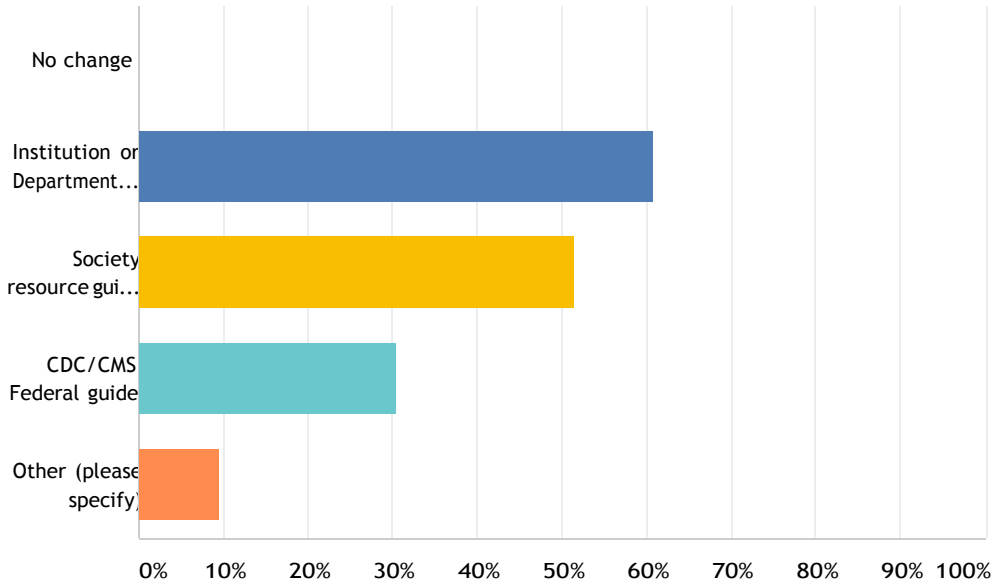
ANSWER CHOICES	RESPONSES	
No change	0.00%	0
Emergency cases only	14.29%	15
Urgent and Emergency cases	74.29%	78
Other (please specify)	11.43%	12
TOTAL		105

COVID MD Survey

#	OTHER (PLEASE SPECIFY)	DATE
1	Emergent, urgent and time sensitive elective	7/10/2020 7:21 AM
2	Our main institution did not change much, our small hospitals became emergency only	7/7/2020 1:42 PM
3	urgent, emergent, and what we deemed "essential" cases	7/7/2020 10:37 AM
4	"essential" cases including urgent and emergent but also AAA>6cm, TAAA>7cm, CLTI with tissue loss, symptomatic CEA/CAS	6/10/2020 5:56 AM
5	Was emergency only but back to normal as of May.	6/5/2020 9:03 AM
6	Initially emergency only, then urgent, next week we start semi-elective	6/4/2020 4:49 PM
7	Closed office for 6 weeks until elective cases permitted by state	6/4/2020 3:11 PM
8	selective elective cases being performed	6/4/2020 12:21 PM
9	priority, urgent, and emergent cases	6/4/2020 11:01 AM
10	Urgent, emergent and "time-sensitive" elective where a delay would be harmful	6/3/2020 7:52 PM
11	Initially Urgent and Emergency, now back to all	6/3/2020 9:28 AM
12	Now doing all cases, 1st few weeks only during urgent and emergency cass	6/3/2020 8:01 AM

Q2 If Operating Policy changed, what resource guide was used?

Answered: 105 Skipped: 0

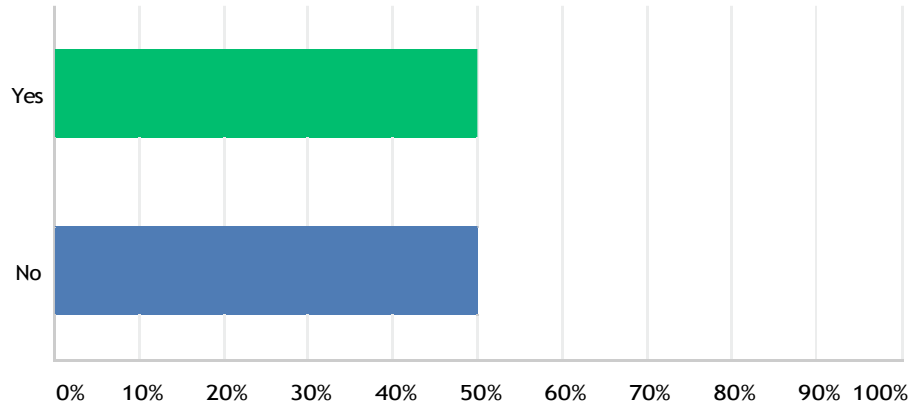


ANSWER CHOICES	RESPONSES	
No change	0.00%	0
Institution or Department mandate	60.95%	64
Society resource guide such as ACS, ACC, SCAI	51.43%	54
CDC/CMS Federal guide	30.48%	32
Other (please specify)	9.52%	10
Total Respondents: 105		

#	OTHER (PLEASE SPECIFY)	DATE
1	state recomendations	7/8/2020 3:35 PM
2	NY state government mandates	7/7/2020 1:42 PM
3	order of state of Ohio	7/7/2020 10:37 AM
4	state of Ohio medical director	6/10/2020 5:56 AM
5	Provincial Ministry of Health	6/9/2020 9:14 PM
6	state	6/5/2020 10:55 AM
7	Hospital and governor mandata	6/4/2020 4:49 PM
8	Ontario Priority ranking	6/4/2020 3:08 PM
9	SVS guidelines and personal decision by practice	6/4/2020 1:52 PM
10	state DOH	6/3/2020 7:45 AM

Q3 Were any elective procedures continued during this time?

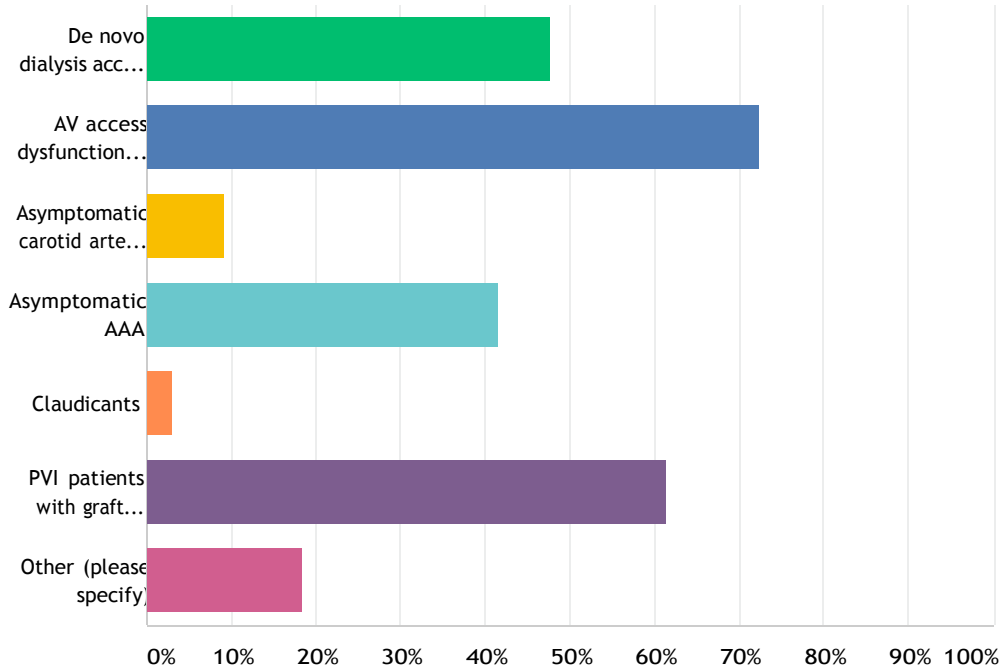
Answered: 105 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	49.52%	52
No	50.48%	53
TOTAL		105

Q4 If yes, please indicate which ones:

Answered: 65 Skipped: 40



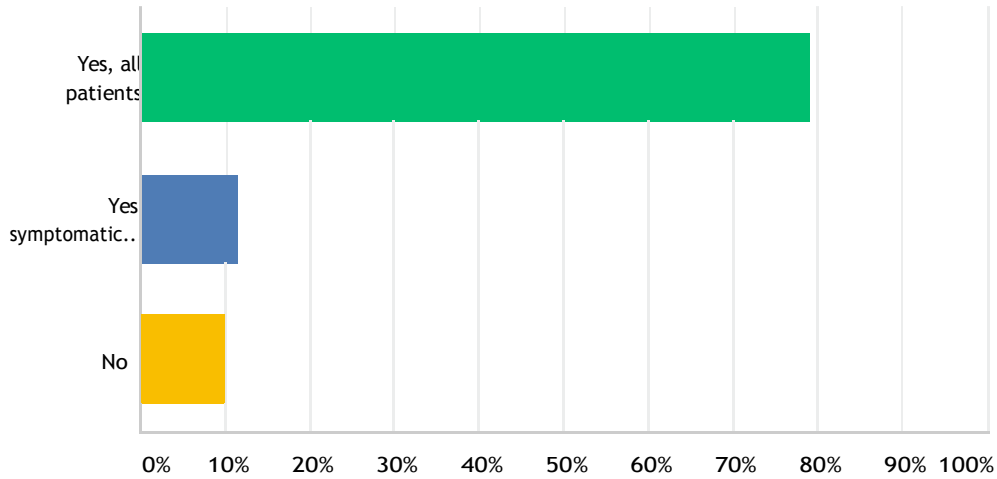
ANSWER CHOICES	RESPONSES	
De novo dialysis access procedures	47.69%	31
AV access dysfunction (thrombosis, steal, revision, etc.)	72.31%	47
Asymptomatic carotid artery disease	9.23%	6
Asymptomatic AAA	41.54%	27
Claudicants	3.08%	2
PVI patients with graft threatening stenosis	61.54%	40
Other (please specify)	18.46%	12
Total Respondents: 65		

COVID MD Survey

#	OTHER (PLEASE SPECIFY)	DATE
1	R IV and V CLTI	7/11/2020 8:22 AM
2	cases considered on an individual basis	7/8/2020 3:35 PM
3	Large AAAs, symptomatic carotids, gangrene	7/7/2020 10:11 PM
4	Large AAA	7/7/2020 1:55 PM
5	In our main institution, we did any type of vascular case if patient wanted it during COVID, in our small hospitals we hardly operated but continued angios	7/7/2020 1:42 PM
6	office based procedures	6/12/2020 9:48 AM
7	see above descriptions of what we categorized as large asymptomatic aneurysms and CLTI	6/10/2020 5:56 AM
8	severe critical limb ischemia with expected imminent limb loss without revascularization, symptomatic carotid stenosis with >70% stenosis	6/6/2020 1:34 PM
9	CLI pts for bypass, Symptomatic carotids, AAA or TAAAs by EVAR if >6 or 6.5 respectively	6/4/2020 3:08 PM
10	"elective" is the wrong terminology to use	6/4/2020 12:29 PM
11	Very large AAA, rest pain/tissue loss PAD cases	6/3/2020 7:52 PM
12	Aneurysms >6.5cm	6/3/2020 8:59 AM

Q5 Is COVID-19 testing mandatory before OR/Cath lab/Angio suite procedure?

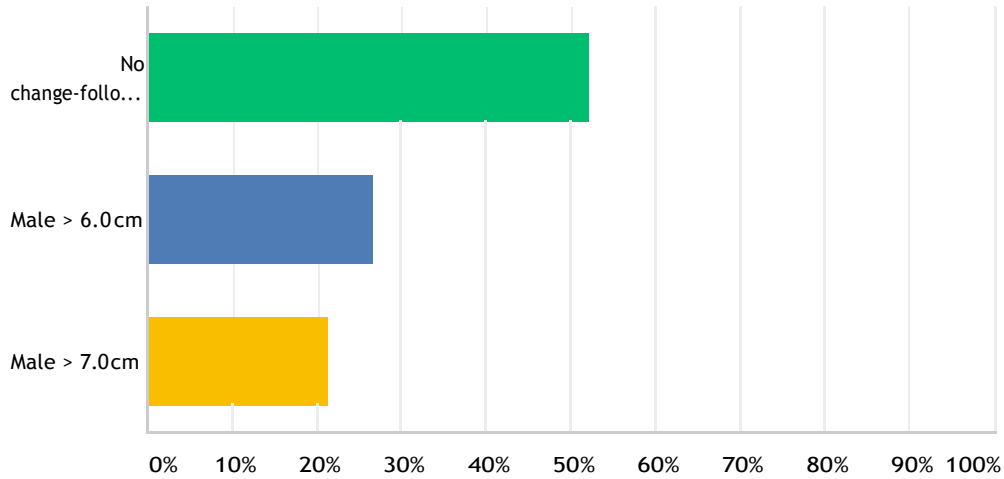
Answered: 105 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes, all patients	79.05%	83
Yes, symptomatic patients only	11.43%	12
No	9.52%	10
TOTAL		105

Q6 If a decision to treat AAA (Open AAA or EVAR) changed from SVS guidelines, what size criteria was used?

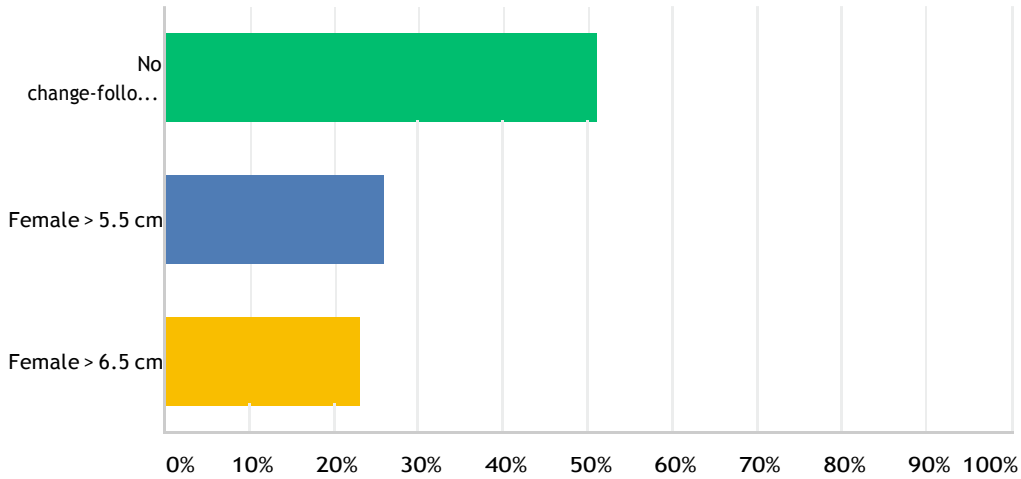
Answered: 98 Skipped: 7



ANSWER CHOICES	RESPONSES	
No change-followed SVS Guidelines	52.04%	51
Male > 6.0 cm	26.53%	26
Male > 7.0 cm	21.43%	21
TOTAL		98

Q7 If a decision to treat AAA (Open AAA or EVAR) changed from SVS guidelines, what size criteria was used?

Answered: 96 Skipped: 9



ANSWER CHOICES	RESPONSES	
No change-followed SVS Guidelines	51.04%	49
Female > 5.5 cm	26.04%	25
Female > 6.5 cm	22.92%	22
TOTAL		96

Average Weekly Registry Procedure Volumes 2018-2020

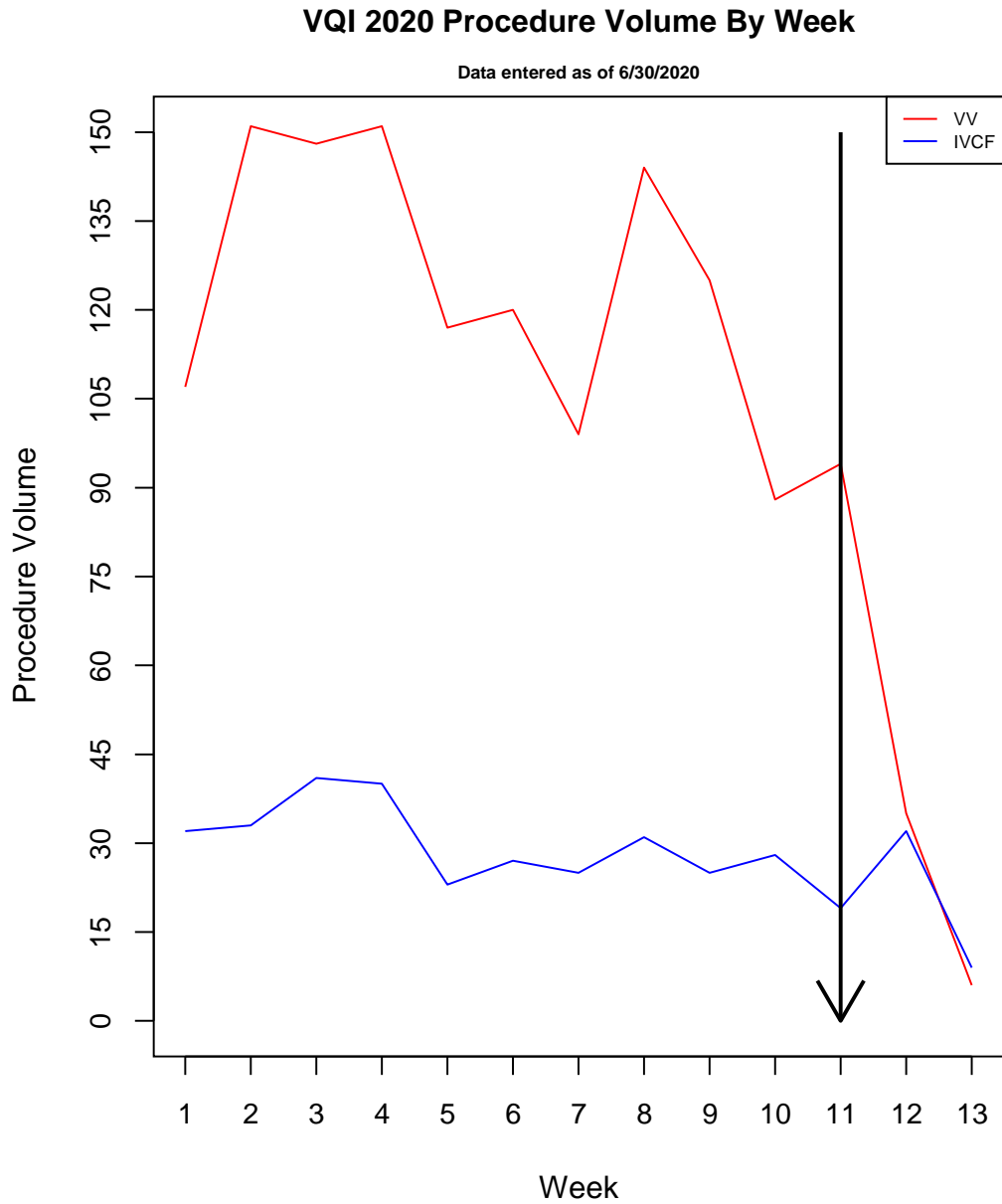
VV = Varicose Vein IVC = IVC Filter

Procedure Volume		Weeks 6-9	Weeks 10-13	Comparison Change (%)
2018	VV	120	127.75	(6.5)
	IVC	33	31.5	(-4.5)
2019	VV	126.25	115.25	(-8.7)
	IVC	34	30.5	(-10.3)
2020	VV	122	55.75	(- 54.3)
	IVC	27	22	(-18.5)

Legend:

Table demonstrating Average weekly volumes for Weeks 6-9 and Weeks 10-13 in first Quarter of 2018-2020. A 6.2-fold decrease in VV volume and a 1.8-fold decrease in IVC filter volume from 2019 to 2020 is demonstrated. This represents a 5-fold reduction for all 2020 venous procedures compared to 2019.

Figure 1:



Graph showing VQI registry data of weekly vascular surgical procedure volumes during the COVID-19 pandemic. Week 1 = Jan 4; Week 5 = Feb 1. Line at week 11 showing steep drop-off in case volume after 3/15/2020. VV = Varicose Vein; IVCF = Inferior Vena Cava Filter

VQI Venous Procedure Volume By Week (2020 vs 2019)

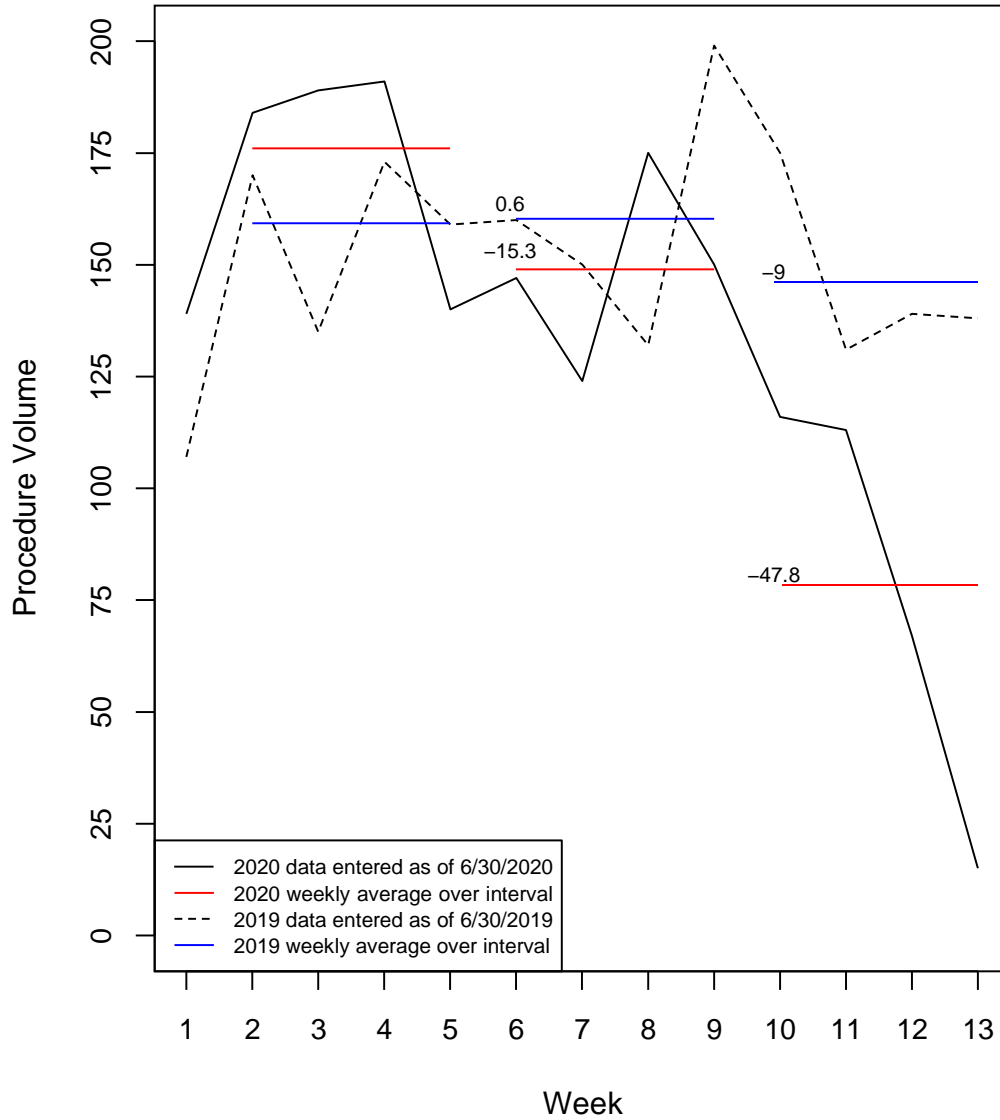


Figure 2

Graph comparing 4-week average procedural volume in 2019 for VV and IVC registries to VQI data during the COVID-19 pandemic in 2020. The number over the red and blue lines represents percent change in a four-week volume during weeks 5-8 and weeks 10-13.

For reference: Week 1 = Jan 4; Week 5 = Feb 1; March 15 = Week 11 when national shutdown occurred.

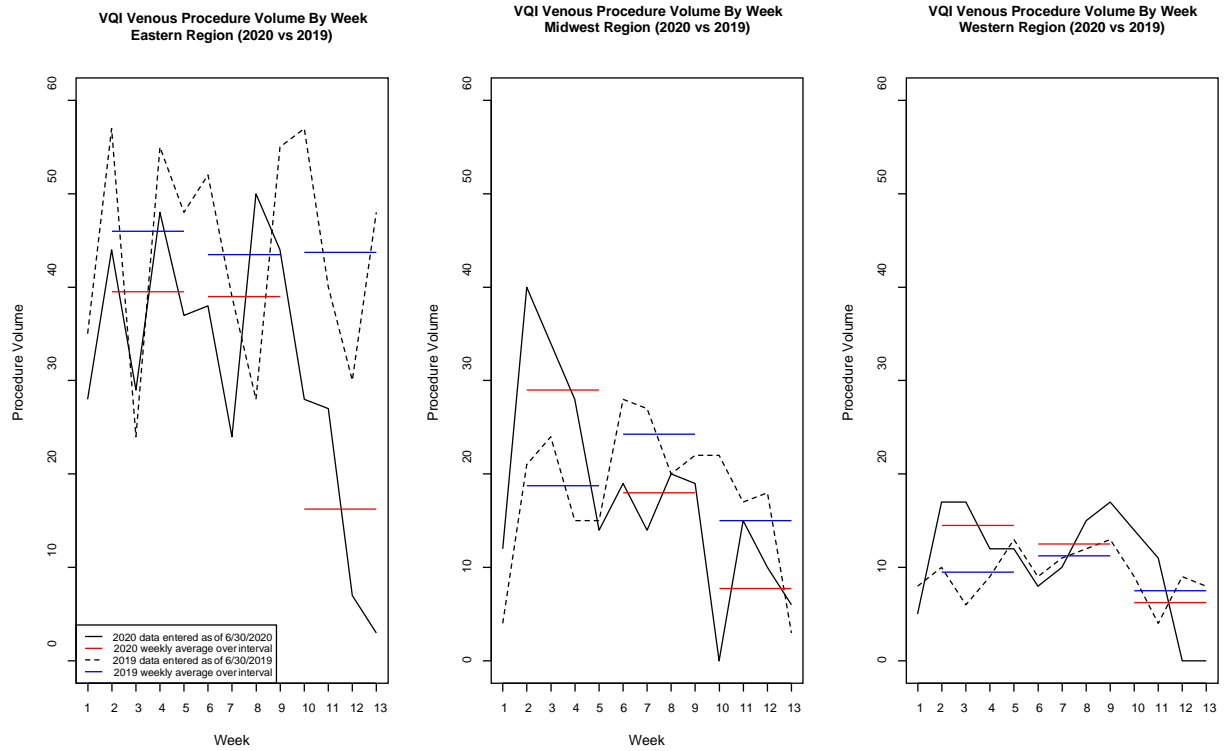


Figure 3

Graph demonstrating a sample of regional distribution from high procedural volume centers of varicose vein and vena cava filter insertion. 1st quarter weeks 1-13 listed for 2019 and 2020. March 15 = Week 11 when national shutdown occurred.

1 **Legends:**

2 Table 1: Table demonstrating Average weekly volumes for Weeks 6-9 and Weeks 10-13 in first
3 Quarter of 2018-2020. A 6.2-fold decrease in VV volume and a 1.8-fold decrease in IVC filter
4 volume from 2019 to 2020 is demonstrated. This represents a 5-fold reduction for all 2020
5 venous procedures compared to 2019.

6

7 Figure 1: Graph showing VQI registry data of weekly vascular surgical procedure volumes
8 during the COVID-19 pandemic. Week 1 = Jan 4; Week 5 = Feb 1. Line at week 11 showing
9 steep drop-off in case volume after 3/15/2020. VV = Varicose Vein; IVCF = Inferior Vena Cava
10 Filter

11

12 Figure 2: Graph comparing 4-week average procedural volume in 2019 for VV and IVC
13 registries to VQI data during the COVID-19 pandemic in 2020. The number over the red and
14 blue lines represents percent change in a four-week volume during weeks 5-8 and weeks 10-13.

15 For reference: Week 1 = Jan 4; Week 5 = Feb 1; March 15 = Week 11 when national shutdown
16 occurred.

17

18 Figure 3: Graph demonstrating a sample of regional distribution from high procedural volume
19 centers of varicose vein and vena cava filter insertion. 1st quarter weeks 1-13 listed for 2019 and
20 2020. March 15 = Week 11 when national shutdown occurred.

21