INTRODUCTION

Across the world, the SARS-CoV-2 coronavirus (COVID-19) pandemic has shaped and changed the course of individuals’ lives. At the time of this study, the United States had reported more than 25 million cases of COVID-19 infection and more than 400,000 associated deaths.1 When the US economy experienced a pause in nonessential sectors,
of COVID-19, there is scarce information on the sentiments of the US public in regard to the pandemic.13–15 During this difficult time, plastic surgeons must find a way to maintain their practices while ensuring the health and safety of their communities.11 It is important to understand the heterogeneity of the US population and the equally heterogeneous perceptions of COVID-19 reflected in the changing and diverse demographics of the United States.12 Today’s plastic surgeon will benefit from a better understanding of the insights, attitudes, and beliefs of the public concerning elective surgical procedures during the pandemic.13

The purpose of this study is to identify distinct segments of the US population that are affected differently by the COVID-19 pandemic and use their responses to advocate on behalf of the public. With this in mind, we conducted a nation-wide prospective survey to explore public opinion on the continuation of elective plastic surgery procedures during the pandemic. The information from this study is intended to help surgeons guide and advocate for their community’s well-being by understanding the concerns, beliefs, and attitudes of the US population.

METHODS

This prospective study was designed to survey adults proficient in spoken and written English residing in the United States. One thousand participants at least 18 years of age were recruited in October 2020. Participants oblivious to the present COVID-19 pandemic were excluded from the study. Google Forms (Google, Mountain View, Calif.) was selected to be the survey platform. Amazon Mechanical Turk (Amazon, Seattle, Wash.) was selected to be the survey distributor and participant base. The study was granted exemption from Institution Review Board oversight at our institution.

Amazon Mechanical Turk

Mechanical Turk (MTurk) is an online crowdsourcing marketplace with over 500,000 unique users, the majority of whom reside within the United States.13,15 From 2010 to 2019, MTurk developed a reputation as a reliable platform, contributing to quality healthcare research with multiple studies showing that the diversity of the MTurk workforce reflects that of the US population.14,15 MTurk has built technology which analyzes Worker performance, identifies high performing users, and monitors their performance over time.16 Users who have demonstrated excellence across a wide range of tasks are awarded the Masters Qualification.16 Masters must continue to pass rigorous statistical monitoring to maintain the MTurk Masters Qualification.16 To ensure the quality of responses, we made our survey only available to MTurk users who have met this highest designation.16 Each MTurk user was on average reimbursed $0.25 for their time and participation, Master MTurk users were reimbursed an additional 5%.

Survey Design

The survey was created to gauge US public attitudes and concerns with resuming elective plastic surgery during the COVID-19 pandemic. Each participant was provided an overview of the study and given the option to withdraw from participation at anytime. After electing to participate in the study, participants were educated on the definitions of elective surgery, outpatient surgery center, hospital surgical unit, and on the current COVID-19 pandemic conditions in the United States. We defined elective surgery as nonemergent and non-urgent, quality-of-life-related surgery.17 We defined an outpatient surgery center as a healthcare facility where surgical procedures are performed and overnight stays are not permitted.17 All participants were referred to the US Centers for Disease Control and Prevention (CDC) website to learn about the most up-to-date guidelines surrounding COVID-19.18 To gauge attentiveness during our survey, study participants were asked the following engagement question: “How many states are in the United States?” Any participants who answered incorrectly were excluded from the study.

The survey consisted of 30 multiple-choice questions divided into 3 sections. The first section surveyed demographic characteristics, assessing age, gender, race, ethnicity, household income, place of residence, and health insurance status. Participants were asked about their prior plastic surgery experiences, interest in obtaining plastic surgery in the future, prior COVID-19 testing, and prior COVID-19 diagnosis. The second section assessed the participants’ beliefs on resuming elective plastic surgical procedures during the COVID-19 pandemic. Special attention was given to capture the participants’ preference on having procedures performed at a hospital versus an outpatient surgery center. The third section assessed the participants’ beliefs regarding current safety practices taken to prevent the spread of COVID-19 in the healthcare setting. We specifically wanted to investigate the public’s perception of telemedicine video clinic visits, COVID-19 testing, and potential COVID-19 vaccination. (See appendix, Supplemental Digital Content 1, which displays full survey, http://links.lww.com/PRSGO/B649.)

Statistical Analysis

Descriptive statistics were employed to characterize the demographic makeup of the study participants. The distribution of participant age, race and ethnicity, gender, and geographic residence were each reported as percentages. Regression modeling was used to define the relationship and correlation between the independent variables (participant demographics) and dependent variables (eg, obtaining elective plastic surgery). Because of the binomial nature of the dependent variable, a logarithmic multivariable binomial regression model was used to analyze the data. The reference cohort for the binomial dependent variables was assigned to the participants of the study who answered “no” to resuming elective plastic surgery. The exponentiation of the B coefficient was referenced as the odds ratio for our regression model. Clinical significance was defined to be a P value of less than 0.05. All data were processed and analyzed utilizing SPSS (International Business Machines, Armonk, N.Y.).


RESULTS

A randomly assigned sample of 1000 US adults (MTurk volunteers) participated in the study. Twenty-seven participants did not pass the engagement question and were excluded. Of the remaining 973 participants, all were well-informed about the present COVID-19 pandemic. Within the sample cohort, most survey respondents identified as non-Hispanic Caucasian (56.6%), male gender (54.1%), privately insured (59.7%), 18–45 years old (80.4%), and evenly distributed across the US’s major geographic areas (Table 1). The majority of participants (68.4%) who expressed some interest in obtaining plastic surgery (9.3%) received a service or underwent a procedure from a plastic surgeon in the past (Table 1). Nearly, 11.4% of participants had COVID-19 testing and 2.1% of participants reported a prior COVID-19 infection (Table 1).

Table 1. Participant Demographics

| Variable                                | Participants | %   |
|-----------------------------------------|--------------|-----|
| Total no. participants                  | 973          | (100%)|
| Age, y                                  |              |     |
| 18–30                                   | 388          | (39.9%)|
| 31–45                                   | 394          | (40.5%)|
| 46–60                                   | 147          | (15.1%)|
| 61 and older                            | 44           | (4.5%) |
| Sex                                     |              |     |
| Female                                  | 447          | (45.9%)|
| Male                                    | 526          | (54.1%)|
| Race and ethnicity                      |              |     |
| Asian                                   | 177          | (18.2%)|
| Black                                   | 112          | (11.5%)|
| Hispanic                                | 78           | (8.0%) |
| Native American                         | 25           | (2.5%)  |
| White                                   | 551          | (56.6%)|
| More than 1 race                        | 30           | (3.1%) |
| Household annual income                 |              |     |
| Less than $50,000                       | 319          | (32.8%)|
| $50,000 to $75,000                      | 320          | (32.9%)|
| $75,000 to $100,000                     | 241          | (24.8%)|
| $100,000 to $200,000                    | 79           | (8.1%)  |
| $200,000 and more                       | 14           | (1.4%) |
| Place of residence in the US            |              |     |
| South                                   | 278          | (28.5%)|
| Midwest                                 | 200          | (20.5%)|
| Northeast                               | 302          | (31.0%)|
| West Coast                              | 112          | (11.5%)|
| Outside Continental US                  | 81           | (8.3%) |
| Health insurance                        |              |     |
| Private                                 | 581          | (59.7%)|
| Medi-Care                               | 135          | (13.9%)|
| Medi-Caid                               | 137          | (14.1%)|
| Military/veterans insurance             | 5            | (0.5%)  |
| Self-pay                                | 115          | (11.4%)|
| Prior COVID-19 testing                  |              |     |
| Yes                                     | 111          | (11.4%)|
| No                                      | 862          | (86.6%)|
| Prior COVID-19 infection                |              |     |
| Yes                                     | 21           | (2.2%)  |
| No                                      | 952          | (97.8%)|
| Personal health                         |              |     |
| Healthy                                 | 296          | (30.4%)|
| Somewhat healthy                        | 490          | (50.4%)|
| Neutral                                 | 159          | (16.3%)|
| Somewhat unhealthy                      | 20           | (2.1%)  |
| Unhealthy                               | 8            | (0.8%)  |
| Prior plastic surgery                   |              |     |
| Yes                                     | 91           | (9.4%)  |
| No                                      | 882          | (90.6%)|
| Interest in elective surgery            |              |     |
| Yes                                     | 666          | (68.4%)|
| No                                      | 307          | (31.6%)|

Baseline demographic characteristics of study participants.

COVID-19 and Plastic Surgery

The majority of participants (86.6%) felt elective plastic surgery should continue in the midst of the COVID-19 pandemic and most participants (74.8%) would undergo elective plastic surgery services and procedures without delay (Fig. 1). If the plastic surgery service or procedure had to be delayed, most participants (79.6%) would prefer to not delay more than 6 months (Fig. 2). Most participants expressed concerns of contracting COVID-19 at elective surgery centers (67.5%) and hospitals (65.9%) during their elective plastic surgery procedures (Fig. 3).

Binomial logarithmic multivariate regression analysis was used to model the interactions between independent variables. Compared to the overall study population, we found that participants in the age group 46–60 years old were 2.8 times more likely to resume elective plastic surgery during the pandemic, \( P < 0.03 \) (Table 2). Similarly, participants who reside in the Midwest were found to be 2.2 times more likely to resume elective plastic surgery, \( P < 0.05 \) (Table 2).

When compared to the overall study population, participants in the age cohort 61 years and older were 2.4 times less likely to support the resumption of elective plastic surgery during the pandemic, \( P < 0.02 \). Participants who have previously tested for COVID-19 were found to be 7.9 times less likely to favor resuming elective plastic surgery during the pandemic, \( P < 0.05 \) (Table 2). The data also indicated that participants who previously experienced COVID-19 infection were 3.8 times less likely to recommend resuming elective plastic surgery during the pandemic, \( P < 0.03 \) (Table 2). No statistically significant relationships were discovered between a participant’s gender, race, income, or insurance and preference for continuing elective plastic surgery.

Elective Plastic Surgery Safety Practices

The majority of participants believed safety practices such as face mask and eye protection (90.3%), hand washing and cleansing commonly used surfaces (87.1%), and social distancing at least 6 feet (86.1%) were important to prevent spread of COVID-19 (Fig. 4). The majority of participants also felt that patients undergoing surgery (84.0%) and surgical center/hospital staff (84.4%) should be routinely tested for COVID (Fig. 4). Once a safe and effective COVID-19 vaccine is approved, the majority of participants believe that those undergoing surgery should be vaccinated (78.7%) as should surgical center/hospital staff (80.4%) (Fig. 4).

The majority of study participants preferred in-person over telemedicine visits for their preoperative appointment (65.1% in-person versus 34.9% telemedicine; see Table 3). When asked about postoperative follow-up, participants also preferred in-person visits over telemedicine visits (59.8% in-person versus 40.2% telemedicine; see Table 3). When queried about the most important factor when considering elective plastic surgery, participants valued the plastic surgeon’s reputation (32.3%) and hospital’s reputation (31.3%) but were less concerned about the location of the hospital (15.9%), safety practices to prevent the spread of COVID-19 (14.6%), and personal cost associated with surgery (5.8%).
DISCUSSION

This prospective national survey of US adults in the midst of the COVID-19 pandemic examines public perception of elective plastic surgery procedures. The demographic profile of the United States is well represented by the cohort surveyed with respect to gender, race, ethnicity, geographic residence, and health insurance. The principal findings synthesized from the data are: (1) the US public believes in resuming/continuing elective plastic surgery during the pandemic; (2) the US public also remains at least somewhat concerned that they may contract the virus while obtaining their elective procedure; (3) the US public agrees with current safety precautions taken by medical facilities to prevent the spread of COVID-19.

Participants residing in Midwestern states (ie, Illinois, Indiana, Iowa, Kansas, Michigan, Ohio, and Wisconsin) were more likely to support the continuation of elective plastic surgery. Data obtained during the first 5 months of the pandemic suggest that the incidence of COVID-19 varied widely among different geographic regions of the United States.
United States.\textsuperscript{19,20} The US CDC reported from June to July 2020, COVID-19 “hotspots” were mostly outside the Midwest.\textsuperscript{19} The lower number of regional COVID-19 cases along with less access to elective plastic surgery services and procedures may, in part, explain why the study participants from the Midwest favor resuming elective plastic surgery. Compared to the general population of the study, participants 46–60 years old were found more likely to support continuing elective plastic surgery and participants over 60 years of age were less likely to support elective plastic surgery. This finding is congruent with epidemiologic data on COVID-19, which suggests that older adults have increased morbidity and mortality due to COVID-19 infection, and they are more concerned about these health risks.\textsuperscript{21–23} The over 60 population is clearly more vulnerable to more serious complications of COVID-19, and plastic surgeons must consider this fact when offering elective procedures.\textsuperscript{21,24}

The participants who underwent COVID-19 testing or had previously been diagnosed with COVID-19 infection were less likely to support the continuation of elective plastic surgery. This segment of the US population will, of course, increase as the pandemic persists. In fact, the most recent projections and models from the US CDC, at the time of the writing, predict between 450,000 to 900,000 new COVID-19 cases every week during the winter months of 2020 and beyond. Plastic surgeons must empathize with those who have suffered from, or are most fearful of, COVID-19 and the potential implications of infection. At a minimum, adherence to strict safety protocols to prevent the spread of COVID-19 will help address some of the most pressing concerns in this growing segment of the population.\textsuperscript{11,25} In the following section, we describe our institution’s safety practices and protocols for conducting elective surgical procedures during the pandemic.

Safety Protocol

Although most study participants believe elective plastic surgical procedures should resume, the majority still harbor concerns about contracting the virus during their elective procedure. It is the duty of physicians to ensure that the clinics, surgery centers, and hospitals, where we perform our procedures and follow rigorous safety protocols to prevent the spread of COVID-19.

At our institution, a rigorous set of safety practices are employed to prevent the spread of COVID-19 before, during and after all procedures. All patients are required to obtain nucleic acid-based COVID-19 testing less than 48 hours before their procedure. Patients who test positive for the novel coronavirus are not eligible to undergo elective procedures. Those who have acute respiratory symptoms such as shortness of breath, coughing, or unexplained sore throat are also ineligible to undergo elective procedures. During hospital and clinic encounters, all staff are required to wear face masks, eye protection, as well as disposable gloves for all patient encounters. All hospital and clinic staff are screened daily with temperature assessment and questioned about any symptoms suggestive of COVID-19 infection. Those with possible signs or symptoms of infection undergo testing for COVID-19 and are required to quarantine at home until testing is negative and symptoms resolve. Postprocedurally, patients are given the option for a telemedicine video follow-up whenever in-person visits are not critical. Any patient requiring postprocedure hospital admission is transferred to a surgical inpatient floor where all neighboring patients have had a negative nucleic acid-based COVID-19 test. We believe these practices should be adopted as standard practice for every patient encounter.

Future of Elective Plastic Surgery

As a matter of necessity, telemedicine has experienced an unprecedented boom during the pandemic.
Our study found that 30%–40% of participants preferred video appointments over in-person visits. Recent literature reports that European and the US plastic surgeons have had very high telemedicine adoption rates, exceeding 50% during the pandemic. These studies demonstrate that plastic surgeons have implemented telemedicine to minimize patient–physician exposure and to decrease the spread of COVID-19. Besides saving time and avoiding travel-related expenses, patients having video visits report higher rates of overall satisfaction when compared to in-person visits. We strongly believe the trend of adopting telemedicine will persist even after the COVID-19 pandemic has subsided, and may become the default option for some routine outpatient clinic visits. After being informed of the differences between an outpatient surgery center and hospital, study participants showed no preference for one over the other. Thus, from a public perspective, surgical venue should not be a barrier to resuming or continuing elective surgical procedures.

Improvements in COVID-19 testing and the development of a safe and effective vaccine are currently areas of intense global effort. The majority of study participants would be willing to undergo a COVID-19 test and receive an approved COVID-19 vaccine to undergo elective plastic surgery services. Once a safe and effective COVID-19 vaccination is available, we believe the global implementation with subsequent immunization against COVID-19 will provide the pivotal step in ensuring the absolute safety of plastic surgery procedures.

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### Table 2. Multivariable Regression Analysis

| Variable                        | Participants | For Resuming Plastic Surgery | Against Resuming Plastic Surgery | OR    | P     |
|---------------------------------|--------------|-------------------------------|----------------------------------|-------|-------|
| **Age, y**                      |              |                               |                                  |       |       |
| 18–30                           | 388          | 335 (86.3%)                   | 53 (13.7%)                       | 1.50  | 0.336 |
| 31–45                           | 394          | 344 (87.3%)                   | 50 (12.7%)                       | 2.06  | 0.079 |
| 46–60                           | 147          | 132 (89.8%)                   | 15 (10.2%)                       | 2.80  | 0.030 |
| 61 and older                    | 44           | 32 (72.7%)                    | 12 (27.3%)                       | 0.41  | 0.021 |
| **Sex**                         |              |                               |                                  |       |       |
| Female                          | 446          | 377 (84.5%)                   | 69 (15.5%)                       | 1.03  | 0.864 |
| Male                            | 527          | 466 (88.4%)                   | 61 (11.6%)                       | 1.32  | 0.785 |
| **Race and ethnicity**          |              |                               |                                  |       |       |
| White                           | 551          | 473 (85.8%)                   | 78 (14.2%)                       | 1.58  | 0.393 |
| Asian                           | 177          | 157 (88.7%)                   | 20 (11.3%)                       | 2.31  | 0.140 |
| Black                           | 112          | 100 (89.3%)                   | 12 (10.7%)                       | 1.90  | 0.298 |
| Hispanic                        | 78           | 70 (98.9%)                    | 8 (10.2%)                        | 2.02  | 0.283 |
| Native American                 | 25           | 21 (84.0%)                    | 4 (16.0%)                        | 0.91  | 0.907 |
| More than 1 race                | 30           | 22 (73.3%)                    | 8 (26.7%)                        | 1.24  | 0.512 |
| **Household annual income**     |              |                               |                                  |       |       |
| Less than $30,000               | 319          | 264 (82.8%)                   | 55 (17.2%)                       | 2.26  | 0.254 |
| $30,000 to $75,000              | 290          | 282 (88.1%)                   | 38 (11.9%)                       | 2.23  | 0.259 |
| $75,000 to $100,000             | 241          | 218 (90.5%)                   | 23 (9.5%)                        | 2.73  | 0.168 |
| $100,000 to $200,000            | 79           | 68 (86.1%)                    | 11 (13.9%)                       | 3.04  | 0.149 |
| $200,000 and more               | 14           | 11 (78.6%)                    | 3 (21.4%)                        | 2.52  | 0.789 |
| **Place of residence in the United States** |          |                               |                                  |       |       |
| South                           | 302          | 268 (88.7%)                   | 34 (11.3%)                       | 1.68  | 0.198 |
| Midwest                         | 200          | 181 (90.5%)                   | 19 (9.5%)                        | 2.28  | 0.047 |
| Northeast                       | 278          | 239 (86.0%)                   | 39 (14.0%)                       | 1.21  | 0.623 |
| West coast                      | 112          | 95 (83.0%)                    | 19 (17.0%)                       | 3.04  | 0.149 |
| Outside continental US          | 81           | 62 (76.6%)                    | 19 (23.4%)                       | 1.85  | 0.592 |
| **Health insurance**            |              |                               |                                  |       |       |
| Private                         | 581          | 499 (85.9%)                   | 82 (14.1%)                       | 1.20  | 0.548 |
| Medi-Care                       | 135          | 126 (93.3%)                   | 9 (6.7%)                         | 1.34  | 0.545 |
| Medi-Caid                       | 137          | 119 (86.9%)                   | 18 (13.1%)                       | 1.04  | 0.917 |
| Military/veterans insurance     | 5            | 5 (100%)                      | 0 (0%)                           | 7.82  | 0.812 |
| Self-pay                        | 115          | 94 (81.7%)                    | 21 (18.3%)                       | 1.32  | 0.548 |
| Prior COVID-19 testing          |              |                               |                                  |       |       |
| Yes                             | 111          | 66 (59.5%)                    | 45 (40.5%)                       | 0.13  | 0.046 |
| No                              | 862          | 735 (85.0%)                   | 129 (15.0%)                      | 1.23  | 0.415 |
| Prior COVID-19 infection        |              |                               |                                  |       |       |
| Yes                             | 21           | 13 (61.9%)                    | 8 (38.1%)                        | 0.26  | 0.051 |
| No                              | 952          | 822 (86.3%)                   | 130 (13.7%)                      | 1.40  | 0.246 |
| **Personal health**             |              |                               |                                  |       |       |
| Healthy                         | 296          | 261 (88.2%)                   | 35 (11.8%)                       | 1.58  | 0.645 |
| Somewhat healthy                | 490          | 427 (87.1%)                   | 63 (12.9%)                       | 1.38  | 0.216 |
| Neutral                         | 159          | 135 (84.9%)                   | 24 (15.1%)                       | 1.61  | 0.154 |
| Somewhat unhealthy              | 20           | 14 (70.0%)                    | 6 (30.0%)                        | 0.77  | 0.655 |
| Unhealthy                       | 8            | 6 (75.0%)                     | 2 (25.0%)                        | 0.65  | 0.629 |
| Prior plastic surgery           |              |                               |                                  |       |       |
| Yes                             | 91           | 87 (95.6%)                    | 4 (4.4%)                         | 1.56  | 0.423 |
| No                              | 882          | 756 (85.7%)                   | 126 (14.3%)                      | 0.53  | 0.269 |
| **Interest in elective surgery**|              |                               |                                  |       |       |
| Yes                             | 666          | 619 (92.9%)                   | 47 (7.1%)                        | 1.98  | 0.786 |
| No                              | 307          | 224 (73.0%)                   | 83 (17.0%)                       | 0.24  | 0.087 |

A binomial logarithmic regression analysis was used to model the relationship between the participant demographic characteristics and resuming elective plastic surgery. A P value of less than 0.05 is considered statistical significance. OR, odds ratio. Values in boldface indicate P < 0.05.
of elective surgical procedures. As suggested by Sarac et al., the responsibility of keeping our communities safe while performing elective plastic surgery procedures ultimately rests on the plastic and reconstructive surgeons’ shoulders.

Limitations

The study cohort recruited to conduct our survey study was assembled from the MTurk workforce. Previous studies have validated the MTurk workforce as representative of the general US public. We acknowledge that the MTurk workforce is skewed toward younger and less affluent segments of the US population. Previous studies conducted using MTurk have discovered similar age distribution discrepancies, with younger age groups being overrepresented. The MTurk survey taker, as with any anonymous survey taker, is susceptible to providing disingenuous responses because of the constraints of limited time. We acknowledge that a small but detectable portion of study participants responded with disingenuous responses based on our results. Despite the shortcoming of MTurk, the alternative which is the traditional approach to obtaining public opinion involves in-person interviews or telephone polls, which on average cost 45 times as much as online methods. Given the present COVID-19 pandemic conditions, the utilization of online workforces, despite having shortcomings in certain demographic areas, will likely be more widely adopted.

In reviewing the methodology of this study, one shortcoming is that a single survey does not adequately capture the evolving public sentiments on COVID-19. To demonstrate the temporal changes influenced by significant current events, future follow-up investigations can be conducted on a semiannual basis to depict how the US public sentiment changes.

CONCLUSIONS

This prospective national survey of US adults conducted during the COVID-19 pandemic reports current US public opinions on the continuation of elective plastic surgery procedures. The demographic heterogeneity of the US population is well represented in our cohort based on sex, race, ethnicity, geographic residence, and health insurance status. Three key findings of the study are (1) the majority of study participants believe in resuming/continuing plastic surgery during the present COVID-19 pandemic; (2) the majority of participants remain concerned about contracting the virus while having elective procedures; and (3) the majority of participants agree with the majority of current safety measures implemented to prevent the spread of COVID-19. The segments of the US population more hesitant to resume/continue plastic surgery during the COVID-19 pandemic are Americans 61 years of age and older and Americans who have had a COVID-19 infection or testing. Plastic surgeons should invest extra time and effort to address each of the concerns these vulnerable cohorts may endorse.
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