~~**A Vocation of Absolute Self-Negation**~~
Admiration, Joy, and Love
The Examination of Emotion in Surgery

by

Julie Ann Evans

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Master's Thesis Committee:

Professor Pam McAuslan, Chair
Professor Marie Waung, Co-Chair
Associate Professor Gurjit Sandhu, Co-Chair

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Abstract

"No other calling . . . demands a more absolute self-negation than the one you have chosen. No other vocation — not even the sacred ministration of religion itself — requires a more constant exercise of the higher faculties of the human mind, or a more earnest devotion of the purer and nobler attributes of the human soul."- Governor J. Proctor Knott to the graduating class of the Kentucky School of Medicine, 1890

Emotional labor is the regulation and management of emotional expressions with others that occur as part of one's professional work role. Everyday emotional labor is preformed parallel to physical labor by surgeons. However, it is widely undocumented within the surgical field. Emotional labor may be taking an under-appreciated toll on surgeons. Unacknowledged emotional labor and related coping mechanisms may be contributing to emotional exhaustion and the alarming levels of chronic burnout among surgeons. The emotional demands of surgery practice on surgical practitioners needs scholarly attention. This thesis uses surgeon-written social media posts to examine surgeon emotion. A thematic analysis of surgeon Tweets was conducted to investigate how surgeons communicate emotion on Twitter. Emotion categorization was conducted using Plutchik's Wheel of Emotions (Plutchik, 1980). The positive psychology framework of Character Strengths and Virtues (Peterson & Seligman, 2004) and the Areas of Worklife Model (Maslach & Leiter, 1997) were used for results interpretation. In the analysis of surgeon emotion on Twitter, it was found that Tweets with positive emotion represented the majority of Tweets (55%). Complex emotions represented 34% of the sample while Tweets with negative emotion represented only 11%. Feelings of admiration, joy, and love were most frequently Tweeted. Despite high levels of emotional exhaustion and chronic burnout in the profession, surgeons overwhelmingly Tweet with positive emotion in association with their work. Positive emotion and positive psychology interventional measures may provide better strategies to combat emotional exhaustion and to promote well-being in surgery. These findings

help advance the understanding of emotion in surgical practice and may help inform best practices for education and training in emotional labor, emotional intelligence, and emotion regulation in surgical work.

Chapter One

1.0 Introduction

Each week in academic surgical departments across the country, you will find faculty and trainees presenting at M&M (morbidity and mortality) or D&C (death and complications) conferences. At these conferences, trainees present on and discuss unexpected morbidity or mortality cases in order to identify opportunities to improve performance and clinical outcomes. These conferences are a critical part of surgical learning (Xiong et al., 2016). They give surgeons the opportunity to assess and analyze adverse events utilizing the surgical hive mind of the department. The data commonly presented at M&M conferences, includes patient history, imaging, differential diagnosis, indications for operation, management options, rationale for management, complication, relevant literature, and comparative data. Presenters typically are given five minutes and are required to be logical, precise, and clear. The trainee is asked questions by faculty about case management, disease process, and current surgical literature. The goal of the dialogue is to determine whether or not the complication or death was preventable. In theory, the discussion should inform the entire department on how such a complication might be averted in the future.

For many surgical trainees and faculty, these unexpected complications and deaths also serve as critical incident experiences. Critical incidents are formative cases which imprint on one's memory and profoundly influence professional identity (Sandhu et al., 2021). This occurs because surgeons treat patients, not only their diseases (Malani & Zylke, 2020). What the M&M presentation fails to adequately address within the narrow scientific presentation of a case is the entire experience of a surgeon. With a focus only on the clinical content, there is no space to recount the human experience. There is no attention to patient frustration, anger, fear, or disappointment. There is no opportunity to communicate the difficult family conversations, nor the tears of the patient’s loved ones. Missing is the moment to discuss the pain or worry that the surgeon and their healthcare team members who provided critical care alongside of them felt.

And there are no questions on how this case may have touched the surgeons mentally or emotionally (Malani & Zylke, 2020).

Chapter Two

2.0 Background

The background of the study presents established literature in emotion within the surgical context, burnout in surgery (including risk factors, personal and professional consequence, and gendered experiences), emotional health in surgery, the study of emotions in social media, and relevant theoretical frameworks.

2.1 Emotion in Surgery

By necessity, surgeons are scientifically trained with an emphasis on foundational sciences, including biochemistry, genetics, physiology, anatomy, histology, neuroscience, endocrinology, and immunology. Their evidence-based education is founded in technical methods and statistics (Malani & Zylke, 2020). The emphasis on physiological structure and function, and on clinical content and case-based discussions is largely devoid of emotion (Malani & Zylke, 2020). Human behavior in medicine is often approached within the context of patient care and illness prevention. Within this framework, physician emotional work and well-being is sidelined. Yet, their struggles to be confident high-functioning surgeons who are trying to balance medicine and all the other parts of their lives create unique emotional challenges (Arnold-Forster, 2020; Arnold-Forster et al., 2021; Malani & Zylke, 2020). The training in emotion skills most surgeons receive are directed at the provider−patient relationship. However, surgeon emotional wellness has substantial impact on both professional behaviors and provider satisfaction (Satterfield & Hughes, 2007). Consequently, the necessary education on emotional wellness and organizational support to buoy this aspect of a surgeon's health are missing from graduate and continuing medical education systems (Załuski & Makara-Studzińska, 2018).

Given the emotional nature of patient care, surgeons are expected to manage the emotions of their patients, patient families, surgical team members, as well as their own emotions when providing care (Grandey et al., 2012). Emotional labor is the regulation and management of emotional expressions that occur as part of one's professional work role. Emotional labor occurs parallel to physical labor; both are occupational elements that require a great deal of effort

(Hochschild, 2015). In healthcare settings, emotional labor often consists of showing interest, concern, and sympathy for patients and their families, while simultaneously suppressing disgust, frustration, or anxiety, during interpersonal interactions (Grandey et al., 2012). The experience of emotional labor is complex and varied and is shaped by professional position, personal characteristics, and event context (Steinberg & Figart, 1999). Active engagement in providing this socioemotional support to patients and colleagues without self-regulatory breaks from such labor leads to burnout (Grandey et al., 2012). The development of emotional detachment is part of the unwritten curriculum in medical education and surgical training (Arnold-Forster, 2020). Yet, this coping mechanism is faulty, as emotional intensity is a core element of patient care (Arnold-Forster, 2020). Unacknowledged emotional labor may in turn be contributing to chronic burnout. The emotional costs of surgical practice on surgeons remains understudied; scholarly attention needs to be paid to the emotional demands performing surgery makes on surgical practitioners.

2.2 Burnout in Surgery

The alarmingly high prevalence of burnout among surgeons continues to be of increasing concern. Burnout is a state of professional exhaustion; the etiology of which is complex and includes physical, intellectual, and psychological components (Khansa & Janis, 2019). In the literature on surgical burnout, the phenomenon is nearly universally measured using a highly reliable and validated tool, the Maslach Burnout Inventory - Human Services Survey for Medical Personnel (MBI-HSS MP). It was developed to measure burnout in individuals who work with people (Bittner IV et al., 2011; Dyrbye et al., 2018). The MBI is comprised of three subscales: emotional exhaustion, depersonalization, and loss of personal accomplishment (Maslach & Leiter, 2017). There are alternative model views of burnout which take into account other factors. The Oldenburg Burnout Inventory covers physical and cognitive exhaustion, as well as disengagement from work (Tipa, 2019). The Copenhagen Burnout Inventory includes personal and professional psychological and physical fatigue and client-related burnout (Dyrbye et al., 2018). Other occupational-specific tools include additional factors such as job satisfaction, intention to quit, investment, psychological symptoms, work stress, social support, and workload (Koeske & Koeske, 1989). However, the MBI remains the most common measurement tool for burnout among researchers examining surgeon well-being.

The theoretical and structural validity of Maslach's model remains strong despite some minor inconsistencies and shortcomings related to the tri-component subscales (Koeske & Koeske, 1989). The central component of burnout is emotional exhaustion (EE). EE is caused by excessive demands, both psychological and emotional. These pressures lead to feelings of being overwhelmed, drained, or depleted, which result in severe fatigue. Depersonalization (DP) is a sense of detachment or an indifferent attitude towards work. DP is characterized by negative, callous, and cynical behaviors when interacting with colleagues or patients; it may represent a psychological attempt to protect against further emotional exhaustion. Loss of personal accomplishment (LPA) is a distorted perception of competence. LPA manifests through the loss of confidence in one's professional abilities (Campbell Jr et al., 2001; Crijns et al., 2020).

Before the COVID-19 pandemic, the prevalence of burnout for surgeons was reported with wide variability between 16 – 89 percent with an average of 40 percent across all age groups, all practice types, and all countries (Sauder et al., 2022; Travers, 2020). In certain higher stress specialties, burnout rates are greater. For example, rates of burnout in trauma surgeons is reported between 40 - 89 percent (Sauder et al., 2022; Travers, 2020), more than 50 percent of cardiothoracic surgeons meet the criteria for burnout (Chow et al., 2021) and 56 percent of orthopedic surgeons report experiencing burnout (Lichstein et al., 2020). Surgery residency is an especially high-risk time for burnout. Prevalence of burnout among surgical residents has been reported as between 19 - 69 percent, depending on training specialty (Beierle et al., 2019; Sauder et al., 2022). Severe surgeon burnout, known as burnout syndrome, can be found in 3 percent of surgeons (Bartholomew et al., 2018).

Burnout among surgeons is primarily driven by high levels of emotional exhaustion and depersonalization (Lebares et al., 2018). High levels of emotional exhaustion are found in 29 - 53 percent of surgeons. Comparatively, 17 – 27 percent experience high depersonalization and 4 – 16 percent reported low levels of personal accomplishment (Arora et al., 2013; Bartholomew et al., 2018; Patti et al., 2018; Yost et al., 2005). Moderate or severe emotional exhaustion is reported in 60 percent of surgical residents (Beierle et al., 2019). Burnout post-pandemic has further deteriorated perceptions of professional well-being (Lazarides et al., 2021). Levels of burnout and emotional exhaustion increased during the pandemic. Average burnout rates increased to 50 percent across surgical specialties. Emotional exhaustion had a proportional increase of nearly 27 percent from September 2019 to January 2022 (Sexton et al., 2022; Shaikh

et al., 2022). Both professional and personal factors precipitated this increase. Personal factors included fear of transmitting COVID to a family member and the possibility of losing a family member. Professional factors were identified as an increased COVID patient load, working in an elevated stress environment, increased call, and limited access to PPE (Shaikh et al., 2022). Researchers have found these heightened levels of emotional exhaustion are associated with higher emotional exhaustion climate scores, a safety culture and workplace well-being metric. This association suggests a social contagion effect associated with emotional exhaustion, where individuals from the same work setting share an exhaustion norm (Sexton et al., 2022).

2.3 Risk factors for burnout

The sources of burnout for surgeons are well described in the literature. Risk factors for surgeon burnout include continually increasing work demands, malpractice lawsuits, junior academic rank, and level of individual health (Khansa & Janis, 2019). Post-pandemic factors include decreases in respect from patients and patient families, greater bureaucratic demands from hospitals and large practices, institutional control policies, reduced autonomy and aggressive media (Crijns et al., 2020; Travers, 2020). Surgical trainees have additional risk factors which include learner-related interpersonal conflicts, such as being subjected to abuse or mistreatment, others taking credit for their work, and public humiliation (Gleason et al., 2020). Resident burnout can also be the result of duty hour violations, long work hours with insufficient time for rest, and low ABSITE scores (Huang et al., 2021). Intern post-graduate trainees have higher levels of burnout (Galaiya et al., 2020; Lu et al., 2020). Risk factors associated with high emotional exhaustion scores included junior academic rank, early training year, unmanageable work volume, inability to attend health maintenance appointments, lack of exercise, and lack of program support (Lichstein et al., 2020).

2.4 A closer look at burnout for women surgeons

Women surgeons are at especially high risk for burnout. The Physician Work Life Study found that female physicians are at a 60 percent higher risk of burnout than male physicians (Khansa & Janis, 2019). Their higher risk is likely in part due to gender-related socio-cultural factors. Women surgeons in various surgical specialties have reported greater difficulty in maintaining balance between work and family life responsibilities (Lu et al., 2020). For women surgeons, gender bias in the workplace is also a risk factor for burnout (Lu et al., 2020). It is important to note, women surgeons report more emotional exhaustion symptoms than men

(Huang et al., 2021). Further investigation is needed to clearly understand how professional and personal gender-related factors leave women surgeons more vulnerable to emotional exhaustion and burnout.

2.5 The consequences of chronic burnout for surgeons

Surgeon burnout affects mental health, work performance, and patient outcomes (Lebares et al., 2018). The personal consequence of burnout includes anxiety, depression, substance abuse (alcohol and illicit drug use), and suicide (Chow et al., 2021; Khansa & Janis, 2019; Lebares et al., 2018; Lichstein et al., 2020). The prevalence of suicidal ideation (SI) among surgeons has been found to be 1.5 to 3.0 times more common than in the general population. The mean suicide rate among surgeons (13.3%) is double that of the general population (Travers, 2020). SI has a large, statistically significant adverse relationship with all three domains of burnout (emotional exhaustion, depersonalization, and low personal accomplishment) and symptoms of depression (Shanafelt et al., 2011). Chronic burnout can lead to substance abuse. One study found 61 percent of orthopedic surgery residents met the criteria for hazardous alcohol use, while 7 percent of residents reported using recreational drugs in the previous year (Lichstein et al., 2020). Burnout also leads to dissatisfaction with work/life balance and low quality of life scores (Galaiya et al., 2020). This imbalance presents as missed health appointments, negative impact on relationships, and low levels of self-perception (Chow et al., 2021; Senturk & Melnitchouk, 2019). Not surprisingly, more women than men reported poor levels of balance/quality of life during training. In one study, residents with children expressed regret toward pursuing surgical training due to the inability to disconnect from their work (Chow et al., 2021; Senturk & Melnitchouk, 2019). Some surgical trainees reported they would not complete surgical training again, if given a choice (Chow et al., 2021).

The professional consequence of burnout include regret associated with career choice, poor job satisfaction, and increased medical errors (Chow et al., 2021). Burnout has been shown to compromise patient care. Burnout and depression have been found to be predictors of reporting a recent major medical error (Beierle et al., 2019; Senturk & Melnitchouk, 2019; Shanafelt et al., 2010). In one study, high levels of emotional exhaustion were associated with a greater number of perceived medical errors (Crijns et al., 2020; Williams et al., 2007). Burnout also is associated with poorer patient satisfaction (Beierle et al., 2019).

2.6 Burnout Prevention in Surgery

Burnout prevention requires a multifaceted approach that addresses the physical, emotional, and psychological dimensions of work-related stress. Promoting physical and mental health is essential for burnout reduction (Gleason et al., 2020; Khan et al., 2021). Administrative factors, regulatory burden, workload, and toxic work environments also need to be addressed. Institutional prevention should focus on alleviating clinician stressors such electronic medical record (EMR) and administrative burdens (Galaiya et al., 2020; Senturk & Melnitchouk, 2019; Travers, 2020). Providing greater programmatic resources, limiting the work week, and the addition of formal mentoring and professional development may decrease levels of burnout (Gleason et al., 2020; Janko & Smeds, 2019). Researchers have found that burnout avoidance is possible through the prevention of emotional exhaustion, and the development of professional autonomy and control (Khansa & Janis, 2019).

A protective factor against surgeon burnout is emotional intelligence (EI; (Galaiya et al., 2020). Emotional intelligence (EI) is defined as the capacity to be aware of, control, and express one's emotions, and to manage interpersonal relationships with fairness and empathy. It has been shown that individuals without burnout had higher overall EI scores (Gleason et al., 2020). (Beierle et al., 2019). The correlation between EI and burnout needs to be fully evaluated in order to design an intervention that may assist with reducing or preventing burnout in surgeons. Interventions that address burnout through the development of empathetic communication skills have been shown reduce levels of compassion fatigue and emotional exhaustion (Khan et al., 2021).

2.7 Prioritizing the Emotional Health of Surgeons

With 40 – 69 percent of surgeons meeting criteria for burnout on the emotional exhaustion and depersonalization subscales, there is great urgency to bolster the emotional health of surgeons (Chow et al., 2021). Interventional efforts often fail to support surgeons' emotional well-being, because the designs of these initiatives are rooted in mental health models. These models suffer from low utilization by surgeons due to problematic views related to surgical identities and culture (Shapiro & McDonald, 2020). The literature examining emotion in surgeons is lacking. A focus on emotional intelligence in surgery occupies much of the current literature. Higher levels of emotional intelligence are correlated with better outcomes for both the surgeon and the patient. Emotional intelligence has been demonstrated to be beneficial for

overall surgeon well-being and job satisfaction. EI has also been shown to protect against burnout (Abi-Jaoudé et al., 2022).

Beyond the focus on EI, the analysis of emotion in surgical work is quite limited. Surgeon emotional experiences of adverse events have been studied suggesting that surgeons must navigate complex emotional responses after the occurrence of adverse events (Luu et al., 2012). Their emotional responses are deep and long lasting, having a long-term impact on their personal and professional identities. Another small qualitative study (n=27) of surgeons' everyday emotional experiences was performed by a French study team (Orri et al., 2015). Burdensome emotions were omni present and invaded the surgeon's life outside the hospital. Surgeons reported their own emotions and their perception of patients' emotions are interwoven. Importantly, they suggest that surgeon emotional responses are influenced by situation, institutional frameworks, surgical culture, and perceptions associated with their surgical identity. These small but vital studies show how emotions are a ubiquitous part of surgical work. The inability to properly manage the everyday stresses inherent in patient care leads to emotional exhaustion and depersonalization which are at the core of burnout. Large-scale research into emotion in surgery is urgently needed. Better understanding of emotion in surgery has the potential to lead to innovative interventions to decrease emotional exhaustion and depersonalization for surgeons, with the hope of alleviating the risk of reoccurring and chronic burnout.

2.8 The study of emotion using social media

Quantitative and qualitative social network analysis has been used to identify patterns, experiences, information sharing, and viewpoints of patients populations and healthcare professionals (De Gagne et al., 2021; Hassan et al., 2021). Social network analysis provides researchers with both textual (original posts, reposts, comments, hyperlinks, time, location, user information) and visual data (emojis, photographs, videos, graphics) (Hassan et al., 2021; Haug et al., 2016). Some researchers find visual tools, like emojis, to be more accurate at capturing the changing nature of emotional states better than words alone. Emojis may also better facilitate communicating the intensity of emotional responses, even if it is hyperbolic (Blewett, 2020). Studies using Twitter data of health professionals have investigated social support and the emotional wellbeing of vulnerable populations (Geia et al., 2017). Twitter is the most commonly used social media forum in public health (Hernandez et al., 2020). Twitter also is the social

media platform of choice for surgeons due to the potential for rapid dissemination of research, wider inclusion for junior surgeons and underrepresented groups, and open conversations and interactions (Grossman et al., 2021). Hashtags are meta tags generated by users. They are a way for users to engage in conversations and maximize the benefits of the Twitter platform (Grossman et al., 2021). Surgeons have utilized hashtags to facilitate social change in their profession. Viral examples are the diversity campaign #ILookLikeASurgeon and the gender equity campaign #HerTimeIsNow.

Analysis of emotion in social media is common across platforms. Emotion detection has proven useful for targeted advertising, the detection and monitoring of mental health, and gathering public opinion on political and sensitive issues (Mondal & Gokhale, 2020). The analysis of the Twitter messages of health professionals have yielded evidence on best practices for public health communications and responses, patient perceptions within disease communities, population-specific understanding of person-center care, and public processing of traumatic grief (Lee et al., 2014; Pérez-Pérez et al., 2019; Selman et al., 2021; Stuart et al., 2020; Ure et al., 2019; Valiavska & Smith-Frigerio, 2022; van Diepen & Wolf, 2021).

2.9 Theoretical framework for emotion categorization and interpretation

Plutchik's Wheel of Emotions was used to inform the coding of the Twitter data collected in the present study. Emotion categorization was conducted using Plutchik's Wheel of Emotions. The emotion typography contains eight primary emotion constructs (Plutchik, 1980) which are the foundation of Plutchik's wheel enabling the deconstruction of emotional complexity (Plutchik, 2000). Plutchik identified eight primary emotions which are the basis for all emotions. These primary emotions are grouped into polar opposites: joy and sadness; acceptance and disgust; fear and anger; surprise and anticipation (Donaldson, 2017). These primary emotions can be combined to produce complex emotions, such as: joy + trust = love, joy + anticipation = optimism, anticipation + anger = aggressiveness, anger + disgust = contempt, disgust + sadness = remorse, sadness + surprise = disapproval, surprise + fear = awe, fear + trust = submission (Pico, 2016). The degree of intensity produces diversity in the amount of emotions we can feel. For example, fear increases in intensity from timidity to terror; surprise increases from uncertainty to amazement, while sadness moves from gloominess into grief (Pico, 2016). Plutchik's Wheel of Emotion has a history of utilization in sentiment analysis, particularly in social media (Mohsin & Beltiukov, 2019; Tromp & Pechenizkiy, 2014). Mondal and Gokhale (2020) used Plutchik's

wheel to develop a machine learning approach to mining emotion on Twitter. The wheel was utilized to process emoticons that were used to express emotions by designing a positive and negative class for each. This process allowed for accuracy, sensitivity, and specificity in emoticon interpretation. Ay et al. (2022) also used Plutchik's wheel to explore third wave feminism. The wheel was used to simplify emotion classification by organizing responses into four opposing emotion pairs. Plutchik's wheel aids in emotion detection because its definitions makes it manageable for rules-based emotion interpretation (Gaber et al., 2015). Using Plutchik's wheel to chart the cartography of surgeon emotion, provides a sound methodological framework for straightforward pinpointing of emotion.

2.10 Thesis Statement

In this thesis, emotion of surgeons was examined using social media messages on Twitter. The resulting investigation provided insight into the ways in which surgeons communicate emotion related to personal and professional practice. These findings help advance the understanding of emotion expression and communication of surgeons on Twitter. They may help inform best practices for the development of interventions to advance emotional intelligence and emotion regulation, as well as provide protection against emotional exhaustion and burnout.

2.11 Research Aim

To better understand emotion in surgical practice, a qualitative analysis of surgeon-written social media posts on Twitter was performed. This analysis explored the ways in which emotions are expressed and communicated by surgical practitioners on the social media platform. Emotional categorization and thematic analysis of surgical activities and experiences provided insight into surgeons' emotions within their practices and how they may contribute to burnout and well-being.

Chapter Three

3.0 Methods

In this section, all details of the methodology, processes, and procedures carried out in the research design are presented. Data materials and sampling procedures are outlined. Inclusion and exclusion criteria for analysis is presented. The analytical frameworks for sentiment and emotion analysis are detailed. Lastly, the protocols developed to ensure inter-rater reliability in the analytical process are explained, along with the researchers' reflexivity statement and their demonstration of rigor.

3.1 Materials and Procedure

Sample selection processes and procedures were guided through consult of University of Michigan's Consulting for Statistics, Computing & Analytics Research (CSCAR). A purposive sampling of practicing surgeons was chosen; this technique enabled the identification an information-rich data set (Patton, 2002) of individuals who are knowledgeable about the phenomenon of interest, surgeon emotions (Cresswell & Plano Clark, 2011). According to the Association of American Medical Colleges, there were 56,153 practicing surgeons in the United States in 2021 across six surgical sub-specialties (general surgery, neurological surgery. orthopedic surgery, plastic surgery, thoracic surgery, and vascular surgery). The optimal sample size to represent this population is 2,303, using a 2% margin of error and a 95% confidence level (CheckMarket, n.d.). The Twitter accounts of 2,303 self-identified surgeons and surgical residents were randomly selected and followed from the 26,126 followers of the Association for Academic Surgery Twitter account (@AcademicSurgery). The Association for Academic Surgery was founded in 1966 and its mission is to develop and inspire academic surgeons. It is recognized as an inclusive surgical organization with over 4,000 members. NCapture, a web-browser extension from QSR International, was used to extract account data from Twitter. NCapture withdraws data which includes Twitter ID, user name, bio information, number of Tweets, number of followers, number following, Tweets, Tweet type, time of Tweet, Retweets, number of ReTweets, time of Retweet, and mentions. NCapture is not an automated process; it

was completed manually for each account. For ease of data management, separate data samples of 230 Twitter accounts were manually pulled from Twitter. Five data samples were pulled (1,150 Twitter accounts), providing a total of 6,981 Tweets that met inclusion criteria. These represented 659 Twitter accounts during the specified data collection period (57.3% of the total sample). This data set exceeded the estimated 5,000 Tweets needed for analysis in the thesis proposal. This raw data downloaded from Twitter was then imported into NVivo for data structuring and analysis (NVivo, 2023).

3.2 Inclusion and Exclusion Criteria

For inclusion in analysis, Tweet content originated from the account of a self-identified surgeon (surgeon in training, current clinician, or former clinician). Original tweets, retweets, replies, bio information, graphics, gifs, photographs, and videos were included as analyzable data. From these accounts, Tweets and Retweets from the sampling timeframe of October 2022 and February 2023 were analyzed. This timeframe was chosen to capture Twitter posts from two national physician health events. In October 2022, the National Academy of Medicine's Clinician Well-Being Collaborative published its National Plan for Health Workforce Well-being to address physician burnout. The plans called for health care leaders, public health leaders, government, payers, industry, and educators to help drive policy and systems change to better support the health workforce. In February 2023, the President of the Association for Academic Surgery, Carrie Cunningham, delivered her Presidential Address, "Removing the Mask." In this 1-hour address, she spoke candidly about her struggles with burnout, mental health, and addiction during her surgical career.

Exclusion criteria included "copypasta" or duplicate tweets, tweets that do not include explicit/implicit emotional context, too little information to identify emotional intent, accounts that were not part of the identified surgical stakeholder group, or tweets from laypeople and advertisers. Copypasta refers to the copy-and-pasting of duplicate content in an attempt to propagate a message; it is used to artificially amplify content, suppress information, or manipulate Twitter's trends. Duplicate content was defined as blocks of text that are identical or "appreciably similar" within or across domains. Non-English Tweets were eliminated from analysis. Super-Tweeters, Twitter accounts with more than 5,000 posted Tweets, were excluded from the sample to keep discrete data manageable for qualitative analysis.

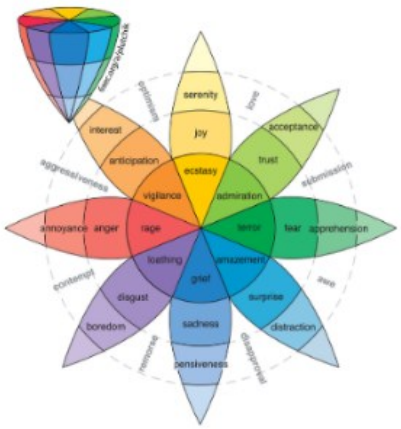
To summarize, in the thesis proposal, it was estimated that 5,000 unique tweets would be collected for analysis. Twitter accounts of 1,150 surgeons, from the initial 2,303 Twitter account sample, yielded 659 Twitter accounts which met the inclusion criteria and contained Tweets within the data collection timeframe. A total of 6,981 unique Tweets were posted from the 659 Twitter accounts during the months of October 2022 and February 2023. These 6,981 Tweets completed the sample and were uploaded into NVivo for analysis.

3.3 Broad Sentiment and Emotion Analysis

A broad sentiment analysis of the 6,981 Tweets was conducted by the author (JE) and an undergraduate research partner (VF). Twitter content was read line by line to identify all relevant content; visual data (emoji, graphics, photographs, videos) with relevant content was also coded. VF engaged in the coding process to serve as a reliability coder and to establish interrater reliability. JE completed the first 10% of coding with VF to train them in qualitative coding and structural management of data in NVivo. The next 20% of the data was independently coded by both JE and VF to establish inter-rater reliability (IRR). Initially, Tweets were coded into broad categories of positive, negative, complex, neutral, not sure, and no content. JE and VF compared reliability sample categorization at three separate timepoints during this process. Positive and negative categories were nearly identically coded across the sample for both coders. Reconciliation of complex and neutral categories were conducted Tweet by Tweet. Any discrepancies in the coding was discussed by JE and VF and were resolved through consensus (Syed & Nelson, 2015). Cohen's kappa was used to calculate overall interrater reliability, with the result score of $\kappa = .81$ interpreted as strong IRR (McHugh, 2012).

Detailed emotion categorization was conducted and initial codes were structured into a codebook based on Plutchik's Wheel of Emotions categories (Donaldson, 2017). Positive emotion categories included admiration, trust, acceptance, ecstasy, joy, serenity, amazement, surprise, distraction, vigilance, anticipation, and interest. Negative emotion categories were rage, anger, annoyance, loathing, disgust, boredom, grief, sadness, pensiveness, terror, fear, and apprehension. Lastly, complex emotions were organized into optimism, love, submission, awe, disapproval, remorse, contempt, and aggressiveness. A detailed view of Plutchik's Wheel of Emotions illustrating emotion organization and primary, secondary, and tertiary intensity levels are found in Figure 1 (Plutchik, 1980).

Figure 1 - Plutchik's Wheel of Emotions



3.4 Qualitative Analysis

Identified emotion codes were further interpreted and thematically organized. Thematic analysis, as described by Braun and Clark, was used for the qualitative approach (Braun & Clarke, 2006). The purpose of this analysis was to explore emotion related to surgical practice expressed in the content of the Tweets, as well as identify additional themes related to emotion from the data.

3.5 Reflexivity Statement and Demonstrating Rigor

Rigor was established through a focus on reflexivity and the creation of an audit trail. The author (JE) and the undergraduate researcher (VF) both identify as women. Both JE and VF have engaged in prior psychology research. JE has five years of experience working with surgeons on surgical culture and health behavior research. Reflexivity was practiced through journal keeping by JE during the research process. The journal includes notations on initial impressions of the information in the data, a segment of inductive coding and data exploration, thoughts on integrating personal Tweets with professional Tweets in the analysis, and deliberation of potential sub-analyses based upon various Tweeter classifications (gender, race, training, and experience). These considerations and subsequent decisions affected the analytic process and the outcomes of the research. An audit trail was compiled to track the decision-making in the analytical process. A record was made of each methodological step taken, the decision-making processes behind them, and the final directions which were established. The audit trail provides a

detailed map of the transformation of the raw Twitter data into its coding structure, thematic organization, and finalized interpretation.

Chapter Four

4.0 Data Presentation, Analysis, and Interpretation

Chapter four reports the results of the data analysis. The final sample is detailed. Demographic characteristics of the sample population are presented. The broad sentiment analysis is presented, along with the thematic emotion analysis. Illustrative examples of raw data are included to provide context and depth to the resulting analysis.

4.1 Sample Size and Information Power

A random sample of 2,303 self-reported surgeons were identified from the Association for Academic Surgery (AAS) Twitter account (Assoc4AcademicSurgery @AcademicSurgery). The Assoc4AcademicSurgery account has 26.9K followers. The initial sample size of the study was amended after establishing a consistent pattern of Tweets in 1,150 Twitter accounts pulled from the sample using Ncapture, with a total of 659 accounts meeting the inclusion criteria. From these Twitter accounts, 6,981 Tweets were generated during the data collection timeframes providing sufficient information power for emotion analysis and in-depth qualitative interpretation.

4.2 Demographic characteristics of Twitter Account Users

The demographic characteristics of this sample were pulled from self-reported information in the bio section of each Twitter account profile. As such, not all accounts included demographic characteristics. The data below represents only a portion of the sample. The bio information from 633 Twitter accounts with demographic characteristics was analyzed (96.1% of the accounts represented in the sample). User demographics most frequently reported were professional status, postgraduate year (PGY) of training, gender, and country of origin (country data was categorized by geographic region). Surgeons in training (resident and fellows) represent a slightly larger portion of the Twitters users (n = 341, 54.9%), with junior residents (PGY1 and PGY2) most represented (n = 29, 23.9%). This sample includes slightly more women (n = 93, 54.9%) than men. Slightly more than 18% (n = 114) of users identified being located outside of North America. These data are included in Table 1. Surgical specialty was also commonly

reported; a frequency table of these data are presented in Table 2. General surgery was the most frequently reported specialty (n = 155, 33.05%); surgical oncology the second most frequent specialty (n = 44, 9.35%). To protect anonymity, personally identifying information including place of work, training institution, and medical school are not reported in this analysis.

Table 1
Self-reported Demographic Characteristics

Twitter Bio Information	*n*	%
Level of Training (n = 633)		
Attending	292	46.12
Fellow	67	10.58
Resident	274	43.28
PGY Level (n = 121)		
PGY1	45	37.2
PGY2	47	38.84
PGY3	21	17.35
PGY4	7	5.78
PGY7	1	0.83
Gender (n = 171)		
Woman	93	54.39
Man	77	45.03
Transgender	1	0.58
Geographic Representation (n = 608)		
Africa	12	1.97
Asia	22	3.62
Australia/New Zealand	4	0.66
Central America	3	0.49
Europe	53	8.71
Middle East	11	1.82
North America	494	81.25
South America	9	1.48

Table 2

Frequency of Surgical Specialty

Surgical Specialty (n = 469)	n	%
Breast	6	1.20
Cardiac	13	2.77
Cardiothoracic	14	2.90
Colorectal	17	3.62
Endocrine	12	2.50
General	155	33.05
Gastrointernological	3	1.00
Global	8	1.70
Hepato-Pancreatico-Biliary	20	4.26
Minimally Invasive Surgery	24	5.11
Neurosurgery	9	1.90
Obstetrics and Gynecology	4	1.00
Orthopedics	5	1.00
Otolaryngology	8	1.70
Pediatrics	21	4.47
Plastics	18	3.83
Surgical Oncologist	44	9.38
Thoracic	11	2.30
Transplant	7	1.40
Trauma	30	6.39
Urology	19	4.05
Vascular	21	4.47

4.3 Introduction of Twitter Data Sample

The communication patterns of surgeons in this Twitter sample are robust. Of the 1,150 self-identified surgeon accounts pulled in this sample, 659 (57%) Twitter users posted Tweets during the data collection timeframes. A total of 6,981 individual Tweets were Tweeted and subsequently coded. The results of a broad sentiment analysis of emotion patterns in the data are delineated in Table 3. Neutral content was found in 696 Tweets; these included Tweets advertising information or events (without emotion qualifiers). Tweets which were non-English,

as well as Tweets without sufficient content or graphic information were categorized as no content (n = 412). A small portion of the sample (268 Tweets) did not provide enough context for categorization and were coded as "not sure." Neutral, not sure, and no content Tweets were not included in this analysis (1,376). There were 5,605 Tweets categorized as containing emotion. Positive emotion, representing 55% of Tweets, was most frequently communicated in this sample. Complex emotion followed, representing 34% of Tweets. Negative emotion was least frequent, representing only 11% of the Tweets.

Table 3

Broad Sentiment Analysis of Twitter Data

Sample	*Files*	*Positive*	*Negative*	*Complex*	*Neutral*	*Not Sure*	*No Content*	*Totals*
Sample 1	113	614	78	304	211	64	111	1382
Sample 2	134	737	100	332	234	56	108	1567
Sample 3	131	597	101	339	128	27	41	1233
Sample 4	148	560	189	480	70	75	77	1451
Sample 5	133	595	128	451	53	46	75	1348
Totals	659	3103	596	1906	696	268	412	6981

4.4 Positive Sentiment and Emotion

Tweets with positive emotion dominated the sample, representing 55% of all categorized Tweets. Tweets categorized with positive sentiment were further categorized using Plutchik's Wheel of emotion into 1) admiration, trust, acceptance, 2) amazement, surprise, distraction, 3) ecstasy, joy, serenity, 4) vigilance, interest, anticipation. The primary positive emotions (admiration, amazement, ecstasy, and vigilance) were the most frequently Tweeted. Together these primary positive emotions represent 59% of the positive sample. Plutchik's primary positive emotions are considered to be discrete and represent the highest level of intensity in the model. As primary emotions lessen in intensity, they give way to similar yet less intense emotions. Admiration lessens to trust, then acceptance. Amazement attenuates to surprise, then distraction. Emotions of ecstasy assuage to joy, then serenity. Vigilance moderates to anticipation, then interest. Frequencies of posted emotion were calculated and thematic analyses of Tweet content were conducted. Table 4 shows the frequency breakdown.

Table 4

Positive Emotion in Surgeon Tweets using Plutchik's Wheel of Emotion

Positive Emotions (n = 3103)	*n*	%
Admiration	1183	38.13
Trust	86	2.78
Acceptance	49	1.58
Amazement	507	16.34
Surprise	86	2.77
Distraction	120	3.86
Ecstasy	78	2.51
Joy	530	17.08
Serenity	19	0.61
Vigilance	43	1.38
Anticipation	56	1.80
Interest	346	11.15

4.4.1 Admiration, Trust, Acceptance:

Together, admiration, trust, and acceptance represented 43% of the positive emotion sample. Admiration was the most frequently communicated emotion (38%), with trust at nearly 3% and acceptance at 1.5%. Admiration dominated communications by surgeons on Twitter.

Admiration. For the purposes of categorization, admiration was defined as respect and warm approval. Admiration for colleagues, mentors, students, scholars was the most frequently Tweeted. Surgeons frequently uplifted their colleagues through compliments, approbation, and praise. Complimentary Tweets highlight awards, honors, presentations, promotions, and both institutional and individual accomplishments. For example, the following Tweets from AG and OS honor colleagues (all identifying information has been removed and anonymized from illustrative Tweets):

> *CONGRATULATIONS Dr. FJ and Dr. CC on this HISTORIC accomplishment. Because of you, we believe! – AG, General Surgeon*

> *@RS_MD @SL @JJ @AW @JHMD @SGMD Honored to have all of you teach us the positive energy of SoMe. Best quote of the session: "Shine in the reflected light"- OS, Transplant Surgeon*

Strong praise of leaders in surgery communities were often Tweeted. These frontrunners serve as aspirational figures for surgeons at all levels. They provide motivation and inspiration. These Tweets show how leaders create tangible pathways for others to follow to success.

Thank you all for being trailblazers and role models. Hope to earn a seat at that (hopefully even larger!) table one day - SK, Pediatric Surgical Fellow

On success in academic surgery: "It's all about location." "Surround yourself with people who care about your success." "Supplement your environment the way a neural crest cell does." - Dr. Allan Goldstein, giving THE lecture – JB, Surgery Resident

Mentors and mentorship were often highlighted, with Tweets as a means of esteem. Surgeons at all levels used Tweets to show appreciation, veneration, and high regard. This surgeon uses a Tweet as a plaudit to her mentor, while simultaneously extoling the value of mentorship.

This is a NM appreciation tweet. That's it. Glad every day to call him a mentor, friend, confidante, & partner. Residents/fellows/faculty, find yourselves a person that will open doors without asking what's in it for them. – AG, Surgical Oncologist

There was reciprocity in these relationships. Mentors also Tweeted about mentees with equal regard and appreciation. These Tweets not only highlight student and trainee work, they show how valuable the mentorship model is in specialty and professional development. LC Tweets to showcase her students' work and their opportunities to change the field.

I'm SO proud of my students, TL and BH, for killing it with their presentations at #ASC2023! The next generation truly will save us! – LC, Surgeon

There were profession-specific observational days and celebrations that were widely acknowledged in the sample. Thank-A-Resident Day, National Physician Assistant Week, and National Women Physician Day were recognized with Tweets. These Tweets go beyond simple acknowledgement of the observance and display sincere emotional gratitude to the honored roles. In these tweets, residents are saluted at all levels and physician assistants are celebrated. For example,

Did y'all hear? It's Thank A Resident Day and we're thanking our surg residents, from intern to research to Chief to everything in between! – CA, resident

In honor of National Physician Assistant Week (#PAWeek), we want to celebrate the PA's at Fox Chase who are a crucial part of our healthcare team. Thank you for all the

extraordinary care you provide in support to our doctors and patients. RT and thank a PA! – JS, General Surgery Resident

Celebrating National Women Physicians Day! Surround yourself with positivity and people who teach you to challenge yourself! Great conference! A weekend of catching up with mentors, meeting inspiring surgeons, and laughing with friends – SG, Surgical Oncology Fellow

Tweets focused on commendation and acclaim of academic work were commonly shared. These Tweets highlighted the work of past and present colleagues, prior and present collaborators, and leaders within their surgical specialty. These Tweets can communicate approval of academic advancements and applause for the people and institutions carrying out the work. For example, a resident lauds the work of his institution's contributions to one of the largest annual surgical conferences and a surgeon shares accolades on essential specialty research and its authors.

Strong showing at #clinicalcongres2022. Looking forward to San Diego and these presentations. – AR, General Surgery Resident

If you are a #GI #Oncologist or #trainee -this Special Series is a must read! Congratulations to @ER, AK & all the contributors...fantastic one-stop resource – AG, Surgical Oncologist

Finally, tributes to individuals were commonly Tweeted. They marked anniversaries, promotions, graduations, and the death of people important to the individual and the surgical community. Occasionally, there were familial or personal tributes. In this Tweet, a fellow pays tribute to three generations of his family who have all completed surgical oncology fellowships.

3 generations of @SurgOncFel. – AR, Surgical Oncology Fellow

Although there were some personal Tweets, the majority of the tributes were professional in nature. They represented people who were personally known to the Tweeter and those renowned in their profession. Here are two examples, a tribute to a surgeon who passed away and a surgeon who was promoted.

He was a great leader and educator to so many vascular surgeons. He will surely be missed. - JL Vascular Surgeon

From us to you @JCMD thank you! What an inspirational career and honest reflection of what it takes, great to see medical students, trainees and consultants come together tonight! – CP, Thoracic Surgeon

Trust. For categorization, trust was defined as a firm belief in the reliability, truth, ability, or strength of someone or something. Trust was less frequent (3%) in this sample of posts. Yet it conveyed essential emotion concerning camaraderie and teamwork. Certitude was often attributed to colleagues and institutions of learning or employment. Colleagues and collegial groups provided surgeons with inspiration for statements expressing their trust in their professional and scholarly conviction. Here, a resident Tweets about the strength of a new faculty member and how this scholar will contribute to the overall strength of the institution.

CULTURE trumps everything else. Vulnerable leaders elicit TRUST. Seek first to UNDERSTAND YOURSELF. Appreciate administrators. Find TIME to REFLECT. – PP, Surgical Oncologist

We warmly welcome JC, Senior Research Professor, to the Department of Surgery team! Dr. C will continue to be a major driving force behind the success of the Surgical Outcomes & Quality Improvement Center – BC, General Surgery Resident

Trust was often communicated through the building of reliance and strong professional and inter-personal connections. Although it was not an official hashtag, the words, "Surgery is a team sport" were Tweeted and re-Tweeted often among this cohort. Official hashtags used were #Teamwork and #StrongerTogether. A resident shared this infographic highlighting the inter-personal aspects of trust. Another resident shared a Twitter-friendly recipe for team trust. Yet another resident points out that trust is not automatic, it is intentional.

We have four kinds of relationships in our lives... - AP, Plastic Surgery Resident

Trust enriches the interactions we have with other people in our lives. - AP, Plastic Surgery Resident

Trust is ESSENTIAL to any high performing organisation/ team/ leader. How do you create it though? In a Twitter word count: - 1) Transparency 2) Consistency over time 3) Competency 4) Integrity 5) Invest in others 6) Congruence 7) Fair – AW, Surgical Trainee

You are not a team because you work together. You are a team because you trust, respect and care for each other. – NI, Reconstruction Surgery Resident

Confidence and the belief in oneself and one's capabilities was Tweeted, as well. Often these Tweets were affirmational and were posted as reminders to surgeons to put trust in their training and abilities. For example, a resident points out its necessity; while, a surgeon warns others to avoid the stranglehold of imposter syndrome.

The most essential 10 letter word - Confidence - trust it. – JN, Surgery Resident

Impostor syndrome is real, but trust your training and don't let it control you… you are incredibly well prepared and ready. – JC, Breast Surgical Oncologist

A small subset of surgeons posted with certitude in their professional abilities. Here, a surgeon outlines her professional journey, free from doubt about her future.

21 years ago, I walked these stairs as a first-year medical student, Today is my first day as full professor of urology. Definitely not a destination, but what a journey! Ready for the next chapter – GF, Urologist

One resident used a Hamilton gif to convey she was prepared and ready for their on call shift[1]; another resident embraced the week with self-assurance.

It's Monday. Let's start the week of with confidence! - LG, General Surgery Resident

[1] On-call physicians MUST respond to the hospital when requested to attend to patients in a timely manner.

- AW, Surgical Trainee

Confidence in surgeon ability to provide care to their patients were communicated in a variety of ways. Some Tweets focused on assuring healthcare partners that their decisions are patient-centered. After an emergency medicine rotation, this resident Tweeted about the reliability of their recommendations for patient care and the need for better interdisciplinary partnerships.

Now having seen both sides, we EM docs generally work pretty hard not to admit unnecessarily. Trust the person who has been w the pt, go to bedside, find the reason, & make an informed decision together if still disagreement. – KB, General Surgery Resident

Other Tweets highlighted the therapeutic alliances they are able to create with both individual patients and the populations they serve. In this Tweet, the surgeon is able to communicate with her patient's family in their native language and ties this experience with the importance of ethnic diversity in surgery.

When your patient's family bursts into tears after you explain a complicated surgery in their native tongue, it really reminds you how important it is that we improve latinX representation in surgery #HispanicHeritageMonth – CS, Surgeon

Acceptance. For coding, acceptance was defined as the action or process of being received as adequate or suitable, typically to be admitted into a group. Acceptance was a conveyed by surgeons on Twitter, with a frequency in the data of 1.5%. Acceptance communications largely fell into two main categories, embracing new members as they advance through surgical training and finding inclusive spaces within the profession as a member of an underrepresented group. Tweets welcoming medical students, residents, fellows, and trainees who return to an educational institution as faculty comprised most of these communications.

These communications used familial, community, and sports language to signify belonging, such as ‘welcome to the family,’ welcome to the tribe,’ and ‘welcome to the team.’

Beyond excited to welcome the next class of residents to Cleveland Clinic’s General Surgery Residency An incredibly accomplished group already! – CW, Surgery Resident

@AS @VAS @cw2015 @SES @ABH @RB Welcome to the fam!!!!! - TW, Urologist

@r19 @AB YaaAAAY!! CONGRAAATSS! WELCOME to our tribe – NA, Urogynocology Resident

Acceptance was also communicated as approval and integration. Surgeons from underrepresented minority groups used Twitter to highlight the importance of visibility and inclusion in the profession. These Tweets provide two different examples of acceptance. The first highlights how colleagues can foster inclusivity and a sense of belonging. The second shows how bias can cloud medical judgment and how patient trust and approval can come from a place of shared community.

@HCM @DKM As a Latina in medicine I appreciate the use of latinx. Thank you Dr. M for your inclusivity and support - KM, plastic surgeon

I walk into the room of a patient who was reportedly being “difficult.” She says, “I trust you because you’re black.” I hadn’t even said anything yet. Representation will always matter. - VN General Surgery Resident

4.4.2 Amazement, Surprise, Distraction:

Amazement, surprise, and distraction represented nearly 23% of the positive emotion sample. Amazement was the most frequently communicated emotion (16%), with surprise at nearly 3% and distraction at 4%. Amazement is the second most frequent emotion communications by surgeons on Twitter.

Amazement. For the purposes of categorization, amazement was defined as a feeling of great surprise or wonder. Amazement was mainly centered around scholarly work and collegial accomplishments. These Tweets commonly showcased research, publications, presentations, and important surgical events or topics. Overall, these Tweets were effusive and expressed high levels of heartfelt gratitude to colleagues and surgical communities.

Amazing science and a cool love story of two awesome people! GD and AOD first met in the lab years ago. Now the husband-wife duo are changing the landscape of cancer

research here at Hillman. Celebrate Valentine's Day by learning more about their story 🔬❤️🧪 *– JM, Colorectal Surgeon*

Amazing faculty at @UFHealth including members of @UFSurgery doing incredible work to transform healthcare delivery using artificial intelligence – AR, General Surgery Resident

A lovely morning learning and speaking about advances in breast cancer care! Amazing to see my fellow residents including @AD with talks! #womeninsurgery - SL, General Surgery Resident

The EXCELLENCE, yall!!!! Whew!!! This is amazing! #BlackGirlsDoSurgery #BlackMenLead #BlackWomenLead #Brilliantly 🤜 *- KC, Resident*

Dr. A presenting our new [roll] out for Family and Parental Leave supported by @Surgery @hz. Amazing work being done here to support our surgeons! – AM, Endocrine Surgeon

Surprise. For coding purposes, surprise was defined as an unexpected or astonishing event, fact, or thing. Tweets conveying surprise as a positive emotion were less frequent (*n*= 86, 3%) in this sample. Surprise showed up in communications regarding research findings and surgical procedures. In these examples, a surgeon shares a revelation in the results of a study; while, a resident is shocked by the anatomy of a patient who underwent a cholecystectomy.

Also a surprise was that the development of multiple organ dysfunction was linked only to changes in the hyperacute window. https://t.co/BQbLdhtVMU - TT, Trauma Surgeon

Another day: Some of these Gall Bladders surprise me. Patient has survived through multiple attacks of pancreatitis – SR, Surgery Resident

Another area where surprise was communicated was in the connection between patient experience and professional satisfaction. Patient gratitude elicited both surprise and positive

emotional responses, awakening dormant feelings of purpose for a resident and a moment of wonder in a surgeon.

> *While off service I saw one of our Spanish speaking uro patients. A pt w/ access barriers, who I've cared for. To my surprise, he & his fam were hoping to see me. Today, he reminded me of my community & the reasons why I pursued medicine/uro* 💔 *#internyrreminders – JR, General Surgery Resident*
>
> *Last year, John Reid lost his 16-year old son in a car crash. He decided to donate his organs, including his heart. This month, the recipient sent him a surprise gift - a teddy bear with a recording of his son's heartbeat. This is the exact moment he heard it. https://t.co/8MhyfApR8w What a surprise! - RC, Surgeon* [author note – I included the hyperlink to this video; IMHO it was the most affecting piece of data I encountered in this analysis]

Distraction. For coding this sample, distraction was defined as a diversion or recreation. For many surgeons in this sample, their Twitter account included a mix of professional and personal communications. As such, the Tweets communicating distraction include amusement, activities, and past-times both work-related and personal. Sports, travel, music, socializing, creative hobbies, and holidays (cultural, religious, and professional) were pleasant diversions surgeons shared in their Twitter feed. Since many of these surgeons are working or training in academic medical institutions, college sports were widely referenced. Tailgates with colleagues were celebrated. Passionate sports fans live Tweeted basketball, football, and hockey games. The

February data collection point captured many Super Bowl Tweets; some were there for the game, some were there for Rihanna.

> *Tales from our annual cardiac surgery tailgate! Good food and great company! Game too close for comfort… - CD, Resident*
>
> *Sometimes surgery residents run half marathons on the weekend :) #SurgeonsWhoRun @SS @lg6 @JU and I cheering at the finish – KB, General Surgery Resident*

Service was also spotlighted as a positive means of distraction.

> *Great way to start the weekend as we held the first general surgery clinic for the uninsured in MKE. Looking forward to many more. @MCWtraumaacs @MCWSurgeryRes – CG, General Surgery Resident*
>
> *Doodle from this morning… heart of palm! Now to get back to grant writing…Happy Valentine's Day* 💔 *- SC, Resident and Surgical Illustrator*

4.4.3 Ecstasy, Joy, Serenity

Ecstasy, joy, and serenity represented 20% of the positive emotion sample. Joy was the most frequently communicated emotion (17%), with ecstasy at nearly 3% and serenity at less than 1%. Ecstasy and joy were often used interchangeably in Twitter posts, with very little distinction communicated in intensity between ecstasy and joy. As such, in the analysis, I collapsed ecstasy and joy into one category.

Ecstasy/joy. The ecstasy/joy category is defined as a feeling of great pleasure, happiness, or joyful excitement (which at times may be overwhelming). Together, ecstasy and joy represent nearly 20% of the positive emotion sample. Sources of delight were numerous and were from

both personal and professional domains. Happiness that centered around professional accomplishments included meaningful interactions with colleagues and students, annual events, and specialty-specific activities. For example, a fellow Tweets about the exhilaration she experienced after attending a surgical conference. Then resident recounts the joyfulness she elicited during her last night float.[2]

I'm leaving #ACSC and #AWS with a heart full of inspiration, learning, and gratefulness. Besides unique scientific sessions, highlights of the congress go to: The incredible friends and mentors (who were only known virtually) which brought tremendous fun and enjoyment! - GB, Surgical Fellow

Things that made this past night float month filled with joy: 1. My amazing @Surgery night squad 2. Golden hour at Eskenazi sky garden 3. Taylor swift's new album on repeat in the work room. - ML, resident

Even small joys were recognized. Here, a surgeon shares a moment where she and a fellow BIPOC surgeon are wearing matching scrub caps.

Twinning with our intern in the OR today!!! This makes me so happy #BlackHistoryMonth – KM, Plastic Surgeon

When you start rounds with coffee from both your intern and chief, you know it's going to be a gooood day #neverenoughcaffeine – CD, General Surgery Resident

With great pleasure and sincere gratification, some surgeons Tweeted about their surgical "joie de vivre." One fellow Tweeted to celebrate National Women Physicians Day.

Happy #NationalWomenPhysiciansDay They don't just look like surgeons, they are surgeons. They save lives- they saved mine. @AH @BOS @cjh - AH, MIS Fellow

Why go into #surgery? Personally, surgery gives you an extraordinary chosen family & field where you can rapidly make a difference. Here @SESC @pt @JS #SESC @ACS @hs @BMCS - KC, resident

Daily symphony - The OR is like a ballroom, a DJ set; There are rules; There's a cadence; Sometimes slow; Sometimes quick; Always ready; But some of us know when all cylinders are firing or when the beat drops it's a literal masterpiece. - AN, Resident

[2] Night float is an overnight rotation that covers admitted inpatients and admits new medical patients overnight, after twilight teams go home.

Serenity. Serenity was the least frequently share positive emotion, with a frequency of less than 1% (n = 19). For the means of categorization, serenity was defined as the state of being calm, peaceful, and untroubled. Although not frequent, moments of serenity were captured and shared among the surgeons in the sample. For example, this surgeon takes a moment during busy morning rounds to find peace and calm.

AM rounds @BMd: "Do you see how gorgeous the view is from up here?!" – EW, Resident

4.4.4 Vigilance, anticipation, Interest

Vigilance, anticipation, and interest represented 14% of the positive emotion sample, with a majority of the sample categorized as interest (11%). Vigilance and anticipation were less frequently communicated, at 1% and nearly 2% respectively. These Tweets were mostly academic in nature, with surgeons sharing information about scholarly work, presentations, and advances in their discipline.

Vigilance. The category of vigilance was defined as the action or state of keeping careful watch for possible danger or difficulties. Vigilance Tweets showed an attentiveness to scholarly works that improved surgeon practice and patient care. For example, this surgeon uses Twitter as a platform to share her work advancing pain management while keeping mindful of the danger of opioid addiction.

Postoperative opioid stewardship and pain management is critical for patient outcomes and a responsibility for all surgical teams! Grateful for @MCCVS and @EBH for opportunities to contribute and improve patient care. – KH, Surgeon Scholar

Conversely, Tweets captured in this data set also called for careful examination of scientific discovery. Here, a surgeon alerts her readers to an article which strongly states the results of a research study and that the subsequent guidelines should be approached with caution.

Please read the official SAGES Response to NordICC Study Regarding Benefit of Screening Colonoscopies. Thank you. We would also ask you retweet this to get the widest possible exposure. - TW, Bariatric Surgeon

Anticipation. Anticipation was defined as the action of expectation or prediction. Due to the time collection points, Tweets about the National Resident Match Day (the system where new medical school graduates are matched into their residency program) dominated the anticipation sample. Tweets communicated the suspense, excitement, and hopefulness for a successful match. They offered advice on how to prepare for the process, what to expect during it, as well as preparing for the results. Additionally, some posts included personal reflections on the experience.

When I told Dr. B I was looking for #diversity in patients, in colleagues, in #mentors & in cases for #residency, he said to add @NYPQ to my list of general surgery programs. I didn't anticipate such a perfect #match. – IS, General Surgery Resident

There were a number of educational tweets categorized under anticipation. Some Tweets were centered around meeting expectations; learners should always be prepped and ready. Yet, others advised for educational engagement and reciprocity.

Tip to medical students rotating on surgery: Be prepared. Always offer to help the residents. Show interest and ask questions. Be nice to nurses and staff. Always know details on your pts. Fund of knowledge is nice but we don't expect you to be experts. Show us u are having fun. – DG, General Surgery Resident

As surgical apprenticeship evolves, trainees are empowered to clarify objectives w/ attendings; speak up/initiate discussion. Help us know what you want to learn/ask what we expect. #Empowerededucation goes both ways – BL, General Surgery Resident

Interest. Interest, defined as exciting curiosity or attention or the state of wanting to know or learn about something or someone, was coded widely across this sample. These Tweets

highlighted proposed and completed studies, surgical cases, surgical techniques, seminars, presentations, education, and surgery culture. In these Tweets, a surgeon calls for attentiveness to racial inequities in kidney disease, another inquisitively shares a session that posits the future of robotic surgery. Lastly, a neurosurgeon communicates his curiosity on VR procedures and how they may impact patient outcomes.

> *Super interesting talk from Dr. L on the implications of including race in eGFR calculations [index for kidney function]. What are we proxying for? Need more nuanced predicting equations! – AD, Colorectal Surgeon*
>
> *Robotic surgery and the future - a tool or an operator? Interesting debate at innovation session @NRCM @isrc @CF49 – HM, Colorectal Surgeon*
>
> *An interesting and practical use for #virtual #reality in #neurosurgery. The question will be whether it improves #outcomes and decreases #morbidity especially because of the increased #cost. #VR – EN, Neurosurgeon*

4.5 Negative Sentiment and Emotion

Tweets with negative emotion were far less frequent in the sample, representing only 11% of all categorized Tweets. Using Plutchik's Wheel of Emotion, Tweets categorized with negative sentiment were further categorized into 1) rage, anger, annoyance, 2) loathing, disgust, boredom, 3) grief, sadness, pensiveness, and 4) terror, fear, apprehension. Rage, loathing, grief, and terror are considered the primary negative emotions and represent the highest level of intensity in Plutchik's model. As primary emotions lessen in intensity, they give way to similar yet less intense emotions. Rage lessens to anger, then annoyance. Loathing attenuates to disgust,

then boredom. Emotions of grief assuage to sadness, then pensiveness. Terror moderates to fear, then apprehension. Frequencies of posted emotion were calculated and thematic analysis of Tweet content were conducted. Table 5 shows the frequency breakdown.

Table 5
Negative Emotion in Surgeon Tweets using Plutchik's Wheel of Emotion

Negative Emotions (n = 596)	*n*	*%*
Rage	39	6.54
Anger	90	15.43
Annoyance	59	9.89
Loathing	13	2.18
Disgust	29	4.86
Boredom	31	5.20
Grief	32	5.36
Sadness	150	25.16
Pensiveness	5	0.82
Terror	57	9.50
Fear	83	13.82
Apprehension	8	1.24

4.5.1 Rage, anger, annoyance

Rage, anger, and annoyance represented 32% of the negative emotion sample, with a majority of these categorized as anger (15%). Annoyance (10%) and rage (7%) were less frequently communicated. Anger and rage were used similarly in Twitter posts, with very little distinction communicated in intensity. In the analysis, I collapsed anger and rage into one category.

Anger/rage. Anger was defined as a strong feeling of annoyance, displeasure, or hostility; while, rage was defined as a feeling or expression of uncontrollable anger. These Tweets were mostly directed at public health concerns, with Tweets related to gun violence, abortion, and racial health disparities most frequently shared. This category also held Tweets concerning international tragedies, including the earthquake in Turkey, the protests in Iran over the death of Mahsa Amini, and the wars in Syria and the Ukraine. Surgeons used their Twitter platforms to communicate their outrage about these issues. For example, this surgeon is enraged by Tennessee anti-abortion laws which prohibit life-saving care for patients.

SHE KEPT ASKING IF SHE WAS GOING TO DIE" - A CHATTANOOGA doctor had to send a pregnant woman in danger of dying on a 6 HOUR AMBULANCE RIDE to get an abortion in North Carolina because Tennessee has a "No Exceptions" ban. #NotProLife #ForcedBirthState – MD, MIS Surgeon

Here, a surgeon expresses anger and exasperation at a conflict with the police department that interfered with care for a patient.

I was more confused and angry…there MUST be an answer as to what...[#policedepartment] can and cannot do in the #emergencydepartment" "Addressing the #educational gap in the role of #lawenforcementpersonnel in the #resuscitationbay" – CG, Critical Care Resident

Annoyance. Annoyance, defined as the feeling or state of irritation, showed up differently in this sample. For surgeons, these Tweets mainly centered around the experiences of social inequities. Experiences of gender and racial biases often were included in this category. For example, this surgeon expressed the indignation of negative gender expectations.

Latest from a recent conference
I: Hi, I just wanted to introduce myself
Prof: (annoyed) Are you a student? Who's your supervisor?
I: No, I am the editor who's handling your paper
Prof: (confused) Oh, but you are a young girl
I: (annoyed) Sure, see you around. Decision letter will follow
– EC, Trauma Surgeon

Here, a surgeon Tweets about his displeasure with losing followers when he posts anti-racist content and his aggravation in the lack of unity in fighting against racism.

As I'm tweeting about #BlackLivesMatter & I see my follower count decrease, I have no regrets - don't want to deal w people irritated by anti-racist messages. #WhiteFragility Though I'm annoyed they've stopped listening bc we should be in this fight together. – JF, Orthopedic Surgeon

4.5.2 Grief, sadness, pensiveness

Grief, sadness, and pensiveness represented 31% of the negative emotion sample. A majority of these Tweets were categorized as sadness (25%), with grief representing 5% and pensiveness just 1%. Grief and sadness were used similarly in Twitter posts, with very little

distinction communicated in intensity. Therefore, grief and sadness were collapsed into one category.

Grief/Sadness. Grief was defined as deep sorrow, especially caused by someone's death. Sadness was defined as a feeling of sorrow or of being unhappy. Tweets which communicated grief and sadness were mainly centered around the deaths of mentors, colleagues, and friends. Grief and sadness was also communicated in Tweets about tragic events which took place within the data collection timeframe, namely the earthquake in Turkey, the mass shooting at Michigan State University, victims of police violence, and the war in the Ukraine. For example, one surgeon shares the heartbreak of the devastation in Turkey.

> *This is a father that can't let go of his deceased daughter's hand. There are thousands of buildings leveled in Turkey. Please donate you can save a life. – OK, Gastrointestinal Surgeon*

Grief also was expressed in relation to patient care. These reflections from a resident on both experiencing grief and aiding their patients in processing grief show how the emotion can manifest.

> *There's a very specific, weird kind of grief that comes with going to chart check someone you've been following and epic asks if you'd like to open the chart of a deceased patient and that's how you find out they passed – AS, Resident*
>
> *When sitting with a patient in moments of grief & sadness and you don't feel like there is anything to say. There probably isn't. Just keep sitting there, holding that space, in silence. - AS, Resident*

It is important to note that racial grief showed up in Tweets from multiple surgeons in this sample. Racial grief is described by Anne Anlin Cheng as a reaction to losses associated with experiencing racism (Cheng, 2000). Here, a resident shares a post created for social media

explaining the experience of Black grief in detail; Black grief is the collective grief Black Americans have suffered as the result of America's long history of racialization and racial violence (Wilson & O'Connor, 2022).

This is an anonymous description of a day in the life of Black America. To the anonymous author, thank you for putting into words our fears and grief. - AN, Resident

"I need to drive my two-year-old to daycare tomorrow morning. To ensure we arrive alive, we won't take public transit (Oscar Grant). I removed all air fresheners from the vehicle and double-checked my registration status (Daunte Wright), and ensured my license plates were visible (Lt. Caron Nazario). I will be careful to follow all traffic rules (Philando Castille), signal every turn (Sandra Bland), keep the radio volume low (Jordan Davis), and won't stop at a fast food chain for a meal (Rayshard Brooks). I'm too afraid to pray (Rev. Clementa C. Pickney) so I just hope the car won't break down (Corey Jones).

When my wife picks him up at the end of the day, I'll remind her not to dance (Elijah McClain), stop to play in a park (Tamir Rice), patronize the local convenience store for snacks (Trayvon Martin), or walk around the neighborhood (Mike Brown). Once they are home, we won't stand in our backyard (Stephon Clark), eat ice cream on the couch (Botham Jean), or play any video games (Atatiana Jefferson).

After my wife and I tuck him into bed around 7:30pm, neither of us will leave the house to go to Walmart (John Crawford) or to the gym (Tshyrand Oates) or on a jog (Ahmaud Arbery). We won't even walk to see the birds (Christian Cooper). We'll just sit and try not to breathe (George Floyd) and not to sleep (Breonna Taylor)." Author unknown

4.5.3 Terror, fear, apprehension

Terror, fear, and apprehension represented 25% of the negative emotion sample. A majority of these Tweets were categorized as fear (14%), with terror representing 9% and apprehension just over 1%. Fear and terror were used similarly in Twitter posts, with little distinction communicated in intensity. As such, I have collapsed fear and terror into one category.

Fear/Terror. Fear was defined as an unpleasant emotion caused by the belief that someone or something is dangerous, likely to cause pain, or a threat. Terror was defined as extreme fear. As this is an international sample, Tweets expressing terror included political messages related to terrorism around the world in Central/South America, the Middle East, and Asia. In the US, terror was most often expressed concerning racism and police violence. Here, a surgeon states the psychological and physiological panic of being Black in America. Another surgeon expresses how her racial experiences contribute to her everyday life.

There is a certain terror in being black in America that escapes words. I haven't seen a cop car while driving in years and not become tachycardic. Sadly, recent events tell me that's not without reason. – SR, Colorectal Surgeon

Having to drive through 3 sundown towns to get to my main campus, not being able to stop for gas or the restroom because you fear for your life is just a slice of Sweet Alabama life - EA, General Surgery Resident

Public Domain Image

Sundown Towns are all-white communities, neighborhoods, or counties that exclude Blacks and other minorities through the use of discriminatory laws, harassment, and threats or use of violence. The name derives from the posted and verbal warnings issued to Blacks that although they might be allowed to work or travel in a community during the daytime, they must leave by sundown. Although the term most often refers to the forced exclusion of Blacks, the history of sundown towns also includes prohibitions against Jews, Native Americans, Chinese, Japanese, and other minority groups.

This category also held Tweets about educational and professional fearfulness and trepidation. These Tweets were often communicated by residents, whose surgical training is accompanied with high-levels of anxiety. Resident surgeons candidly shared their worries, experiences with bias, and attempts at copying strategies.

Second year of surgery residency is like intern year except they took the training wheels off your bike. And lit the bike on fire. And pushed you off a cliff. And also you're also on fire. – MZB, General Surgery Resident

This is unacceptable. Surgeons can be trained without fear tactics. - EA, General Surgery Resident

Is it harder to train a woman in a surgical residency bc you can't "beat them up" as much bc they "are more sensitive" ?? Asking for a friend … who was told that today.

HS1's wise words: "Fear is the same physiologic response as excitement. So whenever you're terrified, convince yourself you're actually REALLY excited." @BMD and I are

channeling our match day excitement on this very nerve-wracking 1st day of residency!! – BG, General Surgery Resident

Apprehension. Apprehension was defined as anxiety or fear that something bad or unpleasant will happen. It was not frequently present in this sample. The two main areas where it was found related to anxiety among medical students and working to negate patient unease and nervousness with surgeons.

My pink hair (been present for some months now) has made establishing rapport with my patients nearly effortless. Most of are so happy to see it/comment on it that I can sense any anxiety or apprehension dissipate. Seems small. Having pink hair in medicine. It matters. – EA, General Surgery Resident

Contact your mentors/referees ASAP to update them about your situation, get advice and new opportunities, and support for the next application cycle. I was apprehensive about how mine would react to my situation, but I was floored by their support. #Match2022 #CaRMS 5/10 – MX, Plastic Surgery Resident

For those who understand the fear & apprehension students have to fully express their concern on this medium: pls create a safe space for them to vent. Phone calls, a zoom meeting, or a text To police oneself in the midst of all of these emotions is a special type of purgatory – KC, Resident

4.5.4 Loathing, disgust, boredom

Loathing, disgust, and boredom represented 12% of the negative emotion sample. Disgust and boredom had similar frequencies hovering around 5% of the negative sample. Loathing was not frequently communicated representing only 2% of Tweets.

Disgust/Loathing. Loathing was defined as a feeling of intense dislike. Disgust was defined as a feeling of revulsion or strong disapproval aroused by something unpleasant or offensive. Loathing and disgust Tweets also were directed at public health concerns (gun violence, abortion, and racism). This category also held Tweets about surgery-specific educational and professional issues. Concerns regarding resident training, specifically the legal and ethical issues around the match system and trainee program demands, were prevalent. Surgeons used their Twitter to communicate their abhorrence for health system practices and innovations. For example, one surgeon shares their great dislike for telehealth in surgery.

In my surgical opinion, telemedicine obfuscates the art of medicine, and renders clinical acumen defunct. I loathe it because I love people and human interaction. It feels cold and impersonal. However, I'm grateful that to still care for my nonurgent patients safely right now. – SF, Colorectal Surgeon

Here, a surgeon unapologetically states her distaste of the system in which she must complete her training.

The entire medical education system is predatory. I said what I said. – AW, General Surgery Resident

Boredom. Boredom was defined as a tedious situation or thing. In most cases, the Tweets represented personal observations of tiresome entertainment or referenced bothersome individuals/things outside of medicine. However, a surgeon posted an insightful thought on the importance of stretching professionally to avoid the dread of boredom.

People are desperate to give 100% of their talents. #Multipliers empower smart teams, #diminishers grow boredom and resentment. Invite your teams to stretch and push themselves! – AG, Surgical Oncologist

4.6 Complex Emotion

In Plutchik's Wheel, combinations of primary emotions yield complex emotions. In many instances, emotions are complex; often, they are actually a combination of two or more primary emotions. According to Plutchik's model, anticipation and joy combine to become optimism. Joy and trust come together to become love. Surprise and fear become awe. Fear and trust lead to submission. Anticipation and anger merge into aggressiveness. Disgust and anger join to create contempt; while disgust and sadness equal remorse. Lastly, sadness and surprise turn into disapproval. Complex emotions comprised 34% of the Twitter sample. Using Plutchik's model, complex Tweets with positive sentiment were further categorized into 1) awe, love, optimism, and submission. Complex Tweets with negative sentiment were further categorized into 2) aggressiveness, contempt, remorse, and disapproval. Frequencies of posted emotion were calculated and thematic analysis of Tweet content were conducted. Table 6 shows the frequency breakdown.

Table 6

Complex Emotion in Surgeon Tweets using Plutchik's Wheel of Emotion

Complex Emotions (n = 1906)	*n*	*%*
Complex Positive		
Awe	295	15.47
Love	339	17.78
Optimism	494	25.92
Submission	108	5.67
Complex Negative		
Aggressiveness	151	7.93
Contempt	201	10.55
Remorse	99	5.19
Disapproval	219	11.49

4.6.1 Awe, Love, Optimism, Submission

Awe, love, optimism, and submission represented 65% of the Tweets in the complex sample. Optimism was the most frequently communicated complex emotion (26%), with awe (15%) and love (18%) Tweeted with similar frequencies. Submission (5%) was least frequently communications by surgeons on Twitter.

Awe. Awe was defined as a feeling of reverential respect mixed with fear or wonder, for the purposes of coding. Surgeons most frequently Tweeted posts in reverence regarding colleagues and individuals in their profession who they honored for their dedication, knowledge, skills, leadership, and camaraderie. For example, this resident Tweets in adulation of the new President of the ACS while also highlighting the diversity this physician brings to the organization.

> *Encouraging and awe-inspiring to see a physician with Caribbean roots becoming President of the American College of Surgeons. Congratulations Dr. F @HF #RepresentationMatters – JA, General Surgery Resident*

In this Tweet, a surgeon shares how idolization continues throughout one's medical career; there is always someone to look up to at every level during your career.

> *Always remember that someone is looking up to you. I recall how as a pre-med I'd be in awe of med students. As a med student I'd be in absolute awe of surgery residents. Now*

I'm in awe of my chiefs and fellows. It never ends. Where you are is so important. – JG, Plastic Surgeon

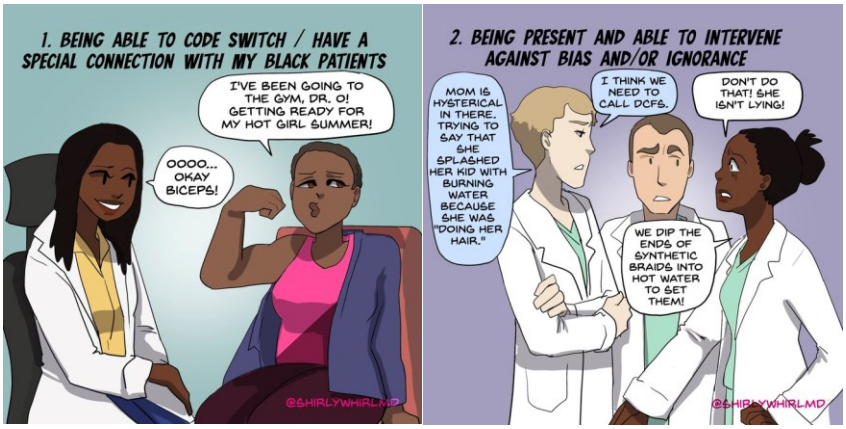
Love. Love, defined as an intense feeling of deep affection or a great interest and pleasure in something, was expressed toward both individuals within and elements of the profession. Deep fondness was shared for interns, residents, attendings, and visiting professors. Although these bonds are not familial, the level of regard moved beyond friendship into brotherliness and sisterliness. Here, a surgeon gives voice to this intimacy and close personal attachment.

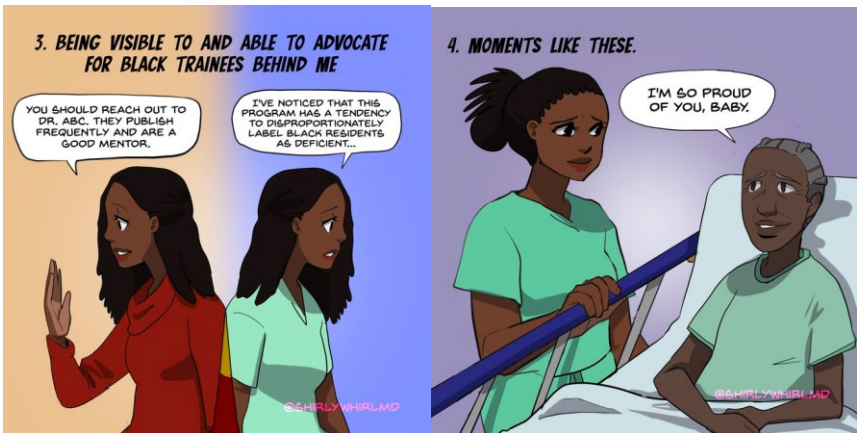
Brothers and Sisters Bound by the Bovie! We each were gifted our special organ. Love my resident family, grateful for each of them, and wouldn't have it any other way! #ResidentAppreciationDay – ME, Surgeon

The endearment for these relationships was often combined with the devotion that surgeons have for their work. In this Tweet, a surgeon shares their fondness for their colleagues while also highlighting the care and compassion they have created in the community through their philanthropic work. Another Tweet communicates (through illustrations) the passion a fellow has regarding being a Black physician and how her kindness and unique understanding of the needs of her community further medical humanity.

Love love love ❤collaborators coming together in trusted spaces to educate our community on #MBC #BreastCancerAwarenessMonth & uplift #HenriettaLacks – LW, Surgical Oncologist

Things I LOVE about being a #blackdoctor #bhm #blackhistorymonth #medtwitter - DT, MIS Fellow





Lastly, a resident shares her passion for education as evidenced by her hand-on teaching and warm interactions with her students.

> *I LOVE teaching medical students! This is how I teach someone to examine the bones of the wrist. Had to break it up… Now you know how to examine your friend when they fall over! #orthotwitter @O_C @og21 – AS, Plastic Surgery Resident*

Optimism. Optimism was defined as hopefulness and confidence about the future or the successful outcome of something. Surgeons often Tweeted full of hopefulness about innovations in treatments and the development of interventions to improve the lives of patients. Sanguine Tweets pointed to positive future states for cancer care, the elimination of health disparities, and campaigns to end public health concerns. For example, a surgeon Tweeted with hope about a new regional campaign encouraging open dialogue on safe gun storage for parents. Another surgeon shares an image illustrating how non-linear progress can be buoyant and sanguine at the same time.

We recently joined hospitals across the region in the "It Doesn't Kill to Ask" campaign, which encourages caregivers to speak up about safe gun storage & helps them feel empowered to ask other parents about access to guns in a home their child might visit. – MV, Trauma Surgeon

As a person I love this. As an oncologist I hate this. – MT, Urologic Oncologist

Tweets also communicated cheer and positivity toward professional and personal accomplishments. One surgeon shares their excitement on their first day as a fully trained pediatric surgeon. Another surgeon Tweets about helping to further progress of their specialty by supporting and uplifting trainees.

#firstdayvibes - Cannot put into words my excitement…Starting as a #pedsurg surgeon at @CM today! Years in the making, it's finally here. #pedsurgbestsurg #dreamsdocometrue - IB, Pediatric Surgeon

So excited to play a small part supporting our @DV residents/fellow along their #Leadership journey! The future of vascular surgery is bright. - MS, Vascular surgeon

Submission. Submission was the least frequently communicated emotion in the positive complex emotion category. The definition of submission for categorization was the action or fact of accepting or yielding to a superior force or to the will or authority of another person. These tweets comprised communications of yielding to challenging realities of training and clinical practice. For example, a resident shares the feelings of defeat that can accompany prospective residents that do not match into a residency program. Another resident communicated the overwhelming nature and capitulation in the integration of medical guidelines in work.

@NJ @surgw It's very hard. I hope both of you will have a categorical spot somewhere soon. The time between not matching the first time and matching the second time was filled with so much anxiety, it was exhausting. – CY, General Surgery Resident

Doctors say there are just not enough hours in a workday to discuss and act on all the medical guidelines they have been told to follow. – DG, General Surgery Resident

4.6.2 Aggressiveness, contempt, remorse, disapproval

Aggressiveness, contempt, remorse, and disapproval represented 35% of the Tweets in the complex sample. Disapproval (11%) and contempt (11%) were Tweeted with similar frequencies; aggressiveness (8%) and remorse (5%) were least frequently communicated.

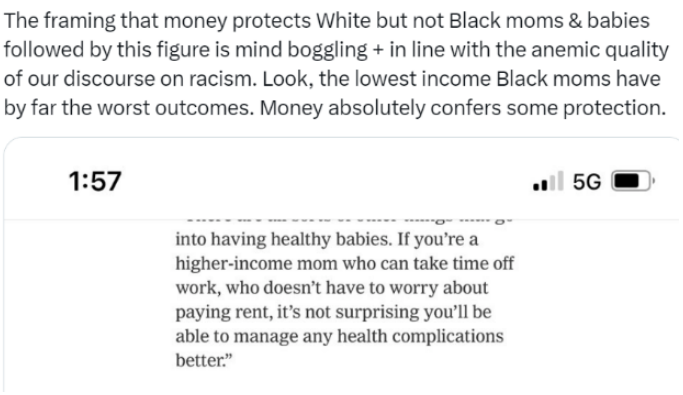
Contempt/Disapproval. Contempt and disapproval represent the largest portion of these Tweets. Contempt was defined as considering (someone or something) to be unworthy of respect or attention. Disapproval was defined as the possession or expression of an unfavorable opinion. Contempt Tweets often contained messages of great distaste and profound objection to serious public health concerns which impact surgical practice or surgical patient care. These public health concerns included medical racism, COVID prevention, abortion, lack of access and affordability in healthcare, international humanitarian crises, and gun control. Here, a surgeon shares a chain of four Tweets focused on the harm of gun violence and criticism of the lack of legal efforts to protect individuals against gun violence. Another surgeon shares findings which point out how medical racism continues to fuel health disparities for Black women and children and his disapproval of current inaction.

Over 4000 children in the US died from Firearms compared to single digits in other similar countries. This is a Public Health Problem & we need a statement from the @Surgeon_General to support our efforts

Victims & survivors have names & are not just numbers - @S @f_g @dh111 #PreventGunViolence @CC @NHealth @JH

Nearly 50,000 died from firearms in 2021, that's a 65% INCREASE over the last 10 years. We MUST do something for this Public Health Crisis #PreventGunViolence @theNAM @CC @mk

Doing something to prevent gun injuries should never be controversial. The number one killer of children #PreventGunViolence @CC @NHealth – RF, Pediatric Surgeon



- RH, Gynecologic Oncologist

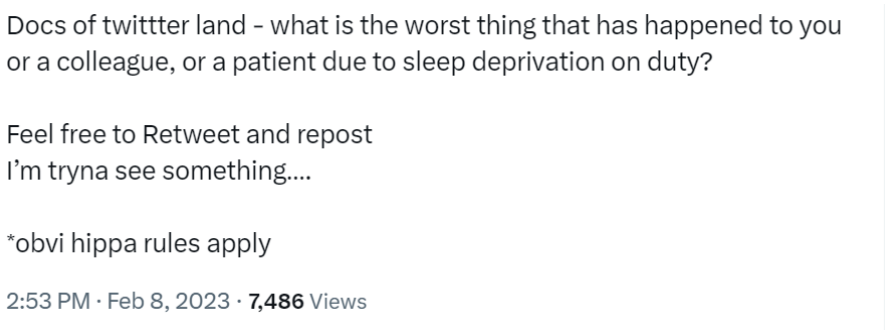
Tweets categorized as disapproval included many of the same public health topics as the contempt categorization. It also included more objections of surgery-specific professional issues. These Tweets criticized inequitable and harmful practices within surgery. Tweets calling attention to gender, race, and ethnic underrepresentation in surgery were shared. Condemnation of toxic training elements and dysfunctional operational practices within the profession and larger healthcare system were communicated. Additionally, here is where Tweets about poor mental and physical health for surgeons were centered. These two examples show Tweets highlighting the dissatisfaction that the profession has not advanced interventions to address surgeon mental health.

I wish more folks understood that people don't fake anxiety and depression. They fake being okay. – RA, Fellow

Easily the best written piece on this subject [suicide in residency]. That tells us there's a problem: there's more than one. Comparison drawn btwn firefighters/soldiers and physicians makes it plainly, and embarrassingly, clear how bad of a job we are doing #MedTwitter #MedEd – TC, Resident

In these Tweets, residents condemn training practices that allow residents to work without rest. One resident points out the alarming physical effects of being awake for 24 hours. Another resident's Tweet is a request for stories of how sleep deprivation has impacted resident work, along with the accompanying thread with eye-opening replies.

Being awake for 24 hours is the equivalent of having a blood alcohol content of 0.10%. This is higher than the legal limit for driving. If doctors aren't fit to use their driver's license after 24 hours awake, should they be asked to use their medical license? – MCN, General Surgery Resident



- *Maybe @dhl will tell about his research project from decades ago.*
- *As a fellow - fell asleep closing skin. After a few minutes the scrub nurse nudged me and I woke up and kept sewing….*
- *On a more serious note, I worry less abt patient harm on duty (I think this is less common) and more about falling asleep behind the wheel - I think it's a serious concern.*
- *I fell asleep on an open abdomen. I was standing up.*
- *I've fallen asleep at least three times post-call while driving. One of those times was a near-miss accident with an 18-wheeler while on I-65. I would rather stay at work post-call in my office to sleep than risk that again.*
- *R3 on a rotation with home call every single night except for the two weekends off/mo. Cumulative nights of poor sleep. I fell asleep while driving, and I ran a red light at 1am, fortunately roads were pretty much empty. Pulled over by the police who witnessed it.*
- *Colleague of mine fell asleep driving back to morning conference from a 24 hr call shift and got into an accident. Thank goodness everyone was more or less ok- but that part was just luck.*
- *Have fallen asleep at the microscope during a case once* 🙃.

Here two surgeons voice their displeasure with equitable standards and representation in surgery. One surgeon points out that equitable representation matters in providing proper patient care in the Hispanic community. Another surgeon objects to the double standards that women surgeons still face in their everyday practice.

> *We are grateful to be part of the 6% of Hispanic/Latinx physicians in the US but evidently we have strides left to be made. We need our frontline workers to represent our population in order to properly address the needs of our community!! – JL, Pediatric Surgeon*

"bossy", "mean", or a "b&tch" for having high standards. Wearing it because we need to constantly repeat ourselves and work extra to be heard. #imspeaking #werespeaking @1001cuts @WomenSurgeons – AM, Surgical Oncologist

Aggressiveness/Remorse. Aggressiveness and remorse were less frequently communicated by surgeons on Twitter. For categorization, aggressiveness was defined as determination and forcefulness. Remorse was defined as deep regret or guilt for a wrong committed. As such, aggressiveness Tweets mostly highlighted determination in scholarly and clinical practice. For example, these two surgeons Tweet about how a trial shifted an approach and the conditions needed for aggressive surgery.

@MM6 @SVS @S_K @WZ We actually found through considering equipoise for the trial we became a little more "endo aggressive". Considering endo for things we otherwise would have jumped to bypass for outside of the trial. #tweetchat #best – KG, Vascular Surgeon

@HPB Problem is when some of us act like this was normality, as if T4 status was just a technical matter. I am not against aggressive surgery in (arbitrarily) selected pts, but the true denominator is different. Only a few of those with arterial involvement will make it for surgery. – GM, Pancreatic Surgeon

When surgeons expressed regret on Twitter, their guilt often was related to the self-perception they are not deserving of professional milestones, accomplishments, or proper renumeration. One surgical resident expressed contrition on matching knowing others did not. A surgeon Tweeted about her guilt over billing and her practice of underbilling.

Just some thoughts on the eve of #MatchDay. I found myself with mixed emotions after learning I matched. I've been alternating between joy and guilt because of how many people I have seen devastated from not matching – TM, Surgical Resident

Met with some #primarycare friends yesterday & what I learned is: I MAJORLY UNDERBILL. When I expressed guilt over billing, they said "you are providing a service. Does your auto repair shop express guilt over payment? No. Bill appropriately." They right. – OM, Minimally Invasive Gyn Surgeon

Here is an insightful Tweet from a resident concerning the self-reproach associated with communications around burnout. He calls out the unease residents have with showing others they are struggling, even though all residents are grappling with similar struggles throughout their intern year.

@pchat I think the guilt of burnout gets perpetuated when people post how amazing intern year is or how great things are going when you know everyone is struggling but people choose to only post the highlights. – AKH, General Surgery Resident

4.7 Carrie Cunningham and the National Academy of Medicine Action Collaborative on Clinician Well-being and Resilience

4.7.1 Carrie Cunningham

Among this sample, the recording of Carrie Cunningham's 2023 Association of Academic Surgery Presidential Address was retweeted 36 times. These messages contained positive emotions mostly associated with admiration and optimism. Commentary accompanying these Tweets included gratitude for sharing her story, praise for her courage, honesty, and vulnerability, relational messages of understanding her experience, and calls urging for positive changes in surgical culture.

That sound you hear is the culture of American surgery breaking—in preparation to be rebuilt for the better. More healthy, more vulnerable, and more human. Thank you to @lubitz_carrie for the most important Presidential address I've had the opportunity to hear.

Leaders lead. They lead even when it is uncomfortable! @lubitz_carrie I have never been prouder of you. What you have done for Academic Surgery with this platform today can never be measured.#ASC2023 @AcademicSurgery

Dr Carrie Cunningham just delivered the most important Presidential address in the history of the AAS and SUS. #ASC2023 @lubitz_carrie #CallToAction #mentalhealth #SuicidePrevention #Addiction

Choose courage over comfort. I know in 10 yrs I will look back on @lubitz_carrie powerful presidential address as the moment that shifted surgical culture about this for the better. Let's take care of each other. Thank you for inspiring us @lubitz_carrie

You could hear a pin drop in the packed room for Dr. Cunningham's presidential address. Incredible strength & compassion to share her story. Her message is one that saves lives. Thank you for your bravery and vulnerability, @lubitz_carrie. #ASC2023

Finally had a chance to listen to the 2023 @AcademicSurgery Presidential Address by @lubitz_carrie. A must listen for all medical trainees, especially surgical trainees. So grateful to have found so many authentic, thoughtful, and supportive peers

This it what it looks like to have the courage to lead. @lubitz_carrie delivering groundbreaking @AcademicSurgery Pres Address, transforming culture of profession, tackling tough discussions. 1/7 surgeons struggle with SI, 25% seek help. Reach out; listen; connections are critical

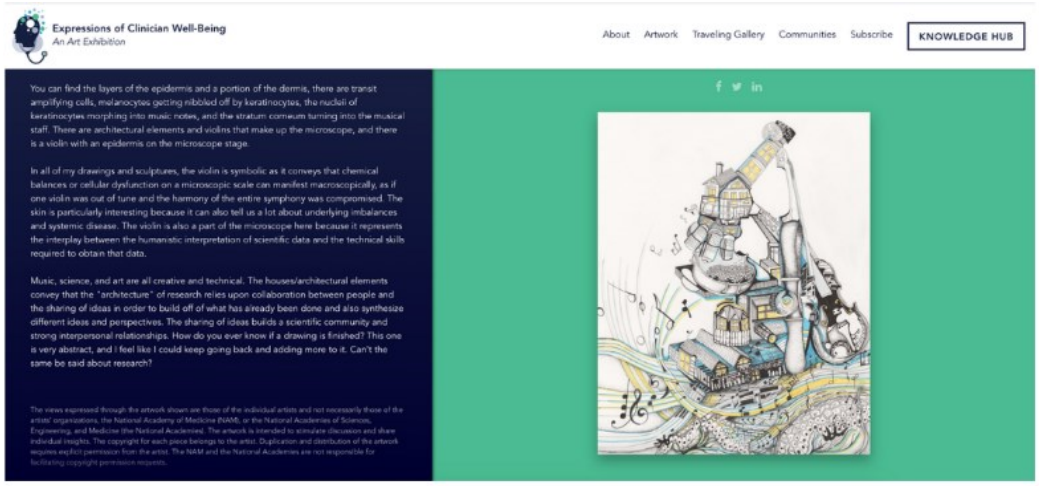
"Suffering is not a competition" - Thank you, @lubitz_carrie for your powerful @AcademicSurgery Presidential Address!

4.7.2 National Academy of Medicine Action Collaborative on Clinician Well-being and Resilience

The Action Collaborative on Clinician Well-being and Resilience was not well represented in the sample, with only 3 references to the campaign. Two individuals were residents who contributed to the campaign, one gave input on resident well-being and another provided artwork as part of the campaign. The third was a surgeon pointing out how electronic health record management adds to burnout.

If you told me that one day I would be talking to the Surgeon General about wellness in the pandemic, I wouldn't have believed you... Thanks @HU for always supporting me and making this unimaginable idea a reality! – TL, Resident

My artwork is part of a traveling exhibit through the National Academy of Medicine! From @theNAMedicine International Community Art Exhibition: "Pizzicato" #ClinicianWellBeing – SC Resident



"Too many clicks on the EHR" is definitely a contributing factor to Burnout. Let's hope the EHR companies and administrators listen to the Surgeon General! @UTHSAS #surgtwitter – DM, Surgeon

Chapter Five

5.0 Findings, Conclusion, and Recommendations

Interpretations of the findings in this study were aligned to the thesis statement and research aim. The examination of surgeon emotion in social media messages on Twitter provided insight into the ways in which surgeons communicate emotion related to surgical practice. Discussion of findings were guided by how emotion may contribute to emotional exhaustion and burnout. Additionally, as positive emotions dominated the sample, protective mechanisms to combat emotional exhaustion and burnout were also explored. These findings may help inform best practices for the development of emotional intelligence and emotion regulation to guard against the prevalence of emotional exhaustion and burnout among surgeons. In addition, the chapter draws conclusions and recommendations of the study, as well as providing areas for further research.

5.1 Discussion of the findings

In an analysis of surgeon emotion on Twitter, it was found that from 659 Twitter accounts 5,605 Tweets were posted containing emotion. Positive emotion, representing 55% of Tweets, was most frequently communicated in this sample. Feelings of admiration, amazement, ecstasy, and vigilance were most frequently Tweeted. Complex emotion followed, representing 34% of Tweets. Complex emotions which were positive in nature, such as optimism, love, and awe comprised a majority of this subset of the complex emotion Twitter sample. Tweets with overall negative emotion were far less frequent, representing only 11% of Tweets. Very few surgeons in this sample Tweeted in response to Carrie Cunningham's AAS address or the National Academy of Medicine's physician wellness campaign. Twitter communication focused on surgeon health and wellness was not robust in this sample. Despite high levels of emotional exhaustion and chronic burnout in the profession, surgeons overwhelmingly Tweet with positive emotion in association with their work. Positive emotion and positive psychology frameworks and interventional measures may provide better strategies to combat emotional exhaustion and environments that promote well-being in surgery.

5.1.1 Positive Emotion and the Sharing of Emotion on SoMe

The finding of large amounts of positive emotion expressed in surgeon's Tweets in the study defied authors expectations. To better understand the results, a dive into the literature on sharing of emotion on social media was necessary. Motivations for sharing on social media, relational aspects of social media communication, and social media platform and communication mechanisms were explored. Social media researchers have found that sharing of emotions helps create stronger interpersonal bonds (Bazarova et al., 2015). It is a reciprocal process that brings people closer together and strengthens relationships. Individuals get feedback, support, and validation from the people around them (Bazarova et al., 2015; Rimé, et al., 2020). Interactions with friends on social media are associated with lower levels of social isolation and loneliness across the life span (Chang et al., 2015). People can get high levels of satisfaction when they share emotions online. Studies show that people report higher levels of satisfaction when they share positive posts (Bazarova et al., 2015; Rimé, et al., 2020). However, there is variation in relational bonds and communication by age. Research shows increasing selectivity of social partners with age (Chang et al., 2015). Friend networks of older adults are smaller but contain a greater proportion of individuals who are considered to be actual friends, compared to younger adults (Chang et al., 2015).

Social media channel differences affect how people share their emotions online. People prefer to keep their public content positive, while saving negative feelings for more private communications with closest friends (Bazarova et al., 2015; Waterloo et al., 2018). Researchers have found that status updates show the least amount of negativity. People share more negative emotions when their posts are visible to fewer people. People use private messages most often to share negative emotion (Bazarova et al., 2015; Waterloo et al., 2018). Similar results were found for emotional intensity. On public channels, the emotions that people display become less and less strong (Bazarova et al., 2015; Waterloo et al., 2018). These findings are in line with the results of this study. There are high levels of positive emotion expression in publicly-viewable messages and high levels of emotion expression in secondary emotion categories.

When examining these findings, it is essential to keep in mind surgeon motivations for Twitter use and professional expression. For surgeons, Twitter functions as an accessible platform which enables rapid dissemination of content and facilitates open dialogs. However, it is infrequently used by surgeons for exclusively professional purposes. Surgeons leverage the

platform personally and professionally for socializing, networking, research, and practice promotion (Grossman et al., 2021). The majority of positive Tweets in this sample may be influenced by expectations of online collegial behavior, influencers with disproportionally strong presences, and the creation of social media echo chambers driven by the desire to obtain more followers and likes (Grossman et al., 2021). It is equally critical to recognize medical cultural factors which may be inhibiting open conversations online about emotional health. Surgeons are hampered in disclosing emotional struggle, as they face the obstacles of medical exceptionalism, the medicalization of mental health, and the individual responsibility to maintain wellness (Arnold-Foster et al., 2022).

5.2 Positive emotion, positive psychology, and factors which can advance work engagement of surgeons

5.2.1 Create a Culture of Appreciation

Maslach and Leiter identified the areas of worklife model (AW) that can be predictive of burnout or work engagement. The six areas are workload, control, reward, community, fairness, and values (Maslach & Leiter, 1997). Twitter is a social media platform which aids surgeons in building a culture of appreciation, facilitating positive worklife factors of rewards and community. The findings in this study show admiration represented 38% of positive emotion, the largest portion of categorized communication. Importantly, admiration showed up at all levels of practice (scholars, colleagues, mentors, trainees, and students). Using Twitter, surgeons frequently uplifted those in their profession through compliments, approbation, and praise for both individual and institutional accomplishments. These accomplishments provided sources for motivation and inspiration, showing tangible pathways for surgeons to ascend into relative areas of success. Acclaim of scholarly work were most shared. These Tweets not only served as digital applause, but also as a means of approved dissemination of scholarly and clinical advancements for both the people and the institutions generating the work. According to the AW model, receiving recognition for one's professional contributions positively engages people in their work and is protective against burnout (Maslach & Leiter, 2017).

Mentoring and mentorship were often highlighted (n = 486), with Tweets posted to show veneration. Notably, there was reciprocity in these relationships; both mentors and mentees Tweeted with equal regard and appreciation. These Tweets not only highlight student and trainee work, they also showed how valuable the mentorship model is in specialty and professional

development. Positive regard in these mentoring relationships aids in the solidification of professional relationships and community, a key component in the AW model (Maslach & Leiter, 2017). Successful mentoring activities enhance professional practice and collegiality in both mentees and mentors (Steven et al., 2008). Professional and personal mentoring relationships have been found to strengthen psychological and social components of health and well-being by fostering peer support (Watson et al., 2017). Greater levels of peer support protect against feelings of isolation and add to workplace satisfaction, an important factor of professional wellbeing (Harrison et al., 2014). Mentoring also influences personal wellbeing, increasing confidence and stress management (Watson et al., 2017). Confidence is critical to surgeon well-being. Imposter syndrome (IS) has a prevalence of up to 81.6% in newly practicing surgeons and surgeons in training (Zaed et al., 2022), with women and minoritized individuals experiencing the highest rates (Medline et al., 2022). IS refers to a pervasive sense of self-doubt in one's abilities combined with a persistent fear of being exposed as a fraud (despite external evidence of success). IS contributes to burnout, threatening mental health and general well-being (Zaed et al., 2022).

Overall, trust was communicated in 86 of Twitter posts. Conviction in scholarly work and clinical practice were communicated, as well as credence in surgeon ability to provide patient-centered care. Certainty in institutions of higher learning and employment also were shared. However, trust most often was communicated through the building of stalwart professional partnerships and celebrating inter-personal connections. Trust is a necessity in the surgical profession; trust affects team performance, with high levels of trust associated with higher levels of performance (Sifaki-Pistolla et al., 2020). The non-official hashtag, "Surgery is a team sport," along with official hashtags, #Teamwork and #StrongerTogether, were at the center of trust communications.

Improving teamwork can have profound effects on team interactions with colleagues and overall work environment. Health care worker well-being has been shown in multiple studies to correlate with the teamwork climate of their work setting (Rehder, et al., 2021). Enhancing trust and instilling civility in teamwork processes may increase well-being in key ways. Team members not only share responsibility for contributing to team outcomes, they also share responsibility for improving team culture. Problem solving with team members can empower the team and strengthen its culture (Maslach & Leiter, 2017).

Acceptance communications (n = 49) embracing individuals as they advanced through medical and surgical training were represented in this sample. Based on the AW model, these Tweets foster community and provide examples of positive social exchanges and ongoing encouragement for those climbing the surgical training ladder (Maslach & Leiter, 2017). Acceptance was also largely communicated as approval and integration into the profession for minoritized surgeons. Surgeons from underrepresented minority groups used Twitter to highlight the importance of visibility and inclusion in the profession. Tweets fell into two main categories. The first highlighted how colleagues can foster inclusivity and a sense of belonging. Amplifying the scholarly and clinical work of members who are underrepresented in surgery may have the potential to extend inclusivity in spaces both digital and physical.

Strong social connections are a large predictor of well-being (Rehder et al., 2021). Creating communities for underrepresented surgeons online enables connection and may provide critical mass for diversity that may not exist physically in institutions. Critical-mass theory posits that underrepresented minoritized individuals have difficulty articulating themselves without an adequate presence of members of the same group (Kanter, 2008; Garces & Jayakumar, 2014; Klawitter, 2013). Conversely, negative interactions with others are significant contributors to burnout (Rehder et al., 2021). A recent study of surgeons and anesthesiologists found a 91% prevalence of sexist microaggressions and an 84% prevalence of racial/ethnic microaggressions, with a significant association between microaggressions and physician burnout (Sudol et al., 2021).

5.2.2 Turn up the Volume of the Positive Channel

The positive emotion triads of amazement, surprise, and distraction represented 23% of the Tweets in the present study and ecstasy, joy, and serenity represented 20%. They were nearly equal in prevalence. Both amazement and joy were expressed when communicating about scholarly work and clinical accomplishments. These posts were enthusiastic and expressed high levels of heartfelt gratitude to colleagues for their hard work and to surgical communities for clinical advancements in their profession. Importantly, happiness was found in meaningful interactions with colleagues and students. Annual conferences, symposiums, and specialty-specific activities of professional organizations facilitated joyful camaraderie. Even small joys were recognized and celebrated.

Positive psychology techniques may be useful in harnessing these positive emotions to combat burnout through training surgeons to cultivate and leverage these positive experiences. Humans have a hard-wired negativity bias; negative stimuli captures and holds attention more than positive stimuli (Frederickson, 2009; Rehder et al., 2021). Positive psychology scholar, Barbara Fredrickson, explains this tendency in her work by saying ‘‘The negative screams at you, but the positive only whispers’’ (Frederickson, 2009, p.214). Positive psychology interventions, which leverage positive emotions and feelings to enhance well-being, have shown to increase happiness and decrease depression symptoms, with stabilized effects for up to six months. This can be achieved through existing easy to access internet-based exercises which cultivate positive emotions, including joy, awe, serenity, interest, and gratitude (Seligman et. al, 2005). It is important to note, the goal of positive psychological intervention is not to ignore negative experiences. It is to reestablish a balance between positive and negative experiences to promote well-being (Rehder et al., 2021).

Ecstasy and joy were communicated in the personal domain, as well. Personal diversions spotlight family activities, sports, travel, music, socializing, creative hobbies, and holidays (cultural, religious, and professional) which fueled joy. Regularly cultivating and engaging in these types of personal diversions furthers self-care (Rehder et al., 2021). For many surgeons, it may be impossible to avoid exhaustion entirely. Yet, it is essential for each surgeon to have effective methods for recovering from emotionally exhausting work. Institutions should facilitate recovery by providing realistic recovery periods from demanding schedules. These recovery periods are essential to provide surgeons the capacity for physical, emotional, and cognitive endurance (Maslach & Leiter, 2017). If recovery periods are not easily accessed, surgeons can take advantage of small moments for decompression. Moments of serenity were captured and shared among the surgeons as brief moments during busy days to find peace and calm. These periods can be used to cultivate a kinder inner voice by using a bite-size positive psychology serenity tool (Rehder et al., 2021).

Tweets conveying surprise revealed an interesting finding. Acts of patient gratitude elicited surprise and the awakening of dormant feelings of purpose for some surgeons and residents. Compassion satisfaction (CS) is professional gratification gained from providing care to patients. Although far from exhaustive, research suggests that high levels of CS may be a protective factor from compassion fatigue and burnout. Modifiable professional factors

associated with high CS are diversity in team composition (students, nurses, nurse practitioners, and physician assistants); receiving support from peers following a medical error/death; satisfaction with institutional response following a medical error/death; participation in work-related activities to process a complication/death; training in self-care and in breaking difficult medical news (Sarosi et al., 2021).

5.2.3 Maximize Openness

The emotion triad of vigilance, anticipation, and interest included Tweets that were mainly academic in nature, with surgeons sharing information about scholarly work, presentations, and advances in their discipline. Vigilance Tweets showed an attentiveness to scholarly works that improved surgeon practice and patient care. Conversely, Tweets also called for careful examination of scientific discovery before blind clinical adoption. Educational tweets categorized under anticipation encouraged learners to predict change, advised for proactive educational engagement, and encouraged active reciprocity in teaching and learning. Interest represented 346 Tweets in the sample. These Tweets highlighted proposed and completed studies, surgical cases, surgical techniques, seminars, presentations, education, and surgery culture.

The vigilance, anticipation, interest triad aligns well with the positive psychology classification of wisdom and knowledge. This classification includes the virtues of creativity, curiosity, open-mindedness, love of learning, and perspective (Seligman et al., 2005). As a professional group, surgeons score significantly higher on openness than non-surgeons (Whitaker, 2017). The personality factor of openness measures intellectual curiosity, creativity, and a preference for novelty over routine (Whitaker, 2017). Positive psychology exercises can be used to activate curiosity and increase creativity and novelty. The positive psychology intervention “using signature strengths in a new way,” has been shown to increase happiness and decreases depressive symptoms for time periods of up to 6-months (Seligman et al., 2005). This exercise asks individuals to inventory their character strengths; then, they are directed to use one of these top strengths in a different way every day for one week. Periodic inoculations to activate wisdom and knowledge may increase levels of happiness and protect against chronic burnout.

5.3 Negative emotion and factors influencing surgeon emotional health and well-being

5.3.1 Find a Place for Courage and Justice

Tweets with negative emotion represented just 11% of the Tweets communicated. The emotions of rage, anger, annoyance, loathing, and disgust represented 230 Tweets or 39% of the negative emotions. These Tweets were mostly directed at public health concerns. Tweets calling out the scourge of gun violence, bringing to light the harm of anti-abortion laws, and focusing on the urgent need to eliminate racial health disparities were most frequently shared. Grief and sadness were also communicated. Tweets about tragic events which took place within the data collection timeframe were part of the sample, namely the earthquake in Turkey, the mass shooting at Michigan State University, victims of police violence (Tyre Nichols and Sinzae Reed), the protests in Iran over the death of Mahsa Amini, and the wars in Syria and the Ukraine. Surgeons used their Twitter platforms to communicate their outrage about these issues, actively participating in targeted social media campaigns developed to create visibility and change.

Terror, fear, and apprehension represented 24% of the negative emotion sample. It is important to note that in the US, terror was most often expressed concerning the dangers of racism, sexism, and the horror of identity-based violence. The existential fear of surgeons with minoritized identities, as well as their everyday personal and professional experiences with racism, sexism, and homophobia contribute to overall lower rates of well-being (Hu et al., 2019; Lund et al., 2022).

Surgeon participation in these efforts supports the positive psychology virtues of courage and justice (Seligman, et al., 2005). Surgeons are not afraid to publicly align themselves with social campaigns; calling out legal and cultural practices which cause harm and impact their clinical practices. This level of engagement shows character strengths of bravery, persistence, fairness, and leadership (Seligman, et al., 2005). These character strengths could be leveraged to activate surgeons to call out and change surgery cultural practices which inhibit well-being. Professional organizations could develop similar social movements and social media campaigns focused on surgeon health and well-being. It will be essential for these organizations to understand the mechanisms that have made other public health campaigns successful to help light a fire for change within the surgical community.

5.3.2 Targeting Fairness and Civility to Alleviate Negative Emotion and Burnout

Annoyance was mainly communicated with experiences of social inequity. Experiences of gender and racial biases often were included in this category. Women surgeons Tweeted about negative experiences with patients and colleagues based on gender. Black and Latinx surgeons lamented about microaggressions they experienced from individuals through the healthcare systems. Allies communicated frustrations about backlash from the public when posting about anti-racism in medicine. Interestingly, many of these Tweets did not rise to the intensity of anger. It may be that with the high prevalence of these incidents, minoritized surgeons have built an emotional tolerance to them. Regardless, the significant association between microaggressions and physician burnout shows they do contribute to high levels of emotional exhaustion (Sudol et al., 2021).

Fairness is a key predictor of work engagement (Maslach & Leiter, 2017). Experiences of injustice exhaust and discourage individuals, creating emotional distance (Maslach & Leiter, 2017). Unjust treatment dilutes workplace community, affecting the work of entire teams (Maslach & Leiter, 2017). Physicians often feel alienated from workplaces that they perceive as treating others unfairly (Rehder et al., 2021). CREW (Civility, Respect, and Engagement at Work) and CARAWay (Civility and Respect at Work) are evidence-based interventions to improve civility and social climates of workgroups (Leiter et al. 2016; Osatuke et al. 2009). These approaches can be used to address incivility in the workplace by increasing the quality of social encounters and expanding an individual's repertoire of positive social behaviors (Maslach & Leiter, 2017).

5.3.3 Keep Burnout on [Top of] the Educational Agenda

Emotions of loathing and disgust were contained in Tweets about surgery-specific educational and professional issues. Surgeons used their Twitter to communicate their abhorrence for health system practices (insurance billing, EMR, invisible work) and particular innovations (call centers, telehealth). Resident training, specifically the legal and ethical issues around the match system and trainee program demands, were prevalent. There is clear distain for many elements of the graduate medical education system. Medical education is a system fraught with formal and informal structures that inhibit well-being (Montgomery, 2014). A detailed examination of these structures is beyond the scope of this paper. However, these findings

provide more evidence that burnout in graduate medical education continues to be an urgent issue.

The recommendations from experts are that burnout needs to be addressed continually, at every level in the educational process. “For physicians, burnout is the inevitable consequence of the way that medical education is organized and the subsequent maladaptive behaviors that are reinforced in healthcare organizations via the hidden curriculum. Thus, burnout is an important indicator of how the organization itself is functioning.” (Montgomery, 2014, p.47). Medical education organization and subsequent maladaptive behaviors have changed little in the last nine years since Dr. Montgomery published this finding. The overall prevalence of burnout among surgical trainees remains between 15-77%, depending upon surgical specialty (Jesuyajolu et al., 2022). Work-related issues, which include malpractice accusations, occupational stressors, low annual income, workplace violence, and frustrating colleagues continue to be associated with burnout (Jesuyajolu et al., 2022). Academic affiliations, being challenged at work, participation in research, and having a good relationship with co-residents were found to be protective against burnout (Jesuyajolu et al., 2022). Transparency with residents around pain points and including burnout on the educational agenda enable educators and trainees to develop and implement strategies to deal with it as an ongoing part of the educational curriculum.

5.4 Complex emotion, positive psychology, and factors influencing surgeon well-being

5.4.1 Finding Humanity and Forging Transcendence

Complex emotion representing 34% of surgeon Tweets. The complex emotions of awe, love, and optimism represented nearly 65% of the complex sample. Awe Tweets expressed reverence for colleagues and other individuals in the surgical profession who were honored for their dedication, knowledge, skills, and leadership. Love was expressed toward both individuals within and elements of the surgical profession. Love for the advancement of clinical work and skillsets, along for the innovative practices in patient care was communicated. Deep fondness was shared for individuals at all levels, including interns, residents, attendings, and surgical scholars. The endearment for these relationships was often combined with the devotion that surgeons have for their work.

The awe and love surgeons extend to their community furthers medical humanity. This aligns with the positive psychology virtue of humanity, with its accompanying character strengths of kindness, love, and social intelligence (Seligman et al., 2005). An evidence-based

positive psychology intervention that can help foster humanity is “Three good things in life” (Seligman et al., 2005). For this exercise, individuals are asked to write down three things that went well each, along with a causal explanation for each good thing, every night for one week. This exercise has been shown to increase happiness and decrease depressive symptoms for up to six months.

Surgeon optimism on Twitter included hopeful Tweets about innovations in treatments and the development of interventions to improve patient lives. These tweets posited positive future states for cancer treatment and patient care, the elimination of health disparities, and the end public health concerns, such as the prevalence of gun violence. Tweets also communicated cheer and positivity toward professional and personal accomplishments. Current and future career milestones were recognized, while strategically supporting and uplifting colleagues.

Surgical optimism is positioned well with the positive psychology virtue of transcendence and the character strengths of appreciation of beauty and excellence, gratitude, hope, humor, and religiousness (Seligman et al., 2005). Two positive psychology exercises may aid in facilitating surgical optimism, “Gratitude visit” and “You at your best” (Seligman et al., 2005). The “Gratitude visit” exercise gives individuals one-week to write and then deliver a letter of gratitude to a person who has been especially kind to them, but they have never properly thanked. This exercise has been shown to cause large positive changes in happiness for up to one-month (Seligman et al., 2005). The “You at your best” exercise first asks individuals to write about a time they were at their best and then reflect the personal strengths they exhibited. Secondly, individuals are asked to reread and reflect on this story once every day for one-week (Seligman et al., 2005). This exercise created positive effects on happiness, but these effects were transient. The positive effects were only sustained if the individual continued to engage in the exercise after the initial one-week time-period (Seligman et al., 2005).

5.4.2 Raise Surgeon Voices and Improve Wellness Agency

Aggressiveness, contempt, remorse, and disapproval (35%) comprise of the negative side of complex emotion categorization. Contempt and disapproval categorization included more objections related to professional issues, including condemnation of toxic culture and dysfunctional operational practices within the profession and larger healthcare system. Here is where Tweets about poor mental and physical health for surgeons were centered. There was dissatisfaction that the profession had yet truly advanced practices that address surgeon mental

and physical health. Monopolistic surgical training structures, which abuse resident health and wellness, were derided. Negative emotion was used to target organizational and system level structures that not only fail to address, but also actively inhibit, surgeon well-being.

Control is one of the six areas of worklife that can predict burnout (Maslach & Leiter, 2017). Being able to participate in decisions which affect one's work is protective against burnout. Having a voice in work area decisions, as well as some measure of autonomy concerning the work environment lowers frustrations that lead to burnout (Maslach & Leiter, 2017). Healthcare leaders must actively engage with and empower surgeons. Walkrounds are an example of an intervention that has shown success in this area; it is a method for leadership to promote quality improvement efforts utilizing worker participation. Walkrounds have been associated with improved safety culture and reduced burnout (Maslach & Leiter, 2017). Another strategy leaders can use is increasing worker agency through high-level involvement in decision-making and problem-solving. It has been found that participation in decision-making is positively correlated with increases in well-being domains, such as teamwork, professional growth opportunities, and career advancement, and negatively correlated to emotional exhaustion and burnout (Maslach & Leiter, 2017). Researchers point out that increasing agency on its own is not enough. It is equally important for leaders to offer well-being resources and role model their use. Workers struggling with burnout should not be asked to dedicate personal time and effort to the development or augmentation of well-being projects (Maslach & Leiter, 2017).

5.5 Conclusion

In conclusion, based on the findings of surgeon expression of emotion on Twitter, positive emotion is associated with nearly all areas of surgical practice. Surgeon camaraderie and feelings of deep admiration pervade surgeon communications on Twitter. The use of positive emotion and positive psychology frameworks can advance workplace well-being through targeted engagement. Facilitating social connection and cultures of appreciation can help advance key worklife factors of community and reward. Surgery is a team sport. Enhancing community can advance teamwork dynamics and interpersonal trust, strengthening overall culture and well-being. Amplifying the work of colleagues raises confidence and decreases feelings of impostorism. This is especially important for the health and well-being of surgeons with minoritized identities. Turn up the volume of the positive by find opportunities to integrate positive emotion expression IRL (in real life) by bettering positive health behaviors. Surgeons

need to retrain themselves to leverage positive experiences, cultivate compassion satisfaction, and grow positive health behaviors. Daily bite-sized positive psychology exercises can be completed in under 10-minutes are easily accessible. Finding ways to maximize openness can spur intellectual curiosity and creativity while increasing happiness.

Overall negative emotion represented a small portion of Tweets. However, the Twitter posts behind these negative emotions spotlight urgent factors that influence surgeon emotional health and well-being. National and international public health concerns affect the daily work of surgeons, effecting both personal and professional well-being. Surgeons use their Twitter platforms to communicate their outrage about these issues, actively participating in targeted social media campaigns developed to create visibility and change. From the prospective of positive psychology, these emotional communications highlight the virtues of courage and justice. Finding a place for courage and justice, as a way to advocate for health and well-being, could bring needed visibility and the establishment of acceptable channels for critical dialogue around these topics. Microaggressions and daily negative experiences of surgeons with minoritized identities were part of this sample. By targeting the development of fairness (as a character strength) and civility (the foundation of healthy community life), there is potential to alleviate negative emotion and burnout. Negative emotion around resident training and trainee wellness was captured. High levels of burnout in surgical training requires organizations and programs to keep burnout on the educational agenda.

Complex emotions which were positive in nature were more often communicated than complex negative emotions. Tweets with complex positive emotion represented awe and love surgeons extend to their community and further medical humanity. Optimism envisioned positive future states of public health and surgical practice. Focusing on the interpersonal quality of humanity and its character strengths of kindness, love, and social intelligence can facilitate positive change at both the individual and team levels. Transcendence and forging connections outside of one's self can provide meaning. Increasing gratitude and positive connection has been shown to increase happiness with lasting effects. Negative complex emotions were used to communicate disapproval of organization and system-level inaction. Raising surgeon voices in organization leadership and advancing surgeon agency to chance health and wellness structures at the system-level is necessary for meaningful positive change surgeon well-being.

5.6 Contribution to knowledge

The study significantly contributed to knowledge by qualifying surgeon emotional expression on Twitter with a thematic analysis of surgical activities and experiences that impact well-being. In addition, the study established the current state of surgeon emotional expression and communication on the social media platform, Twitter. It linked surgeon emotional expression and surgical activities to positive psychology principles and research to inform better practices for the advancement of surgeon well-being. Furthermore, it highlighted the urgent need for more targeted research on the health and well-being needs of surgeons with minoritized identities; digital and physical spaces contain ever-present dangers that diminish their wellness.

5.7 Areas for further study

With regards to the discoveries of this study, I suggest that further research should be carried out on the status of surgeon emotion, non-medical models to advance surgeon well-being, and the well-being of surgeons with minoritized identities. Although surgeons largely communicate positive emotions associated with their work, the patterns of negative communication highlight areas for researchers to focus on in the examination of surgeon emotional exhaustion and emotional labor. In depth interview/survey research with a large group of surgeons could explore the organizational, professional, and cultural elements contributing to exhaustion and burnout. It also would be beneficial to understand how surgeons can become more transparent about their well-being and become more comfortable communicating about their own exhaustion and burnout. Additionally, a focus on team emotion and emotion contagion would be helpful in team well-being and examining surgery as a team sport. Secondly, it is necessary to further investigate non-medical models to advance surgeon well-being, as well as emphasize the importance of optimal health factors and preventative work. Positive psychology interventions could be explored at all professional levels - student, resident, and attending. The development of randomized control trails could establish which positive psychology interventions best treat aspects of burnout in various surgeon populations. Lastly, there is a critical need to focus research on targeted strategies to improve the health and well-being of surgeons with minoritized identities. Research centered within social justice frameworks must be conducted along side all investigations to ensure well-being advancements are equitable for all surgeons.

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