Mental toughness in surgeons: Is there room for improvement?

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Background: Mental toughness is crucial to high-level performance in stressful situations. However, there is no formal evaluation or training in mental toughness in surgery. Our objective was to examine differences in mental toughness between staff and resident surgeons, and whether there is an interest in improving this attribute.

Methods: We distributed a survey containing the Mental Toughness Index (domains of self-belief, attention regulation, emotion regulation, success mindset, context knowledge, buoyancy, optimism and adversity capacity) among general surgery residents and staff at 3 Canadian academic institutions. Responses were recorded on a 7-point Likert scale. Participants were also asked about techniques they used to help them perform under pressure and interest in further developing mental toughness.

Results: Eighty-three of 193 surgeons participated: 56/105 (52.8%) residents and 27/87 (31.0%) staff. The average age was 29 (standard deviation 5) years and 42 (standard deviation 8) years, respectively. Residents scored significantly lower than staff in all mental toughness domains. Men scored significantly higher than women in attention regulation and emotion regulation. Age, staff experience and resident postgraduate year were not significantly associated with mental toughness scores. Twenty residents (36%) and 17 staff (63%) reported using specific techniques to deal with stressful situations; 49 (88%) and 15 (56%), respectively, were interested in further developing mental toughness.

Conclusion: Staff surgeons scored significantly higher than residents in all mental toughness domains measured. Both groups expressed a desire to improve mental toughness. There are many techniques to improve mental toughness, and further research is needed to assess their effectiveness in surgical training.

Contexte : La force mentale est indispensable à un rendement de haut niveau en situation de stress. Par contre, il n'existe pas de méthode d'évaluation formelle ni de formation pour promouvoir la force mentale en chirurgie. Notre objectif était de comparer la force mentale des chirurgiens en poste à celle des résidents, et de vérifier si l'amélioration de cette compétence suscite l'intérêt.

Méthodes : Nous avons distribué un questionnaire sur les divers domaines qui constituent l'indice de force mentale (confiance en soi, régulation de l'attention et des émotions, attitude gagnante, connaissances du contexte, dynamisme, optimisme et résistance à l'adversité) aux résidents et aux chirurgiens en poste en chirurgie générale dans 3 établissements universitaires canadiens. Les réponses étaient consignées sur une échelle de Likert en 7 points. Les participants ont aussi été interrogés sur les techniques qu'ils utilisent pour mieux composer avec la pression et sur leur intérêt pour l'acquisition d'une plus grande force mentale.

Résultats : Quatre-vingt-trois chirurgiens sur 193 ont participé : 56/105 (52,8 %) résidents et 27/87 (31,0 %) chirurgiens en poste. L'âge moyen était de 29 ans (écart-type 5) et de 42 ans (écart-type 8), respectivement. Les résidents ont obtenu un score significativement moindre que les chirurgiens en poste pour tous les domaines constitutifs de la force mentale. Les hommes ont obtenu des scores significativement plus élevés que les femmes pour la régulation de l'attention et des émotions. L'âge, l'expérience des chirurgiens en poste et l'année de formation postdoctorale des résidents n'ont pas été significativement associés aux scores de force mentale. Vingt résidents (36 %) et 17 chirurgiens en poste (63 %) ont indiqué utiliser des techniques spécifiques pour affronter les situations stressantes; 49 (88 %) et 15 (56 %), respectivement, se sont montrés intéressés à acquérir davantage de force mentale.

Conclusion : Les chirurgiens en poste ont obtenu des scores significativement plus élevés que les résidents pour tous les domaines de la force mentale mesurés. Les 2 groupes ont exprimé un intérêt pour l'amélioration de leur force mentale. Il existe plusieurs techniques à cet effet et il faudra approfondir la recherche pour en évaluer l'efficacité chez les chirurgiens en formation.

Success in surgery requires the ability to maintain composure, recover from setbacks, perform under pressure and find victory in no-win scenarios. Mental toughness is commonly referred to as the defining attribute that enables one to thrive in such demanding situations.[1] It is a trait that enables people to manage confrontations with stress and rebound following setbacks.[2] Mental toughness is closely related to resiliency; however, unlike resiliency, it is generally associated with a positive outcome from adversity. In other words, whereas resilient people "survive" difficult situations, mentally tough people "prosper" in such situations.[3] In sports literature, mental toughness is well established and has been shown to relate to improved pain tolerance,[4] problem-/task-oriented coping,[5] use of psychologic coping strategies[6,7] and an enhanced ability to prevent unwanted information from interfering with current goals.[8]

Mental toughness is seen as an asset in many fields, including athletics,[1,2,4–7,9] military and police forces,[10] and business.[11] Many of these areas have dedicated training to help develop mental toughness. Despite a plethora of techniques and resources available, there is very little training within surgical residency to specifically help trainees perform under pressure, other than the development of clinical and technical skills. Although there are numerous studies examining surgical resident burnout and attrition,[12–16] there is little surgical literature on the specific topic of mental toughness, with only 1 study comparing mental toughness in surgeons and Olympians.[1]

The purpose of the present study was to attempt to quantify and compare mental toughness in general surgery residents and staff surgeons by means of a validated mental toughness questionnaire in order to assess whether surgical residents or attending surgeons may benefit from focused mental toughness training. Secondary objectives included examining what, if any, mental toughness techniques are used by surgeons and residents to help them perform under pressure. Our hypothesis was that there would be deficiencies in mental toughness and likely differences in mental toughness scores between staff and residents. Identifying areas of strength and weakness may provide an opportunity to help incorporate dedicated mental toughness training into surgical residency curricula in order to assist surgeons at all levels to optimize their performance under pressure.

Methods

The study was conducted from January to March 2017. After obtaining institutional ethics approval, we issued a survey to all general surgery residents and staff general surgeons at 3 Canadian institutions: the University of British Columbia, the University of Alberta and the University of Calgary. Two institutions participated in the survey online, and 1 through a paper version. The survey included the Mental Toughness Index (MTI) (Table 1), a previously validated tool to measure mental toughness.[9] It consists of 8 questions that cover 7 facets of mental toughness (self-belief, attention regulation, emotion regulation, success mindset, context knowledge, buoyancy and optimism), as well as capacity to deal with adversity. Responses are measured on a 7-point Likert scale from 1 (completely disagree) to 7 (completely agree). The survey also included questions directed at determining which, if any, techniques surgeons use to stay mentally tough and whether they would be interested in mental toughness training.

Statistical analysis

We converted MTI scores to percent positive (for example, a score of 7 was graded as 100%, and a score of 1 as 0%)[1] and compared the results between staff and resident general surgeons using the nonparametric *t* test. We also performed subset analysis to compare other variables, including postgraduate year (PGY), age and gender. Where appropriate, we used a *Z*-test for comparison of proportions. Significance was set as $p < 0.05$ for all statistical analysis.

Results

There were 83 responses from 193 surveyed surgeons, which included 56/106 (52.8%) residents and 27/87 (31.0%) staff. There was no difference in the response rate between the 2 groups ($p = 0.002$). The participants' demographic characteristics are shown in Table 2. Staff were significantly older than residents (mean age 42.9 [standard

Table 1. Eight-item unidimensional model of mental toughness[9]

Domain	Description
Self-belief	I believe in my ability to achieve my goals
Attention regulation	I am able to regulate my focus when performing tasks
Emotion regulation	I am able to use my emotions to perform the way I want to
Success mindset	I strive for continued success
Context knowledge	I effectively execute my knowledge of what is required to achieve my goals
Buoyancy	I am able to execute appropriate skills or knowledge when challenged
Optimism	I can find a positive in most situations
Capacity to deal with adversity	I consistently overcome adversity

Table 2. Demographic characteristics and Mental Toughness Index scores for general surgery residents and staff

Characteristic	Mean ± SD* Residents *n* = 56	Staff *n* = 27	*p* value†
Age, yr	29.1 ± 4.7	42.9 ± 8.3	< 0.001
Male:female ratio‡	29:26	23:4	0.004
Postgraduate year, median	3	—	—
Years in practice	—	10.3 ± 8.8	—
Mental Toughness Index domain, % positive			
Self-belief	83.4 ± 12.7	91.5 ± 8.2	< 0.001
Attention regulation	78.1 ± 12.2	89.5 ± 10.2	< 0.001
Emotion regulation	71.9 ± 14.1	87.8 ± 9.5	< 0.001
Success mindset	87.2 ± 12.1	94.2 ± 8.2	< 0.001
Context knowledge	75.0 ± 11.0	88.9 ± 10.0	< 0.001
Buoyancy	75.5 ± 12.7	90.5 ± 9.7	< 0.001
Optimism	77.0 ± 16.7	86.8 ± 9.7	< 0.01
Adversity capacity	76.8 ± 17.8	84.7 ± 11.8	< 0.05

SD = standard deviation.
*Except where noted otherwise.
†Heteroscedastic Student *t* test, $\alpha = 0.05$.
‡One participant declined to state gender and was excluded from analysis.

deviation (SD) 8.3] yr v. 29.1 [SD 4.7] yr, $p < 0.001$), and a significantly higher proportion were men (23/27 [85%] v. 29/55 [53%], $p = 0.004$) (1 resident declined to state gender). The median PGY for residents was 3 (range PGY1–PGY6). On average, staff had been practising for 10.3 (SD 8.8) years. Residents had a significantly lower percentage positive in all facets of mental toughness compared to staff (Table 2).

Among all participants, men scored significantly higher than women in attention regulation (mean score 84.3% [SD 11.4%] v. 77.1% [SD 12.9%], $p = 0.02$) and emotion regulation (mean score 81.4% [SD 14.3%] v. 68.6% [SD 12.9%], $p < 0.001$) (Table 3). When we analyzed only the resident responses, there was still a significant difference between men and women in mean emotion regulation scores (75.7% [SD 14.3%] v. 67.1% [SD 11.4%], $p = 0.01$). There was no significant difference in any MTI domain between junior (PGY1, PGY2) and senior (PGY3 or later) residents (Appendix 1, available at canjsurg.ca/010818-a1). There was no statistically significant relation between MTI scores and age among all participants. Similarly, there was no statistically significant relation between staff years in practice and MTI scores.

Twenty residents (36%) and 17 staff (63%) reported using specific techniques to help deal with stressful situations (Table 4). The most common techniques used were slowing down and reframing the situation, deep breathing, mindfulness and visualization (Table 5). The majority of both residents (49 [88%]) and staff (15 [56%]) reported interest in developing additional techniques for mental toughness (Table 4).

Discussion

There are multiple reasons mental toughness is an essential skill in surgery: the need to persist during a long case, the need to stay composed during an intraoperative emergency or trauma situation, the ability to quickly recover from a difficult case or serious complication, the necessity to maintain optimal performance during long call shifts and, perhaps most important, in order to effectively function as a leader in and out of the operating room. Furthermore, owing to the close relation between mental toughness and resiliency,[17] mental toughness may play a role in preventing burnout and attrition during surgical training.[13,15] Mental toughness is seen as a key component of military, police, first-responder and athletic training;[9] however; there is very little formal instruction in surgery to help trainees develop this trait. Herein, we have shown areas of strength and weakness in mental toughness, as measured by the MTI, in general surgery residents and that staff general surgeons had significantly higher scores in all measured mental toughness domains. Furthermore, a large proportion of both residents and staff felt they would benefit from dedicated mental toughness training.

Overall, staff surgeons had higher self-reported levels of mental toughness than residents, in all domains measured. This may be due in part to experience, which has been

Table 3. Comparison of Mental Toughness Index scores by gender

Domain	All respondents; mean score ± SD Men *n* = 52	Women *n* = 30	*p* value*	Residents; mean score ± SD Men *n* = 29	Women *n* = 26	*p* value*
Self-belief	87.1 ± 11.4	84.3 ± 12.9	0.4	82.9 ± 11.4	82.9 ± 12.9	0.9
Attention regulation	84.3 ± 11.4	77.1 ± 12.9	0.02	80.0 ± 11.4	75.7 ± 11.4	0.3
Emotion regulation	81.4 ± 14.3	68.6 ± 12.9	< 0.001	75.7 ± 14.3	67.1 ± 11.4	0.01
Success mindset	90.0 ± 11.4	87.1 ± 11.4	0.3	87.1 ± 12.9	85.7 ± 11.4	0.7
Context knowledge	81.4 ± 12.9	77.1 ± 11.4	0.2	74.3 ± 12.9	75.7 ± 10.0	0.8
Buoyancy	82.9 ± 12.9	77.1 ± 11.4	0.1	75.7 ± 11.4	75.7 ± 14.3	0.98
Optimism	82.9 ± 14.3	77.1 ± 17.1	0.1	78.6 ± 17.1	75.7 ± 17.1	0.6
Adversity capacity	78.6 ± 17.1	80.0 ± 14.3	0.9	74.3 ± 21.4	78.6 ± 14.3	0.4

SD = standard deviation.
*Heteroscedastic Student *t* test, $\alpha = 0.05$.

Table 4. Reported use of mental toughness techniques and interest in developing techniques

Variable	No. (%) of respondents: Residents $n = 56$	Staff $n = 27$	p value*
Use specific techniques to perform under pressure			
Yes	20 (36)	17 (63)	0.09
No	19 (34)	4 (15)	0.8
Uncertain	17 (30)	6 (22)	0.02
Interested in developing techniques to perform under pressure			
Yes	49 (88)	15 (56)	0.009
No	1 (2)	10 (37)	0.02
Uncertain	6 (11)	2 (7)	0.2

*Z-test of proportions, $\alpha = 0.05$.

Table 5. Most common techniques reported by staff and resident surgeons to deal with stressful situations

Technique	No. (%) of respondents $n = 33$
Slowing down, reframing situation	11 (33)
Breathing exercises	9 (27)
Mindfulness	9 (27)
Visualization	8 (24)
Planning or preparation	4 (12)
Positive thinking/self-talk	4 (12)
Ignorance/avoidance	2 (6)

shown to be predictor of mental toughness in athletics[5,18] and business,[11] through targeted development, coaching, mentoring or simply life experiences.[3] Within surgery, increased mental toughness may also be influenced by specialty and fellowship training. Although the staff invited to participate in the survey spanned a variety of surgical specialties, we did not capture specific specialty information in the survey. This would be another potential area of study and may help explain variations in mental toughness. Age is also known to affect mental toughness,[11] although we were unable to show any statistically significant trends in mental toughness and age, likely owing to the narrow age range among residents and the wide age range and small numbers of staff. Although not statistically significant, a higher proportion of staff than residents reported using specific techniques to help deal with stressful situations, which may have contributed to the difference in MTI scores as well. The use of psychological strategies has been shown to increase mental toughness in athletes.[19] Thus, dedicated training aimed at developing such strategies may help improve mental toughness among surgical trainees.

Another finding of note was the difference between male and female surgeons, specifically in attention regulation and emotion regulation. Although this finding may have been confounded by the low number of female staff in the study, the difference in emotion regulation remained when we examined only residents. This finding is important for several reasons. Gucciardi and colleagues[9] defined emotion regulation as an "awareness of and ability to use emotionally relevant processes to facilitate optimal performance." A simpler definition would be the ability to control emotional response to a psychologically relevant situation.[20] A 2014 study on resident attrition showed that women are more likely than men to leave a surgical training program,[14] although this has recently been refuted.[12] One of the factors explaining why women leave a surgical program was difficult interaction with a faculty member.[14] This may reflect emotion control, especially in a specialty that may have elements of gender bias.[21,22] Nicholls and colleagues[5] reported higher mental toughness scores, including for emotion control, among male athletes than female athletes. They speculated that these differences may arise from expression of underlying attributes related to mental toughness or from different socialization processes between males and females. If this is the case, this finding further supports formalized mental toughness training, including training in interpersonal dynamics between staff and residents, as different people will likely respond to different techniques. Somewhat surprisingly, we did not observe any differences in MTI scores between junior and senior residents. This may reflect the different clinical responsibilities at each level and the graduated learning that occurs during a surgical training program. It may also indicate that mental toughness is not a skill that is effectively developed during surgical training.

Historically, mental toughness in surgical residency has been developed indirectly, through working long hours, dealing with complications and frequently facing stressful situations (i.e., the proverbial "sink or swim" mentality). However, there are problems with implicit training of psychological skills. In police training, it has been shown that this indirect approach can make mental toughness skills harder to learn, delay the acquisition of technical skills because the trainee lacks mental toughness, undermine operational effectiveness owing to underdeveloped mental toughness and, most important, result in a subgroup of people who never develop mental toughness.[23] Furthermore, having high levels of mental toughness is not always beneficial. Levy and colleagues[6] showed that injured athletes with high mental toughness are less likely to be affected by pain than those with low mental toughness. Although the former were more likely to attend rehabilitation sessions, they were less adherent to rehabilitation programs, which placed them at higher risk for reinjury and prolonged recovery. This again shows the importance of proper development of "healthy" mental toughness, which can be achieved through dedicated mental toughness training.

To our knowledge, the only other study examining mental toughness in surgeons was conducted by Colbert and colleagues,[1] who examined this attribute in surgeons

and Olympic rowers and found higher mental toughness scores in rowers than in consultant and registrar oral and maxillofacial surgeons. Although there are differences between competitive athletics and surgery, those authors highlighted the importance of mental toughness in surgery, as well as specific areas of mental toughness training in athletics that could be incorporated into surgical training.

Several of the techniques reported by residents and staff in our study, including positive self-talk, preparation, visualization and breathing exercises, have been reported in athletics[24] and paramilitary training.[10,23] Although the majority of staff surgeons reported using specific techniques, only a minority of residents reported using any such strategy. As well, 2 participants reported techniques that could be considered potentially negative, such as ignorance or avoidance when dealing with stressful situations. These mechanisms could potentially contribute to the development of unhealthy mental toughness.[6,23] Although these findings suggest that surgeons possess some explicit mental toughness techniques, they also indicate both a need and a desire for improvement of mental toughness among surgeons.

A number of established mental toughness techniques have been described extensively in the paramilitary and athletic literature.[1,5,7,10,25] A comprehensive review of these techniques is beyond the scope of this article; however, they can be divided into individual strategies and trainee-mentor strategies. Individual strategies include visualization, self-talk, affirmations, concentration skills and breathing,[10] which can be employed directly by the surgeon. These techniques are simple to teach and use but still require time and training to master. They are also individualized, and what works for one surgeon may not work for another. Training in these techniques could be readily implemented through didactic sessions scheduled into existing structured academic curricula within surgical residency, as well as additional seminar training from mental toughness experts and senior surgeons/trainees. Trainee-mentor strategies are more complex and are supported by the paramilitary literature.[10,25] These techniques are twofold, as they build mental toughness on top of technical competence. They include reality training, stress inoculation and stress acclimatization.[25] One example of reality training is the concept of "no-lose training." In this setting, trainees are taken through progressively more difficult scenarios; however, the final scenario of the session is always arranged so that the trainee will succeed. Ending the session with a final victory can help create a conditioned behaviour to achieve success despite adversity. Furthermore, this strategy avoids the development of inappropriate responses to failure, such as a conditioned fear of failure, which can be pervasive and difficult to correct, undermining mental toughness and performance.[25] An example of this in surgical training would be a staff surgeon's handing back a difficult case to the trainee after having taken over. Even if just for rudimentary components (such as closure), this gesture has the potential to instill in the trainee a sense of completion and the attitude that, no matter what unexpected intraoperative events transpire, a case can and must be taken to completion. This technique can also be readily used in simulation-based training. Trainee-mentor strategies could be introduced to surgeons and senior residents for use while supervising junior trainees, which may further help develop mental toughness in surgical training. Validation of these techniques in the surgical setting would be paramount.

Limitations

There are several limitations to this study. The overall response rate was relatively low, especially among staff surgeons. Although the MTI is more concise and less labour intensive to complete than other tools to measure mental toughness, we were still unable to achieve a high response rate. This likely led to gender bias within the staff group, as the male-to-female ratio was much higher in this population than in the resident group. As well, there may have been an inherent selection bias, whereby people who do not believe they possess mental toughness may not have responded, thus skewing the results toward generally positive responses, especially among staff. Furthermore, the low response rate may reflect a general apathy toward the study of psychologic constructs such as mental toughness within surgery, despite its demonstrated importance in other fields. Last, the overall high scores, particularly for staff, suggest that the calibration of the MTI may need to be adjusted in a surgeon population. This may be further confounded by the inherent difficulty in using descriptive statistics to measure qualitative data, as responses were based on a Likert scale. However, the MTI still allowed for identification of differences in mental toughness between groups. Regardless of the tool used, both residents and staff surgeons reported interest in further developing mental toughness through dedicated training. Given the availability of techniques to develop mental toughness, incorporation of these skills from other fields into surgical training could prove invaluable to help both surgical trainees and staff surgeons develop psychological coping strategies to deal with the high-stress situations that arise in surgical practice.

Conclusion

Resident general surgeons scored significantly lower than staff in all mental toughness domains measured. Both groups reported use of techniques to help perform under pressure, but there was a desire to improve mental toughness on the part of both surgical residents and staff. Luckily, there exist numerous available techniques to improve

and develop mental toughness that are used in other fields. Further research is needed to assess the effectiveness of these techniques in surgical training and whether surgical trainees would benefit from dedicated mental toughness training.

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