Original Investigation

Moral Injury Among Interventional Radiologists☆

Andrew J. Woerner, MD, Colvin H. Greenberg, BS, Jeffrey Forris Beecham Chick, MD, MPH, Eric J. Monroe, MD, Matthew Abad-Santos, MD, HeeJin Kim, MS, Eunjee Lee, PhD, Mina S. Makary, MD, Anthony N. Hage, MD, Brian Covello, MD, David S. Shin, MD

Rationale and Objectives: To evaluate moral injury (MI) among interventional radiologists using validated assessment tools.

Materials and Methods: An anonymous 29-question online survey was distributed to interventional radiologists using the Society of Interventional Radiology Connect Open Forum website, Twitter, Facebook, LinkedIn, and electronic mail. The survey consisted of demographic and practice environment questions, a global quality of life (QoL) scale (scored 1–100), the MI Symptom Scale-Healthcare Professional (MISS-HP) (scored 1–100), and two open-ended questions. A MISS-HP score ≥ 36 was indicative of experiencing MI. $P < .05$ was considered statistically significant for all two-sided tests.

Results: Beginning on March 30, 2023, 365 surveys were completed over 5 days. Of the respondents, 299 (81.9%) were male, 65 (17.8%) were female, and one preferred not to disclose gender. The respondents included practicing interventional radiologists (299; 81.9%) and interventional radiologists-in-training (66; 18.1%). Practice settings included academic (146; 40.0%), community (121; 33.2%), hybrid (84; 23.0%), or other (14; 3.8%) centers. Mean QoL was 71.1 ± 17.0 (range: 0–100) suggestive of "good" QoL. Mean QoL in the MI subgroup was significantly different from that for the rest of the group (67.6 ± 17.0 vs. 76.6 ± 16.0; $P < 0.05$). 223 (61.1%) respondents scored ≥ 36 on the MISS-HP, and thus were categorized as having profession-related MI. Mean MISS-HP was 39.9 ± 12.6 (range: 10–83). Mean MISS-HP in the MI subgroup was significantly different from that for the rest of the group (47.4 ± 9.6 vs. 28.0 ± 5.7; $P < 0.05$). There was a negative correlation between MI and QoL ($r = -0.4$; $P < 0.001$). Most common themes for greatest contribution to MI were ineffective leadership, barriers to patient care, corporatization of medicine, non-physician administration, performing futile procedures, turf battles, and reduced resources. Most common themes for ways to reduce MI were more autonomy, less bureaucracy, more administrative support, physician-directed leadership, adequate staffing, changes to the medical system, physician unionization, transparency with insurance companies, more time off, and leaving medicine/retirement.

Conclusion: MI is prevalent among interventional radiologists, and it negatively correlates with QoL. Future work should investigate causative factors and mitigating solutions.

Key Words: Moral injury; Quality of life; Burnout; Wellness; Post-traumatic stress disorder; Anxiety; Mental health interventional radiology.

INTRODUCTION

Burnout is prevalent among healthcare professionals, including interventional radiologists (1). With healthcare provider distress on the rise, it is imperative to identify risk factors associated with burnout (2). The concept of moral injury (MI) was established to describe military post-traumatic stress disorder that failed to

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From the Section of Vascular and Interventional Radiology, Department of Radiology, University of Washington, 1959 Northeast Pacific Street, Seattle, Washington, 98195, USA (A.J.W., C.H.G., J.F.B.C., M.A.S., D.S.S.); Section of Vascular and Interventional Radiology, Department of Radiology, University of Wisconsin, Madison, Wisconsin, USA (E.J.M.); Department of Information and Statistics, Chungnam National University, Yuseong-gu, Daejeon, South Korea (H.K., E.L.); Department of Radiology, Division of Vascular and Interventional Radiology, The Ohio State University Wexner Medical Center, Columbus, Ohio, USA (M.S.M.); Department of Radiology, Division of Vascular and Interventional Radiology, Thomas Jefferson Hospital, Philadelphia, Pennsylvania, USA (A.N.H.); Division of Interventional Radiology, Department of Radiology, Aventura Hospital & Medical Center, Aventura, Florida, USA (B. C.).
Received June 3, 2023; revised September 1, 2023; accepted September 5, 2023. **Address correspondence to**: D.S.S. e-mail: davidshin.ir@gmail.com

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respond to conventional treatment (3). MI is defined as "a deep sense of transgression including feelings of shame, grief, meaninglessness, and remorse from having violated core moral beliefs" (4). In healthcare, MI refers to the lasting impact of repeated ethical dilemmas and moral conflicts when providers are unable to act in the best interest of their patients due to organizational or systemic constraints (4).

Burnout describes the negative psychophysiological consequences within an individual and may imply subject fault (e.g. lack of resilience) (1,2,5,6). On the other hand, MI gives attention to the systemic context and cause that have led to an individual's sense of hopelessness and failure (4,7,8). Moral *distress* refers to a more acute and transient sense of being in a situation where one is constrained from doing what is right (9). When repeated moral distresses cause lasting psychological, behavioral, biological, and social impacts on an individual, then the process is described as MI (10).

Previous studies have demonstrated an association between MI and medical errors (11). Reducing MI may improve physician wellness, as well as the safety and quality of patient care. The *MI Symptom Scale-Healthcare Professionals* (MISS-HP) is a validated survey used to evaluate MI among healthcare providers (12). Recent studies demonstrated a 41.3% prevalence of MI in healthcare professionals with associations between MI and depression, anxiety, and burnout, which in turn, may negatively impact quality of life (QoL) (12,13). This study evaluates MI among interventional radiologists.

MATERIALS AND METHODS

Study Design and Data Collection

This *Health Insurance Portability and Accountability Act*-compliant study was exempt from institutional review board approval based on institutional assessment of criteria listed in 45 CFR 46.101(b). The study was assessed using STrengthening the Reporting of OBservational studies in Epidemiology guidelines. An anonymous survey was distributed to interventional radiologists using the Society of Interventional Radiology (SIR) Connect Open Forum website (http://connect.sirweb.org/home), Twitter (Twitter Inc; San Francisco, CA), Facebook (Facebook; Menlo Park, CA), LinkedIn (LinkedIn Corp; Sunnyvale, CA), and via electronic mail (Appendix B). Links to the survey were published via two separate Twitter accounts that were subsequently shared on the SIR Connect Open Forum website, Facebook, and LinkedIn. Where tallied (Twitter), interactions with the posts totaled 21,575 views.

Survey Design and Distribution

A 29-question survey (*Appendix A*) was created using Google Forms (Google; Mountain View, CA) and consisted of questions regarding demographics and practice characteristics, a single-item global QoL scale, the ten-item MISS-HP version, and two open-ended questions to assess perceived contributors and solutions to MI (12,14). The questions related to the demographics and practice characteristics, as well as the two open-ended questions at the end were constructed by the authors. The QoL and MISS-HP questions were adopted from the referenced sources. Responses to all the questions were required to submit the survey, except for the two open-ended questions (questions 28 and 29). Participants' QoL was assessed utilizing the global QoL scale (14,15). This scale defines 100 as a "perfect," 60 as "moderately good," 40 as "somewhat bad," and 0 as "no" QoL. MI assessment was performed using the MISS-HP (12,15). MI was evaluated by summing subscores of 10 questions. A MISS-HP score ≥ 36 was indicative of experiencing MI (12,15). The designed survey was intended to take less than 5 min to complete.

Study Subjects

There were a total of 365 respondents. All 365 respondents completed the QoL and MISS-HP scales. Of the respondents, 195 (53.4%) accessed the survey via Twitter, 122 (33.4%) via professional society-based communication, 27 (7.4%) via electronic mail, 12 (3.3%) via LinkedIn, and nine (2.5%) by other means. The survey was displayed publicly on these platforms. The number of viewers on the social media would not accurately represent the number of eligible respondents. Therefore, a true response rate of the study is unknown.

Statistical Analyses

Statistical analyses were performed by two dedicated statisticians (E.L, H.K.) using R 4.2.2 (The R Foundation; Vienna, Austria). The differences in mean scores for MI and QoL in multiple groups were tested using a Student t-test and one-way ANOVA. A Student t-test was conducted to compare two groups, and one-way ANOVA was performed for more than two groups. When the ANOVA was significant, Tukey's Honest Significant Difference Test was performed for multiple comparisons between means in two groups. $P < .05$ was considered statistically significant for all two-sided tests.

RESULTS

Demographics

Demographic data are shown in Table 1 *and* Figure 1. Of the respondents, 299 (81.9%) were male, 65 (17.8%) were female, and one preferred not to disclose gender. The proportions of the female and underrepresented minority groups among the study participants were similar to those reported in the literature for the IR workforce in the United States (16), suggesting a demographically representative sampling. 292 (80%) were from the United States, 16 (4.4%) from Spain, 15 (4.1%) from the United Kingdom, 10 (2.7%) from Canada, and 32 (8.8%) from other countries. Of the 365

TABLE 1. Demographic Data of Survey Respondents Including Gender and Race or Ethnicity

Demographics	*N* (%)
Gender	
Male	299 (81.9)
Female	65 (17.8)
Prefer not to say	1 (0.3)
Race/Ethnicity	
Asian	77 (21.1)
Black or African American	15 (4.1)
Hispanic/Latinx	23 (6.3)
White	206 (56.4)
Mixed race	14 (3.8)
Other	17 (4.7)
Prefer not to say	13 (3.6)

participants, 209 (57.3%) were familiar with burnout only, 115 (42.5%) were familiar with both burnout and MI, and 1 (0.3%) was familiar with MI alone. Practice settings were academic (146; 40.0%), community (121; 33.2%), hybrid (84; 23.0%), or other (14; 3.8%) centers. Respondents included practicing interventional radiologists (299; 81.9%) and interventional radiologists-in-training (66; 18.1%). The trainees were included in the survey population in an attempt to assess for the presence and impact of MI early in the career in interventional radiology. 66 (18.1%) were interventional radiologists-in-training, 23 (6.3%) were < 1 year post-graduate, 149 (40.8%) were 1–10 years post-graduate, 73 (20%) were 11–20 years post-graduate, and 54 (14.8%) were > 21 years post-graduate. 61 (16.7%) were single, 268 (73.4%) were married, 31 (8.5%) had a long-term partner, and 5 (1.4%) preferred not to answer.

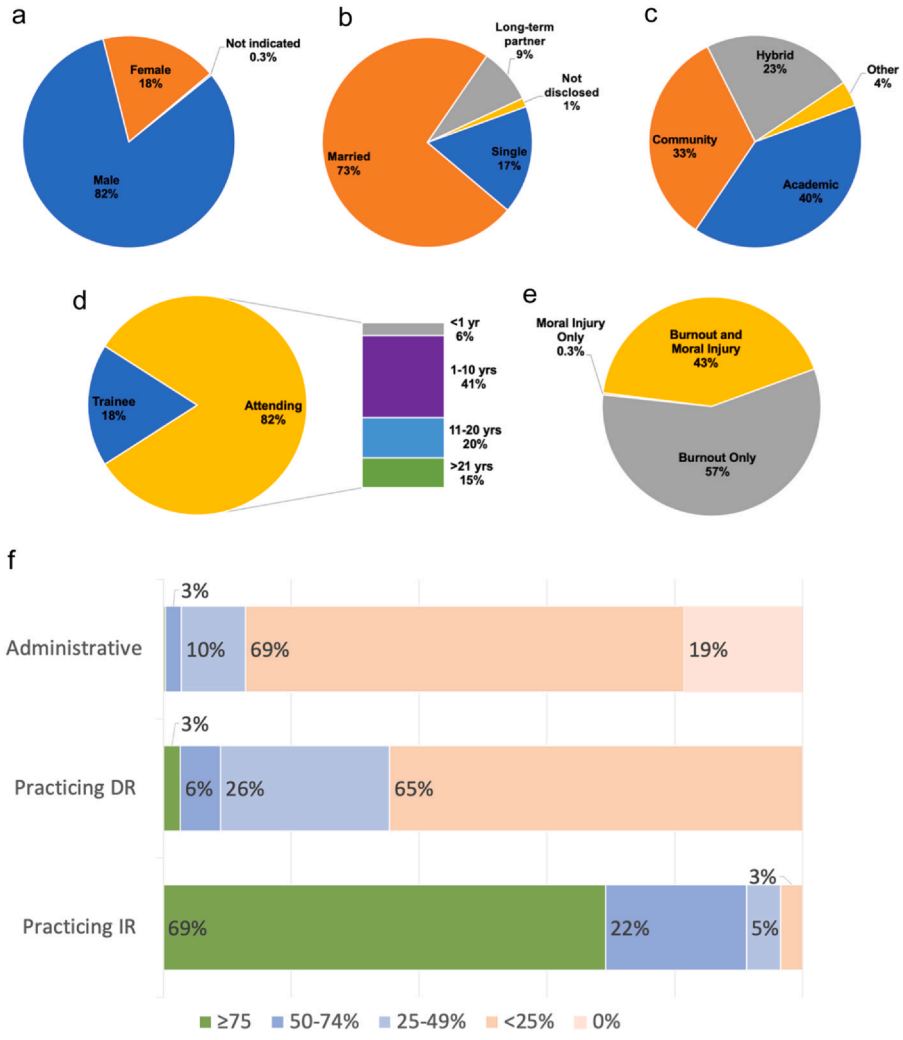

Figure 1. Demographic data of survey respondents including (**a**) gender, (**b**) relationship status, (**c**) practice setting, (**d**) years of experience, (**e**) familiarity with burnout and MI, and (**f**) employment responsibilities. MI, moral injury.

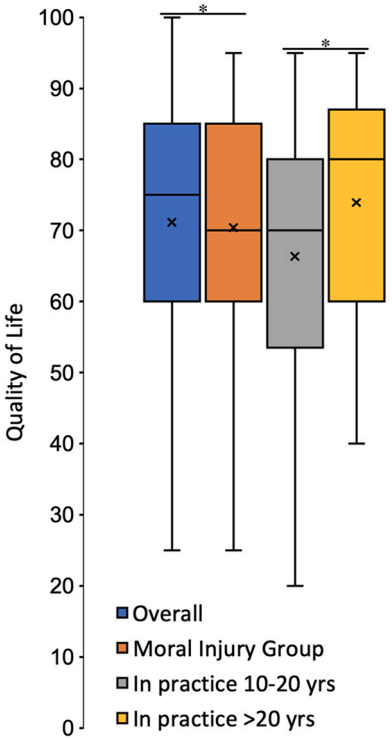

Figure 2. *QoL for the entire cohort, MI, 10–20 years of practice, and > 20 years of practice subgroups.* Mean QoL for the entire cohort was 71.1 ± 17.0, suggestive of "good" QoL. Mean QoL for the MI subgroup was significantly different from that for the rest of the group (67.6 ± 17.0 vs. 76.6 ± 16.0; P < 0.05). There was a significant difference in mean QoL between the practice subgroups with >20 years vs. 10–20 years of experience (73.9 ± 19.8 vs. 66.4 ± 16.9; P < 0.05). MI, moral injury; Qol, quality of life.

Practice Environments

318 (87.1%) participants answered questions regarding practice environments. Of these, 220 (69.2%), 70 (22%), 17 (5.3%), and 11 (3.5%) practiced ≥75%, 50–74%, 25–49%, and < 25% interventional radiology, respectively. 6 (1.9%), 14 (4.4%), 59 (18.6%), and 144 (45.3%) practiced ≥75%, 50–74%, 25–49%, and < 25% diagnostic radiology, respectively. 1 (0.3%), 8 (2.5%), 32 (10%), 218 (68.6%) and 59 (18.6%) spent ≥75%, 50–74%, 25–49%, < 25%, and 0% on administrative duties, respectively.

Quality of Life

QoL data are shown in Figure 2. Mean QoL for the entire cohort was 71.1 ± 17.0 (range: 0–100), suggestive of "good" QoL. Mean QoL for the MI subgroup was significantly different from that for the rest of the group (67.6 ± 17.0 vs. 76.6 ± 16.0; P < 0.05). There was a significant difference in mean QoL between the practice subgroups with >20 years vs. 10–20 years of experience (73.9 ± 19.8 vs. 66.4 ± 16.9; P < 0.05). There were no significant differences in QoL across any other demographic or practice environment variables.

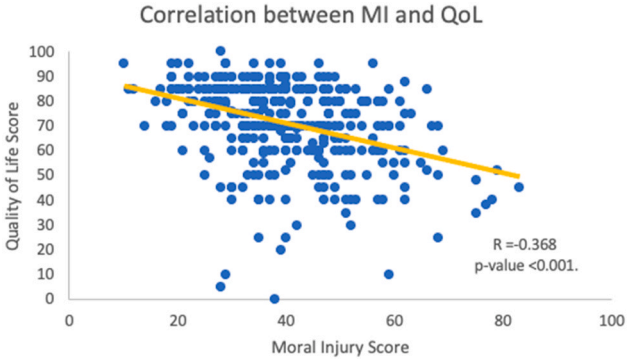

Figure 3. Correlation between *MI and QoL*. There was a negative correlation between MI and QoL (r = –0.4; P < 0.001). MI, moral injury; QoL, quality of life.

Moral Injury

Among the respondents, 233 (61.1%) scored ≥36 on the MISS-HP, and thus were categorized as having profession-related MI. Mean MISS-HP was 39.9 ± 12.6 (range: 10–83). Mean MISS-HP for the MI subgroup was significantly different from that for the rest of the group (47.4 ± 9.6 vs. 28.0 ± 5.7; P < 0.05). MISS-HP varied across the practice experience durations, with the following subgroups listed in a decreasing order of the mean MI score: 10–20 years, 1–10 years, currently in training, > 20 years, and < 1 year (43.5, 40.5, 37.9, 36.8, and 36.5; P < 0.05). There was a significant difference in mean MI between the > 20 years and 10–20 years of practice subgroups (36.8 ± 11.5 vs. 43.5 ± 13.6; P < 0.05). There were no significant differences among all other participant demographics or practice environments with respect to MI.

MI, QoL, and Distress

Correlation between MI and QoL is shown in Figure 3. There was a negative correlation between MI and QoL (r = −0.4; P < 0.001). MI caused no, mild, moderate, very much, or extreme distress or impaired ability to function in relationships, at work, or other areas of life in 108 (29.6%), 139 (38.1%), 89 (24.4%), 24 (6.6%), 5 (1.4%), respectively.

Open-Ended Responses

Open-ended responses are shown in Figures 4 and 5. Of respondents, 268 (73.4%) completed the optional, open-ended response "*as you understand it, what do you believe is the greatest contributor to MI?*" Most common themes for the greatest contribution to MI were ineffective leadership, non-physician administration, barriers to patient care, corporatization of medicine, futile procedures, turf wars, and reduced resources. Various comments referred to "toxic," "untrustworthy," "irresponsible," "unsupportive," or "threatening" leadership at the section, departmental, and hospital levels. Some commented on "diagnostic radiology-

Figure 4. Word-cloud of major contributors to MI from surveyed participants. MI, moral injury.

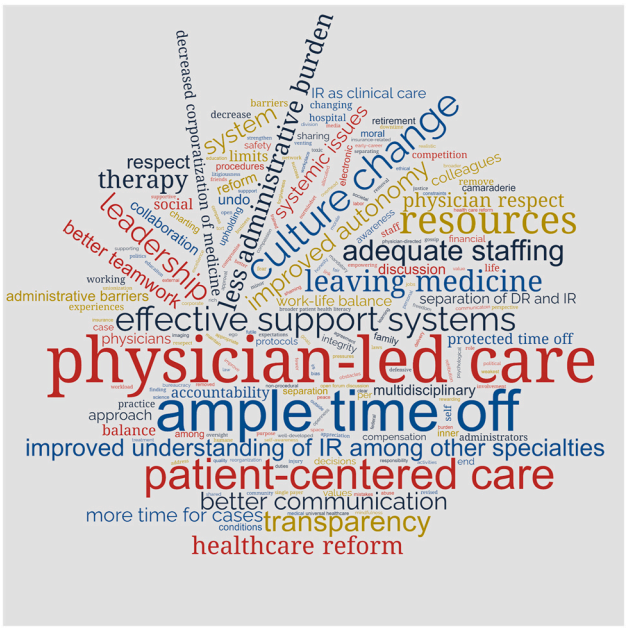

Figure 5. Word-cloud of potential solutions to MI from surveyed participants. MI, moral injury.

focused" or "non-physician" leaders who mandate policies that restrict the best IR practice. Examples of the barriers to patient care included lack of "timely and effective" procedure scheduling, "disconnect" with the support staff, and gaps in "up-to-date knowledge" among physicians. As for the corporatization in medicine, some respondents commented on conflicts with "healthcare bureaucracy and insurance companies" and hospital administrators "who are trying to make a profit." A sense of "futility" was also reported when pressure from the referrers and patients push one to perform procedures that may be safe but of questionable benefit. This can be demoralizing especially when "turf wars" lead to loss of more interesting and profitable procedures to other specialties. Lack of various resources, including support staff, devices and instruments, and dedicated time for periprocedural care, was also highlighted in the responses.

Of respondents, 253 (69.3%) completed the optional, open-ended response "*what do you believe would limit/alleviate MI most?*" Most common themes for ways to reduce MI were more autonomy, less bureaucracy, more administrative support, physician-directed leadership, adequate staffing, changes to the medical system, physician unionization, transparency with insurance companies, more time off, and leaving medicine or retirement.

DISCUSSION

MI has emerged as an important concept to describe a sense of helplessness when one's moral philosophy is at odds with the demands of the work environment. MI affects healthcare providers with a prevalence of 41.3–50.7% (12,17,18).

In this study, 61.1% of interventional radiologists suffered from MI. A negative correlation was observed between MI and QoL ($r = -0.4$; $P < 0.001$), and the mean QoL in the MI subgroup was significantly lower compared to the rest (67.6 ± 17.0 vs. 76.6 ± 16.0; $P < 0.05$). These associations suggest a potential causative link between MI and QoL. There was also a significantly higher mean QoL and lower mean MI for those with > 20 years of practice experience compared to those with 10–20 years (73.9 ± 19.8 vs. 66.4 ± 16.9; $P < 0.05$ and 36.8 ± 11.5 vs. 43.5 ± 13.6; $P < 0.05$). These findings are in keeping with the previous studies which reported lower burnout and increased wellness in physicians who have practiced longer (19,20).

While prior studies have demonstrated correlations between demographic factors and burnout, this study demonstrated no significant differences in MI with respect to gender, race or ethnicity, relationship status, practice setting, and country of practice (1). This suggests that while certain demographic subgroups may be more susceptible to burnout, MI may represent a more global risk factor associated with wellness.

While the impact of the Covid-19 pandemic on the MI among interventional radiologists is unknown, previous studies have noted an increase in the prevalence of MI in healthcare workers without a concomitant rise in the rate of burnout since the onset of Covid-19 (21). Given the IR's involvement in caring for patients at the frontline throughout the pandemic, it is likely that the pandemic has been a contributing factor in the IR physicians' MI as well. In the open response section, interventional radiologists felt that the greatest contributors to MI were ineffective

leadership, barriers to patient care, corporatization of medicine, non-physician administration, futile procedures, turf battles, and reduced resources. Previous studies have identified similar external and systemic barriers as contributors to burnout and MI in healthcare (1,22,23). Unopposed MI may cause increased cynicism, disengagement, and burnout (24).

The goal of identifying MI is to achieve "moral repair," or a reduction in impact of MI on an individual (1,22,23). In the open response section, interventional radiologists felt that "moral repair" may be achieved by improving autonomy, reducing bureaucracy, enhancing administrative support, promoting physician-led leadership, ensuring sufficient staffing, reforming the medical system, unionizing physicians, fostering transparency with insurance companies, increasing vacation time, and pursuing retirement or leaving medicine. These proposed solutions may provide benefit in counteracting MI as they aim to combat external or systemic barriers or return control to the healthcare practitioner (7,8). Unfortunately, many of these proposed solutions are challenging, and perhaps impractical, to execute as they require tackling complex cultural, systemic, and institutional structures, which are beyond the scope of this study.

Given the complexity of contributors to MI in healthcare and the paucity of data on this subject, there is no clear guidance for achieving moral repair. From the limited works published on this topic in general, some strategies for achieving moral repair at the individual level can be considered. Psychotherapy focused on self-compassion, self-forgiveness, and acceptance may be more beneficial to those suffering from MI, compared to the traditional trauma-focused therapy, such as cognitive behavioral therapy (25). Spiritual care support is efficacious for those that feel their spirituality has been impacted by the MI (26). In veterans with MI, adaptive disclosure and acceptance/commitment therapy have demonstrated efficacy in treating MI (26). While these treatment strategies may help support individuals who are no longer incurring repeated MI, individual solutions will be inadequate to resolve any recurring systemic issues that lead to repeated MI. Previous studies have stressed the importance of exploring not only individual-targeted solutions, but also systems-level interventions in leadership, organizations, and policies, to improve physician well-being (6,27,28). Provider wellness is undoubtedly a multifactorial issue which requires a multifaceted approach to address.

The terms moral distress and MI, though often used interchangeably, exhibit nuanced distinctions. Unlike MI, which bears enduring consequences, moral distress manifests as a transient and acute phenomenon (9,10). Moral distress is essential to identify and address as its persistence frequently leads to MI. Existing research has underscored a 98% prevalence of moral distress amongst diagnostic radiologists (29). Within diagnostic radiology, antecedent factors, including increased imaging volumes and interruptions from colleagues, have been previously described (30). Interventional radiologists may grapple with additional causes of moral distress stemming from direct patient interactions, procedural complications, and resource scarcity. Given that both diagnostic radiology and interventional radiology often fall under the same departmental management, understanding the unique determinants of moral distress among interventional radiologists may assist the departmental leadership in building a cohesive and thriving radiology department.

Only 116 (42.8%) of respondents reported being familiar with the concept of MI, indicating a knowledge gap among most participants on this topic. Increasing awareness of MI, through targeted education, may be an important first step in recognizing it as a potential root cause of provider burnouts (6), identifying contributing factors, and suggesting mitigating solutions.

Limitations of this study include what is typical of a cross-sectional survey study, with lack of control in the representativeness of the participants with respect to the target population. For example, those suffering from MI may have been more likely to have responded to this survey on a relatable topic. While the survey was distributed online to a global audience, a vast majority of responders were practicing in the United States, limiting international applicability of the results. Another limitation is the current dearth of studies assessing MI among various physician specialists to place the findings of the present study into a practical context.

In conclusion, MI is prevalent among interventional radiologists and is negatively correlated with QoL. Future studies may explore how the various radiology subspecialties compare in the MI and QoL metrics to inform the departmental/hospital leadership on the various challenges across the radiology disciplines.

FUNDING

This study was not supported by any funding.

DECLARATION OF COMPETING INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

APPENDIX A

Survey: Moral Injury Among Interventional Radiologists.

1. Which of the following concepts are you familiar?
   A. Burnout only
   B. Moral injury only
   C. Both burnout and moral injury

Demographics

2. How did you hear about this survey?
   A. Professional society-based communication (e.g. SIR, SPIR, etc)
   B. Twitter
   C. Facebook

D. LinkedIn
E. Instagram
F. Email
G. Other

3. I am
   A. A practicing interventional radiologist
   B. An interventional radiologist in training
4. How many years have you been in practice?
   A. Currently in training
   B. < 1 year
   C. 1–10 years
   D. 10–20 years
   E. > 20 years
5. Which country do you practice in?
6. What is your gender?
   A. Male
   B. Female
   C. Other
   D. Prefer not to say
7. What is your race/ethnicity?
   A. American Indian or Alaska Native
   B. Asian
   C. Black or African American
   D. Hispanic/Latinx
   E. Native Hawaiian or Pacific Islander
   F. White
   G. Mixed race
   H. Other
   I. Prefer not to say
8. What is your marital status?
   A. Single
   B. Long-term partner
   C. Married
   D. Prefer not to say
9. What best describes your practice?
   A. Academic
   B. Community
   C. Hybrid
   D. Other
10. Do you practice at more than one hospital?
    A. Yes
    B. No
11. Do you have an institutional leadership position? (e.g. program director, section chief, department chair)
    A. Yes
    B. No
12. (Practicing IRs only) What percentage of your clinical responsibilities pertain to interventional radiology?
    A. > 75%
    B. 50–74%
    C. 25–49%
    D. < 25%
    E. No clinical responsibilities
13. (Practicing IRs only) What percentage of your responsibilities pertain to diagnostic radiology?
    A. > 75%
    B. 50–74%
    C. 25–49%
    D. < 25%
    E. No diagnostic radiology responsibilities
14. (Practicing IRs only) What percentage of your time is dedicated to administrative/non-clinical?
    A. > 75%
    B. 50–74%
    C. 25–49%
    D. < 25%
    E. No administrative/non-clinical responsibilities
15. (Trainees only) What is your level of training?
    A. PGY-1 or 2
    B. PGY-3
    C. PGY-4
    D. PGY-5
    E. PGY-6 or higher
    F. Prefer not to say

Global Quality of Life Scale

16. Choose any number between 0 and 100 that describes your quality of life.

100 Perfect quality of life
95 Nearly perfect quality of life
90
85 Very good quality of life
80
75
70 Good quality of life
65
60Moderately good quality of life
55
50
45
40 Somewhat bad quality of life
35
30Bad quality of life
25
20
15 Very bad quality of life
10
5 Extremely bad quality of life
0 No quality of life

Moral Injury Symptom Scale: Healthcare Professions Version (MISS-HP)

Scale 1–10: From strongly disagree (1) to strongly agree (10)

17. I feel betrayed by other health professionals whom I once trusted.
18. I feel guilt over failing to save someone from being seriously injured or dying.
19. I feel ashamed about what I've done or not done when providing care to my patients.

20. I am troubled by having acted in ways that violated my own morals or values.
21. Most people with whom I work as a health professional are trustworthy.
22. I have a good sense of what makes my life meaningful as a health professional.
23. I have forgiven myself for what's happened to me or to others whom I have cared for.
24. All in all, I am inclined to feel that I am a failure in my work as a health professional.
25. I sometimes feel God is punishing me for what I've done or not done while caring for patients.
26. Compared to before I went through these experiences, my religious/spiritual faith was strengthened.
27. Do the feelings you indicated above cause you significant distress or impair your ability to function in relationships, at work, or other areas of life important to you? In other words, if you indicated any problems above, how have these problems made it challenging for you to do work, take care of things at home, or get along with other people?
28. As you understand it, what do you believe is the greatest contributor to moral injury?
29. What do you believe would limit/alleviate moral injury most?

APPENDIX B

The following was used as an introduction for the social media and email survey invitation:

"Burnout is defined as a cluster of symptoms that occur in response to chronic emotional career-related stressors resulting in emotional exhaustion, depersonalization, and lack of personal accomplishment in relation to one's professional activity. Recently, there has been a paradigm shift regarding the characterization and etiology of burnout. Historically, moral injury was a term used to describe soldiers' responses to their actions in war, but more recently this term has been used to describe the emotional and psychological insults health care providers experience when their moral ideals are transgressed.

Please help us better understand moral injury in Interventional Radiology through this brief two-minute survey. We appreciate it."

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