

Research Letter

Hazardous Attitudes: Physician Decision Making in Radiation Oncology



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Abstract

Purpose: The Federal Aviation Administration quantifies hazardous attitudes (HAs) among pilots using a scale. HAs have been linked to aviation risk. We assessed the influence of HAs and other factors in treatment decision making in radiation oncology (RO).

Methods and Materials: An anonymous survey was sent to 809 radiation oncologists in US cities housing the top 25 cancer centers. The survey included an HA scale adapted for RO and presented 9 cases assessing risk-tolerant radiation therapy prescribing habits and compliance with the American Society for Radiation Oncology's *Choosing Wisely* recommendations. Demographic and treatment decision data were dichotomized to identify factors associated with prescribing habits using univariable and multivariable (MVA) logistic regression analyses.

Results: A total of 139 responses (17.1%) were received, and 103 were eligible for analysis. Among respondents, 40% were female, ages were evenly distributed, and 83% were in academics. Median scores for all attitudes (macho, anti-authority, worry, resignation, and impulsivity) were below the aviation thresholds for hazard and data from surgical specialties. On MVA, responders >50 years old with >5 years' experience were 4.45 times more likely to recommend risk-tolerant radiation ($P = .016$). Macho attitude was negatively associated with *Choosing Wisely* compliant treatments (odds ratio [OR], 0.12; $P = .001$). Physicians who reported having previously retreated the supraclavicular fossa without complication were more likely to recommend retreatment in medically unfit patients if they felt the complication was avoided owing to careful planning (OR, 5.2; $P = .008$).

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Research data are not available at this time. As part of the institutional review board approval, the data obtained from this survey are kept until publication, then destroyed.

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Conclusions: To our knowledge, this represents the first study analyzing physician attitudes in RO and their effect on self-reported treatment decisions. This work suggests that attitude may be among the factors that influence risk-tolerant prescribing practices and compliance with *Choosing Wisely* recommendations.

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Introduction

Although radiation oncology (RO) is data driven and evidence based, there exists considerable variability in physician decision-making. In fact, a leading RO journal developed a regular feature showcasing nuance and variability in practice, titled “The Gray Zone.”¹

Physician decision-making remains overall poorly understood, although it is likely influenced by many factors. The airline industry has found attitude to be a significant factor in decision making.² The Federal Aviation Administration tests all pilots for hazardous attitudes (HAs)—those contributing to poor decision-making and risky behavior.³ Five HAs are officially recognized—anti-authority, impulsivity, invulnerability, macho, and resignation (Table 1)⁴—and they have been implicated in plane crashes.⁵ In the modified short HA scale, the single attitude of invulnerability is broken down into lack of worry and excess of self-confidence.

In recent years, the concept of HAs has been applied to medicine. Among orthopedic surgeons, HA expression has been linked to rates of reoperation and readmission.⁶⁻⁸ This work suggests that the HA scale used to determine safe practices in pilots may have merit in medical decision-making as well. Because radiation oncologists routinely make high-impact decisions affecting the lives of patients with cancer, a better understanding of the factors associated with good judgment in radiation oncology would be valuable. The baseline expression of HAs and their influence on physician decision-making in RO is unknown. In this study, we conducted a survey analysis of radiation oncologists to assess the presence and influence of HAs in treatment decision-making.

Methods and Materials

Study design and participants

We developed an anonymous survey including an adapted version of the HA Scale. The institutional Human Investigations Committee deemed this work exempt from review (Yale). The online survey was distributed via email during a 2-month period, ending December 2017, to 809 radiation oncologists registered with the American Society of Radiation Oncology (ASTRO) in the US cities housing the top 25 cancer centers (*US News & World Report* rankings⁹). Practicing radiation oncologists were eligible. Consent was obtained and confidentiality was maintained.

Survey development

We pilot-tested our survey with practicing radiation oncologists to assess questions for clarity and meaning. The survey included 70 closed-ended, multiple-choice questions. It consisted of 4 major components: (1) an attitudes survey using the aviation HA Scale adapted for RO, (2) 4 clinical scenarios to assess willingness to prescribe risk-tolerant treatments (toward organs at risk [OARs]), (3) practice scenarios based on 5 ASTRO *Choosing Wisely*¹⁰⁻¹² recommendations, and (4) demographic data.

Originally an ipsative measurement scale, the instrument assessing HAs was modified into a Likert-type scale and validated.¹³⁻¹⁷ We used an abbreviated 30-item version of the scale consisting of declarative statements adapted for RO.¹⁵ This short scale was selected to be consistent with literature examining HAs in medicine that

Table 1 Definitions and antidotes for hazardous attitudes officially recognized by the Federal Aviation Administration^{4,*}

| Hazardous attitude | Definition | Antidote |
|--------------------|--------------------------|--|
| Macho | “I can do it.” | “Taking chances is foolish.” |
| Antiauthority | “Don’t tell me.” | “Follow the rules. They are usually right.” |
| Resignation | “What’s the use?” | “I’m not helpless. I can make a difference.” |
| Impulsivity | “Do it quickly.” | “Not so fast. Think first.” |
| Invulnerability | “It won’t happen to me.” | “It could happen to me.” |

* Worry and self-confidence are attitudes not officially recognized by the Federal Aviation Administration as hazardous, although they are routinely measured.

measure self-confidence and worry rather than invulnerability. Statements such as “I like to practice unusual aircraft attitudes” were converted to “I like to practice unusual treatment paradigms in radiation oncology.” Like in the aviation scale, 5 unique questions to assess each attitude (macho, antiauthority, resignation, impulsivity, and invulnerability broken down into its separate components of self-confidence and worry) were included. The threshold for concerning levels of individual HA expression (a score >20) was consistent with aviation survey grading.¹⁵

The survey then assessed 2 sets of clinical scenarios: prescribing habits and adherence to society guidelines. Four cases aimed to understand nuances in prescribing habits, including risk tolerance. These 4 cases included (1) radiation therapy (RT) allocation for an elderly woman with stage I breast cancer eligible for RT omission, (2) prescribing habits for an ultracentral lung tumor, (3) retreatment dose-fractionation of the supraclavicular fossa for a patient with symptomatic breast cancer who received prior RT, and (4) balancing risk of RT pneumonitis with adequate planning target volume coverage in lung cancer. Risk tolerance for the purposes of this study was relative to the organs at risk, such that whole-breast RT prescription was considered more risk tolerant than partial breast RT, and stereotactic body RT prescription was considered more risk tolerant than conventionally fractionated RT for an ultracentral lung cancer. In the first 3 cases, variations of patient health were presented. For the case involving retreatment of the supraclavicular fossa, an additional question (Why do you feel you did not observe a complication with retreatment?) was presented if respondents reported prior experience in retreatment of this area without complications. Respondents were asked if they thought the absence of complications was owed to chance, careful planning and delivery, or short patient survival.

The ASTRO *Choosing Wisely* guidelines are well known and felt to represent information that general practitioners would be aware of, even outside of their disease site specializations. Respondents were asked about their preferred treatment in patient scenarios representing targets of ASTRO's prior *Choosing Wisely* campaigns: management of bone metastases, low-risk prostate cancer, low-risk endometrial cancer, brain metastases, and the use of hypofractionated whole-breast RT.¹¹⁻¹² Answer choices were classified as *Choosing Wisely* compliant or noncompliant. Nonidentifiable physician demographics and practice characteristics were also queried.

Data analysis

Descriptive statistics were used to characterize the cohort and HA expression. Demographic data, practice patterns information, and HA responses were

dichotomized for univariable (UVA) and multivariable (MVA) logistic regression analyses. The attitude of self-confidence was not analyzed for association, because radiation oncologists—unlike surgeons and pilots—do not primarily rely on physical abilities, but rather performance of team members (dosimetry, therapy, physics) for job execution. For MVA, an interaction term including age and years since residency was created. We used UVA to identify demographic factors and HAs associated with compliance with *Choosing Wisely* recommendations and risk-tolerant (to OARs) prescriptions. Both UVA and MVA were used to identify demographic factors, practice characteristics, and HAs associated with risk-tolerant prescriptions. Additional UVA was performed to determine whether prior experience with a particular treatment scenario was associated with increased or decreased likelihood of risk-tolerant prescribing. Statistical significance was defined as $P \leq .05$. Stata SE software, version 13.1 (Stata, College Station, Texas), was used.

Results

Respondent demographics

Of the 809 surveys sent, 139 were started, yielding a response rate of 17.1%. Additionally, 12 surveys were accessed by anonymous link. Excluding responses submitted as blank ($n = 2$), with significant missing data ($n = 14$), or without consent ($n = 2$), 103 surveys were eligible for analysis. There was a male predominance in responses, and respondents' ages were evenly distributed (Table 2). Most respondents practiced in academic centers or university settings, completed residency within the prior 10 years, reported an average of 11 to 30 patients on treatment during a typical week, and worked regularly with more than 6 RO colleagues.

Hazardous attitudes in radiation oncology

Median scores for all HAs were below aviation thresholds for hazard (Table 3A). Hazardous levels of macho were expressed in 15.6% of respondents and hazardous levels of worry in 12.5% (Table 3B). Gender was not significantly associated with hazardous levels of any attitude (data not shown).

Factors associated with risk-tolerant prescription

On UVA, age of >50 years (odds ratio [OR], 3.65; 95% confidence interval [CI], 1.39-9.56; $P = .008$) and experience of >5 years (OR, 3.18; 95% CI, 1.08-9.37; $P = .036$)

Table 2 Demographic and practice characteristics of respondents eligible for analysis

| Variable | Respondents, No. (%) (n = 103) |
|-------------------------------------|--------------------------------|
| Age, y | |
| <35 | 23 (22.33) |
| 35-40 | 25 (24.27) |
| 41-50 | 26 (25.24) |
| 51-60 | 18 (17.48) |
| >60 | 11 (10.68) |
| Sex | |
| Male | 61 (59.22) |
| Female | 41 (39.81) |
| Not reported | 1 (0.97) |
| Time since residency, y | |
| Still in training | 3 (2.91) |
| 0-5 | 38 (36.89) |
| 6-10 | 21 (20.39) |
| 11-15 | 8 (7.77) |
| 16-20 | 9 (8.74) |
| >20 | 24 (23.30) |
| Practice setting | |
| Academic or university | 85 (82.52) |
| Private practice, freestanding | 5 (4.85) |
| Private practice, hospital based | 8 (7.77) |
| Military or government | 1 (0.97) |
| Other | 4 (3.88) |
| Patients on treatment, average, No. | |
| 0-10 | 20 (19.42) |
| 11-20 | 60 (58.25) |
| 20-30 | 21 (20.39) |
| >30 | 2 (1.94) |
| Radiation oncology colleagues, No. | |
| 0 | 2 (1.94) |
| 1-5 | 27 (26.21) |
| 6-10 | 28 (27.18) |
| >10 | 46 (44.66) |

were significantly associated with risk-tolerant prescribing. On MVA, respondents >50 years old with >5 years of experience were 4.45 (95% CI, 1.32-15.0) times more likely to recommend risk-tolerant prescriptions ($P = .016$; Table 4).

Previous experience and perceptions surrounding complication avoidance were also associated with prescribing preferences. Physicians who reported prior

Table 3A Hazardous-attitude levels among respondents

| Hazardous attitude | Median (range) level of attitude reported | SD ¹⁸ |
|--------------------|---|------------------|
| Macho | 15 (7-24) | 3.48 |
| Antiauthority | 9 (5-20) | 3.03 |
| Worry | 15 (6-23) | 3.80 |
| Resignation | 12 (6-19) | 2.94 |
| Impulsivity | 15 (8-21) | 2.53 |

Abbreviation: SD = standard deviation.

experience irradiating the supraclavicular fossa without complication were significantly more likely to recommend retreatment in patients with poor health if they felt the complication was avoided owing to careful planning and delivery rather than to chance or patient death (OR, 5.2; 95% CI, 1.55-17.61; $P = .008$).

Compliance with the Choosing Wisely campaign

The macho attitude was negatively associated with compliance with *Choosing Wisely* recommendations (OR, 0.12; 95% CI, 0.03-0.40; $P = .001$). There was no association between compliance and any other HA or demographic or practice characteristic (Table 5).

Discussion

The role of attitude in decision-making has been well established in the aviation industry. Given the recent application of this concept to surgical specialties,⁶⁻⁸ we sought to determine the influence of HAs and other factors on physician decision-making among radiation oncologists. Our analysis demonstrated low levels of HAs among radiation oncologists. The macho attitude was associated with nonadherence to *Choosing Wisely* recommendations, whereas older age and more experience were associated with a

Table 3B Rates of hazardous levels of hazardous attitudes among radiation oncology, neurosurgery,¹⁸ and orthopedic surgery (Hazardous Attitude Score >20)⁶

| Hazardous attitude | Rate, % | | |
|--------------------|------------------------|------------------|------------------------|
| | Radiation oncology (%) | Neurosurgery (%) | Orthopedic surgery (%) |
| Macho | 7.8 | 0.0 | 28 |
| Antiauthority | 0.0 | 1.5 | 3 |
| Worry | 9.7 | 3.7 | 6 |
| Resignation | 0.0 | 7.7 | 0.3 |
| Impulsivity | 1.9 | 0.4 | 1 |

Table 4 Univariable and multivariable logistic regression analysis for variables potentially associated with willingness to recommend risk-tolerant prescriptions (radiation doses that pose greater risk to the organs at risk) in surveyed scenarios*

| Variable | Univariable OR (95% CI) | P | Multivariable OR (95% CI) | P |
|-------------------------------------|-------------------------|------|---------------------------|------|
| Age, y | | | | |
| ≤50 | 1 [Reference] | N/A | - | - |
| >50 | 3.65 (1.39-9.56) | .008 | - | - |
| Sex | | | | |
| Female | 1 [Reference] | N/A | - | - |
| Male | 0.86 (0.34-2.21) | .76 | - | - |
| Time since residency, y | | | | |
| ≤5 | 1 [Reference] | N/A | - | - |
| >5 | 3.18 (1.08-9.37) | .036 | - | - |
| Age, y, and time since residency, y | | | | |
| ≤50 & ≤5 | - | - | 1 [Reference] | N/A |
| >50 & ≤5 | - | - | N/A | N/A |
| ≤50 & >5 | - | - | 1.65 (0.46-5.93) | .44 |
| >50 & >5 | - | - | 4.45 (1.32-15.0) | .016 |
| Practice setting | | | | |
| Academic | 1 [Reference] | N/A | 1 [Reference] | N/A |
| Other | 0.38 (0.08-1.67) | .19 | 0.31 (0.06-1.64) | .17 |
| Patients on treatment, No. | | | | |
| <21 | 1 [Reference] | N/A | 1 [Reference] | N/A |
| ≥21 | 2.13 (0.77-5.9) | .14 | 2.36 (0.77-7.19) | .13 |
| Radiation oncology colleagues, No. | | | | |
| 0-10 | 1 [Reference] | N/A | - | - |
| >10 | 1.32 (0.53-3.3) | .55 | - | - |
| Comfortable with treating lung | | | | |
| No | 1 [Reference] | N/A | - | - |
| Yes | 0.63 (0.26-1.62) | .35 | - | - |
| Comfortable with treating breast | | | | |
| No | 1 [Reference] | N/A | - | - |
| Yes | 0.91 (0.35-2.35) | .85 | - | - |
| Macho | | | | |
| Bottom 3 quartiles | 1 [Reference] | N/A | - | - |
| Top quartile | 2.09 (0.72-6.04) | .17 | - | - |
| Antiauthority | | | | |
| Bottom 3 quartiles | 1 [Reference] | N/A | - | - |
| Top quartile | 0.63 (0.13-3.08) | .57 | - | - |
| Worry | | | | |
| Bottom 3 quartiles | 1 [Reference] | N/A | - | - |
| Top quartile | 0.63 (0.19-2.08) | .45 | - | - |
| Resignation | | | | |
| Bottom 3 quartiles | 1 [Reference] | N/A | - | - |
| Top quartile | 1.01 (0.30-3.46) | .98 | - | - |
| Impulsivity | | | | |
| Bottom 3 quartiles | 1 [Reference] | N/A | - | - |
| Top quartile | 0.96 (0.31-2.95) | .94 | - | - |

Abbreviations: CI = confidence interval; N/A = not applicable; OR = odds ratio.

* Variables with empty spaces in the multivariate column were not included in the final multivariable analysis model.

Table 5 Univariable logistic regression analysis for variables potentially associated with compliance with *Choosing Wisely* scenarios among respondents

| Variable | OR (95% CI) | P |
|------------------------------------|------------------|------|
| Age, y | | |
| ≤50 | 1 [Reference] | N/A |
| >50 | 0.66 (0.20-2.18) | .50 |
| Sex | | |
| Female | 1 [Reference] | N/A |
| Male | 1.60 (0.46-5.59) | .46 |
| Time since residency, y | | |
| ≤5 | 1 [Reference] | N/A |
| >5 | 0.37 (0.10-1.40) | .14 |
| Practice setting* | | |
| Academic | - | - |
| Other | - | - |
| Patients on treatment, No. | | |
| <21 | 1 [Reference] | N/A |
| ≥21 | 1.06 (0.27-4.18) | .93 |
| Radiation oncology colleagues, No. | | |
| 0-10 | 1 [Reference] | N/A |
| >10 | 0.56 (0.18-1.75) | .32 |
| Macho | | |
| Bottom 3 quartiles | 1 [Reference] | N/A |
| Top quartile | 0.12 (0.03-0.40) | .001 |
| Antiauthority | | |
| Bottom 3 quartiles | 1 [Reference] | N/A |
| Top quartile | 1.83 (0.22-15.4) | .58 |
| Worry | | |
| Bottom 3 quartiles | 1 [Reference] | N/A |
| Top quartile | 0.68 (0.19-2.41) | .55 |
| Resignation | | |
| Bottom 3 quartiles | 1 [Reference] | N/A |
| Top quartile | 0.43 (0.17-1.57) | .20 |
| Impulsivity | | |
| Bottom 3 quartiles | 1 [Reference] | N/A |
| Top quartile | 0.63 (0.18-2.26) | .48 |

Abbreviations: CI = confidence interval; N/A = not applicable; OR = odds ratio.
* Too few observations for analysis.

propensity to recommend risk-tolerant prescriptions. We also found that retreatment was almost 5 times more likely to be recommended when the physician felt that careful planning was responsible for avoidance of a complication. To our knowledge, this represents the first study examining hazardous attitudes in RO.

It is not clear why older age and more experience are significantly associated with an increased likelihood of recommending risk-tolerant (to OARs) prescriptions. This difference could reflect the influence of the 3-dimensional era, in which more dose-volume metrics are available, shifting focus to preventing complications. Alternatively, the threshold of 5 years of practice to observe this effect could indicate physicians having practiced long enough to see recurrences and shifting their priorities from avoiding complications to avoiding recurrence.

Although our study is thought-provoking regarding the role of attitude and other factors in decision-making in RO, there are limitations. First, there is potential nonresponse bias. The mean response rate for email surveys is approximately 36%, with recent data exhibiting lower response rates.^{19,20} Among oncology surveys, RO surveys may have response rates as low as 5%.²¹ Our respondents also included a large number of academic physicians and might not be representative of the total population of radiation oncologists. The influence of training site, disease-site specialization, local practice culture, peer influence, and era of training cannot be reliably assessed by these data but is likely to contribute to prescribing preferences. In addition, given that prescribing too much or too little RT can both be risky, it would be worthwhile to determine whether HAs are correlated with prescriptions that are risk tolerant for recurrence.

Conclusions

Our study demonstrates low levels of HAs in radiation oncologists compared with pilots and orthopedic surgeons. However, the macho attitude was associated with nonadherence to *Choosing Wisely* recommendations. Other factors, such as increasing age and experience, were associated with a propensity to recommend risk-tolerant (to OARs) prescriptions. To our knowledge, this is the first study examining physician attitudes in the field of RO. This work lays the foundation for further efforts to identify factors associated with physician decision-making in this field.

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