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ORIGINAL ARTICLE

Radiologists' tendency to collaborate with referring physicians in managing contrast media-related risk factors

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PURPOSE

This study investigates radiologists' tendency to collaborate with referring physicians in managing risk factors associated with contrast media (CM) using a modified control preferences scale (CPS). This study is valuable, as it represents the first effort to capture radiologists' perspectives on this issue.

METHODS

The study was conducted through face-to-face interviews with 50 radiologists working at Kayseri City Hospital between June 2021 and April 2022. During the interviews, a modified CPS was used. Participants were presented with five different preference options, each written on a separate card. These preferences ranged from fully active involvement in managing CM-related risks to a completely passive role. At the end of the interview, the two most preferred roles of each participant were identified, categorized, and analyzed using descriptive statistics. All statistical analyses were conducted using the IBM SPSS statistical package.

RESULTS

Of the 50 interviews conducted, 44 were included in the analysis, as they met acceptable permutations. Among these, 6 interviewees (13.6%) preferred a completely active role and 19 (43.2%) preferred a completely passive role. Additionally, 19 radiologists (43.2%) chose one of the collaborative roles.

CONCLUSION

We believe that the preference for a passive role among the majority of radiologists (43.2%) is more closely related to the inadequacies of the existing medical service system and infrastructure rather than a lack of awareness or emotional/motivational inadequacy regarding team formation. These findings should not be interpreted as a negative indicator of teamwork but rather as data for healthcare managers and legal experts to make necessary organizational adjustments. A substantial proportion of radiologists who favor a collaborative role (43.2%) exhibit the emotional–motivational willingness and cognitive understanding needed to engage in team formation and teamwork.

CLINICAL SIGNIFICANCE

The preference for a passive role among radiologists appears to be driven more by the limitations of the current medical service system and infrastructure than by a lack of awareness or motivation for teamwork. Recognizing these systemic barriers is essential for healthcare managers and policymakers to implement necessary organizational improvements. Additionally, radiologists who prefer a collaborative role are likely aware of the benefits of teamwork, highlighting their potential to contribute to future research and improvements in CM-related risk management. Enhancing collaboration opportunities and addressing structural deficiencies may facilitate the greater involvement of radiologists in multidisciplinary teams, ultimately improving patient care and CM-related risk management.

KEYWORDS

Contrast agent, contrast medium, control preferences scale, organizational psychology, physician's role, team building

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There are three fundamental principles for quality in healthcare management: patient focus, continuous improvement, and teamwork.[1] A team is defined by Salas et al.[2] as "interrelated individuals assigned to achieve a common goal". Four elements are necessary to build a team: goal setting, establishing interpersonal relationships, clarifying roles, and problem-solving.[2,3] In radiology, one of the key challenges requiring effective teamwork is the management of risk factors associated with contrast media (CM).[4]

Like other drugs, CM can cause side effects. Although the severity and incidence of side effects from newer CM are lower than from earlier CM, the widespread use of imaging tools, increased imaging speed, and the preference for defensive medicine have increased public exposure to CM. This has led to an increase in unwanted side effects. Serious side effects can compromise the patient's health, hinder the progress of existing conditions, and necessitate changes in treatment. Consequently, hospital stays are prolonged, and treatment costs increase. Additionally, the patient's trust in the treatment and even in healthcare providers may be undermined, potentially leading to malpractice lawsuits against the clinician. Negative outcomes may eventually compel clinicians to adopt defensive medicine practices, resulting in unnecessary tests, time loss, increased workload for clinicians, and unnecessary costs for the national economy.

Main points

- Effective teamwork in radiology is essential for managing risk factors associated with contrast media (CM).
- This study investigates radiologists' tendency to collaborate with referring physicians in managing CM-related risk factors using a modified control preferences scale.
- A substantial proportion of radiologists who favor a collaborative role (43.2%) are likely aware of the positive outcomes of teamwork and are inclined to contribute to future studies on CM-related risk management.
- The preference for passive roles (43.2%) among radiologists reflects the limitations of the current medical service system and infrastructure rather than a lack of awareness or emotional/motivational deficits related to team building.
- These findings should not be perceived as a negative factor in team building but should instead serve as data points for healthcare administrators and medical-legal professionals to implement necessary institutional regulations.

To mitigate these risks, it is recommended that, prior to any imaging procedure, the indication for contrast-enhanced imaging be clearly established, the benefits and risks carefully weighed, and alternative imaging modalities that can provide comparable or superior diagnostic quality considered.[5] If contrast-enhanced imaging is deemed necessary, it must be ensured that the selected contrast agent is appropriate for both the patient and the specific indication. The benefits of the imaging study should be balanced against potential adverse reactions to ensure an effective and accurate diagnosis. Additionally, healthcare providers must be prepared to manage any potential adverse reactions promptly.[5,6]

To manage the risk factors associated with CM, the team members should naturally include radiologists and physicians. Given the identified challenges, effective teamwork between radiologists and physicians is essential.

Many centers still face unresolved issues stemming from unclear role definitions, which hinder effective teamwork. A crucial question remains unanswered: How should the roles of radiologists and referring physicians be defined to establish effective teamwork in managing CM-related risk factors?

To address this, the American College of Radiology (ACR) provides pre-assessment criteria applicable to both radiologists and physicians during diagnostic processes. Adequate patient evaluation and effective communication between the radiologist and the referring physician are critical before administering CM.[5] According to Bettman[7], radiologists should first calculate creatinine clearance and assess whether a non-contrast imaging modality could achieve the same diagnostic goal. Furthermore, the Royal College of Radiologists (RCR) states that the ultimate responsibility for CM administration lies with the prescribing physician. Ideally, the patient's clinical history should be available at the time of the imaging request, and the radiology department must review this information before injection.[8]

The CM Safety Committee of the Japan Radiological Society conducted a questionnaire-based survey among radiologists on the use and safety of iodinated and gadolinium CM. The majority of respondents selected answers that indicated an active role in CM safety. However, some participants chose the "others" option, which included responses such as "at the discretion of the referring physician" and "under the direct supervision of the referring physician".[9]

The European Society of Urogenital Radiology (ESUR) recommends that physicians complete standardized questionnaires when requesting contrast-enhanced examinations to inform radiologists about potential risk factors.[6] This approach helps define the referring physician's role in the team by providing detailed pre-assessment information, enabling radiologists to prepare for acute reactions or take preventive measures for late-onset reactions. Although ESUR's recommendation promotes cognitive collaboration between team members, effective teamwork should also include motivational factors, such as a proactive willingness to engage in the process.[10,11]

İmamoğlu et al.[3] evaluated clinicians' motivation to collaborate with radiologists in managing CM side effects using the control preferences scale (CPS). A substantial proportion of referring physicians (70.5%) preferred a collaborative role in managing CM-related risk factors.

This study aimed to assess radiologists' tendency to collaborate with physicians in managing CM-related side effects using the CPS. The data obtained will help accurately determine radiologists' cognitive and/or motivational–emotional tendencies, facilitating effective role distribution in teams managing CM-related side effects.

Methods

This study was conducted between June 2021 and April 2022, following approval from the Ethics Committee at Erciyes University Medical Faculty Health Application and Research Center (date: 20.10.2021, decision/protocol no: 2021/701) and Kayseri City Hospital (date: 19.10.2021, decision/protocol no: 55). A total of 50 radiologists working in Kayseri were included. Written informed consent was obtained from each participant. Face-to-face interviews, lasting approximately 15 minutes each, were conducted by a single researcher in an isolated environment. Participants were informed of the study's purpose and scope before data on age, years of expertise, and gender were recorded. Subsequently, the modified CPS was administered.

Control preferences scale

The CPS was developed by Degner et al.[12] to evaluate "the level of control an individual wishes to assume when decisions about their medical treatment are made". Although originally designed for patients with life-threatening diseases, it is applicable to various decision-making processes related to treatment. The scale consists of five separate cards, each representing a different preference along a continuum from fully active (A) to fully passive (E). Each card displays a statement reflecting the level of control preference. Participants make pairwise comparisons between the cards to indicate their preference.

The results are presented as ordered permutations of the letters representing the five cards (e.g., CDBEA, ABCDE, or EDCBA). Only permutations that demonstrate the participant's understanding of the desired level of control are considered valid. For example, although "ABCDE" is a valid permutation, "AEBCD" is not, as it does not include two endpoints (A and E) among the most preferred roles. A list of acceptable CPS permutations is provided in Table 1.

The CPS used in this study was a modified version, with changes made to the introduction question and the statements describing control preferences. The introduction question was revised to the following: "What are your thoughts on sharing the responsibility of managing CM-related risk factors with referring physicians?" The control preference statements ranged from fully active (A) to fully passive (E) in managing risk factors. The statements and corresponding letters on the cards are provided in Table 2. The visual representations of the cards are shown in Figures 1-5.

Figure 1. (Card A) I would like to make decisions regarding the prevention of CM reactions. CM, contrast media.

Figure 2. (Card B) I would like to make decisions regarding the prevention of CM reactions but only after obtaining the physician's views. CM, contrast media.

Figure 3. (Card C) I believe that both the physician and I should share equal responsibility for decisions regarding the prevention of CM reactions. CM, contrast media.

Figure 4. (Card D) The physician should make decisions regarding the prevention of CM reactions but only after obtaining my views. CM, contrast media.

Figure 5. (Card E) The physician should make decisions regarding the prevention of CM reactions. CM, contrast media.

Table 1. Acceptable permutations in the control preferences scale

ABCDE	BCDAE	CDBEA	DECBA
BACDE	CBDAE	CDEBA	EDCBA
BCADE	CDBAE	DCEBA	

Table 2. Statements defining control preferences and corresponding letters on the cards

Letter	Statement
A	I would like to make decisions regarding the prevention of contrast media (CM) reactions.
B	I would like to make decisions regarding the prevention of CM reactions but only after receiving the physician's opinion.
C	I believe that both the physician and I should share equal responsibility in decisions regarding the prevention of CM reactions.
D	The physician should make the decisions regarding the prevention of CM reactions but only after receiving my opinion.
E	The physician should make all the decisions regarding the prevention of CM reactions.

Table 3. Results of the control preferences scale applied in our study

Role*	Count (n)	Percentage (%)
Active–Active (AB, BA)	6	13.6
Active–Collaborative (BC)	6	13.6
Collaborative–Active (CB)	2	4.5
Collaborative–Passive (CD)	8	18.2
Passive–Collaborative (DC)	3	6.8
Passive–Passive (DE, ED)	19	43.2
Total	**44**	**100**

*The meanings of the abbreviations and the definitions of the roles can be found in the "definition of preferences" subsection under the "materials and methods" section.

Definition of preferences

When classifying the results, the first two letters of the acceptable permutations were considered. Accordingly, preferences were classified as follows:

- AB or BA: "Active–Active role"
- BC: "Active–Collaborative role"
- CB: "Collaborative–Active role"
- CD: "Collaborative–Passive role"
- DC: "Passive–Collaborative role"
- DE or ED: "Passive–Passive role"

Statistical analysis

All statistical analyses were conducted using the SPSS software version 30.0 (IBM, Armonk, NY, USA). Descriptive statistics were performed on the role distribution obtained from the CPS classification. The Shapiro–Wilk test was used to assess the assumption of normal distribution. The Mann–Whitney U test was applied to compare control preferences across genders, with a significance level of $P < 0.05$. The Spearman or Kendall correlation test was performed to assess the relationship between age and preferred roles. A significance level of $P < 0.05$ was considered statistically significant.

Results

A total of 50 radiologists were interviewed (18 women, 32 men; age range 30–61 years). However, only 44 interviews were included in the analysis, as they met acceptable permutation criteria. Six interviews were excluded because they did not achieve valid combinations despite repeated attempts.

The results from the 44 interviews are summarized as follows (Table 3):

- Active–active role: 6 radiologists (13.6%)
- Collaborative role: 19 radiologists (43.2% total)

Among those inclined toward collaboration, six (13.6%) preferred an active–collaborative role, two (4.5%) preferred a collaborative–active role, eight (18.2%) preferred a collaborative–passive role, and three (6.8%) preferred a passive–collaborative role.

- Nineteen radiologists (43.2%) preferred a passive–passive role.
- In total, 25 radiologists (56.8%) preferred non-collaborative roles (either active–active or passive–passive).
- Among those who adopted a collaborative role, the most preferred role was collaborative–passive (18.2%). When considering both collaborative and non-collaborative roles, the most preferred role overall was passive–passive (43.2%).

The analysis indicated that men and women had similar preferences, with no statistically significant differences between genders regarding role preferences ($z = -0.433$, $P = 0.665$). Additionally, there was no statistically significant relationship between age and preferred roles ($P = 0.614$).

Discussion

With advancements in modern medicine, diagnostic methods have become increasingly diverse. Imaging techniques, driven by technological progress, have taken a leading role in this field. Despite improvements in diagnostic quality, the necessity for CM, a fundamental component of these techniques, has not diminished accordingly.

Like other drugs, CM is associated with side effects. Although the severity and frequency of side effects related to newer contrast agents are lower than those of earlier agents, the widespread use of imaging tools, the accelerated pace of imaging procedures, and the preference for defensive medicine have substantially increased public exposure to CM. Consequently, adverse effects have become more common. Serious side effects can compromise patient health, overshadow the primary illness, and necessitate changes in treatment. This leads to prolonged hospital stays, increased treatment costs, and diminished patient trust in both the treatment itself and healthcare professionals.

From a physician-focused perspective, the global increase in malpractice lawsuits is a well-documented phenomenon. Such potential negative scenarios may inevitably prompt physicians to practice defensive medicine, resulting in unnecessary investigations, time loss, increased workloads, and avoidable economic burdens on national healthcare systems.

To mitigate these risks, it is recommended that, prior to any imaging procedure, the indication for contrast-enhanced imaging be clearly established, the benefits and risks carefully weighed, and alternative imaging modalities that can provide comparable or superior diagnostic quality considered.[5] If contrast-enhanced imaging is deemed necessary, it must be ensured that the selected contrast agent is suitable for both the patient and the specific indication. The benefits of the imaging study should be balanced against potential adverse reactions to ensure an effective and accurate diagnosis. Additionally, healthcare providers must be prepared to manage any potential adverse reactions promptly.[5,6]

To address these issues, effective teamwork between radiologists and physicians is essential from a healthcare management perspective. As mentioned earlier, Kelly[1] emphasized that quality in healthcare is built on three principles: patient centeredness, continuous improvement, and teamwork. Salas et al.[2] define a "team" as "interdependent individuals assigned to accomplish a shared goal". Key elements of effective teamwork include goal setting, interpersonal communication, clear role differentiation, and problem-solving.[2,3] Kozlowski and Ilgen[10] classify the psychological processes necessary for achieving these goals into three categories: cognitive, emotional–motivational, and behavioral. Team members are expected to cognitively understand the team's tasks, be willing to emotionally and motivationally respond to these tasks, and exhibit the necessary behavioral changes.

If the goal is defined as the effective management of risk factors related to CM, the natural team members would include the

radiologist, physician, and patient. However, for the team to function effectively, active interpersonal communication and clearly defined roles are essential.

To facilitate this, the ACR provides pre-assessment criteria applicable to both radiologists and physicians during any diagnostic process. Adequate patient evaluation and effective communication between the radiologist and the referring physician are critical before administering CM.[5] According to Bettman[7], radiologists should calculate creatinine clearance and determine whether the diagnosis can be established using an alternative imaging method that does not require CM. The RCR states that the ultimate responsibility for CM administration lies with the prescribing physician. However, the injection itself may be delegated to a practitioner in accordance with local rules and protocols. Additionally, a patient's clinical history should ideally be available at the time of the imaging request, and the radiology department must verify this information before administering contrast agents.[8]

The CM Safety Committee of the Japan Radiological Society conducted a questionnaire-based survey among radiologists on the use and safety of iodinated and gadolinium CM. The majority of respondents selected answers that indicated an active role in CM safety. However, some participants chose the "others" option, which included responses such as "at the discretion of the referring physician" or "under the direct supervision of the referring physician." The percentage of responses falling under the "others" category varied between 10.6% and 19.8%, depending on the survey questions.[9] The primary aim of this study was to support practitioners in clinical practice. Therefore, it can be inferred that the survey responses reflect the participants' level of knowledge and practical approach rather than their role preferences.

In this context, the ESUR recommends that physicians requesting contrast-enhanced examinations complete standardized questionnaires to inform radiologists about potential risk factors.[6] According to this recommendation, the role of physicians in the team is to identify risk factors and communicate them to radiologists. This approach enables radiologists to prepare for acute reactions during imaging procedures or take preventive measures against delayed reactions.

However, it is important to recognize that effective teamwork consists not only of cognitive collaboration but also of emotional and motivational engagement.[10] This raises a critical question: Is the cognitive communication between physicians and radiologists adequately supported by emotional and motivational factors?

In this study, the inclination of radiologists in Kayseri to collaborate with physicians in managing CM side effects was investigated. The researcher conducting the interviews did not provide explanations to physicians regarding problem-solving strategies or role definitions. Thus, the adoption of a collaborative role may suggest that radiologists are willing to respond to team-building objectives not only cognitively but also emotionally and motivationally.

The proportion of radiologists who preferred one of the active roles in this study was 31.7%. Several questions arise if radiologists were to assume a more active role:

- Would a separate patient examination room be established for radiologists?
- What methods would be used to identify risk factors? Are there internal guidelines for sharing risk factors with physicians? What is the potential for physician collaboration in creating these guidelines?
- Although acute reactions might be considered the radiologist's responsibility, how would physicians handle unpredictable subacute and chronic reactions?
- Legally, who is responsible for failing to identify risk factors?
- Currently, there are no definitive answers to these questions. In another study using the same method but focusing on physicians, 56.8% preferred one of the active roles.[3]

In general, considering the collaborative attitude without distinguishing subcategories, the percentage of radiologists adopting a collaborative stance was 43.2%. Among those who preferred a collaborative role, the proportion of passive–collaborative radiologists (those prioritizing passivity over collaboration) was 1.5–2 times lower than that of collaborative–passive radiologists (those prioritizing collaboration over passivity). This finding suggests an inherent inclination toward collaboration. On the other hand, İmamoğlu et al.[3] reported that 70.5% of physicians adopted a collaborative attitude.

We infer that radiologists and physicians who favor a collaborative role exhibit both emotional–motivational willingness and cognitive understanding to engage in team formation and teamwork. This group is likely aware of the positive outcomes of teamwork and is inclined to support future studies that could drive advancements in this field.

In this study, a tendency toward adopting a passive attitude among radiologists was observed (68.2%). Notably, a substantial proportion of radiologists (43.2%) preferred to take a completely passive role (as seen in the last row of the table, the passive–passive role). In a previous study, physicians showed a tendency toward adopting a passive attitude at a rate of 43%, with 15.6% preferring to take a completely passive role.[3] Comparing the findings, it is evident that radiologists tend to adopt a passive attitude more frequently than physicians (68.2% vs. 43%).

The predominance of the passive role among radiologists in this study could have several explanations, including the following:

- **Lack of direct patient interaction:** Radiologists do not interact directly with patients, which may lead to limited awareness of clinical and laboratory parameters unless physicians provide this information. As a result, there may be insufficient knowledge of the risk factors needed for managing CM.
- **Excessive workload:** The high volume of daily imaging reports in many healthcare centers makes direct patient interaction challenging.
- **Physical separation of reporting and imaging rooms:** In many healthcare facilities, imaging rooms are located far from reporting rooms, making it difficult to respond promptly to acute reactions.
- **Increasing malpractice cases:** The rising number of malpractice lawsuits has a demotivating effect on radiologists, reducing their willingness to assume additional responsibilities.

Therefore, we believe the preference for passive roles among radiologists is less about a lack of team-building awareness or emotional/motivational deficits and more about the limitations of the current medical service system and infrastructure.

This study has several limitations. It is single-centered, conducted solely among radiologists working in our region, and has a relatively small sample size. Broader, multi-centered studies are necessary to gain a more comprehensive understanding of preferences that align with national or international approaches.

In conclusion, a considerable number of radiologists who favor a collaborative role are likely aware of the positive outcomes of teamwork and demonstrate a willingness to contribute to future studies that could guide this domain. This group exhibits emotional–motivational willingness and cognitive understanding to engage in team formation and teamwork. Radiologists tend to adopt a more passive role than physicians in managing CM reactions. The preference for passive roles among radiologists appears to be driven less by a lack of team-building awareness or emotional/motivational deficits and more by the limitations of the current medical service system and infrastructure. These findings should not be perceived as a negative factor in team building but rather as data points for healthcare administrators and medical-legal professionals to implement necessary institutional regulations. This is particularly important because practices for managing CM reactions are not yet fully institutionalized worldwide. We hope that data obtained from future studies using reliable methodologies—such as the CPS employed in this study—will provide a foundation for developing standardized practices in this field.

Footnotes

Conflict of interest disclosure

The authors declared no conflicts of interest.

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