Chart-stimulated Recall as a Learning Tool for Improving Radiology Residents' Reports

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Abbreviations

BRRAT
Bristol Radiology Report Assessment Tool

CSR
chart-stimulated recall

CG
control group

IG
intervention group

WPBA
workplace-based assessment

Rationale and Objectives: Workplace-based assessments gauge the highest tier of clinical competence. Chart-stimulated recall (CSR) is a workplace-based assessment method that complements chart audit with an interview based on the residents' notes. It allows evaluation of the residents' knowledge and heuristics while providing opportunities for feedback and self-reflection. We evaluated the utility of CSR for improving the radiology residents' reporting skills.

Materials and Methods: Residents in each year of training were randomly assigned to an intervention group ($n = 12$) or a control group ($n = 13$). Five pre-intervention and five post-intervention reports of each resident were independently evaluated by three blinded reviewers using a modified Bristol Radiology Report Assessment Tool. The study intervention comprised a CSR interview tailored to each individual resident's learning needs based on the pre-intervention assessment. The CSR process focused on the clinical relevance of the radiology reports. Student's t test ($P < .05$) was used to compare pre- and post-intervention scores of each group.

Results: A total of 125 pre-intervention and 125 post-intervention reports were evaluated (total 750 assessments). The Cronbach's alpha for the study tool was 0.865. A significant improvement was seen in the cumulative 19-item score (66% versus 73%, $P < .001$) and the global rating score (59% versus 72%, $P < .001$) of the intervention group after the CSR. The reports of the control group did not demonstrate any significant improvement.

Conclusion: CSR is a feasible workplace-based assessment method for improving reporting skills of the radiology residents.

Key Words: Workplace-based assessment; chart-stimulated recall; radiology reports; educational assessment; Bristol Radiology Report Assessment Tool.

INTRODUCTION

Over the last two decades, there has been a progressive shift toward outcome-orientated medical education (1). Assessment plays an essential role in identifying the residents' learning needs and guiding their learning efforts (2). The type and the frequency of assessment should match the objectives of the training program. Workplace-based assessment (WPBA) gauges the real-life practices of the residents, which represent the highest tier of clinical competence (3,4). A number of WPBA methods have been developed including Mini-Clinical Evaluation Exercise, Direct Observation of Procedural Skills, chart audits, and chart-stimulated recall (CSR) (5).

Chart audits have been recommended by the Accreditation Council for Graduate Medical Education as part of the practice-based learning to improve the patients' care (6). The patient's chart is an excellent source of information about the residents' clinical practices. However, the residents' heuristics have to be deduced during a chart audit. According to one estimate, chart audits are only 70% specific when compared to the quality of care assessments by the standardized patients (7).

Chart audit complemented by an interview based on the residents' notes is known as CSR. This process enables the faculty to assess the residents' knowledge, to discuss cognitive processes contributing to their clinical decisions, and to

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provide structured feedback (8). It also allows the residents to self-reflect. CSR is a learning and teaching tool (9).

Radiology reports are similar to clinical notes written by other physicians. The radiologist integrates clinical information with imaging findings and draws conclusions relevant to the patient care. Approximately 86% of the radiology residency programs dedicate 1 hour or less each year to didactic teaching of reporting skills (10). The radiology residents usually learn to dictate reports through apprenticeship and adopt the reporting styles of their senior colleagues. However, this method lacks standardization and may cause conflict in educating the residents (10). We aim to explore if CSR, a structured process, can be used to improve the reporting skills of the radiology residents.

MATERIALS AND METHODS

A prospective study was conducted from June 2015 to August 2015 at a residency program based at a tertiary care hospital with multiple satellite facilities. Pre- and post-intervention evaluations were performed on an intervention group (IG) and a control group (CG). The study was approved by the institutional Ethics Review Committee. Informed consent was obtained from all participants.

Study Tool

A focus group, comprising eight faculty members from the department of Radiology and one from the department of Medical Education, reviewed the literature regarding the Bristol Radiology Report Assessment Tool (BRRAT) (11). A modified BRRAT with a wider 5-point Likert-type scale (1 = poor, 2 = below expectation, 3 = meets expectation or not applicable, 4 = above expectation, and 5 = excellent) was developed to better differentiate the residents' performances (12,13).

A pilot assessment of 15 radiology reports by two faculty members using the modified BRRAT demonstrated satisfactory inter- and intra-observer correlation (intraclass correlation: 0.8, Cronbach's alpha: 0.7). The focus group also recommended focusing on items number 12 (Does the report answer the clinical question?) and number 17 (Does the report add clinical value to patient management?) to prioritize clinical relevance.

Study Participants

All current radiology residents at the time of the study were eligible for participation. A stratified random sampling technique was used. Residents in each year of training were randomly assigned to an IG or a CG.

Three radiology faculty members, each with more than 5 years of teaching experience, served as evaluators. The evaluators discussed the modified BRRAT together at the start of the study to attain similar understanding of the study tool.

Radiology Reports

Standard dictation templates are used throughout the department for reporting cross-sectional imaging studies. Plain radiographs are reported without templates. Preliminary reports of plain radiographs, which had not been reviewed by the faculty, were used for the study because they reflect each individual resident's own vocabulary and judgment.

Five reports of each resident were randomly selected before and after the intervention using the radiology information system. The reports were coded, de-identified, and sent for independent blinded review by all three evaluators.

Intervention

Pre-intervention evaluations of the IG were jointly reviewed by the evaluators to tailor the CSR interviews to each resident's learning needs. The interview was a two-way process encouraging residents to think, reflect, and solve clinical problems (9). Cognitive theory of learning was applied to build new information on the existing knowledge (14). The following is an example of the CSR dialogue:

Faculty: *The clinical history is shortness of breath. What should the clinician understand if your conclusion is "hilar vascular congestion?" What steps should the clinician take based on your conclusion?*
Resident*: I was implying that the patient has inflammation, possibly infection.*
Faculty*: Let's discuss the findings on a chest radiograph associated with infection and how can we clearly communicate these findings to the referring physician.*

Each CSR interview required approximately 20 minutes. The intervention was done over a period of 2 weeks.

Data Entry and Analysis

Data were entered into Microsoft Excel (Microsoft Corporation, Redmond, WA) and then exported to SPSS Statistics 20 (IBM Corp., Armonk, NY) for analyses. All scores were converted to percentages to allow meaningful comparisons among different sections of the study tool. The pre-intervention and post-intervention scores of IG and CG were compared using two-tailed Student's t test. Pearson correlation coefficient was computed to assess the relation between the IG residents' level of training and the difference in mean pre- and post-intervention scores; $P < .05$ was considered significant for all statistical analyses.

RESULTS

A total of 26 residents enrolled in the study (IG: $n = 13$, CG: $n = 13$). One third-year resident dropped out from the IG because of personal reasons. The distribution of the IG and CG residents according to the year of training is shown in Table 1.

The Cronbach alpha for the 19-item modified BRRAT was 0.865. The sum of the 19 items and the global assessment score were significantly correlated (Pearson correlation coefficient: 0.877, $P < .001$). There was a significant improvement in the post-intervention scores of the IG. The largest improvement was documented in the items pertaining to clinical relevance of the radiology report (items number 12 and 17), which were preselected for increased emphasis during the CSR. No significant improvement was observed in the scores of the CG. The pre-intervention and post-intervention scores of the IG and CG are shown in Table 2.

Further analysis of the IG demonstrated that residents in earlier years of training had greater improvement in the cumulative 19-item score (r: −0.551, $P = .336$) as well as the global rating score (r: −0.814, $P = .093$) after the CSR.

DISCUSSION

Effective communication of diagnostic findings is as important as their identification. Graduating radiology residents should be able to write a succinct, accurate, clear, and confident report. The BRRAT assesses the stylistic quality of the radiology report; the style and content of the report reflects the diagnostic abilities, clinical reasoning, and non-interpretative skills of the radiologist (11).

TABLE 1. Distribution of Residents in the Intervention and Control Groups According to the Year of Training

Year	Intervention Group	Control Group	Total
R1	3	2	5
R2	3	3	6
R3	1	3	4
R4	4	4	8
R5	1	1	2
Total	12	13	25

Variability in the radiologists' reporting style is almost ubiquitous (15). In the present study, all three assessors reviewed the modified BRRAT together at the start of the study to gain a similar understanding. Both the internal consistency and the inter-rater agreement of the study tool were similar to those of the original BRRAT (11). Some authors have suggested that assessment of 12–13 cases by multiple evaluators is required to achieve adequate reliability and generalizability (11,16,17). The high reliability coefficient observed in the current study, despite three evaluators and 10 cases per resident, is likely attributable to predefining the attributes of a good radiology report.

CSR was associated with a significant improvement in the residents' reporting skills. Didactic lectures and objective structured clinical examinations can also positively impact this competence (15,18). WPBA and objective structured clinical examinations have similar reliability, validity, feasibility, and acceptability (1). The main strength of CSR is the structured and specific feedback coupled with the assessment (9). Systematic, specific, and constructive feedback motivates learners to appreciate the right practice and is fundamental to effective clinical learning (19,20).

The CSR interview helps the faculty to understand the resident's clinical reasoning abilities in addition to his or her medical knowledge. The faculty and the resident discuss other possibilities that the resident had considered and the reasons they were omitted. Discussions among the experts and the learners lead to mutual learning and closer conceptual constructs (14). Although multiple such opportunities exist during the daily staff-out sessions, CSR provides an organized mechanism combining feedback, dialogue, and self-reflection to improve residents' clinical practices (9,14).

CSR can also be used to discuss "situated cognition"—environmental elements other than knowledge and clinical presentation affecting the clinical decision (21,22). Such factors include volume of studies and call hours. Residents indicated that when pressed for time, they tended to repeat the findings in the conclusion instead of formulating a clinically

TABLE 2. Comparison of Pre- and Post-intervention Scores of the Intervention Group and the Control Group (11)†

	Intervention Group			Control Group		
	Pre-intervention	Post-intervention		Pre-intervention	Post-intervention	
	Mean (SD)	Mean (SD)	*P*	Mean (SD)	Mean (SD)	*P*
Item 12*	66.8 (22.19)	78.9 (13.98)	.000	65.2 (18.70)	61.8 (20.43)	.089
Item 17*	67.8 (18.72)	80.7 (12.13)	.000	64.9 (15.87)	60.3 (17.87)	.007
Technical aspects	68.0 (8.54)	72.2 (6.20)	.000	65.1 (6.90)	64.2 (6.65)	.214
Clarity and structure	49.8 (8.00)	54.6 (6.68)	.000	49.0 (8.03)	46.8 (7.87)	.006
Conclusion	62.3 (10.01)	68.3 (8.35)	.000	61.3 (10.04)	58.5 (9.83)	.006
Consideration of clinical implications	61.4 (6.63)	64.9 (4.18)	.000	59.6 (6.18)	58.1 (6.11)	.016
Total score (items 1–19)	66.2 (8.10)	72.6 (5.07)	.000	63.4 (7.18)	62.2 (6.75)	.096
Global rating score	59.3 (14.22)	71.7 (11.23)	.000	56.8 (14.01)	54.3 (13.38)	.080

* Item 12: Does the report answer the clinical question? Item 17: Does the report add clinical value to patient management? (11).

† Two-tailed Student *t* test for difference between pre- and post-intervention scores of the respective group.

relevant summary statement. When given the opportunity to re-evaluate the case during the CSR interview, every resident was able to provide a clinically relevant impression.

CSR tends to be more resource-intensive than conventional methods of assessment (9). In the present study, approximately 5 minutes were needed to assess report of a radiograph using the modified BRRAT; reports of cross-sectional imaging will likely require more time. Assessment of one report per resident can be easily incorporated into the daily clinical routine. Approximately 20 minutes were required for conducting the CSR interview. This is similar to a prior study where two-thirds of CSR discussions required less than 20 minutes (16). CSR can be used for the mid-rotation assessment and feedback. This WPBA methodology is especially feasible for the curricula, with frequent case discussions among the residents and the faculty (16). The results of the current study also suggest that residents in earlier years of training may benefit more from this learning strategy.

A limitation of the study is the small number of evaluators. Greater variability may be seen in radiology residency programs with a large faculty component. Variations inherent to the preferences of the radiologist and the referring physician shape the radiology reports (23). However, a progressive shift toward standardized radiology reports (10) will likely diminish the impact of this limitation.

CONCLUSION

CSR is a feasible and structured WPBA method for improving reporting skills of the radiology residents.

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