Using Peers to Assess Handoffs: A Pilot Study

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BACKGROUND: Handoffs among post-graduate year 1 (PGY1) trainees occur with high frequency. Peer assessment of handoff competence would add a new perspective on how well the handoff information helped them to provide optimal patient care.

OBJECTIVE: The goals of this study were to test the feasibility of the approach of an instrument for peer assessment of handoffs by meeting criteria of being able to use technology to capture evaluations in real time, exhibiting strong psychometric properties, and having high PGY1 satisfaction scores.

DESIGN: An iPad® application was built for a seven-item handoff instrument. Over a two-month period, post-call PGY1s completed assessments of three co-PGY1s from whom they received handoffs the prior evening.

PARTICIPANTS: Internal Medicine PGY1s at the University of Pennsylvania.

MAIN MEASURES: ANOVA was used to explore inter-person score differences (validity). Generalizability analyses provided estimates of score precision (reproducibility). PGY1s completed satisfaction surveys about the process.

KEY RESULTS: Sixty-two PGY1s (100 %) participated in the study. 59 % of the targeted evaluations were completed. The major limitations were network connectivity and inability to find the post-call trainee. PGY1 scores on the single item of “overall competency” ranged from 4 to 9 with a mean of 7.31 (SD 1.09). Generalizability coefficients approached 0.60 for 10 evaluations per PGY1 for a single rotation and 12 evaluations per PGY1 across multiple rotations. The majority of PGY1s believed that they could adequately assess handoff competence and that the peer assessment process was valuable (70 and 77 %, respectively).

CONCLUSION: Psychometric properties of an instrument for peer assessment of handoffs are encouraging. Obtaining 10 or 12 evaluations per PGY1 allowed for reliable assessment of handoff skills. Peer evaluations of handoffs using mobile technology were feasible, and were well received by PGY1s.

INTRODUCTION

Communication breakdowns commonly occur during handoffs (transitions of patient care from one physician to another) in hospitals and can lead to preventable adverse events.¹ In response, regulatory and national patient safety organizations have called for the development and implementation of a standardized approach to handoffs.² In response to increasing handoffs secondary to duty hour reform,³ the Institute of Medicine Committee Report on Graduate Medical Education and Work Hours called for training in handoffs for all housestaff,⁴ and in 2011 this expectation was incorporated into the common program requirements of the Accreditation Council of Graduate Medical Education (ACGME).⁵ Best handoff communication practices have been published^{6,7} and medical educators are developing innovative curricula to teach and evaluate handoff skills.^{6,8–14}

The ability to capture handoff errors is limited by common barriers to safety reporting.^{15,16} Additionally, since post-graduate year 1 (PGY1) trainees and post-graduate year 2–3 (PGY2-3) trainees typically handoff or “sign-out” to their peers, traditional evaluations by supervisors may be inadequate for assessing handoff skills. A peer who is cross-covering patients, relying on the verbal and written handoff information to make clinical decisions, may be ideally positioned to evaluate handoff practices as they actually use information from the handoff to care for patients overnight. These observations led us to consider peer evaluations as a novel method for handoff evaluation. Peer evaluations are obtained from individuals at the same level of training. These evaluations have been shown to correlate with those of supervising physicians and written examination scores.¹⁷ They have also been shown to influence trainees’ outlook on professionalism and have been rated as helpful by housestaff.¹⁸ Their use, however, is not well studied in other domains, such as handoffs.

Evaluations obtained in real time can improve the evaluation process. Assessing PGY1s in real time significantly increases the numbers of evaluations likely to be collected. For example, if taking call every fourth night for 2 weeks, a PGY1 could potentially sign-out 11 of the 14 nights and potentially be evaluated 11 times. If the evaluation was saved for the end of the rotation, the

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PGY1 would only receive an aggregate retrospective and global assessment of these 11 events in the form of one evaluation. Therefore, we were interested in implementing technologies that would aid in real time data collection. The iPad® has been used successfully in the clinical setting to obtain evaluations of housestaff.¹⁹ The technology allows for evaluations to be electronically collected, thereby eliminating the need for manual entry of information.²⁰ In addition, the platform allows multiple evaluations to be compiled and presented to a PGY1 in real-time since the trainee (or program leadership) could immediately access any collected information.

This study aimed to test the feasibility of the peer assessment of handoffs, by: 1) determining the practicability of using technology to capture these evaluations in real time; 2) estimating inter-person score differences (validity) and score precision (reproducibility) of a newly developed handoff assessment instrument using peers as evaluators; and 3) assessing PGY1 satisfaction with the peer evaluation process.

METHODS

This is a prospective study of peer evaluations of handoffs obtained electronically using an iPad® application. Approval was obtained from the Institutional Review Board of the Perelman School of Medicine at the University of Pennsylvania.

Participants and Setting

All 62 medicine PGY1s (categorical, preliminary, primary care, and medicine/pediatrics) consented to study participation. This study occurred on four medicine services at the primary training site for our internal medicine residency program. Five medicine PGY1s were on call each night covering General Medicine, Liquid Oncology and Solid Oncology (one PGY1 each) and the Gastroenterology/Pulmonary Medicine services (two PGY1s). PGY1s typically worked in teams of four, where three signed out to the PGY1 on-call for each service.

Handoff Training

Formal handoff training was included in the residency curriculum in 2009. Prior to study commencement, all PGY1s received 2 h of formal training in handoffs during orientation. This included a lecture on best handoff practices, a review of written sign-out recommendations, a simulation practicing giving and/or receiving a handoff, and small-group facilitated discussions that incorporated feedback on the simulations.

Development of the Peer Evaluation Instrument

The development of the instrument for peer evaluation of handoffs was informed by reviewing published handoff best practices^{7,8,21} and handoff assessment instruments^{22,23} as well as the six ACGME core competencies, particularly those requiring peer evaluations (communication, professionalism and systems-based practice)⁹ for internal medicine residency programs. The institution's patient safety experts, residency program leadership and housestaff reviewed the instrument for content validity. Housestaff reviewed the instrument to ensure it captured potential on-call observations. The resultant instrument had seven items including an overall handoff quality item (Table 1). Item responses used a visual nine star system in which respondents could click on the star that coincided with their ratings; the end and middle points of the horizontal row of stars were labeled with the anchors shown in Table 1. An iPad application was created using the developed instrument.

Data Collection

For 61 days, beginning in August of 2010, a research assistant approached PGY1s who had just completed a full night of call on each of the included services and asked them to complete iPad® evaluations of the three co-PGY1s who provided handoffs to them the prior evening. PGY1s were orientated to the peer evaluation process prior to each rotation by the research assistant who explained the assessment tool and iPad® application.

Data Analysis – Practicability of Using Technology

The iPad® application allowed users to enter evaluations only while connected to the hospital's wireless internet, and the evaluations were erased from the device as soon as they were uploaded. The practicability of using the iPad® was determined by the percentage of intended evaluations that were completed, loss of completed evaluations, ease in tracking down PGY1s, any difficulty with the use of the application itself and time to complete an evaluation.

Data Analysis – Estimation of Psychometric Properties

As a preliminary assessment of validity, mean scores for each of the seven items were compared among evaluators. Generalizability analyses were performed using an (evaluator: PGY1) x item model to represent a single rotation. An evaluator x PGY1 x item model was used to represent

Table 1. Instrument for Peer Assessment of Inpatient Handoffs

	Low Unsatisfactory			Satisfactory			High Superior		
	1	2	3	4	5	6	7	8	9
Written content	Incomplete written content; “to do’s” omitted or not prioritized. Necessary patient information missing.			Fairly complete written content. May be missing some required information relevant to patient care.			Written content is complete and clear with attention to key cross cover details and prioritization.		
Plan of action	“To Do’s” requested with no rationale or plan, or with inadequate preparation (i.e. request to transfuse but consent not obtained).			“To Do’s” requested with partial rationale or plan.			“To Do’s” accompanied by clear plan of action and rationale. Necessary preparation already completed.		
Verbal sign-out	Discusses too little or too much information without paying attention to key/ relevant patient details.			Discusses adequate amount of patient information. May omit some relevant details.			Focuses on key patient information and provides clear explanation of required cross cover tasks and potential issues.		
Updated content	Content often not updated or irrelevant information included. Written sign-out with too little/too much information.			Content fairly up to date with minimal irrelevant information.			Content complete and necessary amount of information included.		
Anticipatory guidance	No anticipatory information provided (i.e. If/Then) or expectation of what may happen. Fails to notify covering physician of potential issues which may arise overnight.			Some anticipatory information provided. May not inform covering physician of issues that might arise.			Anticipatory information provided with clear rationale for plan to be executed. Informs covering physician of potential issues which may arise.		
Collegiality	Frequently signs out early in the day with multiple patient tasks/procedures which require follow-up. Inappropriately leaves active patients.			Generally signs out at an appropriate time with few episodes of incomplete work left to do.			Signs out when foreseeable work is complete. Patients “tucked” away.		
Overall competency									
Additional comments									

multiple rotations. Simulated D studies, which provide theoretical statistics on how the score precision would change if items or evaluators were added or deleted, estimated optimal numbers of items and evaluators. Cronbach's alpha and correlations between the total scores (sum of the 7 specific items) and the single item of "overall competency" were calculated.

Data Analysis – PGY1 Satisfaction

To assess satisfaction with the peer evaluation process, each PGY1 was asked to complete a nine item survey immediately before their individual mid-year meeting with the program leadership. Questions related to the peer evaluation process itself (e.g., "I believe that PGY1s can reliably evaluate each other on handoff skills" or "I find it valuable to receive handoff evaluations from my peers") and whether to continue the peer evaluation for future PGY1s were rated on a 5-point Likert scale, with 1 representing "strongly disagree" and 5 representing "strongly agree". PGY1s were also asked to choose the "co-PGY1", "PGY2-3" and/or "attending" in response to the question: "Who do you believe should evaluate PGY1s on handoff performance in future years?"

RESULTS

538 of 915 (59 %) possible evaluations were completed. At first, approximately 10 % of the completed evaluations were lost due to inability to connect to the hospital's network. The application was subsequently adjusted so that in that occurrence, the evaluation would be stored on the device until it was possible to connect to the internet. Subsequently, no completed evaluations were lost. The major difficulty was finding the post-call PGY1 and explains the remainder of the incomplete evaluations. The research assistant found that PGY1s were most receptive to completing the evaluations either right before or after signing out on the post-call day, which improved compliance. Early morning prior to rounding was the most difficult time. PGY1s were evaluated a mean of 8.7 times (SD 4.2, range 1–23). PGY1s found the application was easy to use. Completing the evaluation for the first time was most time consuming and could take 3–5 min. Once the PGY1s were familiar with the items, the evaluation could be completed within 1 min.

Fifty-seven of the PGY1s evaluated at least some of the sixty-two PGY1s, resulting in 345 different pairs of rater and PGY1 evaluations. To summarize the performance

across all evaluations completed, PGY1 scores on the “overall competency” item ranged from 4 to 9 with a mean of 7.31 (SD 1.09). The written content and updated information items received lower mean scores, while collegiality received the highest mean score (Table 2).

Mean scores for each item were compared among PGY1 evaluators. We expected to observe a wide range in within-person averages and within-person standard deviations, suggesting evaluators were assigning scores in meaningful ways. Within a PGY1, average ratings of peers had a minimum score of 4.95, a median score of 7.34 and a maximum score of 8.84 with the standard deviation within individual raters ranging from 0.28 to 1.91. Obtaining 10 or 24 evaluations using the seven-item instrument would yield a reproducibility coefficient of 0.59 and 0.78, respectively, using the nested within-single-rotation model (Table 3). If evaluations were being obtained within a single rotation, at least 10 peer evaluations should be obtained per PGY1 to assess his or her handoff skills. If using the instrument across multiple rotations, a coefficient of 0.60 or higher would not be reached until at least 12 evaluations were obtained for each PGY1. To obtain a coefficient of 0.80 or higher, at least 24 evaluations would be needed. The variance components for PGY1s, items and raters were 0.12, 0.11 and 0.71, respectively. Simulated D studies showed that changing the number of instrument items to 3, 5 or 10 did not appreciably change these results (data not shown). Cronbach’s alpha and Pearson correlations between the total scores (sum of scores for the six specific items) and the “overall competency” item were 0.91 and 0.89.

The satisfaction survey was completed by 43 of the 62 PGY1s (73 %). The majority of PGY1s responded favorably to “I believe that PGY1s can reliably evaluate each other on handoff skills”, and, “I find it valuable to receive handoff evaluations from my peers” with 77 % and 70 % rating these items as a 4 or 5, respectively. In fact, 84 % believed that a co-PGY1 was best able to evaluate handoff skills, while 16 % thought a PGY2-3 would be best. However, 23 % indicated that the PGY2-3 may be helpful in evaluating the PGY1 in addition to the co-PGY1. No PGY1 believed that their attending was the best person to evaluate their handoffs. Most PGY1s (74 %) recom-

mended continuing peer handoff evaluations in the future. A minority (19 %) commented that completing evaluations after an overnight call was difficult given the other competing clinical responsibilities. Two respondents specifically commented that evaluating the handoff immediately following the handoff, as opposed to the next morning, may be more feasible.

DISCUSSION

In this current study of implementing an iPad® application for the peer evaluation of inpatient handoffs, 59 % of the solicited evaluations were received. When comparing mean scores received by individual PGY1s across evaluations, a range of scores was observed, suggesting that the instrument allowed raters to report differences in handoff quality. The psychometric properties of the instrument used in this study are promising. Obtaining 10 to 12 evaluations provides enough precision for feedback, while it would take 24 evaluations per PGY1 within or across several rotations for a high-reproducibility coefficient sufficient for high-stakes decisions. Given the increased frequency of cross-coverage with new duty hour regulations, obtaining 24 evaluations per PGY1 can be accomplished quickly. Furthermore, the results of the D study demonstrated that reducing the number of items did not significantly change the score precision. The total average score on the 7-item instrument correlated with the single item assessing “overall competency,” so this single item could be used for a quick assessment of PGY1 handoff skills. However, the overall instrument was specifically designed to meet all of the peer evaluation requirements for internal medicine residency programs. PGY1s rated the peer handoff evaluation process highly and felt that PGY1s were best suited to evaluate handoffs.

Strategies to teach and assess handoffs among physicians have increased in the last decade. The goal of this study was to test an instrument used for evaluation, which, in the future, could be used to provide feedback to individual trainees. Feedback has been shown to be effective in many aspects of medical education²⁴ and has recently been used as a teaching strategy in handoff education^{23,25} and has been shown to improve handoff skills.^{14,22} By evaluating handoff practices in real time, the possibility for immediate and timely feedback arises, which has been shown to be more effective than delayed feedback.^{26,27} Most feedback is typically provided to trainees by their supervisors – PGY2-3s and attending physicians. Peers—those at the same level of training—can also provide feedback.¹⁷ This is the first study to describe the psychometric properties of a peer evaluation instrument as an assessment strategy for handoffs and to start evaluating the feasibility of implementing peer handoff evaluations in a large residency program.

Table 2. Mean Scores for Each Item on the Instrument for the Peer Assessment of Handoffs. N = 538 Evaluations

Item	Mean Score on Item Level (SD)	Range of PGY1 Level Mean Score
Written content	7.07 (1.17)	5.00 to 9.00
Plan of action	7.10 (1.30)	5.33 to 9.00
Verbal sign-out	7.20 (1.35)	5.83 to 9.00
Updated content	7.07 (1.19)	5.67 to 9.00
Anticipatory guidance	7.17 (1.37)	5.67 to 9.00
Collegiality	8.05 (1.07)	7.00 to 9.00
Overall competency	7.31 (1.09)	6.00 to 9.00

Table 3. Simulated D Studies Using a Nested Model to Represent a Single Rotation: (Rater: PGY1) x Item and Using a Crossed Model to Represent Multiple Rotations: Rater x PGY1 x Item

Nested model (evaluating within a single rotation)										
Items	7	7	7	7	7	7	7	7	7	7
Evaluators	3	5	10	12	14	16	18	20	22	24
Standard error	0.53	0.42	0.31	0.29	0.27	0.26	0.24	0.24	0.23	0.22
Coefficient	0.30	0.42	0.59	0.64	0.67	0.70	0.72	0.74	0.76	0.78
Crossed model (evaluating across multiple rotations)										
Items	7	7	7	7	7	7	7	7	7	7
Evaluators	3	5	10	12	14	16	18	20	22	24
Standard error	0.31	0.54	0.42	0.31	0.29	0.27	0.26	0.25	0.24	0.23
Coefficient	0.63	0.34	0.46	0.63	0.67	0.71	0.73	0.76	0.77	0.79

Peer evaluations add a new dimension to handoff assessment strategies. Much of the current handoff education literature has focused on observations of a verbal handoff or grading a written or electronic handoff.^{14,22,23,25} While this approach can help ensure that certain elements are consistently handed off (e.g., which patients are sick and need closer attention), the peer evaluation adds a new and important perspective, that of the receiving PGY1, who can assess how well the handoff information helped them to provide optimal patient care. Notably, the overwhelming majority of PGY1s believed a co-PGY1 was best able to evaluate their handoff skills.

The feasibility of incorporating this assessment strategy into residency education must be considered. In this study, a research assistant obtained evaluations. Although each evaluation only took 1 min to complete, the research assistant usually spent 15 to 20 min arranging to meet a PGY1 and occasionally had to come back several times if the PGY1 was busy. Residency programs wishing to adopt this model would need to identify someone to distribute and gather the iPad® evaluations. Alternatively, an investment in mobile technology could be made or a strategy of using PGY1s' personal smartphones could be employed so that PGY1s could complete the evaluations independently. Other options include placing the instrument on a web-based platform for use by PGY1s or distributing paper assessments. The development of web-based instruments is easier from a technology perspective and would eliminate the need to find PGY1s. However, PGY1s would still need to be reminded to complete evaluations. This was a pilot study to test whether peer evaluations would be possible. Moving forward, different strategies to obtain these evaluations will need to be assessed so that this type of evaluation can be conducted across residency programs outside of the research setting.

There are several limitations to this study. First, it was performed at a single institution. Second, at our institution, PGY1s participate in formal training on handoffs at the beginning of the year. Feedback from our PGY1s suggests that it does not have lasting effects but this could have affected our findings. However, without handoff training, variations across PGY1s may be even greater. Third, only

59 % of planned evaluations were captured, and the major barriers to evaluation completion were network connectivity and inability to find the post-call PGY1. Although most hospital networks cannot provide connectivity for wireless devices 100 % of the time, we believe the efficiency benefit of collecting the primary data electronically outweighs the percentage of lost evaluations. In this study, PGY1s indicated that the time immediately after an overnight shift was most ideal to assess handoffs from the previous night because many handoff communication failures are noted hours after the original handoff.²⁸ In actuality, this proved to be a difficult time given the PGY1s' competing clinical demands. With the new duty hour requirements, obtaining the evaluation following a cross cover period may be more feasible as PGY1s typically leave following their shift rather than continue to work on post-call patient care.

The final limitation is that this pilot study did not compare PGY1 evaluations to those of PGY2-3s and faculty observing the same handoff. At the time of the study, PGY2-3s and faculty were not evaluating handoffs, and given the previously stated advantages of peer evaluation, we opted to start with PGY1 evaluations. The instrument will be expanded to include PGY2-3s and attendings and such a comparison can be made in the future. However, PGY1s will likely have different observations than PGY2-3s and attending physicians because they actually used the handoff information to care for patients. Thus, disagreements between supervisor and PGY1 evaluation of a verbal handoff may not reflect that the PGY1 is less competent to evaluate handoffs but rather that PGY2-3s and PGY1s are observing different aspects of the handoff. For this reason, we believe that peer evaluations can be used to augment traditional handoff teaching and assessment strategies, rather than replacing them.

In summary, we demonstrated that peer assessment of handoffs using mobile technology were feasible, had adequate psychometric properties, and were well received by PGY1s. As the ability to safely transition patients throughout our healthcare system becomes increasingly recognized as a discrete skill and an entrustable professional activity for physicians,^{29,30} medical educators will need to expand their toolkit for handoff education in order to

effectively teach and demonstrate trainee competence in this area.³¹ Our peer evaluation strategy for handoffs is one new tool that could be used.

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