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OrthoPass: Long-term Outcomes following Implementation of an Orthopaedic Patient Handoff Template

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ABSTRACT

Standardized handoff tools improve communication and patient care; however, their widespread use in surgical fields is lacking. OrthoPass, an orthopaedic adaptation of I-PASS, was developed in 2019 to address handoff concerns and demonstrated sustained improvements across multiple handoff domains over an 18-month period. We sought to characterize the longitudinal effect and sustainability of OrthoPass within a single large residency program 3.5 years after its implementation. This mixed methods study involved electronic handoff review for quality domains in addition to survey distribution and evaluation. We conducted comparative analyses of handoff adherence and survey questions as well as a thematic analysis of provider-free responses. We evaluated 146 electronic handoffs orthopaedic residents, fellows, and advanced practice providers 3.5 years after OrthoPass implementation. Compared with 18-month levels, adherence was sustained across five of nine handoff domains and was markedly improved in two domains. Furthermore, provider valuations of OrthoPass improved regarding promoting communication and patient safety (83% versus 70%) and avoiding patient errors and near misses (72% versus 60%). These improvements were further substantiated by positive trends in Agency for Healthcare Research and Quality Surveys on Patient Safety Culture hospital survey data. Thematic analysis of free responses shared by 37 providers (42%) generated favorable, unfavorable, and balanced themes further contextualized by subthemes. At 3.5 years after its introduction, OrthoPass continues to improve patient handoff quality and to support provider notions of patient safety. Although providers acknowledged the benefits of this electronic handoff tool, they also shared unique insights into several drawbacks. This feedback will inform ongoing efforts to improve OrthoPass.

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The challenges of patient care transitions have been well described across medical and surgical fields.^{1,2} In recent years, interventions to improve patient handoffs, particularly within medical and nursing domains, have sought to standardize communication with the explicit goal of minimizing adverse events.³⁻⁷ Such advancements have not been mirrored within surgical disciplines.²

In this context, our group devised OrthoPass, an orthopaedic-focused handoff template adapted from the widely successful I-PASS tool.⁸ This prospective, multicenter effort was internally inspired by a needs assessment. A department-wide poll inclusive of 56 orthopaedic residents, fellows, and advanced practice providers (APPs) identified that 33 respondents (59%) were often uncertain about clinical decisions because of insufficient handoff information. Furthermore, 41 respondents (73%) thought that patient care information was lost during shift changes. Ultimately, 51 providers (91%) supported the creation of a standardized orthopaedic-centric electronic handoff.

OrthoPass was implemented as an electronic ‘smartphrase’ in May 2019 (Figure 1). A 6-month post-intervention survey found that 70% of providers noted improvements in handoff communication and 60%

thought that OrthoPass would lead to reduced patient errors and near misses. Adherence levels were assessed at 18 months postintervention and demonstrated sustained improvement in eight of nine quality domains.⁸

The success of OrthoPass at 18 months inspired a long-term evaluation of its effect. In this study, we sought to characterize both quantitative and qualitative data at 3.5 years postintervention. We hypothesized that the initial improvements would be either sustained or enhanced. Finally, a thematic analysis of provider-free responses was incorporated to provide unique insight on the value of OrthoPass and to identify areas for improvement.

Methods

Study Design

We conducted a longitudinal analysis of a prospective, multicenter intervention study conducted at two level-one trauma centers within a single large orthopaedic residency training program. IRB approval was maintained across the study period. A mixed-methods evaluation was done with quantitative and qualitative components to elucidate and to compare handoff

Figure 1

<p>PATIENT NAME / MRN One-liner: 30 y.o. male s/p left distal radius ORIF and intramedullary nail for left tibial shaft fracture on 1/5/2023. PMH: Type 1 diabetes, asthma</p> <p>Activity: non-weight-bearing left upper extremity, weight-bearing as tolerated left lower extremity Brace: Left short arm splint – no range of motion Analgesia: Tylenol around the clock, oxycodone as needed, NSAIDs ok; no PCA while monitoring for compartment syndrome Abx (med/duration): Ancef 2g q8 hrs x 24 hrs postoperatively VTE Prophylaxis (dose and discharge plan): ASA 81 mg twice daily for 4 weeks Drain, remove: None Foley, remove: None Closure: Left wrist – monocryl; Left leg – nylons / Dressing: Maintain short arm splint until follow-up; remove left leg dressings on postoperative day 7 Imaging/Labs: No additional imaging, AM laboratory test results Dispo/PT?: Mobilize with PT for discharge Follow Up: Follow up in 2 weeks</p> <p>FLOOR SIGNOUT: - Illness Severity: Watcher - Situational awareness/Interval events: High-energy injury with risk of postoperative compartment syndrome; compartment checks every 4 hours overnight - Contingencies (If/then): If concern for developing compartment syndrome based on increased pain and examination, contact overnight senior and prepare to measure compartment pressures as needed</p> <p>ACTION LIST/TO DO: <input type="checkbox"/> Q4 hr compartment checks overnight <input type="checkbox"/> PT/OT evaluations</p>

Illustration showing a sample OrthoPass signout for a postoperative patient.

adherence rates, hospital safety culture results, and provider valuations over the 3.5-year follow-up period.

Quantitative Analysis

A random audit of electronic handoffs was conducted between October and November 2022. Handoffs were evaluated through electronic signouts forwarded by overnight residents. Postoperative signouts were also reviewed. Handoff adherence and safety culture survey results were analyzed and compared with the results from our original investigation.⁸ Handoff quality domains, defined in the original conception of OrthoPass, consisted of two patient identifiers, illness severity, one-liner, medical history, action list, situational awareness, contingencies, anticoagulation plan, and antibiotic plan. Safety culture data obtained from the Agency for Healthcare Research and Quality (AHRQ) Surveys on Patient Safety Culture (SOPS) hospital survey were reviewed and compared with national results.⁹

Qualitative Analysis

A second postintervention survey, identical to the 6-month survey, was distributed to providers at 42 months (Appendix, <http://links.lww.com/JG9/A309>). Providers were asked about adherence, effect, and continued use of OrthoPass. A free response section soliciting feedback on OrthoPass was included. A thematic analysis of these data was performed in accordance with protocols delineated by previous studies.¹⁰ Characterization of free responses into themes and subthemes was completed by the first author.

Statistical Testing

Statistical testing was performed with SPSS Statistics, version 29 (IBM Corp), with $P < 0.05$ considered statistically significant. Descriptive statistics were conducted with chi square and Fisher exact tests when appropriate. Inferential statistics were conducted for ordinal and numeric data; comparative evaluations were performed using either independent sample *t*-tests or Mann-Whitney *U*-tests depending on the results of Kolmogorov-Smirnov normality tests.

Results

Handoff Adherence

A total of 146 handoffs were collected between October and November 2022; these handoffs were compared with 203 preintervention handoffs and 100 18-month postintervention handoffs (Figure 2). As noted previously, at 18 months postintroduction, notable im-

provements were observed in eight of nine handoff quality domains.⁸ Adherence to the OrthoPass template was sustained from 18-month levels across five of the nine quality domains; furthermore, significant improvements were observed in ‘One-liner’ ($P = 0.015$) and ‘Anticoagulation Plan’ ($P = 0.002$) reporting at 42 months. The use of ‘Two Patient Identifiers’ was significantly increased from preintervention levels ($P = 0.03$). Alternatively, ‘Illness Severity’ reporting significantly decreased from 18-month levels ($P < 0.001$).

Safety Culture Results

The AHRQ SOPS hospital survey consists of 10 composite measures of patient safety culture. While the number and type of respondents (surgeons, residents, APPs, and nursing staff) at our institution varied over the 7-year period precluding statistical analysis, positive trends were notable for those categories involving communication and reporting (Figure 3).

Adherence and Staff Perception

Eighty-eight providers completed the 42-month post-intervention survey; respondents consisted of 54 residents (90% response rate), 23 fellows (44% response rate), and 11 APPs (50% response rate). Sixty-three percent of providers reported using OrthoPass 100% of the time while 26% reported using it between 75% and 99% of the time. Variable electronic signouts with and without accompanying verbal signouts were otherwise used.

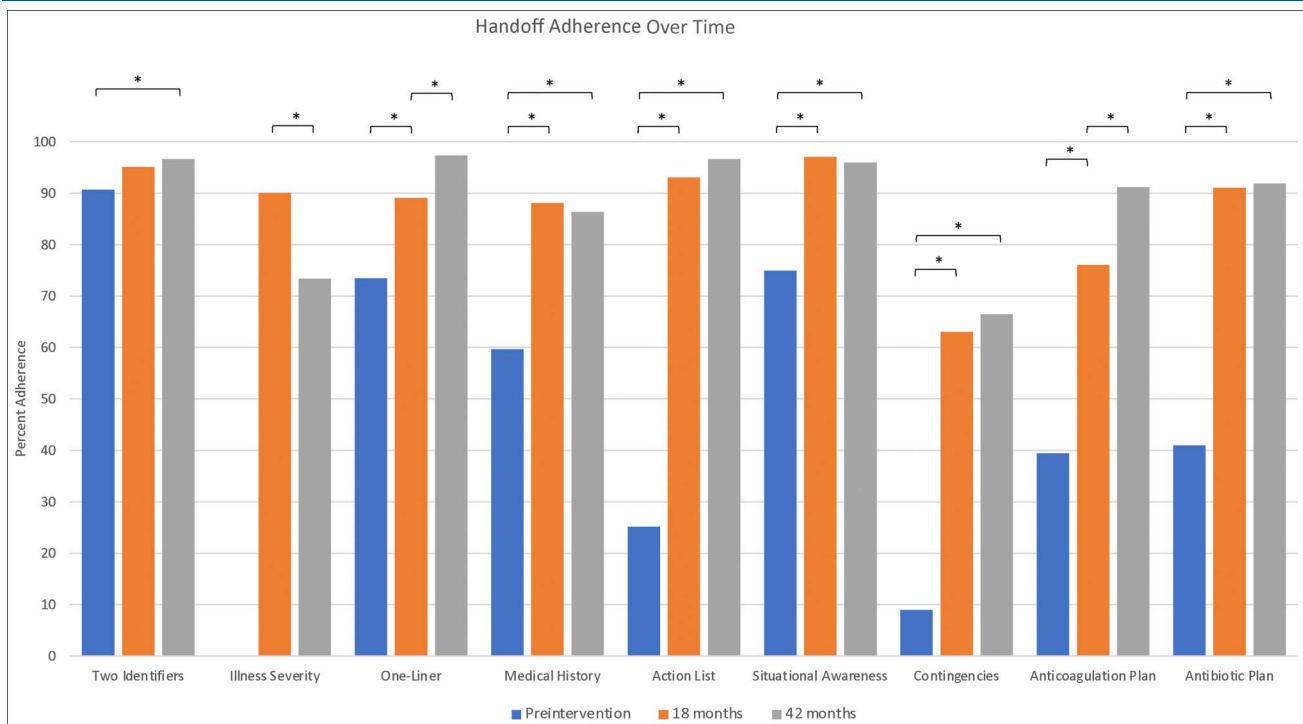
Seventy-three providers (83%) reported improvement in handoff communication and patient safety, an increase from 38 providers (70%) at the 6-month post-intervention time point. Similarly, 63 respondents (72%) thought that OrthoPass reduced patient errors and near misses, improved from 32 respondents (60%). When asked about requiring trainees to use OrthoPass, 75 providers (85%) answered in favor while 6 (7%) replied ‘possibly, if modifications are made.’

Narrative Analysis

A total of 37 respondents (42%) provided free-text responses when asked to share feedback about OrthoPass. Three themes and seven subthemes were identified (Figure 4). These themes (I-III), as well as subthemes (capital letters) and representative quotations, are presented in Table 1.

Favorable themes highlighted the value of standardization, the accessibility of information (particularly for overnight and weekend providers), and the utility of contingency plans. Unfavorable themes focused on the

Figure 2

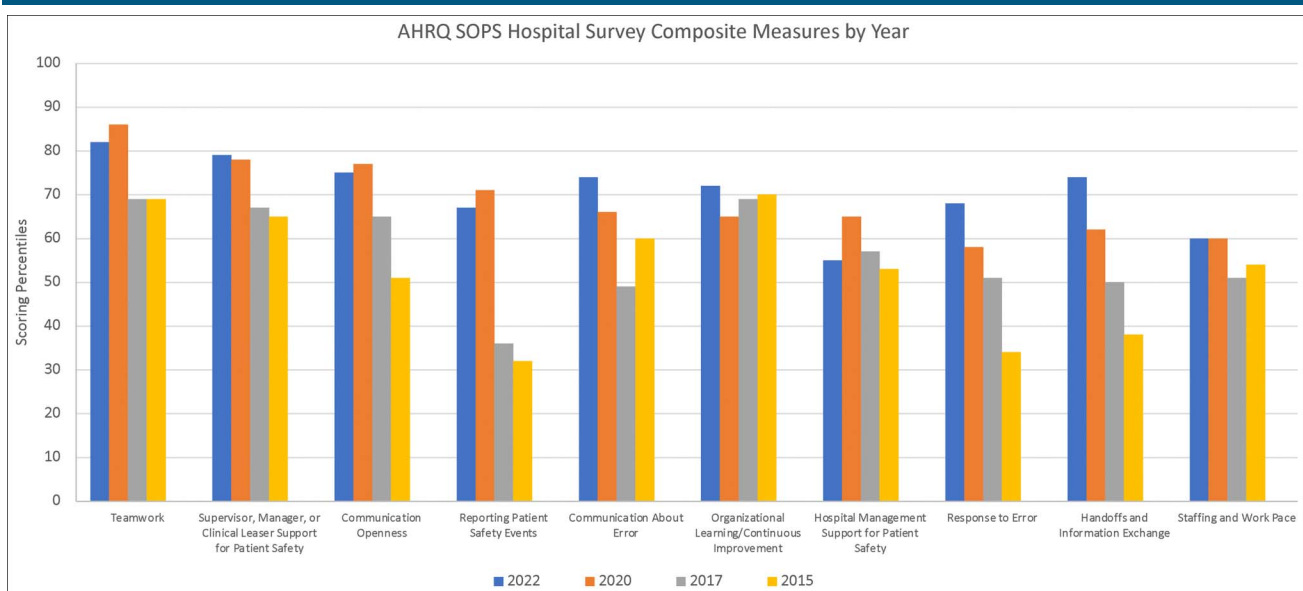


Handoff adherence rates for quality domains across various time points. Brackets and asterisks represent statistically significant differences.

length and impracticality of the signout template for more ‘straightforward’ patients. Furthermore, overgeneralization was also mentioned as a hindrance to appreciating patient-specific details of care.

Many providers shared their thoughts on how OrthoPass can be improved; several thought that electronic handoffs should be balanced by in-person signouts. Furthermore, copy forward use of OrthoPass signouts

Figure 3



Agency for Healthcare Research and Quality’s (AHRQ) SOPS hospital survey showing composite measure data for our institution from 2015 to 2022. SOPS = surveys on patient safety culture.

Table 1. Themes, Subthemes, and Key Findings From Thematic Analysis

Theme or subtheme	Findings	Sample comment
I. Favorable A. Standardization B. Accessibility C. Contingencies	OrthoPass improves. . . Handoff uniformity and inclusion of important information Availability of information for providers	'The use of standardization has gone a long way to improving patient care and team communication.' 'Super helpful, especially when covering on the weekends when we do not know the patients and are answering patient phone calls.'
II. Unfavorable A. Overgeneralization B. Length	Decision making when at a clinical impasse OrthoPass is limited by. . . Unnecessary information	'Takes a little extra time initially but saves a lot more time cumulatively. Protects patients and helps keep everyone on the same page with contingency plans.' 'Many of the things in OrthoPass don't apply to all patients. . . it becomes clutter and hides the important information providers actually need.' 'Takes too long to fill out, many irrelevant sections for most surgeries.'
III. Balanced A. In-person handoffs B. Copy forward use	Time needed to complete the template OrthoPass can be improved by. . . Finding the appropriate balance between in-person and e-mail handoffs Understanding the importance of keeping handoffs updated	'I think in theory having an email-based signout tool is useful to reduce errors. It also serves as a record to refer to regarding signout instructions. However, with it, it nullifies the need for in-person hand off which I believe is more useful + protective to reduce errors, emphasize salient patient care points, and improve overall care.' 'The time stamp on OrthoPass shows how often the handoff has been updated. Oftentimes, it is not updated to current day info. It would help if all team members were more diligent in reviewing to ensure all updates are accurate.'

without appropriate updates was critiqued. Several providers offered new suggestions for dropdown lists within the OrthoPass 'smartphrase.'

Discussion

Transitions in patient care have long been identified as weak links within health systems.¹¹ In 2014, Starmer et al detailed the successes of I-PASS, a standardized

handoff communication tool, in reducing medical errors and adverse events.^{3,4} Unfortunately, adaptations of I-PASS for surgical specialties have yet to gain widespread favor.²

Within orthopaedics, previous efforts to improve communication and patient care have centered around preoperative and postoperative checklists.^{12,13} In contrast, Gagnier et al¹⁴ developed a handoff tool for orthopaedic trauma residents and evaluated its effect on

Figure 4

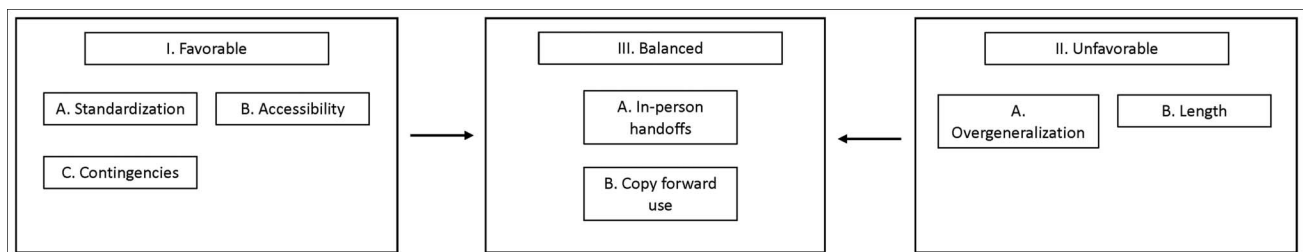


Chart of a thematic map showing favorable, unfavorable, and balanced themes with respective subthemes.

adverse events. After interdisciplinary design and pilot testing, the handoff tool was implemented and data were collected for 127 patients. The authors found a nearly 25% reduction, albeit nonsignificant, in adverse events after controlling for age, sex, and comorbidities. More recently, electronic handoffs have been used to convey medical optimization information, as well as postoperative plans, for patients with multiple comorbidities undergoing total joint arthroplasty.¹⁵ HIPAA-compliant electronic handoff applications have also been explored; however, lingering security concerns have detracted from universal adoption.¹⁶

OrthoPass was adapted from I-PASS with these considerations in mind. Before its introduction, there was no policy for electronic and verbal handoffs, resulting in variable, and oftentimes insufficient, signouts. In this way, OrthoPass received multilevel support from residents, fellows, and APPs alike. Indeed, a preintervention survey demonstrated that 91% of providers supported the idea of a standardized electronic handoff template. After 18 months, 705 electronic patient handoffs were analyzed and notable improvements were observed in eight of nine handoff quality domains (Figure 2).

In this context, we sought to characterize the long-term effect of OrthoPass within our residency program. This mixed-methods study yielded both quantitative and qualitative data for review. Eight of nine quality domains demonstrated either sustained or improved adherence rates from preintervention to 18-month time points, with several domains exceeding 90% adherence rates. In contrast, a notable decrease was observed in the reporting of ‘Illness Severity’ between 18 months and 42 months (90% versus 73%, $P < 0.001$). This was due to customized versions of OrthoPass templates generated by fellows, wherein this specific section was omitted. These service-specific variations also explain the persistent, relatively low reporting of ‘Contingencies’ (63% and 66% at 18-month and 42-month time points, respectively).

Safety culture results from the AHRQ yield insight not only into institutional progress but also allow for comparisons with national data. Although variability in the number of types of respondents limits yearly comparisons, the trends across communication and handoff-related measures at our institution are encouraging. Review of the 2022 SOPS hospital survey national data is notable for poor performance for ‘Handoffs and Information Exchange’ as a composite measure.⁹ Indeed, this measure had one of the lowest positive-response distributions, with a 63% average and 69% and 76% representing the 75th and 90th percentiles, respectively.

Furthermore, trend analyses for hospitals providing SOPS hospital survey data for 2021 and 2022 revealed that only 16% of hospitals increased their handoff composite measure score by five or more percentage points, whereas 39% decreased in this domain by five or more percentage points. With these numbers in mind, the improvement in handoff composite measure scores from 62% in 2020 to 74% in 2022 at our institution is noteworthy and may reflect the effect of OrthoPass.

The 42-month postintervention survey revealed improved qualitative valuations of OrthoPass compared with the 6-month survey. This was true for promotion of handoff communication and patient safety (83% versus 70%) and avoidance of patient errors and near misses (72% versus 60%). Thematic analysis further clarified provider insight into the effect, value, and areas for potential improvement within OrthoPass. Responses ranged from unfavorable to favorable, with balanced suggestions highlighting the utility of OrthoPass in conjunction with in-person signouts and avoidance of copy forward habits. A balance between standardization versus overgeneralization was also apparent. Although many covering physicians appreciated the standard format, it was clear that some providers thought certain sections were unnecessary. Indeed, such feelings likely led to the creation of service-specific templates, which omitted various quality domains.

We recognize several notable limitations of this study. Foremost, we did not attempt to correlate OrthoPass use with clinical outcomes. In our previous investigation, no statistically notable differences were observed in the rates of 30-day readmission, 90-day readmission, urinary tract infection, pulmonary embolism/deep vein thrombosis, surgical site infection, or delirium after OrthoPass implementation.⁸ Because such clinical variables and outcomes are subject to numerous confounders, this analysis was deferred. Furthermore, given the use of voluntary surveys, the effects of both selection and recall bias must be acknowledged. Finally, OrthoPass was created within a single large orthopaedic residency program spanning multiple level-one hospital centers, limiting its generalizability.

With these limitations in mind, we also acknowledge several important points for the continued improvement of OrthoPass. Both quantitative and qualitative data yield insight into the rationale behind service-specific templates. While the inclusion of pertinent handoff information is valuable (ie, preoperative and postoperative neurologic examinations for spine patients), important quality domains, such as ‘Illness Severity’ and ‘Contingencies,’ should not be omitted. We aim to provide OrthoPass refresher talks every year to residents and incoming

fellows to consolidate this policy. Furthermore, we acknowledge that various subspecialties have different handoff needs; future investigations will explore these nuances and potential tailoring of OrthoPass to improve compliance with less burden. Second, we will clarify the balance of in-person and electronic handoffs. While it is appropriate to sign out ‘Stable’ patients through OrthoPass alone, ‘Watcher’ patients should receive concomitant verbal handoffs. Third, we will caution against the use of copy forward habits to mitigate propagation of misinformation and will explore means to promote active updating of relevant fields. Finally, we will continually update OrthoPass with feedback from its users, incorporating suggestions on usability and insights on how to improve its adherence and effect.

In conclusion, the value of effective patient handoffs should not be underestimated and strategies to improve communication and standardization are evolving. OrthoPass was created in 2019 and has demonstrated sustained improvements in the quality of orthopaedic patient handoffs at 3.5 years since its introduction. Quantitative improvements in reporting rates were bolstered by growing support from providers, who indicated that this standardized template augments patient care and safety. Provider-free responses offered unique insight into the benefits, drawbacks, and potential improvements of OrthoPass and will be used to further optimize this handoff tool.

References

1. Starmer AJ, Spector ND, Srivastava R, Allen AD, Landrigan CP, Sectish TC, I-PASS Study Group: I-pass, a mnemonic to standardize verbal handoffs. *Pediatrics* 2012;129:201-204.
2. Shahian DM, McEachern K, Rossi L, Chisari RG, Mort E: Large-scale implementation of the I-PASS handover system at an academic medical centre. *BMJ Qual Saf* 2017;26:760-770.
3. I-PASS Study Education Executive Committee, Starmer AJ, O’Toole JK, Rosenbluth G, et al: Development, implementation, and dissemination of the I-pass handoff curriculum: A multisite educational intervention to improve patient handoffs. *Acad Med* 2014;89:876-884.
4. I-PASS Study Group, Starmer AJ, Spector ND, Srivastava R, et al: Changes in medical errors after implementation of a handoff program. *N Engl J Med* 2014;371:1803-1812.
5. Lee S-H, Phan PH, Dorman T, Weaver SJ, Pronovost PJ: Handoffs, safety culture, and practices: Evidence from the hospital survey on patient safety culture. *BMC Health Serv Res* 2016;16:254-258.
6. Blazin LJ, Sitthi-Amorn J, Hoffman JM, Burlison JD: Improving patient handoffs and transitions through adaptation and implementation of I-PASS across multiple handoff settings. *Pediatr Qual Saf* 2020;5:e323.
7. Fitzgerald KM, Banerjee TR, Starmer AJ, et al: Stack, AM: Effect of a multispecialty faculty handoff initiative on safety culture and handoff quality. *Pediatr Qual Saf* 2022;7:e539.
8. Stenquist DS, Yeung CM, Szapary HJ, Rossi L, Chen AF, Harris MB: Sustained improvement in quality of patient handoffs after orthopaedic surgery I-pass intervention. *J Am Acad Orthop Surg Glob Res Rev* 2022;6:e22.00079.
9. Hare R, Tapia A, Tyler ER, et al: *Surveys on Patient Safety Culture™ (SOPS) Hospital Survey 2.0: 2022 User Database Report*. Rockville, MD, AHRQ Publ, 2022.
10. Lightsey HM, Yeung CM, Bernstein DN, et al: Patient experiences of telemedicine in spine care: A mixed methods study. *Spine* 2022;47:27-33.
11. Horwitz LI, Moin T, Krumholz HM, Wang L, Bradley EH: Consequences of inadequate sign-out for patient care. *Arch Intern Med* 2008;168:1755-1760.
12. LeBlanc J, Donnon T, Hutchison C, Duffy P: Development of an orthopedic surgery trauma patient handover checklist. *Can J Surg* 2014; 57:8-14.
13. Sleiman B, Sayeed Z, Padela MT, et al: Review article: Current literature on surgical checklists and handoff tools and application for orthopaedic surgery. *J Orthop* 2019;16:86-90.
14. Gagnier JJ, Derosier JM, Maratt JD, Hake ME, Bagian JP: Development, implementation and evaluation of a patient handoff tool to improve safety in orthopaedic surgery. *Int J Qual Health Care* 2016;28: 363-370.
15. Meneses M, Muthusamy N, Vetter MJ, Schwarzkopf R: Utilizing a standardized handoff initiative incorporating both medical clearance postoperative recommendations and orthopaedic-specific context to improve information transfer. *Orthop Nurs* 2022;41:282-286.
16. Cline JA, Nolte JA, Mendez GM, et al: Improving electronic patient handoff in an orthopaedic residency using the Listrunner() application. *Kans J Med* 2022;15:97-100.