AMERICAN PSYCHOLOGICAL ASSOCIATION

Journal of Applied Psychology

ISSN: 0021-9010

http://dx.doi.org/10.1037/apl0000814

RESEARCH REPORT

Team Leader Coaching Intervention: An Investigation of the Impact on Team Processes and Performance Within a Surgical Context

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We examined the impact of a team leader coaching intervention on episodic team processes (transition, action, interpersonal) and subsequent team performance outcomes within a surgical context. Specifically, we tested whether coaching team leaders (i.e., surgeons) on promoting effective teamwork facilitates team processes and two important outcomes—delays and distractions. Team processes were indexed using detailed observational protocols by subject-matter experts before and during surgeries. We employed an interrupted time series design whereby half of our participants received coaching midway through the longitudinal period and the remaining served as a quasi-control group. Team processes and outcomes were collected from multiple surgeries, per surgeon, both before and after the coaching intervention (N = 223 surgeries total). Results from a multilevel mixed-model (treatment vs. control, over time) structural equation model suggest that teams where the surgeon (team leader) received the coaching intervention exhibited higher-quality team transition processes. Transition processes related positively to subsequent action and interpersonal processes, which in turn yielded improvements in two different surgical team performance outcomes. Theoretical and applied implications are discussed.

Keywords: team processes, team performance, coaching, team intervention, field study

Coaching interventions have become a common practice in many organizations (Grant, 2013). Team leader coaching refers to a targeted intervention involving a formal one-on-one relationship between a leader and a coach with the purpose of improving the leader's effectiveness. While there has been a substantial level of attention given to the impact of coaching on individual-level outcomes (e.g., De Meuse, Dai, & Lee, 2009; Jones, Woods, & Guillaume, 2016; Sonesh et al., 2015), and a preponderance of such work finding positive relationships, scholars have noted that the literature has not yet addressed the team-level effects of leadership coaching interventions (Athanasopoulou & Dopson, 2018; Ely et al., 2010; Feldman & Lankau, 2005; Grover & Furnham, 2016; Jones et al., 2016). In fact, O'Connor and Cavanagh (2017) noted that a key limitation of the leader coaching literature is that while such interventions seek to create changes in leaders, it is often *assumed* that such a change will impact the functioning of their teams. Likewise, a meta-analysis by Jones and colleagues (2016) reported that they did not locate any studies that included team-level criteria. Similarly, Ely et al.'s (2010) leadership coaching review called upon scholars to examine whether the effects of leadership coaching interventions extend to subordinates and teams. To address these calls, in this study, we examined the effect of a leader coaching intervention on team-level constructs within healthcare (no space between words) teams.

While effective teamwork is viewed as vital for organizational effectiveness (Mathieu, Gallagher, Domingo, & Klock, 2019), it is

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We would like to acknowledge and thank Steve Zaccaro for his thoughts on an earlier version of this study that greatly shaped our thinking around the topic. We also would like to thank David Marshall and Bill Schuler for their integral roles in this project.

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particularly true in healthcare (no space between words) where teamwork (or the lack thereof) can have life-or-death consequences (Salas, Zajac, & Marlow, 2018). For example, The Joint Commission (2016) reported that teamwork-related factors were the root cause of 65% of unanticipated negative events, contributing to medication errors, wrong-site surgeries, as well as negative operative and postoperative events. Consequently, healthcare organizations have implemented many practices to enhance teamwork quality (Shea-Lewis, 2009) such as checklists (Frankel, Gardner, Maynard, & Kelly, 2007), handoff procedures (Hohenhaus, Powell, & Hohenhaus, 2006), team training (Hughes et al., 2016), and crew resource management (CRM; Salas, Burke, Bowers, & Wilson, 2001).

Coaching has been noted as a way to improve teamwork and patient outcomes in surgical contexts (Yule, Flin, Paterson-Brown, & Maran, 2006). Research indicates that external coaching can impact leaders' beliefs, attitudes, and self-report behaviors (Ely et al., 2010), and there is substantial evidence that team leaders' behaviors influence team processes and outcomes both in general (Zaccaro, Rittman, & Marks, 2001) and in healthcare (e.g., Barling, Akers, & Beiko, 2018). Although a logical extension of these findings is that leadership coaching initiatives will have positive downstream consequences for the teams of coached leaders, there is a surprising lack of direct evidence (Yule et al., 2006), and scholars have noted a need for research on coaching interventions directed to surgeons rather than entire surgical teams (Min, Morales, Orgill, Smink, & Yule, 2015). These insights highlight an important question—whether coaching a team leader can beneficially impact their team's teamwork and performance.

We advance a multilevel model suggesting a team leader coaching intervention will yield improved episodic team processes and thus enhance operating room (OR) team outcomes (see Figure 1). We make three key contributions. First, we contribute to the literature on leadership coaching by testing whether coaching team leaders can facilitate team processes and performance outcomes. Second, we leverage Marks, Mathieu, and Zaccaro's (2001) theory of episodic team processes to illustrate the underlying mechanisms by which coached team leaders enhance team outcomes. Third, we feature two team performance outcomes (i.e., surgical delays and distractions) that have important practical implications. Using a quasi-experimental field design, we sampled over 200 surgeries and surgical teams led by 40 surgeons, of whom 20 received a team leader coaching intervention midway through the study period and 20 did not. Recently, Hagen (2012, p. 91) noted a need for quasi-experimental coaching studies, which Eden (2017) characterized as, "although rare, [are] the sterling gold standard of organizational research methods [that yield] the best internally valid and generalizable findings compared to more fallible methods." In our team leader coaching intervention, a retired surgeon observed surgeries and coached surgeons on their teamwork facilitation.

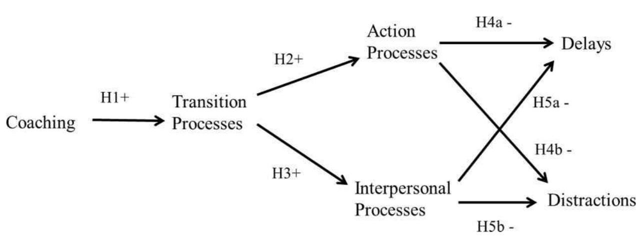

Figure 1. Hypothesized model. H = hypothesis.

Background and Theoretical Development

Coaching

Coaching refers to "a process of equipping people with the tools, knowledge, and opportunities they need to develop themselves and become more effective" (Peterson & Hicks, 1999, p. 14). *Leadership coaching* (often called executive coaching; Feldman & Lankau, 2005) refers to targeted interventions that involve a formal one-on-one relationship between a leader and a coach (who has no formal supervisor authority over the person being coached), with the purpose of improving the leader's effectiveness (e.g., Athanasopoulou & Dopson, 2018). Ely et al. (2010) chronicled evidence that leadership coaching benefits the leader's attitudes, learning (e.g., self-awareness), behavior (e.g., relationship building), and organizational outcomes (e.g., coaching return on investment). Although there is evidence that leadership development tools (e.g., training, feedback, mentoring) can have positive outcomes (e.g., Day, 2000; DeRue & Myers, 2014; Fernandez Castelao, Boos, Ringer, Eich, & Russo, 2015), scholars emphasize that leadership coaching is conceptually distinct from these developmental initiatives (e.g., De Meuse et al., 2009; Feldman & Lankau, 2005; Jones et al., 2016; Sonesh et al., 2015). It is also important to distinguish leadership coaching from *team coaching*, which refers to a leader's "direct interaction with a team intended to help members make coordinated and task-appropriate use of their collective resources in accomplishing the team's work" (Hackman & Wageman, 2005, p. 269). The team coaching literature does not focus on coaching interventions, but rather on how leaders' team coaching behaviors—which can be educational (developing member skill and knowledge), consultative (fostering appropriate work approaches), and motivational (cultivating shared commitment)—influence team member individual performance (Dahling, Taylor, Chau, & Dwight, 2016; Liu & Batt, 2010) and team outcomes such as team processes (Wageman, 2001), empowerment (Rapp, Gilson, Mathieu, & Ruddy, 2016), and performance (Edmondson, 1999). In leader coaching interventions, team leaders are the recipients of the treatment, whereas in team coaching interventions, leaders are administering the treatment and team members are the recipients.

Research suggests that coaching surgical teams as a whole yields improved teamwork, cooperation, and problem solving (McCulloch, Rathbone, & Catchpole, 2011). However, within healthcare, there are challenges associated with coaching entire teams such as scheduling and the time and costs associated with delivering training to complete teams (Wolever, Moore, & Jordan, 2017). Further, surgical teams typically do not work as intact teams and are more akin to crews, where different members are continually paired together (Luciano, Bartels, D'Innocenzo, Maynard, & Mathieu, 2018). Given that surgeons are the de facto OR leaders and can have a powerful influence on team members (Hu et al., 2016; Zaccaro & Klimoski, 2002), we tested whether a team leader coaching intervention can enhance team processes and performance.

Team Processes

Team processes refer to "members' interdependent acts that convert inputs to outcomes through cognitive, verbal, and behavioral activities directed toward organizing taskwork to achieve collective goals" (Marks et al., 2001, p. 357). Marks et al. (2001) maintained that three categories of team processes (transition, action, interpersonal) unfold episodically at distinguishable periods of time during which members work together to accomplish team tasks and feedback becomes available. Healthcare research has found that team processes have important implications for several critical outcomes (Mazzocco et al., 2009; Wahr et al., 2013).

Transition processes occur prior to or between performance episodes when members reflect upon previous work and prepare for future tasks through mission analysis, goal specification, and strategy formulation and planning. *Action processes* refer to behaviors that members engage in while working toward goal accomplishment and include coordination and monitoring progress toward goals, systems, and teammates. Finally, *interpersonal processes* can occur at any time and include conflict management, motivating, confidence building, and affect management. While team researchers now agree that team processes unfold episodically (Ilgen, Hollenbeck, Johnson, & Jundt, 2005; Mathieu, Hollenbeck, van Knippenberg, & Ilgen, 2017), Marks et al. (2001) argued that initial transition processes set the stage for later action and interpersonal processes. Most recently, Mathieu, Luciano, D'Innocenzo, Klock, and LePine's (2019) review noted that to date, no studies have indexed all three higher-order team processes and modeled them episodically.

In the surgical context, preoperative briefings constitute transition processes and are short meetings conducted before a surgery when members (surgeons, nurses, anesthesiologists) review the surgery plan, patient history, and equipment; consider potential risks of the surgery (Lingard et al., 2008); and discuss how the team will function. In contrast, action processes occur during the surgical procedure as members assist one another; monitor systems, resources, and other members' performance; and coordinate their efforts. Examples include when nurses provide updates about patient vitals, anesthesiologists discuss patient reactions to anesthesia, and surgeons share details about complications encountered. Similarly, interpersonal processes can occur throughout a surgery where members seek to maintain a positive emotional climate and keep teammates calm in the face of stressful demands. However, interpersonal processes are rarely exhibited during the concise preoperative briefings and most likely manifest during the surgical procedure.

Coaching and team transition processes. There are reasons to believe that surgeons who receive coaching will facilitate higher-quality team transition processes (i.e., preoperative briefings) as compared to those who do not receive coaching. The teamwork training literature offers support here; for example, Ricci and Brumsted (2012) found that after surgical personnel received teamwork training (e.g., communication, resource management), the use of preoperative briefings increased, while wrong-site surgeries and adverse events decreased. Although their study focused on teamwork training delivered to intact teams, insight from the coaching literature suggests that delivering such training to the team leader (i.e., surgeon) will result in improved team transition processes. In our study, coaching-related activities included providing feedback to surgeons about observed team interactions, analyzing and discussing how the surgeons' behaviors contribute to (or detract from) team performance, and identifying potential areas for improvement. In doing so, the coaching intervention likely improved surgeons' self-awareness about how their actions affect the quality of preoperative team briefings. Further, coaching efforts focused on teamwork likely prompt a concern for team motivational and behavioral processes and emphasize the surgeons' opportunity to lay a productive groundwork during preoperative periods. By providing encouragement and support, coaching can help to build surgeons' commitment to promoting teamwork and increase the likelihood that they will take greater personal responsibility for its occurrence. Indeed, there is evidence that leadership coaching interventions can cultivate improvements in leaders' communication, planning, and goal-setting skills (Athanasopoulou & Dopson, 2018).

Hackman (2012) argued that team leaders promote team processes through three mechanisms: (a) creating and maintaining the structural and contextual conditions that facilitate team goal achievement, (b) launching the group effectively by instilling and reinforcing that structure, and (c) coaching the team as it conducts its work. The first two mechanisms reflect transition processes, and the third action processes. Hackman further proposed that the importance of these mechanisms for enhancing team processes are approximately 60%, 30%, and 10%, respectively. Thus, we expected that the effects of the coaching intervention would be realized primarily by its direct influence on transition processes. Our first hypothesis was as follows: Teams led by surgeons that participated in a team leader coaching intervention will exhibit higher-quality team transition processes than teams led by surgeons that did not.

Team transition, action, and interpersonal processes. There is accruing evidence that engaging in effective transition processes facilitates subsequent action processes (DeChurch & Haas, 2008; Janicik & Bartel, 2003; Mathieu & Schulze, 2006). In medical teams, displaying effective transition processes (e.g., conducting preoperative briefings, using checklists) results in improved collaboration (Makary et al., 2007), coordination, and communication (Calland et al., 2011); shared task understanding (Wahr et al., 2013); and fewer surgical flow disruptions (Wiegmann, ElBardissi, Dearani, Daly, & Sundt, 2007). High-quality transition processes also may provide a foundation for effective interpersonal processes. Mathieu and Schulze (2006) found that formal planning encouraged effective interpersonal processes later in the team's task cycle, whereas Fisher (2014) found that the quality of initial plans regarding team activities positively influenced later team interpersonal processes. Weldon and Weingart (1988) argued that group goals support morale-building communications that inspire the team to action. Our second hypothesis was that the quality of team transition processes will relate positively to the quality of subsequent team action processes, and our third hypothesis was that the quality of team transition processes will relate positively to the quality of subsequent team interpersonal processes.

Team processes and performance outcomes. LePine, Piccolo, Jackson, Mathieu, and Saul's (2008) meta-analysis reported significant correlations between transition, action, and interpersonal processes and team outcomes. Despite the recognition that teamwork is essential to effective healthcare delivery (Manser, 2009), the means by which the combined processes relate to specific surgical outcomes is poorly understood. Answering Mathieu, Luciano, et al.'s (2019) call for team process studies to include multiple team outcomes, we examined two critical surgical performance metrics: *delays* (a surgical efficiency metric; Al-Hakim & Gong, 2012) and *distractions* (a threat to patient safety; Sevdalis et al., 2014).

Although much of the medical literature focuses on equipment and system-related factors (Wong, Khu, Kaderali, & Bernstein, 2010), some research highlights teamwork as a cause of surgical delays (e.g., Nundy et al., 2008) as well as patient morbidity and mortality (Wahr et al., 2013). Wiegmann et al. (2007) found that most surgical disruptions stem from poor team communication, coordination, and monitoring. Team monitoring and backup processes have been found to reduce the likelihood of errors and increase a team's ability to synchronize actions (de Jong & Elfring, 2010; Marks & Panzer, 2004; Porter, 2005). Team interpersonal processes also impact patient outcomes. Conflict occurs in the treatment of 50% to 75% of hospital patients (Wahr et al., 2013), making conflict management an essential OR personnel skill (Rogers et al., 2011). Given that surgical teams operate in a complex setting demanding high cognitive, interpersonal, and technical performance, teams that engage in effective conflict and affect management, and motivation and confidence building, should experience fewer delays and distractions. Thus, our fourth hypothesis was that the quality of team action processes will relate negatively to surgical team (a) delays and (b) distractions, and our fifth hypothesis was that the quality of team interpersonal processes will relate negatively to surgical team (a) delays and (b) distractions.

Method

We sampled surgical teams from a large teaching hospital in the Rocky Mountain region of the United States. Approval to conduct this study was obtained from the Colorado Multiple Institutional Review Board (protocol title and number: "Coaching as an Intervention to Improve Briefings and Debriefings," 11–0662). This project led to another publication (e.g., Kleiner, Link, Maynard, & Halverson-Carpenter, 2014). We observed and coded 161 surgeries conducted by 57 surgeons during a baseline preintervention period and 160 surgeries conducted by 62 surgeons during a postintervention period. Using an interrupted time series with a no-treatment quasi-control group design (Shadish, Cook, & Campbell, 2002, pp. 181–184), we used data from 20 (of 21) surgeons who received coaching and had at least one surgery observed during both periods. These 20 surgeons were randomly chosen to receive coaching, with later adjustments made for scheduling availability. We did not control which procedures surgeons performed nor which team members were paired for surgeries. Thus, we refer to our design as a quasi-experiment. For the coached group, we observed 61 (mean per surgeon = 3.05) and 57 (mean per surgeon = 2.85) surgeries, respectively, for the two periods. We paired them with 20 quasi-control surgeons who did not receive coaching and had at least one surgery observed during the pre- (total = 53, mean per surgeon = 2.65) and post- (total = 52, mean per surgeon = 2.60) periods. The 40 surgeons in our sample did not differ significantly from the ones excluded on any available information.

Coaching Intervention

A retired orthopedic surgeon certified in CRM training was the coach in this study. He observed all surgeons performing surgeries during the baseline period, noting how well each promoted teamwork and potential improvement areas. He later observed surgeries completed by the 20 surgeons in the coaching intervention condition. Immediately after each surgery, he conducted team leader coaching sessions, providing the surgeon with feedback regarding what they had done well and what could have been improved upon to better facilitate effective teamwork. These sessions included discussions of CRM principles (Salas, Cooke, & Rosen, 2008) and examples of what he had (and had not) observed during the surgery to reinforce CRM principles. Although all coaching sessions focused on the surgeon's role in cultivating effective teamwork, coaching sessions were nonstandardized, which is typical of such interventions as coaching is guided by the needs, skills, and experiences of the individual being coached (Ely et al., 2010).

Three trained subject-matter expert observers (SMEs; i.e., a retired surgical nurse, former surgical equipment representative, and healthcare administration doctoral-level student) assessed team processes and outcomes before and during surgeries. SMEs watched initial surgeries in pairs and then calibrated their use of the protocol by discussing observations and coding until reaching saturation. Subsequent surgeries were observed by a single SME.

The SMEs coded surgeries during the baseline period blind as to which surgeons would take part in the intervention. Five months after the coaching intervention, SMEs coded follow-up surgeries (total = 223). Analyses confirmed that there were no significant coder effects and controlling for observer did not alter any of our substantive findings. We dummy coded the intervention so surgeries observed in the baseline period (and postintervention surgeries for the quasi-control condition) were scored as 0. Postintervention surgeries by coached surgeons were coded as 1. This yields a time-varying intervention code for analyses (Bliese, Adler, & Flynn, 2017).

Measures

Our observational protocol was adapted from established healthcare procedures (Hull, Arora, Kassab, Kneebone, & Sevdalis, 2011; Russ et al., 2013; Undre, Sevdalis, & Vincent, 2009; Weaver et al., 2010) and grounded in our study context. SMEs, who were in the OR during preoperative and surgical periods, rated transition processes at the end of the preoperative period and action and interpersonal processes at the end of the surgery, each using a 5-point scale: (1) *poor*, (2) *below average*, (3) *average*, (4) *above average*, and (5) *excellent*. Extensive details of the measures collected and their construct validity, modeled using multitrait multimethod analyses, are presented in the Appendix. Because measures were scaled differently, we created z-scores using the total sample of observations before creating any composites.

Processes. Observers indexed transition processes that occurred during preoperative briefings with checklists for medical procedures (nine items) and teamwork procedures (six items). Action processes were observed and indexed during the surgery as follows. Monitoring and coordination and backup behaviors were indexed with three and two count-based measures, respectively. Interpersonal processes were indexed during surgeries. Motivation and affect management were scored with checklists, and conflict management was scored with two count measures.

Performance and covariates. We indexed two team performance outcomes—delays and distractions. Delays were scored using three count measures. Distractions were indexed via two counts and three ratings. We included three covariates to control for potential contaminating influences. Observers interviewed one or more team members following each surgery and had them rate the procedure's complexity and their degree of shared team task experience using 5-point scales. We also accounted for day of the year to control for any time-varying influences.

Results

The findings reported in the Appendix support the convergent validity (i.e., reliability) and discriminant validity of our measurement protocol. Table 1 reports variable correlations and descriptive statistics. We used multi-level structural equation modeling (Bauer, Preacher, & Gil, 2006) in our analyses. In our design, surgeries are Level-1 repeated measures ($N = 223$) nested within 40 surgeons (Level 2). Our design also represents a discontinuous growth model, with both varying numbers and timing of observations per surgeon (Bliese et al., 2017). Given the limited degrees of freedom this design affords, we used the observed composite measures in our analyses. The hypothesized model fit, $\chi^2(7) = 94.06$, $p < .001$, comparative fit index (CFI) = .849, standardized root mean square residual (SRMR) = .078, was deficient in terms of its CFI (see Table 2). Interestingly, both time of year and shared team task were positively related to delays and distractions. Surgery complexity related positively to transition processes. The coaching intervention correlated significantly with transition and action processes but not with interpersonal processes or the outcomes. Covariates did not relate significantly to action or interpersonal processes.

Controlling for the covariates, the coaching intervention related positively to transition processes (Hypothesis 1: $\beta = .22$, $p < .05$). This represents a significant change in the trajectory of transition processes for the coached surgeons following the intervention as compared to the trajectory of transition processes for the quasi-control group. In turn, transition processes related positively to action (Hypothesis 2: $\beta = .41$, $p < .001$) and interpersonal (Hypothesis 3: $\beta = .32$, $p < .001$) processes. Action processes related negatively to delays (Hypothesis 4a: $\beta = -.26$, $p < .05$) but not distractions (Hypothesis 4b: $\beta = .04$, *ns*). In contrast, interpersonal processes did not relate significantly to delays (Hypothesis 5a: $\beta = .11$, *ns*) but were negatively, significantly related to distractions (Hypothesis 5b: $\beta = -.37$, $p < .001$).

Modification indices showed that coaching would have no other significant subsequent direct effects given those in the model, and allowing the disturbance terms associated with the prediction of action and interpersonal processes to correlate ($\psi = .602$, $p < .001$) would yield a significant model improvement, $\Delta\chi^2(1) = 91.94$, $p < .001$, and excellent model fit, $\chi^2(6) = 2.12$, *ns*, CFI = 1.00, SRMR = .012, but would not alter the significance of hypothesized relationships. It does suggest that there are potential omitted influences on processes observed during surgeries. The hypothesized model explained 11%, 19%, and 12% of transition, action, and interpersonal processes and 12% and 14% of the variance in delays and distractions, respectively.

Discussion

We examined the impact of a team leader coaching intervention on episodic team processes and two team performance outcomes. Our sample consisted of 20 surgeons who participated in a team leader coaching intervention and 20 surgeons who did not. We studied these surgeons and their teams during baseline and postintervention periods, observing a total of 223 surgeries. The quasi-experimental design affords more confidence in our ability to interpret the causal relations associated with the coaching intervention than would be possible with a correlational design (Eden, 2017).

Our results indicate that teams led by surgeons who took part in the coaching intervention exhibited higher-quality team transition processes relative to teams led by surgeons who did not. Teams

Table 1
Variable Correlations and Descriptive Statistics

Variables	1	2	3	4	5	6	7	8	9
1. Coached[a]	—								
Covariates									
2. Time (day of year)	.58	—							
3. Surgery complexity	.50	.68	—						
4. Shared experience	−.48	−.69	−.63	—					
Substantive variables									
5. Transition processes	.30	.24	.33	−.22	.87[b]				
6. Action processes	.14	.17	.22	−.18	.43	.80			
7. Interpersonal processes	.11	.07	.20	−.12	.33	.65	.95		
8. Delays	.08	.09	.13	.10	−.07	−.18	−.04	.79	
9. Distractions	.00	.07	.05	.07	−.04	−.19	−.33	.17	.92
M	.26	89.18	3.47	2.89	−.02	.00	−.01	−.01	.02
SD	.44	79.40	1.13	1.25	.52	.64	.64	.78	.78

Note. $N = 223$ surgeries nested in 40 surgeons. Correlations > |.14|, $p < .05$. Significance levels not adjusted for nonindependence and should be interpreted cautiously.
[a] Coded not coached = 0, coached = 1. [b] Omega reliabilities on diagonal as applicable.

Table 2
Parameter Estimates for Hypothesized Model

Predictors	Transition processes	Action processes	Interpersonal processes	Delays	Distractions
Covariates					
Time (day of year)	−.05 (.09) *−.05 (.09)*	.06 (.10) *.06 (.10)*	.02 (.09) *.02 (.09)*	.23 (.10)* *.24 (.10)**	.17 (.08)* *.18 (.09)**
Surgery complexity	.15 (.07)* *.18 (.08)**	.01 (.12) *.01 (.14)*	.11 (.11) *.13 (.14)*	.14 (.08) *.16 (.09)*	.03 (.07) *.04 (.08)*
Shared experience	−.05 (.06) *−.05 (.07)*	−.00 (.08) *−.00 (.09)*	.07 (.07) *.08 (.08)*	.30 (.09)*** *.34 (.11)****	.16 (.08)* *.17 (.08)**
Substantive variables					
Transition processes		(H2) .41 (.07)*** *.41 (.09)****	(H3) .32 (.07)*** *.32 (.11)****		
Action processes				(H4a) −.26 (.11)* *−.27 (.13)**	(H4b) .04 (.11) *.04 (.14)*
Interpersonal processes				(H5a) .11 (.12) *.11 (.12)*	(H5b) −.37 (.11)*** *−.37 (.14)****
Coaching[a]	(H1) .22 (.11)* *.51 (.25)**				
R^2	.11	.19	.12	.12	.14

Note. Standard font values are standardized structural model parameters; italics font values are corresponding unstandardized estimates. Standard errors in parentheses. N = 223 surgeries nested in 40 surgeons. H = hypothesis.
[a] Coded not coached = 0, coached = 1.
* $p < .05$. *** $p < .001$.

that engaged in effective transition processes during preoperative briefings later exhibited higher-quality action and interpersonal processes, which in turn influenced team outcomes. Notably, action processes related negatively to delays but not distractions, and interpersonal processes related negatively to distractions but not delays. Thus, the coaching intervention put into motion a complex set of processes that impacted team outcomes through different paths. Action processes concern task-focused behaviors (monitoring patient conditions and resources). Interpersonal processes concern social interactions (affect management) that are not as directly tied to task performance. Not surprisingly, interpersonal processes had a stronger relationship with distractions than did action processes. Thus, while the intervention had virtually the same indirect relationship with action and interpersonal processes, via its direct influence on transition processes, subsequent relations with the two outcomes operated through different mechanisms.

Theoretical and Practical Implications and Future Research Directions

Team leader coaching. One contribution of this research is that it offers evidence that a team leader coaching intervention can yield benefits to team processes and performance. A limitation of the leader coaching literature is that it has focused on outcomes related to the leader (e.g., attitude, behaviors, learning) and has relied on the assumption that leader changes will in turn impact their teams' functioning and performance. Our findings are perhaps weaker than one might expect from the coaching literature, but that may be attributable to the more rigorous methods employed. To date, the leadership coaching literature has focused on leaders' attitudes and beliefs—typically with self-report measures—whereas we tested the effects of coaching leaders on the processes and performance of the teams they led using non-self-report measures in the context of a longitudinal field experiment.

An interesting future research area concerns the mechanisms that explain how team leader coaching interventions influence team processes, such as cultivating team leader self-awareness (Ely et al., 2010) about how their behaviors affect team interactions or heightening their concern for team motivational and behavioral processes (e.g., Morgeson, DeRue, & Karam, 2010). Although it was not feasible to gather such data in our study, it may be possible in other contexts. Future research also should consider whether team leader coaching interventions are more or less valuable if the leader or members completed other team-related training (Shuffler, Diazgranados, Maynard, & Salas, 2018). The hospital in this study had previously conducted CRM training, introducing future research questions about whether there may be synergistic (or substitution) effects that may accrue to leaders and teams who have been exposed to multiple team-related interventions.

Further, finding that coaching a single individual had benefits that extended to the team raises questions about whether team-related interventions should be delivered to team leaders, intact teams, or individual members. Beyond team leaders, can coaching a strategic core (Humphrey, Morgeson, & Mannor, 2009) or specific team member (e.g., circulating nurse; Geyer et al., 2016) affect team outcomes? It is also unclear if the benefit of coaching interventions extends beyond the OR (Tesluk, Farr, Mathieu, & Vance, 1995) to benefit other team assignments. These questions speak to the organizational dynamics and relative costs/benefits of interventions (Shuffler et al., 2018).

A final related area for future research concerns how long the benefits of team leader coaching interventions endure over time. Because our postintervention observations occurred 5 months after baseline observations and 2 months after the intervention, our research design offers compelling evidence of the sustainability of the coaching intervention benefits. Future studies should assess how long such benefits endure (Wolf, Way, & Stewart, 2010). It also may be worth examining how frequently coaching inoculations should occur to prolong the benefits of team process and outcome gains. Alternatively, future work could explore whether the process and performance benefits of coaching trigger a positive spiral of reinforcement so the effects of the intervention intensify over time. Clearly, more temporal research is needed.

Episodic team processes. A second contribution of this research concerns our methodologically robust approach to the study of episodic team processes. We used multiple nonsurvey methods that were aligned with when the processes occurred (Luciano, Mathieu, Park, & Tannenbaum, 2018; Marks et al., 2001) and modeled their relationships over time using multiple performance outcomes. Our study is the first to include all three second-order team process dimensions, to index those processes when they occurred, and to temporally model how transition processes influenced later action and interpersonal processes. As hypothesized, we found that team transition processes set the stage for later team action and interpersonal processes and thereby indirectly reduced surgical delays and distractions. Also, Marks et al. (2001) noted the results of one episode serve as inputs for later episodes as team processes and outcomes are linked temporally across episodes. These relationships are salient in many contexts and remain an unexplored phenomenon. However, they were not as relevant in our context because surgical teams work as crews, with team membership changing for each surgery, such that the carry-over effects of prior surgeries are less pronounced.

Our study offers a better understanding of the episodic nature of team processes and demonstrates that team leader coaching interventions can shape team processes and outcomes. However, much work remains to be done. For example, our study context had distinct breaks between transition and action phases and thus may not generalize to less uniform contexts. Also, while our study addressed several of Mathieu, Luciano, et al.'s (2019) research recommendations, future research should examine if reciprocal relationships exist between the various team process categories over time, across episodes. Further, indexing team processes with a network approach (cf. Crawford & LePine, 2013) may reveal more complex and nuanced patterns of teamwork.

Team process—outcome relations. Mathieu, Gallagher, et al. (2019) suggested including multiple performance outcomes when studying team processes. We found that action processes related negatively to delays but not distractions and that interpersonal processes related negatively to distractions but not delays. Thus, we extend the team literature by highlighting the nuanced effect that different processes have on team outcomes. We also contribute to the healthcare literature as little is known about factors that impact OR performance (Antoniadis, Passauer-Baierl, Baschnegger, & Weigl, 2014), which "makes the development of interventions to improve patient safety unsubstantiated and ineffective" (Wiegmann et al., 2007, p. 658). Although scholars (e.g., Wong et al., 2010) recognize OR delays can be caused by team-related factors (e.g., poor communication), most research focuses on system or equipment-related causes (e.g., delayed surgical setup, malfunctioning technology). Our results contribute to a limited understanding of how team processes influence surgical delays.

Reflecting on our results, it is logical that action and interpersonal processes would impact delays and distractions differently. Because most surgery delays result from equipment failure or availability (e.g., Wong et al., 2010), engaging in effective action processes such as system monitoring, tracking supplies, and monitoring equipment should result in fewer delays. Our findings for interpersonal processes and distractions also align with related research. Studies indicate that conflict and disruptive behaviors can cultivate stress in OR teams, which impairs concentration and communication (Rosenstein & O'Daniel, 2006). Thus, teams with higher-quality interpersonal processes should exhibit fewer distractions as evidenced by the need for less repeated communications. Noting that OR teams may use personal communication to reduce social tension (Healey, Sevdalis, & Vincent, 2006) or create a positive social climate (Antoniadis et al., 2014), scholars should examine whether some "distractions" (e.g., small talk) may in fact be functional.

Limitations and Boundary Conditions

Although the surgical team context provides a valuable setting to examine the impact of a team leader coaching intervention on team outcomes using a temporal lens (Salas et al., 2018), how well our findings translate to other team contexts warrants investigation. Also, whereas including two surgical team outcomes, indexed by SMEs who were unaware of our research agenda, is a strength of our study, it would be valuable to examine the impact of team leader coaching interventions on archival and objective outcomes. Additionally, future studies should examine whether team leader coaching interventions are useful as a first step in improving team processes and performance or best utilized with other interventions and whether leader coaching may be more or less effective when the leader is coached on topics their team has (or has not) learned previously. Finally, although all coaching sessions focused on facilitating teamwork, coaching was idiosyncratic to each leader as they differed in terms of needs, skills, and experiences.

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(*Appendix follows*)

Appendix

Measurement Details and Construct Validation

Measures

We followed a fitting approach to construct validity (Luciano et al., 2018) to maximize the alignment of our measures with our theoretical constructs of interests, as manifest in our study context, and collected team process variables when the phenomena were presumed to occur. Observers were present in the OR during the preoperative briefings and surgical periods. Because this was a medical training facility, it was not unusual for observers to be present and taking notes during surgical procedures. The protocol included checklists, counts, and judgment ratings. Checklist items were sometimes scored in terms of whether or not an event occurred (0–1) or on a graduated scale if additional points were warranted. For instance, whether introductions occurred was scored 0 if no introductions were done and an unfamiliar member was present, 1 if no introductions were done but it was clear the surgeon and all crew members knew one another well, and 2 if introductions were done and a new member was present or familiar members greeted one another. Other items had unique graduated scales as well.

Counts were the number of times something occurred (e.g., personal arguments) or the duration of an event (e.g., time the circulator nurse was out of the room).[1] Observers also made overall ratings concerning the quality of different team processes as described below. Because different measures were scaled differently, we z-scored each using the total sample of observations before creating any composites.

Processes. Transition processes refer to team behaviors observed during the preoperative briefings. We used two types of checklists to evaluate transition processes. A medical procedures checklist recorded whether (a) a briefing occurred, (b) all crew members were present, (c) the team used a checklist, (d) and the team made introductions, as well as whether the (e) surgeon, (f) anesthesiologist, (g) circulator nurse, (h) scrub, and (i) other assistants provided updates concerning their responsibilities. A teamwork procedures checklist was used to record the extent to which the team discussed (a) contingency plans, (b) teamwork expectations, (c) “red flag” statements to garner attention, (d) and “time out” protocols, as well as whether (e) members gave full attention during the briefing and (f) questions were solicited. At the conclusion of the preoperative briefing and before the surgery began, observers also rated the overall quality transition processes using the following item: “Overall, how would you rate the team’s briefing (transition) processes?” They used a 5-point response scale anchored as (1) *poor*, (2) *below average*, (3) *average*, (4) *above average*, and (5) *excellent*.

Action processes were observed and indexed during the surgical procedure. Monitoring and coordination actions were indexed in terms of counts of (a) callouts of critical information to the entire team, (b) check-backs (i.e., closed-loop communications), (c) cross-monitoring of patient status, and (d) providing feedback to others. Backup behaviors were indexed in term of (a) providing task assistance to others and (b) providing mutual support, backup, and help as needed. At the conclusion of the surgery, the observers rated the overall quality of the action processes using the following item: “Overall, how would you rate the team’s ability to coordinate action items?” using the response scale described.

Interpersonal processes were also observed and indexed during the surgical procedure. Motivation and affect management were scored in terms of the extent to which members (a) encouraged one another and (b) exhibited and verbalized respect for one another. Conflict management was indexed in terms of (a) the number of negative personal comments and conflicts expressed between members (reverse scored) and (b) mutual respect and support provided to one another. Observers also rated the overall quality of interpersonal processes at the conclusion of the surgery with the following item: “Overall, how would you rate the team’s ability to manage interpersonal relationships?” using the same 5-point response scale. Although Marks et al. (2001) suggested that interpersonal processes occur throughout teams’ episodic cycles, our initial observations of preoperative sessions revealed that they were relatively short with few interpersonal exchanges. There were far more opportunities for interpersonal processes to unfold during surgeries, so we focused exclusively on how they manifest during the episodes.

Performance. As is common practice for surgeries (Wahr et al., 2013; Wolf et al., 2010), we indexed two team performance outcomes: delays and distractions. Delays were scored in terms of counts of the (a) number of times the circulator nurse left the room, (b) number of times the team did not have something that they needed, and (c) total duration (in seconds) of stops in the procedure. Distractions were indexed using counts and ratings. First, the number of (a) repeated communications and (b) personal conversations were tallied. Second, the observers made ratings concerning the extent to which there were (a) confusing communications, (b) distracting music, and (c) outside interruptions during the surgery.

[1] A circulator is a nurse who does not scrub in for a surgery, but rather is present at all times to maintain charts and track supplies and equipment used. Circulators may need to leave a surgery to obtain supplies or advocate for a patient who is anesthetized.

(*Appendix continues*)

Table A1
Multitrait Multimethod Analysis of Observers' Evaluations of Team Processes and Outcomes

	Latent variables						
	Team processes			Outcomes		Measurement methods	
Indicators	Transition	Action	Interpersonal	Delays	Distractions	Checklists/counts	Ratings
Process checklists						.067	
Medical procedures	.689***					−.083	
Teamwork procedures	.852***					−.013	
Monitoring/coordination		.759***				.126	
Backup behaviors		.296**				.029	
Motivation/affect management			.808***			.653***	
Conflict management			.484***				
Observer process ratings							
Transition processes	.451***						.190†
Action processes		.649***					.428***
Interpersonal processes							.431***
Delays			.660***				
# times circular left				.923***		−.230†	
# times missing equipment				.864***		−.108	
Procedural delays (seconds)				.480***		.387***	
Distractions							
# repeated communications					.380***	−.191	
# personal conversations					.854***	.167**	
Confused communications					.561***		−.341***
Distracting music					.782***		−.014
Outside interruptions					.967***		−.023

Note. $N = 223$ surgical observations.
† $p < .10$. ** $p < .001$. *** $p < .001$.

Covariates. We used three covariates in our analyses to statistically control for potential contaminating influences. First, observers interviewed one or more team members at the end of each surgery. To assess the complexity of the procedure, which can influence surgical duration and distractions (e.g., Luciano, Bartels, et al., 2018), they asked, "How complex or unique was this operation/procedure relative to others that you have been a part of?" We recorded responses on a 5-point scale that ranged from (1) *far less complex* to (5) *far more complex*. Multiple responses were available for 90 surgeries that evidenced median agreement indices based on a symmetrical null response distribution (i.e., $r_{wg} = .83$; James, Demaree, & Wolf, 1984), which suggests that members had a shared perception of surgery complexity. Second, observers asked team members about their shared team task experience, which is known to relate significantly to surgical outcomes (e.g., Luciano, Bartels, et al., 2018), using the following: "How often have you worked with members of this team on similar prior cases?" Responses were recorded on a 5-point scale that ranged from (1) *never* to (5) *very frequently*. Members also evidenced sufficient median agreement indices (i.e., $r_{wg} = .83$) on this item, which suggests they had a common perception of their shared team task experience. Finally, we accounted for day of the year to control for any time-varying influences on our substantive variables. Naturally, this will covary positively with our coaching dummy code, which is scored 1 for all coached surgeons during the postintervention phase but also controls for any temporal factors that may otherwise be related to our process and outcome variables (Korsgaard, Kautz, Bliese, Samson, & Kostyszyn, 2018).

Results

Because observers used checklists and counts, as well as made judgments concerning team processes and outcomes, we first needed to establish the construct validity of our measurement protocol. We specified a seven-factor multitrait multimethod confirmatory factor analysis (CFA) to evaluate the degree of substantive construct variance in our observational protocol (Lance & Fan, 2016). The model had five substantive factors corresponding to the three team processes and the two outcome variables and two measurement factors corresponding to the checklist/counts and ratings indices. We fit the seven-factor model whereby each measure had both a substantive and method loading as illustrated in Table A1. We estimated a correlated-traits uncorrelated-methods (CTUM; Lance & Fan, 2016) model that permitted the substantive factors to correlate with one another, but

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not with the method factors, and the two method factors were also constrained to be uncorrelated. To gauge model fit for these and subsequent analyses, we report the SRMR and CFI. We also report chi-square values, which provide a statistical basis for comparing the relative fit of nested models. We adopted the following guidelines for model fit suggested by Mathieu and Taylor (2006): models with CFI values $< .90$ and SRMR values $> .10$ are deficient, those with CFI $\geq .90$ to $< .95$ and SRMR $> .08$ to $\leq .10$ are acceptable, and those with CFI $\geq .95$ and SRMR $\leq .08$ are excellent.

The seven-factor CTUM model evidenced an acceptable fit on the basis of the SRMR index but a deficient fit in terms of its CFI index, $\chi^2(92) = 280.52$, $p < .001$, CFI = .870, SRMR = .086. As shown in Table A1, the substantive factor loadings on the three team process dimensions were all significant ($p < .01$), ranging from $\lambda = .296$ to .852, averaging .63. The loadings on the two substantive outcomes were all significant ($p < .001$), ranging from $\lambda = .380$ to .967, averaging .73. In contrast, only three of the loadings on the checklist/count method factor were significant ($p < .01$), and they ranged from $\lambda = -.230$ to .653, averaging .073. Similarly, only three of the loadings on the ratings method factor were significant ($p < .01$, one of which was negative), and they ranged from $\lambda = -.341$ to .431, averaging .112. All totaled, 66.24% of the total measurement variance was attributable to substantive factors, 10.36% was attributable to measurement factors, and 23.40% was attributable to random error. Notably, inspection of the modification indices from the CTUM CFA model suggested that permitting the observers' ratings of transition processes to also load on the latent action processes dimension ($\lambda = .501$, $p < .01$) would have yielded a significant model improvement, $\Delta\chi^2(1) = 43.94$, $p < .001$, and yielded an acceptable overall model fit, $\chi^2(91) = 236.58$, $p < .001$, CFI = .902, SRMR = .074. This follows from the fact that the two forms of processes are closely intertwined, such as monitoring progress toward goals (during action processes) that were established during transition processes (Mathieu, Luciano, et al., 2019). Adding that parameter, however, would not alter any of the significance of the relationships nor the inferences described above.

Given the results of the CTUM analyses, we calculated the omega reliabilities of the three process and two outcome measures. Unlike Cronbach's alpha, which requires parallel (i.e., tau-equivalent) measures, omega calculates the internal consistency of nonparallel (i.e., congeneric) measures such as checklists, counts, and ratings (McDonald, 1999). The omega reliabilities for our unit-weighted composite process variables were transition $\omega = .87$, action $\omega = .80$, and interpersonal $\omega = .95$, whereas the outcome reliabilities were delays $\omega = .79$ and distractions $\omega = .92$. Therefore, we created composites for each variable by averaging their respective *z*-scored indicators. We also standardized the other variables on the basis of the 223 surgeries for use in the structural model analyses.

Received June 25, 2019
Revision received July 2, 2020
Accepted July 2, 2020 ■