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Team Familiarity and Task Interdependence: A New Perspective on Dynamic Team Composition

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TEAM FAMILIARITY AND TASK INTERDEPENDENCE:
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ABSTRACT

Teams have become an integral part of today's workforce, allowing organizations to accomplish more than any one individual could do alone. Given their relevance to organizations, a plethora of research has been conducted to enhance team effectiveness and inform staffing procedures. However, most of these studies ignore the temporal dynamics inherent to team functioning, assuming that teams are comprised of the same members over time and that all members share the same level of interdependence. In reality, teams, such as those found in healthcare, are much more fluid, with members continually joining and leaving, thus highlighting the need for research regarding the composition of dynamic teams. To bridge this gap, the present study examines the role of team familiarity, or shared team task experiences, in surgical teams, which follow crew-based staffing procedures. Results indicate that team efficiency is positively related to team minimum task experience, while controlling for the urgency of the case and the patient's American Society of Anesthesiologists physical status. However, there was not a significant relationship between team familiarity and team efficiency for either the interdependent or non-interdependent dyads, as there were no main effects or interactions found between familiarity and team efficiency. Although team familiarity was not related to efficiency, the results of this study still advance our understanding of team composition from both a theoretical and practical perspective. By leveraging a compilational approach, this study advances our understanding of dynamic team composition and illustrates the negative implications that one novice team member may have on subsequent team outcomes, which could inform future staffing protocols.

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CHAPTER ONE

INTRODUCTION

As technology has advanced, the very nature of work has shifted into a globalized network of individuals working together across time and space to address more complex problems than previously possible. Together, these groups allow organizations to accomplish more than any one individual could do alone. Much research has been conducted to examine factors that influence team effectiveness and ensure teams are comprised of the *right* individuals. This work has resulted in several meta-analytic studies on team composition in terms of personality (e.g., Peeters, Van Tuijl, Rutte, & Reymen, 2006), cognitive ability (e.g., Devine & Philips, 2001), and demographic diversity (e.g., Bell, Villado, Lukasik, Belau, & Briggs, 2011). However, much of the current research ignores the inherent dynamics that exist in real-world teams (Bell, Brown, Colaneri, & Outland, 2018).

Scholars have continually defined teams as "(a) two or more individuals who (b) socially interact (face-to-face or, increasingly, virtually); (c) possess one or more common goals; (d) are brought together to perform organizationally relevant tasks; (e) exhibit interdependencies with respect to workflow, goals, and outcomes; (f) have different roles and responsibilities; and (g) are embedded in an encompassing organizational system, with boundaries and linkages to the broader system context and task environment" (Kozlowski & Ilgen, 2006, p. 79). Core to this definition is the idea that teams are comprised of individuals that must work together interdependently to complete tasks. Further, they are embedded in a multilevel system with individual, team, and organizational level components that impact their task-relevant processes that unfold dynamically overtime (Kozlowski & Ilgen, 2006). Although dynamism is an implicit part of team functioning, researchers often overlook the embedded complexity in their studies. The need for additional research regarding temporality has been noted by many scholars to no avail (Mohammed, Hamilton, & Lim, 2009; Kozlowski & Bell, 2009; Mathieu, Hollenbeck, Van Knippenberg, & Ilgen, 2017). However, the nature of today's work teams demands additional research regarding these dynamics to appropriately address the needs of teams in practice (Tannenbaum, Mathieu, Salas, & Cohen, 2012).

Indeed, while traditional teams consisted of a set of stable team members that coordinated their efforts to complete tasks, these boundaries are blurred in the current workforce. Team membership is more fluid, with members joining and leaving the team or only combining forces for a short period of time to complete a specific task. Team composition fluidity can be seen in crew-based teams, such as healthcare teams and airline crews, where a group is quickly formed to address a given need (Tannenbaum et al., 2012). These teams create a unique context for team research, as the environment they operate within has distinct contextual constraints, where members continually join together as a team to perform a highly specialized task and then disband. Given the increase in dynamic team composition, additional research examining teams that are not confined to a set of members is warranted (Tannenbaum, Mathieu, Salas, & Cohen, 2012). Specifically, scholars have cited the need to incorporate contextual factors imposed on today's teams as focal constructs, rather than boundary conditions that define the team, to create more actionable solutions (Kozlowski & Bell, 2009; Mathieu et al., 2017). By advancing such theory, we can identify key factors that influence the effectiveness of fluid teams to inform evidence-based recommendations for staffing protocols. This study hopes to fill this gap and advance literature by examining how familiarity among interdependent surgical dyads, which have fluid composition structures, influence team outcomes.

This effort not only examines dynamic team composition as a research foci, but it also will be conducted with real-world teams. Though laboratory studies are beneficial for evaluating teams in a controlled environment, many of the dynamics that occur in practice are not easily recreated in a lab stetting, bringing the relevance and fidelity of these studies into question. For example, while the role of membership change within teams has been studied in lab settings, these studies are often conducted with individuals that have no prior experience working together and perform a team task that requires all team members to be highly interdependent (Dineen, 2005). Such conditions rarely occur in practice, as many employees will be familiar working with one another and perform tasks that require different members to work together closely at different points in the team's lifecycle. To address these issues, this study will apply both qualitative and quantitative methods to examine fluid teams within the operating room (OR).

Though similar studies have been conducted in this setting, there have been mixed results including both positive (Humphrey, Morgeson, & Mannor, 2009; Xiao, Jones, Zhang, Bennett, Mears, Mabrey, & Kennerly, 2015) and curvilinear (e.g., Berman, Down, & Hill, 2002; Lucciano et al., 2018) effects between team familiarity and team performance. By applying a dynamic lens to these teams, I explicate how team familiarity is only critical for those team members that are required to work together closely, rather than having an entire team that is familiar. Specifically, I will examine the role of team familiarity for highly interdependent dyads, rather than assume that all team members should be familiar with one another, thus advancing a new method for examining team composition. In so doing, this study has direct practical implications for surgical team effectiveness and staffing, which influences both patient outcomes and organizational costs (Munoz, Mumoz, & Wise, 2010).

To this aim, my dissertation is organized as follows. First, I review prior team composition research and summarize key concepts that shape the foundations of team composition. This will provide the theoretical grounding for my dissertation and lay the framework for my hypotheses. Leveraging these foundational concepts, I then propose how factors such as team familiarity and task interdependence may influence team effectiveness for teams that possess dynamic composition. Following the hypotheses, I describe the qualitative and quantitative methods applied to conduct this study and the analytical approach employed for assessing the data. I conclude with a discussion of the theoretical and practical contributions this dissertation has for team composition and fluid teams and suggest areas for future research.

Team Composition

A plethora of research has been conducted to inform best practices and key considerations regarding team composition. In an effort to organize this research, Bell et al., (2018) summarized four foundational concepts that shape team composition, including: team member attributes, operationalizations at the team level (e.g., diversity, team mean), the context, and temporal considerations (time). These will be explored in more detail here and then leveraged as the theoretical rational for the hypotheses.

Perhaps the most studied aspect of team composition is the examination of member attributes, which encompass both surface-level and deep-level attributes. Surface-level attributes are easily seen characteristics within a team (e.g., age, sex race), while deep-level constructs are the underlying psychological characteristics (e.g., personality traits, abilities, values, attitudes), that influence team interactions overtime. Though surface-level characteristics are prone to influence team effectiveness by prompting stereotype-based assumptions, research indicates that deep-level characteristics influence team performance above and beyond surface-level composition variables (Bell, 2007; Bell, Villado, Lukasik, Belau, & Briggs, 2011).

When operationalizing these constructs, team composition researchers apply multilevel theory and methods. One of the critical assumptions in team composition research is that researchers choose the appropriate operationalization's of individual attributes to reflect team level phenomenon. To better understand how characteristics that are attributed to individuals may emerge as a team level phenomenon, Kozlowki and Klein (2000) advance two forms of emergence that occur within teams: compositional processes and compilational processes.

Compositional processes assume isomorphism across team members and weight the attributes or contributions of all members equally. Compilational processes occur when lower-level characteristics, behaviors, and/or perceptions vary within a group to create meaningful patterns of these lower-level aspects, and, subsequently, characterize the unit as a whole in a way that is qualitatively distinct at the team level. There are three primary distinctions between composition and compilation. First, individual contributions to higher-level constructs are similar (isomorphism) for composition and are dissimilar (discontinuity) for compilation in type, amount, or both. Second, composition interaction processes and dynamics are incremental and stable, have low dispersion, and create a uniform pattern, while compilation dynamics are irregular, have high dispersion, and exhibit nonuniform patterns. Finally, composition represents emergent phenomenon by a linear convergent point. However, compilation represents emergent phenomenon as a nonlinear pattern or configuration.

Although there are clear differences between these conceptualizations of emergence, they should be considered on a continuum where a mix of both processes contribute to team composition effects (Bell et al., 2018; Kozlowski & Klein, 2001). To advance literature, researchers must define how member attributes may combine to influence team affect, behavior, and cognition and match the appropriate operationalization (e.g., mean, weighted networks) to the predicted emergence. Unfortunately, such considerations are often overlooked, as the application of the team average (i.e., compositional approach) has been routine in team literature.

When determining such operationalizations, it is critical to consider the context that the team operates within to ensure the appropriate metrics are applied. Context can be both internal factors within the team that shape the work conditions and external factors that impact team functioning. Internal contextual influences are factors within the bounds of the team, such as the nature of the team's task and the structure of interdependence between members, that influence subsequent team processes. External contextual features, on the other hand, are largely factors outside of the team's control that influence their operations, such as the organization's competitive advantage strategy or diversity representations in a given industry (Bell et al., 2018). Both internal and external environmental features can influence the salience of team composition attributes and the desirability of behaviors. For example, a recent meta-analysis found that the relationship between team personality and team performance was enhanced for teams that had higher levels of interdependence (Prewett, Walvoord, Stilson, Rossi, & Brannick, 2009). These external and internal contextual features can alter the impact of team composition variables and their operationalizations, shaping the role of team composition in subsequent team processes and outcomes.

Finally, time can also influence team composition in that the attributes of the team will dynamically interact throughout the team's life cycle to influence subsequent team processes. This is seen when examining the diminishing impact of surface-level diversity overtime, as members have had the opportunity to gain more meaningful interactions (Harrison, Price, & Bell, 1998). Adding to this dynamism, the very composition of the team is also likely to shift over time. Today's teams are more commonly comprised with fluid membership structures where members change and leave teams over time. This is particularly true in crew-based structures, where individuals may have little or no experience working together previously. In addition, the context and task environment in which teams operate can also shift, with new tasks requiring different members to be more or less interdependent than their prior tasks.

Although these dynamics exist in real-world teams, Mathieu and colleagues (2014) outline three underlying assumptions for team composition models that largely ignore these factors. Specifically, most models of team composition assume that "(a) members' compositional influence remain consistent overtime, (b) member positions and roles remain consistent and equally important over time, and (c) team membership remains constant over time" (Mathieu, Tannenbaum, Donsbach, & Alliger, 2014, p. 145). By ignoring such dynamics, our research fails to address key composition issues that arise across crew-based teams, as seen in healthcare and spaceflight, where teams are comprised of continually rotating members. Within healthcare, these teams are dynamic in that they have fluid membership and that their tasks and degrees of interdependence also continually shift in their environment (Edmondson, 2012). However, as previously noted, these contextual features are often assumed to be static and tend to adopt a compositional operationalization, where the methods imply that "more is better," assuming that if all team members possess a particular construct (e.g., consciousness) or agree that team trust is high, they will have better performance. This compositional approach assumes that constructs at the lower levels (e.g., individual level) emerge at higher levels (e.g., team level) the same way. However, they fail to consider how patterns of interactions between members may vary across the team and subsequently change how phenomena emerge within a team compilationally. Numerous scholars have called for additional research in this area to better understand how compilational factors impact team effectiveness, particularly in regard to team membership over time (McGrath & Tschan, 2007; Kozlowski & Bell, 2003; Gully, 2000; Mathieu et al., 2014). This study aims to address this gap through the examination of team familiarity and task experience, which are temporally based, between team members that are either highly interdependent or not interdependent.

Team and Task Familiarity

The nature of being "familiar" with one's teammates branches out into two primary sects. The first is focused on how familiar individuals are with their *teammates* and the second concerns how familiar team members are with their role or *task*. While *team familiarity* is gained through experience working as a team on a given task, *task familiarity* is one's experience performing a task regardless of their teammates. Both team and task familiarity can contribute to team effectiveness, but the latter has received little attention in literature to date. Indeed, while some studies may control for organizational tenure, very few team studies include task experience or team tenure as control variables and even less consider them as focal constructs (Tannenbaum, Mathieu, Salas, & Cohen, 2012). This may have many implications for team effectiveness, as more experienced members may perform their tasks quicker than their novice peers and may be viewed as a leader due to their expertise in a given role (Argote & Miron-Spektor, 2011). Team familiarity, on the other hand, has received increasing attention with conflicting results.

Team familiarity encompasses how familiar individuals are with their team members in terms of a given task environment. This is particularly important in complex settings such as healthcare, where team composition is continually changing, as the shared task experiences team members have can facilitate the development of shared expectations and knowledge (Esponia et al., 2007b). These shared knowledge structures, or mental models, pertain to the knowledge team members gain regarding both the task and their teammates and have been linked to numerous team outcomes (Mohammad & Dumville, 2001; Floren, Donesky, Whitaker, Irby, ten Cate, & O'brien, 2018). The task related knowledge that members gain from shared task experience includes information related to task goals, procedures, strategies, and relevant equipment, while team related knowledge involves factors such as role interdependencies, responsibilities, and communication patterns among team members as well as individual knowledge, skills, abilities, and preferences (Floren et al., 2018). While task related knowledge may be gained from performing a task or having experience in a particular role regardless of teammates, team member mental models are acquired from working with the same individuals over time.

In traditional teams that have bounded team membership, team and task mental models tend to develop in tandem, as individuals create shared knowledge regarding both the task and team members together. However, in teams that follow crew-based staffing, members may fail to establish team mental models prior to performing their task, instead resorting to mental models they have formed regarding the task, independently of their current team. For example, in surgical teams, the same procedure type will likely follow similar procedures, fostering shared task mental models across individuals. However, team member mental models will likely be more varied among these teams, as different surgeons and members have diverse preferences for tools and communication within the OR. These differences may create delays in coordination times, as members resort to more explicit forms of coordination. Therefore, prior experience working together may play a critical role in team effectiveness to facilitate the development of shared team mental models.

Given these different knowledge structures, it is important to consider the differential effects that task experience may have in comparison to shared team experience or team familiarity in contexts where members work across numerous teams, such as crews. To this aim, the following sections will first define how team familiarity may impact team outcomes, given specific contextual dynamics, and then examine the role of task familiarity in these environments.

Team Familiarity

Within crew-based teams, members gain familiarity as they work alongside one another across tasks. Indeed, the role of team familiarity, defined as the shared task experience between members, has been well studied within surgical teams, with many surgeons calling for a need to keep their teams consistent over time. For example, studies have cited that having familiar teams can lead to reductions in operation times (Xu, Carty, Orgill, Lipsitz, & Duclos, 2013) and enhance patient outcomes (Kurmann, Keller, Tschan-Semmer, Seelandt, Semmer, Candinas, & Beldi, 2014).

As previously noted, shared task experiences and team familiarity tend to lead to positive outcomes within teams due to the shared knowledge that these teams develop over time (Esponia et al., 2007b). Indeed, several studies have emphasized that team familiarity and experience working together is critical for developing shared mental models within a team. For example, a study conducted with cardiac surgical teams found that when team members were familiar with the surgeon, the number of technical errors and teamwork failures were significantly lower than in teams where the majority of the members were not familiar with the surgeon. The authors attributed this increase in performance to fewer flow disruptions in familiar teams (ElBardissi, Wiegmann, Henrickson, Wadhera, & Sundt III, 2008). Similar improvements have been seen in surgical teams that remained stable throughout the day (Stepaniak, Heij, Buise, Mannaerts, Smulders, & Nienhuijs, 2012) and where the two surgeons performing the surgery had increased familiarity (Elbardissi, Duclos, Rawn, Orgill, Carty, 2013; Xu, Carty, Orgill, Lipsitz, & Duclos, 2013).

However, other studies have found less optimistic outcomes when examining familiar teams. Lucciano and colleagues (2018) found a curvilinear relationship between shared task experience and team performance, and explained that when tasks are performed frequently, they allow complacency to manifest within surgical teams and result in an inverted-U shaped relationship between shared task experience and team efficiency. A similar curvilinear effect was also found in basketball teams, where the positive relationship between shared task experience and performance not only diminished over time, but also became negative (Berman, Down, & Hill, 2002).

These conflicting results may be due to the varying operationalizations of team familiarity. For example, some studies have operationalized familiarity as the degree of experience between two surgeons (e.g., attending and assisting surgeon, Xu et al., 2013; senior and junior surgeon, Kurman et al., 2014), while others have examined team familiarity across all members by first calculating the shared experience each dyadic pair has performing a specific procedure together, and then averaging across all the dyads to aggregate this metric to the team level (Reagans, Argote, & Brooks 2005; Esponia et al., 2007; Lucciano et al., 2018). Such approaches have been criticized for failing to consider the influence of the team context when operationalizing team familiarity. For example, by only examining the degree of familiarity between the surgeons, authors overlook the role of anesthesia and nursing colleagues, which are critical for OR efficiency and patient outcomes (Aggarwal, 2014). Further, by taking the aggregate level of familiarity across all dyadic pairs within a team, one assumes that familiarity plays the same role across the entire team and between all the roles. These discrepancies illustrate that even though team familiarity has been measured in various ways, authors have failed to theoretically ground their construct operationalizations and explain why their metric was best suited for a given context, which can have numerous conclusion fallacies in teams research (Bliese, 2000; Kozlowski & Klein, 2000).

Recent reviews have noted that when operationalizing team level constructs, the chosen metric can have critical implications for study outcomes and interpretation. For example, rather than assuming all team members need to be high in conscientiousness, studies have found that taking the team minimum may be more fitting. The minimum approach illustrates that as long as all team members have a certain base-level of consciousness they will be effective, rather than the aggregate approach, which assumes that “more is better”. Such findings have prompted numerous calls for researchers to better operationalize their constructs by considering both the task environment and team dynamics.

For example, within surgical teams it would be important to consider the role of team interdependence when operationalizing team familiarity, as not all members of the team are required to work together closely. This is an important consideration given that the theoretical grounding for much of the team familiarity research rests on the development of shared mental models, which posits that teams who gain more experience working together become more familiar with the task domain and each other, thus fostering the development of common knowledge regarding how to perform and execute tasks (Esponia et al., 2007a). While this is critical for those members that heavily rely on one another to perform their assigned tasks, team members that are not interdependent may not need the same level of shared knowledge.

Team Task Interdependence

Team task interdependence is the degree to which members must rely on one another to complete their individual tasks and achieve their overarching goal. It also encompasses the interconnections that members have in their workflow and processes, and greatly influences team member interactions (Kozlowski & Bell, 2013). As a structural variable, task interdependence plays an integral role in team functioning and has been cited as a moderator between many variables and team performance (Langfred & Shanley, 2001). Further, meta-analytic results indicate that effect sizes estimating the relationship between team diversity and team performance doubled and tripled when they accounted for contextual factors of the organization and team task, such as interdependence (Joshi & Roh, 2009).

Given its importance, scholars have developed several models to define the different types and degrees of interdependence. For example, task interdependence can range in complexity from most to least complex: intensive, reciprocal, sequential, and pooled (see Van de Ven et al., 1976). In highly interdependent tasks, teams exhibit intensive and reciprocal interdependence; in contrast, in teams with low interdependence, individuals complete their tasks independently and then aggregate everyone's contributions to accomplish team tasks (Saavedra, Earley, & Van Dyne, 1993; Joshi & Roh, 2009). In addition to the different types of interdependence teams may have, they can also exhibit interdependence across different phases of the team's performance cycle. That is, teams may have both process interdependence and output interdependence (Wageman, 1995). Teams that have high levels of process interdependence cannot perform their essential job functions without the support of other individuals on their team, while teams with lower levels of interdependence can complete their work more independently.

To date, much of the research conducted on team interdependence assumes that all members within a team exhibit both the same type and amount of interdependence across a performance episode. However, in reality, interdependence varies between dyadic pairs within the team and may shift given the demands of the task environment. Within crews, not all members of the team are required to work together closely throughout the duration of the task. For example, within flight crews, the pilot and copilot are highly interdependent throughout the flight, while the pilot and flight attendants have a lower degree of interdependence. A similar pattern is seen within surgical teams where the surgeon and surgical scrub tech work closely together throughout the duration of the procedure, while the surgeon and registered nurse have little to no interdependence. Given this variability, it is critical to understand how these dyadic interactions influence team performance in a complilational manner, due to the varying levels of interdependence between members, to impact team performance.

Researchers have made similar distinctions within teams regarding the differential impact that a subset of members may have on team performance. For example, Humphrey, Morgeson, and Mannor (2009) argued that more critical team roles comprise the "strategic core" of a team and may contribute more to team performance than other, peripheral, roles. Specifically, they found that characteristics of the subset of individuals within the "core" were more important for overall team performance than non-core role holders. Such research suggests that team performance is not only predicted by the aggregate contribution of all members, but that specific subsets of individuals may be more appropriate for predicting team outcomes.

While existing literature has examined the impact of core roles within a team, it is also likely that specific team member relationships, or dyads, will be more critical for team performance. Specifically, team familiarity is likely most critical for individuals filling highly interdependent roles, rather than roles that do not exhibit interdependence.

Indeed, for highly interdependent tasks, those members involved in the task must have a shared understanding of the task, task environment, and team to be successful. This is particularly true in action-oriented teams, such as those found in healthcare, where interdependent dyads must be able to anticipate one another's needs and actions to respond to the environment and work in a synchronized manner to meet demands and perform the operation efficiently (Cannon-Bowers, Salas, & Converse, 1993). As previously noted, members that are more familiar with one another tend to anticipate one another's actions and work in a more efficient manner due to the shared knowledge structures they develop over time. While shared knowledge across the team may be beneficial, it is most critical for those dyads performing highly interdependent tasks to have prior experience working together, in comparison to those dyadic pairs with little interdependence. Therefore, it is predicted that:

Hypothesis 1a: Team familiarity in interdependent dyads will be more strongly related to team efficiency than team familiarity in non-interdependent dyads.

Not only will familiar, interdependent team members be able to anticipate one another's actions to work more efficiently, but they will also be able to compensate for lost time in operations. Specifically, it is expected that teams that begin their operation late will feel more inclined to make up for lost time and work at a more efficient rate than they typically would. Compensating for a late start is critical within the operating room, as operations running over their allotted time create high costs, including shifts in the remainder of the OR schedule, shifts in staffing, and delayed starts in subsequent operations (Denton, Viapiano, & Vogl, 2007). However, only those teams that have prior experience working together will be able to adjust their rate of work to make such accommodations. When highly interdependent dyads are less familiar, they must rely on more explicit, rather than implicit, forms of communication, delaying their coordination processes (Pisano et al., 2001).

Hypothesis 1b: In teams that have a late start, the relationship between team familiarity in interdependent dyads and team efficiency will be stronger than teams that start on time.

Task Familiarity and Experience

Teams can be familiar not only with working with one another on a given task, but also with the task itself. While task experience is often controlled for in organizational studies, it is rarely a focal construct of interest. However, as individuals gain experience performing a given role, they develop a mental model of the task to aid in describing, explaining, and predicting future system states (Rouse & Morris, 1986; Klimoski & Mohammed, 1994). Though teamwork mental models are gained from working with the same individuals over time, taskwork mental models can be garnered through experience alone, regardless of the team members.

As previously noted, rather than assume that all team member contributions are equal (e.g., team mean), a key advancement in team theory and measurement illustrates that team members can have a disproportionate influence on teamwork through relative contribution models (Bell et al., 2018; Mathieu, Tannenbaum, Donsbach, & Alliger, 2014). Within these models of team composition, specific roles or individuals may be used as a weighting factor to reflect compilational processes (Bell et al., 2018). For example, researchers identified that the dispositional assertiveness of individuals in critical roles, rather than the team level of assertiveness, can impact both team performance and team satisfaction by improving the team's transactive memory system (Pearsall, Mathew, & Aleksander, 2006). While surgical teams may benefit from their highly interdependent dyads being familiar, it is critical that all members are familiar with their role within the surgical team to quickly respond to unexpected changes in the operation or patient's status. Increases in task experience have been linked to increased performance, while the integration of novice members in highly specialized roles can have detrimental effects (Reagans, Argote, & Brooks, 2005; Argote & Miron-Spektor, 2011). This highlights that teams may only be as strong as their least experienced member. Specifically, the benefits of team familiarity will likely be mitigated when teams have a novice or inexperienced member as these members tend to make more errors and take longer to complete their tasks (Reagans, Argote, & Brooks, 2005).

Hypothesis 2a: Team minimum task experience will moderate the relationship between team familiarity and team efficiency. Specifically, the low task experience of one member will mitigate the positive effects of team familiarity.

Hypothesis 2b: In operations that have a late start, team minimum task experience will moderate the relationship between team familiarity and team efficiency. Specifically, the low task experience of one member will mitigate the positive effects of team familiarity.

CHAPTER TWO

METHODS

Setting

To examine the relationships between team familiarity, team interdependence and performance, both quantitative and qualitative data from the preoperative services department of a large healthcare system in the southeastern United States was examined. Specifically, this study analyzes two years of electronical medical records data for all operations performed from 2017-2019 to assess the focal research question and leverages over two hundred hours of observations to develop the theoretical grounding for the study.

This is an ideal context to examine the role of team familiarity because surgical teams follow a crew-based form of team composition. That is, surgical teams are comprised of members that may or may not have worked together previously, they only remain together for a short period of time (e.g., length of the operation), members are expert specialists that fill a specific role within the team, and members complete tasks that are closely synchronized (Webber & Klimoski, 2004). Further, being a teaching hospital with a conjoined medical school, surgical staff are accustomed to being observed by students and residents, making it well suited for conducting qualitative and observational research.

Within this healthcare system, operating rooms are typically staffed with a registered nurse (RN), surgical scrub tech, surgeon, and certified registered nurse anesthetist (CRNA). Surgeons on a case may be designated as the primary surgeon (e.g., the surgeon that is accountable for the procedure), assisting surgeon, fellow, or resident-assisting. All procedures will have a primary surgeon assigned to the case and may or may not have an additional surgeon present to help perform the surgery. Anesthesiologists are also assigned to every case and tend to oversee multiple surgeries at a time while floating between operations. Each of these surgical roles performs a specific function within the surgical team and share varying degrees of interdependence with the other members. In addition to these core members, some procedures may have general staff or a physician in a case. General staff tend to enter a procedure to perform a specific function of the operation with the surgeon, while physicians join a case to check something regarding the procedure/patient status. Both of these roles primarily only work with the primary surgeon, but the physicians may also work with the assisting surgeon.

Procedures

This study had two phases of data collection. Following recommended strategies for grounded theory development (Miles & Huberman, 1984; Eisenhardt, 1989; Straus & Corbin, 1990), this effort began by conducting observations across a range of settings to qualitatively assess the context. These observations sparked my research question, as I realized much of what has been published regarding teams fails to acknowledge the fluid composition structures and dynamics inherent in real world teams. As detailed in the following section regarding team interdependence, I leveraged these observations to determine the degree of interdependence that exists between members and as the foundation for my research.

In phase two of this study, two years of archival medical records data were analyzed to address the focal research questions. Specifically, surgical data for all operations performed from January 1, 2018 to December 31, 2018 were assessed, with the prior year of data (January 1, 2017 to December 31, 2017) being used to calculate familiarity scores for the focal year.

After removing outliers, as detailed below, the final sample resulted in 1032 unique procedure types during the focal year, with 9600 total operations, and 850 employees. Specifically, within the sample there were 225 unique primary surgeons, 178 assisting surgeons, 20 surgical fellows, 124 surgical residents, 112 physicians, 157 surgical technicians, 52 anesthesiologists, 123 CRNAs, 141 circulating nurses, and 103 general staff members. Some employees may serve in more than one role (e.g., be a primary surgeon and an assisting surgeon), so these counts include some employees more than once.

Measures

Team Familiarity

Team familiarity within this study was operationalized as the amount of experience each dyadic pair on a surgical team had working together when completing a specific type of procedure. This was calculated for each surgery type by counting the number of operations each pair in the team completed one year prior to the date of the surgery. The surgeries being examined began in 2018 and used data from the prior year to calculate team familiarity. For example, if four team members (A, B, C, D) performed a surgery on March 5, 2018, familiarity would be calculated by counting the number of times each dyad (A–B, A–C, A–D, B–C, B–D, C–D) performed the same procedure from March 5, 2017 to March 4, 2018.

After calculating familiarity for each of the dyads in the team, the average familiarity of both the highly interdependent pairs ($M = 1.06$, $SD = 1.97$) and the pairs with low interdependence ($M = 0.65$, $SD = 1.16$) was taken for each team. The division of familiarity into high and low interdependence employs a similar approach to those that divide cumulative experience into separate experience variables based on another category (e.g., firm-specific and non-firm-specific experience in Huckman & Pisano, 2006; team familiarity in the same location or different locations in Staats, 2011). Averaging across dyadic pairs within a team is also consistent with prior research examining team familiarity, but the proposed effort reconceptualizes the appropriate operationalization for team familiarity by identifying *which* dyads should be familiar (Espinosa et al., 2007; Lucciano et al., 2018).

Team Interdependence

Following similar procedures to those outlined by Klein, Ziegert, Knight, & Xiao (2006), I triangulated multiple qualitative data sources to determine the degree of interdependence that exists between dyadic pairs within the operating room. This grounded theory approach aims to identify similarities in how teams coordinate, rather than differences, and occurred over two phases. In phase one, I sought to gain an initial understanding of the context, while phase two focused on validating my prior conclusions.

Specifically, in phase one, I began by reading descriptions of the different surgical team positions on O*Net (2018) to gain an understanding of the team, team leaders, and the setting. Then, I conducted over 200 hours of observations across a range of surgical procedures to better understand how team members coordinate their efforts throughout a procedure. During observations, I had informal conversations with the surgeons, nurses, and technicians to clarify medical jargon and enhance the understanding of procedures, norms, and their surgical routines. I also took notes on member coordination, interdependence, and team member replacements. Leveraging the notes taken during observations and informal interviews, I identified key interdependencies between surgical team members and any gaps that emerged regarding their level of interdependence.

In phase two, I clarified and refined the proposed interdependencies by conducting additional observations and interviewing several subject matter experts (SMEs). These semi-structured interviews were held with the Director of Anesthesiology and several surgical fellows, where I proposed my findings thus far and asked interviewees if my preliminary conclusions regarding team interdependencies and coordination were on target. After conducting these interviews and additional observations, I reached theoretical saturation, where new observations and interviews failed to contribute any new information. Concluding phase two, I determined which surgical team dyads had high interdependence and low interdependence.

As previously noted, commonly staffed roles across procedures includes the surgeon, resident, surgical scrub tech, nurse (RN), and certified registered nurse anesthetist (CRNA). Among the most commonly staffed roles, the highly interdependent pairs include the surgeon and resident, surgeon and surgical scrub tech, surgical scrub tech and the RN, and the surgeon and the CRNA. All other dyads can be found in Table 1. Leveraging these high and low classifications, I then calculated the average level of team familiarity across the highly interdependent dyadic pairs and for dyads that are not interdependent. These two averages were used in subsequent analyses to assess the role of task interdependence in team familiarity.

Team Task Familiarity and Experience

Given that prior experience performing operations is an imperative factor to team success, team task experience was also be examined. To assess the role of task experience within the team, I calculated the number of times each person on the team had completed the procedure in the prior year and then used the team minimum as the aggregate function (Reagans et al., 2005; Espinosa et al., 2007). Therefore, the number surgeries the least experienced team member performed represented the degree of team experience (M = 0.85, SD = 2.028).

Team Efficiency

Within healthcare, one of the greatest costs health systems face is running the operating room (Munoz, Mumoz, &. Wise, 2010). To reduce costs, schedulers and healthcare staff try to ensure all rooms are running as efficiently as possible. This is greatly impacted by whether or not operations extend their anticipated procedure time, which has previously been used to index team efficiency (Lucciano et al., 2018). Therefore, this study operationalizes team efficiency as the actual length of a surgery relative to its scheduled time (i.e., 100 * planned surgery duration / actual surgery duration; M = 102.86, SD = 37.47). The planned surgery duration within this hospital is calculated for each case by examining the length of the prior 10 surgeries that the primary surgeon on the case has performed of that procedure type, dropping their minimum and maximum surgery lengths, and then averaging across the remaining 8 cases. Given the large variations in surgery length for different procedure types and surgeons, indexing team efficiency relative to the scheduled time is an appropriate scaling function (Pandit, Westbury, & Pandit, 2007).

Surgical Start Time

Due to the high costs associated with running an operating room, ensuring operations start on time is critical. When teams are faced with delayed starts, both the operating room schedule and the individual team members' schedules can be impacted for the remainder of the day. To alleviate such schedule shifts, familiar teams may attempt to make up for lost time when cases start late by working faster and remaining task focused. To assess on time start, this study considers all cases where the patient is in the room by the scheduled time as an on time start, and all procedures where the patient arrives after their scheduled time as a late start (Wright, Roche, & Khoury 2010; 45.77% on time start). This is a categorical variable and 47.70% of the surgeries started on time.

Control Variables

In addition to the aforementioned measures and in line with previous research, several constructs were also included as control variables. These include task urgency and patient American Society of Anesthesiologists (ASA) score. Task urgency represents the how quickly a patient needed the procedure to be performed and is rated by the surgeon, where 1 = elective, 2 = emergent, and 3 = urgent. Urgent surgeries are emergency cases that must be performed within 24 hours, emergent cases are also severe cases where an emergency is beginning to arise and should be scheduled in 48 hours, and elective operations are scheduled at the patient's and surgeon's convenience. In the sample, 6.5% were elective, 69.9% were emergent, 3.7% were urgent, and 19.9% were not classified.

Finally, the ASA physical status classification was included as a covariate, which represents a patient's anesthetic risk prior to surgery (Daabiss, 2011). The ASA is a subjective rating by the anesthesiologist assigned to the case, ranging from 1 to 6 where 1 represents a normal healthy patient, 2 is a patient with a mild systemic disease, 3 is a patient with severe systemic disease that is not life threatening, 4 is a patient with severe systemic disease that is a constant threat to life, 5 is a moribund patient who is not expected to survive without the operation, and 6 is a brain-dead patient whose organs are being removed with the intention of transplanting them into another patient (Doyle & Garmon, 2019). This was included as a covariate because patients with higher ASA scores pose greater risks and that may cause unanticipated events, thus lengthen the surgery.

Data Cleaning and Transformations

Prior to running analyses, the data was cleaned to remove cases that did not have a scheduled procedure time, did not document the time the procedure was completed, and all procedures that had a duration less than five minutes, leaving a sample size of 23,325 surgeries. Then, cases that had more than one procedure scheduled or performed were removed from the data, leaving 11,159 cases left in the data. Next, outliers regarding case length were examined and cases where procedures were performed in less than half the scheduled time (i.e., over 200% efficiency) were removed from the data as these procedure times were likely either mis-recorded or not performed as planned (sample size $n = 9613$). Finally, patients with an ASA rating of 6 (e.g., morbid) were removed from the data, leaving a final sample size of 9600.

After removing abnormal cases from the data, the assumptions of normality (Fox, 2015) and homoscedasticity (Rosopa, Shaffer, & Schroeder, 2013) were tested both visually and quantitatively. However, all continuous variables failed to meet these assumptions using standard significance tests. Specifically, the Anderson-Darling normality test for efficiency was 29.57 ($p < 0.05$), indicating the data may not be normally distributed, D'Agostino skewness test was 0.33 ($p < .05$), indicating that data had a postive skew, and the Anscombe-Glynn kurtosis test was = 24.81 ($p < .05$), indicating that kurtosis is not equal to 3. However, the Q-Q plot and histogram (Figures 1 and 2) for efficiency indicate that efficiency appears to be normally distribution. For familiarity among highly interdependent dyads, the Anderson-Darling normality was 1211.60 ($p < .05$), D'Agostino skewness test was 6.46 ($p < .05$), and the Anscombe-Glynn kurtosis test was 95.60 ($p < .05$). In line with these results, both the Q-Q plot and histogram (Figures 3 and 4) indicate that the data is severley positively skewed. A similar pattern is seen in familiarity among non-interdependent dyads; the Anderson-Darling normality test was 1832.50 ($p < .05$), D'Agostino skewness test was 3.82 ($p < .05$), and the Anscombe-Glynn kurtosis test was 21.82 ($p < .05$). Further, the Q-Q plot and histogram indicate a severe postively skew (Figures 5 and 6). Given the signifiance of these tests and their distributions in both the histogram and qqplot, the independent variables of this sample do not appear to be normally distributed and posses a severe positive skew. Due to the their positive skew, data transformations were done to try and create a normal distribution.

First, both the square root and logarithmic transformations were applied, but failed to normalize the varialbes. Then, a reciprocal transformation was applied for both the high interdependence and non-interdependence familairity variables, after adding a constant of 1 to account for zeros in the data. After this transformation, the variables were re-examined for normality. For familiarity in highly interdependent dyads, the Anderson-Darling normality test was 228.55 ($p < .05$), D'Agostino skewness test was -0.43 ($p < .05$), and the Anscombe-Glynn kurtosis test was 1.98 ($p < .05$). For the inverse of familiarity among the non-interdependent dyads, the Anderson-Darling normality test was 233.56 ($p < .05$), D'Agostino skewness test was -0.671 ($p < .05$), and the Anscombe-Glynn kurtosis test was 2.45 ($p < .05$). The significance across these tests and the histograms for both the familiairty variables, indicate that the variables are not normally distributed due to the high number of 0s within the data. This highlights that many teams do not have prior experience working together.

Given that this study is interested in the impact that team familiarity may have on subsequent team outcomes, a new categorical variable for familiarity was create to diffrentiate teams that had prior experience working together from those that did not. Specifcally, teams that had a familiarity score greater than zero, were classified as having familiarity while teams with a familiarity score of zero were classified as having no familiarity. Then, cases without familiarity were removed from the data. The resulting data had 7477 cases and 682 unique procedures.

After creating the subgroups, the variables were reexamined for normality assumtions. Again, both the intertdependent familiarity and non-interdependent familiarity variables failed tests of normality, skewness, and kurtosis, so additional transformations were performed. The best transformation was adding the constant of 1 to all the famililiarity scores and then taking the invese, for both the non-interdependent dyads and the interdependent dyads. After taking the inverse of familiarity for the highly interdependent dyads, the Anderson-Darling normality test was 34.90 ($p < .05$), D'Agostino skewness test was -0.29 ($p < .05$), and the Anscombe-Glynn kurtosis test was 1.98 ($p < .05$). In addition, for the inverse of familiarity in the non-interdependent dyads, the Anderson-Darling test of normality was 4.33 ($p < .05$), D'Agostino skewness test was 0.22 ($p < .05$), and the Anscombe-Glynn kurtosis test was 2.59 ($p < .05$). Though these tests are significant, indicating violations of normality, skewness, and kurtosis for both variables, the histograms and Q-Q plots appear more normally distributed than in the prior model (See Figures 1-10). Given the more normal distribution of these variables and the randomly dispersed residual plot (Figure 11), the relationship between team familiarity and efficiency was evaluated with a one-way analysis of covariance (ANCOVA) in R. Prior to analyses, the variables were transformed into *z*-scores to help with interpretation of the results (Mathieu et al., 2014). Table 1 presents the means, standard deviations and correlations for study variables for the full dataset and Table 2 presents the means, standard deviations, and correlations for study variables within the subset of data where familiarity between team members was greater than zero.

Results and Analyses

A one-way ANCOVA was conducted to determine the differential effects that team familiarity plays in surgical team efficiency between teams that have an on time start in comparison to those who have a late start, while controlling for team minimum experience, patient ASA score, and task urgency. To examine the predicted interaction effects, a reduced model with main effects only for interdependent team familiarity, non-interdependent team familiarity, team minimum experience, on time start, and the control variables was first examined. This model (Model 1) had a significant effect F (11, 7465) = 5.41, $p < .01$ and the variables accounted for .79% of the variance in team efficiency (Adjusted $R^2 = 0.0064$). However, there were no main effects between team familiarity and team efficiency for highly interdependent pairs (t (7465) = -.81, *n.s.*) or non-interdependent pairs (t (7465) = -1.35, *n.s.*), providing no support for Hypothesis 1A.

In contrast, there were significant main effects for minimum team experience (t (7465) = 1.98, $p <. 05$), on time start (t (7465) = -2.17, $p <. 05$), task urgency where cases were classified as emergent (t (7465) = -2.96, $p < . 01$), and for patients with an ASA score of 4 (t (7465) = -3.5, $p < .01$). In regard to team minimum experience, when the team increases their minimum experience by one unit, their efficiency increases by .025. This reveals that team efficiency is driven by the task experience that employees have performing a specific procedure. Further, as teams go from an on time start (M = 104.02, SD = 36.39) to a late start (M = 101.87, SD = 36.88), their effiency decreases by .05 (B =

-0.05; t (7465) = -2.17, $p < .05$). This indicates that teams that begin their procedures on time, tend to be more efficient than those that have a late start.

Post hoc analyses on ASA score revealed that those cases with an ASA score of 4 (M = 97.7, SD = 36.58) were significantly less efficient than ASA 2 patients (M = 104.31, SD = 36.16) and ASA 1 patients (M = 105.52, SD = 36.92), but were not significantly different from ASA 3 (M = 102.37, SD = 36.77) or ASA 5 patients (M = 97.89, SD = 50.23). This indicates that ASA 4 cases tend to be less efficient than cases with lower ASA ratings. Finally, post hoc analyses of task urgency revealed that emergent cases (M = 94.05, SD = 42.31) are less efficient than both elective (M = 103.28, SD = 39.53) and urgent (M = 102.55, SD = 39.69) cases.

After fitting the main effects, a second model was fit to see if the two-way interactions contribute to the variance in team efficiency beyond the main effects (Model 2). This model included the two-way interaction terms between interdependent familiarity and on time start and between interdependent familiarity and team minimum experience. While the model was significant F (13, 7463) = 4.95, $p < .05$ and accounted for .85% of the variance in team efficiency (adjusted $R^2 = 0.0068$), it did not significantly improve the model F (2, 7463) = 2.45, $p = 0.086$ and only accounted for an additional 0.065% variance in efficiency than the main effects alone. In addition, the two-way interactions were not significant, failing to reject Hypotheses 1B and 2A.

Finally, model 3 added the three-way interaction between team familiarity in interdependent dyads, on time start, and minimum team experience to test Hypothesis 2B. While the overall model was significant F (14, 7462) = 4.72, $p < .05$ and explained .88%

of the variance in team efficiency (adjusted $R^2 = 0.0069$), there was not a significant difference between Model 3 and Model 2 $F(1, 7462) = 1.75$, $p = 0.19$ and the model only accounted for an additional .023% of the variance in efficiency. Therefore, Model 1 was retained for this study.

CHAPTER THREE

DISCUSSION

Although team composition has been well researched, there is still much to learn in terms of dynamic composition. This study hopes to advance our field by answering calls for additional research on fluid and crew-based team composition by acknowledging the role that time may play in building team relationships (e.g., familiarity). Overall, the results of this study support the idea that team task experience across all team members plays a critical role within crew-based teams. Indeed, when the minimum experience of the team increased, team efficiency also increased. This illustrates that the introduction of novice members to surgical teams may have unanticipated consequences and result in longer operations.

In contrast, the role that prior experience working with teammates plays within surgical teams is less clear. While the focal research question of this study predicted that team familiarity within interdependent dyads would be more strongly related to team efficiency than team familiarity across non-interdependent dyads (Hypothesis 1A), this hypothesis was not supported. Rather, the relationship between team familiarity and team efficiency appears to be relatively small for both interdependent and non-interdependent dyads, as there were no main effects found between familiarity and team efficiency. There were also no interactions between team familiarity among interdependent dyads and team minimum experience or between team familiarity among interdependent dyads and the starting time of the procedure. While research on the relationship between team familiarity and team performance has been conflicting (Lucciano et al., 2018), the lack of support for my Hypotheses 1B, 2A and 2B may be due to the level of granularity applied to the team familiarity calculation within the present study. Previous studies have operationalized team familiarity as experience working together across numerous procedure types within the same service line or specialty (e.g., counting prior experience working together across all OBGYN procedures to calculate familiarity for a hysterectomy case). However, the present study only considered a familiarity tie to exist between a dyadic pair when they have worked on the *same* procedure type previously. This resulted in a zero inflated assessment of team familiarity with a relatively small average.

Although the effects of familiarity were not significant, this study also highlights the importance of controlling for extraneous variables regarding the health of the patient and the procedure urgency. Indeed, controlling for the patient's ASA status may be critical when estimating surgical team efficiency, as patients with an ASA score of 4, which indicates that the patient has severe systemic disease that is a constant threat to life, were significantly more likely to have less efficient procedures than patients with an ASA rating of one or two. This supports the idea that patient health may influence whether or not a procedure goes according to plan. By better understanding the role that ASA plays in surgery length, we can shed light on staffing protocols by quantitatively illustrating that patients with a lower physical status may need additional time allotted to them to facilitate an on-time finish.

From a staffing perspective, one may also want to consider the impact of prior task experience on surgery duration. Given that prior task experience predicts procedure efficiency, healthcare schedulers may want to avoid staffing multiple novice members within the same team. Further, it would also be beneficial to avoid staffing novice members on complex cases to mitigate delays and enhance patient safety. To better understand the role that minimum team experience plays within a team, future research should continue to examine how varying degrees of task experience across the team may impact different team level outcomes. For example, from a power perspective, having a novice in some roles (e.g., circulating nurse) may be less impactful than having a novice in another role (e.g., surgeon). By illustrating not only *how* task experience may impact subsequent team outcomes, but also *which members* are most critical to possess experience to be successful, new staffing protocols can be developed. Therefore, this study hopes to advance our literature, by leveraging a compilation approach to examine team composition, and our practice, by informing the development of future staffing protocols that consider how additional factors, such as the patient's ASA score, may impact surgery efficiency. These protocols would strive to prevent subsequent operations from starting late by more accurately anticipating the length of a given procedure by considering the individuals on the team (Denton, Viapiano, & Vogl, 2007).

Although this study has several theoretical and practical implications, there are a few limitations that must be considered. One of the primary limitations of this study is the normality issues introduced by the team familiarity variables. The narrow operationalization of team familiarity led to a skewed distribution with many teams in the current sample having very low or null familiarity scores. While other studies have employed more encompassing operationalization's of team familiarity, the narrow scope of this definition was theoretically grounded in the shared mental model literature, which posits that shared knowledge structures are formed after performing a *specific* task (Klimoski & Mohammed, 1994). Overall, additional research regarding team familiarity and its operationalization is needed to standardize how team familiarity is defined and assessed.

Another limitation of this study is the lack of patient data being examined. Specific patient characteristics (e.g., diabetes) can create surgical complications that would be beneficial to include as control variables. Further, it would be beneficial to assess the role that team familiarity plays on not only team efficiency, but also patient status. In an effort to control for patient characteristics, the procedure urgency and patient ASA level were both included as control variables to account for the variability that may arise due to case difficulty and patient status. However, in addition to including patient characteristics as control variables, it would also be beneficial to consider patient outcomes (e.g., length of stay) as a dependent variable of the present study. Indeed, while team efficiency is a key concern for hospital finances and staffing, patient outcomes can be negatively impacted from errors in team performance, regardless of the procedure length. This illustrates one of the key performance debates regarding quality (i.e., patient outcomes) and quantity (i.e., procedure efficiency), that should be examined in future studies.

Although the present study generates inconclusive results regarding the role of team familiarity, it provides a foundation for future research regarding dynamic composition within surgical teams where contextual features, such as team interdependence, are considered when operationalizing study variables. By considering different forms of emergence (e.g., compilational vs. compositional), this study adopts a dynamic lens regarding team composition. This is an important consideration given that much of the research in this area assumes that familiarity among *all* members of the team contributes to performance equally, rather than considering how familiarity between *specific* members may be most critical for team performance. Such discrepancies in operationalizations have led scholars to routinely assume that taking the aggregate of team members is the most appropriate operationalization, despite numerous calls citing the contrary (Kozlowski & Bell, 2013; Mathieu et al., 2014). This study hopes to advance our literature and practice by illustrating how a compilation approach to team composition may be applied and the role that novice team members may play in team efficiency.

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Zhang, Bennett, Mears, Mabrey, & Kennerly, (2015) needs to be added.

Table 1. High and Low Team Task Interdependence Across Surgical Team Roles

	Anest	Circulator	General Staff	Fellow	Resident Assist	Assisting	Physician	Primary	CRNA
Anest									
Circulator	Low								
General Staff	Low	Low							
Fellow	Low	Low	High						
Res-Assisting	Low	Low	Low	High					
Assisting	Low	Low	High	High	High				
Physician	Low	Low	Low	Low	Low	Low			
Primary	Low	Low	High	High	High	High	High		
CRNA	High	Low	Low	High	High	High	Low	High	
Scrub Tech	Low	High	Low	High	High	High	High	High	Low

Notes: Anest = Anesethsiologist; CRNA= Certified Registered Nurse Anesthetist

Table 2. Means, standard deviations, and correlations for full sample.

	M	*SD*	Efficiency	Interdependent familiarity	Noninterdependent familiarity	MTT experience
Efficiency	102.86	37.47				
Interdependent familiarity	1.05	1.97	0.02			
Noninterdependent familiarity	0.65	1.16	0.03**	0.68**		
MTT experience	0.85	2.03	0.03**	0.28**	0.34**	
On time start	47.7%		-0.02	-0.02*	-0.04**	-0.01

Notes: MTT = Minimum team task; on time start coded as 0 = on time; 1 = late start; *p < . 05; **p < . 01; N = 9600

Table 3. Means, standard deviations, and correlations for reduced sample.

	M	*SD*	Efficiency	Interdependent familiarity	Noninterdependent familiarity	MTT experience
Efficiency	102.9	36.66				
Interdependent familiarity	1.35	2	0.02			
Noninterdependent familiarity	0.8	1.20	0.03	0.61**		
MTT experience	1.052	2.23	0.04**	0.24**	0.3**	
On time start	47.9%		-0.03*	-0.04**	-0.05**	-0.01

Notes: MTT = Minimum team task; on time start coded as 0 = on time; 1 = late start; *p < . 05; **p < . 01; n = 7477

Figure1. Q-Q Plot for Team Efficiency

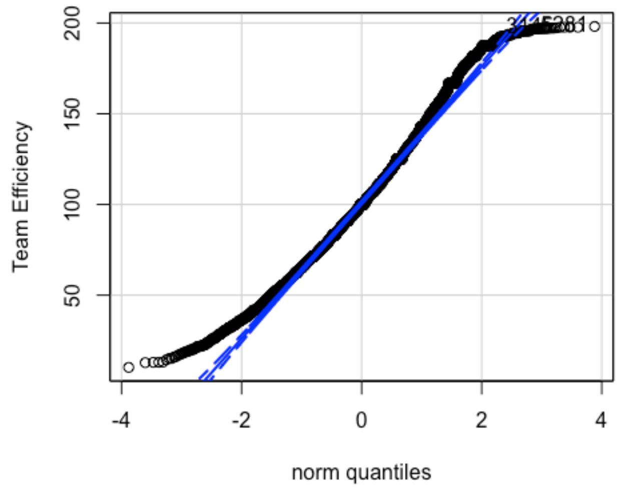

Figure 2. Histogram for Team Efficiency

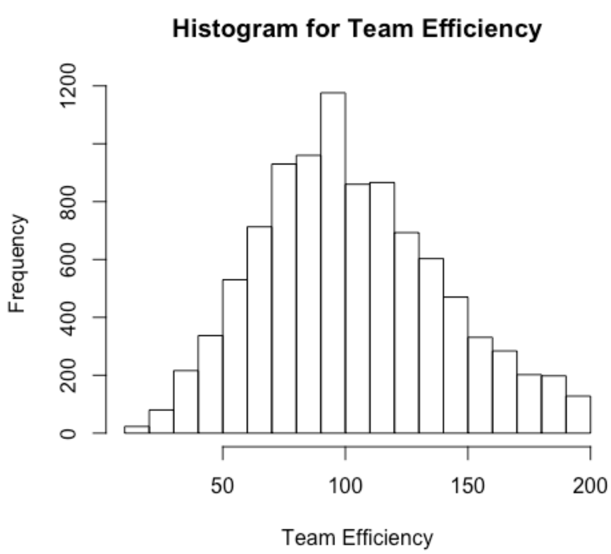

Figure 3. Q-Q Plot of Interdependent Team Familiarity in Original Data

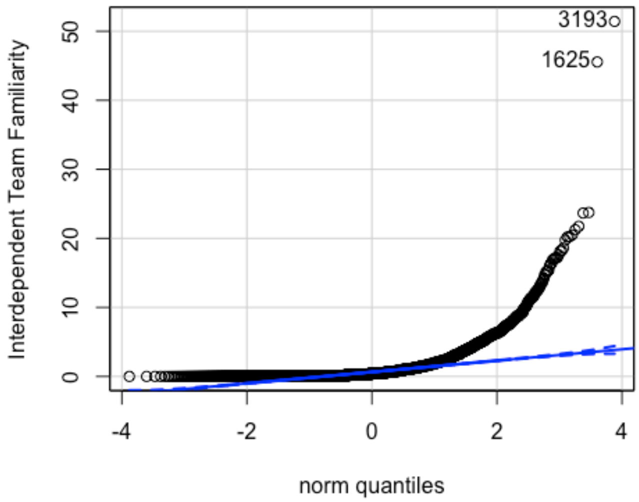

Figure 4. Histogram for Interdependent Team Familiarity in Original Data

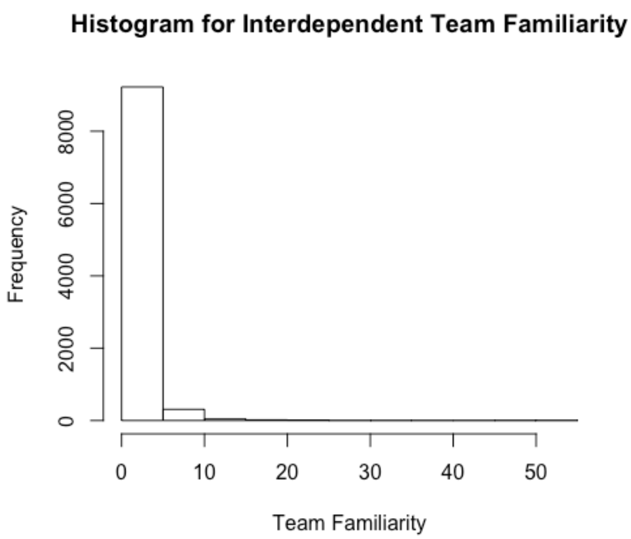

Figure 5. Q-Q Plot of Team Familiarity of Non-Interdependent Dyad in Original Data

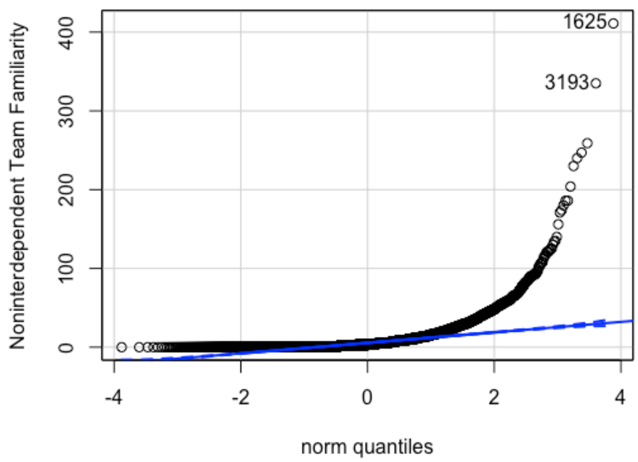

Figure 6. Histogram of Team Familiarity of Non-Interdependent Dyad in Original Data

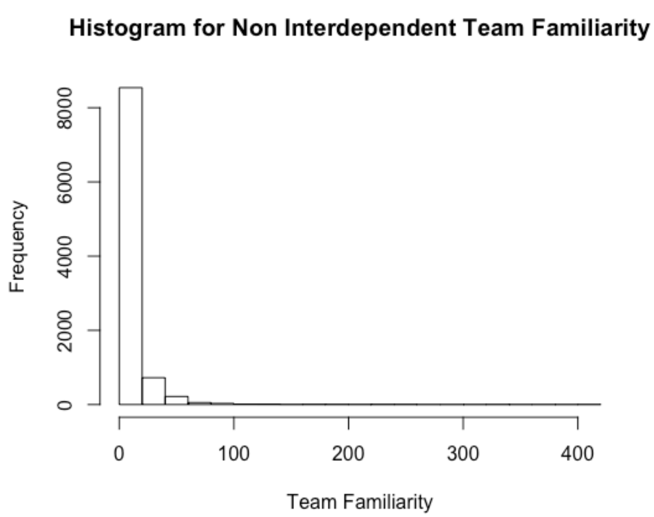

Figure 7. Q-Q Plot of the Inverse of Interdependent Team Familiarity After Removing Cases with no Familiarity

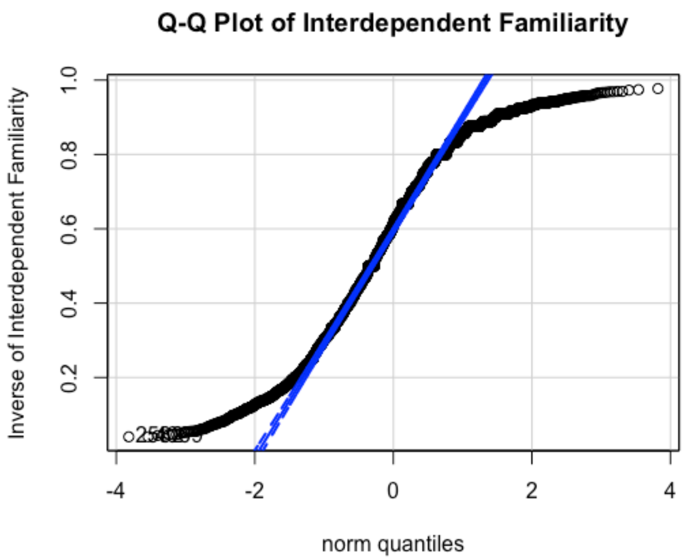

Figure 8. Histogram of the Inverse of Interdependent Team Familiarity After Removing Cases with no Familiarity

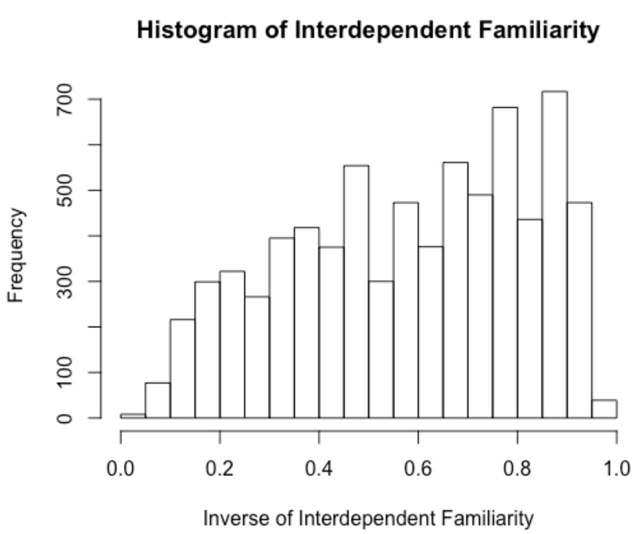

Figure 9. Histogram of the Inverse of Team Familiarity in Non-Interdependent Dyad After Removing Cases with no Familiarity

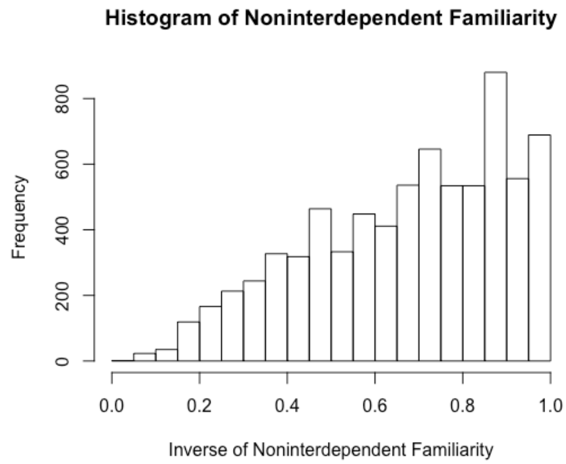

Figure 10. Q-Q Plot of the Inverse of Team Familiarity in Non-Interdependent Dyad After Removing Cases with no Familiarity

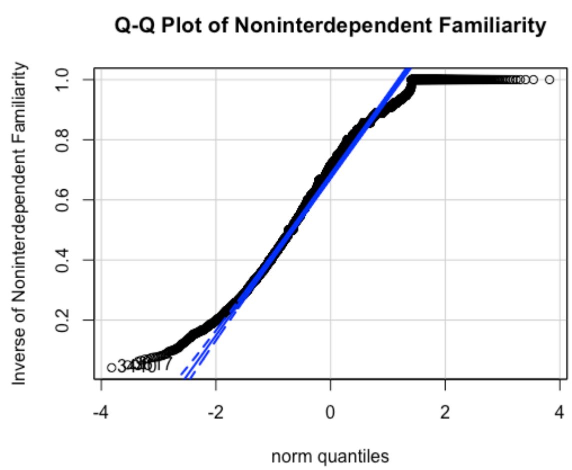

Figure 11. Plot of the Residuals for the Fitted Main Effects Model (Model 1)