© *Academy of Management Journal*
2014, Vol. 57, No. 3, 766–790.
http://dx.doi.org/10.5465/amj.2012.0132

HUMAN CAPITAL FLOWS: USING CONTEXT-EMERGENT TURNOVER (CET) THEORY TO EXPLORE THE PROCESS BY WHICH TURNOVER, HIRING, AND JOB DEMANDS AFFECT PATIENT SATISFACTION

GREG REILLY
University of Connecticut

ANTHONY J. NYBERG
University of South Carolina

MARK MALTARICH
University of South Carolina

INGO WELLER
LMU Munich

The dynamic systems view of voluntary turnover rates advocated in context-emergent turnover theory is used to explore how and why human capital flows impact unit performance over time. We examine hiring rates and employee transfer rates as distinct system components that work alongside voluntary turnover rates to affect job demands, and ultimately patient satisfaction. Our work explores this dynamic system of interrelated constructs, and explains and compares their mutual causality over time. The sample examined consists of 12 nursing units in a large hospital over 72 monthly observations, with patient satisfaction as the measure of unit performance.

Turnover research is currently undergoing a substantive transformation as research focus shifts from the individual level to the unit level. The long history of individual-level turnover research has primarily focused on individuals' motivations to leave a unit (e.g., Hom & Griffeth, 1995; March & Simon, 1958; Mobley, Griffeth, Hand, & Meglino, 1979; Price, 1977); however, the accumulated knowledge from these efforts does not necessarily apply to turnover rates,[1] defined as ". . .aggregate levels of employee departures that occur within groups, work units, or organizations" (Hausknecht & Trevor, 2011: 353). The potential lack of isomorphism between levels in organizational relationships creates an opportunity to develop new theory about the complex mechanisms through which employee turnover affects unit outcomes (Hausknecht & Holwerda, 2013; Shaw, 2011). The introduction of context-emergent turnover (CET) theory (Nyberg & Ployhart, 2013), which describes unit-level turnover within a dynamic systems lens, begins to address this opportunity by building a more sophisticated model and paying greater attention to the processes through which turnover rates affect organizations over time.

While CET theory is a starting point, the deficit in unit-level turnover theory remains and impedes understanding of how and why turnover affects unit performance. To address this deficiency, we focus on human capital flows (employee movement in and out of units) to explain how and why movement impacts unit performance. We make four primary contributions. First, we test several central tenets of CET theory, including the importance of the *quantity* dimension of collective turnover in affecting performance. As Hausknecht and Holwerda recently emphasize, ". . .the quantity of departures—the currency of classic approaches—is clearly fundamental to any argument regarding turnover's effects" (2013: 211), although turnover researchers generally focus on the quality of human capital losses (e.g., Trevor,

[1] Unit-level turnover (e.g., Hausknecht & Trevor, 2011), aggregate turnover (Gardner, Wright, & Moynihan, 2011), and turnover rates (Shaw, 2011) are commonly used terms to represent a turnover construct at a higher level of analysis.

Gerhart, & Boudreau, 1997), thus downplaying the quantity dimension.

Second, we test CET theory's explanation that voluntary turnover rates are integral to changes in a broader system of human capital flows, and expand it by distinctly modeling hiring and transfer events, along with turnover. As recent reviews show, despite being a primary response to turnover, employee replacements are rarely modeled as distinct concerns in turnover research (Hancock, Allen, Bosco, McDaniel, & Pierce, 2013; Park & Shaw, 2013). Similarly, transfer rates are seldom studied as distinct variables (Barber, 1998; Dineen, Ling, & Soltis, 2011), despite employee transfers between units of a firm being a common organizational phenomenon (Dalton, 1997; Dineen et al., 2011). We develop a more comprehensive view of the voluntary turnover rates–unit performance relationship by (a) viewing voluntary turnover rates as one of many reasons for changes to the human capital resource, (b) recognizing that managers can act to counter human capital resource degradation, and (c) examining the differential effects of turnover, hiring, and transfer (in and out) rates on patient satisfaction. This systems theory approach differs from a more traditional *ceteris paribus* approach that isolates bivariate relationships. Our approach extends theory and introduces methodology (the PVAR method, see below for details) tailored to explain and capture the complex relationships that occur within a dynamic system of human actions and counteractions.

Third, we test and extend CET theory's assertion that the timing of turnover matters. To explore this assertion, we examine how the effects of turnover unfold over time in a complex, co-evolving system of human capital flows. We assert that the relative timing of actions and reactions within the human capital flow system plays a critical role in determining when, how much, and how long unit-level turnover will affect outcomes. To date, these temporal dimensions have not been studied in previous unit-level turnover research (Park & Shaw, 2013). Further, empirical approaches that use cross-sectional or panel data may overestimate or artificially downplay the true effects, depending on when the data were gathered, and relationships may be mis-specified. For instance, if turnover rate effects on unit performance are studied prior to rehiring (or prior to when replacement employees are fully functioning), results can exaggerate the negative longer-term impact of turnover by attributing negative and static outcomes to fluid situations. Conversely, if turnover rate effects are unknowingly studied after rehiring, results may underestimate turnover's impact. To address this issue, we develop theory about the interplay among the determining factors within the system over time, including developing specific hypotheses about the duration of effects of human capital flows on unit outcomes.

Fourth, we illuminate an under-studied mechanism driving the relationship between voluntary turnover rates and unit outcomes. We assert that change in job demands, a construct that captures the amount of work faced by employees, is a key mechanism through which turnover rates influence unit outcomes. Although seemingly intuitive, this essential mechanism is generally ignored or taken for granted by researchers. Identifying the mediating role of job demands helps build theory by showing how changes in the *quantity* dimension of CET theory affect outcomes, independent of changes in *quality*.

THEORETICAL BACKGROUND

Unit-level voluntary turnover is a relatively new field because traditional turnover research focused on the individual level. For example, March and Simon (1958) introduced individual-level concepts of push (internal factors that cause an employee to leave) and pull (external factors that attract an employee). These forces are theorized to affect an individual's decision to leave or remain with a unit. Similarly, Lee and Mitchell's (1994) unfolding model of turnover introduced "shocks" that lead an employee to re-evaluate an employment relationship. Again, shocks are measured and considered from the individual employee's perspective.

Unit-Level Turnover

Recent voluntary turnover research has moved beyond investigating why individuals leave toward understanding the unit consequences of voluntary turnover (e.g., McElroy, Morrow, & Rude, 2001; Shaw, Delery, Jenkins, & Gupta, 1998; Shaw, Duffy, Johnson, & Lockhart, 2005a; Shaw, Gupta, & Delery, 2005b). These investigations have examined the relationships between voluntary turnover rates and sales and sales growth (e.g., Batt, 2002; McElroy et al., 2001), net performance (e.g., Glebbeek & Bax, 2004), efficiency (e.g., Kacmar, Andrews, Van Rooy, Steilberg, & Cerrone, 2006), productivity (e.g., Shaw et al., 2005b), accident rates (e.g., Shaw

et al., 2005b), and profits (e.g., Morrow & McElroy, 2007). Moderators of the voluntary turnover rates–unit performance relationship have also been considered, such as percentage of hires (e.g., Hausknecht, Trevor, & Howard, 2009) and labor segment (e.g., Siebert & Zubanov, 2009). A few studies have also examined antecedents to voluntary turnover rates, such as co-worker demographics (e.g., Sacco & Schmitt, 2005), organizational citizenship behaviors (e.g., Podsakoff, Blume, Whiting, & Podsakoff, 2009), and downsizing (Trevor & Nyberg, 2008).

Researchers have also described the direct and indirect costs of turnover (Cascio, 2000) including the value of retaining high performers (e.g., Nyberg, 2010; Sturman, Trevor, Boudreau, & Gerhart, 2003), potential "snowball effects" or "turnover contagion" in which departures lead to additional departures (Felps, Mitchell, Hekman, Lee, Holtom, & Harman, 2009), negative ramifications on social capital (Leana & Van Buren, 1999), and the loss of institutional and operational knowledge that can damage a unit's social network (Dess & Shaw, 2001). However, despite strong interest, 10 years after Dess and Shaw (2001) asserted that a unit-level turnover theory is needed, responses to this call have only recently begun to be put forward (e.g., Hausknecht & Holwerda, 2013; Nyberg & Ployhart, 2013), and there remains substantial room for further development (Hausknecht et al., 2009; Shaw, 2011).

One challenge in modeling the effects of unit-level voluntary turnover is that it plays a central role in a complex chain of events occurring within organizational systems (Hausknecht & Holwerda, 2013). Recognizing voluntary turnover rates as one component in a system of human capital flows highlights the need to account for other flow variables (hiring and transfer rates) in examining turnover effects.[2] Human capital flows are central determinants of job demands, which constitute another key construct in this complex system. Further, modeling timing effects is useful because the causal system is dynamic (i.e., the constructs and the relationships among them are continually coevolving; Steel, 2002). Understanding the interrelatedness among variables in a constantly changing system is particularly challenging because time, potential non-recursiveness (the likelihood of feedback loops where variables are the cause and effect of each other over time), and multiple chains of events continually alter the relationships (Sims, 1980).

[2] The explicit exclusion of involuntary turnover rates from our model stems from the idea that organizational responses to the two types of turnover are distinct, but that the results are often quite similar, and that the relative prevalence of voluntary turnover makes understanding changes in its rates particularly valuable.

HYPOTHESIS DEVELOPMENT

CET Theory

We ground our thinking in CET theory, which introduces logic for differentiating unit-level turnover from individual-level turnover and describes processes through which it affects unit outcomes (Nyberg & Ployhart, 2013). CET theory posits that there is only partial isomorphism between individual-level and unit-level turnover rates, meaning that assumptions at the individual level may not be applicable at higher levels (Kozlowski & Klein, 2000; Rousseau, 1985). The theory builds on these differences to propose that voluntary turnover rates are part of a dynamic system, that quantity and quality are distinct attributes affecting the outcomes of voluntary turnover rates, and that the effects of voluntary turnover rates change over time.

By differentiating turnover rates from individual turnover, and discussing turnover as the depletion of human capital resources that "are intangible unit-level constructs that can possess the characteristics needed to influence unit performance and competitive advantage" (Nyberg & Ployhart, 2013: 113), CET theory describes collective turnover as part of a dynamic system. It emphasizes the microfoundations of human capital resource depletion by describing the emergence of collective turnover. CET theory also embeds the consequences of collective turnover within the nomological network of human capital resources, and discusses how they are affected by the timing of turnover and the flows within a dynamic system (Nyberg & Ployhart, 2013). It also highlights the reciprocal relationship between unit-level turnover and human capital resources, while at the same time noting that the quantity and the quality of voluntary turnover can independently affect the human capital resource.

As described, we provide a test of three core CET theory assertions by testing quantity effects, turnover's role within a system, and the timing of turnover. Our theoretical contributions also extend the insights of CET theory. For instance, we introduce a greater richness into CET theory by recognizing and developing theory about a distinct subset of human capital flows. According to CET theory, the

consequences of turnover are embedded in the nomological network of the human capital resource. Besides turnover, we introduce transfers-out (a within-system process) as an alternative process that depletes the human capital resource. Moreover, we recognize that hiring (a boundary-spanning process) and transfers-in (a within-system process) may replenish the human capital resource. Including hiring and transfers presents a more complete model of the nomological network of the human capital resource. We also provide more precision to the temporal aspects of CET theory by proposing differences that we expect to exist in the relative duration of effects from specific flows within the system. Finally, we introduce job demands as a causal mechanism for connecting the quantity dimension of human capital depletion to other aspects within the system. By illuminating the role of job demands as a central driving force, we more fully explain why quantity changes can be important in human capital flow systems.

Human Capital Flow

We describe the system of changes to quantities of human capital, including employee hiring, turnover, and transfers, as *human capital flow*. Human capital (which encompasses the productive capacities that individuals possess; Becker, 1964) flows out of a unit through turnover and transfers-out, and into a unit through hiring and transfers-in. Describing human capital flow as a system recognizes that units and workers respond to employee mobility. Employee replenishment is one such response (Lazear & Spletzer, 2012), and its inclusion in examining the impact of unit-level turnover provides a more nuanced understanding of how the erosion of the human capital resource may be offset (Ployhart, Weekley, & Ramsey, 2009). However, the influence of hiring rates is rarely theorized or distinguished from the impact of voluntary turnover rates. Our framework asserts that each has unique effects in the system.

Voluntary turnover rates, job demands, and patient satisfaction. Our study also extends CET theory by examining changes to average *job demands*—a unit-level description of the required work for an average employee. Focusing on job demands highlights the expectations faced by remaining unit employees after departures occur, and the fact that replacement hiring is often subject to delay. Measures of job demands quantify the ratio of required output to human resources available in a unit. Job demands at the unit level are similar to productivity (e.g., Shaw et al., 2005b) and capacity (Hausknecht & Holwerda, 2013). However, job demands represent the amount of work and time required of the average employee, whereas productivity captures output per person and capacity captures the potential utilization of the resource. By integrating this theoretically relevant but underresearched mediator into our model, we follow the calls of strategic human resource management researchers to better embed theoretical arguments in causal chains (Becker & Gerhart, 1996), while adding a missing causal link to CET theory.

We theorize and demonstrate that the effects of both voluntary turnover rates and transfer-out rates on job demands are far less deterministic than they might appear because managers can actively influence job demands when employees leave. For instance, they can reduce the amount of assigned work so that remaining employees do not face additional per-person work requirements. If hospital administrators admit fewer patients (according to conversations with hospital management and empirical observations, this occurs regularly), then turnover and transfer-out rates may not impact job demands. Alternatively, units can maintain prior levels of output requirements and increase the work burden on remaining employees.

Changes in job demands have physiological and attitudinal effects (Fox, Dwyer, & Ganster, 1993), including employee burnout (Cordes & Dougherty, 1993), especially in the context of emotional labor (Glomb, Kammeyer-Mueller, & Rotundo, 2004; Rafaeli & Sutton, 1987). Hence, if voluntary turnover rates increase job demands for remaining employees, then those employees are more susceptible to burnout or job dissatisfaction. These changes may further be associated with reduced performance and increased turnover intentions (Chen, Ployhart, Thomas, Anderson, & Bliese, 2011). Employees are also likely to decrease their psychological attachment to, and interactions with, fellow team members (Maslach, 1976). For example, employees may have less time to perform extra-role or citizenship activities (Podsakoff et al., 2009), resulting in more negative interactions with co-workers and customers (Jackson & Schuler, 1983), and the resulting decrease in unit cohesiveness can be problematic for units in which teamwork is useful for maximizing unit performance.

Our framework asserts that higher voluntary turnover and transfer-out rates will be associated with greater average job demands for remaining

employees, and the employees' reactions to higher job demands will negatively impact patient satisfaction. As the job demands within the unit increase, employees may be less able to provide support, help, back-up, or training for each other, and the performance of the entire unit is likely to suffer.

There are other paths through which voluntary turnover and transfer-out rates can impact patient satisfaction. In addition to effects occurring via job demands, voluntary turnover rates may also affect patient satisfaction through changes in group dynamics, reduction in slack resources, group knowledge, and similar factors (Cascio, 2000; Dess & Shaw, 2001; Shaw et al., 2005a). Voluntary turnover rates may also change patterns of employee communication and coordination. Contexts in which repeated and trustful interaction among employees is integral to delivering customer satisfaction are especially susceptible (Collins & Smith, 2006; Hausknecht et al., 2009). In the hospital context, the network disruption effects of employee departures have been shown to hinder group efficiency (Alexander, Bloom, & Nuchols, 1994). This disruption will be accentuated by our focus on patient satisfaction, which can be influenced by employee cohesion, and is critical to the group's mission. In sum, we expect that for nurses who work in care-giving teams, the effects of both voluntary turnover rates and transfer-out rates on patient satisfaction are likely to be negative and monotonic, and partially mediated by job demands.

Hypothesis 1. The negative effects of (a) voluntary turnover rates and (b) transfer-out rates on patient satisfaction are partially mediated by job demands.

Unit-level hiring rates, job demands, and patient satisfaction. CET theory describes turnover rates as the key source of human capital depletion (Nyberg & Ployhart, 2013). It also posits that the rate of replacement for human capital helps determine the effects of turnover on performance. We explore this thinking by describing hiring and transfers-in as key processes through which units can accrete the human capital resource.[3] Both hiring and transfer-in rates are key sources for human capital replenishment, and each uniquely impacts performance. Inflows affect the quantity dimension of the human capital resource by increasing the number of employees in the unit. If all else is held constant, greater inflows lower job demands and increase patient satisfaction because nurses have more time to spend with patients and helping fellow nurses. Additionally, hiring can bring new ideas, new energy, new competencies, provide positive examples, and increase efficiency (e.g., new ideas that streamline work practices).

Reducing job demands is particularly likely to affect performance in service settings where customer interactions influence customer satisfaction (e.g., nurse–patient interactions). In general, reducing average job demands should increase the time for employee–customer interaction, resulting in increased satisfaction. For example, if six nurses are accustomed to working with 24 patients (four each), then hiring two nurses will either make it possible to add eight patients or reduce the responsibilities of each nurse to three patients. In the latter case, nurses with lighter workloads have increased opportunities to focus greater attention on patient needs and to support their colleagues (Organ, Podsakoff, & MacKenzie, 2006).

However, job demands will not necessarily be reduced through hiring or transfers-in. Managers could instead add employees to increase unit output rather than improve quality. For example, hiring more nurses could lead management to admit additional patients, resulting in unchanged or even increased demands, despite the extra nurses.

As noted, if hospitals do not change patient loads after hiring, job demands may be impacted, leading to higher patient satisfaction. However, although new members can eventually benefit the unit, their integration may be disruptive. These disruptions can lead to inefficiencies, poorer communication, and reduced coordination. As new members join, working protocols and relationships can become less effective (George & Bettenhausen, 1990). Despite potential disruptions, we expect that adding employees (through either hiring or transfers-in) will reduce job demands, allow nurses to be more attentive, and thus result in greater patient satisfaction.

Hypothesis 2. The positive effects of (a) hiring rates and (b) transfer-in rates on patient satisfaction are partially mediated by job demands.

[3] Alternative paths exist to human capital resource accretion (e.g., training), but our focus is on hiring and transfer-in.

RELATIVE EFFECTS OF DIFFERENT TYPES OF HUMAN CAPITAL CHANGE

Traditional turnover research primarily focuses on employees who are severed from the organization. We extend theory by comparing effects of transfer-related human capital flows to flows from and to external organizations. Including transfer-in and -out rates provides a more complete model by capturing organizational events that are unaccounted for in traditional turnover research. Comparing differences in the effects from the two flow types yields new knowledge about voluntary turnover and a better understanding of transfers as a common management practice because each can have unique effects on unit outcomes.

We examine the relative effects of different types of human capital change from two distinct perspectives. First, we develop theory about the magnitude of the immediate effect of each type of human capital change on unit outcomes. Second, we predict differences in the duration of effects by proposing mechanisms through which we expect change in each type of human capital flow to reverberate differentially through the system.

Examining Immediate Effects of Different Human Capital Change

Human capital flows have a variety of short-term effects on unit outcomes that can occur until the unit is able to respond to the changes over time. When employees voluntarily leave the unit, the staff is often reduced, thereby removing their knowledge, skills, and abilities that had been part of the unit's total human capital resource. Additionally, their departure alters the social landscape of the unit, including affecting teams' functionality, unit cohesiveness, and social networks, making communication and knowledge transfer more challenging.

The extent to which these consequences of human capital departures impact patient satisfaction in the short-term depends on the unit's responses to the departures. To lessen the impact of human capital losses, managers can adjust workload responsibilities or replace workers, but they have minimal control over access to information held by the departed workers.

Relative strength of departure rates on job demands. While changes in voluntary turnover rates and transfer-out rates both result in human capital losses, we propose that substantive differences in unit responses to these losses will result in differential effects on unit outcomes in the immediate aftermath of these changes. One key distinction is the differing circumstances of the separation of the employees from the unit. Voluntary turnover occurs at the discretion of employees (McElroy et al., 2001)—employees can and do leave when it is best for them, traditionally providing some minimal advance notice. In contrast, transfers to other units of the same organization are much more likely to include planning conversations with managers in the two affected units.

Senior nurses and professionals in our host organization confirmed this difference. They revealed that transfers-out are exclusively voluntary, but that the timing of transfers is subject to management approval. This key distinction highlights the ability of managers to proactively mitigate the immediate consequences of transfers-out. When employees request transfers, managers can time the changes based upon future work requirements and available resources to mitigate disruption. Further, managers can increase hiring or transfer-in rates in advance of the change. Greater administrative control should result in transfer-out rates having a smaller immediate negative effect on job demands than voluntary turnover rates, as managers adjust work requirements and shift resources more seamlessly.

Hypothesis 3a. The immediate effect of voluntary turnover rates on job demands is more strongly negative than the immediate effect of transfer-out rates on job demands.

Relative strength of departure rates on patient satisfaction. In examining how each type of departure rate is expected to differentially affect patient satisfaction in the near term, we focus on the extent to which remaining workers can capture lost information and rebuild disrupted processes. We assert that employees who leave an organization are less likely to be available or willing to provide guidance and information to the remaining employees. In contrast, information held by those who transfer-out is more likely to be within reach of the remaining employees. Employees who have transferred to other units but remain in the organization also have some incentive for being responsive and helpful to their previous units in the immediate aftermath of their departure. This motivation, as well as the relative ease with which the departed employees can be located, will mitigate the decline to the unit's ability to serve patients.

Hypothesis 3b. The immediate effect of voluntary turnover rates on patient satisfaction is more strongly negative than the immediate effect of transfer-out rates on patient satisfaction.

Relative strength of hiring and transfer-in rates on patient satisfaction. When employees are added to a unit, new knowledge, skills, and abilities are available to the unit. However, the short-term performance consequences of human capital additions depend on the abilities of the new workers to make an immediate contribution to existing service delivery processes and the willingness of existing employees to integrate new workers into the unit. Similar to the difference between voluntary turnover and transfer-out rates, we expect changes in hiring rates and transfer-in rates to have differential immediate effects on patient satisfaction.

We base our prediction on the differences in firm-specific human capital among the two classes of new workers. Simply put, we expect transfers-in from other parts of the organization to have superior knowledge, skills, and abilities in domains that are specific to the organization. We predict that transfers-in will therefore be able to deliver better patient satisfaction immediately following their addition to a unit, compared with new external hires. These contributions will be greater because the transfers will be better acclimated to organizational systems and practices, and thus may initially be more effective in working within the existing organizational routines and norms (Schein, 1990; Schmitt & Chan, 1998). Further, transfers-in are more likely than outside hires to have pre-established interpersonal relationships, which are useful for successfully integrating their ability to deliver service, with nurses already in the unit.

Hypothesis 3c. The immediate effect of transfer-in rates on patient satisfaction is more strongly positive than the immediate effect of hiring rates on patient satisfaction.

Modeling Dynamic Systems to Capture Temporal Effects

Effects of voluntary turnover rates are best understood by examining changes within human capital systems over time (Nyberg & Ployhart, 2013). Although a few studies have examined voluntary turnover rates longitudinally (e.g., Kammeyer-Mueller, Wanberg, Glomb, & Ahlburg, 2005), most have used cross-sectional data. With Morrow and McElroy's (2007) work being a notable exception, most studies have also neglected to theorize about how the effects of voluntary turnover rates change over time (Hausknecht & Trevor, 2011; Shaw, 2011). By considering temporal effects, theoretical knowledge regarding why and how a relationship exists can be expanded (George & Jones, 2000; Lee, Gerhart, Weller, & Trevor, 2008; Roe, 2008; Weller, Holtom, Matiaske, & Mellewigt, 2009). Going forward, we test this basic premise of CET theory, and add richness and specificity to it, by explaining a rationale underlying differences in the duration of patient satisfaction effects.

The CET theory focus on time was derived from the recognition of unit-level turnover as a measure of the flow of human capital degradation. The theory asserts that the rate and timing of one component within the system can be expected to differentially affect outcomes because other system components react. We extend this idea by examining the specific timing of relationships where such a connection is likely to matter—turnover, hiring, transfers (-in and -out), job demands, and performance. Thus, there is a complex coevolution among the system variables—change begets change throughout the system.

A basic systems theory view recognizes that stocks and flows in a system are linked via interconnected loops of action and feedback resulting in non-recursive causality of the elements within the system. As Elster points out, "The social sciences, like other empirical sciences, try to explain two sorts of phenomena: events and facts. [. . .] explaining events is logically prior to explaining facts. A fact is a temporal snapshot of a stream of events, or a pile of such snapshots" (1989: p. 3). Events (or flows) constantly shape facts (or stocks) that are cross-sectional insights into the process. Over time, human capital flow, job demands, and patient satisfaction may all affect not only the current state of the system, but also impact changes to the system in the future. Future inflows of human capital may stem from current outflows, interim job demands, market demands, or the organizational recognition of superior patient satisfaction. However, differences in the speed of feedback being received, and execution of subsequent reactions in the human capital flow system, can make duration effects between variables differ.

The adoption of this systems approach leads us to develop and test theory about the effects of flows over time, because they are related to the complex coevolution of variables as the system responds and reacts to change. These temporal effects are

distinct from commonly modeled, temporal factors, such as learning curves, in which the rate of change in a single variable is non-linear over time. Our theory about human capital flows includes the actions and reactions of each component in the system because we examine and compare system responses to departures and additions, and develop theory about how the system responds to changes.

Duration of the effects of leaver rates in the system. Duration represents the length of time a relationship between two variables can be found following a change in one (George & Jones, 2000). When a change occurs in either the voluntary turnover rate or the transfer-out rate, other variables in the flow system are expected to change as the unit recognizes the consequences and adjusts. For instance, departures may lead to changes in job demands and subsequent increases in the hiring rate. Similarly, the duration of the effect of human capital loss on patient satisfaction is likely to depend on the time it takes to adjust work and replace lost workers. The duration may also be influenced by a contagion effect, in which employees react to turnover with further turnover (Felps et al., 2009; Krackhardt & Porter, 1986). Additionally, decreased patient satisfaction could dishearten workers. Further, increased job demands could discourage potential workers from joining the unit, suppressing rates of hiring and transfer-in.

We theorize that changes in voluntary turnover rates will affect patient satisfaction over a longer duration than changes in transfer-out rates. One reason is that stronger immediate effects (Hypothesis 3b) will reverberate longer through the system. A second reason is that inability to control and predict turnover rates can increase the duration of actions and reactions in the system. Following this logic, the contagion effect of human capital departures is likely to be more pronounced after voluntary turnover than transfer-out. This is because those who leave the organization are capable of exposing the remaining employees to external opportunities. As a consequence, voluntary turnover may lead to additional voluntary turnover; moreover, those who remain are burdened with more work and may also respond by leaving. We also view transfers-out as management-sanctioned, thus co-workers who stay in the unit may also view transfers-out differently from those who leave the organization, which could result in a smaller impact on negative attitudes about the current organization and on perceptions about external opportunities. Given these differences, we expect voluntary turnover rates to lead to a chain of actions and reactions in the human capital system that will outlast those from transfers-out.

Hypothesis 4a. The negative effect of voluntary turnover rates on patient satisfaction will have a longer duration than the negative effect of transfer-out rates on patient satisfaction.

Duration of the effects of hiring rates in the system. Systematic reactions stemming from inflows are less intuitive than those related to outflows. Concurrently, there is a dearth of research about the outcomes associated with hiring rates (Siebert & Zubanov, 2009). Our dynamic approach can help explain the relationship between inflows and patient satisfaction.

External hiring rates and transfer-in rates differ in their effect on patient satisfaction (both in the short and long term), as well as on other system variables. We expect that hiring rate effects are likely to increase patient satisfaction over a longer duration than will changes in transfer-in rates. One reason is that new workers are likely to generate more innovative ideas about improving processes and capabilities than incumbents (who have a tendency to resist changes proposed by newcomers). Given that the ideas generated by outside newcomers are likely to be less incremental than the ideas from inside workers (Carpenter & Wade, 2002), we expect that external hiring of nurses will bring a greater variance of ideas than transfers-in. The ideas may not get implemented (Cohen & Levinthal, 1990), but when they do, we expect them to have a longer-lasting impact than ideas from transferred-in nurses. Further, the duration of effects of human capital additions will be partly determined by the reaction of the other system elements. For example, hiring from the outside may create a positive labor market reputation, making future hiring easier and thus more likely.

Hypothesis 4b. The positive effect of hiring rates on patient satisfaction has a longer duration than the positive effect of transfer-in rates on patient satisfaction.

Relative duration of unit-level turnover effects on job demands and patient satisfaction. Having described a rationale for the effects of voluntary turnover rates on both job demands and patient satisfaction, we now explain why we expect the patient satisfaction effect to outlast the job demands effect. Testing this aspect of our theoretical

model is helpful for understanding the systemic effects of outflows over time.

Our theorizing implies that changes in the quantity of human capital will impact patient satisfaction, and this impact will largely be attributable to changes in job demands. However, the systemic impact that runs through job demands cannot be considered in isolation. In addition to job demands effects, voluntary turnover may exert impact through the loss of firm-specific human capital (Hatch & Dyer, 2004; Hausknecht & Holwerda, 2013), shared understanding among unit members (Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000; Zhang, Hempel, Han, & Tjosvold, 2007), group cohesiveness and relationships (Alexander et al., 1994), and other team processes (Kozlowski & Bell, 2003). Even if management acts to alleviate job demands increases, addressing these other issues may be more difficult. To the extent that social and team-based effects persist after workers have been replaced, the effects of voluntary turnover rates on patient satisfaction should outlast its effects on job demands (which can be managed in the short run and is independent from workers' decisions to contribute and participate).

Hypothesis 5. The effect of voluntary turnover rates on patient satisfaction will have a longer duration than will the effect of voluntary turnover rates on job demands.

DATA AND METHODS

Research Setting

We focus on unit-level human capital flows in nursing units. We examine the relationship between unit-level changes and patient satisfaction. By exploring only one job (i.e., nurse) in a single organization, we can gain an understanding of the implications resulting from employee resource changes, and avoid concerns that arise from differences in internal influences (e.g., differing policies, practices, culture) or external influences (e.g., different industries).

Data are from 12 nursing units of a major university hospital system in the Midwestern U.S. that provide a broad range of services, such as general medicine and pediatric oncology. Each unit was observed between 2003 and 2008. On average, each unit employed 91 full-time nurses (average within-unit SD = 7.64), who accounted for more than 97% of the total hours worked. Measures were collected by the hospital as part of their human resource reporting systems. We were able to reconstruct each nurse's individual career path at the hospital for the respective years, including individual hire, turnover, and transfer events. We transformed the hospital's individual-level data into an individual-level panel data format, and then constructed monthly unit-level rates variables from the individual level information.

Measures

Patient satisfaction. *Patient satisfaction* was measured through a questionnaire administered to patients immediately following their hospital stay. Specific items were taken from a broader patient satisfaction survey (Hospital Consumer Assessment of Healthcare Providers and Systems; HCAHPS) that serves as a national standard for measuring consumer impressions of hospital care and is widely used by hospitals. Responses were matched to the month of the patient's hospital stay. Consistent with the hospital's nursing performance assessment, we limited our analysis to the six (of 27) items that focused on nursing services. Patients reported on aspects of nursing care, such as nurses' attitudes and attentiveness. Scores on this measure were aggregated to the unit level to arrive at monthly unit-level patient satisfaction scores (Garver, 2003). The specifics of the aggregation procedure are carefully defined and mandated by the Centers for Medicare and Medicaid Services. Scores theoretically ranged from zero to 100, but the observed range was narrower (64.5–98.5).

The six items for inpatient nursing evaluations include: *friendliness/courtesy*; *promptness of response to call button*; *attitude toward requests*; *attention to special/personal needs*; *kept you informed*; and *nurse skill*. The intraclass correlation of unit-level measures, ICC(1), was 0.12, and the reliability of means, ICC(2), was 0.94. As described by senior hospital executives, the precise survey items are a primary component of the nursing evaluation within the hospital and a marker for unit performance, and the survey is considered heavily in evaluating employees as well as overall unit performance in strategic decisions. Moreover, the items show strong content validity. For example, the item "promptness of response to call button" is likely to be theoretically related to job demands (i.e., the amount of time available for each nurse).

Voluntary turnover rates. For each unit-month, we calculated unit-level *voluntary turnover rates*. As with most turnover research, we focused on

voluntary departures and, as such, did not examine involuntary separations (Trevor et al., 1997), which accounted for only 3.6% of all human capital flow events. We calculated voluntary turnover rates as the number of nurses in a unit who voluntarily left the organization in a given month as a proportion of the number of nurses in the unit at the beginning of that month.

Hiring rates. For each unit-month, we calculated unit-level *hiring rates*. Similarly to voluntary turnover rates, we calculated hiring rates as the number of new nurses hired from outside the organization into a unit within a given month relative to the number of nurses in the unit at the beginning of the month.

Transfer-out rates and transfer-in rates. We calculated unit-level transfer-out rates and transfer-in rates for each unit-month. Following the procedures described above, we calculated transfer-out and -in rates as the monthly number of nurses transferred out of or into a unit relative to the number of nurses in the unit at the beginning of the month.

Job demands. Our measure of job demands was calculated by dividing monthly-adjusted patient-days by the number of nurses employed by the unit in that month. The result is a measure that captures the intensity of activity an average nurse would experience at work.

As our measure of job demands is calculated partly from the number of employees, it may seem that inflows and outflows could have a deterministic effect on job demands. However, each element of our measure—the number of full-time nurses and the number of patient-day equivalents—can change job demands independently, and be countered by management actions. For instance, decisions about patient admissions and unit assignment are subject to management influence. Similarly, not all requests for transfers-in or transfers-out are honored, and management controls their timing. To the extent that management anticipates or intends an increase in job demands, they may be more reluctant to approve transfer-out requests, and quick to facilitate transfers-in. Consistent with our assertion that administrators can impact job demands, the correlation coefficient between voluntary turnover rates in one period and patient-days in the following period ($r = -0.10$, $p < .01$) was negative and statistically significant.

Prior staffing level. The average size of each unit across the period of observation was accounted for by the fixed effects portion of the analysis (see below). However, we reasoned that the staffing levels at the time of a staffing event may impact job demands or patient satisfaction. Thus, in fixed effects regression models, we used the number of nurses employed by each unit at the start of each month to indicate prior staffing levels.

Data transformation. Due to concerns about the distribution of the variables, we transformed the percentage values of turnover, hires, and transfer-out and -in rates by the inverse hyperbolic sine function. This function has many of the same transformational properties as a logarithmic transformation, but better accommodates zero values (Burbidge, Magee, & Robb, 1988; MacKinnon & Magee, 1990; Nyberg, Fulmer, Gerhart, & Carpenter, 2010; Pence, 2006).

ANALYSIS

The various hypotheses were tested with two separate analyses. For short-term effects, including effects on performance that were mediated in the short term by job demands, we used a fixed effects regression approach (Wooldridge, 2002). This modeling choice was informed by tests for autocorrelation and stationary process in the dependent variable, and a Hausman test. However, the complex, reciprocal human capital flow system cannot be represented adequately by standard regression models. Therefore, to examine the longer-term effects of our theory, we used a panel vector autoregressive (PVAR) model (Holtz-Eakin, Newey, & Rosen, 1988).

Panel Vector Autoregression Analysis

The primary feature of a PVAR model is that it treats a set of variables as mutually predictive and co-evolving over time. PVAR is an extension of vector autoregressive (VAR) modeling for panel data, and is based on the simultaneous estimation of several general methods of moments (GMM) equations.

VAR is an econometric model used for evaluating systems with variables that may not be exogenous, and may be auto-correlated over time (Enders, 1995; Wooldridge, 2002). VAR models are more commonly used in finance and marketing to model the effects of dynamic relationships (see Pauwels, Silva-Risso, Srinivasan, & Hanssens, 2004, for a detailed account). While VAR models estimate relationships among variables in a single unit of observation (e.g., in one country; see Pauwels et al.,

2004), PVAR models are used to pool several units of analysis. For instance, PVAR has been used to model relationships across nations, such as public spending and revenues (Noy & Nualsri, 2011), firm investments and country-level financial development (Love & Zicchino, 2006), financial development and economic growth (Blanco, 2009), and market structure and economic growth (Rousseau & Wachtel, 2000).

In PVAR models, the relationships of each variable with all other variables in the period immediately following are estimated by system (or "extended") GMM equations (Arellano & Bover, 1995) that produce a matrix of coefficients and standard errors. Based on those immediate effects estimates, the long-term relationships of each variable with the others in the system are modeled using impulse response functions (IRFs; Hamilton, 1994; Koop, Pesaran, & Potter, 1996; Pesaran & Shin, 1998). An IRF simulates what would happen if a single variable experienced an exogenous one standard deviation increase at one point in time. The IRF uses the short-term GMM coefficients to forecast the effects of a simulated spike in one variable on each other variable during several subsequent time periods as the system responds to the change. The magnitude of each of these effects on the entire system is reflected in a set of impulse response coefficients (IRCs), calculated for each variable at each point in time after the event.

PVAR in the current context. VAR has only infrequently been used in the management literature (for two exceptions, see Makadok & Walker, 1996; Nair & Filer, 2003), but is useful for exploring dynamic systems, and is particularly well suited to the present study. As an example, consider the impact of voluntary turnover rates on patient satisfaction after six months. Simple regression with various lags could account for some of the mediators, such as job demands in period two or hiring in period three. However, our theory and analysis both recognize that these mediators are not independent. Job demands in period two may impact hiring in period three, and either of these could impact turnover rates in period four, which begins a new cycle of impacts that ripple through the system. Traditional regressions consider a small subset of all possible relationships at any given time, and assume away the remaining effects that are not only plausible, but might be hypothesized and tested in other contexts (Sims, 1980).

In our study, PVAR analysis exploits the data structure by evaluating and examining the full set of effects—the impact of each variable on all other variables over several periods. Our data also allow us to pool results across a number of nursing units.

Model specification. To generate an identified model in which the residuals are orthogonal, we used theory to choose the order entry of variables into the model (Love & Zicchino, 2006). The model is specified according to a sequence of causal steps such that each variable predicts future values of all variables in the system, but is allowed to predict same-period values of only those variables that follow it in the theoretically assumed sequence. We specified unit-level turnover as the most exogenous variable. We modeled patient satisfaction as the most endogenous variable because it is likely to be directly affected by the other variables, and because, in practice, patient satisfaction scores were reported back to the unit in the month following the actual performance occurrence. Thus, patient satisfaction is unlikely to have an immediate impact on the other variables in the system.

Fixed effects. In the PVAR model, we accounted for mean differences across units by using a fixed effects model, fixing on unit. However, PVAR models use lagged variables as instruments, and simply accounting for mean differences in this context results in biased coefficients (Holtz-Eakin et al., 1988; Nickell, 1981). Therefore, we used forward demeaning (i.e., using means of only future observations), also known as the "Helmert procedure" (Arellano & Bover, 1995; Love & Zicchino, 2006), to preserve the prior observations as instrumental variables and to produce unbiased coefficient estimates.

Lag length selection and simulation length selection. Properly estimating a PVAR system involves choosing the number of lags of each variable to be included as predictors (Chen, De, & Hu, 2009; Kireyev, 2000). Typically, the number of lags is determined by the use of a statistical criterion, such as the Akaike information criterion (AIC) or the Schwarz' Bayesian information criterion (SBIC). In the PVAR context, the statistical criteria are calculated for each unit of observation separately, and the results aggregated (see Kireyev, 2000). We examined four information criteria (final prediction error, AIC, Hannan–Quinn information criterion, and Schwarz criterion) for each unit to determine the appropriate lag length. Based on the predominance of evidence, we selected a one-month lag length.

The PVAR analysis similarly presents a choice regarding the length of time over which estimates

are simulated. We chose 12 months because this is an adequate time period for the hospital to execute decisions regarding the replacement of workers through transfers or new hires. A one-year period is also consistent with much of the prior turnover literature, since the annual turnover rate has been identified as "the most common metric for operationalizing collective turnover" (Hancock et al., 2013).

Confidence intervals and variance explained. To assess the effects represented by the impulse response functions, we generated estimates of their confidence intervals by subjecting the data to 1,000 Monte Carlo simulations based on the estimated coefficients and their standard errors (Arias & Escudero, 2007; Blanco, 2009; Love & Zicchino, 2006; Noy & Nualsri, 2011). We report the 90% confidence interval for impulse response coefficients, consistent with our unidirectional hypotheses and common practice in PVAR analysis. We also report variance decompositions, which show the percent of total variance in one variable that is accounted for by each other variable in the system over time.

RESULTS

Descriptive statistics for the study variables are presented in Table 1. Values are expressed as untransformed percentages of nurses subject to each event to provide an overview of the prevalence of each kind of addition and departure to the unit. Table 2 presents correlations among transformed variables and their one-period lagged values, both within and between units.

Results from Regression Analyses

The first set of hypotheses predicted the mediating role of job demands in the relationship between human capital flow and patient satisfaction. To test for mediation, we tested a model predicting job demands from human capital flow in the prior month. We then estimated a model predicting patient satisfaction from current job demands as well as human capital flow in the prior month. The statistical significance of the mediated effect was estimated by a product-of-coefficients method (MacKinnon & Fairchild, 2009; Sobel, 1982). This method is more statistically powerful than the Baron and Kenny (1986) method, and requires the estimation of fewer models (MacKinnon, Fairchild, & Fritz, 2007; MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002; Zhao, Lynch, & Chen, 2010).

Results of panel regressions investigating this mediation are summarized in Table 3. Model 1 indicates that the effect of voluntary turnover rates on job demands ($b = 13.30$; $SE = 3.23$; $p < .001$) was positive and statistically significant, as was the effect of transfer-out rates on job demands ($b = 7.89$; $SE = 2.19$; $p < .001$). The impact of hiring rates on job demands ($b = -6.53$; $SE = 1.75$; $p < .001$) was negative and statistically significant. The impact of transfer-in rates on job demands ($b = 0.18$; $SE = 3.62$; n.s.) was not statistically significant. Model 2 predicts patient satisfaction from human capital flow as well as from job demands. In this model, the impact of job demands on patient satisfaction ($b = -0.72$; $SE = 0.22$; $p < .01$) was negative and statistically significant. These results are summarized in Figure 1.

TABLE 1
Descriptive Statistics for System Variables[a]

	Average Within-unit Mean	Average Within-unit *SD*	Average Within-unit Range	Grand Min	Grand Max
Patient satisfaction	86.56	5.05	24.38	64.5	98.5
Job demands	9.87	0.97	4.08	5.77	14.31
Prior staffing level	91.22	7.64	27.08	53	203
Voluntary turnover (number of people)	0.58	0.77	3.08	0	5
Voluntary turnover rates (percent of unit)	0.61	0.86	3.51	0	6.58
Transfers-out (number of people)	0.89	1.24	6.58	0	23
Transfer-out rates (percentage of unit)	0.91	1.28	6.35	0	11.68
Transfers-in (number of people)	0.41	0.66	2.42	0	5
Transfer-in rates (percentage of unit)	0.46	0.76	2.95	0	5.08
Hiring (number of people)	1.30	1.40	5.83	0	11
Hiring rates (percentage of unit)	1.38	1.57	6.69	0	13.41

[a] $n = 838$ observations from 12 units over 73 months. Mean, standard deviation and range are calculated within unit and then averaged.

TABLE 2
Correlations Among System Variables, and their Lagged Values[a]

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Patient satisfaction		−.20	.18	.02	−.06	−.04	−.05	.07	−.17	.16	−.03	.00	.01	−.00
2	Job demands	−.29		−.63	−.04	.03	.13	.23	−.17	.65	−.60	.08	.07	.07	.02
3	Prior staffing level	.09	−.36		.08	.03	−.11	−.19	.16	−.59	.96	−.04	−.07	−.01	−.02
4	Voluntary turnover rates	.03	.02	.08		.03	−.05	.03	.01	−.00	.06	−.02	−.02	−.02	.08
5	Transfer-out rates	−.08	.04	.14	.05		.09	.13	−.05	.06	.04	.07	.06	.01	.04
6	Transfer-in rates	−.04	.07	−.03	−.06	.08		.09	−.01	.15	−.11	−.02	.08	.04	.07
7	Hiring rates	−.06	.23	.08	.08	.16	.08		−.03	.20	−.20	−.01	.14	.07	.16
8	Patient satisfaction$_{(t-1)}$	.17	−.27	.09	.01	−.05	.00	−.04		−.20	.17	.02	−.06	−.04	−.05
9	Job demands$_{(t-1)}$	−.27	.87	−.36	.04	.05	.08	.21	−.29		−.63	−.03	.04	.14	.23
10	Prior staffing level$_{(t-1)}$	.09	−.36	1.00	.07	.15	−.03	.07	.09	−.37		.07	.03	−.11	−.19
11	Voluntary turnover rates$_{(t-1)}$	−.02	.09	.05	.02	.09	.01	.03	.04	.02	.08		.03	−.04	.02
12	Transfer-out rates$_{(t-1)}$	−.00	.06	.12	−.01	.12	.06	.18	−.08	.04	.15	.06		.08	.13
13	Transfer-in rates$_{(t-1)}$	.03	.02	−.01	−.02	.01	.06	.06	−.04	.08	−.03	−.06	.07		.09
14	Hiring rates$_{(t-1)}$	−.04	.10	.12	.10	.08	.06	.28	−.06	.24	.07	.08	.18	.07	

[a] Voluntary turnover, hiring, transfer-in and transfer-out rates represent transformed percentages as used in subsequent analyses.

Correlations below the diagonal are overall correlations between units $n = 838$. Correlations of 0.07 or stronger are statistically significant at $p < .05$ below the diagonal. Correlations above the diagonal represent the average within-unit correlations (n-values between 66 and 72). The between-unit correlation of 1.00 between prior staffing levels in the two time periods summarizes a more precise value of 0.997, which we attribute to stable between-unit differences that are controlled in later analyses.

To test the statistical significance of the hypothesized mediated paths, we estimated the standard error for the product of coefficients in each path (Sobel, 1982). The product of coefficients was statistically significant and in the expected direction for voluntary turnover rates ($a \times b = -9.58$; $SE = 3.74$; $p < .05$) and for transfer-out rates ($a \times b = -5.68$; $SE = 2.35$; $p < .05$). Hypotheses 1a and 1b were supported. The mediated effect of hiring rates on patient satisfaction through job demands was positive and statistically significant ($a \times b = 4.70$; $SE = 1.91$; $p < .05$), supporting Hypothesis 2a. Since the mediated effect of transfer-in rates on patient satisfaction was not statistically significant ($a \times b = -0.13$; $SE = 2.61$; n.s.), Hypothesis 2b was not supported.

TABLE 3
Results of Fixed Effects Panel Regression Analysis (Hypothesis 1)[a]

	Predictors of Job Demands Model 1		Predictors of Patient Satisfaction Model 2	
Prior staffing level	–0.07***	(0.00)	0.03	(0.03)
Voluntary turnover rates	13.30***	(3.23)	0.38	(20.66)
Transfer-out rates	7.89***	(2.19)	9.38	(14.00)
Transfer-in rates	0.18	(3.62)	25.45	(22.90)
Hiring rates	–6.53***	(1.75)	3.89	
Job demands			–0.72**	(0.22)
$R^2_{(Within)}$	0.38		0.03	
$R^2_{(Between)}$	0.11		0.20	

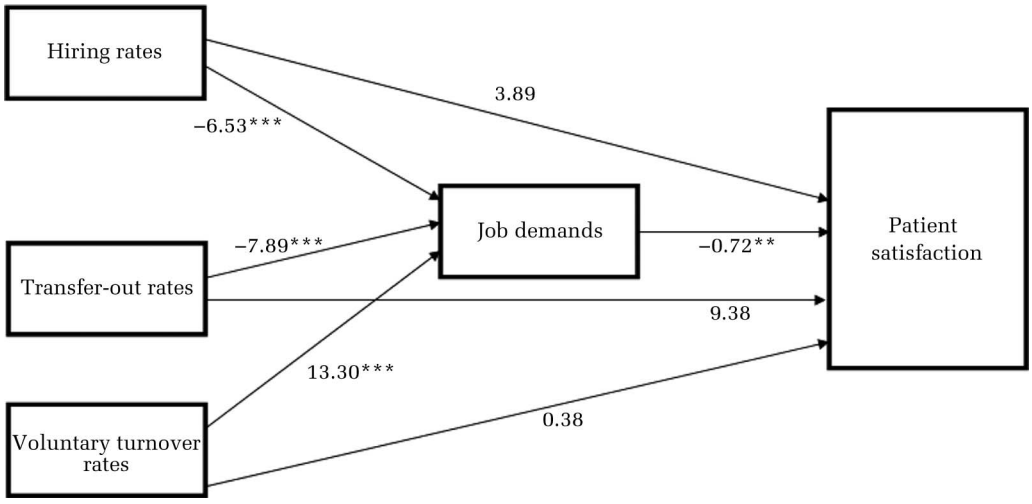
[a] $N_{(obs)} = 826$ from 12 units; one observation from each unit (of 838 total observations) is used as a lag value. Job demands are measured in the same period as patient satisfaction (i.e., not lagged), and other variables are lagged one month. Two-tailed tests are used for hypothesis testing. Standard errors are in parentheses. The statistical significance of the mediated effect was estimated by a product-of-coefficients method (MacKinnon & Fairchild, 2009; Sobel, 1982). This method does not require an estimation of models that exclude the mediator (MacKinnon et al., 2007).

** $p < .01$

*** $p < .001$

To compare the effects of voluntary turnover rates and transfer-out rates on job demands, we compared the coefficients using a Chow test (Chow, 1960). Although the difference in coefficients (5.41) was in the expected direction and large in absolute numbers, the confidence intervals for voluntary turnover (9.16–17.44) and transfers-out (5.08–10.70) overlapped, and the z-value of the difference of the coefficients ($z = 1.39$; *n.s.*) did not attain statistical significance. Hypothesis 3a was not supported. Similar tests comparing the direct effects of voluntary turnover and transfer-out rates, as well as of hiring and transfer-in rates, on patient satisfaction also indicated overlap in the confidence intervals, and the differences between the coefficients did not reach statistical significance ($z = 0.36$, n.s., and $z = 0.85$, n.s., respectively). Hypotheses 3b and 3c were not supported. One explanation for the lack of support for these hypotheses is that the

FIGURE 1
Summary of Short-Term Mediation Effects (from Table 3, Hypothesis 1)[a,b,c,d]



[a] Total Mediated Effect of Hiring Rates = Statistically Significant ($-6.53 \times -0.72 = 4.70$; $SE = 1.91$; Two tailed $p < .05$).
[b] Total Mediated Effect of Transfer-Out Rates = Statistically Significant ($7.89 \times -0.72 = -5.68$; $SE = 2.35$; Two tailed $p < .05$).
[c] Total Mediated Effect of Voluntary Turnover Rates = Statistically Significant ($13.30 \times -0.72 = -9.58$; $SE = 3.74$; Two tailed $p < .05$).
[d] Transfer-In Rates Were Not Statistically Significantly Related to Job Demands or Patient Satisfaction.

fixed effects model estimates the coefficients in a linear and unidirectional manner, whereas the theory suggests that the effects are more complex and discursive.

Results from PVAR Analyses

The next set of hypotheses specifies predictions for the dynamic effects of human capital flow, job demands, and patient satisfaction in a system of mutually causal effects over time. As described above, these hypotheses were tested using a PVAR analysis. Coefficients from the GMM that underlies the PVAR analysis are reported in Table 4.

Our analysis provided estimates for the effects of changes in each variable on each other variable for 12 months, and results relevant to our hypotheses are summarized in Table 5.[4] Variance decompositions reported in Table 6 show the total variance in each variable that is accounted for by each other variable in the system. Overall, results suggest that a substantial portion (24%) of patient satisfaction is accounted for by variance in the system over time. Furthermore, the explained variance in transfers-in (27%) and hires (57%) are consistent with our discussion of administrators' responses to staffing concerns—they replace departed employees. In our sample, it also appears that patient satisfaction is associated with future job demands and future hiring, two findings that are also consistent with management intervention.

PVAR results indicate that the total effect of a one standard deviation change in voluntary turnover rates occurring in one month, accounting for its impact on all other variables and their mutual effects on each other over time, emerged in about three months, and persisted throughout the estimation period. A one standard deviation change in transfer-out rates, on the other hand, had an immediate effect (month 0; see Figure 2), but the effect dissipated quickly and was not statistically significant one month later, or any time thereafter. Hypothesis 4a was supported.

Hypothesis 4b concerned relative duration effects of changes in hiring and transfer-in rates on patient satisfaction. The total effect to the system from a one standard deviation change in hiring rates resulted in a statistically significant increase in patient satisfaction beginning in the second

[4] As a robustness check, we conducted a series of parallel analyses using fixed effects panel regressions with various lags of independent variables. Based on the unique features of PVAR, we did not expect identical results, but we found a general consistency between the two approaches. As expected, the similarity was especially true in models with shorter lags, and the divergence became more distinct as the time horizon expanded.

TABLE 4
System GMM Results for Impact of Each Lagged System Variable on Other System Variables[a]

Dependent Variable	Independent Variable	*b*	*SE*	*t*
Voluntary turnover rates	Voluntary turnover rates	0.01	0.04	0.20
	Transfer-out rates	−0.02	0.03	−0.96
	Job demands	0.00	0.00	0.04
	Transfer-in rates	−0.02	0.04	−0.59
	Hiring rates	0.05*	0.02	2.08
	Patient satisfaction	−0.00	0.00	−0.24
Transfer-out rates	Voluntary turnover rates	0.10	0.05	1.79
	Transfer-out rates	0.11	0.07	1.43
	Job demands	0.00	0.00	0.32
	Transfer-in rates	−0.01	0.06	−0.21
	Hiring rates	0.02	0.04	0.57
	Patient satisfaction	−0.00	0.00	−0.08
Job demands	Voluntary turnover rates	10.49**	3.51	2.99
	Transfer-out rates	8.79***	2.62	3.35
	Job demands	1.16***	0.08	13.91
	Transfer-in rates	−5.74	4.85	−1.19
	Hiring rates	–13.72***	2.22	−6.19
	Patient satisfaction	0.12***	0.03	3.69
Transfer-in rates	Voluntary turnover rates	−0.01	0.04	−0.28
	Transfer-out rates	0.06*	0.02	2.31
	Job demands[b]	0.002*	0.001	2.47
	Transfer-in rates	0.00	0.04	0.03
	Hiring rates	0.02	0.02	0.86
	Patient satisfaction[b]	0.001*	0.000	2.40
Hiring rates	Voluntary turnover rates	−0.04	0.07	−0.60
	Transfer-out rates	0.21***	0.06	3.65
	Job demands	0.01***	0.00	4.91
	Transfer-in rates	−0.02	0.09	−0.23
	Hiring rates	0.12*	0.05	2.24
	Patient satisfaction[b]	0.002***	0.001	3.59
Patient satisfaction	Voluntary turnover rates	−1.26	21.77	−0.06
	Transfer-out rates	−3.51	15.73	−0.22
	Job demands	–1.68***	0.47	−3.58
	Transfer-in rates	41.36	26.87	1.54
	Hiring rates	17.77	14.10	1.26
	Patient satisfaction	−0.26	0.16	−1.63

[a] Independent variables are lagged one period. Two tailed tests for statistical significance. As a result of our measurement approach, designed to facilitate interpretation of the practical significance of PVAR effects, nominal size of some coefficients is zero. The impact of a one standard deviation change in these variables (as reflected in the IRF estimates), however, can be substantial. The practical significance of the effects is discussed in the text.

[b] Coefficients and standard errors for these variables are reported to an additional decimal place for interpretation clarity. We rely on impulse response coefficients and error bands, rather than the GMM estimates, for interpretation.

* $p < .05$
** $p < .01$
*** $p < .001$

month following the change, and persisting throughout the 12-month period. A one standard deviation change in transfer-in rates impacted patient satisfaction to a statistically significant degree in the first, third, and fifth months (see Table 5, Figure 3), but not thereafter, supporting Hypothesis 4b.

The impact of a one standard deviation change in voluntary turnover rates on patient satisfaction and on job demands both persisted throughout the 12-month observation period, thus Hypothesis 5 was not supported (see Table 5, Figure 4).

Practical Effects over Time

While hypothesis testing provides information about the conceptual viability of our theory, assessing the practical significance of our results requires additional interpretation of the size of the effects

TABLE 5
PVAR Analyses Results of the Impact of One Variable on Another Over Time[a]

Relationship	Month 1	2	3	4	5	6
Job demands on patient satisfaction	−.95* (−1.35 to −.54)	−.96* (−1.27 to −.59)	−.88* (−1.18 to −.54)	−.83* (−1.18 to −.50)	−.77* (−1.17 to −.44)	−.72* (−1.16 to −.39)
Voluntary turnover rates on job demands	.08 (.00 to .15)	.09* (.02 to .18)	.09* (.02 to .16)	.08* (.02 to .15)	.07* (.02 to .15)	.07* (.02 to .15)
Voluntary turnover rates on patient satisfaction	−.04 (−.37 to .27)	−.12 (−.27 to .00)	−.11* (−.20 to −.02)	−.10* (−.20 to −.02)	−.10* (−.19 to −.02)	−.09* (−.19 to −.02)
Transfer-out rates on job demands	.04 (−.04 to .12)	.03 (−.04 to .11)	.02 (−.05 to .09)	.02 (−.05 to .09)	.02 (−.04 to .09)	.02 (−.04 to .09)
Transfer-out rates on patient satisfaction	.10 (−.23 to .42)	−.03 (−.17 to .09)	−.02 (−.12 to .08)	−.02 (−.11 to .06)	−.02 (−.11 to .05)	−.02 (−.10 to .05)
Transfer-in rates on job demands	−.10* (−.19 to −.03)	−.06 (−.14 to .01)	−.07* (−.14 to −.01)	−.06 (−.13 to .00)	−.06 (−.13 to .00)	−.06 (−.13 to .00)
Transfer-in rates on patient satisfaction	.43* (.07 to .81)	.05 (−.13 to .17)	.10* (.02 to .22)	.08 (−.01 to .17)	.08* (.01 to .18)	.07 (.00 to .17)
Hiring rates on job demands	−.22* (−.29 to −.16)	−.24* (−.32 to −.16)	−.23* (−.32 to −.14)	−.22* (−.32 to −.13)	−.20* (−.32 to −.11)	−.19* (−.32 to −.10)
Hiring rates on patient satisfaction	.30 (−.09 to .68)	.34* (.16 to .49)	.30* (.17 to .44)	.28* (.15 to .41)	.26* (.13 to .40)	.24* (.12 to .39)

	Month 7	8	9	10	11	12
Job demands on patient satisfaction	−.67* (−1.16 to −.34)	−.63* (−1.17 to −.29)	−.59* (−1.17 to −.25)	−.55* (−1.17 to −.22)	−.51* (−1.22 to −.18)	−.48* (−1.21 to −.16)
Voluntary turnover rates on job demands	.07* (.01 to .15)	.06* (.01 to .15)	.06* (.01 to .15)	.05* (.01 to .15)	.05* (.01 to .15)	.05* (.01 to .14)
Voluntary turnover rates on patient satisfaction	−.08* (−.18 to −.02)	−.08* (−.18 to −.02)	−.07* (−.18 to −.01)	−.07* (−.17 to −.01)	−.06* (−.17 to −.01)	−.06* (−.17 to −.01)
Transfer-out rates on job demands	.01 (−.04 to .09)	.01 (−.04 to .09)	.01 (−.04 to .08)	.01 (−.03 to .08)	.01 (−.03 to .08)	.01 (−.03 to .08)
Transfer-out rates on patient satisfaction	−.02 (−.10 to .05)	−.02 (−.10 to .05)	−.02 (−.10 to .04)	−.02 (−.10 to −.04)	−.01 (−.09 to .04)	−.01 (−.09 to .04)
Transfer-in rates on job demands	−.05 (−.12 to .00)	−.05 (−.12 to .00)	−.05 (−.12 to .00)	−.04 (−.12 to .00)	−.04 (−.12 to .00)	−.04 (−.12 to .00)
Transfer-in rates on patient satisfaction	.07 (.00 to .16)	.06 (.00 to .16)	.06 (.00 to .15)	.05 (.00 to .15)	.05 (.00 to .15)	.05 (.00 to .15)
Hiring rates on job demands	−.18* (−.33 to −.08)	−.16* (−.34 to −.07)	−.15* (−.35 to −.06)	−.14* (−.35 to −.05)	−.13* (−.37 to −.05)	−.12* (−.38 to −.04)
Hiring rates on patient satisfaction	.22* (.11 to .39)	.21* (.09 to .38)	.20* (.08 to .38)	.18* (.07 to .38)	.17* (.06 to .39)	.16* (.05 to .40)

[a] $N_{(obs)}$ = 826 from 12 units; one observation from each unit (of 838 total observations) is used as a lag value. Values in parentheses are 90% confidence intervals. Hypothesis tests are the impact of one variable on another barring other disturbances. Time values indicate months after one-time, one standard deviation increase in the predictor variable.
* 90% confidence interval.

TABLE 6
Table of Variance Explained by Other Variables in the Unit-Level System[a]

	Voluntary Turnover Rates	Transfer-Out Rates	Job Demands	Transfer-In Rates	Hiring Rates	Patient Satisfaction
Voluntary turnover rates	(0.02)	0.01	0.01	0.01	0.00	0.00
Transfer-out rates	0.00	(0.02)	0.00	0.01	0.02	0.00
Job demands	0.01	0.01	(0.27)	0.12	0.35	0.20
Transfer-in rates	0.00	0.00	0.01	(0.27)	0.01	0.01
Hiring rates	0.01	0.00	0.06	0.01	(0.57)	0.02
Patient satisfaction	0.01	0.00	0.19	0.13	0.20	(0.24)

[a] Note: values on the diagonal represent total variance explained by all other variables in the system over. Non-diagonal values are percentages of variance explained in the row variable by the column variable. For example, row 5, column 3 shows that 6% of job demands are explained by hiring rates. Since this is an aggregation of variance explained after the shock, there is not a meaningful statistical significance measure.

we observe in the data. In this section, we report the practical size of the impact exerted by job demands, voluntary turnover rates, transfer rates, and hiring rates.

Job demands effects. Our analysis estimated the system's response to increasing job demands by one standard deviation above normal in a given month. In our data, this corresponded to a change of 0.97 patients per nurse per month. The response of patient satisfaction to such a change peaked in the second month after the change, resulting in an expected decrease of 4.85 points on the patient satisfaction scale at that time. This represents 0.96 standard deviations of patient satisfaction.

Effects of voluntary turnover rates. The analysis also estimated the system's response to increasing voluntary turnover rates by one standard deviation above normal in a given month. In our data, that corresponded to an additional 1.85% of employees departing per month (about 1.69 nurses). The statistically significant response of patient satisfaction peaked during the third month (see Table 5), resulting in an expected decrease of about 0.56 points on the patient satisfaction scale, or 0.11 standard deviations.

Effects of hiring rates. A one-time change in hiring rates of one standard deviation above normal represents hiring an additional 3.70% of the workforce (about 3.38 nurses). The response of patient satisfaction peaked in the second month following such a change and is estimated to increase patient satisfaction by 1.72 points, or 0.34 standard deviations.

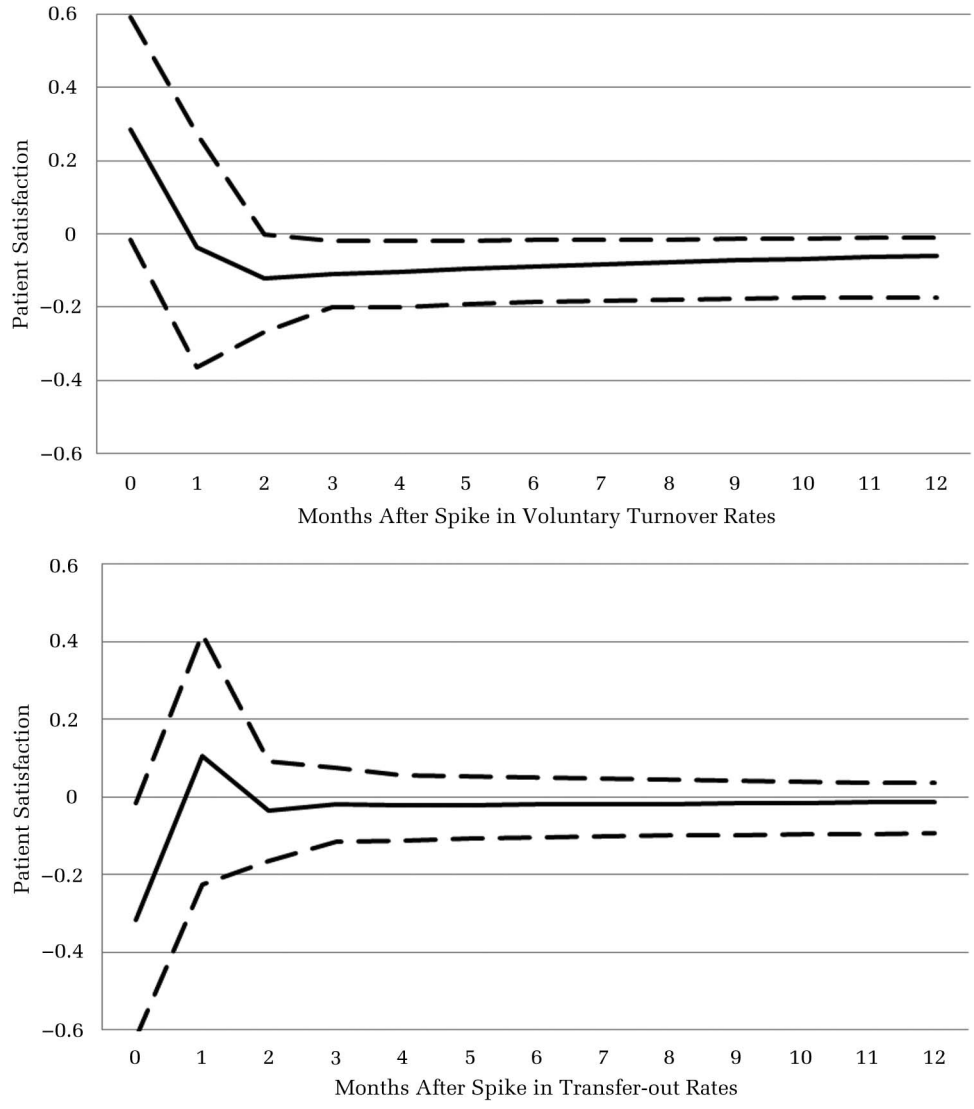
Effects of transfer rates. A one-time change in transfer-in rates of 1.78% of a unit's nurses (about 1.62 workers) on patient satisfaction peaked in the first month after the increase in transfers-in. The expected result was a decrease in patient satisfaction of 2.17 points, or 0.43 standard deviations in the performance measure. A one-time change in transfers-out of 2.83% of a unit (2.58 nurses) on patient satisfaction peaked in the focal month (month 0), and is expected to lead to a decrease in patient satisfaction of 1.62 points.

In practical terms, the magnitude of the absolute values of the effects of employee change on patient satisfaction may seem relatively small, but it is notable that the within-unit standard deviation of patient satisfaction is only 5.05 points. Taken holistically, the findings suggest that a substantial portion of the effects of spikes in voluntary turnover, hiring, and transfer rates on patient satisfaction are driven by their impact on job demands.

DISCUSSION

Our study extends CET theory's emphasis that the human capital flow process involves a complex set of dynamic and reciprocal influences that unfold over time—this includes the role of job demands, which typically has been omitted from empirical models. We also show the effects of management responses to human capital resource outflows by replacing workers through hires and transfers-in, which differ in their timing and effects. Explicating the differences across various types of employee inflows and outflows creates a fuller picture of the systemic changes associated with employee flow. For instance, our model indicates that managers react to turnover rates in a variety of ways, including reducing workflows, transferring replacement employees from other parts of the organization, and increasing hiring rates. Each of these actions has unique theoretical implications for influencing patient satisfaction by stabilizing job demands and

FIGURE 2
Comparison of the Effects of Voluntary Turnover Rates and Transfer-Out Rates on Patient Satisfaction (Hypothesis 4a)



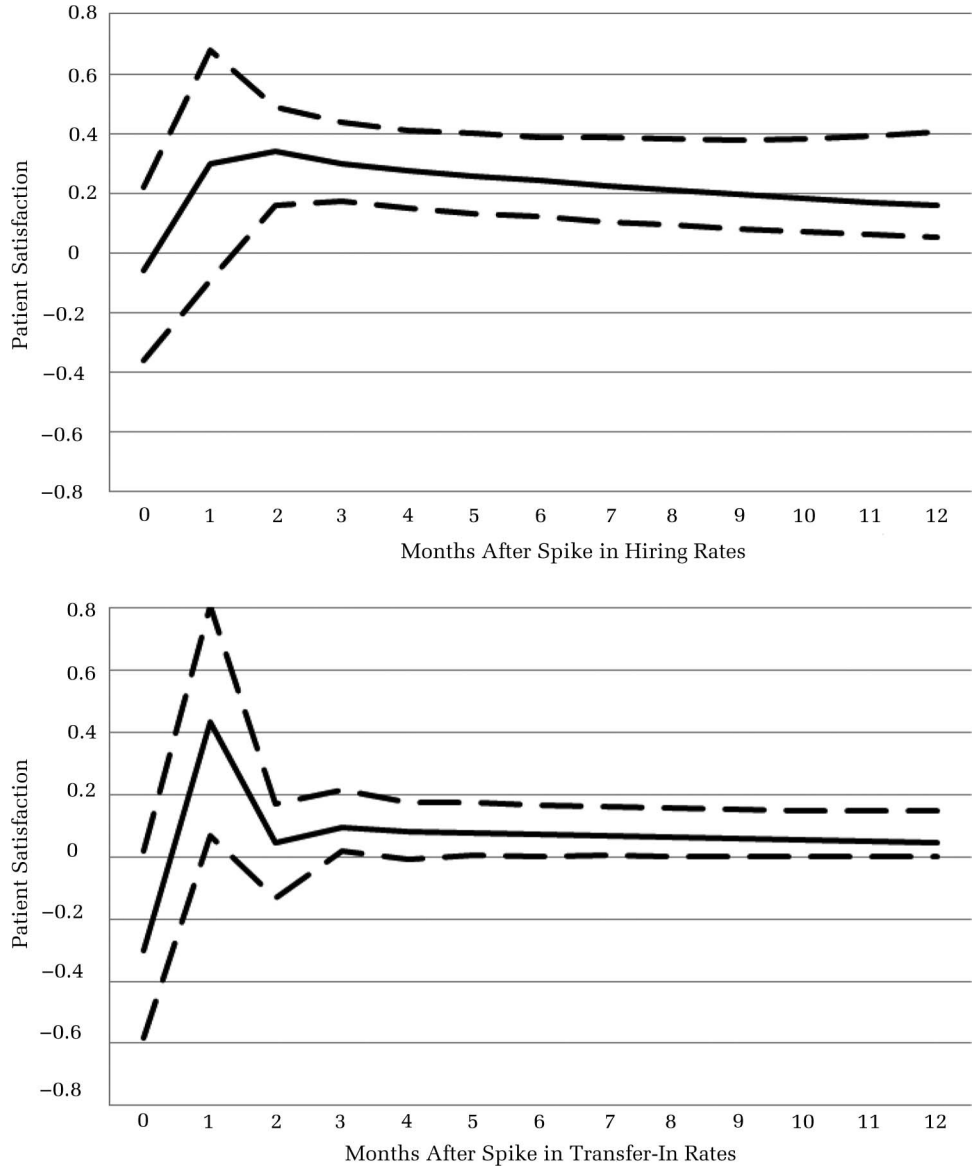
through other causal pathways. Our analytical approach (PVAR), which is well established in other fields but relatively rare in the management literature, allows us to model this theorized dynamic process in a novel and more precise fashion.

Implications for Theory

Our reasoning supports two of the major contributions of CET theory. First, CET theory posits that a reduction in the quantity of human capital is a key driver in the relationship between turnover and performance. Our results also suggest that Hausknecht and Holwerda's (2013) call for more attention to the quantity of human capital may indeed be understated. In the short term, our results imply a strong job demands mediation. Further, we found that the effects of voluntary turnover and hiring on job demands persisted throughout the one-year duration of our analysis.

Second, CET theory implies that human capital flows operate in a dynamic system, in which managers and workers respond to changes in the system, and take actions, including hiring, that not only impact performance measures such as patient satisfaction, but also influence other human capital

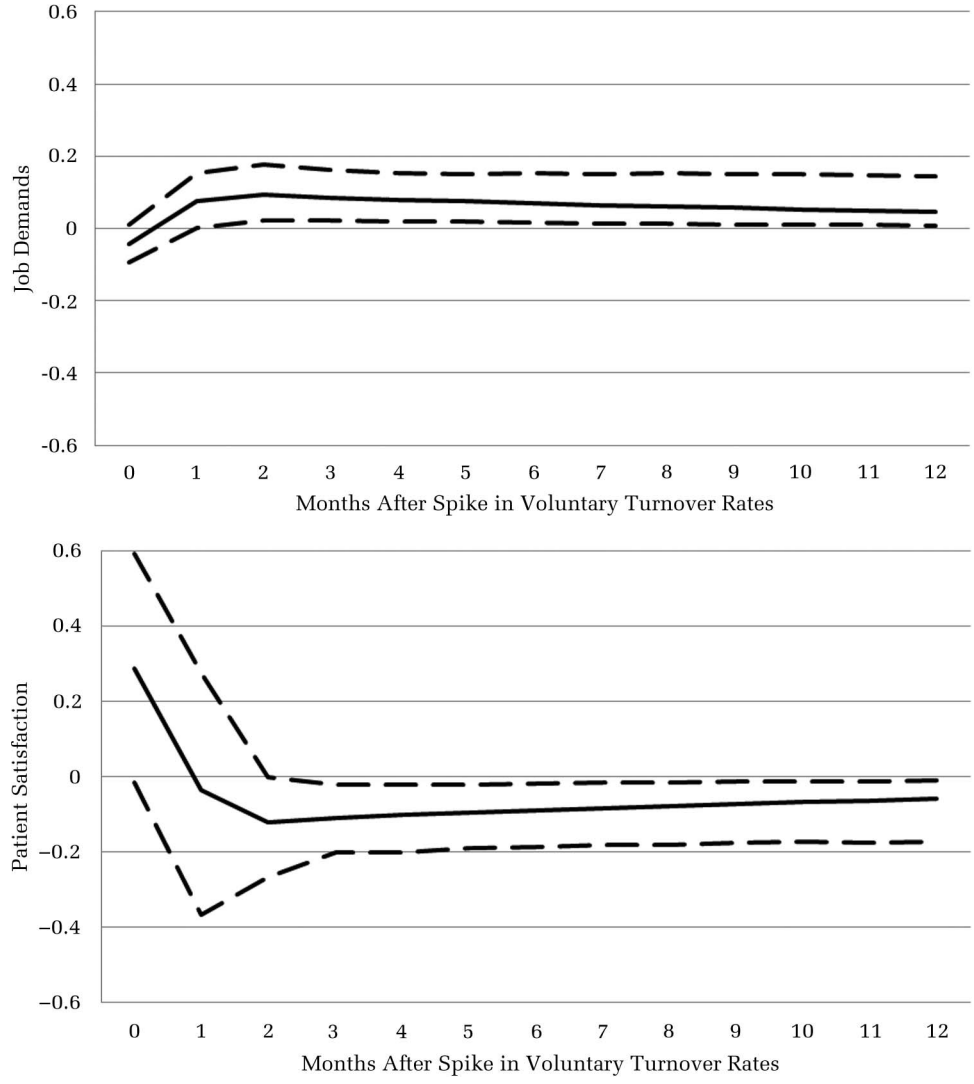
FIGURE 3
Comparison of the Effects of Hiring Rates and Transfer-In Rates on Patient Satisfaction (Hypothesis 4b)



variables in the model. This implies that static models, and even many longitudinal models with time lags, may not adequately examine the full range of complex turnover outcomes. Our use of the PVAR analysis represents a step toward modeling the intricate inter-relations evoked by this theoretical model because it allows for the assessment of the impact of a single event as it echoes through the system. This advance provides additional insights, including an initial look into the duration of turnover effects, and changes in the impact on any given "dependent variable" over time.

Our results also extend CET theory by highlighting the differential impact on human capital flows that occur through transfers from transactions with the external labor market. In our context, hospital administrators used transfers as tools to smooth workflow and offset the less controllable effects of voluntary turnover. Given the central role of job demands in the system of effects that include human capital flows and performance, the finding that transfers had little relationship with job demands provides a critical insight.

FIGURE 4
Comparison of the Effects of Voluntary Turnover Rates on Job Demands and Patient Satisfaction, Respectively (Hypothesis 5)



Implications for Practice

Our study also offers opportunities for influencing managerial behavior. One obvious conclusion is that unit-level voluntary turnover rates are negatively related to patient satisfaction. Similarly, however seldom empirically demonstrated, hiring rates are positively related to patient satisfaction. Elevating job demands to a central variable in the relationship between turnover and unit performance implies that both the timing and source of replacement workers are important because the effects of job demands on patient satisfaction increases subsequent to voluntary turnover's effect on patient satisfaction.

Another implication concerns timing and the degradation of unit-level turnover effects. The negative and durable impact of voluntary turnover rates on patient satisfaction means that managers could benefit from mitigating expected increased job demands through the use of transfers, prior to or concurrent with unit-level turnover. This also suggests an advantage of having some slack human capital resources (Cyert & March, 1963; George, 2005). Slack resources could allow management to respond more quickly and effectively to human capital resource changes, minimizing the effect of job demands increases; however, we recognize the potential increase in costs and reduced efficiency.

Our results also suggest that organizations may benefit from hiring prior to human capital resource degradation whenever possible. When this is possible, a focus on external hiring may yield more benefits than one aiming for higher transfer-in rates in terms of some performance outcomes, although they may also cost more (see Bidwell, 2011). While hiring in anticipation of turnover would incur additional costs (e.g., paying two people for the same job), it could help reduce the performance declines associated with both voluntary turnover and hiring. Therefore, this decision is likely to be more important for highly complex or team-oriented tasks.

Limitations and Future Research Directions

A limitation, albeit one that also presents a research opportunity, is that we were unable to incorporate individual differences in the human capital resource into our model. While the quantity of unit-level turnover and unit-level hiring appears to be important, the quality of employees either coming or going is also likely to matter (Hausknecht & Holwerda, 2013; Nyberg & Ployhart, 2013). In our model, 76% of the variance remains unexplained, and much of this remaining variance may relate to the characteristics of those who leave or join the unit (e.g., their capabilities or social position in the unit). Therefore, future research should attempt to quantify the quality of the human capital resource involved in these relationships. Similarly, measuring firm-specific knowledge, and the social integration of interdependent work units, may produce insights that add nuance to the present work.

Another potential concern is that the data were drawn from a single hospital. While there are advantages to using homogeneous data sets (e.g., they can rule out external factors that may influence the relationships of interest), it also limits generalizability. For instance, different industries or contexts may be subject to different levels of workflow controllability, different replacement timelines, less opportunity to engage transfers, or less standardized procedures and training. All of these characteristics could impact the timing of effects in a particular setting, and perhaps the overall conclusions. Additionally, our context represents a specific type of relationship between customer/patient and the organization—the typical hospital stay nationwide has been estimated to be approximately five days. Satisfaction among customers that have shorter or less-intense interactions with organizational members could plausibly have different experiences or reactions in the face of increased job demands among workers.

Similarly, our time period may not generalize. Using several years of data may ameliorate the effects of short-term economic fluctuations over that time, but our period of observation did not include, for instance, the extended economic downturn that began in 2008. Events that affect the economy and the labor market could have the potential to alter the kinds of relationships we report here. Further research is needed to shed light on the regularities between contexts and how unique aspects alter the relationships among the constructs investigated here.

Another issue is that even month-long units of observation may not have been sufficiently fine-grained to allow for observation of the full process of systemic change. Were we to have used weeks instead of months, for example, we may have observed stronger effect sizes, and observed more nuance in the timing of the effect of the rates of transfers-in and -out. There may also be differences depending on the job type or task complexity. One additional limitation is that we have a relatively small sample (12 units). While our statistical tests are based on substantially more observations ($n = 838$), the small number of units presents the usual power problems associated with small samples, and may therefore mask relationships.

Finally, our analytical strategy regarding longitudinal relationships revealed some interesting complications of standard null hypothesis significance testing. For instance, in testing our hypotheses regarding the duration of various affects, we observed stark differences in durations between, for instance, the duration of voluntary turnover rates (12 months) and transfer-out rates (one month) on patient satisfaction. However, these differences could not be assessed based on standard statistical measures—it is not clear whether one year is statistically significantly different from one month. We anticipate that issues such as this will become increasingly important to researchers studying relationships over time.

CONCLUSION

By their nature, unit-level changes in the human capital resource affect job demands, employees, and unit performance, but not necessarily in a manner that is uniform and linear. We test and extend CET theory by examining several types of human capital resource change at the unit level. We also

generate theoretically driven explanations for how and why these changes impact patient satisfaction. Overall, we find that rates of turnover, transfers, and hiring, as well as job demands, all comprise a dynamic, evolving system that singularly and collectively influence patient satisfaction.

REFERENCES

Alexander, J. A., Bloom, J. R., & Nuchols, B. A. 1994. Nursing turnover and hospital efficiency: An organization-level analysis. ***Industrial Relations,*** 33: 505–520.

Arias, O., & Escudero, W. S. 2007. Assessing trends in informality in Argentina: A cohorts panel VAR approach (*mimeo*). Washington, D. C.: The World Bank.

Arellano, M., & Bover, O. 1995. Another look at the instrumental variable estimation of error-components models. ***Journal of Econometrics,*** 68: 29–51.

Barber, A. E. 1998. ***Recruiting employees.*** Thousand Oaks, CA: Sage Publications.

Baron, R. M., & Kenny, D. A. 1986. The moderator-mediator variable distinction in social psychological research. ***Journal of Personality and Social Psychology,*** 51: 1173–1182.

Batt, R. 2002. Managing customer services: Human resource practices, quit rates, and sales growth. ***Academy of Management Journal,*** 45: 587–597.

Becker, G. S. 1964. ***Human capital.*** New York: Columbia University Press.

Becker, B., & Gerhart, B. 1996. The impact of human resource management on organizational performance: Progress and prospects. ***Academy of Management Journal,*** 39: 779–801.

Bidwell, M. 2011. Paying more to get less: The effects of external hiring versus internal mobility. ***Administrative Science Quarterly,*** 56: 369–407.

Blanco, L. 2009. The finance-growth link in Latin America. ***Southern Economic Journal,*** 76: 224–248.

Burbidge, J. B., Magee, L., & Robb, L. 1988. Alternative transformations to handle extreme values of the dependent variable. ***Journal of the American Statistical Association,*** 83: 123–127.

Carpenter, M. A., & Wade, J. B. 2002. Microlevel opportunity structures as determinants of non-CEO executive pay. ***Academy of Management Journal,*** 45: 1085–1103.

Cascio, W. F. 2000. ***Costing human resources: The financial impact of behavior in organizations*** (4th ed.). Boston, MA: Kent.

Chen, G., Ployhart, R. E., Thomas, H. C., Anderson, N., & Bliese, P. D. 2011. The power of momentum: A new model of dynamic relationships between job satisfaction change and turnover intentions. ***Academy of Management Journal,*** 54: 159–181.

Chen, H., De, P., & Hu, Y. J. 2009. Broadcasting in online social networks: An empirical study of music sales and artists' activities. Available at SSRN: http://ssrn.com/abstract=2201430 or http://dx.doi.org/10.2139/ssrn.2201430

Chow, G. C. 1960. Tests of equality between sets of coefficients in two linear regressions. ***Econometrica,*** 28: 591–605.

Cohen, W. M., & Levinthal, D. A. 1990. Absorptive capacity—A new perspective on learning and innovation. ***Administrative Science Quarterly,*** 35: 128–152.

Collins, C. J., & Smith, K. G. 2006. Knowledge exchange and combination: The role of human resource practices in the performance of high-technology firms. ***Academy of Management Journal,*** 49: 544–560.

Cordes, C. L., & Dougherty, T. W. 1993. A review and an integration of research on job burnout. ***Academy of Management Review,*** 18: 621–656.

Cyert, R. M., & March, J. G. 1963. ***A behavioral theory of the firm.*** Upper Saddle River, NJ: Prentice Hall/Pearson Education.

Dalton, D. R. 1997. Employee transfer and employee turnover: A theoretical and practical disconnect? ***Journal of Organizational Behavior,*** 18: 411–413.

Dess, G. G., & Shaw, J. D. 2001. Voluntary turnover, social capital, and organizational performance. ***Academy of Management Review,*** 26: 446–456.

Dineen, B. R., Ling, J., & Soltis, S. M. 2011. Manager responses to internal transfer attempts: Managerial orientation, social capital, and perceived benefits as predictors of assisting, hindering, or refraining. ***Organizational Psychology Review,*** 1: 293–315.

Elster, J. 1989. ***Nuts and bolts for the social sciences.*** Cambridge: Cambridge University Press.

Enders, W. 1995. ***Applied econometric time series.*** New York: John Wiley & Sons.

Felps, W., Mitchell, T. R., Hekman, D. R., Lee, T. W., Holtom, B. C., & Harman, W. S. 2009. Turnover contagion: How coworkers' job embeddedness and job search behaviors influence quitting. ***Academy of Management Journal,*** 52: 545–561.

Fox, M. L., Dwyer, D. J., & Ganster, D. C. 1993. Effects of stressful job demands and control on physiological and attitudinal outcomes in a hospital setting. ***Academy of Management Journal,*** 36: 289–318.

Gardner, T. M., Wright, P. M., & Moynihan, L. M. 2011. The impact of motivation, empowerment, and skill-

enhancing practices on aggregate voluntary turnover: The mediating effect of collective affective commitment. ***Personnel Psychology,*** 64: 315–350.

Garver, M. S. 2003. Best practices in identifying customer-driven improvement opportunities. ***Industrial Marketing Management,*** 32: 455–466.

George, G. 2005. Learning to be capable: Patenting and licensing at the Wisconsin Alumni Research Foundation 1925–2002. ***Industrial and Corporate Change,*** 14: 119–151.

George, J. M., & Bettenhausen, K. 1990. Understanding prosocial behavior, sales performance, and turnover: A group-level analysis in a service context. ***Journal of Applied Psychology,*** 75: 698–709.

George, J. M., & Jones, G. R. 2000. The role of time in theory and theory building. ***Journal of Management,*** 26: 657.

Glebbeek, A. C., & Bax, E. H. 2004. Is high employee turnover really harmful? An empirical test using company records. ***Academy of Management Journal,*** 47: 277–286.

Glomb, T. M., Kammeyer-Mueller, J. D., & Rotundo, M. 2004. Emotional labor demands and compensating wage differentials. ***Journal of Applied Psychology,*** 89: 700–714.

Hamilton, J. D. 1994. ***Time series analysis.*** Princeton, NJ: Princeton University Press.

Hancock, J. I., Allen, D. G., Bosco, F. A., McDaniel, K. M., & Pierce, C. A. 2013. Meta-analytic review of employee turnover as a predictor of firm performance. ***Journal of Management,*** 39: 573–603.

Hatch, N. W., & Dyer, J. H. 2004. Human capital and learning as a source of sustainable competitive advantage. ***Strategic Management Journal,*** 25: 1155–1178.

Hausknecht, J. P., & Holwerda, J. A. 2013. When does employee turnover matter? Dynamic member configurations, productive capacity, and collective performance. ***Organization Science,*** 24: 210–225.

Hausknecht, J. P., & Trevor, C. O. 2011. Collective turnover at the group, unit, and organizational levels: Evidence, issues, and implications. ***Journal of Management,*** 37: 352–388.

Hausknecht, J. P., Trevor, C. O., & Howard, M. J. 2009. Unit-level voluntary turnover rates and customer service quality: Implications of group cohesiveness, newcomer concentration, and size. ***Journal of Applied Psychology,*** 94: 1068–1075.

Holtz-Eakin, D., Newey, W., & Rosen, H. S. 1988. Estimating vector autoregressions with panel data. ***Econometrica: Journal of the Econometric Society,*** 56: 1371–1395.

Hom, P. W., & Griffeth, R. W. 1995. ***Employee turnover.*** Cincinnati, OH: SouthWestern.

Jackson, S. E., & Schuler, R. S. 1983. Preventing employee burnout. ***Personnel,*** 60: 58–68.

Kacmar, K. M., Andrews, M. C., Van Rooy, D. L., Steilberg, R. C., & Cerrone, S. 2006. Sure everyone can be replaced . . . but at what cost? Turnover as a predictor of unit-level performance. ***Academy of Management Journal,*** 49: 133–144.

Kammeyer-Mueller, J. D., Wanberg, C. R., Glomb, T. M., & Ahlburg, D. 2005. The role of temporal shifts in turnover processes: It's about time. ***Journal of Applied Psychology,*** 90: 644–658.

Kireyev, A. 2000. ***Comparative macroeconomic dynamics in the Arab world: A. Panel VAR approach (IMF Working Paper # 0054).*** Washington, D.C.: International Monetary Fund.

Koop, G., Pesaran, M. H., & Potter, S. M. 1996. Impulse response analysis in nonlinear multivariate models. ***Journal of Econometrics,*** 74: 119–147.

Kozlowski, S. W. J., & Bell, B. S. 2003. Work groups and teams in organizations. ***Handbook of Psychology,*** 12: 333–375.

Kozlowski, S. W. J., & Klein, K. J. 2000. A multi-level approach to theory and research in organizations: Contextual, temporal, and emergent processes. In K. J. Klein, & S. W. J. Kozlowski (Eds.), ***Multilevel theory, research, and methods in organizations.*** San Francisco, CA: Jossey-Bass.

Krackhardt, D., & Porter, L. W. 1986. The snowball effect: Turnover embedded in communication networks. ***Journal of Applied Psychology,*** 71: 50–55.

Lazear, E. P., & Spletzer, J. R. 2012. Hiring, churn and the business cycle. ***American Economic Review,*** 102: 575–579.

Leana, C. R., & Van Buren, H. J. 1999. Organizational social capital and employment practices. ***Academy of Management Review,*** 24: 538–555.

Lee, T. H., Gerhart, B., Weller, I., & Trevor, C. 2008. Understanding voluntary turnover: Path-specific job satisfaction effects and the importance of unsolicited job offers. ***Academy of Management Journal,*** 51: 651–671.

Lee, T. W., & Mitchell, T. R. 1994. An alternative approach: The unfolding model of voluntary employee turnover. ***Academy of Management Review,*** 19: 51–89.

Love, I., & Zicchino, L. 2006. Financial development and dynamic investment behavior: Evidence from panel var. ***Quarterly Review of Economics and Finance,*** 46: 190–210.

MacKinnon, D. P., & Fairchild, A. J. 2009. Current direc-

tions in mediation analysis. ***Current Directions in Psychological Science,*** 18: 16–20.

MacKinnon, D. P., Fairchild, A. J., & Fritz, M. S. 2007. Mediation analysis. ***Annual Review of Psychology,*** 58: 593–614.

MacKinnon, D. P., Lockwood, C. M., Hoffman, J. M., West, S. G., & Sheets, V. 2002. A comparison of methods to test mediation and other intervening variable effects. ***Psychological Methods,*** 7: 83–104.

MacKinnon, J. G., & Magee, L. 1990. Transforming the dependent variable in regression models. ***International Economic Review,*** 31: 315–339.

Makadok, R., & Walker, G. 1996. Search and selection in the money market fund industry. ***Strategic Management Journal,*** 17: 39–54.

March, J. G., & Simon, H. A. 1958. ***Organizations.*** New York: John Wiley.

Maslach, C. 1976. Burned-out. ***Canadian Journal of Psychiatric Nursing,*** 20: 5.

Mathieu, J. E., Heffner, T. S., Goodwin, G. F., Salas, E., & Cannon-Bowers, J. A. 2000. The influence of shared mental models on team process and performance. ***Journal of Applied Psychology,*** 85: 273–283.

McElroy, J. C., Morrow, P. C., & Rude, S. N. 2001. Turnover and organizational performance: A comparative analysis of the effects of voluntary, involuntary, and reduction-in-force turnover. ***Journal of Applied Psychology,*** 86: 1294–1299.

Mobley, W. H., Griffeth, R. W., Hand, H. H., & Meglino, B. M. 1979. Review and conceptual analysis of the employee turnover process. ***Psychological Bulletin,*** 86: 493–522.

Morrow, P., & McElroy, J. 2007. Efficiency as a mediator in turnover—Organizational performance relations. ***Human Relations,*** 60: 827–849.

Nair, A., & Filer, L. 2003. Cointegration of firm strategies within groups: A long-run analysis of firm behavior in the Japanese steel industry. ***Strategic Management Journal,*** 24: 145–159.

Nickell, S. 1981. Biases in dynamic models with fixed effects. ***Econometrica,*** 49: 1417–1426.

Noy, I., & Nualsri, A. 2011. Fiscal storms: Public spending and revenues in the aftermath of natural disasters. ***Environment and Development Economics,*** 16: 113–128.

Nyberg, A. 2010. Retaining your high performers: Moderators of the performance-job satisfaction-voluntary turnover relationship. ***Journal of Applied Psychology,*** 95: 440–453.

Nyberg, A. J., Fulmer, I. S., Gerhart, B., & Carpenter, M. A. 2010. Agency theory revisited: CEO return and shareholder interest alignment. ***Academy of Management Journal,*** 53: 1029–1049.

Nyberg, A. J., & Ployhart, R. E. 2013. Context-emergent turnover (CET) theory: A theory of collective turnover. ***Academy of Management Review,*** 38: 109–131.

Organ, D. W., Podsakoff, P. M., & MacKenzie, S. B. 2006. ***Organizational citizenship behavior: Its nature, antecedents, and consequences.*** Thousand Oaks, CA: Sage Publications, Inc.

Park, T., & Shaw, J. 2013. Turnover rates and organizational performance: A meta-analysis. ***Journal of Applied Psychology,*** 98: 268–309.

Pauwels, K., Silva-Risso, J., Srinivasan, S., & Hanssens, D. M. 2004. New products, sales promotions, and firm value: The case of the automobile industry. ***Journal of Marketing,*** 68: 142–156.

Pence, K. M. 2006. The role of wealth transformations: An application to estimating the effect of tax incentives on saving. ***B.E. Journal of Economic Analysis and Policy,*** 5: 1–23.

Pesaran, M. H., & Shin, Y. 1998. Generalized impulse response analysis in linear multivariate models. ***Economics Letters,*** 1: 17–29.

Ployhart, R., Weekley, J., & Ramsey, J. 2009. The consequences of human resource stocks and flows: A longitudinal examination of unit service orientation and unit effectiveness. ***Academy of Management Journal,*** 52: 996–1015.

Podsakoff, N. P., Blume, B. D., Whiting, S. W., & Podsakoff, P. M. 2009. Individual- and organizational-level consequences of organizational citizenship behaviors: A meta-analysis. ***Journal of Applied Psychology,*** 94: 122–141.

Price, J. L. 1977. ***The study of turnover.*** Ames, IA: The Iowa State University Press.

Rafaeli, A., & Sutton, R. I. 1987. Expression of emotion as part of the work role. ***Academy of Management Review,*** 12: 23–37.

Roe, R. A. 2008. Time in applied psychology. ***European Psychologist,*** 13: 37–52.

Rousseau, D. M. 1985. Issues of level in organizational research: Multi-level and cross-level perspectives. ***Research in Organizational Behavior,*** 7: 1–37.

Rousseau, P. L., & Wachtel, P. 2000. Equity markets and growth: Cross-country evidence on timing and outcomes, 1980–1995. ***Journal of Banking and Finance,*** 24: 1933–1957.

Sacco, J. M., & Schmitt, N. 2005. A dynamic multilevel model of demographic diversity and misfit effects. ***Journal of Applied Psychology,*** 90: 203–231.

Schein, E. H. 1990. Organizational culture. ***American Psychologist,*** 45: 109–119.

Schmitt, N., & Chan, D. 1998. ***Personnel selection: A theoretical approach.*** Thousand Oaks: Sage Publications.

Shaw, J. D. 2011. Turnover rates and organizational performance: Review, critique, and research agenda. ***Organizational Psychology Review,*** 1: 187–213.

Shaw, J. D., Delery, J. E., Jenkins, J. G. D., & Gupta, N. 1998. An organization-level analysis of voluntary and involuntary turnover. ***Academy of Management Journal,*** 41: 511–525.

Shaw, J. D., Duffy, M. K., Johnson, J. L., & Lockhart, D. E. 2005a. Turnover, social capital losses, and performance. ***Academy of Management Journal,*** 48: 594–606.

Shaw, J. D., Gupta, N., & Delery, J. E. 2005b. Alternative conceptualizations of the relationship between voluntary turnover and organizational performance. ***Academy of Management Journal,*** 48: 50–68.

Siebert, W. S., & Zubanov, N. 2009. Searching for the optimal level of employee turnover: A study of a large U.K. Retail organization. ***Academy of Management Journal,*** 52: 294–313.

Sims, C. A. 1980. Macroeconomics and reality. ***Econometrica,*** 47: 1–48.

Sobel, M. E. 1982. Asymptotic confidence intervals for indirect effects in structural equations models. ***Sociological methodology,*** 13: 290–312.

Steel, R. P. 2002. Turnover theory at the empirical interface: Problems of fit and function. ***Academy of Management Review,*** 27: 346–360.

Sturman, M. C., Trevor, C. O., Boudreau, J. W., & Gerhart, B. 2003. Is it worth it to win the talent war? Evaluating the utility of performance-based pay. ***Personnel Psychology,*** 56: 997–1035.

Trevor, C. O., Gerhart, B., & Boudreau, J. W. 1997. Voluntary turnover and job performance: Curvilinearity and the moderating influences of salary growth and promotions. ***Journal of Applied Psychology,*** 82: 44.

Trevor, C. O., & Nyberg, A. J. 2008. Keeping your headcount when all about you are losing theirs: Downsizing, voluntary turnover rates, and the moderating role of HR practices. ***Academy of Management Journal,*** 51: 259–276.

Weller, I., Holtom, B. C., Matiaske, W., & Mellewigt, T. 2009. Level and time effects of recruitment sources on early voluntary turnover. ***Journal of Applied Psychology,*** 94: 1146–1162.

Wooldridge, J. M. 2002. ***Econometric analysis of cross section and panel data.*** Cambridge, MA: The MIT Press.

Zhang, Z.-X., Hempel, P. S., Han, Y.-L., & Tjosvold, D. 2007. Transactive memory system links work team characteristics and performance. ***Journal of Applied Psychology,*** 92: 1722–1730.

Zhao, X., Lynch, J. G., & Chen, Q. 2010. Reconsidering Baron and Kenny: Myths and truths about mediation analysis. ***Journal of Consumer Research,*** 37: 197–206.

Greg Reilly (greilly@business.uconn.edu) is Assistant Professor at the University of Connecticut School of Business. He received his PhD from the University of Wisconsin-Madison. His current research interests include teams, goals, and strategic human resources.

Anthony J. Nyberg (anthony.nyberg@moore.sc.edu) is an associate professor in the Darla Moore School of Business at the University of South Carolina. He received his PhD from the University of Wisconsin-Madison. His research focuses on strategic human resource management, human capital, compensation, and employee movement.

Mark A. Maltarich (mark.maltarich@moore.sc.edu) is Assistant Professor in the Darla Moore School of Business at the University of South Carolina. He received his PhD from the University of Wisconsin-Madison. His research interests include human capital resources, and the process and performance of teams.

Ingo Weller (weller@bwl.lmu.de) is Professor of Management at the Munich School of Management at the LMU Munich (Germany). He received his Habilitation from the Freie Universität Berlin (Germany) and his doctoral degree (Dr) from the University of Flensburg (Germany). His research interests include matching processes and strategic human resource management.