

Associations between safety culture and employee engagement over time: a retrospective analysis

Elizabeth Lee Daugherty Biddison,¹ Lori Paine,² Peter Murakami,³ Carrie Herzke,¹ Sallie J Weaver⁴

► Additional material is published online only. To view please visit the journal online (<http://dx.doi.org/10.1136/bmjqs-2014-003910>).

For numbered affiliations see end of article.

Correspondence to

Dr Elizabeth Lee Daugherty Biddison, Department of Medicine, Johns Hopkins School of Medicine, Baltimore, MD 21287, USA; edaughe2@jhmi.edu

Received 23 December 2014

Revised 6 May 2015

Accepted 13 May 2015

ABSTRACT

With the growth of the patient safety movement and development of methods to measure workforce health and success have come multiple modes of assessing healthcare worker opinions and attitudes about work and the workplace. Safety culture, a group-level measure of patient safety-related norms and behaviours, has been proposed to influence a variety of patient safety outcomes. Employee engagement, conceptualised as a positive, work-related mindset including feelings of vigour, dedication and absorption in one's work, has also demonstrated an association with a number of important worker outcomes in healthcare. To date, the relationship between responses to these two commonly used measures has been poorly characterised. Our study used secondary data analysis to assess the relationship between safety culture and employee engagement over time in a sample of >50 inpatient hospital units in a large US academic health system. With >2000 respondents in each of three time periods assessed, we found moderate to strong positive correlations ($r=0.43-0.69$) between employee engagement and four Safety Attitudes Questionnaire domains. Independent collection of these two assessments may have limited our analysis in that minimally different inclusion criteria resulted in some differences in the total respondents to the two instruments. Our findings, nevertheless, suggest a key area in which healthcare quality improvement efforts might be streamlined.

An environment that is deficient in joy and meaning, where the workforce is burdened by extreme production pressures, toxic sociocultural norms, and the risk that they could be physically or psychologically harmed, is an environment where both the workforce and patients suffer.¹

—Lucian Leape Institute

Roundtable on Joy and Meaning in Work and Workplace Safety, 2013

INTRODUCTION

The patient safety movement has grown in parallel with increasing challenges to maintaining the well-being, engagement and resilience of the healthcare workforce. Efforts to measure, evaluate and improve processes and outcomes are increasingly complicated by narrow financial margins and exponential growth in the number of patients presenting with multiple comorbidities and complex care needs. These factors together have created a perfect storm in which the healthcare workforce struggles both to meet expectations and to flourish in doing the work to which they have dedicated their lives. For >14 years, studies have repeatedly found high levels of burnout, job-related stress, depression and turnover among members of the healthcare workforce.²⁻⁵

Theoretical models of job performance have underscored the effects of prolonged job-related stressors on individual behaviour, performance and retention, as well as effects on organisational outcomes, safety and reliability.⁶⁻⁸ In parallel, conceptual models of positive valence indicators of workforce well-being, such as employee engagement,⁹ and other constructs that can be collected under the broad and diverse umbrella of positive psychology (eg, participative management)¹⁰ and organisational citizenship behaviours,¹¹ emphasise psychological involvement of employees in their work as a means to improve work outcomes.

Evidence supporting the relationship between indicators of workforce well-being, patient safety-related and other outcomes in healthcare continues to grow

To cite: Daugherty Biddison EL, Paine L, Murakami P, et al. *BMJ Qual Saf* Published Online First: [please include Day Month Year] doi:10.1136/bmjqs-2014-003910

as well. For example, a study of 7076 registered nurses working in 161 hospitals found significant relationships between nurse burnout and rates of both hospital-acquired urinary tract infections (UTI) and surgical site infections (SSI).¹² Their results indicated that each 10% increase in the proportion of nurses reporting high burnout was associated with an increase of nearly one UTI and two SSIs per 1000 patients. Extrapolating these findings, organisations could estimate annual cost savings of \$28–69 million from prevented UTIs and SSIs were they to realise a 30% reduction in nursing burnout. Similarly, a study of 178 recently hospitalised patients and their main inpatient providers found correlations between aspects of physician burnout and patient satisfactory. Importantly, this study also found a significant increase in postdischarge recovery times for those patients whose physicians reported burnout symptoms. Such findings suggest that healthcare workforce well-being may also impact costs associated with illness and injury of their patients, including lost time from work.¹³

Such findings underscore recommendations from the National Patient Safety Foundation, Institute of Medicine and numerous leading professional associations, articulating the need to address patient safety and care quality from a systems perspective that is both patient and workforce centred.¹⁴ Drawing from the theoretical lenses of positive psychology and concepts of psychologically healthy workplaces,^{15–17} this perspective is hypothesised to be critical for developing a workforce that has the bandwidth and motivation to be active, engaged organisational citizens, who feel supported by the system in which they work.¹ Thus, creating the conditions that facilitate an engaged workforce may also offer pathways for improving patient safety and care quality. To this end, strategic goals dedicated to helping healthcare workers find joy and meaning in their work have been advocated by safety-focused national entities and professional associations alike.

RATIONALE

Despite a history of study in other organisational contexts,^{8 18 19} relatively limited work in the healthcare context to date has explored hypothesised relationships between positive valence indicators of workforce well-being, such as employee engagement and organisational safety characteristics or attitudes.^{20 21} These are important relationships to explore, with potential to offer insight into unexamined barriers and facilitators of patient safety improvement and change efforts. Theories of high reliability and resilience^{22 23} suggest that organisations that are able to achieve high levels of reliably safe performance do so in part through shared norms of vigilance, willingness to speak up regarding concerns or creative ideas, a unified learning orientation and a shared motivation to

continuously seek opportunities to improve. Arguably, engaged team members may have greater bandwidth and motivation to create or sustain these safety-oriented norms compared with team members who are actively disengaged or burned out. Thus, engagement may influence or moderate safety-related aspects of organisational culture and team member perceptions of that culture, as well as influencing safety and quality outcomes. Frameworks for patient safety improvement similarly highlight that improvement efforts, a form of organisational change, require both technical interventions (eg, checklists, changes to work processes or care algorithms) and adaptive interventions (eg, interventions aimed at engaging organisational members in the change process and developing or strengthening cultural norms).²⁴ Much of the work in this area has focused on safety culture or workforce perceptions and attitudes regarding safety culture, known as safety climate.²⁵ Employee engagement is another arguably important ‘adaptive’ component that has received comparatively little attention, however, particularly in the patient safety literature. Meta-analyses have demonstrated organisation-level effect sizes of -0.21 to -0.28 between indices of employee engagement and safety indices; however, only a very small number of studies were available to estimate these effects.²⁶ Additionally, previous studies have not explored relationships between engagement and foundational aspects of reliably safe operations such as safety climate. To address this gap, we examined the relationship between employee engagement and healthcare worker perceptions of patient safety culture (often a foundational element that, when weak or poor, has been identified as a common root cause in both safety and quality breakdowns) across multiple years in a sample of >50 inpatient hospital units nested within a large academic health system in the northeastern US.

Employee engagement

Employee engagement, conceptualised as a positive, work-related mindset including feelings of vigour, dedication and absorption in one’s work,^{9 26} has demonstrated an association with a number of important worker outcomes in healthcare, including staff turnover, productivity and patient safety events.^{26–28} When engaged, clinicians, staff and administrators feel ‘physically involved, cognitively vigilant and emotionally connected’ to their work.^{26 29} Some theories define engagement as the direct opposite of burnout with the two constructs conceptualised as two ends of a single continuum. Engagement reflects relatively high reserves of emotional energy and capacity for mental resilience (high energy), a high degree of involvement in one’s work fed by a sense of significance, enthusiasm, inspiration, pride and challenge, and a sense that one’s efforts are meaningfully related to the feedback, evaluations and outcomes received in

the context of one's work. Conversely, burnout reflects a combination of emotional exhaustion (low energy), cynicism (low involvement) and inefficiency (low sense of efficacy and/or learned helplessness).^{30 31} Thus, engaged healthcare workers view both their 'daily process of care' work and their more general professional work as meaningful, and they likely feel responsibility and a realistic degree of autonomy. They also likely perceive strong ties between their efforts, the evaluations of their work and other outcomes.³²

Perceptions of patient safety culture

While conceptual clarity and theoretical grounding continues to emerge,^{33 34} patient safety culture has generally been defined as a group-level (eg, team, unit, department or organisation) construct reflecting patient safety-related norms, artefacts such as policies, procedures, communication and teamwork patterns, leadership and day-to-day behaviours. It has been proposed to influence a variety of patient safety outcomes, as well as staff satisfaction and performance.^{35–37} The related concept of patient safety climate reflects team members' perceptions or attitudes about the organisational safety culture in which they work. A great deal of peer-reviewed literature has examined interventions to build or improve patient safety climate,^{25 38} and climate has been found to moderate the effectiveness of other, technically oriented safety interventions, like checklists, training/education or procedural algorithms.³⁹ Although theories of safety culture and climate have been developed in both the general organisational and management sciences that have articulated numerous factors affecting development and sustainment of both organisational and work-area-level climates,^{40 41} employee motivation and engagement are (1) commonly unaccounted for in these theories and (2) not robustly tested as potential influences on climate or as moderators of the relationships between climate and other safety-related outcomes. Arguably, theories and studies of engagement suggest that engaged employees likely have a higher probability of also displaying safety-related attitudes and behaviours that define safety climate, given that the high degrees of self-efficacy, motivation and sense of being invested in by their organisation may provide the bandwidth and attention necessary to develop safety-related attitudes and demonstrate safety-related behaviours. The inter-relationships between these constructs have not been extensively explored, however. In hopes of offering initial insight into the potential relationships between these two constructs, we examined them in a series of secondary analyses. Specifically, we asked: to what extent are group-level measures of engagement associated with group-level perceptions of patient safety culture and does that association persist over time? We hypothesised that work-area-level engagement and

team member perceptions of safety culture in their work area would be positively related.

METHODS

Since 2006, the Johns Hopkins Hospital (JHH) has administered the Safety Attitudes Questionnaire (SAQ) every 18–24 months. The SAQ has been shown to be psychometrically sound and reliable in a variety of healthcare settings.⁴² Additionally, JHH has assessed employee engagement across both inpatient and outpatient units annually since 2009 using an instrument developed by the Gallup organisation, known as the Gallup Q¹².⁴³ The Q¹² was validated by the Gallup organisation using an iterative process that involved characterising a range of units from ones with high workplace turnover to, on the opposite end of the spectrum, ones with high-functioning, productive teams.^{27 43} Both surveys are distributed to all staff, using a mix of electronic and paper-based methods. All responses are anonymous. Results are reported to hospital, department and unit leadership in aggregate form. For the SAQ, all work areas with a survey response rate >60% receive a score on each of seven domains, as well as scores on individual survey items. All SAQ responses are scored on a five-point Likert scale from 'disagree strongly' to 'agree strongly', and scores are reported as the percentage of respondents in a given unit reporting that they 'agree slightly' or 'agree strongly' with a given statement. Thus, a unit's score for a given SAQ domain reflects the proportion of respondents in a given unit who rank their unit highly on the 3–7 items within that domain. Items for each domain are listed in online supplementary table A1. For the Q¹², each work area manager receives a report containing scores on each of the 12 items, as well as Grand Mean score across all items.

In this analysis, time-matched SAQ and employee engagement data were analysed from 58 inpatient units in 2009, 61 in 2011 and 59 units in 2013. Based on institutional safety interest and needs, the Safety Culture Assessment was revised in 2013 such that four of the original seven SAQ domains had available data over all three time periods. In all analyses, a *p* value of <0.05 was considered statistically significant. Analyses were performed using R statistical software V3.0.2.^{44 45}

RESULTS

In 2009, of the 2722 total eligible staff assigned to the units in this analysis, 90.9% (*n*=2473) completed the SAQ. For 2011 and 2013, response rates for the SAQ were 73.8% (*n*=2646) and 73.2% (*n*=3020), respectively. Respondents included nurses, physicians and support personnel. Median scores across all units for the included SAQ domains are summarised in [table 1](#) for all time periods.

For employee engagement in 2009, of the 3222 assigned staff on the included units, 63.3% completed

Original research

Table 1 Median SAQ scores (and IQR) by domain across included units and time periods by year

SAQ domain	2009 (n=58 units)	2011 (n=61 units)	2013 (n=59 units)	p Value
Teamwork climate	0.70 (0.18)	0.66 (0.22)	0.67 (0.16)	<0.01
Safety climate	0.70 (0.19)	0.65 (0.22)	0.70 (0.15)	0.16
Perceptions of hospital management	0.45 (0.23)	0.43 (0.28)	0.43 (0.18)	0.16
Perceptions of unit management	0.68 (0.19)	0.60 (0.18)	0.69 (0.13)	0.02

p Values are for the null hypothesis of no difference in mean domain scores across the three time periods.
SAQ, Safety Attitudes Questionnaire.

the Q¹² (n=2041). For 2011 and 2013, response rates for employee engagement were 64.2% (n=2024) and 68.3% (n=2382). The median engagement survey response rates by unit within the three time periods were 64.0%, 66.0% and 72.0%, respectively. For these time periods, the median unit-level Grand Mean engagement scores were 3.84 (IQR 0.34), 3.91 (IQR 0.39) and 3.84 (IQR 0.31). In order to account for potential non-linear associations and non-normal distribution of scores and to provide robustness to outliers, Spearman's rank correlation coefficients were chosen to examine the association between unit-level engagement and safety attitude scores. Spearman's correlations between each of the four SAQ domain scores and Grand Mean engagement scores are shown in [table 2](#).

We then explored the relationships between each of the 12 items that comprise the employee engagement Grand Mean score and the four SAQ domains (see [table 3](#) for safety and teamwork climate domains and online supplementary table A2 for complete data). Only correlations of 0.40 or higher, listed in bold in [table 3](#), were considered robust. The 0.40 criteria were chosen to reflect a moderate effect size based upon common effect size conventions.^{46 47} Results suggested consistent relationships between safety climate, which focuses on perceived norms related to communication, learning, and error management

Table 2 Spearman's correlations between SAQ domains and employee engagement grand mean by year

SAQ domain	Employee engagement		
	2009 (n=58 units)	2011 (n=61 units)	2013 (n=59 units)
Teamwork climate	0.54*	0.52*	0.43*
Safety climate	0.69*	0.57*	0.44*
Perceptions of hospital management	0.52*	0.55*	0.48*
Perceptions of unit management	0.59*	0.52*	0.51*

*p<0.001.

SAQ, Safety Attitudes Questionnaire.

Table 3 Spearman's correlations for individual Q¹² employee engagement items and SAQ domains

Employee engagement item and SAQ domain	Year		
	2009	2011	2013
1. I know what's expected of me at work.			
Teamwork climate	0.38*	0.37*	0.45*
Safety climate	0.55*	0.43*	0.31*
2. I have the materials and equipment I need to do my work right.			
Teamwork climate	0.49*	0.29*	0.36*
Safety climate	0.54*	0.25	0.38*
3. At work I have the opportunity to do what I do best every day.			
Teamwork climate	0.48*	0.38*	0.41*
Safety climate	0.6*	0.39*	0.39*
4. In the last seven days, I have received recognition or praise for doing good work.			
Teamwork climate	0.31*	0.35*	0.15
Safety climate	0.51*	0.44*	0.26*
5. My supervisor, or someone at work, seems to care about me as a person.			
Teamwork climate	0.5*	0.35*	0.31*
Safety climate	0.66*	0.54*	0.45*
6. There is someone at work who encourages my development.			
Teamwork climate	0.55*	0.56*	0.41*
Safety climate	0.66*	0.57*	0.42*
7. At work, my opinion seems to count.			
Teamwork climate	0.53*	0.48*	0.46*
Safety climate	0.55*	0.53*	0.37*
8. The mission or purpose of my company makes me feel my job is important.			
Teamwork climate	0.47*	0.45*	0.3*
Safety climate	0.58*	0.47*	0.2
9. My associates or fellow employees are committed to doing quality work.			
Teamwork Climate	0.44*	0.5*	0.36*
Safety Climate	0.52*	0.45*	0.34*
10. I have a best friend at work.			
Teamwork climate	0.05	0.23	0.17
Safety climate	0.13	0.2	0.43*
11. In the last six months, someone at work has talked to me about progress.			
Teamwork climate	0.38*	0.38*	0.25
Safety climate	0.39*	0.41*	0.42*
12. In the last year, I have had opportunities at work to learn and grow.			
Teamwork climate	0.47*	0.52*	0.39*
Safety climate	0.51*	0.54*	0.34*

*p<0.05, correlations >0.4 are listed in bold.

SAQ, Safety Attitudes Questionnaire.

and engagement items reflecting (1) clarity of goals and expectations, (2) opportunities for employee development and constructive feedback and (3) supervisory support. Teamwork climate, which focuses on team relationships and resolution of conflict, was also consistently associated with perceptions of voice (ie, that one's opinions and input is meaningfully counted).

DISCUSSION

Our results suggest moderate to strong positive correlations ($r=0.43-0.69$) between employee engagement and unit-level indices of safety attitudes. All four safety attitude domains demonstrated similar, moderate to positive correlations with engagement across three time points, suggesting a relatively consistent relationship between the two measures. Importantly, this relationship remained relatively stable despite increases over time in the number of eligible respondents. Although changes in unit structure over time (eg, moves and reconfigurations occurring largely in 2012) prevented us from conducting true longitudinal analysis, the results suggest a potentially meaningful association between employee engagement and healthcare worker perceptions of safety culture that may warrant more robust future investigation. Clearly numerous factors may mediate, moderate or otherwise help to characterise and explain this simple observed association. Future research can provide valuable insight in these areas.

Others have evaluated the association between either safety culture or engagement on a variety of outcomes important to healthcare delivery and patient safety, and many methods proposed to improve scores on one or the other instrument.^{25 48-51} In practice, many hospitals across diverse international settings have chosen to invest significant resources in measuring healthcare worker perceptions of patient safety culture and/or engagement on a regular basis in an effort to improve organisational culture, staff satisfaction, commitment and patient safety. For example, the UK's National Health Service (NHS) has invested in measuring employee engagement across its nearly 1.3 million staff since 2009.⁵² The NHS has also supported evaluations of patient safety culture metrics and periodic efforts to measure perceptions of culture across multiple trusts since 2006.^{53 54} Additionally, accreditation standards, including those of the Joint Commission and Joint Commission International, call for regular assessment of safety culture.⁵⁵ In the USA alone, >650 hospitals voluntarily contributed patient safety culture survey data to a national database maintained by the Agency for Healthcare Research and Quality in 2014.⁵⁶ Despite widespread implementation of these metrics, the relationship between safety culture and employee engagement had remained relatively unclear.⁵⁷⁻⁵⁹ Also unclear has been the degree to which the two tools reflect attitudes or behaviours similar enough to warrant focusing time and effort on use and improvement of a single tool, or, alternatively, whether interventions may be developed to impact both arenas more efficiently. Additionally, our results suggest value in understanding the reciprocal impact of different interventions designed to improve engagement, reduce burnout or improve perceptions of patient safety culture.

LIMITATIONS AND FUTURE DIRECTIONS

Although this analysis of routinely collected organisational data does not support inferences regarding causality, it does advance understanding of the directionality and degree of association between healthcare worker perceptions of safety culture and engagement at work. Independent collection of these two assessments did limit our analysis in that minimally different inclusion criteria, turnover and unit staffing allocation methods resulted in differences in the total number of respondents surveyed by the two instruments. Additionally, although all engagement data were collected via online survey for the units included in this study, 39% of hospital units collected SAQ data in 2009-2010 via paper, while only 14% used only paper in 2013, which may have introduced non-response bias. We were not able to control for survey modality, but we note that even though overall response rates decreased across the time period of our study, actual survey scores did not demonstrate a uniform pattern of change corresponding to the decreased use of paper-based methodology. Arguably, moreover, conducting the surveys independently helped to mitigate some forms of mono-method bias. Our findings must also be considered in the context of multiple comparisons. Adjusting for multiple comparisons (eg, using a Bonferroni-style correction method) can reduce type I error (ie, the error of rejecting the null hypothesis when it is true) but it will be at the cost of inflating type II error (ie, incorrectly accepting the null hypothesis to be true when instead the alternative hypothesis is correct). Given the exploratory nature of this work, we opted to not apply such a correction when interpreting statistical significance, though we recognise its importance. In light of this fact, although results with a p value of <0.05 are considered significant and worth mentioning, we note that all of our findings related to engagement Grand Mean scores (table 2) demonstrated p values at or below 0.001, and, on the item, level we focused on findings with associations of 0.40 and above (table 3). Finally, our findings may also be limited by the fact that we were unable to control for staffing levels and severity of illness in the study units, given the retrospective nature of the work. Our findings do, however, suggest an area in which healthcare quality improvement efforts might be streamlined.

CONCLUSIONS

Overall, our results suggest an association between unit-level perceptions of safety culture and employee engagement over time in a large urban academic medical centre. Future research is needed in order to more fully understand temporal patterns and causal pathways between engagement and the broader construct of patient safety culture; however, our results support conceptual arguments that patient safety and working environments that motivate and engage

employees are meaningfully associated. Practically, these findings support the development of approaches to improving patient safety that pair human resource, development and leadership interventions with traditional safety and quality improvement approaches.

Author affiliations

¹Department of Medicine, Johns Hopkins School of Medicine, Baltimore, Maryland, USA

²Johns Hopkins University School of Medicine, Baltimore, Maryland, USA

³Department of Biostatistics, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland, USA

⁴Department of Anesthesiology and Critical Care Medicine, Johns Hopkins School of Medicine, Baltimore, Maryland, USA

Twitter Follow Sallie Weaver at @SallieJWeaver

Acknowledgements We would like to acknowledge the important contributions of the members of the Johns Hopkins Provider Behavior Group including Paula Kent, Myles Leslie, MarieSarah Pillari, Melinda Sawyer, Carol Woodward, and Jiangxia Wang. We would also like to thank Drs Cynthia Rand and Michelle Eakin for their helpful feedback in the development of this work.

Contributors ELDB and SJW contributed to study design, analysis and manuscript writing. LP contributed to the study design and manuscript editing. PM contributed to analysis and manuscript writing. CH contributed to study design and manuscript editing.

Funding This study was supported by a grant from the NIH NHLBI (K23HL098452 to the Johns Hopkins University) and a grant from the Johns Hopkins Institute for Clinical and Translational Research (ICTR), which is funded in part by Grant Number 1KL2TR001077-01 from the National Center for Advancing Translational Sciences (NCATS), a component of the National Institutes of Health (NIH), and NIH Roadmap for Medical Research. Its contents are solely the responsibility of the authors and do not necessarily reflect the official views of Johns Hopkins ICTR, NCATS or NIH.

Competing interests None declared.

Ethics approval Johns Hopkins IRB-X.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

- Lucian Leape Institute. Through the Eyes of the Workforce: Creating Joy, Meaning, and Safer Health Care. 2013. National patient safety foundation. http://www.patientcarelink.org/uploadDocs/1/Through-Eyes-of-the-Workforce_online.pdf (accessed 15 Dec 2014).
- McManus IC, Winder BC, Gordon D. The causal links between stress and burnout in a longitudinal study of UK doctors. *Lancet* 2002;359:2089–90.
- Embriaco N, Papazian L, Kentish-Barnes N, *et al*. Burnout syndrome among critical care healthcare workers. *Curr Opin Crit Care* 2007;13:482–8.
- Kluger MT, Townend K, Laidlaw T. Job satisfaction, stress and burnout in Australian specialist anaesthetists. *Anaesthesia* 2003;58:339–45.
- Soler JK, Yaman H, Esteva M, *et al*. Burnout in European family doctors: the EGPRN study. *Fam Pract* 2008;25:245–65.
- Sutcliffe KM, Vogus TJ. *Organizing for resilience*. San Francisco: Berrett-Koehler, 2003.
- Edmondson AC, Zhike L. Psychological safety: the history, renaissance, and future of an interpersonal construct. *Annu Rev Organ Psychol Organ Behav* 2014;1:23–43.
- Nahrgang JD, Morgeson FP, Hofmann DA. Safety at work: a meta-analytic investigation of the link between job demands, job resources, burnout, engagement, and safety outcomes. *J Appl Psychol* 2011;96:71–94.
- Bakker AB, Schaufeli WB, Leiter MP, *et al*. Work engagement: an emerging concept in occupational health psychology. *Work Stress* 2008;22:187–200.
- Lawler III, Edward E. *High-involvement management. Participative strategies for improving organizational performance*. San Francisco, CA: Jossey-Bass Inc., Publishers, 1986.
- Podsakoff NP, Podsakoff PM, MacKenzie SB, *et al*. Consequences of unit-level organizational citizenship behaviors: A review and recommendations for future research. *J Organ Behav* 2014;35(Suppl 1):S87–119.
- Cimiotti JP, Aiken LH, Sloane DM, *et al*. Nurse staffing, burnout, and health care-associated infection. *Am J Infect Control* 2012;40:486–90.
- Halbesleben JR. Linking physician burnout and patient outcomes: exploring the dyadic relationship between physicians and patients. *Health Care Manage Rev* 2008;33:29–39.
- Leape L, Berwick D, Clancy C, *et al*. Transforming healthcare: a safety imperative. *Qual Saf Health Care* 2009;18:424–8.
- Turner N, Barling J, Zacharatos A. Positive psychology at work. In: Snyder CR, Lopez SJ, eds. *Handbook of positive psychology*. New York: Oxford University Press, 2002: 715–28.
- Luthans F, Avolio BJ, Avey JB, *et al*. Positive psychological capital: measurement and relationship with performance and satisfaction. *Personnel Psychol* 2007;60:541–72.
- Warr PB. Jobs and job-holders: two sources of happiness and unhappiness. In: David SA, Boniwell I, Ayers AC, eds. *The Oxford handbook of happiness*. Oxford: Oxford University Press, 2013:733–50.
- Truss C, Delbridge R, Alfes K, Shantz A, Soane E, eds. *Employee engagement in theory and in practice*. New York, NY: Routledge.
- Christian MS, Carza AS, Slaughter JE. Work engagement: a quantitative review and test of its relations with task and contextual performance. *Personnel Psychology* 2011;64:89–136.
- West MA, Dawson JF. Employee engagement and NHS performance. The King's Fund. 2012. https://northwest.ewin.nhs.uk/storage/northwest/knowledge/e806_employee-engagement-nhs-performance-west-dawson-leadership-review2012-paper.pdf (accessed 16 Feb 2015).
- Rivard PE, Katz-Navon T. Employee engagement, organizational culture, and healthcare outcomes. Academy of Management Proceedings, January 2014 (Meeting Abstract Supplement) 16985. 10.5465/AMBPP.2014.16985abstract. <http://proceedings.aom.org/content/2014/1/16985?related-urls=yes&legid=amproc;2014/1/16985> (accessed 16 Feb 2015).
- Weick K, Sutcliffe K. *Managing the unexpected: resilient performance in an age of uncertainty*. San Francisco, CA: Jossey Bass, 2007.
- Vogus TJ, Sutcliffe KM. Organizational resilience: towards a theory and research agenda. *IEEE Int Conf Syst Man Cybern* 2007;1–8:3476–80.
- Pronovost PJ, Goeschel CA, Marsteller JA, *et al*. Framework for patient safety research and improvement. *Circulation* 2009;119:330–7.

- 25 Weaver SJ, Lubomksi LH, Wilson RE, *et al.* Promoting a culture of safety as a patient safety strategy: a systematic review. *Ann Intern Med* 2013;158(5 Pt 2):369–74.
- 26 Harter JK, Schmidt FL, Hayes TL. Business-unit-level relationship between employee satisfaction, employee engagement, and business outcomes: a meta-analysis. *J Appl Psychol* 2002;87:268–79.
- 27 Harter JK, Schmidt FL, Agrawal S, *et al.* The relationship between engagement at work & organizational outcomes. 2013. <http://employeeengagement.com/wp-content/uploads/2013/04/2012-Q12-Meta-Analysis-Research-Paper.pdf> (accessed 15 Dec 2014).
- 28 Harter JK, Schmidt FL, Asplund JW, *et al.* Causal impact of employee work perceptions on the bottom line of organizations. *Perspect Psychol Sci* 2010;5:378–89.
- 29 Khan WA. Psychological conditions of personal engagement and disengagement at work. *Acad Manage J* 1990;33:692–724.
- 30 Maslach C, Leiter MP. *The truth about burnout*. San Francisco: Jossey Bass, 1997.
- 31 Maslach C, Schaufeli WB, Leiter MP. Job Burnout. *Annu Rev Psychol* 2001;52:397–422.
- 32 Pritchard R, Ashwood E. *Managing motivation: a manager's guide to diagnosing and improving motivation*. New York, NY: Routledge, Taylor & Francis Group, 2008.
- 33 Waterson P. Patient safety culture-Setting the scene. In: Waterson P, ed. *Patient safety culture: theory, methods, and application*. Surrey, England: Ashgate, 2014:15–138.
- 34 Zohar D1, Livne Y, Tenne-Gazit O, *et al.* Healthcare climate: a framework for measuring and improving patient safety. *Crit Care Med* 2007;35:1312–17.
- 35 Abdollahian D, Nagy P. Quality and safety as the spark for employee engagement. *J Am Coll Radiol* 2014;11:209–11.
- 36 Pronovost P, Needham D, Berenholtz S, *et al.* An intervention to decrease catheter-related bloodstream infections in the ICU. *N Engl J Med* 2006;355:2725–32.
- 37 Berenholtz SM, Pham JC, Thompson DA, *et al.* Collaborative cohort study of an intervention to reduce ventilator-associated pneumonia in the intensive care unit. *Infect Control Hosp Epidemiol* 2011;32:305–14.
- 38 Etchegaray J, Thomas E. Safety attitudes questionnaire: recent findings and future areas of research. In: Waterson P, ed. *Patient safety culture: theory, methods, and application*. Surrey, UK: Ashgate, 2014:285–99.
- 39 Haynes AB, Weiser TG, Berry WR, *et al.* Changes in safety attitude and relationship to decreased postoperative morbidity and mortality following implementation of a checklist-based surgical safety intervention. *BMJ Qual Saf* 2011;20:102–7.
- 40 Zohar D, Luria G. The use of supervisory practices as leverage to improve safety behavior: a cross-level intervention model. *J Safety Res* 2003;34:567–77.
- 41 Zohar D. *Safety climate: conceptual and measurement issues*. Washington DC: American Psychological Association, 2003.
- 42 Sexton JB, Helmreich RL, Neilands TB, *et al.* The Safety Attitudes Questionnaire: psychometric properties, benchmarking data, and emerging research. *BMC Health Serv Res* 2006;6:44.
- 43 Gallup. Gallup's Q12 survey features, 2013.
- 44 R Core Team. R: A language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing, 2013.
- 45 Bates D, Maechler M, Bolker B, *et al.* lme4: Linear mixed-effects models using Eigen and S4. R package version 1.0–5, 2013.
- 46 Cohen J. *Statistical power analysis for the behavioral sciences*. 2 edn. Hillsdale, NJ: Lawrence, 1988.
- 47 Hinkle DE, Wiersma W, Jurs SG. *Applied statistics for the behavioral sciences*. Chicago, IL: Rand McNally College Publishing, 1979.
- 48 Burger J, Sutton L. How employee engagement can improve a hospital's health. *GALLUP Bus J* 2014. <http://www.gallup.com/businessjournal/168149/employee-engagement-improve-hospital-health.aspx?version=print> (accessed 28 May 2015).
- 49 Halm B. Employee engagement: a prescription for organizational transformation. *Adv Health Care Manag* 2011;10:77–96.
- 50 Sexton JB, Berenholtz SM, Goeschel CA, *et al.* Assessing and improving safety climate in a large cohort of intensive care units. *Crit Care Med* 2011;39:934–9.
- 51 Singer SJ, Vogus TJ. Reducing hospital errors: interventions that build safety culture. *Annu Rev Public Health* 2013;34:373–96.
- 52 Dromey J. Meeting the Challenge Successful Employee Engagement in the NHS. The IPA, 2014 April. London, UK. <http://www.nhsemployers.org/~media/Employers/Documents/Retain%20and%20improve/Meeting%20the%20Challenge%20-%20Employee%20Engagement%20in%20the%20NHS%20-%20WEB%20%281%29.pdf>measure (accessed 30 Apr 2015).
- 53 The Health Foundation. *Measuring safety culture: a research scan*. London: UK, 2011. <http://www.health.org.uk/public/cms/75/76/313/2600/measuring%20safety%20culture.pdf?realName=p6V3x0.pdf> (accessed 20 Apr 2015).
- 54 Hutchinson A, Cooper KL, Dean JE, *et al.* Use of a safety climate questionnaire in UK health care: factor structure, reliability and usability. *Qual Saf Health Care* 2006;15:347–53.
- 55 Facts About the Joint Commission. July 16, 2014 (accessed 29 Apr 2015) http://www.jointcommission.org/facts_about_the_joint_commission/default.aspx
- 56 Sorra J, Famolaro T, Yount ND, *et al.* Hospital Survey on Patient Safety Culture 2014 User Comparative Database Report. (Prepared by Westat, Rockville, MD, under Contract No. HHSA 290201300003C). Rockville, MD: Agency for Healthcare Research and Quality, AHRQ Publication No. 14-0019-EF, March 2014.
- 57 Paine LA, Rosenstein BJ, Sexton JB, *et al.* Assessing and improving safety culture throughout an academic medical centre: a prospective cohort study. *Qual Saf Health Care* 2010;19:547–54.
- 58 Fogarty GJ, Shaw A. Safety climate and the theory of planned behavior: towards the prediction of unsafe behavior. *Accid Anal Prev* 2010;42:1455–9.
- 59 Thorp J, Baqai W, Witters D, *et al.* Workplace engagement and workers' compensation claims as predictors for patient safety culture. *J Patient Saf* 2012;8:194–201.

Associations between safety culture and employee engagement over time: a retrospective analysis

Elizabeth Lee Daugherty Biddison, Lori Paine, Peter Murakami, Carrie Herzke and Sallie J Weaver

BMJ Qual Saf published online June 3, 2015

Updated information and services can be found at:

<http://qualitysafety.bmj.com/content/early/2015/06/03/bmjqs-2014-003910>

These include:

**Supplementary
Material**

Supplementary material can be found at:

<http://qualitysafety.bmj.com/content/suppl/2015/06/03/bmjqs-2014-003910.DC1.html>

References

This article cites 34 articles, 8 of which you can access for free at:

<http://qualitysafety.bmj.com/content/early/2015/06/03/bmjqs-2014-003910#BIBL>

**Email alerting
service**

Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Notes

To request permissions go to:

<http://group.bmj.com/group/rights-licensing/permissions>

To order reprints go to:

<http://journals.bmj.com/cgi/reprintform>

To subscribe to BMJ go to:

<http://group.bmj.com/subscribe/>