Creating a Culture of Innovation in Healthcare Settings: A Systematic Review

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PREFACE

The VA Evidence Synthesis Program (ESP) was established in 2007 to provide timely and accurate syntheses of targeted healthcare topics of importance to clinicians, managers, and policymakers as they work to improve the health and healthcare of Veterans. These reports help:

- Develop clinical policies informed by evidence;
- Implement effective services to improve patient outcomes and to support VA clinical practice guidelines and performance measures; and
- Set the direction for future research to address gaps in clinical knowledge.

The program comprises 3 ESP Centers across the US and a Coordinating Center located in Portland, Oregon. Center Directors are VA clinicians and recognized leaders in the field of evidence synthesis with close ties to the AHRQ Evidence-based Practice Center Program and Cochrane Collaboration. The Coordinating Center was created to manage program operations, ensure methodological consistency and quality of products, and interface with stakeholders. To ensure responsiveness to the needs of decision-makers, the program is governed by a Steering Committee composed of health system leadership and researchers. The program solicits nominations for review topics several times a year via the program website.

Comments on this evidence report are welcome and can be sent to Nicole Floyd, Deputy Director, ESP Coordinating Center at Nicole.Floyd@va.gov.

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This report is based on research conducted by the Evidence Synthesis Program (ESP) Center located at the **West Los Angeles VA Medical Center, Los Angeles, CA**, funded by the Department of Veterans Affairs, Veterans Health Administration, Health Services Research and Development. The findings and conclusions in this document are those of the author(s) who are responsible for its contents; the findings and conclusions do not necessarily represent the views of the Department of Veterans Affairs or the United States government. Therefore, no statement in this article should be construed as an official position of the Department of Veterans Affairs. No investigators have any affiliations or financial involvement (*eg*, employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties) that conflict with material presented in the report.

ACKNOWLEDGMENTS

This topic was developed in response to a nomination by Allison Amrhein, MPH, director of operations for VHA Innovators Network, and Brynn Cole, director of programming for VHA Innovators Network for the purpose of understanding how to create a culture of innovation in healthcare settings. The scope was further developed with input from the topic nominators (*ie*, Operational Partners), the ESP Coordinating Center, the review team, and the technical expert panel (TEP).

In designing the study questions and methodology at the outset of this report, the ESP consulted several technical and content experts. Broad expertise and perspectives were sought. Divergent and conflicting opinions are common and perceived as healthy scientific discourse that results in a thoughtful, relevant systematic review. Therefore, in the end, study questions, design, methodologic approaches, and/or conclusions do not necessarily represent the views of individual technical and content experts.

The authors gratefully acknowledge the following individuals for their contributions to this project:

Operational Partners

Operational partners are system-level stakeholders who have requested the report to inform decision-making. They recommend Technical Expert Panel (TEP) participants; assure VA relevance; help develop and approve final project scope and timeframe for completion; provide feedback on draft report; and provide consultation on strategies for dissemination of the report to field and relevant groups.

Allison Amrhein, MPH
Director of Operations, VHA Innovators Network (iNET)
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Brynn Cole
Director of Programming, VHA Innovators Network (iNET)

Technical Expert Panel (TEP)

To ensure robust, scientifically relevant work, the TEP guides topic refinement; provides input on key questions and eligibility criteria, advises on substantive issues or possibly overlooked areas of research; assures VA relevance; and provides feedback on work in progress. TEP members are listed below:

Anaïs Tuepker, PhD, MPH
Qualitative Core Director, Center to Improve Veteran Involvement in Care (CIVIC) – VA Portland Health Care System
Assistant Professor (Research), Division of General Internal Medicine & Geriatrics – Oregon Health & Science University

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Sara Singer, PhD, MBA
Professor of Medicine, School of Medicine, and Professor of Organizational Behavior (by courtesy), Graduate School of Business and Freeman Spogli Institute for International Studies – Stanford University

Peer Reviewers

The Coordinating Center sought input from external peer reviewers to review the draft report and provide feedback on the objectives, scope, methods used, perception of bias, and omitted evidence. Peer reviewers must disclose any relevant financial or non-financial conflicts of interest. Because of their unique clinical or content expertise, individuals with potential conflicts may be retained. The Coordinating Center and the ESP Center work to balance, manage, or mitigate any potential nonfinancial conflicts of interest identified.

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INTRODUCTION

Organizational culture plays a critical role in shaping healthcare delivery environments and service quality. Organizational culture may be defined as shared basic assumptions, values, and beliefs that characterize a setting and influence practices, routines, and priorities.[1, 2] There are multiple facets of organizational culture (*eg*, safety culture, innovation culture), and scholarship has increasingly acknowledged the value of focusing on specific types.[3, 4] Cultures that value and support innovation can foster innovative behaviors, which in turn are associated with positive staff and patient outcomes.[1, 5] One such culture is a culture of innovation.

Prior efforts have sought to synthesize existing models and describe characteristics of organizational culture that supports innovation.[6] However, additional work focusing on the practical application of these concepts and relationships in real-world settings is needed. For example, more research is needed to identify programs and interventions that foster a culture of innovation, and to determine how culture of innovation can be evaluated and measured.

This report seeks to extend beyond that by examining 3 key questions:

KQ1: How is culture of innovation defined in literature related to healthcare settings?

KQ2: What metrics are used to capture culture of innovation in healthcare settings?

KQ3: What are key characteristics and outcomes of programs designed to improve or establish a culture of innovation in healthcare settings?

METHODS

TOPIC DEVELOPMENT

This topic was developed in response to a nomination by Allison Amrhein, MPH, Director of Operations at VHA Innovators Network and Brynn Cole, BA, Director of Programming at VHA Innovators Network. Key questions were then developed with input from the topic nominator, the ESP Coordinating Center, the review team, and the technical expert panel (TEP). The Key Questions were:

KQ1: How is culture of innovation defined in literature related to healthcare settings?

KQ2: What metrics are used to capture culture of innovation in healthcare settings?

KQ3: What are key characteristics and outcomes of programs designed to improve or establish a culture of innovation in healthcare settings?

SEARCH STRATEGY

We conducted broad searches using terms relating to "culture of innovation" or "culture of creativity". We searched Web of Science, Ovid Medline, and PsycINFO from inception to 9/18/2020. See Appendix A for complete search strategy.

We also searched the gray literature on 04/03/20, starting with terms like "building a culture of innovation" in a Google search and then also using the Google-generated search terms "7 ways to create a culture of innovation", "creating an innovation culture McKinsey", "how to drive innovation culture", "culture innovation examples", "how to foster innovation culture", "organizational culture and innovation", "culture strategy innovation", and "how to measure innovation culture." From these searches, we reviewed the first 50 hits for studies that would meet eligibility criteria.

STUDY SELECTION

Three team members working independently screened the titles of retrieved citations. For titles deemed relevant by at least 1 person, abstracts were then screened independently in duplicate by 2 team members. All disagreements were reconciled through group discussion. Full-text review was conducted in duplicate by 2 team members, with any disagreements resolved through discussion. Because we were looking for literature that had real-world applications of culture of innovation measurement or intervention, publications were required to (1) use some specified measure or metric for culture of innovation and/or (2) describe an intervention or program to improve or establish a culture of innovation to be included. See Appendix C for screening criteria.

DATA ABSTRACTION

Data extraction was completed in duplicate. All discrepancies were resolved with full group discussion. We abstracted data on the following: setting, sample size, response rate, country, study design, data analysis approach, culture of innovation metric(s), other metric(s), culture of

innovation terms, culture of innovation definitions, and findings from abstract. See Appendix C for data abstraction form.

QUALITY ASSESSMENT

Typically, quality assessments are used to describe the risk of bias for outcomes from the evaluation of an intervention. As the majority of our studies did not include interventions, this would not help describe the body of literature we identified overall, nor would it help readers interpret key questions 1 or 2. We were not able to identify an existing assessment or determine a set of criteria that would be suitable to assess quality for studies defining culture of innovation or using a metric, as is the focus of these 2 questions. While there are quality assessment criteria for the development of a metric,[7] which are used for a primary study developing an instrument, not all our included studies described this process, so these criteria would be inappropriate for studies describing fielding of an existing instrument.

We do describe key characteristics of the included studies, most notably including description of the sample size and response rate, which is key information the audience would need to be able to assess credibility of the included studies.

For the subset of intervention studies, we describe the major risks of bias and their considerable impact on the interpretation of the studies narratively.

DATA SYNTHESIS

Our review is a narrative analysis. We synthesized descriptions of culture of innovation definitions, metrics, and programs from included publications.

PEER REVIEW

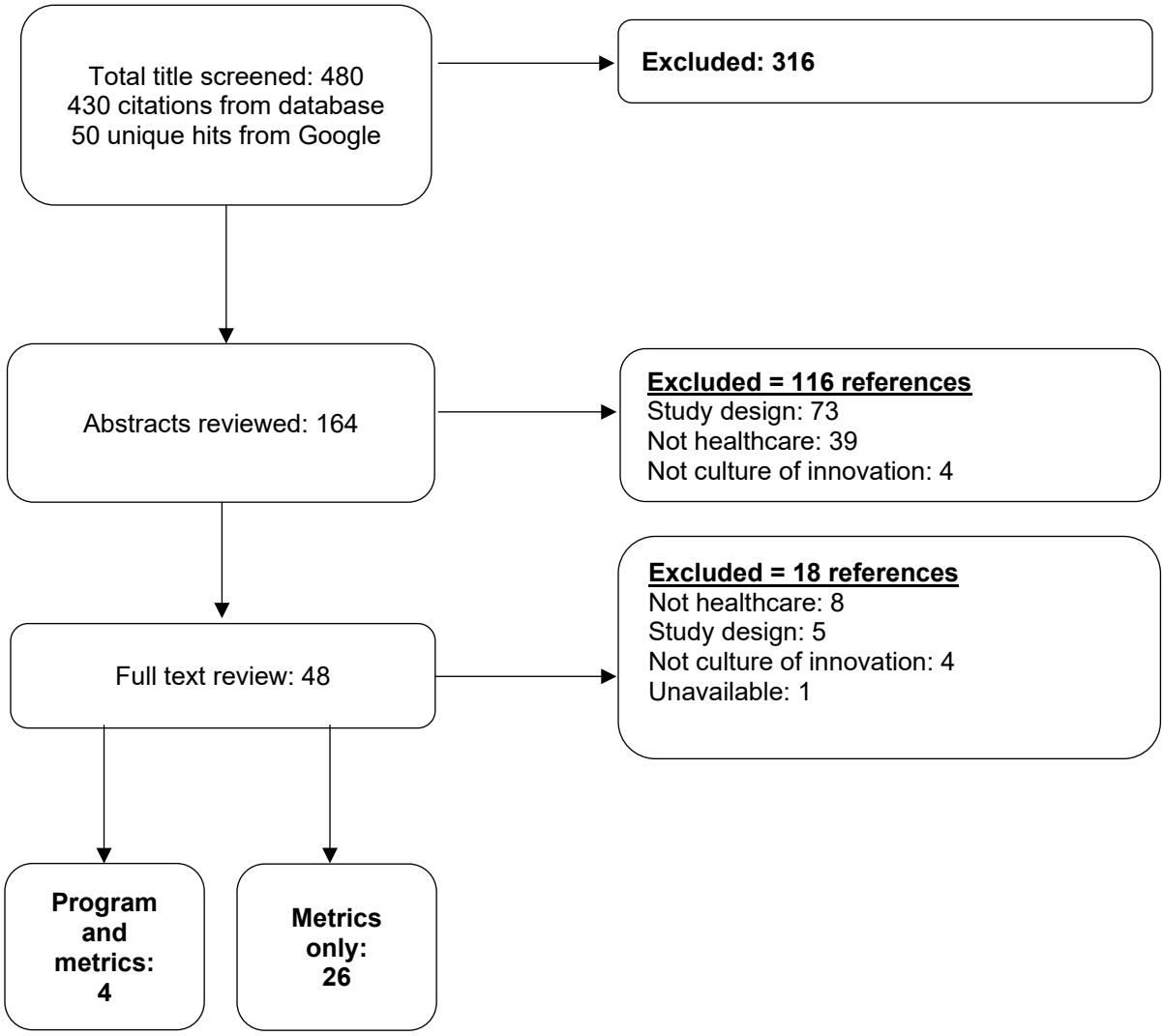
A draft version of the report was reviewed by technical experts and clinical leadership. Reviewer comments and our response are documented in Appendix B.

RESULTS

LITERATURE FLOW

We identified 480 potentially relevant citations, of which 164 were included at the abstract screening level. From these, a total of 116 abstracts were excluded: study design (n=73), not healthcare (n=39), and not culture of innovation (n=4). This left 48 publications for full-text review, of which 18 were excluded for the following reasons: not healthcare (n=8), study design (n=5), not culture of innovation (n=4), and unavailable (n=1). A full list of excluded studies from the full-text review is included in Appendix G. A total of 30 publications were identified at full-text review as meeting initial inclusion criteria: 4 publications with intervention/program and metric(s), and 26 publications with metric(s) only. See Figure 1 for literature flow. Descriptions of included publications are available in the Evidence Table (Appendix F).

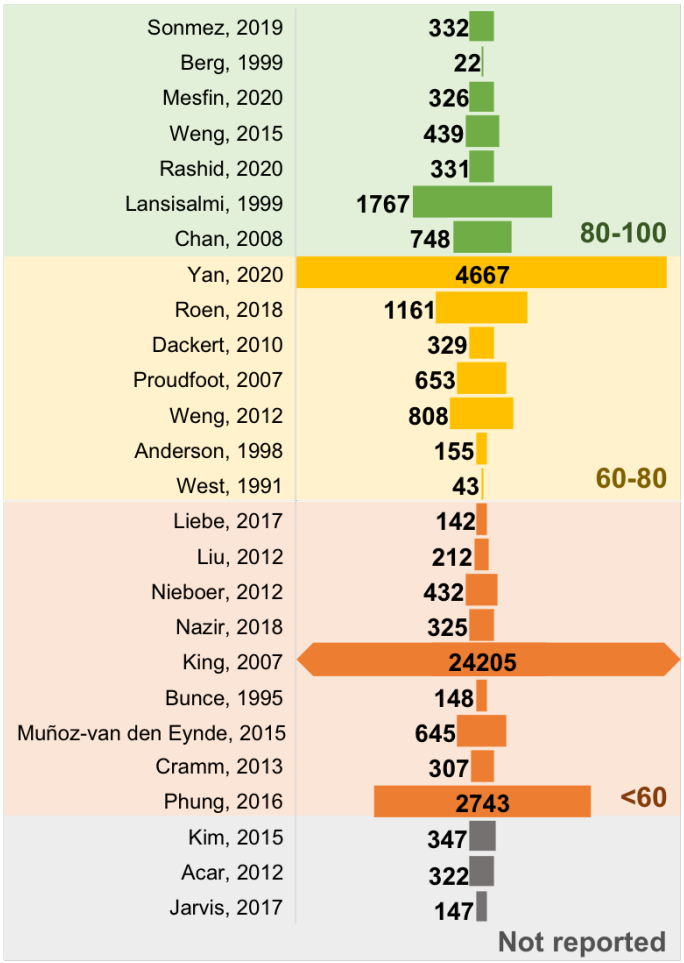
Figure 1. Literature Flow Chart



DESCRIPTION OF THE EVIDENCE

We identified 30 publications that met the inclusion criteria. None were randomized controlled trials. One meta-analysis was included.[3] The majority of studies employed the cross-sectional design; 2 studies imposed a pre-post study design[8, 9] and 2 studies used a repeated measures design.[10, 11] One of the included studies was a meta-analysis of 43 studies presenting data for 6341 organizations. In terms of analysis approach, 3 studies provided descriptive statistics only, 20 studies presented descriptive statistics and some sort of quantitative analysis (*ie,* structural equation modeling, hierarchical linear modeling, linear regression, *etc*). Four studies included programs or interventions about a culture of innovation.[8, 11-13] See Appendix F Evidence Tables with more detailed descriptions of individual studies.

Figure 2. Studies with Individual Respondent Sample Size Categorized by Response Rate



Included studies originated from 15 different countries: the United Kingdom (n=7), United States (n=3), Taiwan (n=3), Turkey (n=3), China (n=2), Sweden (n=2), the Netherlands (n=2), and 1 study each from Australia, Ethiopia, Finland, Germany, Norway, Pakistan, South Korea, and Spain. Twenty-six studies were multi-site and 4 were single site. Sample size ranged from 22 to 24,205 for individuals, from a range of 11 to 175 teams or groups. Excluding studies with no individual response rates[14-16] and the meta-analysis,[3] 7 studies reported response rate of 80% of

higher, 7 studies reported response rate of 60-80%, 9 studies reported under 60% response rate, and 3 studies did not report response rate (Figure 2).[17]

KEY QUESTION 1 – HOW IS CULTURE OF INNOVATION DEFINED IN LITERATURE RELATED TO HEALTHCARE SETTINGS?

When reviewing the included studies, there were several ways that terminology and definition captured the concept of "culture of innovation." The variations on the terminology and key words used to describe this concept were 1 source of variety. In addition, some studies provided explicit definitions or explanations of culture of innovation. Finally, nearly all the publications provided citations related to the concept of culture of innovation. For details on each of the studies and the terms, definitions, and citations they used, please see Appendix D.

Four studies used the term "innovative behavior" as the phrase related to culture of innovation.[12, 16, 18, 19] The next most common term was "innovative culture", which was used by 3 studies.[8, 20, 21] Four terms were used by 2 studies: "the adhocracy culture",[22, 23] "innovative organizational culture",[19, 24] "culture for innovation",[15, 16] and "support for innovation".[10, 25] There were 18 additional terms used by the included studies, many of which used variants of the same key words.

Because many terms were variants on the same language, we also looked for patterns in the key words used. Variants of the word "innovation," which itself had 14 uses, were used 29 times. The word "culture" was used 12 times, whereas "climate" was used 8 times. Words invoking the collective nature of the concept were also common: "organizational" (n=6), "team"/"teams" (n=3), and "workgroup"/"groups" (n=2). The word "behavior" appeared 5 times. Variations on "support" were used by 4 studies. Some additional terms were used only once, or, in the case of "adhocracy", twice. The word cloud below includes all variants of terms used, with their size proportional to the number of uses (Figure 3).

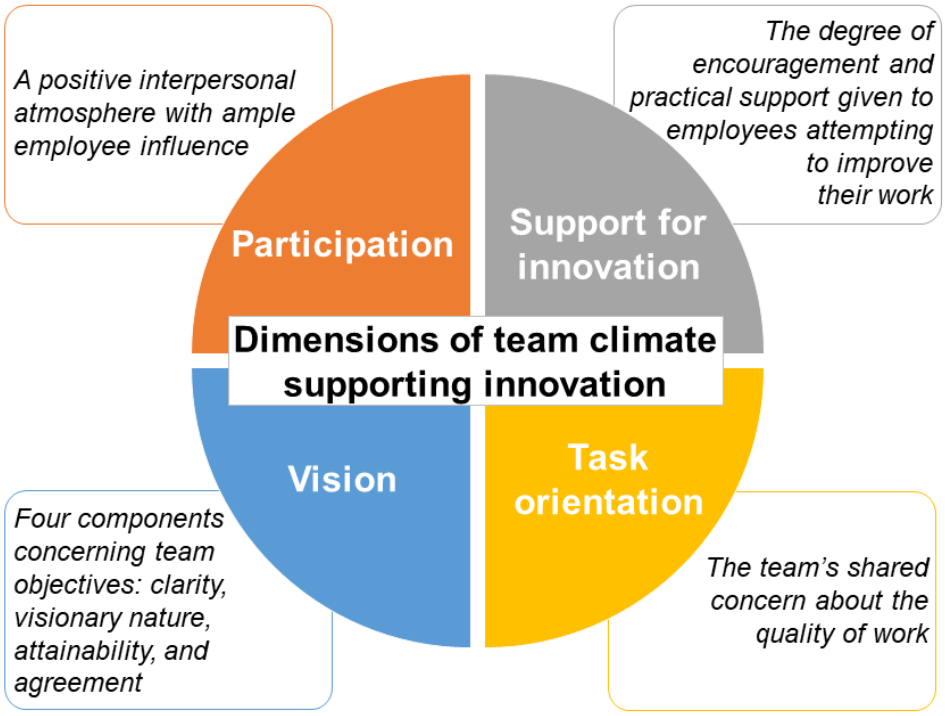
Figure 3. Words Used in Key "Culture of Innovation" Terms

While publications varied on whether or not they described key domains or explicit definitions related to their "culture of innovation" terms, all the included publications provided relevant

citations. The narrative descriptions of the terms, including definitions, domains or other narrative context for the use of the term, are provided in Appendix D. There were 171 unique citation provided among the included studies, with 20 citations cited more than once. While many were used only once and may only apply to specific clinical professions or settings, the works of Anderson and West,[26] Scott and Bruce,[27] and Caldwell and O'Reilly[28] appeared numerous times and stood out as noteworthy exceptions in their more consistent use.

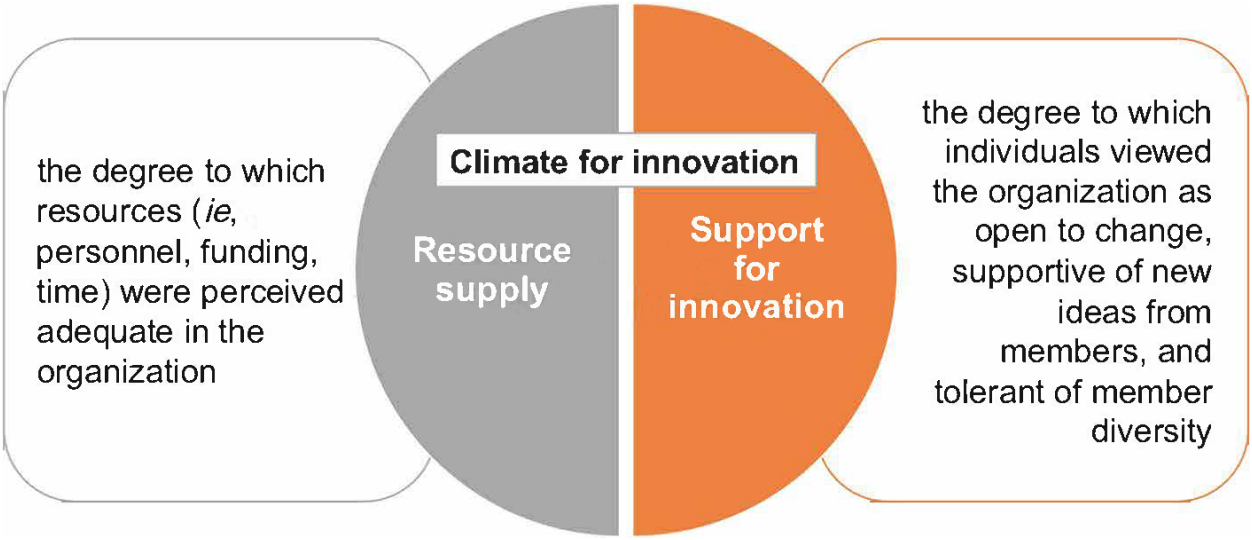
While the specific citations may have varied somewhat, nearly all studies related to Anderson and West referred to the "Support for Innovation" domain of the Team Climate Inventory metric, described in more detail under Key Question 2, below.[26] The 4 dimensions—support for innovation, vision, task orientation, participation—and their definitions are detailed in Figure 4.

Figure 4. Dimensions of Support for Innovation, Defined by Anderson and West[26]



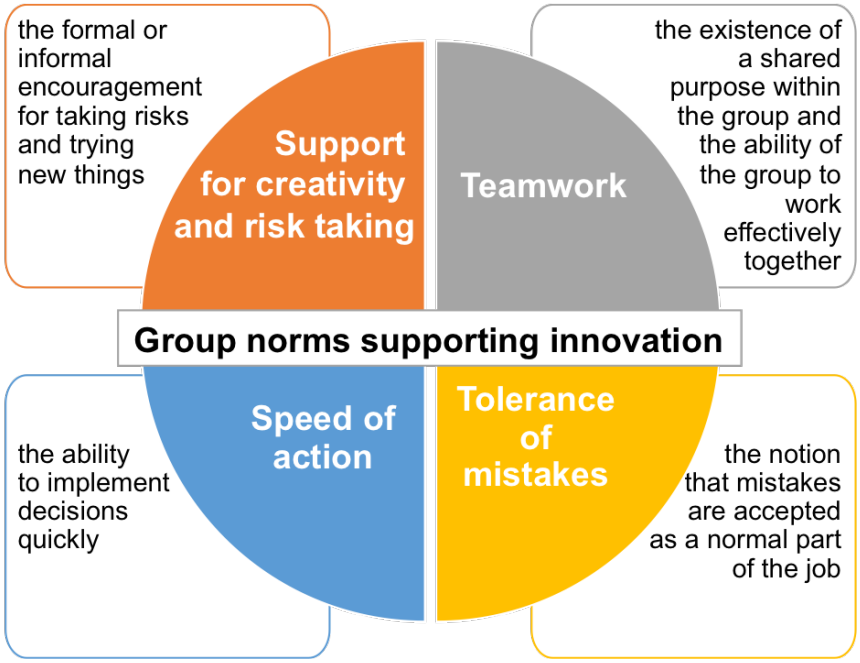
Scott and Bruce "viewed individual innovative behavior as the outcome of 4 interacting systems—individual, leader, work group, and climate for innovation".[27] Adapting the work of Siegel and Kaemmerer, Scott and Bruce included 2 dimensions in their definition of "climate for innovation": resource supply and support for innovation. The climate for innovation domain is described in more detail under Key Question 2, below.[27] The 2 dimensions and their definitions are detailed in Figure 5.

Figure 5. Dimensions of Climate for Innovation[27]



Caldwell and O'Reilly examined "group variables associated with innovation, particularly norms that develop within a group."[28] They identified social variables related to innovation from case examples which provided "an understanding of the actual experience of teams in organizations and…a broad range of attributes associated with innovation in teams." Their work is premised on "the assumption that innovation requires both the development of creative responses and the ability to implement them." Four domains emerged from their investigation – support for creativity and risk taking, teamwork, speed of action, and tolerance of mistakes – and are described in more detail under Key Question 2, below.[28] The 4 dimensions and their definitions are detailed in Figure 6.

Figure 6. Group Norms Supporting Innovation[28]



These 3 examples are highly representative of the definitions overall, and there seems to be a loose consensus around the definition for “culture of innovation”. Some common themes extracted from relevant citations include: a shared set of beliefs between people that supported improvement or change, resources to support innovation, and acceptance of change.

KEY QUESTION 2 – WHAT METRICS ARE USED TO CAPTURE CULTURE OF INNOVATION IN HEALTHCARE SETTINGS?

Twenty-seven studies reported using 26 different instruments to measure some version of the construct "culture of innovation". Nineteen studies employed 1 instrument: 10 studies used an instrument without adaptations,[9, 11, 14, 15, 20, 24, 25, 29-31] 7 studies modified an existing instrument,[8, 26, 32-36] and 2 studies developed a "homegrown" instrument.[21, 37] Eight studies used more than 1 instrument: 1 study adapted an existing instrument and added a "homegrown" composite innovation score;[10]2 studies employed 2 complete instruments;[19, 38]3 studies used 2 modified instruments;[12, 16, 23] 1 study developed 2 "homegrown" instruments;[18] and 1 study employed an instrument in its entirety and developed 2 "homegrown" innovation scores.[39] While some were developed in a healthcare setting, others were adapted from other disciplines such as management and economics.[28, 40-42] Six instruments were employed to measure "culture of innovation" in more than 1 included study.[27, 28, 43-45] See Appendix E for a crosswalk denoting studies and the instruments they used.

Seven studies[10, 16, 25, 30, 32, 33, 36] employed Team Climate Inventory (TCI), developed by Anderson & West.[26] The TCI was based on the 4-factor model of work group innovation developed by West,[46] which hypothesized that vision, participative safety, task orientation, and support for innovation are predictive of innovativeness. The 38-item self-report questionnaire measured team climate among healthcare management teams and it is intended to provide an aggregate measure of climate of innovation at the group level.

Two of the 7 studies administered the full TCI,[25, 30] while 4 studies only included 8 items from 1 of TCI's domains, Support for Innovation.[10, 16, 32, 33] One study created a 9-item instrument to measure "climate for innovation" by adding an item from Patterson et al[47] to the 8-item "support for innovation".[36]

The items in the "Support for Innovation" domain (Figure 7) examined "the extent to which respondents [felt] a climate encouraging innovation, and new and improved way of doing things, exists in their work groups."[10] There are 2 subscales in the domain: 4 items from Siegel and Kaemmerer's climate for innovation measure, "designed to assess organizational level attributes",[48] and 4 items developed by Anderson and West to "tap enacted support for innovation, [which] assessed the extent to which time, cooperation, practical support and resources were given by team members to implement new ideas and proposals."[26]

Figure 7. Support for Innovation Items from the Team Climate Inventory

Scott and Bruce devised the Climate for Innovation Measure to assess "individual differences with respect to the perception of the innovative climate in an organization".[27] They developed a 22-item instrument with 2 subscales and surveyed employees of a large non-healthcare industrial facility in the United States. The 2 subscales are: support for innovation (16 items) and resource supply (6 items). The support for innovation domain was adapted from Siegel and Kaemmerer's 26-item instrument, Climate for Innovation.[45] Another measure developed within the same study was the Innovative Behavior measure, which was used by 2 included studies[12, 38] to measure innovative work behavior (IWB). Consisting of 6 items under a single subscale, this measure assessed the tendency of employees to exhibit innovative behavior.[27]

The National Health Service's culture of innovation instrument,[49] developed by the NHS Institute for Innovation and Improvement, was used by 2 included studies seeking to measure culture of innovation.[15, 29] The 7-dimension instrument measured "the degree to which there are resources, support, and rewards for innovation within practices".[15] Organization culture for innovation was measured on 7 dimensions: risk, resources, information, targets, tools, reward, and relationships.

Two studies[8, 20] employed Group Innovation Inventory (GII), a 36-item instrument aimed "to identify the pattern of norms fostering innovation" with 4 domains: creativity and risk taking (9 items), teamwork (7 items), speed of action (4 items), and tolerance of mistakes (5 items).[28] Caldwell and O'Reilly developed the GII by asking a large sample of non-healthcare senior-level managers from Asia, Europe, Africa, and the United States to identify "norms or expectations that if widely held would facilitate innovation."[28] Responses were summarized and formed the basis of the instrument, reflecting "the informal expectations, beliefs, and group processes seen as important for fostering innovation."[28]

Other studies reported using instruments without adaptations.[9, 11, 14, 19, 20, 24, 31, 38, 39] Instruments employed include Innovative Work Behavior (Scott & Bruce),[38] Situational Outlook Questionnaire (SOQ),[11] Group Innovation Inventory,[20] Creative Climate Questionnaire (CCQ),[9] Climate for Innovation (Siegel & Kaemmerer),[39] instruments to measure individual innovative behaviors (Kleysen & Street) and innovative organization culture,[19] an instrument to measure

innovation capability of Chief Information Officers (Esdar),[24] an instrument to measure development culture (Tseng & Lee),[14] and Nurse Organizational Innovation Climate Scale.[31]

Five studies developed "homegrown" instruments: a composite innovation score,[10] a total innovation score and a role innovation score,[39] 2 instruments to measure "innovation climate" and "nursing innovation behavior",[18] an instrument to measure "nursing innovation",[37] and Radiography of Innovation Culture-Multidimensional Questionnaire (RIC-MQ) to measure "innovative culture".[21]

Several studies employed adapted or truncated versions of existing instruments.[8, 10, 12, 16, 23, 26, 32-36] The most frequently adapted instrument is the TCI, discussed above.[10, 16, 32, 33, 36] Some studies adapted items from existing instruments,[10, 12, 23, 35] while other studies incorporated parts of validated instruments such as Group Innovation Inventory,[8] Nordic Questionnaire for Psychosocial and Social Factors at Work,[34] Climate for Innovation developed by Scott & Bruce,[16] and Climate for Innovation developed by Siegel and Kaemmerer.[26]

Three of the 30 included studies did not directly measure "culture of innovation" but administered instruments to describe organizational culture using pre-specified categories. Two of the studies used the Competing Values Framework (CVF),[3, 50] while the third study used the Organizational Culture Assessment Instrument (OCAI), which is derived from CVF.[22] The CVF can be used to explain "the relationships of culture traits with innovation"[3] and identify implications of each culture type on organizational culture.[22] The most common organizational culture found for innovative organizations is the adhocracy (creative or development) culture, which emphasizes "an external and a flexibility orientation."[3]

KEY QUESTION 3 – WHAT ARE KEY CHARACTERISTICS AND OUCOMES OF PROGRAMS DESIGNED TO IMPROVE OR ESTABLISH A CULTURE OF INNOVATION IN HEALTHCARE SETTINGS?

Four studies described programs that reported outcomes using a quantitative measure of culture of innovation.[8, 9, 11, 29] One publication, which described a leadership program in the UK, treated innovation climate as a primary outcome.[11] The other 3 studies included culture of innovation as either a secondary outcome or 1 of a few various outcomes. Three of these studies were larger, including multiple sites,[8, 11, 29] while the final study included a smaller sample of nurses from 1 site.[9] Participants in 3 of the studies were frontline healthcare workers, including long-term care providers,[8] nurses,[9] and paramedics.[29] The final study included a combination of frontline and senior management.[11] Each of these studies is described in further detail below.

Our review found multiple related studies from the UK's National Health System (NHS), including 1 leadership learning program (Figure 8).[11] The goal of the study was to "explore the role leadership learning can play in supporting a climate for innovation", which followed 5 cohorts from senior manager and frontline manager training programs. These 2 programs had similar structures, meeting over the course of 8-10 months for module activities, coaching, evaluation activities, and working as a group to solve a real-world issue. Climate for innovation outcome data were collected from 24 of the 148 program participants. The respondents and their teams completed the Situational Outlook Questionnaire (SOQ) before and after completing the program. Additional data were collected from interviews and surveys around the sustainability and influence of the program's training on dimensions such as conflict and trust and risk-taking. While the response rate (16%) is very low, this study does signal some potential benefits of leadership training in improving dimensions of climate for innovation including challenge/involvement, freedom, trust/openness, idea-time, playfulness/humor, idea-support, debate, and risk-taking.

Figure 8. Leadership Learning Program

Two studies examined quality improvement collaboratives (QIC) (Figure 9).[8, 29] QICs were created to "improve quality in a specific area of practice, with expert support, involving multi-professional teams from multiple sites working collaboratively and using quality improvement methods."[51] The first QIC study included 22,117 paramedics in 12 ambulance services in the UK, and was focused on training participants on quality improvement (QI) methods and applying these methods to improve acute myocardial infarction and stroke care bundles. The clinical outcomes from this QIC were published separately, and the focus of the included study was on culture of innovation, leadership behavior, and uptake of QI methods. The 2,743 paramedics responding to a survey (12% response rate, from 11 of 12 ambulance services) suggest that participation in the QIC may improve uptake of QI methods and leadership behavior. The second QIC, comprised of 12 collaboratives, adapted the Institute for Healthcare Improvement Breakthrough Collaborative method and "focused on improving 1 specific quality topic [related

to long-term care] varying from malnutrition to process redesign".[8] The analyses compared data collected before and after the collaborative, with 307 of the 1,161 participants included in the analysis (26% response rate). Findings suggest that QIC participation may not improve innovative culture, but other factors like perceived effectiveness of the QIC, organizational support, and management support played an important role in predicting innovative culture.

Figure 9. Quality Improvement Collaboratives

The final study that included a program was a clinical supervision intervention at 1 general psychiatric ward in Sweden, including 22 nurses (Figure 10).[9] This intervention involved 1 year of systematic group clinical supervision, using Hallberg's model,[52] and each participant supervised individually on how to plan and document nursing care through nursing diagnosis.[53] All 22 nurses completed the Sense of Coherence scale, the Creative Climate Questionnaire (CCQ), the Work-Related Strain Inventory, and the Satisfaction with Nursing Care and Work Questionnaire before and after implementation of the clinical supervision. This small, single site study found increases in some creative and innovative climate dimensions, but their overall findings were mixed.

Figure 10. Clinical Supervision Intervention

There were similarities between the 4 programs, but no inherent patterns were identified. Three of these studies were larger, including multiple sites, while the fourth study included a smaller sample of nurses from 1 site. Participants in 3 of the studies were frontline healthcare workers, including long-term care providers, nurses, and paramedics. The remaining study included a combination of frontline and senior management. Two programs used QICs with a specific clinical focus: 1 used QI methods to improve acute myocardial infarction and stroke care bundles and the other adapted the Instituted for Health Care Improvement Breakthrough Collaborative method to improve a specific quality topic related to long-term care. Another program

incorporated a leadership program aimed at solving a “real world issue” as a group over the course of 8-10 months with a focus on a “relational and experiential approach to learning”. The remaining program was a nurse-led program focused on improving nursing care in a psychiatric ward with a year-long program comprised of group clinical supervision and individual learning about how to plan and document nursing care through nursing diagnosis. While 4 studies with culture of innovation outcomes were identified, their small scale or low response rates and variable details provided about the components of each intervention limited the conclusions to be drawn.

DISCUSSION

In this systematic review we describe how "culture of innovation" has been defined and measured in studies that have measured or sought to improve or establish a "culture of innovation" in healthcare settings. We identified 4 programs with culture of innovation outcomes.

SUMMARY OF KEY QUESTIONS

KQ1: How is culture of innovation defined in literature related to healthcare settings?

When reviewing the included studies, there were several ways that terminology and definition captured the concept of "culture of innovation." The variations on the terminology and key words used to describe this concept were 1 source of variety. In addition, some studies provided explicit definitions or explanations of culture of innovation; nearly all the publications provided citations related to the concept of culture of innovation. The works of Anderson and West,[26] Scott and Bruce,[27] and Caldwell and O'Reilly[28] appeared numerous times and stood out as noteworthy exceptions in their more consistent use.

While the specific citations may have varied somewhat, nearly all studies related to Anderson and West referred to the "Support for Innovation" domain of the Team Climate Inventory (TCI). The other 3 domains are vision, participation, and task orientation.[26] Scott and Bruce included 2 dimensions in their definition of "climate for innovation": resource supply and support for innovation. Caldwell and O'Reilly examined "group variables associated with innovation, particularly norms that develop within a group."[28] Four domains emerged from their work: support for creativity and risk taking, teamwork, speed of action, and tolerance of mistakes.

These 3 examples are highly representative of the definitions overall, and there seems to be a loose consensus around the definition for "culture of innovation". Some common themes extracted from relevant citations include: a shared set of beliefs between people that supported improvement or change, resources to support innovation, and acceptance of change.

KQ2: What metrics are used to capture culture of innovation in healthcare settings?

Twenty-seven studies measured some version of the construct "culture of innovation" using 26 different instruments. Ten studies administered a single instrument without adaptation, 7 studies modified or truncated an existing instrument, 2 studies developed "homegrown" instruments, and 8 studies incorporated a mix of adapted, homegrown, and/or instrument without modifications. Six instruments were used in more than 1 study to measure "culture of innovation". TCI and related conceptual work were used in 7 studies, with each study incorporating the 8 items related to "support for innovation" domain within the TCI. Two additional instruments were identified among 3 studies that did not directly measure "culture of innovation". These studies instead described organizational culture using pre-specified categories. While some instruments were developed in a healthcare setting, others were adapted from other disciplines such as management and economics.

KQ3: What are key characteristics and outcomes of programs designed to improve or establish a culture of innovation in healthcare settings?

Four studies described programs that reported outcomes using a quantitative measure of culture of innovation. One publication, which described a leadership program in the UK, treated innovation climate as a primary outcome. The other 3 studies included culture of innovation as either a secondary outcome or one of a few various outcomes.

There were similarities between the 4 programs, but no inherent patterns were identified. Three of these studies were larger, including multiple sites, while the fourth study included a smaller sample of nurses from 1 site. Participants in 3 of the studies were frontline healthcare workers, including long-term care providers, nurses, and paramedics. The remaining study included a combination of frontline and senior management. Two programs used QICs with a specific clinical focus: 1 used QI methods to improve acute myocardial infarction and stroke care bundles and the other adapted the Instituted for Health Care Improvement Breakthrough Collaborative method to improve a specific quality topic related to long-term care. Another program incorporated a leadership program aimed at solving a "real world issue" as a group over the course of 8-10 months with a focus on a "relational and experiential approach to learning". The remaining program was a nurse-led program focused on improving nursing care in a psychiatric ward with a year-long program comprised of group clinical supervision and individual learning about how to plan and document nursing care through nursing diagnosis. While 4 studies with culture of innovation outcomes were identified, their small scale or low response rates and variable details provided about the components of each intervention limited the conclusions to be drawn.

LIMITATIONS

Publication Bias

We were not able to test for publication bias and can make no conclusions about its possible existence. However, we supplemented our database search with a Google search to locate possible publications not indexed in traditional databases or published in healthcare journals. The primary challenge for topics without a specific disease or therapy is identifying relevant literature. Because terminology related to culture of innovation is evolving, there are no reliable, standardized terms for systematically searching databases for literature related to this topic, so relevant literature might have been missed. In addition, every healthcare organization has its own culture that is fluid and dynamic, but these changes are not measured/quantified or evaluated, so there are likely real-world examples of successful implementations of innovative culture that are not represented here.

There are several challenges common in literature synthesis studies that also affect this review. The lack of program studies with rigorous study designs limits our ability to draw conclusions about the causal effect of the programs identified on culture of innovation. The low response rates (or no response rate reported) in the majority of studies, especially the program studies identified in KQ3, also introduce uncertainty and potential bias. There is also large variation in the manner in which culture of innovation has been measured. Despite the similarities in how culture of innovation and related constructs were operationalized across studies, there are also vast differences that made interpreting results across studies challenging.

While "culture" and "climate" or "creativity" and "innovation" are often used interchangeably, some researchers have distinguished between these terms in prior literature. Culture is more "observable in the practices and policies of the organization",[54] while climate refers to "the behavioral evidence for the culture within an organization".[55] Creativity "focuses on the individual thought processes and intellectual activity to general new insights, ideas, or solutions to problems"; innovation extends beyond this notion of creativity by focusing on "the adoption, exploitation and successful implementation of these insights, ideas, or solutions to problems".[56] The distinctions between these terms are nuanced but could be important when attempting to identify facilitators and moderators of culture of innovation. Since the goal of this review is to present the breadth of how culture of innovation has been characterized in healthcare settings, our resulting language may lack definitional clarity.

Applicability of Findings to the VA

None of the identified literature in our searches came from the VA, but there is increasing interest in the concept of culture of innovation and measurement within the VA.[6, 57] Many healthcare systems are invoking the term "innovation" in programs; however, they vary in their scope, function, and purpose. There are institutions offering competition-type events to encourage advancement of solutions and ideas to improve the quality of healthcare and to build employee capacity through education and training, such as programs at Brigham and Women's Hospital (Brigham Digital Innovation Hub) and the Henry Ford Innovation Institute. Other institutions, such as Seattle Children Improvement and Innovation (SCII) program or the University of Chicago Center for Healthcare Delivery Science and Innovation, partner with companies to help solve issues facing patients, families, and clinicians with innovative solutions. We were unable to identify evaluations of these programs that described their impact on culture of innovation.

There were only a small number of studies identified within published literature with metrics and interventions. Of those programs that have been published with measurable culture of innovation outcomes,[8, 9, 11, 29] the studies conducted at United Kingdom's National Health Service (NHS) would best approximate the VA's setting, given the scale of the organization and the type of work NHS has been doing. The NHS' sustained work may be the best place for the VA to gain insight.

RESEARCH GAPS AND RECOMMENDATIONS FOR FUTURE RESEARCH

This review identified numerous ways "culture of innovation" has been defined and measured in healthcare settings. The various ways researchers have tried to measure the construct could be a signal that "culture of innovation" is a unique construct. Broadening the search strategy would likely reveal the overlap between culture of innovation and other related constructs, such as organizational learning and patient safety culture. More work is needed to refine the definition and critically assess the dimensions and subscales different researchers have attached to this construct.

There is also overlap between research on fostering leadership and research on fostering innovation. One of the included studies from NHS where a leadership training program used innovation climate as an outcome is a strong example of this.[11] Questions such as whether some

concepts of innovation rely more on innovation from "above" by individuals in formal leadership positions, or if there are other concepts/approaches to innovation rely more on distributed leadership/initiative from “below” are interesting for future research.

There is an increasing body of work dedicated to the understanding of how organizational culture affects team composition and function. Our review included studies discussing development culture, which has been shown to promote innovation and continuous adaptation to changing environment.[14] More work is needed to examine the relationship between healthcare team composition and culture of innovation.

Another area of interest for future research is to examine how teams can improve and sustain innovative culture over time and what impact innovative culture has on system, clinical, and patient outcomes. How to evaluate and assess effectiveness of programs and interventions implemented to improve or cultivate a culture of innovation is also of interest. As discussed, the majority of empirical research conducted in this area employed a cross-sectional study design, giving only a static view of an organization’s culture of innovation at 1 point in time. Since organizational culture is dynamic and constantly evolving, incorporating longitudinal approaches may capture a more complete picture. Moreover, longitudinal study design would allow for examination of causal relationships between culture of innovation and system, clinical, and patient outcomes.

CONCLUSIONS

While we were able to identify a moderate amount of literature defining and quantitatively measuring culture of innovation in healthcare settings, this area of research has yet to see rigorous evaluations of intervention work or process of changing culture. Such studies would require multi-site studies with large sample sizes and may build from the early work in this area to focus on interpersonal dynamics, leadership, and/or quality improvement collaboratives.

A culture of innovation in a healthcare organization may have implications for quality of care, population health outcomes, cost of care, and employee satisfaction. An organization exhibiting a culture of innovation may be more likely to have an orientation towards improvement and the ability to continuously adapt to changing environment. More work is needed to understand how to build a culture of innovation in healthcare settings and harness the benefits of culture of innovation as the link between effective organizational practice and high-quality healthcare, thus improving system, clinical, and patient outcomes.

REFERENCES

1. Glisson C. The Role of Organizational Culture and Climate in Innovation and Effectiveness. *Hum Serv Organ Manag Leadersh Gov*. 2015;39(4):245-250. doi:10.1080/23303131.2015.1087770
2. Schneider B., Ehrhart MG, W. M. Organizational climate and culture. *Annu Rev Psychol*. 2013;64(361-388)
3. Büschgens T, Bausch A, Balkin DB. Organizational culture and innovation: A meta-analytic review. *Journal of product innovation management*. 2013;30(4):763-781.
4. Singer SJ, Falwell A, Gaba DM, et al. Identifying organizational cultures that promote patient safety. *Health Care Manage Rev*. Oct-Dec 2009;34(4):300-11. doi:10.1097/HMR.0b013e3181afc10c
5. Hogan SJ, Coote LV. Organizational culture, innovation, and performance: A test of Schein's model. *Journal of Business Research*. 2014;67(8):1609-1621.
6. Greene J, Yuthas K, A. T. *Training for innovation: evidence to inform evaluation of the VA Innovators Network*. 2017.
7. Mokkink LB, de Vet HCW, Prinsen CAC, et al. COSMIN Risk of Bias checklist for systematic reviews of Patient-Reported Outcome Measures. *Qual Life Res*. May 2018;27(5):1171-1179. doi:10.1007/s11136-017-1765-4
8. Cramm JM, Strating MMH, Bal R, Nieboer AP. A large-scale longitudinal study indicating the importance of perceived effectiveness, organizational and management support for innovative culture. *Social science & medicine (1982)*. 2013;83:119-24. doi:https://dx.doi.org/10.1016/j.socscimed.2013.01.017
9. Berg A, Hallberg IR. Effects of systematic clinical supervision on psychiatric nurses' sense of coherence, creativity, work-related strain, job satisfaction and view of the effects from clinical supervision: a pre-post test design. *Journal of psychiatric and mental health nursing*. 1999;6(5):371-81.
10. Bunce D, West MA. Self perceptions and perceptions of group climate as predictors of individual innovation at work. *Applied Psychology: An International Review*. Jul 1995. 2017-09-25 1995;44(3):199-215. doi:http://dx.doi.org/10.1111/j.1464-0597.1995.tb01076.x
11. Jarvis C, Kars S, Sheffield R. Healthy Returns: Leadership Learning and Innovation Climate in the UK Health Sector. *Proceedings of the 12th European Conference on Innovation and Entrepreneurship*. Acad Conferences Ltd; 2017:330-339. *Proceedings of the European Conference on Entrepreneurship and Innovation*.
12. Nazir S, Qun W, Hui L, Shafi A. Influence of Social Exchange Relationships on Affective Commitment and Innovative Behavior: Role of Perceived Organizational Support. Article. *Sustainability*. Dec 2018;10(12)doi:10.3390/su10124418
13. *Human performance technology: Concepts, methodologies, tools, and applications*. Business Science Reference/IGI Global, Hershey, PA; 2019:1946-Chapter xxxix, 1946 Pages.

14. Gozukara I, Colakoglu N, Simsek OF. Development culture and TQM in Turkish healthcare: importance of employee empowerment and top management leadership. Article. *Total Quality Management & Business Excellence*. Aug 2019;30(11-12):1302-1318. doi:10.1080/14783363.2017.1366266

15. Apekey TA, McSorley G, Tilling M, Siriwardena AN. Room for improvement? Leadership, innovation culture and uptake of quality improvement methods in general practice. *Journal of evaluation in clinical practice*. 2011;17(2):311-8. doi:https://dx.doi.org/10.1111/j.1365-2753.2010.01447.x

16. Nowak R. Responding to Key Exogenous Changes: The Joint Effect of Network Heterogeneity and Culture of Innovation. Article. *International Journal of Innovation Management*. May 2019;23(4)doi:10.1142/S1363919619500300

17. Fincham J. Response rates and responsiveness for surveys, standards, and the Journal. . *American journal of pharmaceutical education*. 2008;72(2)

18. Weng R-H, Huang C-Y, Chen L-M, Chang L-Y. Exploring the impact of transformational leadership on nurse innovation behaviour: a cross-sectional study. *Journal of nursing management*. 2015;23(4):427-39. doi:https://dx.doi.org/10.1111/jonm.12149

19. Kim SJ, Park M. Leadership, Knowledge Sharing, and Creativity The Key Factors in Nurses' Innovative Behaviors. Article. *Journal of Nursing Administration*. Dec 2015;45(12):615-621. doi:10.1097/NNA.0000000000000274

20. Nieboer AP, Strating MMH. Innovative culture in long-term care settings: the influence of organizational characteristics. *Health care management review*. 2012;37(2):165-74. doi:https://dx.doi.org/10.1097/HMR.0b013e318222416b

21. Muñoz-van den Eynde A, Cornejo-Cañamares M, Diaz-Garcia I, Muñoz E. Measuring innovation culture: development and validation of a multidimensional questionnaire. *Advances in Research*. 2015:122-141.

22. Mesfin D, Woldie M, Adamu A, Bekele F. Perceived organizational culture and its relationship with job satisfaction in primary hospitals of Jimma zone and Jimma town administration, correlational study. *BMC health services research*. 2020;20(1):438. doi:https://dx.doi.org/10.1186/s12913-020-05319-x

23. Acar AZ, Acar P. The effects of organizational culture and innovativeness on business performance in healthcare industry. *8th International Strategic Management Conference*. Elsevier Science Bv; 2012:683-692. *Procedia Social and Behavioral Sciences*.

24. Liebe J-D, Esdar M, Thye J, Hubner U. Antecedents of CIOs' Innovation Capability in Hospitals: Results of an Empirical Study. *Studies in health technology and informatics*. 2017;243:142-146.

25. Proudfoot J, Jayasinghe UW, Holton C, et al. Team climate for innovation: what difference does it make in general practice? *International journal for quality in health care : journal of the International Society for Quality in Health Care*. 2007;19(3):164-9.

26. Anderson NR, West MA. Measuring climate for work group innovation: development and validation of the team climate inventory. Article. *Journal of Organizational*

Behavior. May 1998;19(3):235-258. doi:10.1002/(SICI)1099-1379(199805)19:3<235::AID-JOB837>3.3.CO;2-3

27. Scott S, Bruce R. Determinants of innovative behavior: A path model of individual innovation in the workplace. . *Academy of management journal*. 1994;37(3):580-607.

28. Caldwell DF, O'Reilly CA. The determinants of team-based innovation in organizations: The role of social influence. . *Small Group Research*. 2003;34(4)

29. Phung V-H, Essam N, Asghar Z, Spaight A, Siriwardena AN. Exploration of contextual factors in a successful quality improvement collaborative in English ambulance services: cross-sectional survey. *Journal of evaluation in clinical practice*. 2016;22(1):77-85. doi:https://dx.doi.org/10.1111/jep.12438

30. Liu F-C, Cheng K-L, Chao M, Tseng H-M. Team innovation climate and knowledge sharing among healthcare managers: mediating effects of altruistic intentions. *Chang Gung medical journal*. 2012;35(5):408-19.

31. Yan D, Wen F, Li X, Zhang Y. The relationship between psychological capital and innovation behaviour in Chinese nurses. *Journal of nursing management*. 2020;28(3):471-479. doi:https://dx.doi.org/10.1111/jonm.12926

32. Rashid A, Nawaz S, Zaman U. Examining the effect of inclusive climate on public health official's creative performance: Mediating role of innovation climate. Article; Early Access. *Journal of Public Affairs*. 2020;doi:10.1002/pa.2273

33. Dackert I. The impact of team climate for innovation on well-being and stress in elderly care. *Journal of nursing management*. 2010;18(3):302-10. doi:https://dx.doi.org/10.1111/j.1365-2834.2010.01079.x

34. Roen I, Kirkevold O, Testad I, Selbaek G, Engedal K, Bergh S. Person-centered care in Norwegian nursing homes and its relation to organizational factors and staff characteristics: a cross-sectional survey. *International psychogeriatrics*. 2018;30(9):1279-1290. doi:https://dx.doi.org/10.1017/S1041610217002708

35. Lansisalmi H, Kivimaki M. Factors associated with innovative climate: What is the role of stress? Article. *Stress Medicine*. Oct 1999;15(4):203-213. doi:10.1002/(SICI)1099-1700(199910)15:4<203::AID-SMI816>3.0.CO;2-B

36. King EB, De Chermont K, West M, Dawson JF, Hebl MR. How innovation can alleviate negative consequences of demanding work contexts: The influence of climate for innovation on organizational outcomes. Article. *Journal of Occupational and Organizational Psychology*. Dec 2007;80:631-645. doi:10.1348/096317906X171145

37. Weng RH, Huang CY, Huang JA, Wang MH. The cross-level impact of patient safety climate on nursing innovation: a cross-sectional questionnaire survey. Article. *Journal of Clinical Nursing*. Aug 2012;21(15-16):2262-2274. doi:10.1111/j.1365-2702.2012.04170.x

38. Sonmez B, Yildirim A. The mediating role of autonomy in the effect of pro-innovation climate and supervisor supportiveness on innovative behavior of nurses. Article; Proceedings Paper. *European Journal of Innovation Management*. Jan 2019;22(1):41-58. doi:10.1108/EJIM-05-2018-0088

39. West MA, Wallace M. Innovation in health care teams. *European Journal of Social Psychology*. 1991;21(4):303-315. doi:http://dx.doi.org/10.1002/ejsp.2420210404

40. Isaksen S, Lauer K, Ekvall G. Situational outlook questionnaire: A measure of the climate for creativity and change. . *Psychological reports*. 1999;85(2):665-74.

41. Quinn RE, Spreitzer GM. The psychometrics of the competing values culture instrument and an analysis of the impact of organizational culture on quality of life. *Research in Organizational Change and Development* 1991;5:15–42.

42. Wang CL, Ahmed PK. The development and validation of the organisational innovativeness construct using confirmatory factor analysis. . *European Journal of Innovation Management*. 2004;7(4):303-313.

43. Anderson N WM. The Team Climate Inventory: Development of the TCI and its applications in teambuilding for innovativeness. . *European Journal of work and organizational psychology*. 1996;5(1)

44. Agency NM. *Improvement Leaders' Guide: Building and Nurturing an Improvement Culture.* 2005.

45. Siegel S, Kaemmerer W. Measuring the perceived support for innovation in organizations. . *Journal of Applied Psychology* 1978;63(5):553.

46. West MA. The social psychology of innovation in groups. 1990;

47. Patterson M. *Development and validation of an organizational climate measure*. 2004.

48. Siegel SM, Kaemmerer WF. Measuring the perceived support for innovation in organizations. *Journal of Applied Psychology*. 1978;63(5):553.

49. Agency NM. *Improvement Leaders' Guide: Building and Nurturing an Improvement Culture*. 2005.

50. Chan YH, Taylor RR, Markham S. The role of subordinates' trust in a social exchange-driven psychological empowerment process. *Journal of Managerial Issues*. 2008;20(4):444-467.

51. Hulscher ME, Schouten LM, Grol RP, Buchan H. Determinants of success of quality improvement collaboratives: what does the literature show? *BMJ Qual Saf*. Jan 2013;22(1):19-31. doi:10.1136/bmjqs-2011-000651

52. Hallberg IR, Hansson UW, Axelsson K. Satisfaction with nursing care and work during a year of clinical supervision and individualized care. Comparison between two wards for the care of severely demented patients. *J Nurs Manag*. Nov 1993;1(6):297-307. doi:10.1111/j.1365-2834.1993.tb00231.x

53. Carnevali D, Patrick M. *Nursing Management for the Elderly, 2th edn.* . JB Lippincott Company; 1986.

54. Ahmed PK. Culture and climate for innovation. *European Journal of Innovation Management*. 1998;1(1):30-43.

55. Schein EH. *Organizational Culture and Leadership (Vol. 2)*. John Wiley & Sons.; 2010.

56. Amabile TM, Conti R, Coon H, Lazenby J, M. H. Assessing the work environment for creativity. *Academy of management journal*. 1996;39(5):1154-84.

57. Brunelle J, Frisk D, Benjamin M, Randall P, Sheikh A. *Measuring the Impact Of Innovation Activities in Government*. 2019.

58. Ekvall G. Organizational climate for creativity and innovation. . *European Journal of Work & Organizational Psychology*. 1996;5(1):105.

59. Tseng YF, Lee TZ. Comparing appropriate decision support of human resource practices on organizational performance with DEA/AHP model. . *Expert Systems with Applications*. 2009;36:6548–6558.

60. Kleysen R, Street C. Toward a multi-dimensional measure of individual innovative behavior. *J Intell Cap*. 2001;2(3):284-296. .

61. Esdar M, Liebe J, Weiß J, Hübner U. Exploring Innovation Capabilities of Hospital CIOs: An Empirical Assessment. . *Stud Health Technol Inform*. 2017;235:383-387.

62. O'Reilly CA, Chatman J, Caldwell DF. People and organizational culture: A profile comparison approach to assessing person-organization fit. *Acad Manag J*. 1991;34:487–516.

63. Kwon J. The influence of innovative organization culture to human resource innovation and organizational commitment. *J Bus Res* 2011;23(1):153-182.

64. Kim N, Lee J. Empirical study on organizational culture types, CEO leadership styles, and behavioral performance. . *Korean J Manage* 1997;5(1):193-238.

65. Dallner A, Elo A-L, Gambrele F, et al. Validation of the General Nordic Questionnaire for Psychological and Social Factors at Work. *Nordic Council of Ministers Copenhagen, DK Nord*. 2000;

66. Qian Y, Zhang Y-Q, Wu J-M, Wang H-C. Development and psychometric test of Nurse Organizational Innovation Climate Scale. *Chinese Journal of Nursing*. 2016;51(2):243–247.

67. Phillips W. *The Organizational Health Survey.* 1988:141±160. *The 1988 Annual: Developing Human Resources*.

68. Jansen JJP, Van Den Bosch FAJ, Volberda HW. Exploratory innovation, exploitative innovation, and performance: Effects of organizational antecedents and environmental moderators. . *Management Science*. 2006;52(11):1661-1674.

69. Burningham C, West MA. Individual, climate, and group interaction processes as predictions of work team innovation. . *Small Group Research*. 1995;26

70. Cameron K, Quinn R. *Diagnosing and changing organizational culture: Based on the competing values framework.* 2011.