Assessing an organizational culture instrument based on the Competing Values Framework: Exploratory and confirmatory factor analyses

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Abstract

Background

The Competing Values Framework (CVF) has been widely used in health services research to assess organizational culture as a predictor of quality improvement implementation, employee and patient satisfaction and team functioning, among other outcomes. CVF instruments are generally presented as well-validated with reliable aggregated subscales. However, only one study in the health sector has been conducted for the express purpose of validation, and that study population was limited to hospital managers from a single geographic locale.

Methods

We used exploratory and confirmatory factor analyses to examine the underlying structure of data from a CVF instrument. We analyzed cross-sectional data from a work environment survey conducted in the Veterans Health Administration (VHA). The study population comprised all staff in non-supervisory positions. The survey included 14 items adapted from a popular CVF instrument, which measures organizational culture according to four subscales: hierarchical, entrepreneurial, team and rational.

Results

Data from 71,776 non-supervisory employees (approximate response rate 51%) from 168 VHA facilities were used in this analysis. Internal consistency of the subscales was moderate to strong ($\alpha = 0.68$ to 0.85). However, the entrepreneurial, team and rational subscales had higher item-to-scale correlations than item-to-subscale correlations indicating poor divergent properties. Exploratory factor analysis revealed two-factors,

comprising the ten items from the entrepreneurial, team and rational subscales loading on the first factor, and three of four items from the hierarchical subscale loading on the second. Results from confirmatory factor analysis suggested that the two-subscale solution provides a more parsimonious fit to the data as compared to the original four-subscale model.

Conclusions

This study suggests there may be problems applying conventional CVF subscales to non-managers, and underscores the importance of assessing psychometric properties of instruments in each new context and population they are used. It also further highlights the challenges management scholars face in assessing organizational culture in a reliable and comparable way. More research is needed to determine if the emergent two-subscale solution is a valid or meaningful alternative and whether these findings generalize beyond VHA.

Background

Organizational culture comprises the fundamental values, assumptions and beliefs held in common by members of an organization [1]. It is stable, socially constructed and subconscious. Employees impart the organizational culture to new members, and culture influences in large measure how employees relate to one another and their work environment. Theorists propose that organizational culture is among the most critical barriers to leveraging new knowledge and implementing technical innovation [1].

Health services researchers have frequently used Quinn and Rohrbaugh's [2] competing values framework (CVF) to assess organizational culture and its association with important indicators of healthcare processes and outcomes [3-11]. As a result, scholars have credited (or faulted) organizational culture with contributing to significant differences among healthcare facilities in organizational performance [11], quality improvement implementation [3], patient-care quality and efficiency [12], effectiveness of provider teams [8, 9], healthcare provider job satisfaction [6, 7], and patient satisfaction [10].

Although instruments based on the CVF are the most frequently used in healthcare research to assess organizational culture [13], there has been limited validation of CVF instruments [1, 14]. The only published study conducted in a healthcare setting for the express purpose of CVF model validation was restricted to hospital managers from a single geographic locale [15]. It is not clear whether the same CVF model is viable when applied to non-managers, although they typically constitute the largest portion of an organization's members and most often deliver goods and services. It is

important therefore to understand if an organizational culture instrument is reliable and valid when applied to this group.

The objective of the present study is to test psychometric properties of a CVF instrument on a large sample of organizational members who have no supervisory responsibility. We chose to focus on employees without supervisory responsibility because this instrument in particular, and CVF instruments in general, have not been previously validated among non-managers in health care organizations.

The Competing Values Framework

In the early 1980s, organizational theorists and researchers developed the CVF as a conceptual framework to integrate criteria of organizational "effectiveness" [16]. The framework is a synthesis of organizational theories, and posits that most organizations can be characterized along two dimensions, each representing alternative approaches to basic challenges that all organizations must resolve in order to function [17]. The first set of competing values is the degree to which an organization emphasizes centralization and control over organizational processes versus decentralization and flexibility. The second set of competing values is the degree to which the organization is oriented toward its own internal environment and processes versus the external environment and relationships with outside entities, such as regulators, suppliers, competitors, partners and customers. Cross-classifying organizations on these two values dimensions results in four archetypes, referred to as hierarchical, rational, entrepreneurial and team cultures (Figure 1).

In the CVF, organizations with an internal focus and emphasis on control, called hierarchical cultures (also sometimes referred to as "bureaucratic" culture), adopt

centralized authority over organizational processes; respect formal hierarchy; and adhere to rules. They place a premium on stability and predictability. Organizations with an internal focus and emphasis on flexibility, called team cultures, encourage broad participation by employees, emphasize teamwork and empowerment and make human resource development a priority. Organizations with an external focus and emphasis on flexibility, called entrepreneurial cultures, exhibit creativity and innovativeness; they place a premium on growth and expanding resources. Finally, organizations with an external focus and an emphasis on control, called rational cultures, are characterized by clarity of tasks and goals. They place a premium on efficiency and measurable outcomes.

These four cultures are proposed as archetypes. In reality, organizations are expected to reflect all four cultures to some degree. The CVF does not specify a preferred organizational culture and there are many competing hypotheses about what cultures or combinations of cultures are superior and under what conditions [18]. However, a fundamental supposition of the CVF is that all four cultures operate at an organizational level and to remain relatively stable over time [17]. Furthermore, all four cultures are hypothesized to permeate most facets of the organization, from the comportment of its managers, to the values that bind employees to one another, to the priorities the organization pursues. Therefore, one expects the dominant culture to manifest itself in the views of employees at all levels of the organization [16, 17].

The CVF survey instrument most commonly used in health services research was developed by Cameron and initially tested in three studies of organizational culture [18-20]. This instrument is most commonly attributed to Zammuto and Krakower [20], who published the complete survey items. A modified 20-item instrument has been used in

health services research [3] and is sometimes referred to as the Quality Improvement Implementation Survey [13, 14]. The original instrument as published by Zammuto and Krakower comprises 16 items divided equally into four subscales, each representing one of the four archetypal cultures.

It was originally validated by Quinn and Spreitzer [19] by means of multi-trait / multi-method analysis and multi-dimensional scaling using survey data from executives of public utilities. The researchers used two versions of the instrument, one with ipsative scales and one with Likert scales. The ipsative or "forced distribution" scales required respondents to allocate 100 points among four survey items according to how well each item described the organization relative to the other items, with each representing one of the four cultures. For example, a respondent might distribute 25 points to team culture, 15 points to entrepreneurial culture, 40 points to bureaucratic culture, and 20 points to rational culture. The Likert scales required respondents to allocate between one and five points per item, independent of how they scored other items. Item wording varied between the two instruments. Quinn and Spreitzer found that data from both versions of the instrument conformed to the CVF and items among the four subscales correlated, by and large, as predicted in the model. They concluded that the CVF had good construct validity and that the instruments were reliable.

Subsequently, Kalliath and colleagues [15] conducted the only validation of the CVF in a healthcare setting by administering a 16-item, seven-point Likert-scale version of the classic CVF instrument to 300 managers and supervisors from a multi-hospital system in the Midwest. They used structural equations modelling to assess the underlying structure of the survey data to determine if it conformed to the CVF. Their findings were

generally consistent with the four-subscale CVF, although they found an extremely high, positive correlation ($r = 0.73$) between the hierarchical and entrepreneurial subscales, which they anticipated would be uncorrelated or negatively correlated under the CVF. The authors attributed this correlation to the chaotic business environment for hospitals at the time, and concluded that the relationship between the subscales was not fundamentally inconsistent with the CVF.

A significant limitation in both validation studies was their reliance on data exclusively from executives and managers. There are documented "gaps" in the perceptions of managers versus service providers in areas such as customer expectations [21]; it is conceivable that individuals in supervisory roles may adopt different cognitive maps of organizational values and assumptions than those adopted by rank and file employees. This raises the question to what extent the hypothesized subscales of the CVF emerge among frontline workers in healthcare organizations.

Methods

In the current study, we analyzed cross-sectional data from a survey of employees of the Veterans Health Administration (VHA) on their work environment, including the organizational culture of their facilities. We conducted three series of analyses on the data. We first conducted item analysis to examine subscale reliability and assess the divergent and convergent properties of the subscales, i.e., the extent that items within subscales correlated versus across subscales. Then we used exploratory factor analysis to determine the underlying structure of the items. Finally, we used confirmatory factor analysis to compare emergent and conventional factor structures. This study was reviewed and approved by the University of Washington Human Subjects Division.

Data

The 2004 All Employee Survey was distributed to 212,877 VHA employees, which included all active clinical, administrative and support staff, from all supervisory levels including frontline workers to executive leaders. Surveys were voluntary and anonymous, and were conducted by a third-party contractor in May 2004. The overall response rate was 51%. Employees had the option of completing surveys online (which 76% of respondents did), by telephone (14%) or by mail (10%).

A total of 75,135 surveys were returned from employees who had no supervisory responsibilities. Because of the large sample size, we elected to exclude 3,359 observations (4.5% of returned surveys) with missing responses for one or more culture items rather than attempting to impute missing data. Compared to respondents who completed all organizational culture items, a higher proportion of respondents with missing items also had missing values on demographic variables such as age, gender and tenure with the VHA (approximately 3% as compared to 1%). Respondents with missing values for organizational culture items also more frequently self-identified as African-American (34% versus 22%) and Hispanic (9% versus 8%), and less frequently as White (53% versus 68%).

The final sample comprised 71,776 surveys returned from employees in 168 VHA facilities who reported having no supervisory responsibility. We used split samples for the exploratory and confirmatory factor analyses [22]. Observations from each of the 168 facilities were randomly assigned to two samples, stratified by facility: a test or model-building sample for the exploratory factor analysis (n = 35,848), and a validation sample for the confirmatory factor analysis (n = 35,928). This ensured roughly equal

representation of each facility in both samples, with the facility being the theoretical level of aggregation for the instrument.

Instrument

The VHA All Employee Survey was fielded in 2004 for organizational development purposes and included 14 organizational culture items adapted from the classic 16-item CVF instrument as reported by Zammuto and Krakower [20]: 4 items each measuring hierarchical, entrepreneurial, rational, and team cultures. As a result of pilot testing, wording of some items were adapted by VHA to improve readability and one item each from rational and team culture dimensions were eliminated. The original and revised instruments are included as appendices.

Respondents scored each item on a five-point Likert scale measuring agreement or disagreement with how well the statement described their facility. For example, the first item states, “My facility is a very dynamic and entrepreneurial place. People are willing to stick their necks out and take risks.” A score of one indicates strong disagreement; three indicates neither agreement nor disagreement; and five indicates strong agreement.

Item Analysis

We conducted item analyses to assess the reliability and the convergent / divergent properties of the culture subscales. By subscale reliability and convergent / divergent properties, we mean the extent to which item responses correlated highly within the same subscale and failed to correlate highly with items from across subscales, as predicted by the CVF. We used three measures.

First, we tested the convergent/divergent properties of the items by comparing Pearson's correlations coefficients among all items to see if (1) items from the same subscale were correlated at a moderate magnitude (e.g., Pearson's correlation coefficient at between 0.40 and 0.60) and (2) item responses correlated higher within subscales than between subscales. Second, we calculated item-rest and item-to-scale correlations for each item to examine whether items were more highly correlated with their correspondent subscales than with the overall item set (i.e., the mean of the remaining 13 items in the full scale). Item-rest correlation is the correlation between a given item in a subscale and the aggregate of the remaining items in that subscale. Item-to-scale correlation is the correlation between a given item and the remaining items in that overall item set. An item-rest correlation of 0.20 is often considered a minimum acceptable threshold for retaining items in a scale, and has previously been used for item retention in organizational culture instruments [23]. We expected the item-rest correlations to exceed the item-to-scale correlations. Finally, we calculated Cronbach's alpha to test internal consistency of items within a subscale [24]. Cronbach's alpha reflects both the length of a scale and the average correlation among items within a scale. A small Cronbach's alpha may suggest that a scale has too few items or the items do not reliably measure a common construct. An alpha of 0.80 or greater is generally considered an indicator of acceptable scale reliability [25].

Exploratory factor analysis

We conducted exploratory factor analysis to identify emergent factor solutions and determine if the data supported alternative factor solutions. We used principal factor analysis with Promax (oblique) rotation using STATA software (Version 9.2). Principal

factor analysis is generally the preferred method for assessing the underlying structures of data [17]. We used oblique rotation, which allows the factors to correlate [26], because the theory underpinning the CVF model anticipates that factors may be correlated [19]and this was consistent with the observed item-to-scale versus item-rest correlations.

Factors were retained based on three criteria [26]. First, we looked for factors with eigenvalues greater than 1.0. Second, we made a plot of the eigenvalues in descending order to identify the scree, or the point at which the slope of decreasing eigenvalues approaches zero. This indicates the point at which eliminating additional factors would not eliminate significant variance. Third, we retained only factors with two or more items loading at significant levels; we attributed an item to a given factor if the factor loading equalled or exceeded 0.40 [26]. Factors had to meet all three criteria.

Confirmatory factor analysis

We conducted confirmatory factor analysis to test emergent factor solutions from exploratory factor analysis and compare them with the original four-factor solution to determine which provided a better fit for the data. Confirmatory factor analysis was conducted using weighted least squares (WLS) on polychoric correlation and asymptotic covariance matrices. WLS is usually preferred for analyzing ordinal data because it is more efficient in parameter estimation than other methods and it corrects standard errors by incorporating weights that are inversely proportional to the variance at each level of the measurement in model fitting [27, 28].

We evaluated the model fit using multiple fit indices. The Bentler-Bonnett non-normal fit index (NNFI) [22]and the comparative fit index (CFI) [29]are designed to reflect the goodness of fit of a model independent of sample size. The standardized root

mean square residual (SRMR) represents the average absolute value by which observed sample variances and covariances differ from those predicted by the model [30]. Acceptable fit was defined as 0.95 or greater for NNFI and CFI and 0.08 or smaller for SRMR [31]. We also report the Akaike Information Criterion (AIC) which is used to compare models, where smaller values indicate model parsimony [32]. We also report chi-square statistics as an indicator of the overall model fit, with the caveat that the chi-square as a fit index has been criticized for excessive sensitivity in large samples, which may suggest a poor model fit in the absence of true data issues, such as skewness and kurtosis [33]. To provide a metric for the latent constructs, the coefficient of one indicator variable for each of the latent variables was set to 1.0. Based on recommendations by Anderson and West [34], we tested several competing models in which correlations among the latent variables were freely estimated allowing factors to correlate. Analysis was performed using LISREL 8.72 [35].

Results

Distributions for aggregate scores for all four subscales approximated normal. The overall subscale means ranged from 2.75 (entrepreneurial subscale) to 3.42 (hierarchical subscale). The hierarchical and rational subscales were both left skewed. Subscale scores and indicator scores of individual items were approximately equal for the exploratory and confirmatory samples (Table 1). Although bivariate test suggested that scores of several items were statistically significantly different between the two samples, this is likely due to the large sample sizes in this study.

INSERT TABLE 1 ABOUT HERE

To confirm the success of the randomization, we compared the exploratory and confirmatory samples with regard to gender, age, tenure with the VHA, and ethnic and racial background. The samples were virtually identical. Among respondents, 63% were female. Thirty-five percent were between the ages of 50 and 59, and another 33% were between the ages of 40 and 49. Almost 50% of respondents reported being with the VA more than 10 years, and 20% more than 20 years. Sixty-eight percent of respondents self-identified as white, 22% as African American, 5% as Asian, 3% as American Indian / Alaskan and 1% as Hawaiian / Pacific Islander. Across racial groups, 8% percent self identified as Hispanic.

Item Analysis

Item-rest correlations met conventional minimum thresholds of 0.20 for all four subscales, indicating that no individual items had exceptionally poor correlations with their subscales (Table 1). Item-to-scale correlations (i.e., treating all 14 items as a whole) were also greater than 0.20, except for item 2, which was low at 0.19. For the entrepreneurial, team, and rational subscales, the majority of item-to-scale correlations exceeded the item-rest correlations indicating that the subscales had poor divergent properties.

The entrepreneurial, team, and rational subscales met conventional minimum thresholds for Cronbach's alpha statistics of 0.80, while the hierarchical subscale did not (alpha = 0.69). Next to each item in Table 1, we also report what the Cronbach's alpha for the subscale would be if that item was dropped. For example, dropping item 13 from the hierarchical subscale would minimally improve Cronbach's alpha to 0.70. Dropping

any other items from their correspondent subscales would worsen the internal consistency for the subscale.

Overall, item analysis indicated poor convergent/divergent properties for items among the entrepreneurial, team and rational subscales. The item-to-scale correlations generally exceeded the item-rest correlations suggesting they may collectively be accounted for by a common underlying factor. Conversely, the hierarchical subscale had a low Cronbach's alpha indicating mediocre scale reliability. The subscale may include too few items, or items in the subscale may not map onto a single distinct factor. In order to assess the model's overall fit with the data, and to determine if alternative subscales better fit the data, we conducted two sets of factor analyses.

Exploratory factor analysis

Principal factor analysis revealed a two-factor solution (Table 2). All items from the entrepreneurial, team and rational subscales loaded significantly on the first factor and items from the hierarchical subscale loaded higher on the second factor. Item 10 ("The glue that holds my facility together is the emphasis on tasks and goal accomplishment. A production orientation is commonly shared") loaded higher on the first factor (factor loading of 0.48), although it had a borderline factor loading of 0.39 on the second factor. Items 2 and 13 from the hierarchical subscale had high uniqueness, of 0.73 and 0.80, respectively, indicating 73% and 80% of the observed variance in these two items was not attributable to either of the common factors.

INSERT TABLE 2 ABOUT HERE

The items with the highest factor loadings on the first factor were Item 3 ("Managers in my facility are warm and caring. They seek to develop employees' full potential and act as their mentors or guides.") and Item 11 ("My facility emphasizes human resources. High cohesion and morale in the organization are important."), emphasize supporting employees, fulfilling potential and developing high morale. The items with the lowest factor loadings that still loaded significantly on the first factor were Item 14 ("My facility emphasizes competitive actions and achievement. Measurable goals are important."), Item 7 ("The glue that holds my facility together is loyalty and tradition. Commitment to this facility runs high."), and Item 8 ("The glue that holds my facility together is commitment to innovation and development. There is an emphasis on being first."). All of the items loading significantly on the first factor emphasize commitment, competitive achievement and fulfilling potential and seem to appeal to a view of organizations as promoting or facilitating human virtues. We label this first factor *humanistic culture*.

Three of four items from the hierarchical subscale loaded onto the second factor. The exception was item 13 ("My facility emphasizes permanence and stability. Keeping things the same is important."), which loaded primarily on the second factor, but had a modest factor loading of 0.36. The three items loading significantly on the second factor emphasize formal rules, bureaucracy and structure. We labelled this second factor *prescriptive culture*.

Because prior validations of the CVF supported a four-factor solution, we conducted an exploratory factor analysis specifying four factors to be extracted from the data. Results from this analysis did not support a four-factor model. The CVF items were

primarily loaded on 2 of the 4 factors. The factor loadings followed the same pattern presented in Table 2, with slightly lower but salient factor loadings on the correspondent factors. One item each from the other 2 factors has a loading just under 0.35, while the rest of the items have factor loading less than 0.20.

Based on the above results, we examined subscale reliability for humanistic culture and prescriptive culture. Item-rest correlations of humanistic culture items ranged from 0.64 to 0.78, generally exceeding item-rest correlations for CVF subscales and the item-to-scale correlations for 14 items as a whole. The internal consistency of items on the humanistic culture subscale was high, with a Cronbach's alpha of 0.93. Reliability was mediocre for prescriptive culture, comprising the three items from the hierarchical scale, with a Cronbach's alpha of 0.70 and with item-rest correlations ranging from 0.42 to 0.56. The humanistic and prescriptive cultures had a moderate, positive and significant correlation ($r = 0.36$, $p<0.001$).

Confirmatory factor analysis

Based on findings from the exploratory factor analysis, we tested several factor solutions. We started by testing a two-factor solution and comparing it with the conventional four-factor solution to examine which provided a better fit for the data. The four-factor model comprised all 14 items loading onto the factors proposed in the CVF. The two-factor model comprised 13 items with 10 items loading onto humanistic culture and 3 items on prescriptive culture (dropping Item 13 which failed to load significantly on either factor in the EFA). We also tested alternative models of the two-factor solution, first allowing Item 10 to cross-load on both factors and then excluding Item 2, which had

a low reliability. All models had correlated factors. Results of confirmatory factor analysis are summarized in Table 3.

INSERT TABLE 3 ABOUT HERE

Results of fitting the conventional four-factor, 14-item model and the two-factor, 13-item model (suggested by the EFA) indicated that neither met the criteria for a satisfactory model fit (Table 3). The NNFI and CFI were slightly under the conventional cutoff of 0.95 and the SRMR were greater than the cutoff of 0.08. Although each item has a substantial loading on its corresponding factor, the majority of standardized residuals were skewed to the negative side, indicating the models overestimated covariance between items. For both models, the reliability estimate (R^2) of item 2 was low at approximately 0.25, which is consistent with the exploratory factor analysis results, where its variance not accounted for by the factors was high at 0.73. As expected, the chi-square statistics were highly significant likely due to the large sample size.

Three subscales (entrepreneurial, team, and rational) of the four-factor model were correlated at r = 0.97, suggesting nearly perfect collinearity between these subscales. The hierarchical subscale was moderately correlated with the other subscales, ranging from r = 0.62 to r = 0.73, indicating sufficient independence between this and other subscales. For the two-factor model, the subscales were correlated at r = 0.64. The largest modification index was for the path from the prescriptive culture to Item 10. This indicated that we could expect an improvement in model fit by including this path in the

model. This is again consistent with findings from exploratory factor analysis where factor loading of Item 10 was close to 0.40 on the prescriptive culture subscale.

Following these findings, we tested three alternative solutions of the two-factor model: (1) allowing Item 10 to cross-load on both factors, (2) excluding Item 2 from the model, and (3) allowing Item 10 to cross-load on both factors and excluding Item 2 from the model.

The solution from the first alternative model (i.e., allowing Item 10 to cross-load on both subscales) yielded a χ^2 reduction of 1,201 at the cost of one degree of freedom, suggesting a significant improvement in model fit. Goodness-of-fit indices were slightly improved from the initial model. The path from the humanistic culture subscale to Item 10 dropped from 0.86 to 0.62 as that from the prescriptive culture subscale rose from 0.0 to 0.29. The estimated correlation of humanistic and prescriptive culture subscales also dropped slightly from 0.64 to 0.56. Based on the fit indices, the second alternative model (i.e., excluding item 2 from the model alone) made a relatively smaller difference in the confirmatory factor analysis results.

The third alternative model, allowing item 10 to cross-load and dropping item 2, achieved a significant improvement in fit. NNFI and CFI derived from this alternative model were both greater than the cutoff score of 0.95, indicating a reasonably good fit between the hypothesized model and the observed data. AIC for this model was the smallest among the models tested, indicating the most parsimonious representation of the data among the models tested. At the same time, despite the data being fitted very much ad hoc at this point, the SRMR remained high at 0.11 and numerous large negative

residuals were observed in the solution. Both are potentially indicative of model misspecification.

Discussion

We found problems with the convergent / divergent properties of the CVF subscales when applied to a survey of non-supervisory VHA employees. Employees did not appear to distinguish among entrepreneurial, team and rational cultures. Furthermore, the four-item hierarchical subscale had mediocre reliability. These findings could reflect one or more problems with external, internal and construct validity.

External validity

The CVF as a model, or the CVF instrument, may not generalize to the VHA, or to non-managers (or to the combination of both). The CVF was originally validated among managers of non-governmental organizations, whereas we applied it to non-supervisors in VHA, a national, integrated health care delivery system and agency of the federal government.

An important next step in this research will be to conduct measurement equivalence / invariance analysis (ME/I) [36]to compare response equivalence among employees at different supervisory levels to determine whether perceptions of organizational culture are systematically differ among organizational members belonging to various organizational hierarchy levels or subgroups. In addition, measurement equivalence / invariance analysis is needed to compare response equivalence among employees of an organization over time. Time invariance studies are important to determine whether observed differences reflect changes of phenomenon being studied or

changes in the relationships between the factors or constructs and their correspondent items [33].

Internal validity

The instrument used in this study may have contributed to poor internal validity, owing either to measurement problems with the original instrument published by Zammuto and Krakower [20], or to modifications made to the survey used in VHA. Because the Zammuto and Krakower instrument has previously been validated using multi-trait / multi-method analysis [19], we focus here on describing the modifications to the VHA instrument, and why we believe they do not represent significant threats to internal validity.

There were three modifications to the instrument used in VHA. First, the wording of individual items was adapted to fit VHA and it is possible that this altered the instrument's psychometric properties. However, for eight items, wording was unchanged except for the use of "organization" instead of "institution" or "school." In two more items (Items 3 and 4), sentence structures and wording were modified, but the key terms remained the same and the essential meaning appears unchanged. For example, instead of being a "mentor, sage or father / mother figure," managers were "warm and caring, and acted as mentors or guides;" and instead of being an "entrepreneur, an innovator, or a risk-taker," managers were "risk takers" and "encourage employees to take risks and be innovative."

In the remaining four items, item wording was modified and some key terms did not carry over. Modification of these items appears the most significant threat to internal validity. The clearest example is item 6 of the rational subscale, which reads, "Managers

in my facility are coordinators and coaches. They help employees meet the facility's goals and objectives." In the original survey, the equivalent items reads, "The head of institution D is generally considered to be a producer, a technician, or a hard-driver." Thus, in the revised item, the manager is presented in a more supportive light, while the sense of the manager as a task master is lost.

The other three significantly-modified items are all from the hierarchical subscale. Item 5 reads, "Managers in my facility are rule-enforcers. They expect employees to follow established rules, policies, and procedures;" whereas the original item reads, "The head of institution C is generally considered to be a coordinator, an organizer, or an administrator." Item 9 reads "The glue that holds my facility together is formal rules and policies. People feel that following the rules is important," whereas the original item reads, "The glue that holds Institution C together is formal rules and policies. Maintaining a smooth-running institution is important here." Item 13 reads, "My facility emphasizes permanence and stability. Keeping things the same is important", whereas the original item reads, "Institution C emphasizes permanence and stability. Efficient smooth operations are important." In the modified items, the element of coordination and operational efficiency are lost and that of rule adherence and stability is reinforced.

These changes are not inconsequential, and may account for the poor reliability of the hierarchical subscale. This is suggested by the fact that dropping item 13 marginally improved reliability; one can speculate that had a fourth item with better item-rest correlation been included, the hierarchical subscale may have met conventional thresholds of reliability.

Nevertheless, these changes fail to account for the poor convergent / divergent properties of the rational, entrepreneurial and team subscales. Item 6 likely contributed to the poor divergent properties, however, the revised item seems to overlap more with the hierarchical scale ideas of coordination. Furthermore, it does not explain the numerous other cross-scale correlations. In fact, the other two items that form the rational subscale along with item 6 were virtually unaltered from the original instrument but had similar high correlations with items from the entrepreneurial and team subscales. Item 6 alone cannot account for the emergence of the humanistic factor.

The second modification is that the VHA instrument had two fewer items than the original 16-item scale. One item was dropped from each of the team and rational subscales following pilot testing at VHA. It is conceivable though unlikely that shortening the instrument altered its psychometric properties. Adding the two items back would not likely alter the high item-to-scale correlations relative to item-rest correlations among the items for the entrepreneurial, rational and team subscales. Moreover, the alpha statistics for the team and rational subscales (the subscales from which the two items were dropped) were already reasonably high, and improving them further would not change our conclusions. The hierarchical subscale, on the other hand, included four items and had poor reliability.

The third and final difference (not a modification per se) is the way the scales were scored relative to the Zammuto and Krakower instrument. Most research in health services using the CVF [3, 5-9] has, like Zammuto and Krakower [20], used ipsative scales which require respondents to allocate 100 points among four statements, each reflecting one of the hypothesized culture types. Ipsative scales, by their nature, are

correlated. For example, respondents can only rate one culture stronger by rating weaker one or more of the others. This imposition of interdependence among subscales often inflates reliability statistics [37]. It also makes such data unsuitable for correlation-based statistical modeling, such as factor analysis and regression modeling [19]. Our use of data based on normative scales is therefore not a threat to internal validity, but it may help explain why we find lower reliability for the hierarchical subscale relative to past studies using ipsative scales. We note that although most studies have used ipsative scales, the validation by Quinn and Spreitzer [19] used two versions of the instrument, one with ipsative scales and one normative (Likert) scales, and the subsequent validation by Kaliath [15] also used normative scales.

There are also potential threats to internal validity carried over from the original CVF instrument that we briefly note. First, terms such as “bureaucratic” and “innovative” likely carry normative connotations for lay readers that may overwhelm the technical nuances they are intended to elicit. For example, organizational theorists often use "bureaucracy" in reference to Weber's three principles of the bureaucracy (e.g., fixed and official jurisdiction for roles within the organization) [38], whereas bureaucracy is a popular byword for pathological adherence to rules and the arbitrary exercise of administrative power. Second, most of the original CVF items consist of two declarative statements, often addressing clearly different aspects of culture, such as smooth-running operations and adherence to rules. Respondents may react to each statement differently but are obliged to apply a single score. This introduces potential measurement error. Third and finally, items were intentionally organized across four organizational domains or content areas: institutional characteristics, institutional leader, institutional “glue” and

institutional emphases. A major theoretical assumption of the CVF is that organizational culture pervades and unifies the organization across these different domains. Accordingly, there was one item per culture type for each domain. However, it may be that different cultures exist within each of these domains, or that the cultures operate differently in different domains. By using items across different domains to assess a single culture subscale, the instrument may have introduced measurement error.

Construct validity

There may be poor construct validity for three of the four CVF culture types. Factor analysis indicates that what have been previously described as entrepreneurial, rational and team cultures are accounted for by a single common factor. We find a simplified 12-item, two-factor model fits the data marginally better and more parsimoniously than the classic CVF. More importantly, the convergent / divergent properties of the two-factor solution are superior. This modified two-factor model may provide an alternative to the CVF subscales, and to that end we describe what we believe are the defining characteristics of each factor, which we dub prescriptive culture and humanistic culture.

In the three items constituting the prescriptive culture subscale, the facility is "very formalized and structured;" managers are "rule-enforcers;" and employees adhere to "formal rules and policies." Hierarchy defines relationships and rules guide employees' actions. Thus, motivation is extrinsic, deriving from the organization. The prescriptive culture subscale only differs from the hierarchical subscale in the absence of item 13, which refers to "permanence and stability" and "keeping things the same." But this difference is crucial: stability and permanence are values that may be

pursued through formal structures and rules, but neither require nor inherently follow from them.

Humanistic culture appears to encompass more conceptually diverse qualities, from “warm and caring” to “commitment to innovation and development” to “loyalty and tradition.” Nonetheless, the nine items in the subscale share generally positive connotations. They all reflect qualities that one might characterize as human virtues, and which imply that individuals are intrinsically motivated. The organization works to engender loyalty and commitment to innovation, but these values ultimately derive from the individual employees and the survey items suggest impulsion rather than compulsion.

One item, Item 10 from the rational subscale loaded almost equally onto humanistic and prescriptive cultures, but neither at significant levels. It states, “The glue that holds my facility together is the emphasis on tasks and goal accomplishment. A production orientation is commonly shared.” Conceptually, the reference to tasks and goal accomplishment may map more closely to prescriptive culture. The reason for the cross-loading may be lay readers' confusion over the term “production orientation.” Had the item referred only to tasks and goal accomplishment, it may have correlated more highly with the prescriptive culture subscale.

The moderately strong, positive correlation between humanistic and prescriptive cultures suggests that VHA employees do not see cultures of intrinsic and extrinsic motivation as mutually exclusive. In fact this supports a central contention of the original CVF model that the same organization may simultaneously exhibit qualities of fundamentally competing value systems, and that the “best” organizational culture may be one of equilibrium [17]. We find a timely example of this in a recent study of top-

ranked hospitals for acute cardiac care, which simultaneously exhibited a high degree of flexibility (for example, in applying clinical protocols) and a high degree of rigidity (for example, in selecting and pursuing specific performance targets) [39]. Shortell and colleagues also found culture balance related to the number and depth of changes made by teams in chronic care settings [9], and this finding is consistent with Kalliath and colleagues' observed positive correlation between hierarchical and entrepreneurial cultures [15].

Although we chose new labels, the two factors strongly resemble past management theories including Burns and Stalker's "mechanistic" and "organic" organizations [40] and McGregor's "Theory X" and "Theory Y" of management [41]. Mechanistic organizations are said to be characterized by a clear understanding among employees of their performance obligations and what they can expect from the organization in return; clear policies regarding behavior; and an emphasis on chain of command. Organic organizations are characterized by an ethic of diffuse responsibility and decision making such that each employee is expected to do whatever is necessary to get the job done at the time; they rely on shared values and goals to govern behavior rather than specific and extensive rules and instructions. Theory X holds that employees primarily desire stability and security and require supervision to be productive. Theory Y holds that employees who share the organization's goals will be intrinsically motivated to do their best and will actively seek responsibilities. Humanistic and prescriptive cultures may be iterations of these constructs. In fact, a wry article in the lay press recently proclaimed that virtually all management theory boils down to some version of a dualistic "humanistic" versus "mechanistic" view of organizations [42].

Directions for Future Research

Our study raises questions about the validity of a popular instrument based on the CVF when applied to a sample of managers. We identify and describe several explanations our findings. We also describe a two-factor scale solution that emerged as an alternative to the conventional four-factor scale. We dub these two factors humanistic and prescriptive. However, our study is not the final word on the CVF, nor is it a sufficient basis to conclude the two-factor solution is a valid or meaningful alternative. Significant additional research is needed.

The first need is for further analysis of the differences in perception of organizational culture among managers and non-managers. Measurement equivalence / invariance analysis should be conducted to determine how item response varies among supervisory groups, and also how item response varies within organizations over time.

Second, further research is needed on the psychometrics of particular items. We describe potential issues with item wording and structure, deriving both from the original CVF instrument and from changes made to the VHA survey, that may account for some of our findings, notably the poor reliability of the hierarchical subscale. There is also need to explore how experiences with different parts of an organization may influence respondents. For example, perhaps employees perceive different cultures in different workgroups or departments: a physician might perceive their internal medicine service as relatively supportive and entrepreneurial, but their human resources department as relatively rule bound and bureaucratic. If so, it is not clear how respondents answer questions based on the overall organization.

Third and finally, additional research is needed on the emergent two-factor solution both to determine if it is observed in other settings, and whether it is associated

with theoretically relevant organizational processes or outcomes, such as performance measures, in order to establish criterion validity.

Conclusions

The Competing Values Framework has been the most widely used model in health services research to measure organizational culture. It has been offered as an explanation for organizational differences in implementation of quality improvement activities and quality of care. CVF instruments are generally presented as well-validated with reliable, generalizable subscale solutions. They have been frequently fielded among managers under the assumption that the results provide an accurate gauge of culture as experienced by the broader organization.

Overall, this study strikes a note of caution in drawing inferences based on aggregated CVF scales when applied to populations where they have not been validated, such as non-managers. Our findings highlight the challenges management scholars and practitioners face in assessing organizational culture in a reliable and comparable way, and underscore the importance of validating organizational culture instruments in each new context they are used.

Abbreviations

CVF – Competing Values Framework

VHA – Veterans Health Administration

NFI – the Bentler-Bonnett normal fit index

NNFI – the non-normal fit index

CFI – the comparative fit index

SRMR – standardized root mean square residual

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

CDH conceived of the study and framed the research design, carried out the reliability analyses, assisted with the exploratory factor analysis, interpreted findings, and drafted the manuscript. YFL carried out the exploratory and confirmatory factor analyses, interpreted findings and helped draft the manuscript. DCM helped frame the study, assisted with the confirmatory factor analysis, interpreted findings, and helped draft the manuscript. MM helped frame the study, interpret findings and draft the manuscript. AES helped frame the study, advised on statistical analyses, interpreted findings and helped draft the manuscript. All authors read and approved the final manuscript.

Acknowledgements

We wish to thank the US Department of Veterans Affairs, Veterans Health Administration and especially the VHA All Employee Survey Committee for access to its survey data. We also wish to thank Dr. Haili Sun of the Northwest HSR&D Center of Excellence who assisted with initial evaluation of dataset reliability. Dr. Helfrich conducted this research under a postdoctoral fellowship in Health Services Research and Development from the Veterans Health Administration. Drs. Mohr and Meterko were supported by the VA Center for Organizational Leadership and Management Research and Drs. Li and Sales were supported by the VA Northwest HSR&D Center of Excellence. The authors' conclusions are solely their own and do not necessarily represent the views of the VA.

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Figures

Figure 1 - The competing values framework of organizational effectiveness

Adapted from: Kalliath, T. J., A. C. Bluedorn and D. F. Gillespie (1999). "A confirmatory factor analysis of the competing values instrument." Educational and Psychological Measurement 59(1): 143-58.Tables

Tables

Table 1. Sample Means for Culture Items and Item Analysis Statistics for Competing Values Framework Subscales.

	EFA sample (n = 35,848)		CFA sample (n = 35,928)					
	Mean	SD	Mean	SD	p	Item-to-scale correlation†	Item-rest correlation‡	Cronbach's α
Entrepreneurial	**2.75**	**0.91**	**2.76**	**0.91**	**0.07**			**0.85**
1. My facility is a very dynamic and entrepreneurial place. People are willing to stick their necks out and take risks.	2.53	1.08	2.54	1.09	0.24	0.63	0.69	0.80
4. Mangers in my facility are risk-takers. They encourage employees to take risks and be innovative.	2.50	1.08	2.50	1.08	0.70	0.62	0.66	0.81
8. The glue that holds my facility together is commitment to innovation and development. There is an emphasis on being first.	2.90	1.11	2.91	1.11	0.03	0.72	0.69	0.80
12. My facility emphasizes growth and acquiring new resources. Readiness to meet new challenges is important.	3.07	1.12	3.08	1.11	0.02	0.75	0.69	0.80
Hierarchical	**3.42**	**0.74**	**3.42**	**0.74**	**0.25**			**0.69**
2. My facility is a very formalized and structured place. Bureaucratic procedures generally govern what people do.	3.51	1.07	3.51	1.07	0.78	0.19	0.43	0.65
5. Managers in my facility are rule-enforcers. They expect employees to follow established rules, policies, and procedures.	3.67	1.02	3.68	1.01	0.28	0.40	0.52	0.58
9. The glue that holds my facility together is formal rules and policies. People feel that following the rules is important.	3.45	1.02	3.46	1.01	0.31	0.53	0.59	0.54

13. My facility emphasizes permanence and stability. Keeping things the same is important.	3.05	1.02	3.05	1.03	0.34	0.37	0.35	0.70
Group	**2.88**	**1.01**	**2.90**	**1.02**	**0.08**			**0.82**
3. Mangers in my facility are warm and caring. They seek to develop employees' full potential and act as their mentors or guides.	2.81	1.20	2.81	1.20	0.63	0.71	0.69	0.76
7. The glue that holds my facility together is loyalty and tradition. Commitment to this facility runs high.	3.00	1.17	3.02	1.17	0.02	0.65	0.65	0.79
11. My facility emphasizes human resources. High cohesion and morale in the organization are important.	2.84	1.17	2.86	1.17	0.09	0.74	0.71	0.73
Rational	**3.21**	**0.91**	**3.22**	**0.90**	**0.07**			**0.80**
6. Managers in my facility are coordinators and coaches. They help employees meet the facility's goals and objectives.	3.08	1.14	3.09	1.13	0.59	0.76	0.63	0.73
10. The glue that holds my facility together is the emphasis on tasks and goal accomplishment. A production orientation is commonly shared.	3.33	1.02	3.34	1.01	0.03	0.69	0.63	0.73
14. My facility emphasizes competitive actions and achievement. Measurable goals are important.	3.23	1.07	3.24	1.06	0.04	0.70	0.65	0.71

† We use item-to-scale correlation to indicate the correlation of the item to the sum of all other items in the scale as a whole.

‡ We use item-rest correlation to indicate the correlation of the item to the sum of the rest of the items in that subscale.

Bolded items are statistics for the overall subscale; non-bolded are for the individual item. Cronbach's α for the individual items indicates what the α statistic for that subscale would be were the item in question removed.

Table 2: Factor Loadings from Principal Axis Analysis with Promax Rotation (n = 35,848)

	Factor 1	Factor 2	Uniqueness[†]
Entrepreneurial			
1. My facility is a very dynamic and entrepreneurial place. People are willing to stick their necks out and take risks.	**0.77**	-0.11	0.47
4. Mangers in my facility are risk-takers. They encourage employees to take risks and be innovative.	**0.79**	-0.15	0.46
8. The glue that holds my facility together is commitment to innovation and development. There is an emphasis on being first.	**0.75**	0.06	0.39
12. My facility emphasizes growth and acquiring new resources. Readiness to meet new challenges is important.	**0.78**	0.06	0.34
Hierarchical			
2. My facility is a very formalized and structured place. Bureaucratic procedures generally govern what people do.	-0.19	**0.58**	0.73
5. Managers in my facility are rule-enforcers. They expect employees to follow established rules, policies, and procedures.	-0.01	**0.66**	0.57
9. The glue that holds my facility together is formal rules and policies. People feel that following the rules is important.	0.08	**0.72**	0.43
13. My facility emphasizes permanence and stability. Keeping things the same is important.	0.15	0.36	0.80
Group			
3. Mangers in my facility are warm and caring. They seek to develop employees' full potential and act as their mentors or guides.	**0.82**	-0.05	0.36
7. The glue that holds my facility together is loyalty and tradition. Commitment to this facility runs high.	**0.68**	0.14	0.44
11. My facility emphasizes human resources. High cohesion and morale in the organization are important.	**0.81**	0.01	0.34
Rational			
6. Managers in my facility are coordinators and coaches. They help employees meet the facility's goals and objectives.	**0.77**	0.08	0.35
10. The glue that holds my facility together is the emphasis on tasks and goal accomplishment. A production orientation is commonly shared.	**0.48**	0.39	0.46
14. My facility emphasizes competitive actions and achievement. Measurable goals are important.	**0.61**	0.21	0.46

Note: Factor loadings in bold exceed the conventional threshold of 0.40 for attributing variables to a given factor.

[†] Uniqueness indicates the proportion of variance unaccounted for by the factors

Table 3. Fit Statistics for the Four-Factor and Two-Factor Models (n = 35,928)

	χ^2	df	χ^2/df	NNFI	CFI	SRMR	AIC
Four factor model							
14 items	10346	71	145.72	0.93	0.94	0.140	10414.00
Two factor model							
13 item, no cross-load	9950	64	155.47	0.93	0.94	0.150	10003.89
13 items, item 10 cross-loaded	8749	63	138.86	0.94	0.95	0.120	8803.67
12 items, no cross-load, item 2 dropped for low reliability	8351	53	157.57	0.94	0.95	0.130	8401.41
12 items, item 10 cross-loaded, item 2 dropped for low reliability	7057	52	135.71	0.95	0.96	0.110	7109.47

Note: NNFI: Non-Normed Fit Index; CFI: Comparative Fit Index; SRMR: Standardized RMR; AIC: Akaike's Information Criterion.
All models used correlated factors.

Additional files

Additional file 1 – Item wording from Original Competing Values Framework instrument
Source: Zammuto, R. F. and J. Y. Krakower (1991). Quantitative and qualitative studies of organizational culture. Research in organizational change and development. R. W. Woodman and W. A. Pasmore. Greenwich, CT, JAI Press. **5**.

Additional file 2 – Item wording from adapted Competing Values Framework instrument used by the Veterans Health Administration
Source: 2004 VH All Employee Survey. The complete All Employee Survey is available at: http://www.colmr.research.med.va.gov/resources/org_surveys/employee_survey.cfm

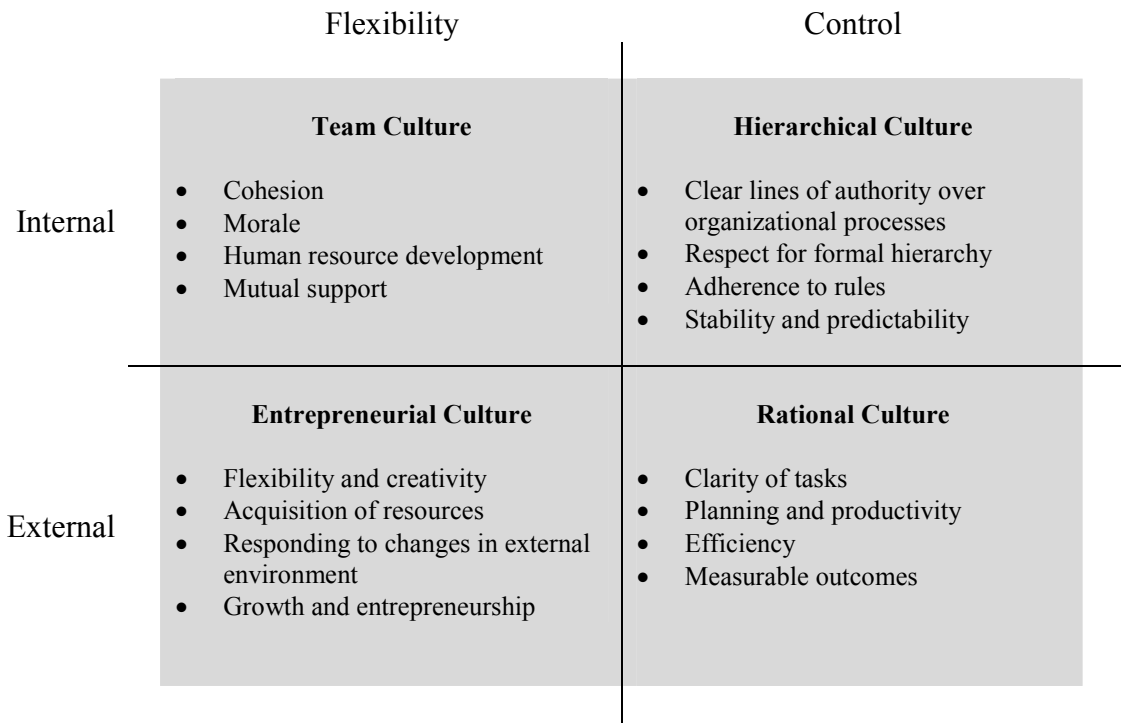
Flexibility
Control
Internal
External
Team Culture
Cohesion
Morale
Human resource development
Mutual support
Hierarchical Culture
Clear lines of authority over organizational processes
Respect for formal hierarchy
Adherence to rules
Stability and predictability
Entrepreneurial Culture
Flexibility and creativity
Acquisition of resources
Responding to changes in external environment
Growth and entrepreneurship
Rational Culture
Clarity of tasks
Planning and productivity
Efficiency
Measurable outcomes

Figure 1

Additional files provided with this submission:

Additional file 1: Original_CVF_items.pdf, 92K
http://www.implementationscience.com/imedia/3573434621077852/supp1.pdf
Additional file 2: CVF_items_adapted_by_VHA.pdf, 15K
http://www.implementationscience.com/imedia/1188366270107785/supp2.pdf