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The Association of Organizational Readiness with Lung Cancer Screening Utilization

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Abstract

Introduction: Lung cancer screening with low-dose computed tomography (LDCT) is widely underutilized. Organizational factors, such as readiness for change and belief in the value of change (change valence), may contribute to underutilization. The aim of this study was to evaluate the association between healthcare organizations' preparedness and lung cancer screening utilization.

Methods: Investigators cross-sectionally surveyed radiology and primary care clinicians, staff and leaders at 10 Veterans Affairs medical centers from November 2018-February 2021 to assess organizational readiness to implement change (ORIC). In 2022, investigators used simple and multivariable linear regression to evaluate the associations between facility-level ORIC and change valence with lung cancer screening utilization. ORIC and change valence were calculated from individual surveys. The primary outcome was the proportion of eligible Veterans screened using LDCT. Secondary analyses assessed scores by healthcare role.

Results: The overall response rate was 27.4% (n=1,049) with 956 complete surveys analyzed: median age 49, 70.3% female, 67.6% white, 34.6% clinicians, 61.1% staff, and 4.3% leaders. For each 1-point increase in median ORIC and change valence there was an associated 8.4-percentage-point (95% CI 0.2, 16.6) and 6.3-percentage-point increase in LDCT utilization (95% CI −3.9, 16.5), respectively. Higher clinician and staff median scores were associated with increased LDCT utilization while leader scores were associated with decreased utilization after adjusting for other roles.

Conclusions: Healthcare organizations with higher readiness and change valence utilized more lung cancer screening. These results are hypothesis-generating. Future interventions to increase organizations' preparedness, especially among clinicians and staff, may increase lung cancer screening utilization.

Introduction

Lung cancer screening with low-dose computed tomography (LDCT) is recommended by the United States Preventive Services Task Force (USPSTF).[1–4] Yet, less than 20% of the eligible United States (US) population received screening in 2021.[5–8] Several organization-level factors may contribute to this suboptimal utilization, such as size, location, patient population characteristics, academic affiliations, and organizational structure.[9] Understanding organizational readiness for change can allow implementation tailored to local structures and factors.[10] Assessing readiness is valuable because it also highlights existing attitudes and perceptions to increase the chance of successful implementation.[11]

Organizational readiness for change is commonly measured[12] and is described by Weiner as "organizational members' shared resolve to implement a change (change commitment) and shared belief in their collective capability to do so (change efficacy)."[13] Change valence refers to organizational members' belief that pursuing change is beneficial and valuable to the organization.[13] Change valence is thought to precede organizational readiness for change. These concepts reflect healthcare systems' preparedness and openness to changes in practices, policies and programs and may relate to clinical actions, such as the delivery of lung cancer screening.

Previous studies have evaluated organizational readiness for change and change valence with regard to lung cancer screening. A previous study assessed organizational readiness for change and change valence in lung cancer screening implementation at a single VA medical center (VAMC) and found organizational readiness to be lower among primary care clinicians than radiology clinicians.[14] The study found that change valence was higher among leaders compared to non-leaders and that organizational readiness did not vary by healthcare role (leaders, clinicians, or staff).[14] A separate evaluation by Tukey et al. described variability in organizational readiness among pulmonologists.[15] While these studies demonstrated that organizational readiness and change valence vary across professional specialties and hierarchical levels respectively, it remains unclear whether organizational readiness impacts implementation of evidence-based practices at the point of care. Investigators hypothesized that higher levels of healthcare systems' organizational

readiness and change valence would be associated with higher levels of lung cancer screening utilization.

Methods

Study Population

This study cross-sectionally surveyed radiology and primary care clinicians, staff, and leaders at 10 VAMCs during 12-week windows from November 2018 to February 2021. The selected sites volunteered to participate in the Veteran Affairs Partnership to increase Access to Lung Screening (VA-PALS) national program (Atlanta, Cleveland, Chicago-Hines, Denver, Indianapolis, Milwaukee, Nashville, Philadelphia, Phoenix, St. Louis).[16] Sites joined VA-PALS at different points in time, and each program's stage of implementation varied based on local processes and contextual factors (leadership, resources, personnel, etc.) (Appendix Table 1).[16] At the time of the survey, one site had not hired a navigator while most were in the first two years of implementing lung cancer screening programs.[14] Potential study participants were identified from administrative lists and email listservs. Clinical outcome data were obtained from the Veterans Health Administration (VHA) administrative database and reflect patient care captured in the electronic medical record.

Measures

The study team emailed participants an anonymous questionnaire through Veterans Affairs Research Electronic Data Capture (VA REDCap). Non-respondents and participants with partial responses received weekly reminders. Surveys without complete readiness or change valence scales or from participants who reported being at a different VAMC than expected were excluded from analyses. All survey participants received organizational readiness and change valence items (Appendix Table 2); self-identified clinical providers were also asked about preferences for lung cancer screening implementation.

Local facility leaders sent out monthly reminders about the study. The single site, pilot study raffled 20 ($50) gift cards to encourage participation. Following the pilot, the three sites with the highest response were recognized with lunch for their work unit.

For independent variables, investigators measured organizational readiness using Shea's validated Organizational Readiness for Implementing Change (ORIC) scale and Shea's change valence scale.[12,14] The ORIC scale contains 9 items in two sub-scales: change commitment (4 items) and change efficacy (5 items). Change commitment reflects the organizational desire to support a particular course of action. Change efficacy reflects the organizational members' belief in the ability to engage in those actions necessary to implement a change. Shea's change valence scale contains 10 items reflecting organizational members' belief that pursuing change is beneficial and valuable to the organization.[13] Items were slightly adapted to reflect lung cancer screening (Appendix Table 2). Answer choices were on a 7-point Likert-type scale ranging from strongly disagree (1) to strongly agree (7). Median ORIC score, ORIC subscale scores, and change valence score were calculated for each participant for whom all items in that scale or subscale were complete. Higher ORIC scores indicated higher readiness for change (including subscales of commitment and

efficacy). Higher change valence scores indicated higher perceived value of change.[12] For each scale, investigators calculated median facility-level scores overall and by healthcare role.

The primary outcome was the rate of lung cancer screening utilization per 100 estimated eligible Veterans calculated for each site. This study used the VHA Corporate Data Warehouse and Observational Medical Outcomes Partnership (OMOP) dataset that contains information from Veterans' electronic health records (EHR) and claims. For the numerator, investigators obtained counts of LDCTs performed using CPT codes G0297, 71250, and 71271 during the survey time frame plus the 6 weeks before and after the survey window at each site, for a total of 24 weeks. To ensure the study captured LDCTs, investigators included exams with descriptions of "low-dose," "lung cancer screening," "VCAR," or "LDCT" (Appendix Table 3) and ensured that all sites were included in this definition. Volume computed algorithm (VCAR) is a radiology software used to analyze screening LDCTs for three-dimensional volumetric assessment as a reliable approach for non-calcified lung nodules.

To estimate the denominator, investigators obtained counts by year of unique Veterans seen at each site between the ages of 55 to 80 (based on 2013 USPSTF criteria[17]). Investigators estimated counts across the 24 weeks and multiplied these by 32%, the national proportion of age-eligible Veterans who met the 2013 USPSTF smoking history criteria in the VHA's Clinical Lung Cancer Screening Demonstration Project.[18]

For healthcare role, respondents could check as many as applied from a list of 17 healthcare roles. Investigators created a 3-level categorical healthcare role variable with values of leader, clinician, and staff. Leaders were those who self-reported as "Administrative - Executive Leader, Division Chief, Section Chief" or "Administrative - Clinical Informatics, Decision Support System." Clinicians were those who did not report a leadership role and who self-reported a role with clinical decision-making abilities (physicians, physician assistants, advanced practice registered nurses (APRNs), psychologists, social workers). Staff were defined as those who did not report a leadership or clinician role and who self-reported as clinic schedulers, other clerical or administrative employees, nurses other than APRNs, nursing assistants, diagnostic imaging technicians, or other direct patient care providers.

Statistical Analysis

The primary analysis evaluated the relationship between a facility's ORIC or change valence score and proportion screened for lung cancer. Investigators used simple linear regression with facility-level median ORIC or change valence score as the predictor and facility-level screening rate (proportion of eligible Veterans screened) as the outcome.

In secondary analyses, investigators assessed the relationship between median ORIC or change valence score by healthcare role and facility-level screening utilization rate. Each secondary analysis was identical to the primary analysis, except that the predictor of interest was the facility-level median ORIC or change valence score for a single healthcare role. To account for all three healthcare roles at once, a final analysis used a single multivariable

linear regression including each of the three (staff, clinician, leader) healthcare-role-median ORIC or change valence scores. Due to the limited number of degrees of freedom, investigators did not adjust for facility-level covariates.

Investigators repeated primary and secondary analyses with change efficacy ORIC subscale score and change commitment ORIC subscale score. Because outcome data were available only at the facility level, mixed-effects models and other hierarchical approaches would not have been appropriate; all analyses were conducted using summary datasets with one row per site. To make sure that analyses were robust to uncertainty in the estimation of the site-level median scores, investigators conducted sensitivity analyses in which all analyses were bootstrapped, from median score estimation through regression analysis using a nonparametric bootstrap with 10,000 resamples. A Methods Appendix provides further details on model specifications. Analyses were conducted with R statistical software version 4.0.5 in 2022.[19]

VA Central IRB and the VA Tennessee Valley Healthcare System's Research and Development Committee approved the study with a waiver of informed consent.

Results

There were 3,822 individuals from 10 VAMCs who were invited to participate, of whom 1,049 returned surveys. The overall response rate was 27.4% (individual site range 13.9% −53.7%). After excluding responses with incomplete organizational readiness or change valence scales (n=74) and responses from those who reported working at a VAMC other than the one expected (n=19), 956 surveys were included in the final analytic sample (Table 1). Comparison of available characteristics of respondents and individuals invited is in Appendix Table 4.

Respondents had a median age of 49 years (interquartile range 40, 56). Of the respondents who reported race, ethnicity, and gender, most self-identified as non-Hispanic or Latino (95.4%), White (67.6%), and female (70.3%). Clinical division included 64.4% primary care and 26% radiology. Respondents' healthcare roles were classified as: 4.3% leader, 34.6% clinician, and 61.1% staff.

Median overall ORIC scores ranged from 4.9 to 6.0 (Figure 1). Median change commitment and change efficacy scores ranged from 4.6 to 6.0 and from 5.0 to 6.0, respectively. Median change valence scores varied from 4.9 to 6.0. The median number of unique Veterans eligible for lung cancer screening during the study time period across all VAMCs was 6,890 (IQR 4,849, 9,139). The median lung cancer screening utilization rate in the 10 VAMCs was 8.9% (6.0%, 13.4%), with the lowest rate 4.7% and the highest 21%.

Simple linear regression found an association between facility-level median ORIC score and lung cancer screening utilization using LDCT. For every 1-point increase in median ORIC score, there was an 8.4-percentage-point increase in screening utilization (95% CI 0.2, 16.6). One-point increases in median change commitment and change efficacy scores were associated with a 7.0-percentage-point increase (95% CI 2.0, 11.9) and 8.7-percentage-point-increase in screening utilization (95% CI 3.2, 14.2), respectively (Figures 2 and 3).

Every 1-point increase in change valence score was associated with a 6.3-percentage-point increase in screening utilization, with a wide confidence interval (95% CI, −3.9, 16.5).

A 1-point increase in median leader ORIC score was associated with a slight percentage-point decrease in screening rates (−2.1; −6.5, 2.2). However, a 1-point increase in median clinician or staff ORIC score was associated with increased screening utilization, 5.4 (−0.3, 11.1) and 11.7 (0.8, 22.6) percentage points, respectively. Results for all three healthcare roles were similar after adjusting for median ORIC scores from the other roles. Results for the commitment and efficacy subscales followed a similar pattern. A 1-point increase in median change valence score for leaders was associated with a decrease in screening utilization (−4.3; −7.8, −0.8). For median clinician and staff change valence score, screening utilization increases were 5.6 (0.2, 11.0) and 7.3 (−0.4, 15.1) (Figure 3).

Results from the bootstrapped sensitivity analyses were similar in magnitude and direction to the results from the main analysis.

Discussion

This study found higher levels of organizational readiness for change were associated with increased lung cancer screening utilization rates. This study is among the first to demonstrate a relationship between an organization's preparedness and lung cancer screening implementation. These findings support Weiner's theoretical model of organizational readiness that emphasizes the importance of change and change valence to implementing complex health interventions. The study findings also point to the value of understanding particular facilitators and barriers for a given site such that implementation can be more precisely tailored and more likely to be successful.

A prior study assessed the relationship between baseline Organizational Readiness for Change Assessment (ORCA) and future implementation of hepatitis prevention services among nine substance use disorder clinics in VHA. ORCA is a 77-item instrument based on the Promoting Action on Research Implementation in Health Services framework and developed and validated in VHA to be used prior to implementation efforts.[20] After baseline ORCA measurement, each clinic received training in hepatitis preventive services. Services were measured at one, three and six months post training by surveying clinic directors, and clinics were divided into "high" and "low" implementation teams. High implementation teams' ORCA scores were associated with higher scores in the patient experience and leadership culture subscales. Another study measured Medical Organizational Readiness for Change in an emergency department and three community health programs to assess implementation of screening, brief intervention and referral to alcohol and drug use treatment. Investigators found variability in survey responses among clinical and administrative staff and used these data to focus implementation efforts in areas where sites scored low.[21] It is clear that readiness for change can inform clinical implementation. The present study adds to this body of literature by using a brief 19-item measure of organizational readiness that has been validated for lung cancer screening in VHA[14] and associating readiness with clinical implementation using VHA's administrative databases.

It is unclear why some sites had higher readiness than others. All VAMCs were motivated to start lung cancer programs but not all lung cancer screening programs were at the same implementation stage at the time of survey deployment.[16] It may have been that differences in communication in workflow, benefits of screening or launch of a new program was more effective at some sites versus others. Differences could have been related to structural reasons, such as regular huddles, meetings, or ongoing quality improvement. This underscores the importance of ongoing qualitative work to understand the specific barriers and facilitators of lung cancer screening at each site as well as exploring additional relationships between contextual factors (navigator start date, time delays in care, program model type, etc.) and clinical outcomes.

Contrary to prior work on organizational change that emphasizes the outsize importance of leader commitment or executive champions,[22] this study found that the change readiness of clinicians and staff (rather than leaders) was associated with higher utilization of lung cancer screening. This finding suggests the importance of staff and clinician readiness for change and their belief in its value for successful implementation of change/adoption of evidence-based programs, policies, or practices. This work points to the need for research on when and how leader readiness for change matters as well as the relationship between leader and clinician/staff readiness for change. Middle managers also play an important role in implementation of evidence-based practices and understanding their organizational readiness as it relates to clinical outcomes is an area deserving of future exploration.[23]

Implementing new evidence-based clinical practices is challenging. Thoroughly assessing readiness for change can help identify challenges to implementation and point to interventions more carefully attuned to the strengths and barriers at each site.[21] The study findings suggest that future efforts should focus on assessing and increasing organizational readiness for change in lung cancer screening. Involving broad-based participation in change efforts can result in success.[24] This could involve the use of quality improvement initiatives, champions at various workflow levels or communication of screening benefits from Veterans to staff and clinicians.[25] Regular communication of relative performance among sites and facilitating sharing of best practices may further spur greater lung cancer screening.[26] Additionally, reducing fear associated with change can help increase readiness for it, as such, cultivating psychological safety - the belief that a workplace is safe for taking an interpersonal risk[27] can enhance readiness for change.[28] Specific leader behaviors like being more inclusive[29] through words and deeds that invite and appreciate others' contributions have been shown to create higher levels of psychological safety and increase learning and change oriented behaviors and projects. Relatedly, a randomized trial of increasing individualized meetings between manager and employees and focusing on employee needs and aspirations during those meetings increased psychological safety.[30]

Limitations

This study has limitations. As with all survey research, non-response and social desirability biases may have influenced the results. The survey response rate was low (27%), and the respondents may not be fully representative of the population that influences organizational change. This may be of concern at a single facility where a different incentive procedure was

used to encourage participation. Screening exam misclassification may have occurred. This was minimized by using exams with phrases “low-dose CT,” or “lung cancer screening,” or “LCS,” and ensuring that each VA-PALS site was included in the primary outcome definition. Furthermore, investigators do not expect exam misclassification to be differential because the same definition was used for all sites. Because smoking history is not accurately captured in the medical records, the denominator in the screening rates represents an estimate of the eligible population. Denominator calculations are specific to the Veteran population and take into account pack-years and years since quitting, criteria needed to assess lung cancer screening eligibility. The cross-sectional nature of this study is another limitation; as readiness and screening utilization were measured concurrently, this study is unable to draw causal conclusions. Because the survey was anonymous, linkage to individual provider-level screening rates was impossible, and the outcome was measured at the facility level, prohibiting use of multi-level models; the size of the sample precluded adjustment for potential confounders. In future research, investigators hope to link and expand the number of sites to address these issues. Finally, while this study included multiple medical centers, it was conducted within VHA and may not be generalizable to other healthcare systems.

Conclusions

This study found that higher levels of organizational readiness were associated with higher rates of lung cancer screening utilization. This finding is consistent with prior theory that higher levels of organizational readiness for change lead to more effective and comprehensive implementation of new practices. Furthermore, this study found that higher levels of organizational readiness among clinicians and staff were positively associated with utilization, but that leaders’ levels of organizational readiness were negatively associated with utilization. These results are hypothesis-generating and suggest that interventions, especially at the clinician and staff levels, may translate into improved implementation of lung cancer screening.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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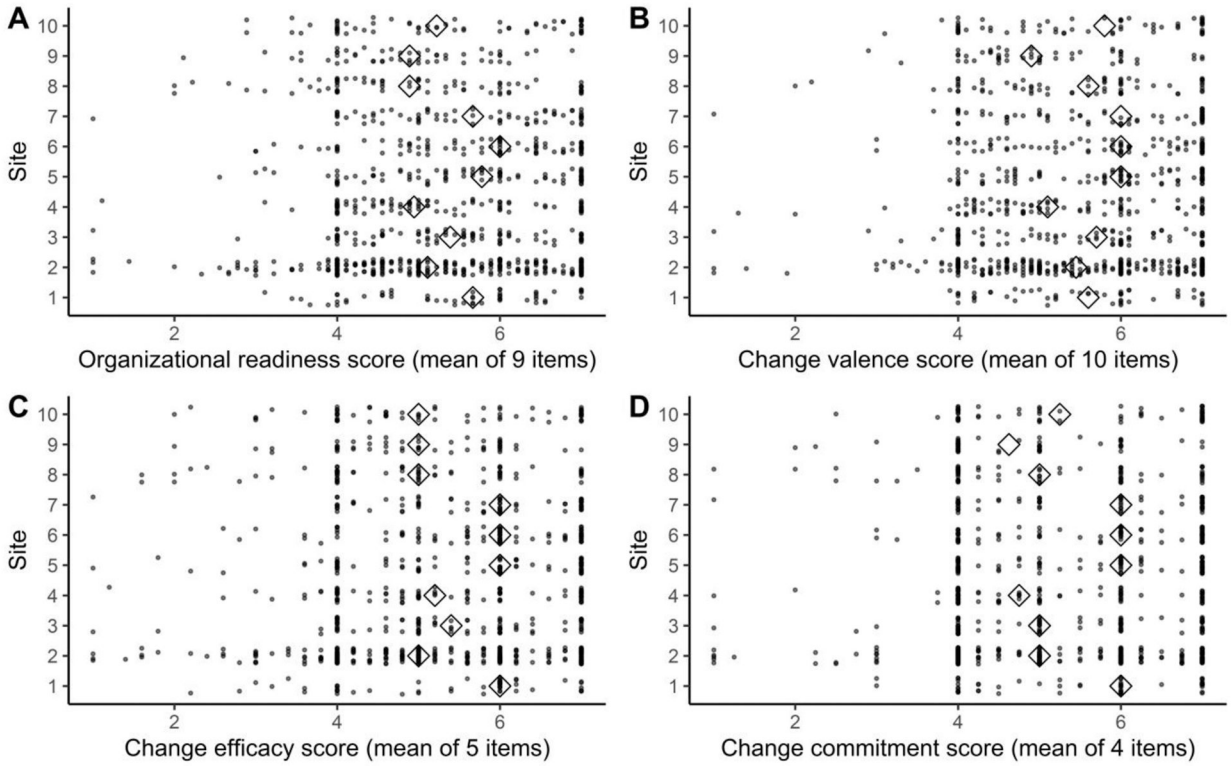

Figure 1: Organizational Readiness by Facility[a]

a. Overall ORIC Score

b. Change Valence Score

c. Change Efficacy Score

E;d. Change Commitment Score

a. Black dots represent individual scores, and blue diamonds represent medians. Organizational readiness for implementing change (ORIC) includes two subscales: change commitment and change efficacy.

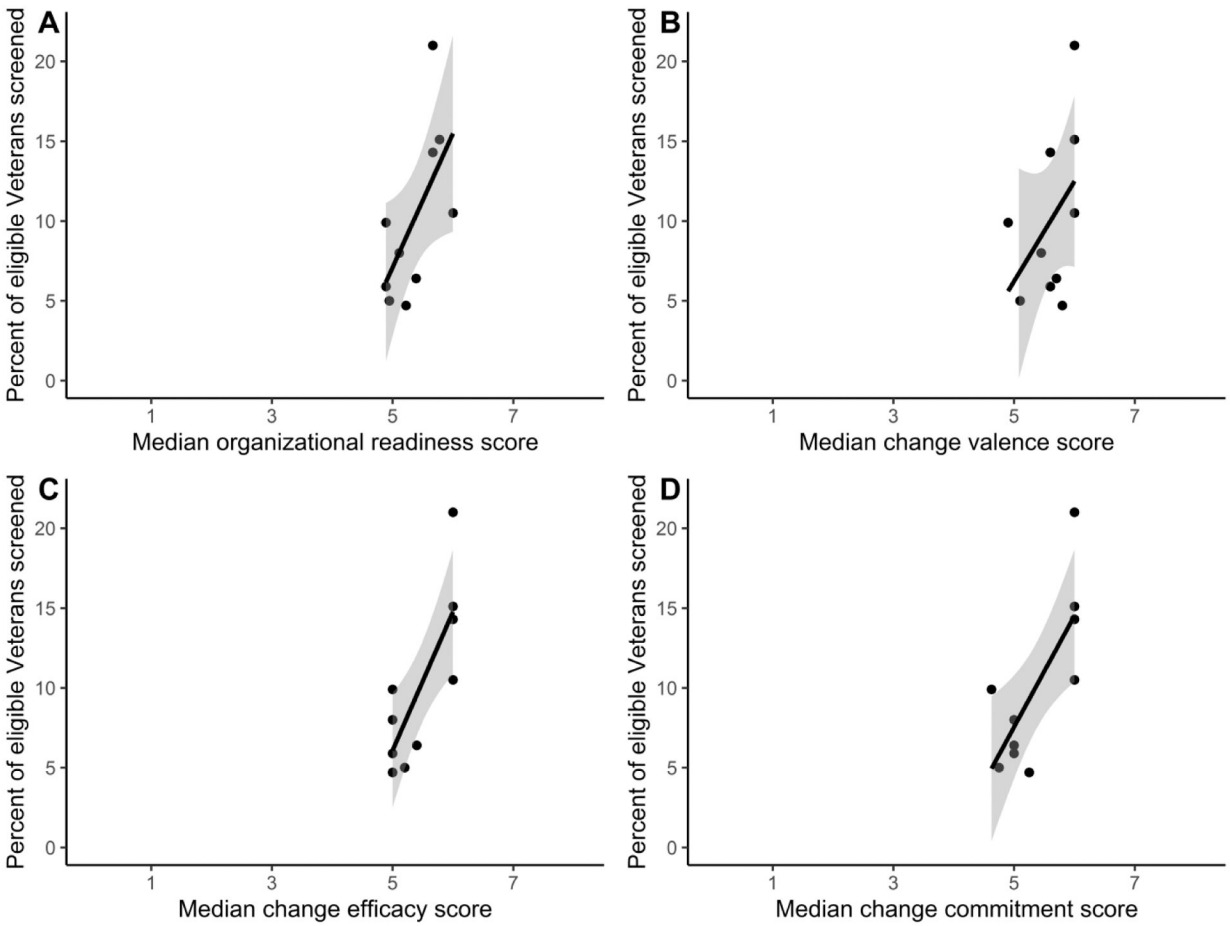

Figure 2: Association of Facility-Level Median Organizational Readiness with Lung Cancer Screening Utilization[a]

a. Overall ORIC Score

b. Change Valence Score

c. Change Efficacy Score

d. Change Commitment Score

a. Black dots represent facility-level medians. Blue lines and grey ribbons show ordinary least squares regression lines with 95% confidence intervals. Organizational readiness for implementing change includes two subscales: change commitment and change efficacy.

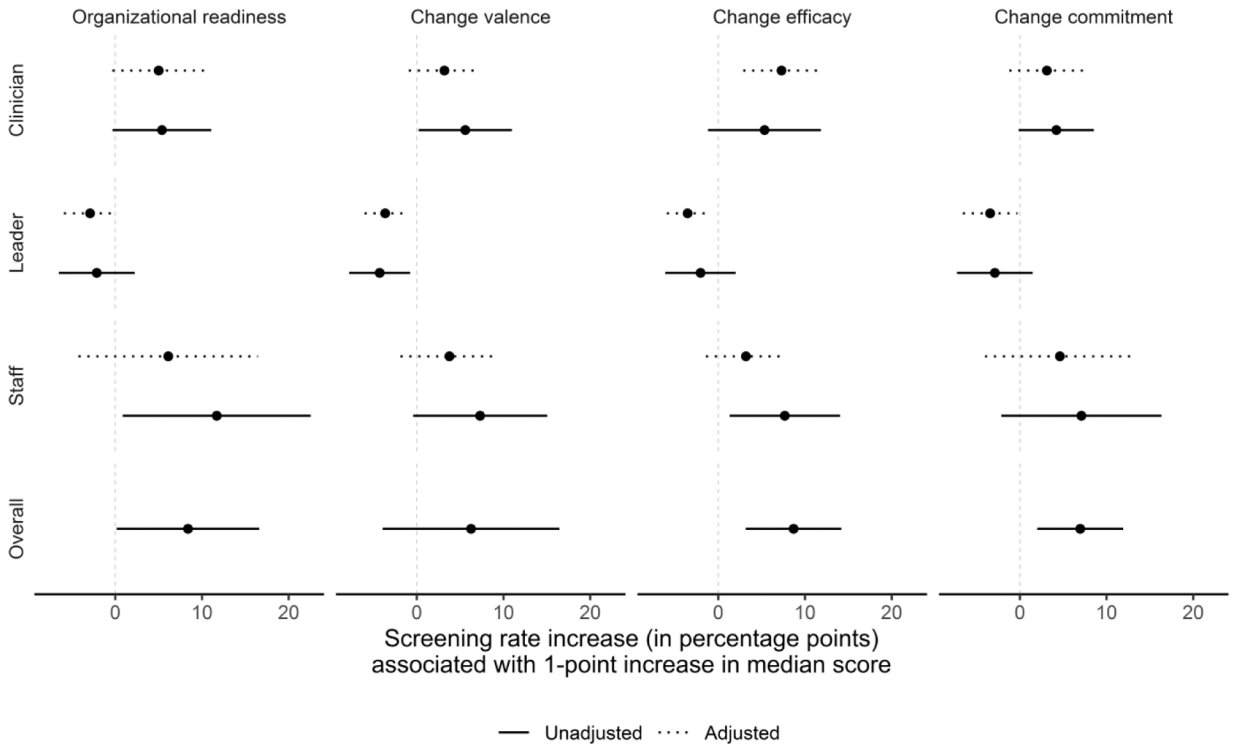

Figure 3: Association of Organizational Readiness with Lung Cancer Screening Utilization by Healthcare Role

Points with lines show coefficient estimates with 95% confidence intervals for the indicated group (Clinician, Leader, Staff, Overall) from the indicated regression model (unadjusted or adjusted) for the score type indicated at the top of the column. For each score type, the unadjusted models have a single predictor variable (clinician, leader, staff, or overall site-level median score) and the adjusted model has three predictor variables (clinician, leader, and staff site-level median scores).

Table 1:

Survey Sample Characteristics

Survey sample consisted of radiology and primary care employees 2018–2021

Respondent Characteristics	TOTAL	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10
N, invited	3,822	224	525	353	390	378	254	394	606	291	407
N, analyzed	956	54	270	90	93	94	87	72	74	53	69
Age, median (IQR)	49.0(40.0 , 56.0)	48.5(37, 55)	4.08(38, 56)	51.0(41, 56)	52.0(44, 57)	50.0(40, 57)	47.0(36. 5, 56)	47.5(40. 8, 56)	51.0(44. 2, 57)	52.0(44 , 56)	50.0(43 , 59.2)
Age missing, n (%)	4(0.4)	0	1(0.4)	1(1.1)	0	1(1.1)	0	0	0	0	1(1.4)
Ethnicity, n (%)											
Hispanic or Latino	30(3.1)	1(1.9)	0	7(7.8)	1(1.1)	3(3.2)	2(2.3)	6(8.3)	3(4.1)	2(3.8)	5(7.2)
Not Hispanic or Latino	625(65.4)	52(96.3)	0	81(90.0)	85(91.4)	87(92.6)	79(90.8)	62(86.1)	69(93.2)	48(90.6)	62(89.9)
Missing	301(31.5)	1(1.9)	270(100.0)	2(2.2)	7(7.5)	4(4.3)	6(6.9)	4(5.6)	2(2.7)	3(5.7)	2(2.9)
Race, n (%)											
American Indian or Alaska Native	4(0.4)	2(3.7)	0	0	0	0	0	0	0	1(19)	1(14)
Asian	52(5.4)	1(1.9)	0	9(10.0)	7(7.5)	1(1.1)	4(4.6)	12(16.7)	9(12.2)	4(7.5)	5(7.2)
Black or African American	109(11.4)	5(9.3)	0	16(17.8)	10(10.8)	15(16.0)	8(9.2)	7(9.7)	39(52.7)	4(7.5)	5(7.2)
White	443(46.3)	43(79.6)	0	53(58.9)	66(71.0)	67(71.3)	65(74.7)	44(61.1)	19(25.7)	38(71.7)	48(69.6)
Other	47(4.9)	2(3.7)	0	10(11.1)	3(3.2)	7(7.4)	4(4.6)	5(6.9)	5(6.8)	3(5.7)	8(11.6)
Missing	301(31.5)	1(19)	270(100.0)	2(2.2)	7(7.5)	4(4.3)	6(6.9)	4(5.6)	2(2.7)	3(5.7)	2(2.9)
Gender, n (%)											
Male	279(29.2)	16(29.6)	72(26.7)	31(34.4)	27(29.0)	26(27.7)	18(20.7)	23(31.9)	15(20.3)	17(32.1)	34(49.3)
Female	660(69.0)	37(68.5)	193(71.5)	59(65.6)	63(67.7)	67(71.3)	66(75.9)	47(65.3)	59(79.7)	35(66.0)	34(49.3)
Other/answer declined	17(1.8)	1(1.9)	5(1.9)	0	3(3.2)	1(1.1)	3(3.4)	2(2.8)	0	1(1.9)	1(1.4)
Clinical practice, n (%)											
Primary Care	616(64.4)	39(72.2)	171(63.3)	69(76.7)	71(76.3)	60(63.8)	50(57.5)	37(51.4)	48(64.9)	36(67.9)	35(50.7)
Radiology	249(26.0)	14(25.9)	71(26.3)	14(15.6)	9(9.7)	24(25.5)	35(40.2)	24(33.3)	15(20.3)	17(32.1)	26(37.7)
No clinical care	91(9.5)	1(1.9)	28(10.4)	7(7.8)	13(14.0)	10(10.6)	2(2.3)	11(15.3)	11(14.9)	0	8(11.6)
Practice Setting, n (%)											
Hospital-based	488(51.0)	39(72.2)	117(43.3)	59(65.6)	32(34.4)	46(48.9)	66(75.9)	45(62.5)	28(37.8)	20(37.7)	36(52.2)
Community-based	468(49.0)	15(27.8)	153(56.7)	31(34.4)	61(65.6)	48(51.1)	21(24.1)	27(37.5)	46(62.2)	33(62.3)	33(47.8)
Position, n (%)											
Clinician	331(34.6)	30(55.6)	65(24.1)	33(36.7)	47(50.5)	32(34.0)	27(31.0)	21(29.2)	23(31.1)	27(50.9)	26(37.7)

Respondent Characteristics	TOTAL	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10
Staff	584(61.1)	23(42.6)	193(71.5)	53(58.9)	42(45.2)	54(57.4)	58(66.7)	49(68.1)	47(63.5)	25(47.2)	40(58.0)
Leader	41(4.3)	1(1.9)	12(4.4)	4(4.4)	4(4.3)	8(8.5)	2(2.3)	2(2.8)	4(5.4)	1(1.9)	3(4.3)