



# Resident Vitality in 34 Programs at 14 Academic Health Systems: Insights for Educating Physicians and Surgeons for the Future

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**OBJECTIVE:** To clarify our understanding of how the culture of residency training influences the well-being of residents, this study reports on the vitality of residents at 34 programs across the United States and identifies characteristics of the programs, institutions and residents that are associated with high resident vitality.

**DESIGN:** In 2014 to 2015, residents nationally were surveyed using the validated C - Change Resident Survey. The survey assessed residents' vitality and 12 other dimensions that characterize residents' perspectives of the culture of the residency training programs: Self-efficacy, Institutional/program support, Relationships/inclusion/trust, Values alignment, Ethical/moral distress, Respect, Leadership aspirations, Mentoring, Work-life integration, Gender equity, Racial/ethnic minority equity, and self-assessed Competencies. Multilevel models were used to assess vitality within and across programs, and examine predictors including resident, program, and institution characteristics.

**PARTICIPANTS:** Two thousand four hundred and fifty-two residents from 11 General Surgery, 12 Internal Medicine, and 11 Pediatrics programs at 14 U.S. academic health systems.

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**RESULTS:** One thousand seven hundred and eight residents responded (70% response rate). The mean Vitality score was 3.6 (range 1–5, where values of 4–5 represent high Vitality). There was wide variation among the 34 programs in the percent of residents who had high Vitality scores, ranging from 17% to 71%. However, the average Vitality scores within specialty (Surgery, Medicine, and Pediatrics) were not significantly different. The strongest predictors of Vitality were Work-life integration, Relationships/inclusion/trust, Institutional/program support, Respect, Values alignment, and Ethical/moral distress, which together accounted for 50% of vitality variance. Individual demographics accounted for just 3% of variance.

**CONCLUSIONS:** Vitality is an essential component of resident well-being, and within each specialty there are programs that have excelled in promoting a culture of high vitality. Our findings suggest that we should test interventions to enhance resident vitality by focusing greater attention on providing institutional support, aligning individual and institutional values, integrating work and personal life, and facilitating relationships, inclusiveness and trust. (J Surg Ed 75:1441–1451. © 2018 The Authors. Published by Elsevier Inc. on behalf of Association of Program Directors in Surgery. This is an open access article under the CC BY-NC-ND license.

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**KEY WORDS:** Residents, Culture of medicine, Vitality, Clinical learning environment, Resident well-being

**COMPETENCIES:** Practice-Based Learning and Improvement, Patient Care, , Systems-Based Practice, Medical Knowledge, Interpersonal and Communication Skills, Professionalism

## INTRODUCTION

*One does not train humanistic practitioners by treating residents in anything other than a humanistic fashion.*

—T Nasca et al.<sup>1</sup>

Leaders of graduate medical education share the goals of enhancing the competence, compassion, productivity, creativity, energy, resourcefulness, and well-being of resident physicians. Even so, the harrowing nature of residency training has been well documented over the past 50 years,<sup>2–7</sup> and this scholarship calls into question whether physicians and surgeons in training can conduct their clinical work and learning with optimal vitality, compassion, competence, personal safety, and high professional standards.

A body of literature has focused on the concerning rates of stress, burnout, suicide, and depression among U.S. residents and experienced physicians.<sup>1–4,6–16</sup> In a U.S. national study of Internal Medicine residents, burnout was reported in 51% of residents and “bad quality of life” was reported by 15% of all residents.<sup>10</sup>

Organizational factors and the culture of residency are increasingly recognized as drivers of burnout and impaired well-being,<sup>6,17–19</sup> and recent articles suggest the need to assess the residency learning environment to guide and evaluate interventions.<sup>20,21</sup> However, there are relatively fewer studies of the culture for residents<sup>5,22</sup> than for medical school faculty<sup>23–32</sup> or medical students.<sup>33,34</sup> One recent national study found that the individual institutions and specific specialty did not explain resident satisfaction with their learning environment or workload.<sup>35</sup> The authors advocated for a more in-depth assessment of the culture of residency programs, suggesting that the microenvironments of these programs were important to resident well-being.

To complement prior reports relating to resident anguish, this report highlights the central issue of well-being, and more specifically, resident vitality and the culture of residency programs. As well-being is an imprecise term, we suggest that *vitality* may be a better alternative, offering a clearer contrast to the state of burnout, a term commonly used to express the negative mental state experienced by many residents. We define vitality as the vigorous commitment to ongoing professional, intellectual, and personal growth, full engagement, enthusiasm, energy, and a positive feeling of purpose.<sup>36</sup> The concept of vitality captures the joy and meaningfulness of work,<sup>37</sup> the absence of burnout, and what has also been referred to as engagement.<sup>17</sup> Thus, we believe that vitality may be

a more useful attribute to assess in residents because it is more precise than well-being, and it is an important aspirational target. We suggest that vitality affects learning and professional engagement, and is critically important to enhancing growth in competence and compassion. Vitality also results in finding joy in work. Seeking to develop a national agenda for research on physician well-being,<sup>18</sup> a recent research summit recommended the use of validated tools for well-being assessment, which, until recently,<sup>5,23,33,38,39</sup> were lacking.

This report seeks to clarify the reasons for the gap between aspirational training intentions and the lived experiences of residents. Building on prior scholarship, this study compares the vitality of residents across 34 programs (11 General Surgery, 12 Internal Medicine, and 11 Pediatrics) at 14 U.S. academic health centers and seeks to identify the cultural characteristics of the programs and institutions, as well as resident characteristics that predict resident vitality.

## METHODS

In an initial phase of research by the National Initiative on Gender, Culture and Leadership in Medicine (known as C - Change for culture change), in-depth interviews were conducted with male and female faculty in five academic medical centers in order to document the culture and issues affecting faculty productivity and well-being.<sup>25–28</sup> Those qualitative interview data served as the basis for the construction of a quantitative survey instrument, the C - Change Faculty Survey, which systematically explores and documents the experiences of medical school faculty and organizational culture in their academic medical centers.<sup>23,24,29–32</sup> The C - Change Resident Survey (CRS) was developed by adapting the reliable and well-validated C - Change Faculty Survey, which has been used extensively throughout the United States, Canada, and Europe. The evidence supporting the reliability and validity of the CRS has been previously published.<sup>5</sup>

## SURVEY METHODS

### Measures

The 10-minute, 69-item CRS measures resident Vitality and 12 other dimensions of the culture, described in [Table 1](#): Self-efficacy in Career Advancement; Institutional/program Support; Relationships/Inclusion/Trust;

**Table 1.** Description of C - Change Dimensions of the Culture for Residents Including Number of Items and Estimated Cronbach  $\alpha$  Coefficients

| Dimension of the Culture and Description   | Number of Items* | Cronbach $\alpha$ |
|--|------------------|-------------------|
| <b>Vitality</b><br>Find work energizing, personally meaningful and satisfying; self-assessment of burnout.   | 5                | 0.84              |
| <b>Self-efficacy in career advancement</b><br>Confident in ability to progress in career and overcome barriers to advancement.   | 4                | 0.78              |
| <b>Institutional/Program support</b><br>Perceive that the institution/program is committed to residents' success and professional development; provides career help, feedback and appropriate credit.                                | 4                | 0.85              |
| <b>Relationships/Inclusion/Trust</b><br>Resident relationships; being in a trustworthy environment; able to express views authentically; feelings of belonging and being included.   | 5                | 0.83              |
| <b>Values alignment</b><br>Extent of alignment of residents' personal values with observed institutional values vs. espoused values, including value placed on service, teaching, clinical excellence and inclusive decision-making. | 6                | 0.84              |
| <b>Ethical/Moral distress</b><br>Feel ethical or moral distress; need to compromise values; being adversely changed, developing personally undesirable behaviors such as aggression, deceit, self-promotion.                         | 8                | 0.81              |
| <b>Respect</b><br>Residents feel respected; intimidation; observe bullying.  | 6                | 0.82              |
| <b>Mentoring</b><br>Mentoring received; quantity and quality; components of mentoring.   | 6                | 0.89              |
| <b>Leadership aspirations</b><br>Want to make positive change; aspire to be a leader in medicine.  | 5                | 0.81              |
| <b>Work-life integration</b><br>Institutional support for managing work-life integration; able to take time for personal/family issues; maintain a reasonable balance in life.   | 3                | 0.79              |
| <b>Gender equity</b><br>Perceive that institution treats female residents equitably and supports the advancement of women; unconscious bias.   | 6                | 0.86              |
| <b>URMM equity</b><br>Perceive that institution treats URMM residents equitably; supports the advancement of URMM; demonstrates commitment to diversity.   | 5                | 0.83              |
| <b>Competencies</b><br>Self-assessment of competencies.  | 6                | 0.85              |

\*All items use a 5-point response scale from 1 (strongly disagree) to 5 (strongly agree)  
URMM: Underrepresented in medicine minority

Values Alignment; Ethical/Moral Distress; Respect; Mentoring; Leadership Aspirations; Work-life Integration; Gender Equity; Underrepresented in Medicine Minority Equity; and Competencies. Items were scored on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). Additionally, the CRS collected information from respondents on gender, sexual orientation, race/ethnicity, age, presence of children at home younger than age 18 years, year of post-graduate training, and whether their medical degree was obtained in the United States or elsewhere.

The dimension of Vitality was measured by an average score of five survey items: feeling energized by work, looking forward to coming to work, finding work personally meaningful and satisfying, and feeling burnt out (reverse coded). Therefore, Vitality scores could range from 1 to 5, with 5 representing the highest vitality state.

## Sample

We purposefully sampled 14 academic health centers to represent different attributes of residency programs, including study site diversity by region of the United States, the size of programs, patient population served, and institutional funding (public or private) (Table 2). We tried to achieve balance across the listed criteria. Within these 14 academic health centers, we invited all residency programs in General Surgery (12), Internal Medicine (12), and Pediatrics (11) to participate. These 3 specialties were selected as they are represented in almost all academic health centers and are usually the largest residency programs. Thirty-four of the 35 residency program directors agreed to include their programs in the resident survey study. All residents in each participating residency program were

**Table 2.** Characteristics of 14 Academic Health Systems, 34 Residency Programs and 1708 Residents Participating in the Culture of Residency Study

|                                       |                                 |                          |                   |                |
|---------------------------------------|---------------------------------|--------------------------|-------------------|----------------|
| <b>Location in U.S.</b>               | <i>n Sites</i>                  |                          |                   |                |
| Mid-Atlantic                          | 3                               |                          |                   |                |
| Mountain                              | 2                               |                          |                   |                |
| New England                           | 2                               |                          |                   |                |
| North Central                         | 1                               |                          |                   |                |
| Pacific                               | 3                               |                          |                   |                |
| South Atlantic                        | 3                               |                          |                   |                |
| <b>Academic health system funding</b> | <i>n Sites</i>                  |                          |                   |                |
| Public                                | 6                               |                          |                   |                |
| Private                               | 5                               |                          |                   |                |
| Both public and private               | 3                               |                          |                   |                |
| <b>Population served (% Medicaid)</b> | <i>n Sites</i>                  |                          |                   |                |
| <25%                                  | 2                               |                          |                   |                |
| 25% to 49%                            | 9                               |                          |                   |                |
| 50% to 75%                            | 3                               |                          |                   |                |
| <b>Residency program specialty</b>    | <i>n Programs (n residents)</i> |                          |                   |                |
| General surgery                       | 11 (311)                        |                          |                   |                |
| Internal medicine                     | 12 (956)                        |                          |                   |                |
| Pediatrics                            | 11 (441)                        |                          |                   |                |
| <b>Residency program size</b>         | <i>Mean (range)</i>             |                          |                   |                |
| General surgery ( <i>n</i> = 11)      | 43 (17–74)                      |                          |                   |                |
| Internal medicine ( <i>n</i> = 12)    | 111 (31–170)                    |                          |                   |                |
| Pediatrics ( <i>n</i> = 11)           | 58 (21–142)                     |                          |                   |                |
| <b>Residents</b>                      | <b>Total</b>                    | <b>Internal Medicine</b> | <b>Pediatrics</b> | <b>Surgery</b> |
| Female, no. (%)                       | 879 (51)                        | 437 (46)                 | 312 (71)          | 130 (42)       |
| URMM,* no. (%)                        | 268 (16)                        | 142 (15)                 | 87 (20)           | 39 (13)        |
| IMG,* no. (%)                         | 305 (18)                        | 172 (18)                 | 90 (20)           | 43 (14)        |
| Children < 18 y at home, no. (%)      | 201 (12)                        | 91 (10)                  | 59 (13)           | 51 (17)        |
| LGBTQ,* no. (%)                       | 70 (4)                          | 42 (4)                   | 16 (4)            | 12 (4)         |
| PG Year, no. (%)                      |                                 |                          |                   |                |
| 1                                     | 619 (36)                        | 367 (38)                 | 152 (34)          | 100 (32)       |
| 2                                     | 507 (30)                        | 297 (31)                 | 149 (34)          | 61 (20)        |
| 3                                     | 490 (29)                        | 292 (31)                 | 140 (32)          | 58 (19)        |
| 4+                                    | 92 (5)                          |                          |                   | 92 (29)        |
| Age, mean (SD)                        | 30 (3)                          | 30 (3)                   | 30 (3)            | 31 (3)         |

\*Abbreviations: URMM is underrepresented in medicine minority resident; IMG is international medical graduate; LGBTQ is lesbian, gay, bisexual, transgender or questioning resident.

included in the study. C - Change did not offer any incentives or compensation to residents for completing the survey.

## Data Collection

The CRS was sent electronically to all 476 general surgery residents, all 1333 internal medicine residents, and all 643 pediatric residents who were enrolled in the 34 participating programs. Residents from all program years were included. The survey was administered in 3 phases from late fall 2014 to spring 2015 with frequent electronic reminders sent by C - Change. All data were stored by C - Change on a secure, password-protected external site. Results were reported only in aggregate form, and no record-level data were provided to programs or institutions to assure the confidentiality of respondents.

Brandeis University Institutional Review Board for the Protection of Human Subjects approved this study, (protocol number 07077BN).

## Analytic Methods

To account for the correlation of Vitality scores within residency programs (intra-class correlation), we used hierarchical models, which ensures calculation of appropriate standard errors and enables us to describe and evaluate within-program and between-program variation.<sup>40,41</sup> A 3-level hierarchical model (residents clustered within programs, and at most 3 programs clustered within the 14 academic health centers) proved impractical. For all models, we used empirical Bayes estimation and restricted maximum likelihood using the EM

algorithm in Hierarchical linear modelling 7.0 software (Scientific Software Intl, Skokie, Illinois).

Nine of the dimensions of the culture were identified *a priori* as potential predictors of Vitality, based on the same conceptual model used to evaluate faculty vitality.<sup>23</sup> The 3 other dimensions—Self-Efficacy in Career Advancement, Leadership Aspirations, and Competencies—were represented in our conceptual model as being partly caused by Vitality, rather than as predictors of Vitality, because all 3 constructs involve personal agency on the part of the respondent.

We first assessed the strength of each of the 9 cultural dimensions to individually predict Vitality, after adjusting for individual and programmatic characteristics in the hierarchical model. Individual characteristics included gender, age, racial/ethnic minority status, sexual orientation, parental status, international medical graduate, and year in residency program (PGY1-4). Program characteristics included specialty, institutional funding (public, private, or both), program size, percent of Medicaid patients served, and region of the country. We compared the within- and between-program (as well as total) variance explained by these models containing just one dimension of the culture in each. The ranking of total variance explained by the individual dimensions was used as the order of entry into a model containing multiple dimensions.

To avoid the bias caused by excluding respondents who had some missing survey data (complete case analysis), we performed multiple imputations of missing values using chained equations in Stata 14 (StataCorp, College Station, Texas).

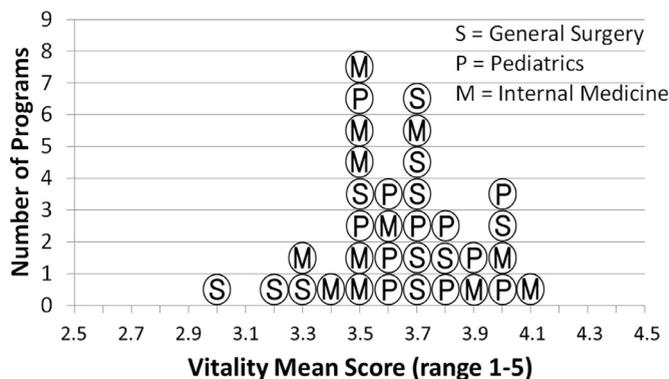
## RESULTS

### Response Rate

The overall response rate for residents in the 34 participating programs was 70% (range: 51%-87%), with little variation by specialty (65% for General Surgery, 72% for Internal Medicine, and 69% for Pediatrics). In all, 1708 of 2452 residents responded to the survey (Table 2).

### Variation by Specialty

The overall mean Vitality score was 3.6 (standard deviation 0.9; range 1-5). Figure 1 shows the distribution of mean Vitality scores for each of the 34 programs, which demonstrates great variability across programs, from a program with a mean Vitality score of 3.0 to a program with a mean score of 4.1 (a difference of greater than one standard deviation of the distribution of all resident Vitality scores). However, there were no statistically significant differences in mean Vitality scores for the General Surgery programs (3.51, 95% CI: 3.35-3.68), Internal



**FIGURE 1.** Estimated vitality scores for 34 residency programs. The circular markers represent the mean Vitality scores for the 34 programs. There were no significant differences among the 3 subgroup means for the General Surgery (S), Internal Medicine (M), and Pediatrics (P) programs.

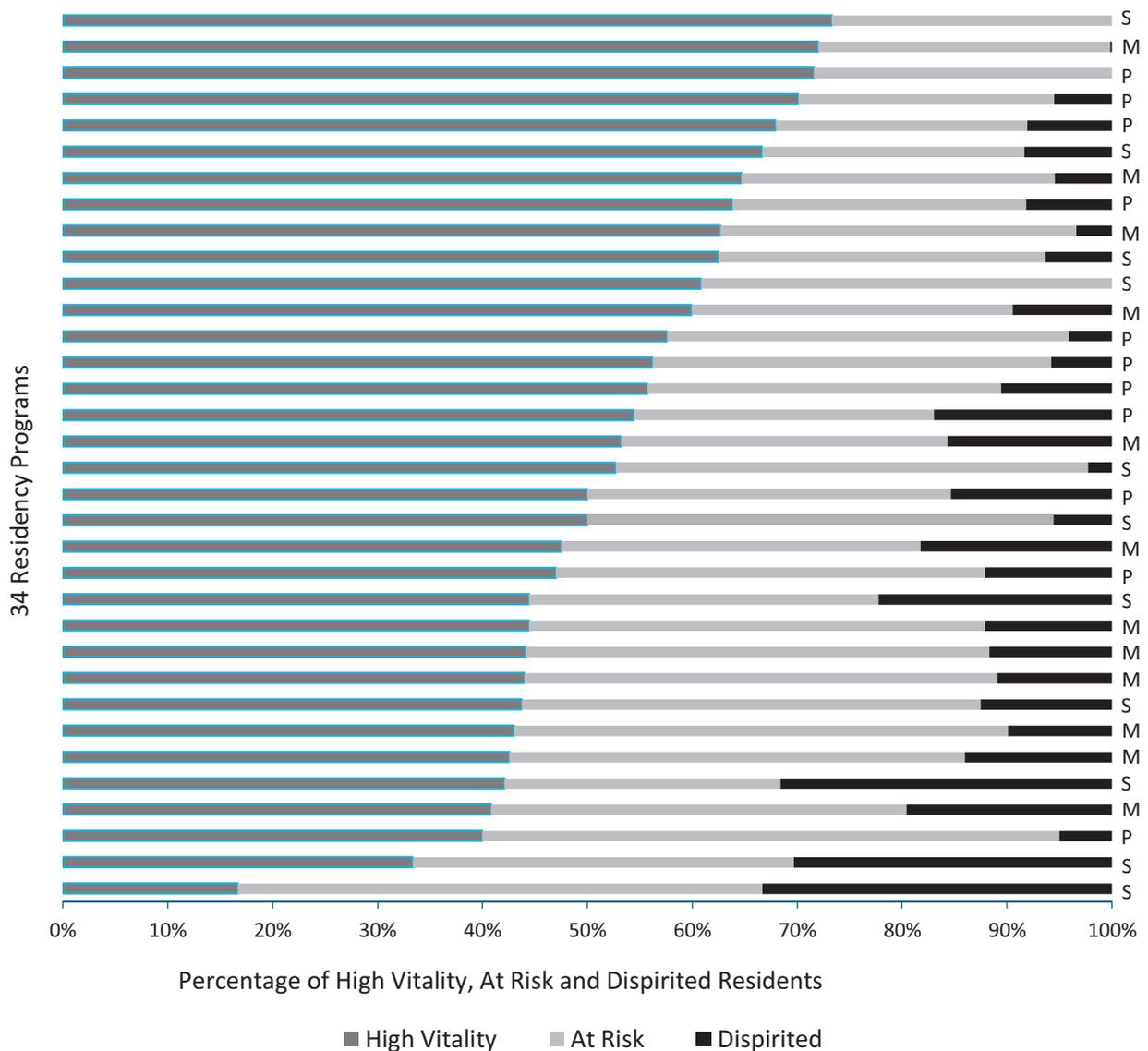
Medicine programs (3.54, 95% CI: 3.40-3.68), or Pediatric programs (3.69, 95% CI: 3.56-3.82) ( $p > 0.2$ , comparing the means of the 3 specialty subgroups). Nevertheless, there were critical and statistically significant differences in mean Vitality scores across programs within each of the specialties ( $p < 0.001$ ) and even across programs within the same academic health center.

Figure 2 displays a horizontal bar for each of the 34 programs, sorted by the percentage of residents in the program with “High Vitality” (mean score 4-5). Each bar also depicts the proportion of residents “At Risk” (mean score 3) and “Dispirited” (mean score 1-2). Of note, the program at the top (the program with the most residents with High Vitality) was a General Surgery program, while the second program was Internal Medicine, and the third and fourth were Pediatrics programs. This is another illustration of the similarity in Vitality across the 3 specialties. Each of these top four programs had at least 70% of residents categorized as High Vitality, with less than 1% as Dispirited. In contrast, 3 programs had over 30% Dispirited residents.

### Within-program and between-program variation

In order to understand the explanatory contribution of each dimension of the culture in predicting Vitality, we estimated models of Vitality predicted by each dimension of culture individually and by sequential additions of other dimensions of culture.

Only 3% of the variation in Vitality was explained by demographic characteristics of residents (Table 3). Within programs, Work-life Integration was the cultural dimension that was the best predictor of resident Vitality, explaining 36% of variation. Relationships/Inclusion/Trust, Institutional/program Support, and Respect dimensions each explained 34% of variation (as single predictors). Institutional/program Support and Values



**FIGURE 2.** Estimated distribution of vitality scores of residents in 34 programs displayed as high vitality, at risk and dispirited\*.  
\*Percentage of high vitality ■, at risk ■ and dispirited ■ residents. This displays a horizontal bar for each of the 34 programs, sorted by the percentage of residents in the program with "High Vitality" (mean score 4–5, range 1–5). Each bar also depicts the proportion of residents "At Risk" (mean score 3) and "Dispirited" (mean score 1–2).

Alignment, on the other hand, were the best predictors of differences in mean Vitality scores across programs (Table 3). Each dimension of the culture, individually, was a significant predictor of resident Vitality (each,  $p < 0.001$ ). The two equity dimensions and Mentoring were less powerful predictors of Vitality.

The combination of the 9 cultural dimensions explained half of the total variance in Vitality (Table 3). These 9 items were even better in predicting the mean program

scores for the 34 programs: 2 of them, Values Alignment and Institutional/program Support, when entered individually, explained 99% of the variance in program means.

## DISCUSSION

Vitality of residents differed dramatically across programs, ranging from 17% to 71% of residents within a

**Table 3.** Estimated Variance in Resident Vitality Explained by Within- and Between-Program Characteristics\* and Dimensions of the Culture

|  | <b>Within-Program Variance Explained</b> | <b>Between-Program Variance Explained</b> | <b>Total Variance Explained by Single Dimension of the Culture<sup>†</sup></b> | <b>Total Variance Explained by Cumulative Dimensions of the Culture<sup>‡</sup></b> |
|--|--|---|--|---|
| Model with within- and between-program characteristics, <i>excluding all measures of the culture<sup>‡</sup></i> | 3%                                       | 32%                                       |  |   |
| Models with within- and between-program characteristics, <i>including a single dimension of the culture</i>      |  |   |  |   |
| Work-life integration  | 35%                                      | 53%                                       | 36%  | 36%   |
| Relationships/Inclusion  | 32%                                      | 77%                                       | 34%  | 46%   |
| Institutional/program support  | 32%                                      | 99%                                       | 34%  | 49%   |
| Respect  | 32%                                      | 85%                                       | 34%  | 49%   |
| Values alignment   | 30%                                      | 99%                                       | 32%  | 50%   |
| Ethical/Moral distress   | 28%                                      | 84%                                       | 30%  | 50%   |
| Mentoring  | 18%                                      | 46%                                       | 19%  | 50%   |
| URMM equity  | 9%                                       | 38%                                       | 10%  | 50%   |
| Gender equity  | 7%                                       | 56%                                       | 9%   | 51%   |

\*Within-program (individual) characteristics included gender, age, whether any children under 18 were at home, underrepresented in medicine minority status, LGBTQ, international medical graduate and postgraduate year. Between-program (programmatic and institution) characteristics included location, funding (public or private), population served (% Medicaid patient population), specialty, and program size.

<sup>†</sup>Dimension of the Culture models included within- and between-program characteristics, in addition to one or more dimensions of the culture.

<sup>‡</sup>Model with within- and between-program characteristics, but excluding dimensions of culture, was compared to the null model. Total variance explained by this model was 4%.

URMM: Underrepresented in medicine minority.

program reporting High Vitality. These differences were not explained by specialty or demographic characteristics, but, instead, were largely explained by the unique cultural dimensions of the residency program. These cultural characteristics were not consistent across programs within the same institution. They are unique to the specific residency program and include program features that affect work-life integration, relationships, trust, a sense of belonging, alignment of individual and institutional values, moral distress, mentoring, respect, fairness, and support. Other residency program and institutional characteristics, such as size, funding, and population served, were unimportant in predicting resident vitality. These findings also challenge the common, but apparently mistaken, notion that Surgery training programs significantly are more likely to impair resident well-being.

Our results are consistent with those of Gruppen and colleagues.<sup>35</sup> Although we demonstrated strong associations between aspects of the culture and vitality, our study design precludes determination of causality. Nevertheless, based on these data, it is reasonable to recommend the evaluation of interventions to improve program culture to enhance resident vitality. For example, program leadership might focus on working with residents to identify ways that clinical work and education could be reorganized to more successfully manage

the integration of professional responsibilities and personal life roles - for all residents - regardless of whether there are children at home. Cultivating and strengthening relationships among peers and with faculty, and fostering feelings of belonging in the organization, and of working in a trustworthy environment might also be reasonable interventions. Creating explicit opportunities for dialogue about personal and institutional values alignment, respectful and ethical behaviors, and the meaningfulness of work would also likely enhance vitality.

A prominent theme in the literature of resident well-being is the role of resident duty hours,<sup>42–43</sup> which is included, among other items, in the dimension of Work-life Integration. Graduate medical educators have struggled to maintain the quality of training programs amid changing requirements, and contradictory outcomes, associated with duty-hour restrictions.<sup>44–46</sup> Of interesting alignment, Philibert et al. noted in a meta-analysis<sup>46</sup> that the effects of duty-hours reduction were inconclusive. The Accreditation Council for Graduate Medical Education (ACGME) study highlighted the complex relationships among the variables in the learning environment, particularly the value of faculty supervision, and of residents connecting with peers and faculty in the workplace. Additionally, the study identified the need to assess the ability of each new physician to recognize his or her physical and emotional limits, and how these

affect the care of patients. The ACGME report concluded that additional studies could be useful in assessing how duty-hour limits and other attributes of the learning environment interact in producing the mixed outcomes they observed in safety and quality of care.<sup>46</sup> Rather than solely emphasizing duty hours, we need to work more broadly on various aspects of the culture - which may then lead to better work-life integration, and also result in improved resident-patient healing relationships.

Our study has several limitations. First, only 3 specialties were represented and institutional sites were not selected randomly, but purposefully selected to reflect the largest residency programs and a broad range of regionally representative and different academic health centers. Second, these were self-reported data and therefore subject to various biases. We sought to enhance validity and minimize bias by collecting data independent of program leadership and by assuring confidentiality, reporting only aggregate results. Third, our study is open to the risk of method bias, which is a greater threat when the constructs under study are latent variables and measured at the same time, using the same survey instrument, with items that share a similar format and response options; however, the fact that our questions are well-defined for each dimension of culture and have been tested on multiple populations within medical education helps to ensure that respondents focus on the explicit content of items, rather than mechanistically focusing on particular responses.<sup>47</sup>

## CONCLUSIONS

In conclusion, we found that some residency programs—independent of specialty or institution—have successfully established a culture that supports high vitality in most of their residents, while other programs include many residents with low levels of vitality. In addition, we have shown that these programmatic differences in vitality correlate with differences in program-specific culture. We need to learn more from programs that have excelled in promoting a culture of high vitality.

We believe that programs wanting to improve resident vitality should focus attention on the synergy between institutional and program support, relational trust, values alignment and work-life integration. Activities and experiences that promote relational connection and the feeling of working in a trustworthy and moral environment are likely to have an impact on how residents spend their clinical and education work hours as well as their overall well-being. These proposed interventions need not be resource intensive. For example, studies of faculty at academic health centers have

demonstrated successful interventions targeting culture change.<sup>48–50</sup>

Residents function as both students of medicine and as employees providing patient care. The environment in which residents work is a complex balance between service and education. The ACGME in the United States is the advocate for the public, and the public's justifiable desire to be served by future generations of highly skilled, technically proficient, professional, and humanistic physicians and surgeons.<sup>1</sup> Aligned with this philosophy, we hope that residency programs will systematically measure the vitality of their residents<sup>51</sup> and intervene to fashion a program culture that will support the humanity of physicians and surgeons in training, and sustain them in a life of learning and service.

## AVAILABILITY OF DATA AND MATERIALS

The datasets generated during the current study are not publicly available so as to protect the individual privacy of respondents. The C - Change Resident Survey is copyrighted and available for use by contacting the National Initiative on Gender, Culture and Leadership in Medicine: C - Change at [cchange@brandeis.edu](mailto:cchange@brandeis.edu).

## ROLE OF THE SPONSORS

The financial sponsors had no involvement in: the study design, analysis and interpretation of data; the writing of the report; and the decision to submit the article for publication.

## DECLARATIONS OF INTEREST

None.

## AUTHORS' CONTRIBUTIONS

LP (PI): survey and study design, implementation, data analysis and interpretation, drafting of the manuscript and critical revision of the manuscript for important intellectual content.

AE: survey design, statistical analysis, data analysis and interpretation, drafting of the manuscript and critical revision of the manuscript for important intellectual content.

JC: survey design, data collection, statistical analysis, data analysis and interpretation, drafting of the manuscript and critical revision of the manuscript for important intellectual content.

SS: study coordination at sites, data interpretation, drafting of the manuscript and critical revision of the manuscript for important intellectual content.

RB: statistical analysis, data analysis and interpretation, drafting of the manuscript and critical revision of the manuscript for important intellectual content.

All authors read and approved the final manuscript.

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## COMPETING INTERESTS

The authors have no competing interests. That the survey under discussion is funded at any time by financial support for administering the survey and analyzing data, and that any investigator could be paid from these funds may seem to qualify in the strictest sense as a potential conflict of interest in a paper reporting on the survey results. In this regard, the National Initiative on Gender, Culture and Leadership in Medicine, C - Change is entirely externally funded. All grants and contracts from various institutions requesting our survey administration and “blind” data analysis of collected data are awarded to Brandeis University, which pays some salary support to some of the investigators (LP, JC, RB). C - Change maintains rigorous scientific standards for conducting its studies, and there is complete separation of income flowing into the University from the survey administration and analysis.

## SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.jsurg.2018.04.021](https://doi.org/10.1016/j.jsurg.2018.04.021).

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