


The Patient Care Ownership Scale: External Validation of an Instrument that Measures Patient Care Ownership Among Internal Medicine Trainees—a Multi-Institutional Study



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BACKGROUND: Patient care ownership improves accountability, clinical skills, and quality of patient care among resident physicians, but appears to be gradually eroding. Research is limited by the lack of a reliable, objective measure of ownership.

OBJECTIVE: To validate the Patient Care Ownership Scale, an instrument that measures decision ownership among internal medicine residents.

DESIGN: Multi-institutional, cross-sectional study using a 66-item, online survey that queried residents on ownership's key constructs (advocacy, responsibility, accountability, follow-through, knowledge, communication, initiative, continuity of care, autonomy, self-efficacy, and perceived ownership) as well as mood and burnout.

PARTICIPANTS: Internal medicine residents in five geographically diverse residency programs completing an inpatient rotation.

MAIN MEASURES: We performed exploratory and confirmatory factor analysis in two randomly split groups to evaluate for subscales and inform item reduction. We conducted reliability testing with Cronbach's α . We performed bivariate analyses to examine construct validity and identify correlates of ownership.

KEY RESULTS: Of the 785 eligible residents, 625 completed the survey (80% response rate); we included responses from 563 in the analysis. We identified three factors

corresponding to assertiveness, conscientiousness, and confidence or perceived competence. After iterative item reduction, the 13-item ownership scale demonstrated good reliability (Cronbach's $\alpha = 0.82$). Convergent validity was supported by a significant association with perceived ownership (eliminated from the final scale) ($r = 0.67, p < 0.001$). There was a positive association between ownership and training level ($p < 0.01$) and prior experience in the intensive care unit ($p < 0.001$). There were significant, inverse relationships between ownership and self-defined burnout ($r = -0.24, p < 0.001$), depression ($r = -0.22, p < 0.001$), detachment ($r = -0.26, p < 0.001$), and frustration ($r = -0.15, p = 0.02$), and significant positive associations between ownership and feeling energetic ($r = 0.29, p < 0.001$), happy ($r = 0.33, p < 0.001$), and fulfilled ($r = 0.34, p < 0.001$).

CONCLUSIONS: The Patient Care Ownership Scale is valid in diverse residency program settings. Medical educators and investigators can use our scale to assess interventions aimed at fostering ownership.

KEY WORDS: graduate medical education; medical decision-making; behavioral science; health services research.

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INTRODUCTION

Ownership of patient care is thought to be essential to delivering high-quality medical care.^{1, 2} According to psychology

research, decision ownership is a cognitive-affective state where the decision-maker utilizes both analytical and emotional processes.^{1, 2} It is a possessive feeling of responsibility for medical decisions while reflecting on knowledge and experience (cognitive component) and feelings of self-efficacy and competence (emotional component).¹ In medicine, the personal investment in patient care separates decision ownership from similar constructs like responsibility and commitment.^{1, 3} According to organizational psychology research, decision ownership influences attitudes and decision-making, suggesting that patient care ownership might affect clinician behavior.^{1, 2, 4-7} For resident physicians, fostering ownership is expected to increase accountability and improve clinical skills, and therefore likely impacts quality of care.¹

Residency program directors have raised concerns that increases in shift work generated by the 2011 Accreditation Council for Graduate Medical Education (ACGME) work-hour regulations have adversely affected patient care due to decreased ownership among residents.^{1, 8-12} However, this previous research was limited to single-item questions that did not use a standardized definition of ownership nor a validated tool to measure it. Instead, the single-item assessed whether sense of self-defined ownership was subjectively worse with duty hour restrictions. How work-hour restrictions actually affect residents' decision ownership and how, in turn, ownership affects outcomes (such as care utilization and quality of care) and residents' burnout is unknown and requires the development of a reliable, objective measure of patient care ownership.¹³

We previously developed the Patient Care Ownership Scale, an instrument to quantify patient care ownership in trainees.¹³ The survey measures ownership's key constructs: advocacy, responsibility, accountability, follow-through, knowledge, communication, initiative, continuity of care, autonomy, and perceived ownership. The pilot study demonstrated acceptable internal consistency and preliminary evidence of validity of the scale. However, initial testing demonstrated the need to add items addressing self-efficacy and to improve how we measured communication.^{2, 3, 7, 14, 15}

The objectives of this study were to improve the original scale by adding items measuring self-efficacy and communication and to confirm the scale's validity in a more heterogeneous population of residents across multiple sites. We also sought to identify correlates of ownership to inform interventions aimed at fostering ownership among medical residents.

METHODS

Study Design

We conducted a cross-sectional, multi-institutional, survey-based study of internal medicine resident physicians in five academic residency programs in the USA. This study was deemed exempt from full review by the Institutional Review Boards at all participating institutions.

Survey Design

Description of the Original Instrument. The development and preliminary validation of the original scale have been previously described.¹³ Briefly, we adapted an existing, non-medical ownership scale¹⁴ to the constructs and themes identified in qualitative studies on ownership of patient care.^{3, 15} We iteratively revised the survey through cognitive interviewing and psychometric analysis. Our final scale was a 15-item questionnaire measuring ownership's key constructs: advocacy, responsibility, accountability, follow-through, knowledge, communication, initiative, continuity of care, and autonomy. Consistent with conventions in scale development,^{16, 17} we also included a single-item measuring the resident's sense of self-defined ownership, hereafter referred to as perceived ownership.¹³ Items assessed how the resident felt while on service using a 7-point Likert-type scale¹⁸ ranging from 1 = strongly disagree to 7 = strongly agree. The original scale demonstrated good internal consistency and reliability (Cronbach's $\alpha = 0.89$).

Scale Refinement. In our pilot study, we identified self-efficacy and communication as two constructs that were essential to the working definition of ownership but inadequately represented in the scale.^{3, 13, 15}

Based on peer-review feedback of our pilot study, we expanded the original ownership scale to measure these two constructs.^{19, 20} We constructed new survey items with the goal of minimizing social desirability bias and the ceiling effect.²¹

We conducted cognitive interviews to assess the face validity of new scale items and the remainder of the survey.²¹⁻²³ We used purposive sampling to select residents at Yale-New Haven Hospital who did not participate in the pilot study and who were thought by their instructors to exhibit strong ownership of patient care. The cognitive interviewing process employed the think aloud approach with concurrent, scripted verbal probing.^{13, 24} We iteratively revised the new items, and concluded cognitive interviewing when responses were saturated (i.e., no further changes were made to the scale after the interview). All versions of the scale, including the prototype and the revisions made during cognitive interviewing, are detailed in [Appendix B](#) in the Supplementary Information.

Based on the cognitive interviews, we developed a 66-item questionnaire which included the modified 18-item ownership scale. We included questions on demographics, training level and program, prior intensive care unit (ICU) experience, service type, inpatient setting (whether the intern had a supervising resident, whether the resident worked with an intern, perceived length of stay of the patients cared for), and call schedule. Items also assessed perceived degree of burnout, stress, depression, exhaustion, emotional detachment, frustration, energy, fulfillment, and happiness (rated on 5-point scales, ranging from 1 = never to 5 = every day). To assess burnout, we used a single-item, self-defined

Table 1 Ownership Scale (18-Item)

| Dimension measured | Item |
|---|---|
| Advocacy | 1. I was vocal and assertive about my patients' best treatment/care.* 2. I felt comfortable telling the attending what I felt was the right thing to do for my patients, rather than just letting them decide.* 3. I challenged the team as needed if I felt it was in my patients' best interest, no matter how much push back I got.* |
| Responsibility, accountability and follow-through | 1. <i>I frequently deferred to other providers for many aspects of my patients' care. (reverse)*[‡]</i> 2. I personally made sure to go back and check that all orders were actually carried out.* 3. When carrying out my patient's management plan, I took extra care to make sure that things did not fall through the cracks.* 4. I felt responsible for my patients' care, even after my shift ended.* |
| Knowledge Communication | 1. I was the "go-to" person for knowledge about my patients.* 1. I made sure that the nursing staff was updated with the day's plan.* 2. <i>I felt like <u>IDID NOT</u> have enough time or resources to communicate effectively with my patients (such as repeating things, using an interpreter, and performing teach back). (reverse)[‡]</i> |
| Initiative | 1. I was proactive in checking up on my patients, rather than being called with questions or concerns.* |
| Continuity of Care Autonomy | 1. I ensured good continuity of care even when I was absent from the service.* 1. <i>I was given the opportunity to make decisions independently about my patients' care.*[§]</i> 2. <i>I felt that my attending(s) micromanaged me (reverse)*[§]</i> 3. I felt comfortable making decisions independently about my patients' care.* |
| Self-efficacy | 1. I was confident that I could deal with unexpected events effectively. 2. I could overcome self-doubts after having had tough setbacks |
| Perceived ownership | 1. <i>I felt a strong sense of ownership of my patients' care.*</i> |

The table showed the 18-item, modified ownership scale that was developed iteratively using the scale from the pilot study and modifying it based on limitations of and reviewer feedback from the pilot study, and iterative scale development based on cognitive interviewing in this study. Items that are italicized are those that were eliminated iteratively based on factor analysis (see superscripts for rationale of dropping each item); items in normal text are those that ultimately made up the final, 13-item scale that that we used to conduct all analyses

*Items that were part of the 15-item scale published in the pilot study

[‡]Eliminated because of poor factor loading

[§]Eliminated because of poor reliability ($\alpha = 0.47$) of the corresponding subscale

Eliminated because of cross-loading (i.e., loaded significantly onto more than one factor)

burnout measure previously validated against the Maslach Burnout Inventory.¹⁷ The final scale and the corresponding constructs that each item measures are listed in Table 1. The full study questionnaire is detailed in Appendix A in the Supplementary Information.

Data Collection

We used purposive sampling to identify internal medicine residency programs that were large in size and geographically diverse. We recruited chief residents (who became site collaborators) from five institutions: Baylor College of Medicine, University of California Los Angeles, University of Colorado Denver, University of Michigan, and University of South Florida. Resident physicians training in internal medicine were eligible to participate in this study upon completion of an adult inpatient service during the study period.

We invited eligible residents to complete an online survey between April and June 2019 to replicate the timing in our pilot study. We invited residents via e-mail after completion of an inpatient medical service to take an online questionnaire using Qualtrics survey software. Residents were informed that participation was voluntary and no one from their training programs (including the chief residents who are co-investigators in this study) would see their responses. Non-respondents were reminded to complete the survey three times weekly for 1 month. Participants were enrolled into a random drawing to win a \$150 gift card at each participating institution.

Statistical Analysis

Criteria for Inclusion in the Analysis. We excluded responses from participants who did not complete the Patient Care Ownership Scale portion of the study questionnaire, finished the survey too quickly (were in the bottom 5th percentile of survey completion time), or because of zero variance among their responses (Fig. 1). We also excluded those with duplicate responses ($n = 22$ due to a survey error). We performed bivariate analysis (t test and χ^2 test) to examine differences between those included versus excluded.

Factor Analysis. We performed factor analysis to evaluate subscales and inform item reduction.²⁵ Prior to extraction, the correlation matrix was assessed using the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity. We performed exploratory factor analysis in a random half of the sample using principal component analysis and varimax rotation; promax rotation did not improve model fit. We then iteratively dropped items if they loaded poorly (< 0.4) or did not load on a single factor. We compared fit indices of the overall model at each step of item reduction to ensure improved model fit. We then performed confirmatory factor analysis on the second half of the sample. We estimated root mean square error of approximation and comparative fit index of the final model. For each subscale, we reviewed the scale items that met the aforementioned criteria for significant loading and then identified a unifying theme to inform the subscale's construct (e.g., assertiveness). We ran

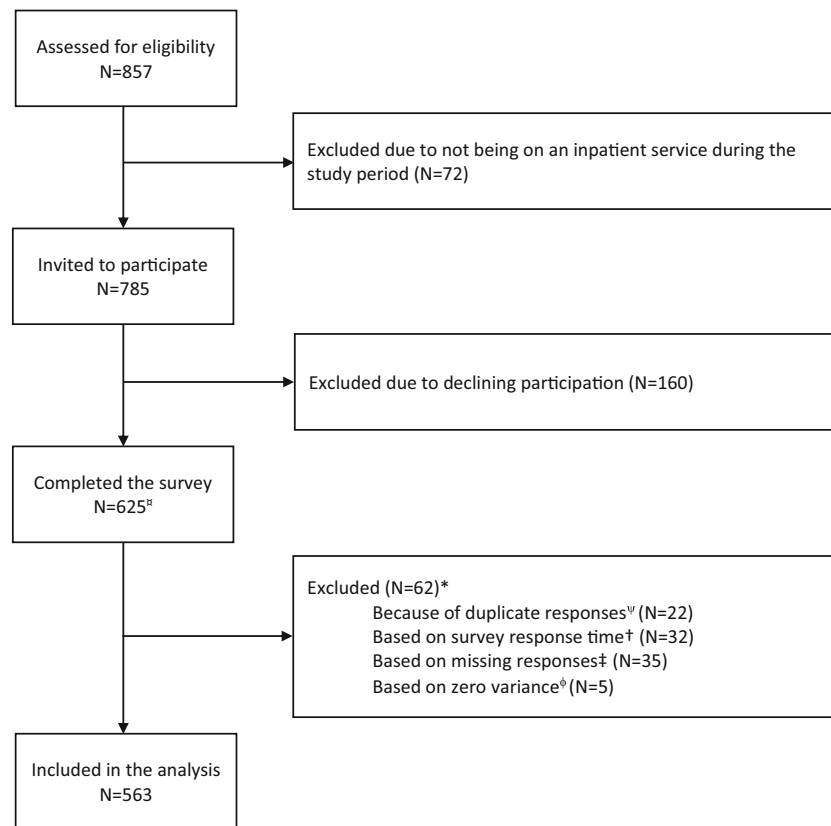


Fig. 1 CONSORT diagram. Flow diagram identifying the participants whose survey responses were included in the analysis. [‡]Corresponds to 80% response rate. *Categories of exclusion may not add of perfectly as some respondents were excluded for more than one reason (e.g., they were in the bottom 5th percentile of survey completion time and completed $\leq 48\%$ of the survey). [†]Due to a glitch in survey distribution early in the data collection period, 22 residents completed the survey twice. We excluded their responses from the second participation in 17 cases, but in the other 5 (where they initially completed $< 26\%$ of the survey), we excluded their first survey response and instead included responses from their second submission. [‡]Those who were in the bottom 5th percentile of survey completion time. [§]Those who completed $\leq 48\%$ of the survey were excluded from the analysis. We chose this cutoff because the end of the ownership scale represents 48% survey completion, and the primary objective of this study is to externally validate the ownership scale. [¶]We excluded those who had zero variance across the two dimensions (autonomy and responsibility, accountability and follow-through dimensions) that included a reverse item, unless the respondent answered neutrally.

all subsequent tests and analyses using the item-reduced ownership scale.

Reliability Testing. We calculated Cronbach's α to determine the internal consistency of the final ownership scale and subscales. For each respondent, ownership was calculated by averaging all of the items on the scale. We used descriptive statistics to determine the mean (standard deviation [SD]) ownership in our study population.

Bivariate and Correlational Analysis. To examine construct validity, we performed pairwise correlation between ownership (derived from item-reduced scale) and perceived ownership and burnout. We then assessed differences in mean ownership by resident characteristics. We used 2-tailed t tests and analysis of variance, adjusting for multiple comparisons using Tukey's range test. We used the Spearman correlation to assess the relationships between ownership and continuous variables, because some independent variables were not normally distributed; we adjusted for multiple comparisons using the Bonferroni correction. We performed pairwise correlations

between the significant predictors of ownership and each subscale. We used Stata version 16.²⁶

RESULTS

Cognitive Interviews

We completed seven cognitive interviews, after which responses were saturated and there were no further modifications to the ownership scale or study questionnaire. The ownership scale included 18 items measuring advocacy, responsibility, accountability and follow-through, knowledge, communication, initiative, continuity of care, self-efficacy, and perceived ownership (Table 1).

Study Population Characteristics

Of the 857 residents across the five programs participating in this study, 785 met inclusion criteria and were invited to participate; of these, 625 completed the survey (80% response rate) and responses from 563 were included in the analysis (Fig. 1). There were no significant differences in

Table 2 Characteristics of Study Participants and Inpatient Service Just Completed (N = 563)

| Variable | No. (%) |
|--|------------|
| Age: median (IQR) years | 29 (28–30) |
| Female* | 249 (44%) |
| Race and ethnicity | |
| Asian | 195 (35%) |
| Black | 9 (2%) |
| Hispanic | 32 (6%) |
| White | 290 (52%) |
| Other | 32 (6%) |
| No response | 5 (1%) |
| Training site | |
| Baylor College of Medicine | 145 (26%) |
| University of Colorado Denver | 117 (21%) |
| University of Michigan | 87 (15%) |
| University of California Los Angeles | 125 (22%) |
| University of South Florida | 89 (16%) |
| Level of training | |
| PGY-1 | 235 (42%) |
| Categorical | 199 (85%) |
| Preliminary | 36 (15%) |
| PGY-2 | 164 (29%) |
| PGY-3† | 154 (27%) |
| PGY-4‡ | 10 (2%) |
| Training program (excluding preliminary interns) | |
| Traditional internal medicine | 439 (83%) |
| Primary care | 41 (8%) |
| Combined internal medicine and pediatrics | 33 (6%) |
| Hospital internal medicine‡ | 14 (3%) |
| No. of months previously spent in the ICU | |
| 0 to < 2 months | 179 (32%) |
| ≥ 2 months and < 4 months | 238 (42%) |
| ≥ 4 months | 146 (26%) |
| Type of service | |
| General medicine wards | 325 (58%) |
| Subspecialty wards | 60 (11%) |
| SDU or ICU | 178 (32%) |
| Hospital type | |
| Academic medical center or university hospital | 262 (47%) |
| Community hospital | 47 (8%) |
| County hospital | 79 (14%) |
| Veterans Affairs hospital | 170 (30%) |
| None of the above | 5 (1%) |
| Duration on service | |
| 1–2 weeks | 185 (33%) |
| 3–4 weeks (or 1 month) | 378 (67%) |
| Schedule§ | |
| On days | 349 (62%) |
| On nights | 51 (9%) |
| On days and nights | 100 (18%) |
| Taking 24+ hour call intermittently | 162 (29%) |
| Call frequency if taking call | |
| Every 3 days | 10 (6%) |
| Every 4 days | 53 (33%) |
| Every 5 days | 20 (12%) |
| Every 6 days | 29 (18%) |
| Every 7 days | 17 (10%) |
| Every 8 days | 33 (20%) |

Characteristics of included study participants. Percentages may not add up to 100 due to rounding

IQR, interquartile range; PGY, post-graduate year; SDU, step-down unit; ICU, intensive care unit

*One resident identified as non-binary in this cohort

†For all analyses, we combined these two groups into "PGY 3 or 4"

‡This track was only at University of Colorado Denver

§Participants could select more than one response to this question. Therefore, each variable represents a dummy variable; percentages refer to proportion of responses out of the entire cohort of 563 participants (rather than comparison to other response options)

Participants reported taking call between every 3rd and every 8th day. The majority (33%) reported taking call every fourth day

demographics, training level, prior ICU experience, inpatient setting, or call schedule between those who were included versus excluded.

Median time to complete the study questionnaire was 8.0 min. Median age was 29 years. The sample was 44% female (the national average²⁷), and 47% nonwhite, evenly spread across training levels. Additional detail is presented in Table 2.

Factor Analysis and Reliability Testing

Exploratory factor analysis identified 4 factors with Eigenvalues > 1. Both the KMO measure and Bartlett's test of sphericity indicated the data were appropriate for factor analysis (KMO = 0.87, Bartlett's test = 2958.24, $df = 153$, $p < 0.001$). We iteratively eliminated five items (Table 1). After dropping these items, 3 factors (or subscales) remained, accounting for 54% of the variance in total scores. These factors correspond to conscientiousness ($\alpha = 0.73$), assertiveness ($\alpha = 0.80$), and confidence or perceived competence ($\alpha = 0.71$). The confirmatory factor analysis identified similar factor loadings for all subscales (Table 3). The final 13-item scale had good to excellent fit (root mean squared error of approximation = 0.05; comparative fit index = 0.95) and good internal consistency (Cronbach's $\alpha = 0.82$).

Bivariate and Correlational Analysis

There were no significant associations between ownership and age, gender, race, training program, whether the trainee worked alone or with an intern/resident, or perceived length of stay of the patients (Table 4). Mean (SD) ownership was higher among participants who self-identified as Hispanic (5.85 [0.56]) compared with those who did not (5.66 [0.61]) ($p < 0.05$). Mean (SD) ownership was higher among more senior residents: 5.60 (0.58), 5.63 (0.60), and 5.82 (0.63) among post-graduate years 1, 2, and 3–4, respectively (overall $p < 0.001$). There was also a significant association between ownership and the number of months previously spent in the ICU ($p < 0.001$), service type ($p < 0.001$), hospital type ($p = 0.033$), and working on days instead of nights ($p < 0.01$). We report the full results of the bivariate analysis between ownership and categorical variables in Table 4.

The pairwise correlations between the single-item measuring perceived ownership and each subscale were as follows: conscientiousness $r = 0.52$, $p < 0.00$; assertiveness $r = 0.60$, $p < 0.001$; confidence and perceived competence $r = 0.38$, $p < 0.001$. There was no significant relationship between conscientiousness and training level, yet there was a significant relationship between training level and assertiveness ($p = 0.026$, driven by the difference in assertiveness between PGY-3 and PGY-1) and confidence ($p < 0.001$, where mean confidence was significantly higher in the senior group compared with the junior group across all permutations).

There was a statistically significant association between ownership scores on the 13-item scale and the single-item perceived ownership scores ($r = 0.67$, $p < 0.001$). There was a significant, positive association between ownership and feeling energetic ($r = 0.29$, $p < 0.001$), happy ($r = 0.33$, $p < 0.001$), and fulfilled ($r = 0.34$, $p < 0.001$). There was a

Table 3 Factor Loading of the Ownership Scale: Exploratory and Confirmatory Factor Analysis

| Item name | Item question | Conscientiousness | | | | |
|--|---|-------------------|-------------|-------------|-------------|------|
| Assertiveness | | | | | | |
| Confidence/perceived competence | | | | | | |
| Advocacy Q1 | I was vocal and assertive about my patients' best treatment/care. | 0.30 | 0.81 | <i>0.87</i> | 0.13 | |
| Advocacy Q2 | I felt comfortable telling the attending what I felt was the right thing to do for my patients, rather than just letting them decide. | 0.07 | 0.77 | <i>0.71</i> | 0.26 | |
| Advocacy Q3 | I challenged the team as needed if I felt it was in my patients' best interest, no matter how much push back I got. | 0.05 | 0.84 | <i>0.77</i> | 0.04 | |
| RAFT Q2 | I personally made sure to go back and check that all orders were actually carried out. | 0.55 | <i>0.55</i> | 0.14 | 0.10 | |
| RAFT Q3 | When carrying out my patient's management plan, I took extra care to make sure that things did not fall through the cracks. | 0.67 | <i>0.67</i> | 0.27 | 0.17 | |
| RAFT Q4 | I felt responsible for my patients' care, even after my shift ended. | 0.40 | <i>0.52</i> | 0.07 | 0.40 | |
| Knowledge | I was the "go-to" person for knowledge about my patients. | 0.66 | <i>0.51</i> | 0.05 | 0.08 | |
| Communication Q1 | I made sure that the nursing staff was updated with the day's (or overnight) plan. | 0.54 | <i>0.42</i> | 0.18 | 0.11 | |
| Initiative | I was proactive in checking up on my patients, rather than being called with questions or concerns. | 0.58 | <i>0.65</i> | 0.35 | 0.21 | |
| Continuity of care | I ensured good continuity of care even when I was absent from the service. | 0.66 | <i>0.59</i> | 0.14 | 0.17 | |
| Autonomy Q3 | I felt comfortable making decisions independently about my patients' care. | 0.09 | | 0.11 | 0.89 | 0.82 |
| Self-efficacy Q1 | I was confident that I could deal with unexpected events effectively. | 0.12 | | 0.13 | 0.88 | 0.66 |
| Self-efficacy Q2 | I could overcome self-doubts after having had tough setbacks | 0.16 | | 0.28 | 0.54 | 0.53 |

The table shows the results of the exploratory factor analysis on one random half of the sample (n = 282) and confirmatory factor analysis on the other half (n = 281). Factor loadings in boldface refer to those items that correspond to the subscale using a cutoff of 0.4. We report the factor loadings of the exploratory factor analysis in the left column of each subscale, and report the factor loadings of the confirmatory factor analysis in italics in the right column of each subscale.

RAFT, responsibility, accountability, and follow-through dimension

significant, inverse relationship between ownership on the 13-item scale and self-reported burnout ($r = -0.24, p < 0.001$), depression ($r = -0.22, p < 0.001$), detachment ($r = -0.26, p < 0.001$), and frustration ($r = -0.15, p = 0.02$). Ownership and exhaustion were not significantly related ($r = -0.11, p = 0.32$).

DISCUSSION

Decision ownership of patient care is important to deliver high-quality healthcare but is understudied due to the lack of an objective instrument.^{1,2} In this multi-center, cross-sectional study, we found that the Patient Care Ownership Scale is a reliable and valid measure of ownership in a heterogenous group of resident physicians. Additionally, through factor analysis, we expanded the operational definition and identified significant correlates of ownership including an inverse relationship with burnout.

Construct validity was established via a strong association between the ownership scale and a single-item evaluating perceived ownership. However, the single-item measuring perceived ownership does not perfectly correlate with the 13-item scale nor subscales, suggesting that this single-item cannot replace the full scale. Moreover, a single-item, while face valid, is subject to social desirability bias. The inverse relationship between ownership and self-defined burnout and negative moods (depression, exhaustion, detachment, frustration) and the positive relationship between ownership and positive moods (happiness, feeling energetic, fulfillment) demonstrate concurrent validity. These findings mirror our

pilot study and reflect the effect of decision ownership on attitudes and behaviors demonstrated in organizational psychology research.^{2, 4-7} While there is a strong, significant correlation between ownership and positive mood, the relationship between ownership and negative mood, while significant, was modest. This suggests that, rather than being the opposite of depression or burnout, ownership is a distinct psychological process.

Factor analysis identified 3 factors (subscales): conscientiousness, assertiveness, and confidence/perceived competence. These differ somewhat from the factors identified in our pilot study: assertiveness, being the "go-to" person, and diligence.¹³ The conscientiousness subscale in this study is a hybrid of the factors that corresponded to diligence and being the "go-to" person in the pilot study. The assertiveness subscale mirrors the same subscale in the pilot study. Confidence, a new factor, includes new self-efficacy items that were not in the pilot study (Table 1).^{3, 13-15} Therefore, through iterative item development, confirmed by factor analysis, we expanded the operational definition of ownership. We found several correlates of patient care ownership. Ownership was higher among senior residents and those who had more ICU experience, surrogates for knowledge and experience. Hence, we infer that knowledge and experience are key predictors of ownership. The affective component of decision ownership requires reflecting on self-efficacy and competence, both of which depend on knowledge and experience. Of the three subscales, we found that training level and ICU experience were associated with assertiveness and confidence, but not with conscientiousness. Whereas time and experience are

Table 4 Bivariate Analysis Comparing Mean Ownership Between Categorical Variables (N = 563)

| Variable | No. of observations | Mean ownership* | SD ownership* | Within-group p value |
|--|---------------------|-----------------|---------------|----------------------|
| Demographics | | | | |
| Gender | | | | |
| Female | 249 | 5.63 | 0.61 | 0.132 |
| Male | 314 | 5.71 | 0.6 | |
| Race | | | | |
| Nonwhite | 248 | 5.66 | 0.66 | 0.937 |
| White | 280 | 5.66 | 0.56 | |
| Ethnicity | | | | |
| Hispanic | 40 | 5.85 | 0.56 | 0.048* |
| Non-Hispanic | 518 | 5.66 | 0.61 | |
| Background | | | | |
| Training level ^{††} | | | | |
| PGY-1 | 235 | 5.60 | 0.58 | 0.002 [†] |
| PGY-2 | 164 | 5.63 | 0.60 | |
| PGY-3 and 4 | 164 | 5.82 | 0.63 | |
| Training program (excluding preliminary interns) | | | | |
| Traditional internal medicine | 439 | 5.71 | 0.62 | 0.173 |
| Primary care | 41 | 5.51 | 0.42 | |
| Combined internal medicine and pediatrics | 33 | 5.58 | 0.56 | |
| Hospital internal medicine [§] | 14 | 5.70 | 0.61 | |
| Intern training program | | | | |
| Categorical | 199 | 5.62 | 0.56 | 0.509 |
| Preliminary | 36 | 5.55 | 0.68 | |
| No. months previously spent in the ICU ^{††} | | | | |
| 0–2 months | 179 | 5.56 | 0.59 | <0.001 [‡] |
| ≥2 to < 4 months | 238 | 5.65 | 0.60 | |
| ≥ 4 months | 146 | 5.85 | 0.59 | |
| Inpatient setting | | | | |
| Service type ^a | | | | |
| General medical wards | 325 | 5.75 | 0.58 | <0.001 [‡] |
| Subspecialty wards | 60 | 5.41 | 0.66 | |
| Step-down unit or ICU | 178 | 5.61 | 0.61 | |
| Hospital type ^b | | | | |
| Academic medical center or university hospital | 262 | 5.61 | 0.62 | 0.033* |
| Community hospital | 47 | 5.60 | 0.57 | |
| County hospital | 79 | 5.74 | 0.63 | |
| VA hospital | 170 | 5.77 | 0.57 | |
| Duration on service | | | | |
| 1–2 weeks | 185 | 5.61 | 0.62 | 0.068 |
| 3–4 weeks | 378 | 5.71 | 0.60 | |
| Schedule: call versus no call | | | | |
| Call [¶] | 162 | 5.74 | 0.60 | 0.100 |
| No-call | 401 | 5.64 | 0.61 | |
| Schedule: days versus nights [#] | | | | |
| Days | 349 | 5.69 | 0.56 | 0.001 [†] |
| Nights | 51 | 5.41 | 0.69 | |
| Positive learning environment ^{**} | | | | |
| Yes | 79 | 6.14 | 0.58 | <0.001 [‡] |
| No | 484 | 5.6 | 0.54 | |

Table detailing results of bivariate analysis between mean ownership (on the 13-item ownership) and categorical variables of interest. We used *t* test and ANOVA for all analyses presented. For variables with > 2 categories and a significant within-group comparison, we report the post hoc comparisons between each category below

ICU, intensive care unit; PGY, post-graduate year; VA, Veterans Affairs

* $p < 0.05$, [†] $p < 0.01$, [‡] $p < 0.001$

[§]This track was only at University of Colorado Denver

We excluded the 5 respondents who answered "none of the above" to this question from this bivariate analysis

[¶]Call refers to any service that included a shift of ≥ 24 h in house at least once per week

[#]Among those who were not on a service with 24+ hour call. We also excluded those who reported being on both days and nights during their rotation from the days versus nights analysis

^{**}Positive learning environment refers to a summative score of ≥ 60 on 15-item Mini-Rez scale developed by Linzer et al.

Between-category comparisons

^{††}There was no significant difference in mean ownership between PGY-1 versus PGY-2 ($p = 0.914$); however, there was a significant difference between PGY-1 versus PGY-3 ($p = 0.002$) and PGY-2 versus PGY-3 ($p = 0.014$)

^{‡‡}There was no significant difference in mean ownership between 0 and 2 months versus 2 and 4 months ($p = 0.293$); however, there was a significant difference in 0–2 months versus ≥ 4 months ($p < 0.001$) and between 2–4 months versus ≥ 4 months ($p = 0.003$)

^aThere was no significant difference in mean ownership between SDU or ICU versus subspecialty wards ($p = 0.067$); however, there was a significant difference in mean ownership between subspecialty wards and general medical wards ($p < 0.001$) and between SDU or ICU and general medical wards ($p = 0.033$)

^bThere was no significant difference in mean ownership between academic medical center/university hospital versus community hospital ($p = 1.000$) or county hospital ($p = 0.311$), nor between county versus community hospital ($p = 0.570$), VA versus community hospital ($p = 0.331$), nor VA versus county hospital ($p = 0.991$). There was a significant difference in mean ownership between the VA hospital and academic medical center/university hospital ($p = 0.04$)

constrained by a residency program's educational requirements, conscientiousness—which appears to be independent of time and experience—may be more modifiable. Our findings suggest that interventions to foster ownership during residency training may be most effective if they focus on nurturing conscientiousness. Additionally, the lack of association between ownership and taking 24+ hour call suggests that changes in call schedules alone may not be sufficient to foster ownership.

Several aspects of inpatient clinical rotations were associated with ownership. Residents exhibited more ownership on the medical ward than on subspecialty wards or in the ICU. This may be because residents have more knowledge and experience about general medicine and feel more competent in these settings. However, we could not account for heterogeneity across institutions (e.g., differences in team structures or workload), which also could have contributed to observed differences in ownership between rotation types in this analysis so this conclusion is speculative. Ownership's positive association with being on a day (versus night) schedule is unsurprising given resident preferences for such schedules.¹² The lack of association with 24+ hour call challenges the idea that shorter shifts reduce ownership by limiting continuity¹ and suggests that changes in call structure alone may not be sufficient to foster ownership. However, because of heterogeneity in rotation structures among residency programs, more research is needed to understand these potential causal pathways.

Finally, we found an inverse relationship between self-defined burnout and ownership, which mirrors our pilot study findings. This is consistent with previous evidence that burned-out physicians are less likely to find meaning in work.^{28, 29} Since personal investment in decision-making is a defining feature of ownership, ownership might counter elements of burnout such as emotional exhaustion (losing enthusiasm for work) and depersonalization (viewing or treating patients as if they were objects).³⁰ However, it is unclear whether decision ownership attenuates the effect of burnout or if this relationship is indirect. On the contrary, it is possible that the presence of burnout may harm decision ownership.

Implications

In this study, we validated the Patient Care Ownership Scale for use by medical educators and investigators. We hope that medical educators will use our scale to inform the design and evaluate the effectiveness of interventions aimed at fostering ownership. We hope that researchers will use our scale to investigate the relationship between decision ownership and clinical outcomes like patient satisfaction and care utilization.

Limitations

Our study has some minor limitations. It was limited by common issues in survey research, including the possibility of recall

and social desirability biases, and the limited ability to infer causality from correlations. Cognitive interviews were limited by experimenter bias and confirmation bias, issues common to qualitative research. Our study was also limited to the inpatient, team-based setting, and is specific to medical residents. Further research should examine the Patient Care Ownership Scale in the ambulatory setting, in other specialties, and for use among medical students and attending physicians.

A key assumption of this study is that decision ownership varies and is modifiable. Although there may be an aspect that is immutable, we were more interested in uncovering aspects of ownership that can be fostered or changed. Future longitudinal studies can examine ownership in relation to external measurements such as ACGME milestones or faculty's perception of trainee ownership. A critical next study is to examine the relationship between ownership and clerical burden and work environment.

CONCLUSIONS

In this multisite study, we validated the Patient Care Ownership Scale, an instrument that measures decision ownership among internal medicine residents. Medical educators and investigators can use our scale to assess interventions aimed at fostering ownership, which may also decrease burnout. Further research can identify the best method of fostering ownership and the effect of decision ownership on healthcare outcomes.

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Authors' Contribution Dr. Djulbegovic contributed to the study design, collection, cleaning, analysis and interpretation of the data, and initial draft of the manuscript, and provided revisions of the manuscript.

Dr. Fraenkel contributed to the study design and interpretation of the data, and provided feedback on manuscript drafts and revisions.

Dr. Canavan and Dr. White contributed to the analysis of the data and interpretation of the data, and provided feedback and revisions on manuscript drafts.

Dr. Dr. Kulkarni, Dr. Chen, MD, Dr. McGuire, MD, Dr. Shah, Dr. Reddy MD, and Dr. Kay contributed to the collection of the data. Dr. Chen also contributed to the study design.

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