



Burnout and Association With Resident Performance as Assessed by Pediatric Milestones: An Exploratory Study

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ABSTRACT

INTRODUCTION: Prior work demonstrating that burnout is associated with decreased performance in medical trainees has relied on self-report and/or single-site studies. We explored the relationship between burnout status and Milestones-based scores in pediatric residents nationally.

METHODS: In April to June 2016, we confidentially surveyed residents using the Maslach Burnout Inventory. Separately, programs submitted resident Milestones scores in June 2016. We examined the relationship between burnout and performance as assessed by Milestones scores for each domain of competence. We performed multivariate analysis to determine which components of burnout (depersonalization [DP], emotional exhaustion, and lack of personal accomplishment [PA]) were most impactful.

RESULTS: About 1494 of 2368 (63%) residents at 32 programs completed the Maslach Burnout Inventory and had Milestones scores submitted. Residents who scored positive for burnout scored lower in all Milestones domains. Subgroup analysis demonstrated that this association was only significant ($P < .05$) in the post-

graduate year 1 (PGY1) categorical pediatric cohort. In the PGY1 residents ($n = 442$), those positive for burnout had lower Milestones scores in patient care (PC) (2.78 vs 2.98), systems-based practice (2.69 vs 2.87), practice-based learning and improvement (2.77 vs 2.93), professionalism (3.09 vs 3.24), and interpersonal and communication skills (2.95 vs 3.12), but not medical knowledge. Multivariate analysis demonstrated that, in PGY1 residents, lower PC score was associated with lower PA and higher DP.

CONCLUSIONS: Burnout is associated with decreased Milestones performance for pediatric PGY1 residents. DP and low PA were associated with lower PC scores in PGY1 residents. Future research should address whether strategies to mitigate burnout improve PGY1 performance.

KEYWORDS: burnout; medical education; milestones; pediatric; performance; resident

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WHAT'S NEW

This study provides a large national sample of pediatric residents with corresponding burnout and performance data (Pediatric Milestones scores). This provides an opportunity to explore the relationship between burnout and performance for trainees in all domains of competency.

BURNOUT HAS BROADLY recognized negative effects on clinicians' physical and mental health, including increased

risk of suicide.^{1–3} Additionally, the negative effects extend to patients and the broader healthcare system.^{4,5} A recent meta-analysis demonstrated the association between burnout and patient safety, patient care (PC) related to professionalism (PR), and patient satisfaction; the risk of an adverse event occurring in any of these domains doubled for the burned out physician and was greatest for residents and early stage physicians.⁴ Eleven pediatric residency programs in the northeastern United States found that burnout was associated with self-reported measures of negative PC attitudes, negative behaviors, and poor

communication.⁶ Medical students with burnout are more likely to self-report that they engaged in dishonest and unprofessional behavior.⁷

A notable limitation of previous work is that the outcome measures of performance were based on self-report and prone to recall bias. Single-program studies examining the association between burnout and the competencies of medical knowledge, PR, and communication using objective measures such as the in-training exam and observed medication errors have had mixed results.^{8–11} Gaps remain in our understanding of relationships between competency, performance, and burnout with lack of data from larger, multisite samples.

The most standardized, current measure of performance in pediatric residents is the Pediatric Milestones. The Milestones are a measure of learner performance disseminated by the Accreditation Council for Graduate Medical Education (ACGME), which incorporate a descriptive framework of behaviors that span the educational continuum from medical students early in their education to practicing physicians.^{12–14} Since 2014, ACGME-accredited programs have been required to report on 21 Milestones for each trainee biannually.¹⁵ They include 6 domains of competency including PC, systems-based practice (SBP), practice-based learning and improvement (PBLI), PR, interpersonal and communication skills (ICS), and medical knowledge (MK). Since their implementation, Milestones have gained validity evidence to document progression within individual learners and between levels of learners.^{16,17} Li et al established norms for end of year Pediatric Milestones assessments for each post-graduate year (PGY).¹⁸ Milestones provide one of the only evidence-based and comparable outcome measures that can assess performance across a large number of learners from different programs.

Our study objective was to examine the relationship between pediatric resident burnout status and performance using Milestones score domains as outcome measures. Based on prior literature, we hypothesized that burnout status would be most closely associated with decreased Milestones performance in the domains of PC, PR, and ICS and the association would not differ by post-graduate residency year (PGY1 vs PGY2 vs PGY3).^{6,19–22}

METHODS

Pediatric residency programs that were members of the Pediatric Resident Burnout-Resilience Study Consortium (PRB-RSC) in 2016 were invited to participate in this study. The PRB-RSC is a national consortium of pediatric residency training programs that are interested in examining issues of burnout and resiliency.

The purpose of the PRB-RSC is to provide a collaborative platform for members to perform multicenter research that addresses burnout in residents and to develop interventions that may enhance resiliency.²³ Membership in the consortium is voluntary and members were solicited based on interest. In 2016, the PRB-RSC enlisted 34

residency programs across the United States, of which 32 fully participated in this study. Among the 32 programs, 2 were small sized (<30 residents), 13 were medium-sized (30–60 residents), and 17 were large programs (>60 residents). PRB-RSC member institutions ranged in size from 19 to 199 total residents (median 74; mean 80 residents per program).

Residency programs in the PRB-RSC are also members of the Association of Pediatric Program Directors (APPD) Longitudinal Education Assessment Research Network (LEARN).^{24,25} Recruitment for the consortium took place via e-mail through the APPD list serve and advertisements at APPD national meetings.

All residents in pediatrics programs (categorical or combined) at these institutions were eligible to participate. There were no exclusion criteria.

A confidential, cross-sectional survey that assessed potential risk factors for burnout and protective factors for resilience was developed and distributed via a web-based platform from April to June 2016.²² APPD LEARN staff assisted with survey distribution and data coordination. The instrument included 141 items and took 12 to 15 minutes to complete.²² Residents self-selected their participation in either a categorical or combined training program. The Maslach Burnout Inventory (MBI) was included in this survey.

The primary exposure of interest was burnout as assessed by the MBI, a validated 22-item questionnaire used widely across populations of medical professionals.^{1,26} It contains 3 subscales that measure the components of burnout: depersonalization (DP), emotional exhaustion (EE), and lack of personal accomplishment (PA). Data from the MBI were utilized in 2 ways in our analyses. First, we used the accepted dichotomized definition of burnout as a high score in either DP (≥ 13) or EE (≥ 27), and also evaluated each of the domains (EE, DP, and PA) as distinct continuous variables as has become more standard (and recommended by the authors of the MBI manual) in our multivariate analysis.^{26–28}

Separately, in June 2016, participating residency programs submitted their January to June ACGME Milestone scores for each resident to APPD LEARN. Programs' Clinical Competency Committees (CCCs) were provided the standard guidance from the ACGME on assignment of Milestones and used their own methods for rating learners in assigning Milestones. Generally, programs used assessments of residents completed by a combination of faculty, co-residents, nurses, and parents for the reporting period to assign Milestones ratings. Milestones scores for the 21 competencies are reported on a 5-point scale (1–5, with 0.5 increments) with 1 scoring the novice and 5 scoring the master clinician for each competency, with the exception of PC4 relating to transfer of care, SBP1 assessing coordination of care, and SBP3 relating to working within a team rated on a 4-point scale (1–4, with 0.5 increments).

APPD LEARN provided the program with web-based software to create confidential unique LEARN IDs for each resident; APPD LEARN only received data identifiable by

this ID. Residents submitted their survey directly to APPD LEARN using this ID, and program staff submitted resident Milestones scores also using this APPD LEARN-specific ID. APPD LEARN staff used this unique identifier to pair the survey and Milestones scores for each resident.

ANALYSIS

Mean Milestones performance was calculated for each resident in each domain of competence. Data were analyzed by group means for each Milestones domain. Milestones mean scores and burnout status were calculated by PGY level of training and by program type (categorical vs combined); at each PGY level, mean scores were compared between residents with and without burnout using *t* tests.

Additionally, we adjusted for clustering of data by residency program, using a mixed-effect model. This model allowed each residency program to have its own average competency domain scores. Thus, we could examine the association between burnout and domain scores while adjusting for discrepancies between programs' Milestone assignments. As a standard approach in multisite research, we fitted a linear-mixed model to domain scores with resident year as a fixed effect (PGY1 as reference) in order to compare MBI subscales with 2-way interactions of resident year and domain scores. To account for differences in CCC proceedings among programs and associated clustering of resident scores, the model assigned random intercepts to each program. Computations used R 3.3 (R Core Team, Vienna, Austria) with lme4 statistical package.²⁹

Institutional review board approval or exemption was obtained at each participating institution.

RESULTS

Thirty-two pediatric residency programs participated in this study, resulting in 2368 eligible residents. Of these, 71% completed the survey and 89% of those had Milestones scores submitted by their program. In total, we received both MBI and Milestones scores for 1494 of 2368 (63%) of eligible residents (Table 1). Most (1310 of 1494 or 87%) described themselves as categorical pediatrics residents, 116 (8%) were in medicine/pediatrics programs while 68 (5%) were in other combined

pediatric programs (Fig. 1). The relatively small numbers of residents in the combined programs were insufficient for analysis of those programs, so the results presented focus solely on categorical pediatric residents.

Within the cohort of 1310 categorical pediatric residents, the prevalence of burnout was 55%. The range of mean scores for Milestones assigned within each program at specific PGY levels varied from 0.93 to 1.4 points. Burnout was associated with lower scores in all domains of competence ($P < .05$). The difference in mean domain scores between residents with and without burnout was relatively consistent by domain; SBP had the greatest difference (0.17) followed by PC and ICS (0.16), PBLI (0.15), PR (0.14), and MK (0.11). In subgroup analyses by year of training, PGY1 residents had the greatest degree of burnout (60%), followed by PGY2 (56%) and PGY3 residents (48%). These differences were not statistically significant. PGY1 residents were the only subgroup with a statistically significant association between burnout status and Milestones scores. Compared with PGY1 residents without burnout, those with burnout had lower Milestones scores in all competency domains except MK. Within PGY1, burnout was associated with the greatest change in PC Milestones (0.20) followed by SBP (0.18), ICS (0.17), PBLI (0.16), PR (0.15) (Fig. 2).

In the multivariate model of the PC domain, there were no main effects from resident year, but several interactions between year and burnout were noted. In PGY1 residents, there were statistically significant associations between both the MBI's PA and DP subscale scores and the mean score of the PC domain; each point decrease in PA was associated with a decrease of 0.008 in the mean PC score and each point increase in DP was associated with a decrease of 0.013 in the mean PC score. No significant interactions were noted in PGY2 and PGY3 residents.

Similar results are included for each domain of competency. Table 2 reports the PGY1 simple slopes (the predicted change in the domain score from a single point of change in a burnout score) for burnout scores associated with domain scores. Notably, each competency domain in the table was run as a separate regression model. Low PA scores were associated with low mean domain scores in

Table 1. Participant Description

	Overall	PGY1	PGY2	PGY3 & 4
N	1494	508	499	487
Age (mean [SD])	29.2 (3.1)	28.4 (3.9)	29.2 (2.2)	30.2 (2.5)
Female (%)	1076 (72.0)	376 (74.0)	354 (71.4)	346 (70.9)
Caucasian (%)	1058 (70.8)	376 (74.0)	349 (69.9)	333 (68.4)
African American (%)	46 (3.1)	13 (2.6)	14 (2.8)	19 (3.9)
Asian (%)	225 (15.1)	68 (13.4)	78 (15.6)	79 (16.2)
Hispanic (%)	71 (4.8)	20 (3.9)	30 (6.0)	21 (4.3)
Other/not listed (%)	94 (6.3)	31 (6.1)	28 (5.6)	35 (7.2)
Burnout + (%)	830 (55.6)	308 (60.6)	283 (56.7)	239 (49.1)

PGY indicates post-graduate year; SD, standard deviation.

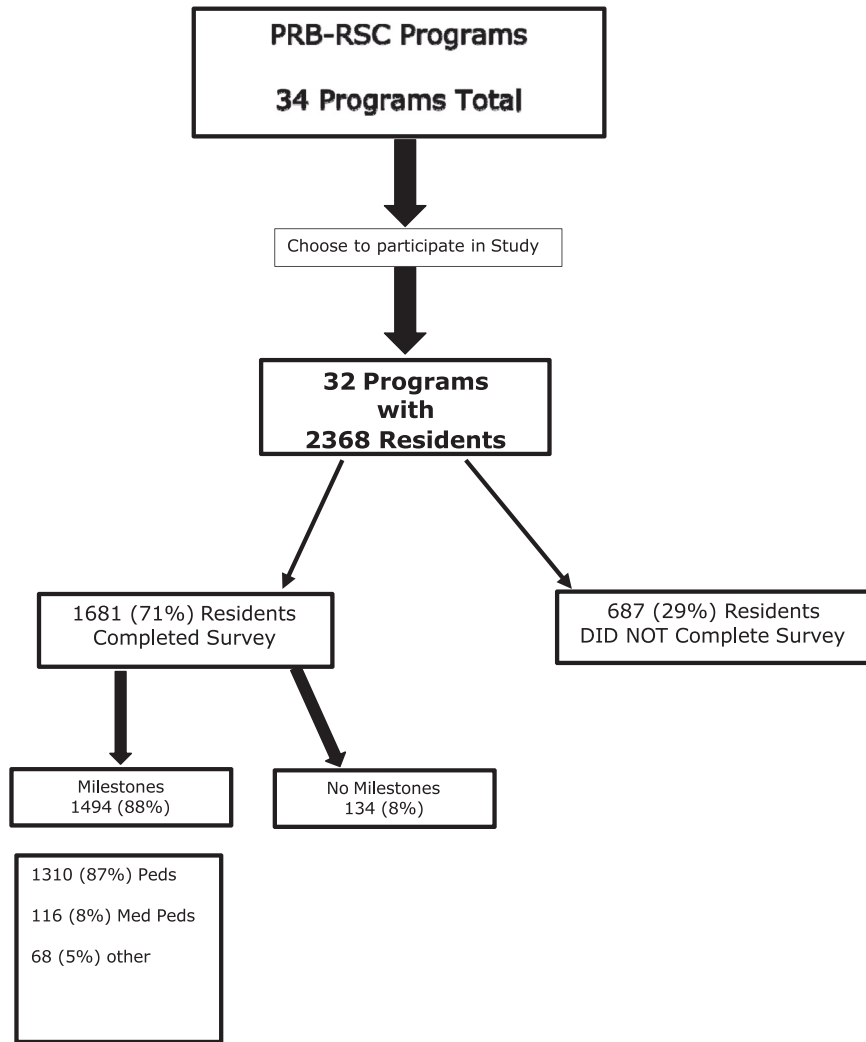


Figure 1. Having recruited 32 volunteer programs and their 2368 residents, we received complete surveys and Milestones from 1310 categorical pediatric residents who were the subjects of this study. PRB-RSC indicates Pediatric Resident Burnout-Resilience Study Consortium.

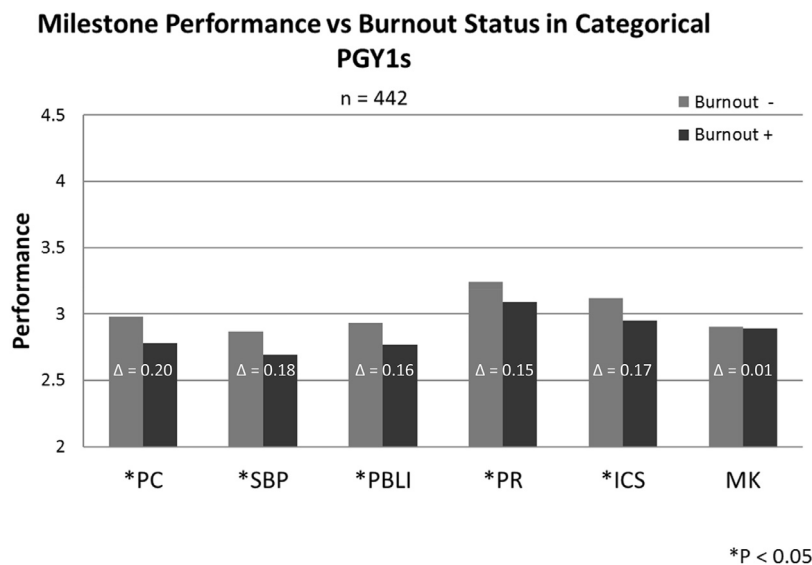


Figure 2. There was a statistically significant difference between the Milestone scores in those with burnout compared with those without in all domains of competency except MK. ICS indicates interpersonal and communication skills; MK, medical knowledge; PBLI, practice-based learning and improvement; PC, patient care; PGY, postgraduate year; PR, professionalism; and SBP, systems-based practice.

Table 2. Multivariate Models for PGY1 Categorical Pediatric Residents

	PC	SBP	PBLI	PR	ICS	MK
PGY1						
DP	-0.013 (0.004)*	-0.004 (0.004)	-0.005 (0.004)	-0.008 (0.004)*	-0.014 (0.005)*	-0.002 (0.005)
Lack of PA	-0.008 (0.003)*	-0.007 (0.003)*	-0.007 (0.003)*	-0.007 (0.003)*	-0.011 (0.004)*	-0.006 (0.004)
EE	0.004 (0.003)	0.000 (0.003)	0.001 (0.003)	0.003 (0.003)	0.005 (0.003)	0.000 (0.003)

DP indicates depersonalization; EE, emotional exhaustion; ICS, interpersonal communication skills; MK, medical knowledge; PA, personal accomplishment; PBLI, practice-based learning and improvement; PC, patient care; PGY, post-graduate year; PR, professionalism; and SBP, systems-based practice.

Subgroup analysis did not reveal statistically significant differences for PGY2 and PGY3. Columns represent separate linear-mixed models fitted to milestone domains with fixed effects of PGY and MBI subscale scores, and 2-way interactions between PGY and scores, and a random effect of program. Cell values represent the simple slopes (predicted impact of a one point change in each score adjusted for other predictors) of the domain score for PGY1 with standard errors in parentheses; simple slopes were never significant in PGY residents >1.

* $P < .05$.

all domains except MK and high DP scores were associated with low mean domain scores in PC, PR, and ICS in PGY1 residents. High EE scores were not associated with a significant change in domain scores.

DISCUSSION

In our large nationally representative sample of more than 1300 categorical pediatric residents, more than half (55%) met criteria for burnout. Our results demonstrate a statistically significant association between burnout status and lower Milestones scores in 5 of 6 domains for categorical pediatric interns. Milestones scores in the cohort of trainees who reported burnout ranged from 0.15 to 0.20 points lower than those without burnout ($P < .05$). While these data support our first hypothesis that Milestones scores would be lower in the domains of PC, PR, and ICS, the scores were also lower in SBP and PBLI.^{6,19–21} Only MK did not show a significant difference.

To our knowledge, only 1 other study has evaluated the relationship between burnout and Milestones performance, but it was limited by its small, single-center sample size (38 internal medicine residents) and low (30%) response rate.³⁰ In that study, residents who scored higher on burnout measures had lower Milestones domain scores in the PC domain yet higher domain scores in the PR and SBP domains. Milestones scores in that study were analyzed as dichotomous (residents rated as below average or at or above average) while we treated Milestones scores as a continuous variable.³⁰ It is important to note that each specialty currently has different Milestones and varied descriptions of progression along the levels of achievement.

Although the magnitude of the decrease in Milestones performance in these 5 domains among the trainees with burnout is statistically significant, the differences are small (0.15–0.20). The educational significance is unknown and deserves further exploration. The small variation in assigned mean Milestones scores in practice may be due to the imprecision of Milestones assessments since these are currently recorded as ordinal values with incremental changes of 0.5. Additionally, in the discipline of Pediatrics, the 1 to 5 developmental levels describe the progression from new third-year clerkship students to master clinicians, in effect, limiting the range of ratings

for the development through residency to 1.5 to 4.5 (only 7 choices of rankings). While we found similar negative associations between burnout and Milestones scores for 5 of the competency domains, more research is needed in Milestones assessments to better determine what differences meet educational significance. Our study found a typical range of approximately 1.2 to 1.3 points in Milestones scores at each PGY level. As noted above, PGY1 residents with burnout had Milestones scores 0.15 to 0.20 points lower compared with those who were not burned out. This implies that the presence of burnout accounts for about 13% to 17% of the difference in Milestones for these PGY1 residents, suggesting a notable association.

Our second hypothesis that the association between burnout status and lower Milestones scores would be present across all PGY levels of training was not supported by our data. The PGY1 class was the only one with a significant negative association between burnout status and Milestones scores. Our initial hypothesis was driven by work done by our group and others that suggested no statistically significant differences in burnout rates across PGY levels of training.²²

We suggest several reasons why burnout had an association with lagging performance in PGY1 residents and not with those in upper levels of training. In the APPD LEARN study of Pediatric Milestones (2030 residents, 47 programs) trainees entered residency with a wide range of skills in the various competencies, with decreased variability in performance ratings noted with advancing levels of training.¹⁸ The ability to detect decreased performance associated with burnout in categorical pediatric interns may be due to the relatively larger variability among initial intern performance that diminishes during PGY2 and PGY3 years. In another study conducted by APPD LEARN (1704 residents, 41 pediatric programs), there were 2 Milestones competencies that showed outstanding discrimination between marginal/unsatisfactory and satisfactory interns. Those 2 competencies were both from the PC domain (PC2: organize and prioritize responsibilities to provide PC and PC3: provide transfer of care that ensures seamless transitions).³¹ In that study, residents were more likely to be reported as marginal/unsatisfactory earlier in training. These findings of increased variability in skills as rated by the Milestones earlier in training, particularly in ratings of

performance in the PC domain, may more readily reveal significant differences as compared to later in residency when Milestones ratings have less variability.

The performance gap associated with burnout in the PGY1 may, alternatively, be explained by dynamics unique to the intern year. Several studies have described the rate of change from lower burnout levels preresidency to much higher levels of burnout mid to late intern year.^{1,32–34} Rosen et al demonstrated that chronic fatigue, burnout, and mood disturbances increased over the intern year for internal medicine residents.³³ Block et al demonstrated that burnout and fatigue were prevalent across internal medicine interns.¹⁹ In addition, repeated exposure to the “hidden curriculum” (the pervasive unprofessional culture that persists in academic teaching hospitals and is witnessed by new learners) results in value conflicts between striving for PR and the unprofessional culture that has been associated with higher burnout and cynicism scores across all years of training.²¹ Perhaps exposure to a new professional environment affects the interns’ performance in comparison to the assimilated upper level residents. Additionally, other studies report that new interns frequently feel unprepared for intern year, secondary to underdeveloped clinical skills, inadequately defined roles, and difficulties balancing work and personal life.³⁴ Interns perceive less social support and pressure to “prove themselves,” with reports of resultant perceived job stress being related to suicidal ideation among house officers.^{32,35} Leadership within pediatric residency training programs need to be alert to the development of burnout, especially early during internship, and develop interventions to mitigate this at both the individual and organizational levels. More research needs to be done to investigate protective factors among PGY1 residents, and all trainee levels to encourage programs to monitor for and support learners through any difficulty with burnout.

Multivariate analysis demonstrated that 2 burnout components—DP and lack of PA—were associated with a decrease in Milestones ratings for interns, but not for upper level residents. In a meta-analysis of 47 studies by Panagioti, DP was associated with 3-fold the risk of poor PC due to PR issues.⁴ In that review, lack of PA and high EE were each associated with a 2.5-fold the risk of poor PC and PR issues. The investigators found the link between burnout and low PR was greater in residents and early career physicians compared to those later in their careers, but did not perform analysis specifically by level of residency training.⁴ Our analysis found a similar association between higher DP and lack of PA with lower Milestones in PC, but only in interns. High EE in our study was not independently associated with lower competency. We were surprised by this finding and are unsure of why this was observed in our study population.

Other studies of trainees have described different impacts of the components of burnout. Dyrbye et al examined burnout among US students, residents, and early career physicians.³⁶ In that study (1701 trainees), DP was highest during residency at 51% and recovered during the early career period. The prevalence of high EE was 44% among residents and fellows, while the prevalence of low PA was only 22%

and increased progressively from residency to early career. In the study by Billings et al among internal medicine residents at 2 institutions, factors associated with the hidden curriculum and concerns regarding PR were associated with higher DP and greater EE.²² One potential explanation of why a sense of PA may have been so impactful on the PGY1 residents is that residents early in training typically feel vulnerable and seem to lack confidence in their new-found skills and knowledge. More study is needed to explore this finding, as it is likely another important area for helpful interventions specific to residents in training.

Future research is essential to further delineate factors during residency training that may mitigate burnout and enhance resilience. Next steps for investigation include using conceptual frameworks such as the one Shanafelt has proposed in addressing organizational strategies with more in-depth study of the concepts of workload and job demands, efficiency, control and flexibility, work-life integration, social support, community at work, and meaning in work.³⁷ These are also potential areas for medical school and residencies to focus their interventions to optimize the learning environments of medical trainees.³⁸

Limitations of this study include the cross-sectional study design, which addresses association rather than causation; future studies would benefit from a longitudinal design to better assess causality and the stability of characteristics such as burnout and performance ratings over time. There was also the possibility of selection bias as program participation in the consortium was voluntary. However, the national scope of our study makes our results likely to be generalizable to the entire population of pediatric residents. While Milestones ratings are currently the best generalizable and standardized tool for comparing resident performance across programs, we acknowledge that CCC assessment methodology has not been calibrated across all programs. However, programs receive guidance from the ACGME on how to organize and run CCC proceedings providing an outline for common practices. There is also a growing body of literature that describes the functioning of pediatric CCCs and best practices that have been broadly disseminated.^{39,40} Furthermore, our analysis accounted for variation of CCC practices by using random intercepts for each program. Finally, although the differences in Milestone performance are statistically significant, we acknowledge their educational significance is unknown.

Given the large numbers of residents and programs that contributed to this study, and the consistent negative association of burnout with 5 of the Milestone domain scores in PGY1s, future studies should investigate these relationships longitudinally to better understand the association of burnout and performance, as assessed by Milestones and other methods, in trainees.

CONCLUSIONS

Our study shows that burnout is associated with the delay of professional development of categorical

pediatric interns as demonstrated by decreased Milestones performance. Program leaders must consider burnout as one of the many factors that influence performance ratings in interns. Developing strategies to address burnout in early-career trainees will not only lead to a more favorable learning environment, but will allow pediatric interns to achieve their full potential. Monitoring performance ratings can provide an early clue to program directors that a trainee may be experiencing burnout. Our findings demonstrate that burnout is significantly associated with decreased Milestones performance as rated by CCCs for categorical pediatric interns. Burnout is one of many factors that influence performance in interns. Additionally, faculty and program leadership should be alerted for the signs and symptoms of burnout in their trainees. Concerted efforts to address burnout are likely to enhance learning environment and general work force. Further, additional study to determine the cause and effect of burnout and clinical effectiveness/competency should be undertaken.

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