Implementation Strategies to Mitigate Burnout Among Resident Physicians: A Scoping Review

Emylia Terry, MA
Graduate Research Assistant/Doctoral Student
Department of Environmental and Occupational Health, School of Public Health, University of Nevada, Las Vegas
4700 S. Maryland Pkwy. Suite 335, Las Vegas, NV 89119
702-895-5090
Emylia.Terry@unlv.edu

Haniyeh Shariatmadari, MHA
Graduate Research Assistant/Doctoral Student
Department of Healthcare Administration and Policy, School of Public Health, University of Nevada, Las Vegas

Gabriela Buccini, PhD, MSc, IBCLC
Assistant Professor
Department of Social and Behavioral Health, School of Public Health, University of Nevada, Las Vegas

AUTHOR NOTE

ABSTRACT

Resident physicians have completed medical school and are undergoing specialized training in a specific area of medicine. The demanding workload of residency, high levels of responsibility, and exposure to traumatic events can lead to chronic stress and fatigue, which can increase the risk of developing burnout syndrome, a psychological state characterized by feelings of exhaustion, detachment, and cynicism toward one's work. This has significant implications for the well-being of resident physicians and the quality of patient care they provide. Our scoping review identifies implementation strategies to reduce resident burnout within U.S. healthcare settings. Using PubMed and CINAHL databases and key search terms, eligible studies underwent review and assessment based on inclusion (i.e., must include residents, must take place in a healthcare setting) and exclusion criteria (i.e., non-U.S. studies, gray literature). The search identified 215 articles and following the removal of duplicates and our inclusion/exclusion criteria, 9 papers were eligible for inclusion. Researchers utilized ERIC and Proctor implementation frameworks to extract relevant characteristics and themes. Emergent themes included the importance of stakeholder feedback to interventions; the criticality of adapting interventions; implementing support-based interventions; the importance of education and training to implementation; and the consequences of non-adherence to implementation strategy criteria. The strategies and outcomes identified can help inform the curriculum of residency programs, the guidance of implementing burnout-mitigating interventions among residents, and the development of workplace initiatives to combat burnout.

KEYWORDS

INTRODUCTION

The World Health Organization's International Statistical Classification of Diseases and Related Health Problems (ICD) provides important information about the scope, causes, and impacts of disease. ICD defines burnout as a chronic workplace stress-related syndrome, characterized by feeling exhausted or drained of energy, increasingly distancing oneself mentally from one job or feeling cynical or negative toward their work, and diminished efficacy in the workplace (World Health Organization, 2019; World Health Organization, 2023). Burnout is complex, involving a combination of individual (e.g., poor self-esteem and insufficient coping skills) and organizational factors (i.e., stressful organizational climate) (Green et al., 2014; Maslach et al., 2001). There are also disparities with regard to burnout, likely due to the stigma and discrimination that certain communities face (Barboza-Wilkes et al., 2023; Rabelo & Cortina, 2014). For example, one study found that young women of color are especially vulnerable to experiencing burnout, while another study found that sexual minority individuals had higher job burnout ratings on surveys (Barboza-Wilkes et al., 2023; Rabelo & Cortina, 2014).

A systematic review of the effects of burnout caused by chronic workplace stress found that the syndrome has several negative consequences that impact employees' mental and physical health (Salvagioni et al., 2017). It significantly predicted many adverse health impacts, including high cholesterol, heart disease, cardiac-related hospitalizations, stomach issues, chronic fatigue, insomnia, symptoms of depression, and mental health-related hospitalizations (Salvagioni et al., 2017). Despite physicians treating these ailments daily, they are not immune to burnout syndrome.

According to the American Academy of Family Physicians and the American Medical

Association (2023), burnout among physicians is an epidemic in the United States (Drummond, 2015). Nearly 63% of doctors report signs of burnout at least once per week, such as an apathetic attitude toward work or emotional exhaustion. In their systematic review of the literature, Patel et al. (2018) found that physician burnout can have grave professional and personal consequences, perhaps leading to increased malpractice risks, lower patient satisfaction scores, a greater frequency of medical errors, and subpar patient outcomes and quality of care. Further, burnout may contribute to increased risks of car accidents, mood disorders, depression, and substance misuse, perhaps contributing to physicians having a two-fold increased risk of suicidality, with doctors having higher risks of completing suicide compared to the general population (28 to 40 per 100,000 versus 12.3 per 100,000, respectively) (Patel et al., 2018).

Resident physicians are doctors in training and may be particularly susceptible to developing burnout syndrome (Thomas, 2004). As residents learn and develop skills within their specialty area, they experience high rates of sleep deprivation, an intense workload with many responsibilities, and low salaries (Geurts et al., 1999; Lockley et al., 2004; Zis et al., 2014). A systematic review by Rodrigues et al. (2018) found that residents within the fields of obstetrics/gynecology, orthopedics, surgery, and anesthesiology residents had the highest prevalence of burnout at nearly 41%; pediatrics, plastic surgery, and internal medicine residents had a burnout prevalence of 30%; and neurology and otolaryngology residents had a prevalence of burnout at 15.4%, with an overall prevalence of 35.7% across all specialties. Given the consequences above of burnout for doctors and patient care outcomes, this issue must be addressed within medical education, training, and work (Rodrigues et al., 2018).

According to Theobald et al. (2018), implementation research provides a means of understanding and addressing health disparities by employing context-tailored, evidence-based interventions. Implementation research generates collaboration, influence, and shared ownership to build trust, partnerships, and the mutual creation of knowledge (Theobald et al., 2018). Implementation science has the goal of identifying the most effective methods to increase the uptake of evidence-based best practices into routine healthcare, using models and frameworks that are specific to the field (Eccles & Mittman, 2006). These frameworks can describe how research is translated into practice, assess what aspects are helpers and hinderers to implementation, and assist with evaluating the outcomes associated with implementation initiatives (Esmail et al., 2020; Nilsen, 2015).

Having a common language for expressing key aspects and terms relating to implementation strategy is key to integrating interventions and operationalizing strategy (Grol & Grimshaw, 1999; McNett et al., 2020; Powell et al., 2019). The Expert Recommendations for Implementing Change (ERIC) is a framework that allows for the classification of implementation strategies for replication and adaptation in other settings (Powell et al., 2015). Thus, implementation research can be effectively employed to design policy, empower communities, and support beneficiaries (such as resident physicians), and frameworks are key to understanding critical aspects of the implementation process (Theobald et al., 2018). According to the World Health Organization (2023), in order to address burnout among resident physicians, it is important to recognize that this is a pressing public health issue with significant consequences such as reduced quality of patient care, increased medical errors, lower job satisfaction and retention rates, negative impact on mental and physical health, and decreased productivity. Fortunately, there are preventative and therapeutic responses and interventions that may be effective for mitigating burnout, including modifying work processes and helping new physicians develop resilience and other health-protective behaviors (Kumar, 2016).

Despite the necessity of reducing resident burnout and establishing evidence-based best practices such as developing mindfulness, or the "the awareness that emerges through paying attention, on purpose, and non-judgmentally to the unfolding of experience moment by moment," the scholarship surrounding the implementation of burnout-mitigating interventions is limited (Kabat-Zinn, 2003; Malik, & Annabi, 2022). This scoping review identifies implementation strategies utilized in successfully reducing resident burnout among U.S. resident physicians. We aim to assess implementation strategies and interventions to reduce resident burnout within U.S. healthcare settings by analyzing implementation processes and outcomes, classifying them according to ERIC and Proctor parameters, and making recommendations about burnout interventions to mitigate burnout and associated symptoms.

METHODS
Protocol and registration
This scoping review was conducted following the Preferred Reporting Items for Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist (Appendix 1). On June 4, 2023, the protocol for this scoping review was preregistered

with the Open Science Framework (OSF) (osf.io/fgv6p).

Eligibility criteria

Eligibility criteria were used to select studies for this scoping review. First, publication dates had to be between 2017 and 2022 (5 years) to include the most up-to-date literature. We also wanted burnout intervention studies focused on adult human subjects who are medical residents located within a U.S. healthcare system setting, such as hospitals or clinics, as this is where the population of interest works. We also sought peer-reviewed journal articles, which have been assessed by experts in the field prior to publication, and studies in English, as both reviewers are English-speaking. We excluded reviews or editorials, as scoping reviews focus on the implementation of interventions, and studies involving children.

A scoping review approach was adopted to synthesize data from across a variety of research designs (Arksey & O'Malley, 2005). The Population/Concept/Context (PCC) framework is often leveraged when conducting scoping reviews because it helps identify research questions and refine search strategies, making it important to this review (University of South Australia, 2023). In this paper, only primary research studies that implemented interventions within a U.S. healthcare setting such as a hospital or clinic (the context) to lessen resident physician burnout (the concept) were included in this review to collect peer-reviewed best practices published in academic journals. While this paper initially focused on implementation strategies to mitigate burnout among resident nurses and physicians, our focus became solely on resident physicians (the population), as nurse residency programs are not required and do not need to be accredited, unlike physician residency programs within the United States (Munday, 2023).

United States healthcare settings (hospitals, clinics) were selected due to ongoing physician shortages and burnout being at an all-time high due to the COVID-19 pandemic, affecting ⅔ of physicians (Whang, 2022). Chronic job stress-related burnout has been demonstrated to have a number of detrimental effects on both the mental and physical health of workers, also making this an important area of focus (Salvagioni et al., 2017). Resident physicians in particular are vulnerable to burnout syndrome, since they experience a lack of sleep, a hard job with numerous duties, and low compensation while they study and build abilities in their specialist field, making this a key issue for action (Thomas, 2004). This study was exempt from University of Nevada, Las Vegas Institutional Review Board approval because it involves secondary research analysis with no identifiable human subjects.

Search strategy

Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA-ScR) standards for scoping reviews, which were established by the Enhancing the Quality and Transparency of Health Research Network to establish review guidelines, we carried out a systematic search and evaluation of the literature (Carpiano, & Daley, 2006; Moher et al., 2010) (Figure 1). The NIH National Library of Medicine MeSH platform was utilized to search identified relevant terms, keywords, and synonyms using PubMed-linked keywords in related studies and AND/OR Boolean search strategy for maximizing results. One of us met with Xan Goodman, Health Sciences Librarian at UNLV, who approved the final search strategy and keywords:

(((((((((((((("Professional Burnout" OR "Occupational Burnout" OR "Burnout, Occupational" OR "Career Burnout" OR "Burnout, Career") AND ("nurse" OR "nurses" OR "nursing" OR "physician" OR "physicians" OR "doctor" OR "doctors")) AND ("clinic" OR "clinics" OR "hospital" OR "hospitals" OR "health setting" OR "health settings" OR "healthcare setting" OR "healthcare settings" OR "Emergency" OR "urgent")) AND ("Strategy" OR "strategies" OR "intervention" OR "interventions" OR "program" OR "programs" OR "pilot" OR "pilots" OR "trial" OR "trials"))

Given that CINAHL indexes the best nursing and health sciences-related published literature, including nursing journals and articles, and that PubMed is a free web browser that primarily accesses the MEDLINE dataset of bibliography and abstracts on biological sciences and biomedical subjects, these two databases were selected. Selecting articles published in English between 2017 to 2022 within the PubMed and CINAHL filter options limited sources to the most current interventions in the language both researchers share (Brazier & Begley, 1996). While the CINAHL database allowed for filtering out articles that did not originate in the U.S., it is important to note that the PubMed database did not include this geographic option in their filters. After applying the search strategy and database filtered, we exported the articles (n = 215) into the reference management platform RefWorks and then the Rayyan blind review platform, which detected

five duplicates for elimination (n = 5), leaving 210 articles for title and abstract screening.

Selection of sources of evidence

Inclusion criteria for study selection included adult human participants, peer-reviewed journal articles/studies, healthcare system setting, implementation strategies (trials, pilot studies, etc.), resident physicians, and publication in the U.S. (for PubMed articles). Articles outside of the timeframe, study designs outside of our scope of interest such as reviews, gray literature, articles without resident physicians, articles outside of the U.S., and non-human studies comprised the exclusion criteria. Utilizing these factors, we reviewed the titles and abstracts for each of the non-duplicative papers imported into Rayyan (n = 210) and screened for exclusion and inclusion criteria. The screening was completed independently and blindly by reviewers. Reviewers first screened all titles and abstracts. After, all included full texts were independently screened and reviewed, and conflicts were discussed for consensus.

Data extraction and data analysis

We created a shared Excel sheet used to extract data from each article following three implementation frameworks. ERIC's 73 implementation strategies fall under nine clusters: uses evaluative and iterative strategies (e.g. solicits and provides feedback, assesses readiness), provides interactive assistance (e.g. provides local technical support, centralizes technical support), adapts and tailors to context (e.g. tailors to context, utilizes data experts), develops stakeholder interrelationships (e.g., identifies and trains advocates, uses advisory boards), trains and educates stakeholders (e.g., offers ongoing training, develops educational collateral), supports clinicians (e.g., reminds providers, changes professional duties), engages consumers (e.g., increases demand, leverages media), utilizes financial strategies (e.g., streamlines billing, offers incentives), and changes infrastructure (e.g., mandates change, alters record systems) (Waltz et al., 2014). In addition, we used Proctor et al. (2013) protocol for "naming, defining, and operationalizing implementation strategies," which includes seven dimensions, as implementation strategies must be described by their components and usage to be applied in real-world settings or research settings. This method includes defining implementation strategies' actor (who is leading the strategy), action (what the strategy entails), the target of the action (what the action should do), temporality (how often the strategy should take place), dose (the amount of the intervention), implementation outcome (what

happened), and the justification (research supporting the intervention).

Lastly, we used the Proctor et al. (2011) framework for classifying six implementation outcomes: acceptability ("perception among implementation stakeholders that a given treatment, service, practice, or innovation is agreeable, palatable, or satisfactory"), adoption ("the intention, initial decision, or action to try or employ an innovation or evidence-based practice"), appropriateness ("the perceived fit, relevance, or compatibility of the innovation or evidence-based practice for a given practice setting, provider, or consumer; and/or perceived fit of the innovation to address a particular issue or problem"), costs ("the cost impact of an implementation effort"), feasibility ("the extent to which a new treatment, or an innovation, can be successfully used or carried out within a given agency or setting"), and fidelity ("the degree to which an intervention was implemented as it was prescribed in the original protocol or as it was intended by the program developers").

Both authors worked together to gather relevant data from each article, working collaboratively to ensure the accuracy of data extraction. Finally, after all data was extracted and charted, the authors conducted a descriptive analysis as well as a thematic analysis by grouping together studies by their commonalities and underlying messages to facilitate the generation of broad themes (Ezezika et al., 2021). Using both ERIC and Proctor frameworks further developed our comfort with implementation factors, while also adding complexity and structure to the data extraction. Echoing the work of Ezezika et al. (2021), grouping implementation strategies and outcomes within the articles could allow us to distill important themes using standardized implementation tools in order to better understand what implementation factors are associated with reducing burnout among residents. Classifications and themes were confirmed and validated by the third author.

RESULTS

Our search identified 210 articles. A total of 148 (n = 148) articles were excluded by title screening, leaving 62 for full screening. Among those, 53 articles were eliminated after a full-text review for not including resident physicians. The final sample size of this scoping review includes nine articles (n = 9) (Figure 2).

Of the articles included in the scoping review, the majority were published between 2020 to 2022 (n = 7, 78%), while two were published in 2017 and 2019 (n = 2, 22%). For all articles, data collection occurred at least a year prior to

publication, though it is notable that none of the studies had a focus on the COVID-19 pandemic. With regard to geography, settings were varied. While two studies involved residency training programs in hospitals around the country (n = 2, 22%), three studies specified their geographic settings and took place in a hospital emergency department, the University of Colorado teaching hospital, and a large urban children's hospital in Indiana, Colorado, and the southwestern United States, respectively (n = 3, 33%). The remaining studies were geographically undisclosed and had settings within a large teaching hospital, a military teaching hospital, a large urban academic emergency department, and an urban residency training program (n = 4, 44%).

The articles utilized diverse designs, with randomized clinical trials being the most common (n = 4, 44%). The remaining five studies used various designs, including a two-pronged mixed methods study that first utilized a quasi-experimental design and then followed up with a subsequent survey-based design to assess burnout (n = 1, 11%); a descriptive study (n = 1, 11%); a prospective cohort study (n = 1, 11%); a case study (n = 1, 11%); and a case study with thematic analysis (n = 1, 11%). Most studies emphasized implementing interventions to teach residents key burnout-reducing skills such as mindfulness, humanism, and wellness strategies (n = 5, 56%). The most common areas of focus to reduce burnout were implementing support-related interventions in the form of peer, coaching, and web-based group support (n = 2, 22%) and changing physicians' environments (n = 2, 22%). For example, one study incorporated therapy dogs into resident physicians' workdays, while another limited non-emergent, workflow-disrupting communication by implementing an electronic health record-based messenger system. Lastly, with regard to overall study characteristics, it is notable that just 3 out of 9 studies (n = 3, 33%) described more than one sociodemographic criterion related to participant diversity such as race, gender, or sexuality, limiting scope and utility.

After coding the articles for adherence to ERIC and Proctor frameworks for cataloging implementation strategies and outcomes, respectively, there were several broad takeaways. After coding each article for ERIC compliance, we determined that, on average, the articles included 1/3 of the 9 overarching strategies. On the highest end of the spectrum, training and educating stakeholders was a strategy used in eight of the articles (n = 8, 89%), while utilizing financial strategies was incorporated in none of the studies. With regard to coding for outcomes per the Proctor framework, the

studies averaged an inclusion score of 2.78 out of 6 overarching outcomes themes. On the high end of the spectrum, adoption, appropriateness, and feasibility were present in five studies (n = 5, 55%). On the low end, implementation cost was addressed in just two studies (n = 2, 22%). Below, we present the following five concepts that emerged following our thematic analysis.

Theme 1: Importance of stakeholder feedback to interventions

Stakeholder feedback is important to implementing and sustaining interventions, as input from employees and stakeholders is gathered to assess how effectively the intervention is working and how it performs overall (Dyrbye, & Shanafelt, 2016). The operation and performance of the intervention can be adjusted and improved by paying attention to and appreciating the opinions and feedback of stakeholders (Vudriko et al., 2018). The importance of stakeholder feedback to interventions reflects the use of evaluative and iterative strategies of the ERIC framework during the implementation process, and it can also lend insights into the Proctor outcome evaluation process by providing insight into whether the intervention was a good fit for those it serves (Waltz et al., 2014).

Five articles mentioned that they utilized stakeholder feedback within their interventions and changed their protocol in response. For instance, one study implemented burnout-mitigating, compassion workshops for residents (Neff et al., 2020). When they solicited feedback from residents, the researchers found that residents felt that the program was rushed, so they increased the session durations. At the study's conclusion, participants reported significant increases in well-being and a decrease in burnout, and these results were sustained for three months (Neff et al., 2020).

For example, in their work, Kesselheim et al. (2020) implemented a new educational curriculum within residency programs, and it included teachings on how to mitigate burnout. Feedback surveys from the residents indicated that over 90% were satisfied with the curriculum, and they tested higher on the study's satisfaction scale surrounding physician burnout. The feedback helped researchers to understand that the curriculum resonated with residents and helped to explain why the program is still in use within some sites, while other residency programs were inspired by the curriculum and created their own resources, and aligns with the Proctor outcomes framework (Kesselheim et al., 2020; Proctor et al., 2011).

Theme 2: Adaptation of interventions

An implementation strategy of the ERIC framework is adapting and tailoring interventions to the appropriate context (Shelef et al., 2016). This is important because each community is unique, and a one-size-fits-all approach may not be appropriate. Of the nine studies included in this review, five studies crafted their strategies according to their population and context. For example, the hospital in Kline et al. (2020) expanded their patient-focused animal therapy department to also provide support to physicians as a way to combat burnout. While they could have selected various other interventions, they leveraged resources that were already available, effectively reducing stress among providers (Kline et al., 2020).

Similarly, Keyser et al. (2021) adapted an existing, evidence-based peer support intervention that trains providers to facilitate peer support sessions. Prior to this work, this program had not been implemented in large hospitals and had not been used in military hospitals, which have additional stressors such as deployments and high staff turnover rates. They further adapted the program by scaling it up to include smaller military healthcare facilities nearby after identifying this as a need (Keyser et al., 2021). This speaks to ERIC's emphasis on tailoring implementation strategies to fit the context in question and likely contributed to the success of the program in reducing burnout. Moreover, because the peer support network rapidly spread across several hospitals within the military health system, its adaptability supports its overall feasibility and the fact that it can be effectively translated from large to small, military and non-military health systems to improve burnout among resident physicians (Proctor et al., 2011; Waltz et al., 2014).

Theme 3: Implementation of support-based interventions

Support-based interventions can take various forms, including active listening and basic therapy for mental and other disorders. Coaching and peer support groups are two significant types of supportive interventions. According to research, effective interventions to increase well-being often involve providing support to those who need it (Cooke et al., 2001). Three studies implemented support-based interventions by utilizing group-based training, coaching, and/or peer support programs (Chaukos et al., 2018; Fainstad et al., 2022; Keyser et al., 2021).

The use of professional coaching to lessen burnout among resident doctors is supported by research (Malling et al., 2020). Further, studies where providers utilize wellbeing coaching services have been found to improve some, but not all, components of physician well-being. Fainstad et al. (2022) noted that female resident physicians are disproportionately impacted by burnout. While professional coaching can reduce burnout among residents, individual coaching may not be feasible or affordable for residency programs. To address this, they implemented an online group coaching intervention for female resident physicians, and this reduced key burnout factors, such as emotional exhaustion (Fainstad et al., 2022).

Implementing a peer support program (PSP) is another strategy to combat the growing rate of physician burnout, as clinicians who are under a lot of emotional stress find support within such programs (Keyser et al., 2021; Shanafelt et al., 2010). While Keyser et al. (2021) found that their implementation of a PSP rapidly spread to other military hospitals, Chaukos et al. (2018) implemented a resident-led, resident-developed group curriculum that taught meditation, behavioral skills, and mindfulness techniques. In line with the ERIC implementation strategy, they changed the infrastructure of the residency program by acquiring protected curricular time (Chaukos et al., 2018; Waltz et al., 2014). Additionally, the program had high fidelity due to its formal, regimented structure, ensuring proper delivery and thus aligning with key Proctor implementation assessment outcomes (Chaukos et al., 2018; Proctor et al., 2011).

Theme 4: Criticality of education and training to implementation

Notably, Chaukos et al. (2018) conducted a needs assessment to determine resident needs prior to developing and training them to facilitate a peer curriculum focused on well-being. Kesselheim et al. (2020) similarly conducted a national needs assessment before creating and implementing resident well-being modules within various residency programs. This work is in line with ERIC's recommendation of using iterative, evaluative implementation strategies and speaks to the importance of tailoring resources and educational materials to best serve the communities they are meant to impact (Waltz et al., 2014).

Both Chaukos et al. (2018) and Kesselheim et al. (2020) focused on developing stakeholder relationships by creating academic partnerships, and both modified the infrastructure of the programs by mandating curriculum changes (Waltz et al., 2014). Their adherence to key ERIC principles in the implementation stages undoubtedly influenced their successful resonance among participants. With regard to Proctor outcomes framework (2011), Kesselheim et al. (2020) and Chaukos et al. (2018) satisfied acceptability, adoption, appropriateness, feasibility, and fidelity outcomes. For example, Kesselheim et al.

(2020) satisfied appropriateness criteria with the intervention's smooth integration into the program curriculum and its positive feedback from participants, while Chaukos et al. (2018) satisfied adoption criteria, with 88% of all residents at a large teaching hospital volunteering to participate in the intervention.

Theme 5: Consequences of non-adherence to implementation strategy criteria

The above articles demonstrate the efficacy of certain interventions to mitigate burnout among resident physicians, which is a pressing issue. Our scoping review also shows the importance of thorough implementation science to achieving intervention success and highlights studies that may serve as cautionary tales of what non-adherence looks like. For example, Hart et al. (2019) implemented The Happiness Practice program, a program that has been successfully used to reduce burnout among nurses by building their resilience. They had one of the lower adherence scores for ERIC strategies (33%), and consequently, they satisfied 0 of 6 Proctor criteria for evaluating outcomes. The intervention increased key burnout factors such as emotional exhaustion, and only two of seventeen feedback responses were positive.

Similarly, Fraiman et al. (2022) implemented a mindfulness program to decrease burnout among residents. The training did not involve training facilitators in advance to administer the program, citing that this is an obstacle to implementing such workshops within residency programs. However, the researchers had one of the lowest adherences to ERIC strategies, satisfying 2 out of 9 criteria. They did not achieve significant burnout-reducing results, and they also met 0 of 6 Proctor criteria for outcomes evaluation. Perhaps advanced communication, needs assessments, relationship-building, and soliciting feedback during the intervention would have allowed for stronger outcomes.

Lastly, Luu et al. (2022) noted that physician workflow is often interrupted through traditional means of communication between physicians and nurses, such as phone calls and paging, contributing to stress, workload, and burnout. Their hospital implemented an electronic messaging system to reduce interruptions. However, while non-emergent calls decreased, physician burnout was unimpacted. This may be related to ERIC strategies, of which only 3 out of 9 were included. For example, the intervention was seemingly implemented without feedback from providers that they wanted the new system or that the existing one was a problem, and training on the new system was limited to emails and team huddles. Proctor adherence was also relatively low, with only 2 out of 6 outcome criteria being satisfied. Together, the lack of sound implementation strategy may in part explain why burnout rates did not decline despite having fewer workflow interruptions.

DISCUSSION

These studies highlight the criticality of solid implementation to the success of interventions focused on reducing resident burnout. Studies with higher adherence to ERIC and Proctor criteria tended to achieve burnout-reducing outcomes, as evidenced by research highlighted above that worked collaboratively and in partnership with key stakeholders. As demonstrated by studies such as Neff et al. (2020), interventions that solicit feedback and incorporate changes can increase successful intervention outcomes. Similarly, interventions that are adapted and customized to their context can also increase positive quality outcomes, as observed in the PSP implemented in military hospitals by Keyser et al. (2021).

Further, implementations of support-based interventions, and creating educational collateral and training stakeholders, contributed to burnout reduction in several studies. The Fainstad et al. (2022) study's online group support program lessened burnout rates among resident female physicians, while Kesselheim et al. (2020) developed a new curriculum that addressed physician mental health, leading to participants having higher satisfaction scores on scales related to burnout and other measures of well-being. Studies that emphasized mindfulness and support tended to lower burnout among residents, which aligns with a past scoping review and systematic review that supports the efficacy of mindfulness, meditation interventions, and self-care workshops to reduce physician burnout (Busireddy et al., 2017; Malik & Annabi, 2022). Unfortunately, the limited number of studies that addressed sociodemographic information about participants highlights a significant barrier to understanding the effectiveness of implementation strategies for reducing burnout among resident physicians who are traditionally underrepresented in the discipline and who may be disproportionately impacted by burnout (Barboza-Wilkes et al., 2023; Rabelo & Cortina, 2014).

This above underscores the necessity of inclusive and sound, evidence-based implementation strategies to improve burnout among resident physicians. It is important to note, however, that high adherence does not guarantee reduced burnout among resident participants. While Chaukos et al. (2018) had relatively high ERIC and Proctor criteria satisfaction

(6 out of 9 and 5 out of 6, respectively), they found that burnout was not significantly reduced among participants. However, the participants greatly appreciated and valued the intervention, presumably because the researchers did their legwork in conducting a needs assessment, soliciting feedback, and providing training and support to ensure its relevance and resonance. Their high level of engagement and relationship-building leaves the door open for working with this teaching hospital in the future. This contrasts with Hart et al. (2019), an intervention that applied a program effective at combatting nurse burnout in a resident population, seemingly without stakeholder participation to ensure the program was customized to residents. This program was unsurprisingly negatively received and increased burnout.

Adherence to implementation science and standardized practices can help elicit better outcomes to address resident burnout. While there were exceptions in some cases, in which some studies had high adherence with unchanged burnout scores, the researchers still did the legwork to collaborate with residents and other stakeholders, earning high satisfaction scores. However, it is important to note that this relationship-building likely helped with certain interventions achieving high satisfaction scores among participants, even though burnout was unchanged. Even when interventions were ineffective at decreasing burnout, participants indicating that they gained valuable tools and resources is still extremely valuable. In these cases, adherence to implementation strategies undoubtedly helped position the researchers to maintain a solid working relationship with their stakeholders, allowing them to continue to try and implement evidence-based, burnout-mitigating interventions in the future.

In summary, these studies highlight the criticality of solid implementation practices to the success of interventions focused on reducing resident burnout. Studies with higher adherence to ERIC and Proctor criteria tended to achieve burnout-reducing outcomes, as evidenced by the research highlighted above, while non-adherence tended to lead to reduced outcomes in most cases. Arguably, even studies that did not see burnout decreases despite high adherence put in the effort to build relationships, collaborate, and modify based on feedback, creating future opportunities for continued collaboration.

Limitations

This study had several limitations that should be considered when evaluating our results. Our review was limited by several factors, including search terms, the number of databases and selection of databases, the time frame, and focusing only on the United States. For example, while 2017 - 2022 allowed us to limit our results to the timeliest articles, we may have missed past implementation strategies with valuable insights. Further, only focusing on the U.S. eliminates lessons gleaned from international burnout intervention implementation studies. Additionally, as we only extracted processes and outcomes data, our study may have limited information and lessons learned if we used a framework different from ERIC and Proctor.

CONCLUSION

The results of this scoping review study can assist in the creation of implementation plans that are expressly intended to lower physician resident burnout in U.S. healthcare settings. Based on applying the ERIC framework, we found that training and educating stakeholders was a strategy used in eight of the articles. However, using financial strategies was incorporated in none of the studies. Given that studies with higher adherence tended to have better burnout-reducing results, implementation efforts to reduce burnout may want to consider utilizing financial strategies in the future. For example, given that residents tend to be overworked and underpaid, perhaps participation in interventions can be incentivized to potentially increase participation. Similarly, based on the Proctor framework adoption, appropriateness and feasibility had the highest utilization, while implementation cost was addressed in just two studies. In order for residency programs to implement evidence-based interventions, it is important to know the financial impacts in advance.

This scoping review found that implementation strategies with high adherence to ERIC and Proctor criteria tended to lead to reductions in burnout. Effective strategies tended to incorporate training and educational material development, modified based on feedback, and focused on promoting mindfulness and support. Based on the limited sample size of studies included in our review, and the inefficacy of some strategies despite high adherence, we argue that these findings can be rated as "moderate."

Given the high rates of pandemic-related burnout, future studies should focus on implementation strategies to reduce burnout among healthcare providers during COVID-19 (Whang, 2022). Moreover, future research should include more rigor and transparency surrounding the cost of implementing burnout-mitigating interventions, as this will potentially increase intervention implementation and resultant uptake. Cost appears to be an understudied topic but is critical to assist hospitals and residency programs with adopting

evidence-based, effective strategies such as mindfulness workshops. Lastly, given the disproportionate burdens of burnout, additional research should focus specifically on underrepresented resident physicians, including physicians of color and LGBTQIA+ physicians, who may require different strategies to reduce burnout and keep their valuable experiences and perspectives within the profession (Barboza-Wilkes et al., 2023; Rabelo & Cortina, 2014).

Key policy implications

- Burnout is a huge issue among resident physicians, potentially exacerbating the physician shortage crisis the U.S. is currently facing. Mitigating burnout is an area for focus and intervention, and developing a greater understanding of what interventions can best support underrepresented resident physicians is critical for both future research and implementation efforts.
- Implementation of evidence-based interventions should benefit from high adherence to ERIC strategy and Proctor outcomes criteria and should include, but not be limited to, creating educational and training resources, soliciting feedback at all stages, and analyzing program feasibility and other important facets.
- Hospitals and resident programs should consider mandating curriculum and workplace training that includes peer support, mindfulness, and/or coaching to effectively reduce burnout among resident physicians.

REFERENCES
American Medical Association. (2023, February 16). What is physician burnout? https://www.ama-assn.org/practice-management/physician-health/what-physician-burnout

Arksey, H., & O'Malley, L. (2005). Scoping studies: Towards a methodological framework. *International Journal of Social Research Methodology, 8*(1), 19-32. https://doi.org/10.1080/1364557032000119616

Barboza-Wilkes, C. J., Le, T. V., & Resh, W. G. (2023). Deconstructing burnout at the intersections of race, gender, and generation in local government. *Journal of Public Administration Research and Theory, 33*(1), 186-201. https://doi.org/10.1093/jopart/muac018

Brazier, H., & Begley, C. M. (1996). Selecting a database for literature searches in nursing: MEDLINE or CINAHL? *Journal of Advanced Nursing, 24*(4), 868-875. https://doi.org/10.1046/j.1365-2648.1996.26426.x

Busireddy, K. R., Miller, J. A., Ellison, K., Ren, V., Qayyum, R., & Panda, M. (2017). Efficacy of interventions to reduce resident physician burnout: A systematic review. *Journal of Graduate Medical Education, 9*(3), 294-301. https://doi.org/10.4300/JGME-D-16-00372.1

Carpiano, R. M., & Daley, D. M. (2006). A guide and glossary on post-positivist theory building for population health. *Journal of Epidemiology and Community Health, 60*(7), 564-570. https://doi.org/10.1136/jech.2004.031534

Chaukos, D., Chad-Friedman, E., Mehta, D. H., et al. (2018). SMART-R: A prospective cohort study of a resilience curriculum for residents by residents. *Academic Psychiatry, 42*(1), 78-83. https://doi.org/10.1007/s40596-017-0808-z

Cooke, D. D., McNally, L., Mulligan, K. T., Harrison, M. J., & Newman, S. P. (2001). Psychosocial interventions for caregivers of people with dementia: A systematic review. *Aging & Mental Health, 5*(2), 120-135. https://doi.org/10.1080/713650019

Drummond, D. (2015). Physician burnout: Its origin, symptoms, and five main causes. *Family Practice Management, 22*(5), 42-47.

Dyrbye, L., & Shanafelt, T. (2016). A narrative review on burnout experienced by medical students and residents. *Medical Education, 50*(1), 132-149. https://doi.org/10.1111/medu.12927

Eccles, M. P., & Mittman, B. S. (2006). Welcome to implementation science. *Implementation Science, 1*(1), 1. https://doi.org/10.1186/1748-5908-1-1

Esmail, R., Hanson, H. M., Holroyd-Leduc, J., et al. (2020). A scoping review of full-spectrum knowledge translation theories, models, and frameworks. *Implementation Science*, 15(1), 11. https://doi.org/10.1186/s13012-020-0964-5

Ezezika, O., Gong, J., Abdirahman, H., & Sellen, D. (2021). Barriers and facilitators to implementing large-scale nutrition interventions in Africa: A scoping review. *Global Implementation Research and Applications, 1*(1), 38-52. https://link.springer.com/article/10.1007/s43477-021-00007-2

Fainstad, T., Mann, A., Suresh, K., et al. (2022). Effect of a novel online group-coaching program to reduce burnout in female resident physicians: A randomized clinical trial. *JAMA Network Open, 5*(5), e2210752. https://doi.org/10.1001/jamanetworkopen.2022.10752

Fraiman, Y. S., Cheston, C. C., Cabral, H. J., et al. (2022). Effect of a novel mindfulness curriculum on burnout during pediatric internship: A cluster randomized clinical trial. *JAMA Pediatrics, 176*(4), 365-372. https://doi.org/10.1001/jamapediatrics.2021.5740

Geurts, S., Rutte, C., & Peeters, M. (1999). Antecedents and consequences of work-home interference among medical residents. *Social Science & Medicine, 48*(9), 1135-1148. https://doi.org/10.1016/s0277-9536(98)00425-0

Green, A. E., Albanese, B. J., Shapiro, N. M., & Aarons, G. A. (2014). The roles of individual and organizational factors in burnout among community-based mental health service providers. *Psychological Services, 11*(1), 41-49. https://doi.org/10.1037/a0035299

Grol, R., & Grimshaw, J. (1999). Evidence-based implementation of evidence-based medicine. *Journal of Joint Commission on Quality Improvement, 25*(10), 503-513. https://doi.org/10.1016/s1070-3241(16)30464-3

Hart, D., Paetow, G., & Zarzar, R. (2019). Does implementation of a corporate wellness initiative improve burnout? *Western Journal of Emergency Medicine, 20*(1), 138-144. https://doi.org/10.5811/westjem.2018.10.39677

Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: Past, present, and future. *Clinical Psychology: Science and Practice, 10*(2), 144-156. https://doi.org/10.1093/clipsy.bpg016

Kesselheim, J., Baker, J. N., Kersun, L., et al. (2020). Humanism and professionalism training for pediatric hematology-oncology fellows: Results of a multicenter randomized trial. *Pediatric Blood & Cancer, 67*(11), e28308. https://doi.org/10.1002/pbc.28308

Keyser, E. A., Weir, L. F., Valdez, M. M., et al. (2021). Extending peer support across the military health system to decrease clinician burnout. *Military Medicine, 186*(Supplement_1), 153-159. https://www.ncbi.nlm.nih.gov/pubmed/32830273

Kline, J. A., VanRyzin, K., Davis, J. C., et al. (2020). Randomized trial of therapy dogs versus deliberative coloring (art therapy) to reduce stress in emergency medicine providers. *Academic Emergency Medicine, 27*(4), 266-275. https://doi.org/10.1111/acem.13939

Kumar, S. (2016). Burnout and Doctors: Prevalence, prevention and intervention. *Healthcare, 4*(3), 37. https://doi.org/10.3390/healthcare4030037

Lockley, S. W., Cronin, J. W., Evans, E. E., et al. (2004). Effect of reducing interns' weekly work hours on sleep and attentional failures. *New England Journal of Medicine, 351*(18), 1829-1837. https://doi.org/10.1056/NEJMoa041404

Luu, T., Spiegelman, L., Nykin, D., et al. (2022). Implementation of an electronic health record-based messaging system in the emergency department: Effects on physician workflow and resident burnout. *Journal of Patient Safety, 18*(2), e542-e546. https://doi.org/10.1097/PTS.0000000000000869

Malik, H., & Annabi, C. A. (2022). The impact of mindfulness practice on physician burnout: A scoping review. *Frontiers in Psychology, 13*, 956651. https://doi.org/10.3389/fpsyg.2022.956651

Malling, B., de Lasson, L., Just, E., & Stegeager, N. (2020). How group coaching contributes to organizational understanding among newly graduated doctors. *BMC Medical Education, 20*(1), 193. https://doi.org/10.1186/s12909-020-02102-8

Maslach, C., Schaufeli, W. B., & Leiter, M. P. (2001). Job burnout. *Annual Review of Psychology, 52*, 397-422. https://doi.org/10.1146/annurev.psych.52.1.397

McNett, M., O'Mathúna, D., Tucker, S., Roberts, H., Mion, L. C., & Balas, M. C. (2020). A scoping review of implementation science in adult critical care settings. *Critical Care Explorations, 2*(12), e0301. https://doi.org/10.1097/CCE.0000000000000301

Moher, D., Schulz, K. F., Simera, I., & Altman, D. G. (2010). Guidance for developers of health research reporting guidelines. *PLoS Medicine, 7*(2), e1000217. https://doi.org/10.1371/journal.pmed.1000217

Munday, R. (2023, January 24). What is a nurse residency program? *NurseJournal.* https://nursejournal.org/resources/nursing-residency-programs/

Neff, K. D., Knox, M. C., Long, P., & Gregory, K. (2020). Caring for others without losing yourself: An adaptation of the Mindful Self-Compassion Program for Healthcare Communities. *Journal of Clinical Psychology, 76*(9), 1543-1562. https://doi.org/10.1002/jclp.23007

Nilsen, P. (2015). Making sense of implementation theories, models and frameworks. *Implementation Science, 10*, 53. https://doi.org/10.1186/s13012-015-0242-0

Patel, R. S., Bachu, R., Adikey, A., Malik, M., & Shah, M. (2018). Factors related to physician burnout and its consequences: A review. *Behavioral Sciences, 8*(11), 98. https://doi.org/10.3390/bs8110098

Powell, B. J., Fernandez, M. E., Williams, N. J., et al. (2019). Enhancing the impact of implementation strategies in healthcare: A research agenda. *Frontiers in Public Health, 7*, 3. https://doi.org/10.3389/fpubh.2019.00003

Powell, B. J., Waltz, T. J., Chinman, M. J., et al. (2015). A refined compilation of implementation strategies: Results from the Expert Recommendations for Implementing Change (ERIC) project. *Implementation Science, 10*, 21. https://doi.org/10.1186/s13012-015-0209-1

Proctor, E. K., Powell, B. J., & McMillen, J. C. (2013). Implementation strategies: Recommendations for specifying and reporting. *Implementation Science, 8,* 139. https://doi.org/10.1186/1748-5908-8-139

Proctor, E., Silmere, H., Raghavan, R., et al. (2011). Outcomes for implementation research: Conceptual distinctions, measurement challenges, and research agenda. *Administration and Policy in Mental Health, 38*(2), 65-76. https://doi.org/10.1007/s10488-010-0319-7

Rabelo, V. C., & Cortina, L. M. (2014). Two sides of the same coin: Gender harassment and heterosexist harassment in LGBQ work lives. *Law and Human Behavior, 38*(4), 378-391. https://doi.org/10.1037/lhb0000087

Rodrigues, H., Cobucci, R., Oliveira, A., et al. (2018). Burnout syndrome among medical residents: A systematic review and meta-analysis. *PLoS One, 13*(11), e0206840. https://doi.org/10.1371/journal.pone.0206840

Salvagioni, D. A. J., Melanda, F. N., Mesas, A. E., González, A. D., Gabani, F. L., & Andrade, S. M. (2017). Physical, psychological and occupational consequences of job burnout: A systematic review of prospective studies. *PLoS One, 12*(10), e0185781. https://doi.org/10.1371/journal.pone.0185781

Shelef, D. Q., Rand, C., Streisand, R., et al. (2016). Using stakeholder engagement to develop a patient-centered pediatric asthma intervention. *The Journal of Allergy and Clinical Immunology, 138*(6), 1512-1517. https://doi.org/10.1016/j.jaci.2016.10.001

Shanafelt, T. D., Balch, C. M., Bechamps, G., et al. (2010). Burnout and medical errors among American surgeons. *Annals of Surgery, 251*(6), 995-1000. https://doi.org/10.1097/SLA.0b013e3181bfdab3

Theobald, S., Brandes, N., Gyapong, M., et al. (2018). Implementation research: New imperatives and opportunities in global health. *The Lancet, 392*(10160), 2214-2228. https://doi.org/10.1016/S0140-6736(18)32205-0

Thomas, N. K. (2004). Resident burnout. *JAMA, 292*(23), 2880-2889. https://doi.org/10.1001/jama.292.23.2880

University of South Australia. (23 AD, March 16). Guides: Scoping reviews: Apply PCC. https://guides.library.unisa.edu.au/ScopingReviews/ApplyPCC#:~:text=What%20is%20PCC%3F,then%20inform%20your%20search%20strategy

Vudriko, P., Okwee-Acai, J., Byaruhanga, J., et al. (2018). Evidence-based tick acaricide resistance intervention strategy in Uganda: Concept and feedback of farmers and stakeholders. *Ticks and Tick-borne Diseases, 9*(2), 254-265. https://doi.org/10.1016/j.ttbdis.2017.09.011

Waltz, T. J., Powell, B. J., Chinman, M. J., et al. (2014). Expert Recommendations for Implementing Change (ERIC): Protocol for a mixed methods study. *Implementation Science, 9*, 39. https://doi.org/10.1186/1748-5908-9-39

Whang, O. (2022, September 29). Physician burnout has reached distressing levels, new research

finds. *The New York Times*.
https://www.nytimes.com/2022/09/29/health/doctor-burnout-pandemic.html

World Health Organization. (2023). International Statistical Classification of Diseases and Related Health Problems (ICD). https://www.who.int/standards/classifications/classification-of-diseases

Zis, P., Anagnostopoulos, F., & Sykioti, P. (2014). Burnout in medical residents: A study based on the job demands-resources model. *The Scientific World Journal*, 2014, 673279. https://doi.org/10.1155/2014/673279

Appendix

Figure 1: Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTS ON PAGE #
TITLE			
Title	1	Implementation Strategies to Mitigate Burnout among Resident Physicians: A Scoping Review	1
ABSTRACT			
Structured summary	2	Abstract provided	2
INTRODUCTION			
Rationale	3	Physician burnout among physicians is an epidemic in the US, and physician burnout can have grave professional and personal consequences.	3,4,5
Objectives	4	- Assess implementation strategies and interventions to reduce resident burnout within U.S. healthcare settings. - Analyze implementation processes and outcomes, classifying them according to ERIC and Proctor parameters to better understand key components of strategies. - Make recommendations about burnout interventions to mitigate burnout and associated symptoms.	6
METHODS			
Protocol and registration	5	NA	
Eligibility criteria	6	- Years 2017 to 2022 (5 years): most up-to-date literature - Adult human subjects that are resident physicians or nurses: nurses and physicians are on the frontlines of healthcare - Peer-reviewed journal articles: have been assessed by experts in the field prior to publication - Not a review or editorial: scoping reviews focus on the implementation of interventions - Healthcare system setting (e.g., hospitals, clinics): this is where our population works - English language: Reviewers are both English-speaking - No children, as they cannot work - Inside the United States	7,8
Information sources*	7	PubMed and CINAHL: these databases focus on medical research and include health personnel-related studies	6,7
Search	8	(((((((((((("Professional Burnout" OR "Occupational Burnout" OR "Burnout, Occupational" OR "Career Burnout" OR "Burnout, Career") AND ("nurse" OR "nurses" OR "nursing" OR "physician" OR "physicians" OR "doctor" OR "doctors")) AND ("clinic" OR "clinics" OR "hospital" OR "hospitals" OR "health setting" OR "health settings" OR "healthcare setting" OR "healthcare settings" OR	7

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTS ON PAGE #
		"Emergency" OR "urgent")) AND ("Strategy" OR "strategies" OR "intervention" OR "interventions" OR "program" OR "programs" OR "pilot" OR "pilots" OR "trial" OR "trials"))	
Selection of sources of evidence	9	Articles were evaluated based on title and abstract for inclusion criteria and were included for subsequent full-text screening.	7
Data charting process‡	10	Team members created a chart for relevant variables (below). Articles were each independently assessed based on title and abstract and compared for reviewer agreement. Articles selected for additional screening were reviewed independently, with disagreements discussed together by reviewers.	7,8
Data items	11	Article # Author(s) Year of Publication Date of Data Collection study design Action (implementation of intervention strategy) Actor (who leads the initiative) Setting (hospital, clinic, etc.) Target of Action (population and sample size) Goals of the strategy Dose/frequency of intervention (how often/when should the strategy occur) Implementation outcomes Justification for implementing the strategy Proctor ERIC	8
Critical appraisal of individual sources of evidence§	12	N/A	
Synthesis of results	13	Reviewers used an online platform (Rayyan) for article management, screening, and review. Google Drive Excel sheet was used to collaboratively extract data from each article.	7
RESULTS			
Selection of sources of evidence	14	We exported the articles (n = 215) into the reference management platform RefWorks and then the Rayyan blind review platform, in which 5 articles were (n = 5) duplicates for elimination, leaving 210 articles for title and abstract screening.	7,8
Characteristics of sources of evidence	15	Characteristics for each source of evidence, characteristics addressed for which data were charted and citations were provided.	10-14
Critical appraisal within sources of evidence	16	N/A	
Results of individual sources of evidence	17	Individual sources of evidence have been addressed and researchers presented the relevant data related to the review questions, with objectives mentioned.	8,9,10
Synthesis of results	18	5 studies taught residents key burnout-reducing skills such as	9,10

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTS ON PAGE #
		mindfulness, humanism, and wellness strategies. Studies showed the importance of stakeholder feedback to interventions and the importance of support-based interventions. Also, it was illustrated that training and educating stakeholders is an important implementation strategy to these interventions.	
DISCUSSION			
Summary of evidence	19	Adherence to implementation science and standardized practices can help elicit better outcomes to address resident burnout.	15,16
Limitations	20	Our review was limited by several factors, including search terms, the number of databases and selection of databases, the time frame, and focusing only on the United States. Our study may have limited information and lessons learned than if we used a framework different from ERIC and Proctor.	16,17
Conclusions	21	These studies highlight the criticality of solid implementation practices to the success of interventions focused on reducing resident burnout. Studies with higher adherence to ERIC and Proctor criteria tended to achieve burnout-reducing outcomes, while non-adherence tended to lead to reduced outcomes in most cases. Arguably, even studies that did not see burnout decreases despite high adherence put in the effort to build relationships, collaborate, and modify based on feedback, creating future opportunities for continued collaboration. Future research is needed on strategies to combat burnout in traditionally underrepresented physician residents.	17,18
FUNDING			
Funding	22	Most articles included in the review were funded through grants to conduct their research. This scoping review is not funded. N/A	

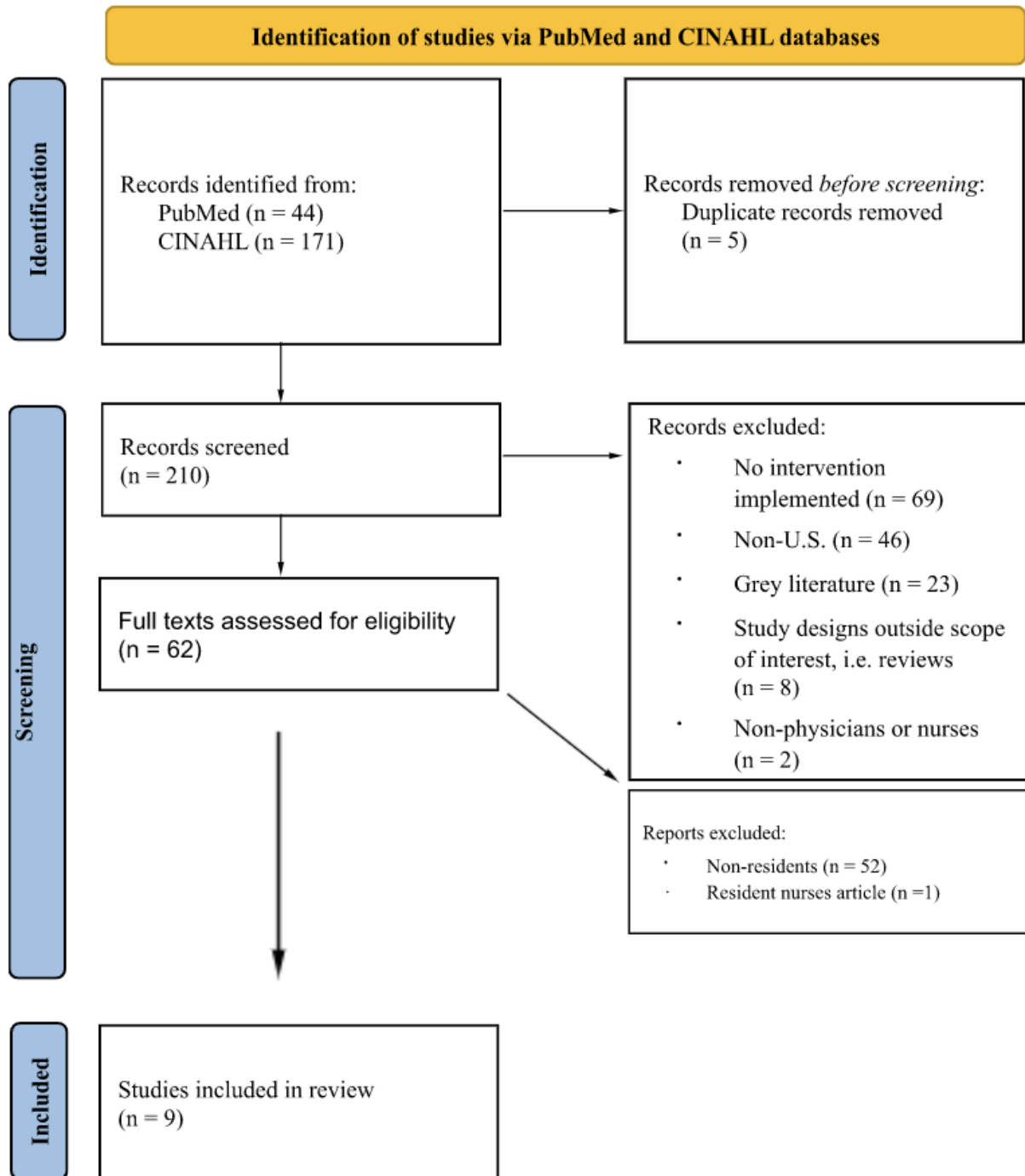## Figure 2: PRISMA 2020 flow diagram

Table 1: Article characteristics and Proctor criteria

Article Title	Author(s)	Year of Publication	Date of Data Collection, Focus on COVID-19 Pandemic?	Study Design	Action (Implementation of intervention strategy - brief overview)	Actor (who leads the initiative)	Setting (hospital, clinic, etc)	Target of Action (population, N = _, and sample size, n = _)	Goals of the Strategy	Dose/frequency of intervention	Implementation outcomes (what happened/results)	Proctor	Justification for implementing the strategy
Randomized Trial of Therapy Dogs Versus Deliberative Coloring (Art Therapy) to Reduce Stress in Emergency Medicine Providers	Jeffrey A. Kline, Kimberly VanRyzin, Jacob C. Davis, Jonathan A. Parra, Maxwell L. Todd, Liza L. Shaw, Benjamin R. Haggard, Michelle A. Fisher, Katherine L. Pettit, MS, and Alan M. Beck	2020-04-01	May 28, 2018, until August 8, 2019; No	Prospective, randomized controlled clinical trial	At the beginning, in the midpoint, and close to the conclusion of the shift, participants gave three self-reports of stress and saliva samples. Patients were invited to respond to a survey on the empathetic behaviors they had seen in doctors.	Research team	Hospital Emergency Department (Indiana)	Emergency medicine physicians and nurses; 122 providers, 59 resident physicians. (N = 122, n = 59)	Find out if stress reduction techniques like coloring and art therapy are useful for emergency medicine doctors, especially residents, and nurses.	From 5/28/2018, until 8/8/2019, enrollment took place everyday from 7 AM to 2 AM and was scheduled in accordance with when therapy dogs were consistently accessible.	At T1, there was no difference in the mean VAS score between the groups. At T3, VAS tends to go up with colors, stay the same in controls, and go down a little with dogs. Compared to the control group, salivary cortisol levels were considerably lower in the dog and coloring groups.	Acceptability - NA Adoption - NA Appropriateness - x Feasibility - NA Fidelity - NA Implementation Cost - NA; 1/6	Studies show that humans have reduced stress when interacting with animals and nature.
Caring for others without losing yourself: An adaptation of the Mindful Self-Compassion Program for Healthcare Communities	Kristin D. Neff, Marissa C. Knox, Phoebe Long, and Krista Gregory	2022-07-06	Did not specify date of data collection; No	Study 1: Quasi-experimental design, with follow-up survey measures on self-compassion and well-being; Study 2: used established survey measures	They carried out a number of pilot studies under the direction of a seasoned instructor of MSC. Based on the participants and the instructor feedback, they changed the protocol, gave participants more time to complete it, and sessions on they provide the following topics: the concept of self-compassion, self-compassion processes, inspiring oneself with compassion, coping mechanisms for challenging emotions, caregiving fatigue, and provided information on.	Experienced MSC instructors	Large, urban children's hospital in the Southwestern United States	58 healthcare workers, with 25 in the intervention goup, 12 participants were residents/physicians. (N = 58, n = 12)	Examine the effectiveness of the Self-Compassion for Healthcare Communities (SCHC) program for increasing wellbeing and lowering burnout among healthcare workers.	Participants attended one of the two SCHC trainings that were held in the spring. Six weeks of instruction were spent one-hour sessions being held.	Based on study 1, SCHC dramatically improved happiness and self-compassion. According to Study 2, SCHC dramatically decreased burnout and secondary traumatic stress while boosting wellbeing. Those with lower starting levels of self-compassion benefited from SCHC more than those with higher initial levels.	Acceptability - x Adoption - x Appropriateness - x Feasibility - x Fidelity - x Implementation Cost - NA; 5/6	Self-compassion may be taught using the MSC program, which provided direction for the creation of SCHC. Studies have shown that it is associated with psychological health.
Humanism and professionalism training for pediatric hematology-oncology fellows: Results of a multicenter randomized trial	Jennifer Kesselheim, Justin N. Baker, Leslie Kersun, Cathy Lee-Miller, Scott Moerdler, Jennifer M. Snaman, Ann Warwick, Shicheng Weng, and Zilu Zhang	2020-07-30	2016-2017 academic year, No	Cluster-randomized trial	"Researcher provided pediatric hematology-oncology (PHO) residents either the traditional resident program in humanism and professionalism (UT) or the new curriculum (intervention)". The major result was the Pediatric Hematology-Oncology Self-Assessment in Humanism (PHOSAH), while the Maslach Burnout Inventory, Patient-Provider Orientation Scale, and Empowerment at Work Scale served as the secondary measures.	Trained faculty facilitators	PHO programs around the country	59 fellows from 19 PHO programs representing 100 fellows were given the new curriculum (N = 19, n = 100).	The goal is to encourage PHO fellows to think on the feelings, difficulties, and tensions encountered while caring for children and families who have been afflicted by cancer or blood diseases.	4 modules taught over the academic year, with pre- and post-tests before and after the curriculum, respectively	33 of the 36 modules were distributed across the nine intervention locations. The UT and intervention arms did not substantially vary in terms of change scores on the PHOSAH. fellows in the intervention group reported substantially better scores on a number of categories on the satisfaction measure that dealt with physician burnout, physician depression, balancing work and personal obligations, and general humanism.	Acceptability - x Adoption - x Appropriateness - x Feasibility - x Fidelity - x Implementation Cost - NA; 5/6	Despite the fact that professionalism and compassion are essential to practice medicine, there aren't many structured curriculum for medical students.

Table 1: Article characteristics and Proctor criteria (continued)

Article Title	Author(s)	Year of Publication	Date of Data Collection, Focus on COVID-19 Pandemic?	Study Design	Action (Implementation of intervention strategy - brief overview)	Actor (who leads the initiative)	Setting (hospital, clinic, etc)	Target of Action (population, N = _, and sample size, n = _)	Goals of the Strategy	Dose/frequency of intervention	Implementation outcomes (what happened/results)	Proctor	Justification for implementing the strategy
Effect of a Novel Mindfulness Curriculum on Burnout During Pediatric Internship: A Cluster Randomized Clinical Trial	Yarden S. Fraiman, Christine C. Cheston, Howard J. Cabral, Celeste Allen, Andrea G. Asnes, Jefferson T. Barrett, Maneesh Batra, William Bernstein, Tammy Bleeker, Pam M. Dietz, Joanna Lewis, Su-Ting, Marsha Ma, Mahan, Catherine D. Michelson, Sue E. Poynter, Mark A. Vining, Katherine Watson, Colin M. Sox	2022-01-24	June 14, 2017 to February 28, 2019; No	Cluster-randomized clinical trial	During residency, researchers used a monthly mindfulness curriculum, and 1-hour social meals for the intervention group. The 9-question EE subscale of the Maslach Burnout Inventory was used to examine emotional fatigue. Depersonalization, exhaustion, and personal achievement were considered to be secondary consequences. The Five Facet Mindfulness Questionnaire and the Perspectives Taking and Empathetic Concerns Subscales from the Interpersonal Reactivity Index were used in the study to assess mindfulness and empathy, respectively.	Facilitators at the pediatric residency programs	Pediatric residency programs	15 programs representing 340 interns, with 194 residents assigned to the intervention and 146 assigned to the control (N = 15, n = 340).	The goal is to determine if an innovative mindfulness program introduced during the first six months of an internship decreases burnout.	From the first quarter of the internship year for six months, the intervention was given once a month over the course of seven sessions. Surveys were given out at the beginning, six months, and fifteen months.	340 of the 365 invited interns responded to the baseline survey; 273 also responded at month 6, and 195 responded at month 15. There were 146 in the control group and 194 new interns participated in the mindfulness intervention. Although EE ratings in both arms were greater at 6 and 15 months compared to baseline, multivariable analysis did not reveal a difference in EE scores between the two arms.	Acceptability - NA Adoption - NA Appropriateness - NA Feasibility - NA Fidelity - NA Implementation Cost - NA; 0/6	Mindfulness training can reduce physician burnout, however implementing these programs creates challenges to educate and run these programs for facilitators.
Effect of a Novel Online Group-Coaching Program to Reduce Burnout in Female Resident Physicians: A Randomized Clinical Trial	Tyra Fainstad, Adrienne Mann, Krithika Suresh, Pari Shah, Nathalie Dieujuste, Kerri Thurmon, and Christine D. Jones,	2022-05-06	January 1 to June 30, 2021; No	Randomized Clinical Trial	A 1:1 algorithm was created to randomly allocate participants to intervention and control groups. Better Together Physician Coaching, a web-based program for group coaching, was given to the intervention group. The program was provided to the control group after the trial was over. The MSI and its three subscales measuring: depersonalization, emotional weariness, and professional achievement were used to assess burnout. Using Neff's Self-Compassion Scale-Short Form, the Moral Injury Symptom Scale for Healthcare Professionals, and the Young Impostor Syndrome Scale, also examined the secondary outcomes.	Certified physician coaches	University of Colorado	101 female resident physicians, with 50 assigned to the intervention and 51 assigned to the control (N = 101).	The objective is to determine if a formal, professional group coaching program would reduce burnout among female resident doctors.	Participants in the 6-month intervention might take part in:1) Two weekly live group coaching calls, 2) limitless anonymous coaching, 3) weekly self-study module with worksheets and videos.	Emotional weariness had decreased in the intervention group after 6 months of professional coaching as opposed to increasing in the control group. Comparing the intervention group to controls, impostor syndrome was much less prevalent in the intervention group. In comparison to the control group, the intervention group's self-compassion scores improved. Depersonalization, professional success, or moral damage ratings showed no statistically significant differences.	Acceptability - NA Adoption - x Appropriateness - NA Feasibility - x Fidelity - x Implementation Cost - NA; 2/6	burnout adversely affects the careers and well-being of female resident doctors. Professional group coaching is recommended in the literature to lessen resident burnout.
Extending Peer Support Across the Military Health System to Decrease Clinician Burnout	Erin A. Keyser, Larissa F. Weir, Michelle M. Valdez, James K. Aden, and Renée I. Matos	2021-01-25	December 2018 to December 2019; No	Descriptive study	The Brigham and Women's Hospital (BWH) and Dr. Jo Shapiro's work inspired the San Antonio Uniformed Services Health Education Consortium to create the Peer Help Program (PSP), a flexible project that includes educating clinician peers to support colleagues one-on-one.	Nationally recognized expert	Large military teaching hospital	254 clinicians, with 102 residents/fellows (N = 254, n = 102).	Determine if Peer Support Programs at military hospitals encourage physician well-being during times of increased vulnerability and stress	Two 5-hour training sessions were offered.	254 physicians got one-on-one peer assistance throughout the first year of expert training, with 135 medical, 59 surgical, 43 obstetric, and 18 pediatric specialties making use of the program. Patient mortality (25%), risk management notification (22%), medical error/complication (15%), and poor patient outcome (13%) were the most frequent occurrences resulting in a need for peer assistance.	Acceptability - x Adoption - x Appropriateness - x Feasibility - x Fidelity - NA Implementation Cost - x 5/6	Research demonstrates that PSPs support clinical workforce welfare at times of increased susceptibility and stress.
SMART-R: A Prospective Cohort Study of a Resilience Curriculum for Residents by Residents	Deanna Chaukos, Emma Chad-Friedman, Darshan H. Mehta, Laura Byerly, Alper Celik, Thomas H. McCoy Jr., and John W. Denninger	2017-11-02	NA; No	Prospective cohort study	The 6-hour, group-based Stress Management and Resiliency Training Program for Residents (SMART-R) curriculum imparts health techniques including meditation. A wearable device that records health behaviors was utilized to assess the viability of adopting such technology for investigating behaviors related to resident health. Burnout risks and resistance characteristics were assessed before and after the program.	Residents and research team	Large US teaching hospital	75 of the 85 residents in the medical and psychiatric departments took the SMART-R curriculum. (N = 85, n = 75).	The goal is to assess the viability of a resilience curriculum that was developed by residents, for residents, and delivered by locals.	The 6-hour curriculum was divvied up into three sessions that were administered during the first 6 months of the year.	The program received positive first response when 31 out of 75 participants (41%) completed the pre- and post-surveys evaluating burnout risk and resilience characteristics. Within the first three months of the trial, 25 out of 62 individuals (or 40%) used the health monitor more than 50% of the time.	Acceptability - x Adoption - x Appropriateness - x Feasibility - x Fidelity - x Implementation Cost - NA 5/6	Mind-body wellness programs for doctors reduce stress and boost self-assurance in one's coping skills. Resident-led initiatives may give residents the capacity to practice self-care.

Table 1: Article characteristics and Proctor criteria (continued)

Article Title	Author(s)	Year of Publication	Date of Data Collection, Focus on COVID-19 Pandemic?	Study Design	Action (Implementation of intervention strategy - brief overview)	Actor (who leads the initiative)	Setting (hospital, clinic, etc)	Target of Action (population, N = _, and sample size, n = _)	Goals of the Strategy	Dose/frequency of intervention	Implementation outcomes (what happened/results)	Proctor	Justification for implementing the strategy
Implementation of an Electronic Health Record-Based Messaging System in the Emergency Department: Effects on Physician Workflow and Resident Burnout	Tiffany Luu, Lindsey Spiegelman, David Nykin, Kimberly Abido, Jennifer Roh, Scott Rudkin, and Shannon Toohey	2022-03	May 2019 to August 2019	Case study	A major urban university emergency department served as the site of this investigation (ED). With defined message rules in place, surveys were delivered through email. An organized survey was used to assess how the change affected resident doctors.	Lead nurse and lead resident physician	Large urban academic ED	Participants were 24 residents, 20 full-time educational faculty attendings, and 5 to 8 attending physicians (N = 52, n = 24).	To examine the adoption of an EHR-based communication system for non-emergency between residents, and the influence of the system's installation on resident burnout and workflow.	The messaging platform was implemented May 2019 through August 2019.	The number of RNs' non-urgent phone calls and the frequency of non-emergency, workflow-impeding calls dropped, but burnout from these calls stayed roughly the same.	Acceptability - NA Adoption - NA Appropriateness - NA Feasibility - NA Fidelity - x Implementation Cost - x ; 2/6	Alternative forms of professional communication are crucial since traditional ones, including as paging and phone calls, disrupt patient care, add to burden and stress, and promote burnout.
Does Implementation of a Corporate Wellness Initiative Improve Burnout?	Danielle Hart, Glenn Paetow, and Rochelle Zarzar	2019-01	2016–2017	Case study with thematic analysis	The Happiness Practice (THP) program was implemented between 2016 and 2017 during the compulsory resident seminar hours for emergency medicine (EM). The Maslach Burnout Inventory was completed before and after each session, and the researchers then gathered data on responses at the session-level.	Developed and led by two former business executives who co-founded THP.	Urban residency training program	Participants were 46 residents (N = 46).	To adopt a workplace wellness program that has a track record of effectiveness with other populations of healthcare providers and to determine whether it may reduce burnout among emergency medicine residents.	Six month, one-hour sessions from September through February, with each session focusing on a different principle (such as be conscious, honor feelings) after an introductory session.	Following the intervention, there was a little trend toward higher emotional weariness and depersonalization ratings as well as higher personal achievement scores. This program received a 1.5 overall scores. Residents said that 43% of them felt their overall burnout was subjectively exacerbated as a result of this intervention, and 39% said their burnout did not change at all.	Acceptability - NA Adoption - NA Appropriateness - NA Feasibility - NA Fidelity - NA Implementation Cost - NA; 0/6	Research demonstrates that THP is effective in reducing burnout, boosting wellbeing, and improving patient satisfaction among EM-based non-physicians.
											Overall scores:	Acceptability -4/9 Adoption - 5/9 Appropriateness - 5/9 Feasibility -5/9 Fidelity - 4/9 Implementation Cost -2/9	
											Average total:	2.78 was the average score for Proctor criteria	

Table 2: ERIC Criteria

Article Title	Use evaluative and iterative strategies	Provide interactive assistance	Adapt and tailor to context	Develop stakeholder relationships	Train and educate stakeholders	Support clinicians	Engage consumers	Utilize financial strategies	Change infrastructure	Total
Randomized Trial of Therapy Dogs Versus Deliberative Coloring (Art Therapy) to Reduce Stress in Emergency Medicine Providers	NA	NA	x	NA	NA	NA	NA	NA	NA	1/9
Caring for others without losing yourself: An adaptation of the Mindful Self-Compassion Program for Healthcare Communities	x	NA	x	NA	x	NA	x	NA	NA	4/9
Humanism and professionalism training for pediatric hematology-oncology fellows: Results of a multicenter randomized trial	x	NA	NA	x	x	NA	NA	NA	x	4/9
Effect of a Novel Mindfulness Curriculum on Burnout During Pediatric Internship: A Cluster Randomized Clinical Trial	NA	NA	x	NA	x	NA	NA	NA	NA	2/9
Effect of a Novel Online Group-Coaching Program to Reduce Burnout in Female Resident Physicians: A Randomized Clinical Trial	NA	NA	NA	NA	x	NA	x	NA	NA	2/9
Extending Peer Support Across the Military Health System to Decrease Clinician Burnout	x	NA	x	x	x	NA	x	NA	NA	5/9
SMART-R: A Prospective Cohort Study of a Resilience Curriculum for Residents by Residents	x	x	x	x	x	NA	NA	NA	x	6/9
Implementation of an Electronic Health Record-Based Messaging System in the Emergency Department: Effects on Physician Workflow and Resident Burnout	NA	NA	NA	NA	x	x	NA	NA	x	3/9
Does Implementation of a Corporate Wellness Initiative Improve Burnout?	x	NA	NA	x	x	NA	NA	NA	NA	3/9
	5/9	1/9	5/9	4/9	8/9	1/9	3/9	0/9	3/9	3/9 average