

## Motivations to conduct research and burnout in medical education: a mixed methods study of students and residents Motivations à s'engager dans la recherche et épuisement professionnel en éducation médicale : étude à méthodes mixtes auprès des étudiants en médecine et des résidents

Devin Box,<sup>1</sup> Skylar Healey,<sup>1</sup> Stefani Mihilli,<sup>1</sup> Kristen Barton,<sup>1</sup> Ryan Degen,<sup>2</sup> Mary Ott<sup>3</sup>

<sup>1</sup>Schulich School of Medicine, Western University, Ontario, Canada; <sup>2</sup>Division of Orthopedic Surgery, Schulich School of Medicine, Western University, Ontario, Canada; <sup>3</sup>Faculty of Education, York University, Ontario, Canada

Correspondence to: Mary Ott, Ph.D. 250 Winters College - 4700 Keele Street, Toronto ON, Canada M3J 1P3; email: [mott@edu.yorku.ca](mailto:mott@edu.yorku.ca)

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### Abstract

**Background:** Burnout is on the rise in medical training as workload increases. One such demand is the pressure for research productivity earlier in training. However, little is known about the impacts of this trend and its mediating factors as trainees progress. Important influences may be motivation sources and supports, since intrinsic motivation is linked to well-being. This mixed methods study investigated associations between burnout and motivations for conducting research in a sample of medical students and residents in one academic centre.

**Methods:** Participants completed an online survey including validated scales for measuring burnout (Maslach Burnout Inventory) and intrinsic research motivation (using the Situational Motivation Scale) along with open response items to identify supports for autonomy, competence, and relatedness in the process of conducting research. Results were synthesized from the statistical and thematic analyses, using the framework of self-determination theory.

**Results:** Forty-three survey responses were analyzed. Overall prevalence of burnout was high (60.5%) and evidenced a progressive impact, with a significant increase in depersonalization among residents compared to medical students. Participants articulating more intrinsic reasons for doing research had lower levels of burnout. Intrinsically motivated individuals were more likely to have increased relational and academic supports and less likely to internalize barriers to conducting research. Residents expressed more competence in their ability to do research but less relational supports.

**Discussion/Conclusions:** Burnout is a multifaceted condition requiring multiple mitigation strategies. This study identified a correlation between research motivation and burnout and mediating protective factors. These findings can inform study of interventions focussed on targeted motivational supports to advance research training in medical education.

### Résumé

**Contexte :** L'épuisement professionnel est en hausse dans la formation médicale, en lien avec l'alourdissement de la charge de travail. Parmi ces exigences croissantes figure la pression exercée dès les premières étapes de la formation pour produire des travaux de recherche. Toutefois, les répercussions de cette tendance et les facteurs qui pourraient les moduler demeurent peu connus à mesure que les apprenants progressent dans leur parcours. Les sources de motivation et les mécanismes de soutien pourraient jouer un rôle important, notamment parce que la motivation intrinsèque est associée au bien-être. Cette étude à méthodes mixtes a examiné les liens entre l'épuisement professionnel et les motivations à faire de la recherche auprès d'un échantillon d'étudiants en médecine et de résidents dans un centre universitaire.

**Méthodes :** Les participants ont rempli un questionnaire en ligne comprenant des échelles validées pour mesurer l'épuisement professionnel (Maslach Burnout Inventory) et la motivation intrinsèque à faire de la recherche (à l'aide de la Situational Motivation Scale), ainsi que des questions ouvertes visant à identifier les soutiens à l'autonomie, à la compétence et au sentiment d'appartenance dans le processus de recherche. Les résultats ont été synthétisés à partir d'analyses statistiques et thématiques, en s'appuyant sur le cadre théorique de l'autodétermination.

**Résultats :** Quarante-trois réponses au questionnaire ont été analysées. La prévalence globale de l'épuisement professionnel était élevée (60,5 %) et témoignait d'un impact progressif, avec une augmentation significative de la dépersonnalisation chez les résidents comparativement aux étudiants en médecine. Les participants qui formulaient des raisons davantage intrinsèques pour faire de la recherche présentaient des niveaux moindres d'épuisement professionnel. Les personnes motivées de façon intrinsèque bénéficiaient généralement de plus grands soutiens relationnels et universitaires, et étaient moins enclines à interioriser les obstacles à la réalisation de travaux de recherche. Les résidents exprimaient un plus grand sentiment de compétence dans leur capacité à mener des projets de recherche, mais disposaient de moins de soutiens relationnels.

**Discussion/Conclusions :** L'épuisement professionnel est une condition multifactorielle nécessitant des stratégies d'atténuation variées. Cette étude a mis en évidence une corrélation entre la motivation à faire de la recherche et l'épuisement professionnel, ainsi que des facteurs protecteurs médiateurs. Ces résultats peuvent orienter l'étude d'interventions ciblant le soutien motivationnel afin de favoriser le développement de la formation à la recherche en médecine.

## Introduction

A research rich curriculum vitae (CV) is often considered favourable by medical programs when differentiating residency applicants, thereby incentivizing medical student research participation.<sup>1-3</sup> Could this competitive urge to ‘publish or perish’<sup>4</sup> be a potential factor in their burnout? The phenomenon of medical student burnout and its detrimental effects on well-being are well described in the literature.<sup>5</sup> The demands of the medical training environment influence burnout across a wide range of specialties<sup>6-11</sup> and have consequences for personal health<sup>5,12-15</sup> and patient outcomes.<sup>16-19</sup> It is vital that medical schools and postgraduate training programs understand the factors influencing this phenomenon of chronic work overload<sup>20</sup> to develop mitigation strategies. One contributor to increasing levels of burnout may be the source of motivation to engage in research.<sup>21,22</sup> Intrinsic motivation to engage in medical learning is more favourable than extrinsic motivation, as it results in deeper learning and enhanced sense of well-being.<sup>23</sup> Nevertheless, prominent extrinsic factors associated with the competitive nature of medical education are well documented, including institutional expectations and the need to build a more impressive CV.<sup>2,22</sup> While the link between increased work demands and burnout in medical training is well documented, little is known about the association between research motivations and levels of burnout in students and residents, or about potential protective factors. This mixed methods study addresses this gap using measures and theoretical perspectives from the psychology of burnout and motivation.

### Burnout

Burnout is defined as a psychological syndrome of emotional exhaustion, depersonalization, and impaired personal accomplishment induced by repeated workplace stressors.<sup>20</sup> Close to 50% of physicians and surgeons in North America have experienced symptoms of burnout.<sup>6,7</sup> This state of ill-being may begin early on in medical education, having roots in medical school<sup>5,12-15</sup> and residency.<sup>5,10, 11</sup> Burnout in medical school and residency is associated with both personal and professional detriments including depression,<sup>5,9,10</sup> alcohol and drug use,<sup>5</sup> suboptimal patient care,<sup>8</sup> and perceived medical errors.<sup>16</sup> As medical learner burnout appears to be closely related to work demands and work hours,<sup>24, 25</sup> research is needed to understand the impacts of additional responsibilities. Increasing calls for trainees to engage in research projects<sup>1-4</sup> may place further burden on medical learners at a vulnerable stage in their professional development.

### Self determination theory

Self determination theory (SDT) understands human motivation and flourishing as the fulfillment of psychological needs for autonomy, relatedness, and competency; when individuals are intrinsically motivated to pursue goals and behaviours, it satisfies the need for autonomy—control over one’s choices and outcomes.<sup>23,26</sup> Conversely, when people feel pushed to engage in activities they do not perceive as valuable, this external motivation reduces their autonomy and leads to stress.<sup>23,26</sup> The stress of being driven to do something you don’t want to do is further exacerbated if individuals feel incapable or unsupported in that area. This leads to unmet needs for competency and relatedness which can have a compounding effect on medical learners.<sup>27,28</sup> From the perspective of SDT, it seems likely that trainees who are more extrinsically motivated to do research are more likely to experience symptoms of burnout,<sup>29</sup> but that supports for autonomy, competency, and relatedness in doing research could provide protective factors.<sup>23</sup>

## Methods

This study investigated research participation and burnout among medical students and residents in one academic centre to determine if there is an association between level of burnout and type of motivation driving learner research. We used a mixed methods design to explore the following questions:

1. Are medical students and residents intrinsically or extrinsically motivated to do research and is this associated with burnout?
2. Does this relationship change as learners progress through medical education from medical school to residency?
3. Are there institutional, personal, and academic factors that mediate the relationship between research motivation and burnout in medical research as learners progress from undergraduate to post-graduate medical education?

We selected a mixed methods survey design for its ability to bring quantitative and qualitative data together to better understand a problem.<sup>30-34</sup> To answer research questions 1 and 2, we assessed and correlated levels of burnout with types of motivation using the validated measures of the Maslach Burnout Inventory (MBI)<sup>35,36</sup> and Situational Motivational Scale (SIMS).<sup>37</sup> While quantifiable measures are necessary for understanding levels and rates of a phenomenon in a population,<sup>38,39</sup> they fail to capture the individual and social complexities that contribute to

responses.<sup>24</sup> Qualitative analysis allows for the identification of patterns in lived experience and perspectives.<sup>40</sup> We used open response questions to collect data for thematic analysis, then integrated the quantitative and qualitative results of the entire survey to answer the third research question.

### Study design

We employed a hybrid approach to the “sequential explanatory” and “concurrent” mixed methods designs described by Kroll and Neri,<sup>31</sup> in that we collected quantitative and qualitative data concurrently and conducted an initial analysis of each, then did an integrative analysis of these results to add further explanation. We developed a survey (Supplemental File 1) which included demographic questions (age, gender), academic details (current year, previous degrees), and prior research experience. Demographics were collected to assess responses as a function of progression through medical school.<sup>5</sup> In addition, two validated scales were used in survey development for data collection; the SIMS,<sup>37</sup> and the MBI.<sup>20</sup>

The SIMS is a scale that corresponds to self determination theory as a measure of an individual’s situational motivation.<sup>41,42</sup> It includes 16 statements which participants rank on a 7-point Likert scale ranging from “corresponds not at all” to “corresponds exactly,” in reference to their level of motivation for a given activity. For this study, the activity was defined as conducting research as a medical student or resident. Scores of the SIMS categorize respondents on a scale from intrinsic motivation to extrinsic motivation for the activity. The SIMS scale was used to quantify the type of motivation participants have for performing research.

Level of burnout was assessed using the MBI general survey (MBI-GS) that has been validated for large populations of healthcare professionals.<sup>43</sup> The MBI-GS contains 22 statements and participants are asked to rate the frequency with which they experience specific feelings related to their work using a 7-point Likert scale ranging from “never” to “always.”<sup>44</sup> The MBI-GS can be contextualized to address work roles.<sup>28</sup> We adapted this survey to reflect the roles of medical trainees (i.e., “patients” was used instead of “clients”). The MBI-GS was used to quantify the prevalence of burnout within our sample.

The following open response questions were included for the qualitative portion of the survey to ascertain students’ motivations, facilitators, and barriers to research, using questions designed to elicit the categories of autonomy,

(intrinsic motivation), relatedness (sense of belonging and support) and competence (ability to meet expectations) that are predictors in SDT of higher performance and wellbeing.

1. What factors contribute to your motivation to pursue research during your medical education?
2. What supports (personal and institutional) have helped you conduct research during your medical education?
3. What barriers have you encountered in conducting research during your medical education?

### Study participants

Criteria for study participation included any current medical student or resident studying within the institution or its affiliated hospital network. Incomplete quantitative responses were excluded from the analysis. The inclusion of students across all levels of medical education was chosen to account for potential differences in burnout due to the unique mediators and stressors associated with progression through medical education.<sup>5</sup> A breakdown of demographic information is included in Suppl. File 2.

### Data collection

Surveys were distributed electronically at our institution’s medical school using two methods. For undergraduate students, distribution through class emails was used for mass recruitment. For residents, emails were sent directly to residency program assistants, who distributed recruitment materials amongst their respective programs. Data was collected between December 2022 to June 2023. Informed consent was obtained from all participants at the beginning of the survey. Demographic information collected was anonymized. All procedures used in the study were approved by our institutional ethics review board. To maintain the validity of the study scales, only fully completed questionnaires were included in the analysis.

### Procedures for quantitative analysis

Demographic data were reported as number of respondents, and age shown as mean  $\pm$  SD and range (Supplemental materials). Statistical analysis was performed using Stata (StataCorp. 2019. *Stata Statistical Software: Release 16*. College Station, TX: StataCorp LLC). The overall prevalence of burnout was calculated by convention as outlined by the MBI questionnaire.<sup>44</sup> Cronbach’s alpha was calculated to ensure the internal consistency of the MBI. Participant motivation type was assessed based on the overall self-determination index score from the SIMS questionnaire, calculated by

convention, with a theoretical maximum of 18 and a minimum of -18 (< 0 indicating extrinsic motivation; > 0 indicating intrinsic motivation).<sup>45</sup> Unpaired T-tests were performed on subcategories of MBI and SIMS measures between medical students and residents with a p value of < 0.05 considered significant. Cohen's d was reported for subgroup analysis as a measure of effect size. Sensitivity and specificity values were calculated by convention for burnout prediction in upper and lower quartiles of amotivation scores.

### Procedures for qualitative analysis

Answers to open response survey questions underwent thematic analysis, using a deductive and iterative approach to coding qualitative data<sup>40</sup>. Initial themes were generated using the theoretical framework of psychological needs for autonomy, relatedness, and competency defined by SDT. Autonomy describes a sense of initiative, control, and ownership over one's actions that fosters intrinsic motivation. Competence is a sense of mastery and ability to succeed that is best satisfied within environments that provide structure, suitable challenges, positive feedback, and opportunity for growth. Relatedness is the sense of attachment, belonging to a group, and social connection enhanced by a supportive and inclusive environment. Thus, one's social and environmental setting plays a key role in facilitating or posing barriers to meeting these needs.

To ensure coding reliability, two authors independently coded the data from all participant responses line by line. Initial subthemes were identified based on commonalities in responses and categorized according to the themes of autonomy, relatedness, and competence. After the initial independent analysis, the two coders met to reconcile differences in the initial codes through discussion. The codebook (Supplemental File 3) was refined through an iterative approach, modifying codes to develop a schema which allowed all responses to be assigned to distinct subthemes. Any conflicts that arose in coding were resolved by a third author and coders reached 100% agreement on final codes. Components of each response were coded independently according to their themes, however, if the same code was found numerous times, it was counted once per participant. Results were then quantified in each theme by totaling the number of responses.

### Integrative analysis

Pairwise correlational analysis was performed on the subcategories of the MBI and SIMS. The upper and lower

quartiles of the amotivation score on the SIMS were used to assign cut off values as a predictor of burnout rates, and sensitivity and specificity values for these cutoffs were calculated. This categorized our respondents into two distinct cohorts with the highest and lowest quartile scores of amotivation: Low Intrinsic Motivation (LM) and High Intrinsic Motivation (HM) groups, respectively. These two groups were analyzed in a separate subgroup analysis to compare extremes of motivation types with the qualitative findings on motivational factors. The middle quartile respondents were included in the initial qualitative analysis of the full sample but excluded for this subgroup analysis, as our aim was to characterize key experiential factors that differentiated the LM and HM groups in terms of sources of research motivation, supports, and barriers (Tables 3-5) to identify possible areas for intervention. A visual summary of the study design and results is provided in Figure 1.

## Results

A total  $n = 54$  responses were gathered, of those,  $n = 11$  participants were excluded due to incomplete survey responses. Therefore, a total of  $n = 43$  complete responses were included in the analysis, comprising  $n = 27$  medical students and  $n = 16$  residents. Beyond the comparison of medical students to residents, no statistical differences were found between respondent demographics and any study outcomes.

Our study investigated associations between research motivation type and degree of burnout in medical learners. We hypothesized that intrinsic motivation for research would be protective against burnout. While the overall prevalence of burnout for the entire group was found to be 60.5%, our results showed differences in burnout between medical students and residents, and subgroup analysis of the quantitative data highlighted important factors mediating this phenomenon, such as amotivation and depersonalization. We found that depersonalization was significantly correlated to low motivation on the SIMS scale, with a 94% specificity for predicting burnout in respondents. Our integrated analysis of the quantitative and qualitative data showed that the most highly motivated group reported 'personal interest' as the primary intrinsic driver for participating in research, citing "genuine interest" and "desire to make a positive impact," which were sharply contrasted by the lowest motivation group whose responses largely echoed the sentiment of being extrinsically compelled by "having to do it."

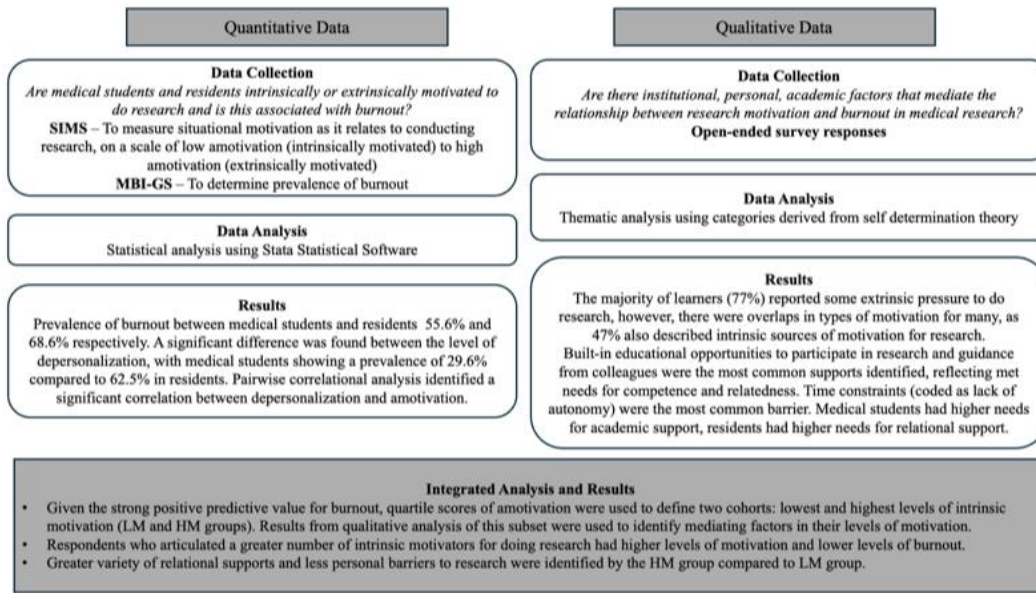


Figure 1. Visual summary of results

### Burnout

The prevalence of overall burnout and of elevated subcategories of the MBI are summarized in Table 1. Prevalence of burnout between medical students and residents was 55.6% and 68.6% respectively. Burnout was not significantly related to any of the demographic information gathered. Between medical students and residents, no statistical difference was found in the prevalence of burnout (diff = -0.13,  $t^{41} = -0.084$ ,  $p = 0.20$ ), emotional exhaustion (diff = -0.081,  $t^{41} = -0.050$ ,  $p = 0.309$ ), and personal accomplishment (diff = -0.12,  $t^{41} = -0.080$ ,  $p = 0.214$ ). Between medical students and residents, a significant difference was found between the level of depersonalization (diff = -0.329,  $t^{41} = -2.18$ ,  $p = 0.018$ ), with medical students showing a prevalence of 29.6% compared to 62.5% in residents. This effect size, measured by Cohen's  $d$ , was  $d = 0.8$ , indicating a large effect. The MBI demonstrated good internal consistency ( $\alpha = 0.82$ , 22 items).

### Motivation

Scores for each category of the SIMS scale were averaged as per convention and summarized in Table 1. No statistically significant differences were found between medical students and residents. Although non-significant, it is worth noting that the SDI score is positive for medical students (0.30) but negative for residents (-1.16). While this does not exemplify a large difference in overall scores, by convention of the SIMS tool, this result implies that the overall motivation type is intrinsic for medical students and extrinsic for residents.

Table 1. Prevalence of burnout by Maslach Burnout Inventory (MBI) subcategories of emotional exhaustion, depersonalization, and personal accomplishment. Scores for each category of the SIMS including intrinsic motivation, identified regulation, external regulation, amotivation, and self-determination index in medical students and residents.

Burnout category	Medical Students (%)	Residents (%)	Cohen's $d$	p-value
Burnout	55.6	68.8	0.27	0.20
High Emotional Exhaustion	48.1	56.3	0.16	0.309
High Depersonalization	29.6	62.5	0.80	0.018*
Low Personal Accomplishment	63	75	0.24	0.214
SIMS category	Medical students (score)	Residents (score)		p-value
Intrinsic Motivation	3.21	2.86	0.27	0.142
Identified Regulation	4.08	3.72	0.29	0.479
External Regulation	4.90	4.69	0.15	0.312
Amotivation	2.66	2.95	0.24	0.993
Self Determination Index	0.30	-1.16	0.24	0.451

Non-parametric t-tests were utilized to compare scores of burnout and motivation categories.  $p$ -values < 0.05 are indicated in bold, \* $p$  < 0.05. Medical students ( $n=27$ ) and residents ( $n=16$ ) were included.

### Correlational analysis

A pairwise correlational analysis was performed on the subcategories of the MBI and SIMS scales. A statistically significant moderate correlation was found between Depersonalization and Amotivation ( $r = 0.42$ ,  $p = 0.005$ ).

### Burnout prediction

Given the significant correlation with depersonalization, the upper and lower quartiles of the amotivation score were used to assign categories as a predictor of the presence of burnout. Sensitivity, specificity, positive predictive value, and negative predictive values were calculated and summarized in Table 2. Most notably, being in the high category for amotivation showed a 93.75% specificity for predicting burnout, and a positive predictive value of 88.89%. However, it has a low sensitivity of 30.77% and a negative predictive value of 45.45%.

Table 2. Sensitivity and specificity matrix for participants with high amotivation (AM) on the SIMS scale and rate of burnout.

		Burnout			
		Yes	No		
High AM	Yes	8	1	PPV	88.89
	No	18	15	NPV	45.45
		Sensitivity	Specificity		
		30.77	93.75		

Measures of sensitivity, specificity, PPV and NPV were calculated by convention.

### Thematic analysis of open-response questions

The majority of learners (77%,  $n = 33$ ) expressed some level of extrinsic pressure to do research, describing a lack of autonomy in statements such as “I do not have particular interest in clinical or QI research, and while I love basic science, it is not feasible to do with full time clinical care requirements. I therefore have no internal motivation to do the research because it is not interesting to me but do it because of the program requirements” (P4) and: “Mandatory. Getting through ethics took us two years and if I didn't have to do this project I wouldn't be doing it. I expected it to be done at the end of second year and at the end of third year we are JUST starting to interview participants” (P37). However, there were overlaps in types of motivation for many, as 47% ( $n = 20$ ) also described intrinsic sources of motivation for research. For example, several participants saw that research improved their learning: “It provides me with a different outlook on medicine which I believe to be beneficial in my growth as a medical student” (P44) and “It builds important skills in both academic and personal growth spheres of my life” (P28). Another reflected on the feeling of accomplishment and social credibility that research affords: “The prestige of it also plays in - like it feels nice to tell academically minded people about the projects you are doing because it feels like they respect you more” (P29). One recognized research as a meaningful way of connecting with communities and improving healthcare, describing their goal “to learn more about a historically underserved population that experiences social stigma, and hopefully to contribute positively to improving the care of that population” (P6). As

this answer demonstrates, if research is seen as ‘added value’ to the individual, the psychological need for autonomy is met and motivation improves.

Furthermore, survey respondents identified personal or institutional support that they had in place during their research. Overall themes included *Supporting Autonomy* as coded by ‘Resources provided’; *Supporting Competence* represented by several codes including ‘Prior Knowledge and Experience,’ ‘Structure and Built in Education Opportunities,’ and ‘Guidance from Colleagues’; and *Supporting Relatedness* coded as examples of ‘Emotional Support.’ Guidance from colleagues along with built-in educational opportunities to participate in research were the most common supports identified, which convey the themes of support for competence and relatedness. A total of 72% ( $n = 31$ ) of survey respondents described having these supports, with responses such as “a laid-out curriculum to keep me and my supervisor on track to complete the project” (P23), “my peers and PI have been quite helpful in navigating difficult research questions” (P32), and “[having a] research coordinator who is well versed in REB applications, timelines for grants, certain research methodologies” (P6).

Finally, survey respondents reflected on barriers to research they have faced throughout their medical education. Responses were coded within the themes *Lack of Autonomy*, *Lack of Competence*, and *Lack of Relatedness*. Lack of Autonomy was represented by several codes including ‘Limited Time,’ and ‘Reliance on Others’. The codes ‘Limited Personal Knowledge’ and ‘Substantial Administrative Workload’ were used to represent *Lack of Competence*. Responses depicting ‘Interpersonal Tension’ were within the theme *Lack of Relatedness*, highlighted by responses stating: “Group member absolutely not pulling their weight.” (P9) or “Supervisors tend to give very little direction and help when it comes to research projects, can make you feel helpless at times.” (P28). Most survey respondents 53% ( $n = 23$ ) expressed ‘time constraints’ as the most prominent barrier to research: “I also could be more productive in research if I had more time – research is so time-consuming” (P36) and “No time to work on it” (P3). This emphasizes the theme of a lack of autonomy in having control of one’s time as a deterrent to conducting and completing research. Further contributing to this theme is the 26% ( $n = 11$ ) of survey respondents who reported feeling limited by ‘reliance on others’ to move their projects forward, as this quote illustrates: “my supervisor gave minimal direction, and I was unable to do it without support” (P23).

### Integrated analysis of burnout and research motivation

Given its strong positive predictive value for burnout, quartile scores of amotivation were used to describe two distinct cohorts (Table 2). The cohort with highest levels of extrinsic motivation represents respondents within the low internal motivation (LM) group, the cohort with lowest scores represent the high internal motivation (HM) group. The LM group included a total of nine survey respondents. Of these, 56% ( $n = 5$ ) were medical students and 44% were residents ( $n = 4$ ). The HM group included a total of 11 survey respondents, 64% ( $n = 7$ ) were medical students and 36% ( $n = 4$ ) were residents. Tables 3, 4, and 5 depict the differences between groups in numbers of coded themes. In what follows we describe the specific motivators, supports, and barriers to research for these groups.

**Motivators for research.** Within the HM group, 64% of survey respondents identified personal interest as a motivator, stating they are “intrinsically curious” (P42) and have a “genuine interest in research” (P46). These responses aligned with the theme of autonomy. Contrastingly, only 33% of the LM group mentioned personal interest as a motivator, with one even stating that they “actively hate” (P45) their research. In the LM group, 77% of responses mentioned either obtaining a residency/career position or mandatory program requirements as reasons for participating in research, as illustrated by the following: “I was largely motivated by people (staff, residents, med students) saying that the only way to get into the program was through having significant relevant research experience” (P29) and “to successfully match into my residency program, honestly, don’t care for research otherwise” (P45). All but one participant had responses categorized within the theme of lack of autonomy, indicating this unmet need is the strongest predictor of burnout for those within the LM group.

On the other hand, responses of those in the HM group conveyed the theme of relatedness as an important motivator (73%). These individuals strongly expressed their desire to contribute to medicine with their research stating, “I appreciate the importance of research in shaping the future of medicine” (P44) and noting the importance of “social accountability” (P46). While this group also displayed the theme of lack of autonomy, as many responses (64%) mentioned extrinsic motivators, they identified a greater variety of motivators, including intrinsic values for pursuing research when compared to the LM group.

*Table 3. Prevalence of thematic codes identified in qualitative analysis, comparing research motivating factors between the high internal motivation (HM) and low internal motivation (LM) groups.*

Codes	LM ( $n = 9$ )	HM ( $n = 11$ )	Theme
Personal interest	3	7	Autonomy
Program requirement	3	3	Lack of Autonomy
To obtain desired residency position or career placement	4	7	
Pressures / expectations	1	2	
Personal growth / skill development	1	2	Competence
Prestige / achievement	1	2	
Contribution to medicine / society	1	6	Relatedness
Relationships	2	2	

*The theme of autonomy was identified by a greater proportion of participants within the HM vs. LM group (64% vs. 33%, respectively). Comparatively, 77% of the LM group responses aligned with the theme of lack of autonomy. The theme of relatedness emerged as a motivator for the HM group (73%) and was seldomly reported by the LM group (11-22%).*

**Supports for research.** Guidance from colleagues was identified as a major supportive factor for research participation, regardless of group. Participants stated they had “very supportive research teams” (P4 and P44) and “amazing supervisors” (P26). However, emotional support, such as from friends and family, was a more prominent factor in the HM group with nearly half of the survey respondents (45%) making note of this: “My classmates that are going through the same thing I am” (P15) and “my parents and friends with whom I share my struggles, my PI’s have been quite understanding of my other commitments” (P46). Only a single individual in the LM group identified emotional support. These results show that needs for competence in conducting research are being met in both groups and that supervision is widely agreed upon as a supportive element for research, but that those with LM appear to have more unmet needs for relatedness. Within the theme of supporting competence, 36% of individuals in the HM group reported the importance of built-in opportunities by the school/residency program. Of note, 75% of these survey respondents were residents, suggesting that the school may be under-supporting research in undergraduate medical education. Like the between-group comparison on supports for autonomy, the HM group identified a greater variety of supports for research compared to those in the LM group.

*Table 4. Prevalence of thematic codes identified in qualitative analysis, comparing supportive factors for research participation between the high internal motivation (HM) and low internal motivation (LM) groups.*

Codes	LM (n = 9)	HM (n = 11)	Theme
Resources provided	1	2	Supporting Autonomy
Prior knowledge / experience	0	0	Supporting Competence
Structure and built in education opportunities	1	4	
Guidance from colleagues	5	9	
Emotional support	1	5	Supporting Relatedness

*Themes supporting autonomy and competence were similarly prevalent among both the HM and LM group, with divergence of the HM group reporting greater guidance from colleagues. Responses of the theme of supporting relatedness were more prevalent in the HM group compared to the LM group (45% vs. 11%, respectively).*

**Barriers to research.** The LM group reported three key barriers to research: limited time, intrapersonal tension, and limited personal knowledge, corresponding to unmet needs for autonomy, relatedness, and competence. These barriers were each endorsed by 33% of survey respondents in this group. Participant responses stated that they felt as though they “signed up for way too many things” (P29) or were conflicted about how to best spend their time “I just don’t want to anymore. I don’t feel like I get a good work life balance when I do research in addition to school/homework. - I feel like I want to spend my time outside of school with family, friends, participating in sports, arts, or volunteering in my community” (P26). Others mentioned that there is “poor guidance” (P21), and it is often “hard to understand how to actually do the research” (P17).

No participants in the HM group identified intrapersonal tension as a barrier, but they did signal unmet needs for autonomy. This was highlighted in 64% of survey respondents’ responses who noted limited time as a barrier and 55% of survey respondents who felt that reliance on others was a barrier. Participants in this cohort stated, “there is no protected time to do research” (P46) and complained of “the slow speed at which supervisors advance the projects” (P44). The theme of lack of competence was much less pronounced in this group and centered around administrative workload as illustrated by these responses: “you have to put in a lot of work to secure a research position” (P46) and “supervisors being very specific in requirements to the point that it becomes inefficient” (P44).

*Table 5. Prevalence of thematic codes identified in qualitative analysis, comparing barriers to research participation between the high internal motivation (HM) and low internal motivation (LM) groups.*

Codes	LM (n = 9)	HM (n = 11)	Theme
Limited time	3	7	Lack of Autonomy
Reliance on others	1	6	
Intrapersonal tension	3	0	
Limited personal knowledge / expertise	3	2	Lack of Competence
Substantial administrative workload	1	3	
Interpersonal tension	1	0	Lack of Relatedness

*The theme of lack of autonomy was prevalent among both HM and LM groups. The HM group reported limited time and reliance on others as the main barriers within this theme, while the LM group reported limited time and intrapersonal tension as their main barriers. While the theme of lack of competence was endorsed by both groups, the HM group reported this as an administrative workload, and the LM group noted it as limited personal knowledge.*

## Discussion

Burnout is a workplace phenomenon. The present mixed methods study demonstrated that burnout has an increasing impact on medical learners from medical school to residency in the experience of depersonalization; that the requirement to do research alongside clinical training, which increases workload, may be one of the contributors to this decline in well-being; and that sources of research motivation may play a mediating role. There has been an increase in mandatory participation in research for medical learners globally,<sup>1-4,15</sup> and not having adequate protected time to complete research can be detrimental to learning.<sup>46,47</sup>

Modifying medical learning environments can reduce burnout<sup>48</sup> and optimize learning and well-being.<sup>49</sup> Our study suggests there are strategies medical schools and training programs could explore to support well-being in the process of learning to do research, although further research to observe their efficacy in doing so is required. The use of SDT in our correlational study exposes a new hypothesis of why and how learners with higher levels of intrinsic motivation for doing research at the same time experienced lower levels of burnout, potentially creating options for more targeted interventions. While lack of autonomy in the choice to do research remains a problem given the pressures for research productivity,<sup>1-4,15</sup> the literature on SDT is clear that supports for competence and relatedness can help students perceive the value of learning outcomes and develop more intrinsic motivations

for achieving them.<sup>23</sup> Medical education systems have essential roles to play in creating environments that increase motivation in the context of learning to do research,<sup>21,22,27-29,50</sup> although further research is required to show that efforts to change these environments correlate with or even cause increased motivation or research productivity.

### Supports for developing research competence in medical school

Evidence from our study affirms other research showing that medical students need more built-in supports to develop competency in conducting research.<sup>2,3,21,22,51</sup> Medical students in the HM group identified they had more supports for contributing to research studies, which included dedicated time, explicit instruction, and pathways for joining research teams, but these opportunities were not consistently available to all. Meanwhile, residents across motivational type affirmed they had pathways in their training to do research, indicating the need for developing competence was being met, but less time to engage in supportive relationships.

### Supports for belonging in residency training

Our study identified emotional support as a protective factor predominantly in the HM group, reflecting more met needs for belonging. Recognition of this by residency programs is of critical importance, as opportunities to connect with friends and family diminish throughout residency training. Current evidence suggests that peer-to-peer burnout recognition and intervention is ineffective, meaning implementation of effective well-being initiatives may need to be spearheaded by training programs.<sup>52</sup> Notably, the most effective interventions to reduce burnout in healthcare professions are reductions in workload.<sup>53</sup> While not a replacement for this, supplementary approaches with promise for burnout mitigation include group discussion, mindfulness training, and counselling.<sup>53</sup> However, residents often fear repercussions for accessing these resources, potentially stemming from stigma that may be internalized within the program's culture.<sup>54</sup> Further studies could explore whether well-being initiatives such as protected time for research or a strong culture of supporting resident research are associated with reduced burnout. A critical question remains, however, whether expectations for all trainees to engage in research are realistic if they do not align with future practice goals.

### Identifying internal vs external barriers to conducting research

In our study, despite similar burnout rates in other categories, rates of depersonalization were significantly elevated (more than double) in residents compared to medical students (62.5% and 29.6% respectively). The MBI category of depersonalization was identified as an important mediating factor between burnout and motivation type. Within healthcare, depersonalization often presents as cynicism towards patients and can ultimately result in patients being seen as objects rather than people.<sup>44</sup> Consequently, healthcare providers can exhibit diminished empathy towards their patients, potentially negatively influencing the quality of care that they provide.<sup>55</sup> Depersonalization in medical training and practice has been analysed independently as its own phenomenon.<sup>56-58</sup> Resident depersonalization rates reported in the literature range from 43.6%, to 79%,<sup>59,60</sup> which was comparable in our study. Although direct comparisons are scarce, evidence suggests that the steep increase in responsibilities within residency may play an important role in driving the depersonalization process.<sup>48</sup> This needs to be urgently and thoroughly researched.

Exploring the barriers to conducting research between groups, the HM group was noted to identify more *external factors* as limitations, while the LM group pointed to their *internal conflict* as a limitation. There are two implications for further research related to this finding. Given the higher rate of depersonalization in the LM group, education to help learners identify if they are internalizing limitations to conducting research may encourage them to seek help earlier in their careers. However, medical education programs could also take a proactive role in identifying learners for wellness checks and exploring their needs for motivation supports.<sup>23,27</sup> Our finding of amotivation that predicts burnout suggests the potential use of this subset measure on the SIMS as a screening tool to identify those most at risk for burnout, although this subset measure has low sensitivity and cannot definitively rule out burnout.

### Limitations

Limitations of our study include that this was a correlational study with a single centre sample. First, correlation is not necessarily causation; we cannot say that research or low motivation for research causes burnout. Second, generalizability of our results would be enhanced by studies in other institutions. Differences that exist between medical schools and residency programs may vary widely even in the same academic institution regarding

their work demands and available supports for doing research. Additionally, qualitative analysis of open response survey questions is limited by the amount of detail participants share in writing. Studies using semi-structured interviews would add further nuance.

## Conclusions

This mixed methods study assessed research motivation and level of burnout in medical students and residents and explored how these states were related. Our study presents novel findings demonstrating a link between extrinsically driven research demands and learner burnout, and identifying influences on intrinsic motivation that are correlated with lower levels of burnout. Further research is required to determine if program-led changes, such as incorporating protected time for relational supports and research endeavours in residency and designing more built-in opportunities for research training in medical schools can positively impact productivity and reduce burnout. With increasing demands on medical learners for research skills and productivity, educators must be aware of the negative consequences of burnout that can be fuelled by a lack of these supports.

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