



# Burnout among neurology residents during the COVID-19 pandemic: a national cross-sectional study

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Received: 13 April 2021 / Accepted: 15 October 2021 / Published online: 30 November 2021  
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## Abstract

**Background** Neurology residents are particularly vulnerable to burnout because of the novel logistical and clinical challenges brought about by the coronavirus disease 2019 (COVID-19) pandemic. Despite its implications, knowledge on burnout and its predictors among neurology residents is lacking. This study aimed to determine the prevalence of burnout among neurology residents during the pandemic, to compare burnout subscale scores and sociodemographic and work characteristics, and to explore residents' perceptions on how to address burnout.

**Methods** We conducted a cross-sectional survey among all 120 residents from the nine institutions in the Philippines offering neurology residency programs from March to August 2020. We obtained sociodemographic and work characteristics using questionnaire. We measured burnout using the Maslach Burnout Inventory. We performed an inductive thematic analysis to analyze perceptions on how to reduce burnout.

**Results** The response rate was 71.67% (86/120). The mean age was  $30.1 \pm 3.1$  years. Using predefined subscale critical boundaries, the prevalence of burnout was 94% (95% CI 89, 99). The lack of compensation and number of on-duty days influenced emotional exhaustion scores. The number of on-duty days influenced depersonalization scores. Thematic analysis revealed five themes: increasing manpower; self-care; reducing clerical tasks; improving work environment; and adequate compensation.

**Conclusions** The prevalence of burnout among neurology residents during the COVID-19 pandemic was alarmingly high. Reforms in hiring policies, work-hour management, manpower organization, work environment, and logistics may be considered.

**Keywords** Burnout · Neurology residents · Coronavirus disease 2019 · Pandemic

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## Introduction

Burnout is a psychological syndrome arising from prolonged exposure to interpersonal stressors in the workplace characterized by three main features: emotional exhaustion or the loss of drive to do work; depersonalization, also known as compassion fatigue or the tendency to regard patients as objects; and career dissatisfaction or the diminished sense of worth or accomplishment [1]. It has been recognized as an occupational hazard in professions that entail lengthy and intense interpersonal contact such as healthcare, education, and other service-oriented occupations as professionals from these fields are expected to be generous and self-sacrificing towards their clients, patients, or students.

The prevalence of burnout among physicians ranges from 0 to 80.5% [2–5]. In a nationwide study in the United States (USA), the rate of burnout was higher among physicians

(37.9%) compared to the general workforce population (27.8%) [2]. The study also disclosed a higher rate of work-life balance dissatisfaction among physicians compared to the general workforce (40.2% vs 23.2%). Among the medical subspecialties, family medicine, general internal medicine, and emergency medicine were noted to have the highest rates of burnout. In a multinational survey among intensive care physicians and nurses in Asia, 50.3% of physicians and 52.0% of nurses have signs of burnout [3]. Burnout is also common among neurologists. In a study involving 1,671 American neurologists, 60.1% of the respondents had at least one symptom of burnout (emotional exhaustion, depersonalization, and/or career dissatisfaction) [4].

Burnout among physicians is known to significantly affect patient care. It is linked to a lack of compassion, increased tendency towards medication errors, and consequently, poor patient satisfaction and poor outcomes. A cross-sectional study on the relationship between physician burnout and patient outcomes concluded that physician's emotional exhaustion and physician depersonalization are significantly correlated with longer recovery time and patient dissatisfaction [6]. Indirectly, the physician burnout also compromises patient care as it relates to higher attrition rates and consequently to a diminished healthcare workforce pool. Emotional exhaustion is significantly associated with decreased professional work effort [7].

The coronavirus disease 2019 (COVID-19) pandemic introduced added psychosocial, emotional, physical, and logistical burdens to healthcare workers. In the authors' institution, certain changes in the working environment were made. The neurology residents had to take additional shifts as physicians-on-duty in the COVID intensive care units, as safety officers in the donning-doffing areas, and as naso-pharyngeal swab specimen collectors. In a tertiary private hospital in the country, physical restructuring was implemented in the neurosciences unit—acute stroke and neurocritical unit was converted to a COVID-19 intensive care unit, and certain ward units were restructured to quarantine facilities for healthcare workers [8]. Training and service delivery of neurology residents were also revised—minor elective rotations were temporarily put on hold to give way to COVID-related shifts, outpatient clinics were closed, didactics and other training activities adopted virtual platforms, medical interns were pulled out from on-site clinical rotations, and certain research projects were postponed because of pandemic restrictions [8]. Recent cross-sectional studies involving nurses, physician trainees, and physicians concluded that healthcare professionals who were directly involved in the care of COVID-19 patients had significantly higher rates of depression, anxiety, insomnia, stress, and burnout [9, 10]. The identified sources of distress and anxiety include (a) lack of access to personal protective equipment, (b) fear of being exposed to COVID-19 and

fear of spreading the infection at home, (c) fear of not being able to get tested immediately should COVID-19 signs and symptoms emerge, (d) worry that the institution will not be able to cover for their needs should they contract the infection, (e) lack of access to childcare services in the setting of expanded working hours, (f) inability to provide for basic needs, (g) fear of not being able to provide competent care if assigned to a new area, and (h) lack of access to recent information and communication [11].

Neurologists and neurology residents are at particular risk for burnout during the COVID-19 pandemic. They are faced with added uncertainties and challenges as a significant number of patients with COVID-19 infection present with non-specific neurologic manifestations such as myalgia, headache, altered sensorium, hyposmia, and hypogeusia portending the performance of essential neurodiagnostic tests (e.g., electroencephalography) and management dilemmas [12–14]. Furthermore, the pandemic hampers the healthcare system's ability to render specialized services to patients with stroke and other neurologic conditions [15]. Despite its implications, the literature on prevalence and predictors of burnout among neurologists and residents in the time of the COVID-19 pandemic is still lacking.

The primary objective of this study was to determine the prevalence of burnout among neurology residents during the COVID-19 pandemic. This study also aimed to investigate possible associations between sociodemographic and work characteristics of neurology residents and burnout and to explore residents' perceptions on how to address physician burnout.

## Methods

### Study design, setting, and participants

In March to August 2020, we conducted a cross-sectional survey among all 120 adult neurology residents from institutions offering Philippine Neurological Association-accredited programs: Baguio General Hospital and Medical Center, Jose R. Reyes Memorial Medical Center, Quirino Memorial Medical Center, St. Luke's Medical Center, The Medical City, University of the East Ramon Magsaysay Memorial Medical Center, Inc., University of Santo Tomas Hospital, Philippine General Hospital University of the Philippines, and East Avenue Medical Center. Trainees from the subspecialty fields, such as but not limited to, epilepsy and electroencephalography, neurophysiology, vascular neurology, interventional neurology, and pediatric neurology, were excluded. We also excluded residents who were under the dual neurology-psychiatry programs. Neurologists and neurosurgeons who already completed their residency

training programs as well as neurosurgery residents were not included in the study.

## Variables and measures

Using the pen-and-paper method, we measured burnout using the full 22-item Maslach Burnout Inventory Human Services Survey for Medical Personnel MBI-HSS (MP), a well-validated tool designed to investigate the three burnout dimensions, emotional exhaustion (EE), depersonalization (DP), and personal accomplishment (PA) [1]. To be able to use the tool in a pen-and-paper format, we purchased a “license to reproduce” the MBI-HSS from Mind Garden via mindgarden.com, an accredited online resource for psychological assessment tools. In the literature, there is considerable variability in the definition of burnout using the MBI-HSS tool [5, 16, 17]. Burnout was considered if a participant obtained a high score on EE, high score on DP, or a low score in the PA subscale [16, 17]. We used the critical boundaries using standardized  $z$  values based on the reference population norm for physicians as follows: high EE if score is  $\geq 26.995$  (at  $z = \text{Mean} + [\text{SD} * 0.5]$  where mean and SD for EE are 22.19 and 9.53); high DP if score is  $\geq 13.645$  (at  $z = \text{Mean} + [\text{SD} * 1.25]$  where mean and SD for DP are 7.12 and 5.22); and low PA if score is  $\leq 37.264$  (at  $z = \text{Mean} + [\text{SD} * 0.10]$  where mean and SD for PA are 36.53 and 7.34) [18]. We also used a general questionnaire to obtain personal and professional characteristics such as participant’s age, sex, marital status, permanent residence, nature of employment, type of institution (government-owned versus private), years in the training, number of on-duty days per week, number of days on leave per year, number of outpatient clinic duties per week, average patient load at a time, and non-clinical workload (research work, administrative work, academic/teaching work). The modified Bedford scale, a subjective ordinal rating scale of workload (1 = “Work is a piece of cake”; 10 = “Adequate performance of tasks is impossible”), was used to assess participants’ personal rating of non-clinical workload.

## Qualitative analysis

At the end of the questionnaire, participants were instructed to answer an open-ended question, “how can physician burnout be reduced?”. We used inductive and semantic approaches of thematic analysis to investigate the themes on participants’ perception on how physician burnout can be addressed.

## Study size

This study aimed for total enumeration. However, to address the primary objective of determining prevalence of burnout

in the study population, a minimum of 55 participants should be enrolled assuming 95% confidence and an error rate of 10% in the prevalence estimate, and assuming a prevalence rate of up to 80.5% [5] and a total population of 136 using the following sample size formula for the estimation of exact prevalence by Levy and Lemeshow:

$$n \geq \left( z^2 N P_y (1 - P_y) \right) \div \left( (N - 1) \epsilon^2 P_y^2 + z^2 P_y (1 - P_y) \right).$$

## Statistical analyses

Demographics and practice characteristics were described using descriptive statistics. Bivariate analyses among the variables were done using cross tabulations, analysis of variance (ANOVA)/independent  $t$  test, or Kruskal–Wallis test/Wilcoxon rank sum test. Data were analyzed using Stata® Statistical Software: Release 16 (College Station, TX: Stata-Corp LLC). The responses to the open-ended question given at the end of the questionnaire were qualitatively analyzed using inductive approach of thematic analysis (see Supplementary Table for the approach to coding).

## Results

### Participants

A total of 120 neurology residents were identified. Thirty-four did not give written consent (response rate of 71.7%). Figure 1 summarizes the flow of participant recruitment in the study.

### Demographics of the participants

Among the participants, 64 (74.4%) were from government institutions and 22 (25.6%) were from private hospitals. The socio-demographics and work characteristics of the participants are summarized in Table 1.

The mean age was  $30.1 \pm 3.1$  years. More than half were females ( $n = 47$ , 54.7%) and almost all were single ( $n = 76$ , 90.5%). The majority were residing in an urban

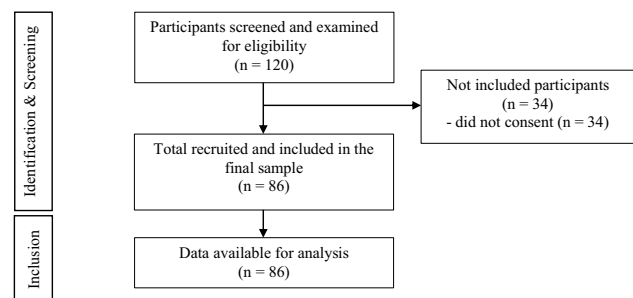


Fig. 1 Flow diagram of participants in the study

**Table 1** Demographic and practice characteristics of the respondents ( $n = 86$ )

Background characteristics	Frequency (%*)
<b>Institution</b>	Government 64 (74.4) Private 22 (25.6)
<b>Age, in years</b>	Mean $\pm$ SD, in years 30.1 $\pm$ 3.1 Less than 30 40 (45.4) 30–34 33 (38.4) 35 and over 7 (7.0)
<b>Sex</b>	Female 47 (54.7) Male 38 (44.2)
<b>Marital status</b>	Single 76 (88.4) Married 8 (9.3)
<b>Permanent residence</b>	Urban 64 (74.4) Rural 21 (24.4)
<b>Nature of employment</b>	With compensation 75 (87.2) Without compensation 9 (10.5)
<b>Years in training</b>	1st 26 (30.2) 2nd 18 (20.9) 3rd 26 (30.2) 4th 16 (18.6)
<b>Number of on-duty days per week</b>	0 to 2 17 (19.8) 3 to 4 53 (61.6) 5 to 7 15 (17.4)
<b>Number of days on leave per year</b>	0 to 15 83 (96.5) 16 to 30 2 (2.3)
<b>Number of outpatient clinic duties per week</b>	0 to 2 52 (60.5) 3 to 4 23 (26.7) 5 to 7 10 (11.6)
<b>Average patient load at a time</b>	0 to 5 7 (8.1) 6 to 10 26 (30.2) 11 to 15 24 (27.9) 16 to 20 13 (15.1) > 20 15 (17.4)
<b>Non-clinical workload (modified Bedford)</b>	1 to 3 3 (3.5) 4 to 6 52 (60.5) 6 to 10 29 (33.7)
<b>Socioeconomic status of patients</b>	Low 59 (68.6) Middle 21 (24.4) High 3 (3.5)

\*Percentages may not add up to 100% due to missing data

setting (74.4%) and most were employed with compensation ( $n = 75$ , 87.2%). The majority of the participants had 3 to 4 on-duty days a week ( $n = 53$ , 61.6%). Nearly all of the participants were allowed 0 to 15 days of leave per year ( $n = 83$ , 96.5%). In terms of the number of outpatient clinic duties, the majority had 0–2 clinic duties per week ( $n = 52$ , 62.5%). In terms of inpatient load, the majority ( $n = 57$ , 66.2%) handled 0–15 patients at a time. Most of the participants took care of patients of low-socioeconomic status ( $n = 59$ , 68.6%). On the perceived degree of non-clinical workload, the mean modified Bedford score was  $5.86 \pm 1.2$

(“There is some but not enough spare time to attend to other tasks.”).

Using the critical boundaries in the different subscales of burnout, the prevalence of burnout among the participants is 94% ( $n = 81$ ; 95% CI 89, 99). The mean EE score was  $21.63 \pm 10.56$  with a third of the respondents ( $n = 30$ , 34.8%) having significantly high scores. The mean DP score was  $6.58 \pm 5.01$  with 8.14% ( $n = 7$ ) having significantly high scores. The mean PA score was  $24.63 \pm 8.15$  with 93.0% ( $n = 80$ ) having significantly low. Four participants (4.65%) had a high degree of burnout in all three subscales.

## Comparisons of burnout subscale scores according to personal/professional characteristics

Table 2 shows the comparisons between the burnout subscales and personal and practice characteristics of the participants. Participants with compensation had significantly lower mean emotional exhaustion scores ( $21.0 \pm 10.2$ ) than those without compensation ( $28.8 \pm 9.8$ ,  $p = 0.036$ ). There was statistically significant difference between at least two groups in terms of number of on-duty days per week on the emotional subscale scores ( $p = 0.033$ ). Post hoc analysis revealed that the significant difference was between the 3–4 on-duty days and 5–7 on-duty days groups ( $p = 0.041$ ). There is statistically significant difference between at least two groups in terms of number of on-duty days per week on the depersonalization subscale scores ( $p = 0.025$ ). Post hoc analysis revealed that the significant difference is between the 0–2 on-duty days and 3–4 on-duty days groups ( $p = 0.007$ ). The rest of the comparisons between burnout subscale scores and personal and practice characteristics showed no significant difference.

## Thematic analysis of residents' perspectives on how to reduce physician burnout

### Increasing manpower and reducing working hours: key to reducing burnout

The majority of the participants highlighted that hiring more residents, increasing the physician–patient ratio, and effectively distributing the workload would reduce burnout. One participant said, “[burnout] can be reduced by increasing the number of staff to decrease the workload and have ample time for rest.” Some participants added that decreasing the working hours, decreasing the frequency of on-duty days (every four instead of every three), allowing 1 to 2 days off a month, and instituting mental health leave may extinguish feeling of burnout.

### Building self-care action plan: a remedy for burnout

The second theme was about dedicating activities to promote one's own physical, emotional, and psychosocial health to alleviate burnout. Aside from ensuring that residents had adequate nutrition and ample time for sleep, some participants provided other specific examples such as practicing mindfulness techniques, namely writing reflective journals, doing meditation, and practicing hobbies and personal interests.

## Less non-clinical tasks means less burnout

Several participants highlighted that the burden of certain non-clinical tasks such as administrative assignments, clerical duties, lectures, and conferences significantly contributes to burnout. One participant stated that one way to lessen burnout is through “delegation of non-clinical and non-residency work to administrative personnel.” Another participant highlighted that dedicating a protected time for administrative and research work and to not be interfered with by clinical work would alleviate burnout.

## A nurturing psychosocial and physical work environment is vital for burnout prevention

Many participants described how a nurturing psychosocial work environment may prevent burnout. One illustrative account mentioned that “a good working relationship with co-residents and a supportive working environment will lessen the tendency for burning-out.” Other accounts highlighted the importance of having a working culture without the need for humiliation, having a hospital administration that listens to the “woes” of the residents, maintaining camaraderie and respect among residents regardless of age and status, and upholding effective interpersonal communication and effective conflict resolution strategies. The importance of the physical working environment was also highlighted. A participant said that burnout can be prevented by “having a decent lounge for trainees with acceptable amenities (sleeping quarters, air-conditioning, fridge, water).”

## Adequate compensation and logistical support: Essential strategy against burnout

Some participants highlighted the need for adequate and timely compensation, security of employment with compensation, adequate supplies and equipment, and improved privileges to combat burnout. One illustrative account was from a participant who emphasized that burnout can be reduced if there is “financial security [because] we don't really feel secure since we don't have plantilla [compensation].”

## Discussion

The results of this study indicated an alarmingly high level of burnout among neurology residents during the COVID-19 pandemic, with a prevalence rate of 94%. This may be an overestimation for the reason that the authors utilized a sensitive approach in defining burnout—at least one alteration reaching the critical boundary in any of the three subscales [5, 16]. This estimation supports the findings of previous studies which showed that the pandemic may be

**Table 2** Mean distribution of burnout subscale scores of the neurology residents by personal and practice characteristics

Background characteristics		Exhaustion <sup>a</sup>		<i>P</i> value <sup>b</sup>	Depersonalization <sup>a</sup>		<i>P</i> value <sup>b</sup>	Personal accomplishment <sup>c</sup>		<i>P</i> value <sup>b</sup>	<i>N</i>
		Mean	SD		Mean	SD		Mean	SD		
<b>All respondents</b>	21.6	10.6		6.6	5.0			24.6	8.2		86
<b>Institution</b>											
	Government	21.6	10.9	0.985	6.2	4.6	0.277	24.2	8.1	0.382	64
	Private	21.6	10.0		7.8	6.1		26.0	8.6		22
<b>Age, in years</b>											
	Less than 30	22.7	10.7	0.734	7.2	5.0	0.498	23.6	8.1	0.202	40
	30–34	20.7	9.7		6.1	5.0		26.8	7.5		33
	35 and over	22.4	15.4		7.3	6.6		23.3	8.9		7
<b>Sex</b>											
	Female	22.0	10.3	0.687	5.7	3.9	0.167	24.6	7.9	0.931	47
	Male	21.1	11.2		7.7	6.1		24.7	8.8		38
<b>Marital status</b>											
	Single	22.1	10.5	0.390	6.7	5.2	0.801	25.0	8.3	0.270	76
	Married	18.6	12.0		5.8	4.2		21.1	8.1		8
<b>Permanent residence</b>											
	Urban	22.9	10.7	0.100	6.8	5.0	0.393	24.7	8.8	0.741	64
	Rural	18.5	9.8		6.0	5.4		24.0	6.2		21
<b>Nature of employment</b>											
	With compensation	21.0	10.2	<b>0.036<sup>b</sup></b>	6.5	5.0	0.648	25.0	8.3	0.257	75
	Without compensation	28.8	11.2		7.9	5.9		21.7	8.5		9
<b>Years in training</b>											
	1st	21.7	12.5	0.748	5.9	4.6	0.389	23.6	8.8	0.780	26
	2nd	19.8	9.6		7.1	4.4		26.0	5.2		18
	3rd	23.3	8.6		7.5	5.6		24.3	6.4		26
	4th	20.9	11.9		5.6	5.6		25.4	12.2		16
<b>Number of on-duty days per week</b>											
	0 to 2	23.1	6.2	<b>0.033<sup>b</sup></b>	9.0	4.6	<b>0.025<sup>b</sup></b>	23.5	7.2	0.586	17
	3 to 4	19.6	10.7		5.8	5.0		25.1	8.8		53
	5 to 7	27.5	12.7		6.9	5.3		23.0	6.3		15
<b>Number of days on leave per year</b>											
	0 to 15	21.4	10.5	0.099	6.7	5.1	0.771	24.4	8.1	0.851	83
	16 to 30	34.0	11.3		5.0	-		25.5	0.7		2
<b>Number of outpatient clinic duties per week</b>											
	0 to 2	22.3	11.1	0.708	6.2	4.3	0.922	22.8	7.8	0.085	52
	3 to 4	21.5	10.9		7.7	6.9		27.0	7.9		23
	5 to 7	19.2	7.7		6.4	3.7		27.1	8.0		10
<b>Average patient load at a time</b>											
	0 to 5	22.3	8.6	0.396	6.1	4.3	0.350	18.9	6.1	0.338	7
	6 to 10	18.4	10.3		6.7	4.9		25.4	9.1		26
	11 to 15	21.7	10.0		7.0	4.8		24.7	7.9		24
	16 to 20	23.4	12.4		4.5	4.7		26.8	9.4		13
	>20	24.8	11.4		7.6	6.3		24.3	6.4		15
<b>Non-clinical workload (modified Bedford)</b>											
	1 to 3	2.60	8.2	0.066	4.7	6.4	0.057	24.0	2.6	0.750	3
	4 to 6	19.3	9.8		5.8	5.0		25.3	7.4		52
	6 to 10	24.7	11.6		7.9	4.8		23.9	9.9		29

**Table 2** (continued)

Background characteristics		Exhaustion <sup>a</sup>		<i>P</i> value <sup>b</sup>	Depersonalization <sup>a</sup>		<i>P</i> value <sup>b</sup>	Personal accomplishment <sup>c</sup>		<i>P</i> value <sup>b</sup>	<i>N</i>
		Mean	SD		Mean	SD		Mean	SD		
<b>All respondents</b>	21.6	10.6		6.6	5.0			24.6	8.2		86
<b>Patient profile (socioeconomic status)</b>											
	Low	21.7	10.5	0.280	6.1	4.5	0.563	25.0	7.6	0.089	59
	Middle	21.9	11.2		7.0	5.1		22.7	8.7		21
	High	11.7	10.3		12.0	12.0		33.7	14.5		3

<sup>a</sup>Analysis of variance OR independent test was used

<sup>b</sup>Significant at  $P < 0.05$

<sup>c</sup>Jarque-Bera test of normality was employed and the test indicates that personal accomplishment is not normally distributed; hence, non-parametric Kruskal–Wallis test and Wilcoxon rank sum test were used

a fundamental contributor to burnout among healthcare professionals [9, 10]. This estimation was far from the data presented in a pre-pandemic cross-sectional study estimating prevalence rate among neurologists in the USA to be approximately 60% [4]. This disparity was expected given that the burnout experience is understood to be significantly varied across different economies, geographical regions [19], culture, and ethnicity [20]. Burnout prevalence was also expected to vary in terms of subspecialty. In the Philippines, pre-pandemic cross-sectional studies on burnout that used the same tool among family medicine residents revealed a lower prevalence rate of approximately 30% [21, 22].

In terms of the EE subscale, the number of on-duty days in a week may affect EE scores. This was consistent with the results of previous studies showing a significant correlation between hours worked per week and burnout [2, 23]. Interestingly, this was also congruent with the findings in the qualitative analysis of this study stating that participants perceived that reducing workload and limiting working hours would significantly reduce the burnout experience. Another significant factor that may influence EE is compensation. This study revealed that residents with compensation had significantly lower EE scores compared to those without compensation. This pattern was similar to the findings of the survey done among professors in the USA showing negative correlation between salary and EE [24]. Appealingly, this logical pattern was also consistent with our qualitative findings. Participants expressed that financial security in the form of adequate compensation may steer motivation and alleviate burnout.

Contrary to the findings of the previous studies [19, 25] which showed significant direct correlation between the number of working hours and burnout scores in the DP subscale, our study revealed that participants who had 0–2 on-duty days in a week had significantly higher DP scores than

those who had 3–4 on-duty days per week. This pattern was somehow similar to the findings of cross-sectional studies done among Filipino emergency physicians and nurses and of a cross-sectional study among Brazilian anesthesiologists which concluded that compassion fatigue—a concept that is synonymous with depersonalization—has no direct association with working hours [26–28]. The reason behind this finding may be due to the presence of unaccounted variables such as job satisfaction and work colleague relationship—the two variables that have a positive correlation with compassion in a study among Filipino nurses [26]. Residents who have more on-duty days might be more exposed to positive work relationships, thereby lowering their risk for DP. Another factor that might contribute to this trend is the work setup. Neurology residents who were given off days were those who rendered services in critical COVID-19 areas [8].

Most neurology residents had a high level of burnout in the PA subscale. Among the personal and practice characteristics considered, no comparison showed significant difference on PA subscale. The reason behind this finding may be due to the presence of unaccounted variables. In the literature, it is suggested that outpatient clinic activities may be related to higher PA subscale scores. In a meta-analysis comparing PA scores of hospitalists and outpatient physicians, there was a tendency of higher PA scores among outpatient physicians [29].

The limitations of this study include its risk for responder/selection bias. Although it had a fairly high responder rate of 71.67%, the residents who did not consent to participate in the study may be experiencing true burnout syndrome. To increase the response rate, future studies may focus on survey flexibility to allow prospective participants to choose their preferred survey platform, on having multiple means of reminders, and using personalized hand-addressed envelopes in mail surveys [30].

Another limitation was the limited personal and practice characteristics included in the statistical analyses. Future studies may redesign the questionnaire to make it more inclusive and to incorporate details or measures on personality factors such as extraversion, neuroticism, openness, consciousness, and agreeableness [31]; on depression and fatigue [32]; on resilience [20]; on levels of occupational stress [25]; and on career calling and psychological attachment [33] as these factors significantly influence one's predisposition to burnout. Including these factors might also provide explanation as to how there have been paradoxical relationships between DP scores and number of working hours and between PA scores and number of outpatient duty days mentioned above. Ensuing studies may also explore the prevalence and risk factors of burnout among board-certified neurologists and neurology subspecialists (in epileptology, vascular neurology, neurophysiology, dementia, movement disorders, neuro-oncology, etc.) in the various settings. Another limitation of this study was the lack of a control group or pre-pandemic baseline scores for burnout. The pandemic mobilized all neurology residents in the country to render medical care to COVID-19 patients with neurological conditions. Future studies should consider re-assessing the burnout experience of neurology residents in the post-pandemic setting.

The strength of this study lies in its inclusion of qualitative methods of analysis to capture the perspectives of the participants on ways to reduce physician burnout. Very little is known about the prevalence of and factors associated with burnout among Filipino physicians; hence, it is imperative to apply a method to attempt to capture not just the reductionist numerical data which may fail to recognize the individuality and uniqueness of human experience on burnout but as well as the holistic picture of the perspective of the residents on burnout. Succeeding studies may explore a more in-depth approach in assessing human experience by applying exhaustive face-to-face interviews using flexible open-ended questions.

Taking into account the quantitative and qualitative findings of this research, the investigators recommend that policymakers and administrators should consider (a) improving the physician–patient ratio by hiring residents through employment with compensation, (b) allowing residents to have protected time for self-care, (c) hiring administrative workers to handle clerical tasks for the residents, (d) establishing a nurturing working environment, and (e) providing adequate logistical support for residents. These themes are congruent with the findings of several studies that showed that patient care work overload, work-life imbalance [2], demanding clerical work [4], workplace conflict [1], and lack of effective support in the workplace [4] were significant contributors to burnout.

## Conclusion

The prevalence of burnout among neurology residents during the COVID-19 pandemic was alarmingly high (94%), occurring in approximately 9 out of 10 residents. Reforms in hiring policies, work-hour management, manpower organization to include administrative personnel, work environment, and logistical support may be considered.

## Data and materials availability

The supplementary materials include the authors' approach to coding and the questionnaire used.

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s10072-021-05675-4>.

**Author contribution** CWTR: conceptualization, data curation, formal analysis, interpretation of data, writing (original draft), writing (review), and editing. AIE: conceptualization, data curation, formal analysis, interpretation of data, writing (original draft), writing (review), and editing. IDNM: conceptualization, data curation, formal analysis, interpretation of data, writing (original draft), writing (review), and editing. RDGJ: conceptualization, data curation, formal analysis, interpretation of data, writing (original draft), writing (review), and editing.

**Funding** This study was partially funded by the BRAIN Foundation and the Philippine General Hospital Expanded Hospital Research Office via the 2020 Residents and Fellows Research Grant.

**Code availability** Not applicable.

## Declarations

**Ethics approval** This study was performed in line with the principles of the Declaration of Helsinki. The study received ethical approval from the University of the Philippines Manila Research Ethics Board (protocol number: UPMREB 2019–314-01) and Single Joint Research Ethics Board of the Department of Health (protocol number: SJREB-2020–52). The protocol was registered in the UPM Research Grants and Administration Office (registration number: RGAO-2019–0515). All included participants provided written informed consent.

**Consent to participate** All included participants provided written informed consent.

**Consent for publication** All included participants signed an informed consent form which includes statement that data gathered may contribute to the growing body of literature about physician burnout.

**Conflict of interest** The authors declare no competing interests.

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