BMJ Open

An online yoga program for resident physicians in Québec: an evaluation of feasibility and impact on mental health. (Abbreviated title: An online yoga program for resident physicians in Québec)

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2023-082391
Article Type:	Original research
Date Submitted by the Author:	22-Nov-2023
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Keywords:	Burnout, Physicians, MENTAL HEALTH, Quality of Life, Anxiety disorders < PSYCHIATRY

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TITLE: An online yoga program for resident physicians in Québec: an evaluation of feasibility and impact on mental health. (Abbreviated title: An online yoga program for resident physicians in Québec)

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WORD COUNT: 3993 words.

ABSTRACT

Objectives: To evaluate feasibility of the Bali Yoga Program for Residents (PYB-R), an 8-week virtual yoga-based intervention, and determine its impact on the mental health of resident physicians.

Design: Single-group repeated measures study.

Setting: Four medical schools in Québec, Canada.

Participants: Overall, 55 resident physicians were recruited to participate of which 53 (96.4%) completed the PYB-R. The post-intervention assessment was completed by 43 residents (78.2%) and 39 (70.9%) completed all phases (including 3-month follow-up). Most were in their first year (43.4%) or second year (32.1%) of residency. The majority were female (81.1%) with a mean age of 28±3.6 years.

Primary and secondary outcome measures: The primary outcome measure was feasibility as measured by participation in the PYB-R. Secondary outcomes measures were psychological variables (anxiety, depression, burnout, emotional exhaustion, compassion fatigue, and compassion satisfaction) and satisfaction with the PYB-R. Residents were further subgrouped based on quality of work life and number of PYB-R sessions attended.

Results: The attrition rate for program completion was 19%. Of the 43 residents that completed the PYB-R, 90.6% attended between 6-8 sessions. Repeated-measures Analysis of Variance (ANOVAs) at 3 time points (baseline, PYB-R completion, 3-month follow-up) confirmed a decrease in scores for depression and anxiety, and an increase in scores for compassion satisfaction. No changes were observed in the other psychological variables evaluated. ANOVAS also confirmed that a better quality of life at work helps develop

compassion satisfaction, a protective factor to compassion fatigue. Most participants (92.9%) indicated they were satisfied or very satisfied with the quality of the program.

Conclusions: A virtual yoga-based program is feasible and has lasting positive effects on the mental health of resident physicians. Further research is warranted to validate these findings using a larger, randomized sample of residents.

KEYWORDS: Yoga, depression, anxiety, compassion satisfaction, compassion fatigue, burnout, medical residents, physicians, mental health, selfcare, selfcompassion, quality of life, work environment, QOL, QOLW.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- A yoga-based mind-body intervention was designed for medical residents and led by a certified yoga instructor.
- The program was designed to be flexible regarding scheduling and modalities used in order to maximize participation.
- Data collected from residents was self-reported and thus susceptible to social desirability and expectancy bias.
- It was not possible to verify that residents viewed each video to completion.
- Lack of a control group limits our abillity to draw a causal link between participation in the program and the observed effects on mental health.

INTRODUCTION

There are growing concerns regarding the mental health of physicians and their Quality of Work Life (QWL) due to heightened levels of stress and burnout in the wake of the COVID-19 pandemic.[1] According to data from the Canadian Medical Association (CMA), the number of physicians experiencing burnout increased from 25% in 2018 to 53% in 2021.[2, 3] Pre-pandemic burnout rates were even higher among medical residents (52%) and depression was common (18%);[2] these levels increased moderately by 2021.[3, 4] The estimated annual cost of reduced hours, absenteeism, turnover and preventive retirement due to physician burnout is $213 million/year in Canada.[5] In the United States, burnout is estimated to cost the healthcare system $4.6 billion/year.[6]

The effects of physician burnout are largely felt on three levels: QWL, patient care, and care for society. Physicians who experience burnout are more likely to engage in substance abuse and workplace violence, and have higher suicide rates.[7] Physician burnout is also associated with reduced quality of care and increased rates of medical errors.[7] In particular, patients and families who perceive a lack of compassion from their physician are more likely to experience "unexpected" medical events, to have worse symptom management, and to file complaints with the institution.[8] Resident physicians may be particularly vulnerable to the effects of poor mental health.[9] Although they reportedly have lower prevalence of burnout and depression at the start of medical school (compared to similarly aged individuals in the general population), the work and study conditions under which they train make them more susceptible to experiencing poor QWL and developing symptoms of psychological distress.[10] Factors associated with burnout include the high pressure of acadmemic competition, long work hours, lack of autonomy,

abuse of power, difficulty maintaining healthy social life, and development of professional cynicism.[11-18]

Physician wellbeing and QWL can be improved by reducing triggers (e.g., poor working conditions, long shifts, stressful on-call duties, lack of appreciation, workplace bullying, etc.) and implementing stress management programs including activities such as mindfulness and yoga.[19] Generally speaking, wellbeing is a reflection of corporate culture; institutions that evaluate the QWL of their physicians and provide tangible mental health resources have observed improvements in the quality of care delivered.[20] Interventions involving meditation, self-care techniques, and reduced work hours can significantly reduce burnout symptoms in residents.[21] Previous studies of interventions involving meditation, self-care techniques, and reduced working hours have reported significant reductions in resident burnout,[21, 22] coupled with positive effects on empathy, self-compassion and the sense of accomplishment, all of which directly impact physician performance.[23-28] Compared to meditation-based approaches, yoga adds a bodily aspect which promotes mind-body balance using three primordial elements: breathing exercises, postures and mindfulness exercises. The benefits of yoga on the sympathetic and parasympathetic nervous systems have been demonstrated; over-activation of the former can lead to both psychological and physiological dysfunction, while activation of the latter attenuates activation of the former, thus limiting the development of problems.[29-31]

Evidence from systematic reviews of mind-body interventions (MBIs) to improve physician wellbeing suggest more work is needed to determine the ideal context for implementing and evaluating these interventions.[32-34] Few studies have investigated the

effect of practicing yoga on the mental health of medical residents;[35-38] these studies found yoga has beneficial effects on burnout, anxiety, compassion, satisfaction, and blood pressure. The aim of this study was to evaluate the feasibility of a virtual yoga program for residents physicians and to determine the impact of this program on the mental health and wellbeing of participants. We hypothesized that a virtual yoga program would be feasible in terms of attendance, home practice and overall satisfaction. Furthermore, we hypothesized that program completion would reduce the intensity of symptoms related to compassion fatigue (CF), burnout, anxiety and depression, that it would increase levels of compassion satisfaction (CS), and that these effect would be maintained for up to 3 months. As secondary analyses, we evaluated if resident physicians with better QWL pre-intervention showed greater improvement in psychological variables after completing the virtual yoga program, and whether regular yoga practice following program completion was associated with improvements in psychological variables at 3 months.

METHODS

Study design, population and setting

A single-group repeated measures study was conducted between January 10, 2021 and June 20, 2021. Participants were recruited from four university hospitals in the Canadian province of Québec (University of Montreal, McGill University, Laval University, University of Sherbrooke) via their respective students associations and using Facebook. The sole inclusion criterion was to be a resident physician working at a healthcare facility in Québec. Each participant received an individual email that included an anonymized Qualtrics link to complete the questionnaires and sign the consent form. Ethical approval

was obtained from the University of Quebec in Montreal Research Ethics Committee for Student Projects in November 2020. This study was performed in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for observational studies.

Survey instruments

Participants completed each of the following questionnaires: the Oldenburg Burnout Inventory (OLBI), the revised 21-item Professional Quality of Life (ProQOL-21) scale measuring CS and CF,[39] the General Anxiety Disorder 7-Item Assessment (GAD-7) measuring anxiety,[40] the Patient Health Questionnaire (PHQ-9) measuring depression,[41] and the Quality of Work Life Systemic Inventory (QWLSI©).[42] The QWLSI© is a tool for assessing QWL based on the perceived gap between the situation experienced in the present moment and the personal goals set in 34 different areas of professional life. Low QWL scores on the QWLSI© have been associated with burnout.[43] Finally, participants also completed two questionnaires developed in-house: a 16-question socio-demographic questionnaire and a yoga program satisfaction questionnaire.

Intervention

We developed a virtual yoga program based on the Bali Method of Yoga with the assistance of a certified yoga instructor (Aura Wellness Center, yoga academy registered with the Yoga Alliance and the International Yoga Federation) who previously taught the Bali Method as part of two studies on attention-deficit/hyperactivity disorder (ADHD) in children.[44]. The Bali Yoga Program for Residents (PYB-R) was offered as an 8-week

program with one hour of group practice per week. Participants had the option of performing the program offline if their work schedule precluded real-time attendance. The PYB-R was adapted from a program that has been used repeatedly for nearly a decade in different populations.[45-49] Each PYB-R session included a period of psychoeducation on mental health, instruction on yoga poses (see Supplemental Table 1), and a meditation session. Topics covered included the impact of everyday thoughts, pressure to perform, breathing as a tool, burnout, CF, setting limits, learning self-benevolence, learning self-care, and focusing on the present moment (see Supplemental Figure 1).

Statistical analysis

Descriptive statistics were used to provide a socio-demographic portrait of participants. The analysis included residents who participated in at least 50% of PYB-R sessions. T-tests were used to compare characteristics of participants retained for analysis with those excluded, and to compare participants who attended 6-8 sessions versus those who attended 5 or fewer. To determine feasibility we evaluated session attendance, individual practices, and program satisfaction using descriptive statistics. The effect of participation in the PYB-R on the mental health and wellbeing of resident physicians was assessed by performing repeated measures Analysis of Variance (ANOVAs) across three time points (T1 = baseline survey; T2 = completion of PYB-R at 8 weeks; T3 = 3-month follow-up assessment) for each psychological variable. We used post-hoc tests to explore pairwise differences between levels of the repeated measures and corrected for multiple comparisons using the Bonferroni-Holm procedure.

To test whether residents with better QWL scores at baseline showed greater improvement in psychological variables after completing the program, a mixed-group ANOVA (low QWL [<25th percentile] vs. average-to-good QWL [≥25th percentile]) by time (T1, T2) was performed.[43]. A significant interaction led to the analysis of simple effects according to specific differences between the two groups at each time point and between groups over time. We also compared participant scores on the questionnaires between residents who practised yoga regularly (≥30 min/week) from T2 and T3 versus those that practiced yoga less frequently (<30 min/week) using repeated measures ANOVAs. We tested for association between resident age and session attendance (≥6 sessions vs. <6 sessions) using the Mann-Whitney test, and we tested the association of age with medical specialty and residency level using chi-square analysis. We also compared characteristics of those who did or did not complete the program to assess for potential bias. All analyses were performed using JASP (version 0.18.0).

RESULTS

Of 55 resident physicians recruited to participate, 53 (96.4%) completed the baseline questionnaire and the PYB-R program (Figure 1). The post-intervention questionnaire was filled out by 43 residents (78.2%), and 39 residents (from 11 different specialties) completed all three phases of the study including the 3-month follow-up assessment (70.9%).

Table 1 compares characteristics of residents completing the baseline and post-intervention questionnaires (N=39) versus those only completing the baseline questionnaire (N=14). These groups were similar in age, gender, ethnicity, and years of

residency. Residents completing the baseline and post-intervention questionnaires had a mean age of 28±3.1 years, the majority were female (84.6%; 33/39), and most were in their first year (38.5%; 15/39) or second year (30.8%; 12/39) of residency. Overall, family medicine (28.3%; 15/53) and psychiatry (15.1%; 8/53) were the most common specialities represented.

Table 1 Comparison of characteristics between residents that completed the pre- and post-intervention questionnaires versus those completing only the baseline questionnaire

Characteristic	Completed baseline and post-intervention questionnaires (N=39)	Completed baseline questionnaire only (N=14)	p-value	Overall (N=53)
Age, mean	28±3.1	28±3.6	0.20	29±4.7
Sex			0.20	
Female	33 (84.6)	10 (71.2)		43 (81.1)
Male	6 (15.4)	4 (28.6)		10 (18.9)
Ethnicity			0.44	
Caucasian	34 (87.2)	11 (78.6)		45 (84.9)
Other	5 (12.8)	3 (21.4)		8 (15.1)
Residency level			0.15	
1	15 (38.5)	8 (57.1)		23 (43.4)
2	12 (30.8)	5 (35.7)		17 (30.8)
3	8 (20.5)	-		8 (15.1)
Missing	4 (10.3)	1 (7.1)		5 (9.4)
Specialty			0.54	
Family medicine	10 (25.6)	5 (35.7)		15 (28.3)
Psychiatry	5 (12.8)	3 (21.4)		8 (15.1)
Physiatry	4 (10.3)	2 (14.3)		6 (11.3)
Other	20 (51.3)	4 (28.6)		24 (45.3)

No differences in mental health were observed between residents who completed the pre- and post-intervention questionnaires (N=39) versus those completing only the baseline questionnaire (N=14) (see Supplemental Table 2). When we compared psychological variables between residents who participated in 6 to 8 yoga sessions (N=48)

versus ≤5 sessions (N=5), no differences were observed (see Supplemental Table 3). All variables were normally distributed; however, large effect sizes were observed when comparing residents completing 6-8 sessions versus ≤5 sessions.

Regarding feasibility of the PYB-R in terms of participation, the attrition rate for program completion was 19% and the total attrition rate (including 3-month follow-up) was 29%. Among residents that completed the PYB-R, 91% attended 6-8 sessions; the average attendance was 6.9 sessions (median=8, SD=1.7). Over the course of the program, the mean synchronous attendance was 4.9 sessions (median=5, SD=2.4) and the mean asynchronous attendance was 2 sessions (median=1.0, SD=1.8). Nine participants attended all 8 sessions synchronously and 17 participants attended all 8 sessions via the hybrid option. Weekly individual practice (excluding face-to-face or virtual yoga sessions) was achieved on average by 60% of residents (SD=0.10, median=56.9). Mean practice time during the 8 weeks was 70.8 minutes (SD=7.6, median=71.0). Resident satisfaction with the PYB-R was high with 85.7% of participants responding that the PYB-R met their needs and 92.9% indicating they were satisfied or very satisfied with the quality of the program (Table 2). Only 7% of participants felt the PYB-R was not the right program for them. The majority of residents reported being extremely or very satisfied with the components of the PYB-R including psychoeducation, postures, meditation and group practice (see Supplemental Table 4).

Table 2 Satisfaction of medical residents with the Bali Yoga Program

Item (N=42)	Satisfied or very satisfied	Little or not satisfied
PYB-R met your needs	36 (85.7)	6 (14.3)

PYB-R has helped you	38 (90.5)	4 (9.5)
Quality of the PYB-R	39 (92.9)	3 (7.1)
PYB-R is a desirable tool	39 (92.9)	3 (7.1)
Overall satisfaction with the PYB-R	34 (81.0)	8 (19.0)

PYB-R, Bali Yoga Program for Residents.

Table 3 compares variables related to mental health at baseline (T1), following program completion (T2), and at 3-month follow-up (T3). Between T1 and T2, we observed a decrease in mean scores for depression (7.1±5.3 vs. 3.3±4.0; p<0.001) and anxiety (7.0±4.2 vs. 4.6±3.0; p<0.001), and an increase in mean scores for CS (19.1±3.1 vs 28.5±5.2; p<0.001). No changes were observed in disengagement, emotional exhaustion, burnout global scale, or CF between baseline and course completion. Comparing these variables between T2 and T3 did not show any significant differences. The repeated-measures ANOVAs (T1-T2-T3) did show a decrease in scores for depression ($F_{2,76}$ = 14.08, p<0.001, η_p^2 = 0.33) and anxiety ($F_{2,76}$ = 14.14, p<0.001, η_p^2 = 0.27), and an increase in the scores for CS ($F_{2,75}$ = 185.44, p<0.001, η_p^2 = 0.83). No significant changes were observed across the three time points with respect to disengagement ($F_{2,76}$ = 1.39, p=0.28, η_p^2 = 0.03), emotional exhaustion ($F_{2,76}$ = 0.72, p=0.49, η_p^2 = 0.02), total burnout ($F_{2,76}$= 1.39, p=0.26, η_p^2 = 0.04) or compassion fatigue ($F_{2,76}$ = 1.27, p=0.85, η_p^2 = 0.03). When we compared psychological variables between residents who completed 6-8 sessions versus those completing ≤5 sessions, no differences were observed (see Supplemental Table 4).

Table 3 Mean scores for variables related to mental health at baseline, following program completion, and at 3-month follow up

Variable	Baseline (T1)	PYB-R Completion (T2)	p-value*	3-Month Follow up (T3)	p-value**

Depression	7.1±5.3	3.3±4.0	<0.001	4.2±3.3	0.16
Anxiety	7.0±4.2	4.6±3.0	<0.001	4.2±2.8	0.48
Disengagement	17.6±2.2	17.3±3.6	0.64	16.7±3.7	0.27
Emotional exhaustion	24.1±1.8	24.0±2.6	0.84	23.7±3.0	0.36
Burnout global score	41.7±3.2	41.3±5.7	0.68	40.3±6.3	0.24
Compassion fatigue	22.8±7.1	21.7±7.0	0.14	21.9±6.2	0.80
Compassion satisfaction	19.1±3.1	28.5±5.2	<0.001	28.4±5.5	0.96

*Comparison between T1 and T2.
**Comparison between T2 and T3.

We tested whether initial QWL was associated with improvement in psychological variables at T2 and observed significant changes in depression, anxiety, and CS (Figure 2). Group analysis (low QWL [<25th percentile] vs. good QWL [≥25th percentile]) by time (T1-T2) revealed a significant interaction ($F_{1,41}$ = 8.25, p=0.006, η_p^2 = 0.03). At T1, scores for depression were significantly lower in the good QWL group (mean 6.0±4.4 vs. mean 12.0±6.4). Following completion of the PYB-R, the scores for depression were similar between the two groups. Regarding anxiety, the group-by-time interaction was significant ($F_{1,41}$ = 11.39, p=0.001, η_p^2 = 0.06). At T1, anxiety levels were significantly lower in the good QWL group (mean 6.0±3.1 vs. 12±5.5), but there was no difference observed at T2. Finally, the group-by-time interaction for CS was significant ($F_{1,40}$ = 4.90, p=0.03, η_p^2 = 0.02). The good and low QWL groups showed similar levels of CS at T1. Although these levels increased in both groups after program completion, the mean score at T2 was significantly higher in the good QWL group (t(40)= 3.48, p (Holm)=0.003, d=-1.54). No interactions were observed between time (T2 to T3) and practice (≥30 min/week vs. <30 min/week in the 3 months following PYB-R completion) on symptoms of depression, anxiety, or CS.

DISCUSSION

Overall, our results demonstrate that implementing a virtual yoga-based intervention to enhance the mental health and wellbeing of resident physicians is both feasible and effective. We observed high participation rates with 90.6% of residents attending at least 6 of the 8 sessions. Furthermore, 60% of participants attended weekly practices for an average of 70 mins/practice, which is noteworthy considering their busy work schedules. With the availability of a hybrid option, it was possible for 60% of residents to attend all 8 sessions. Lasting improvements in CS and reductions in symptoms of anxiety and depression were observed for up to 3 months. The vast majority of residents reported they were satisfied with the quality of the PYB-R and that the program met their needs.

Strengths and limitations

This study has several strengths and limitations to highlight. The PYB-R was led by a certified yoga instructor and was designed to be flexible with respect to scheduling and modalities to maximize participation among medical residents. These features make it possible to reach large numbers of individuals across different regions with minimal costs involved. Despite these strengths, this study has limitations. It was not possible to verify the videos were viewed to completion. Use of software to confirm viewership would have strengthened our results regarding PYB-R feasibility. The lack of a control group also limits our ability to draw a causal link between the program and the observed effects on the mental health of residents. Our findings are based on self-reported measures which are known to be potentially biased, notably through social desirability and expectancy bias.[50] There is evidence, however, that social desirability is not always correlated with self-

reported well-being questionnaires, and that when it is, it has a limited effect on variance (3% to 10%).[51] Evidence also suggests the psychological changes observed during MBIs are not associated with the initial expectations of individuals.[52] Thus, it is unlikely that social desirability and expectation bias had a large effect on the results of this study.

Strengths and weaknesses in relation to other studies

Participation in the PYB-R program was considerably higher than rates reported in other studies investigating yoga-based MBIs which range from 33% to 68%.[35, 36, 38] In a recent randomized trial examining the feasibility of a yoga-based MBI called RISE (resilience, integration, self-awareness, engagement), Loewenthal and colleagues observed improvements in multiple measures of psychological health in resident physicians including reduced levels of stress and burnout.[38] However, 6 weekly in-person sessions with suggested home practice was not feasible and participants suggested having the program online to increase feasibility, which is supported by the results of our study. Unlike our study, Loewenthal et al. included a control group; this group showed no improvement in psychological health measures from baseline to post-program, suggesting that the effect of time had minimal impact on the sample.[38]

Comparison with the wider literature

There is growing evidence that MBIs can improve the wellbeing of physicians and other healthcare professionals at all levels of experience and training.[53] Our findings that participation in the PYB-R reduced symptoms of anxiety and improved CS for up to 3 months following program completion is consistent with the literature on MBIs in

healthcare.[35, 54-57] While we also observed improvements in symptoms of depression among PYB-R participants, previous studies of yoga-based MBIs have reported no changes in depression post-intervention.[35, 38] Although self-reported levels of burnout did not change following completion of the PYB-R, others have demonstrated yoga-based interventions can effectively reduce symptoms of burnout.[36, 56, 57-59] The lack of effect on burnout and CF we observed among PYB-R participants could be due to the fact that these variables are largely related to the work environment which was particularly disrupted and unstable during the winter of 2021 during the height of the COVID-19 pandemic. Although the PYB-R provides tools to help improve emotional regulation, these techniques may not be sufficient in a stressful context.[60]

Resident physicians who completed the PYB-R showed significant improvements in CS. Similar results were observed among healthcare professionals in Japan who participated in a yoga-based MBI during the COVID-19 pandemic.[61] Compassion satisfaction is a protective element of burnout and CF, and is directly linked to self-compassion.[62, 63] During the course of the pandemic, fear of infection likely increased stress levels and may have contributed to lower levels of CS among healthcare professionals.[64] Since, resident physicians generally work in competitive environments under difficult conditions, they are often trained to strive for self-improvement rather than CS and self-compassion.[65] As demonstrated in a recent study by Wang and colleagues,[66] self-compassion is essential to the development of CS. The PYB-R aims to teach self-compassion through a better understanding of its limits and an awareness of its psychological symptoms.

Discussing important differences in results

We found residents with better QWL had fewer symptoms of depression and anxiety at baseline compared to those with poor QWL. After completion of the PYB-R, these symptoms were reduced in both groups but to a much greater degree in the group with poor QWL, suggesting that participation in the program alleviated some of the difficulties experienced in the work environment. Similarly, we observed improvements in CS in both groups, but to a greater degree in the group with better QWL. A work environment that meets the physical and psychological needs of the professional facilitates the development and maintenance of self-compassion and CS.[67-69] Ultimately, it is the responsibility of the institution to provide this conducive working environment.

Implications of the study

Changes to the Canadian healthcare system during the COVID-19 pandemic have had, and will continue to have, serious consequences for the workforce.[1] A 2021 report from the CMA highlighted the need to raise awareness and destigmatize mental health among physicians, to enhance and expand the availability of specialized support services, and to better evaluate the effectiveness of these services.[3] Healthcare institutions must provide employees with the necessary tools to manage their emotions and cognitive flexibility in order to minimize anxiety, depression, CF, and burnout. The findings of this study highlight the value of the PYB-R as a preventive tool, not only for the psychological health of individual residents, but also for the performance of the healthcare system and the quality of care provided.

Unanswered questions and future research

While the findings of this study are encouraging, conducting a larger randomized study with a control group is warranted to validate the generalizability of our results. Further research is required to determine how long the beneficial effects observed in PYB-R participants are maintained (6 months, 1 year, etc.) and to optimize how and when the program is offered to maximize participation. Additional research is also needed to investigate the impact of yoga-based MBIs on the quality of care in terms of patient outcomes and satisfaction. Feedback from participants of the PYB-R suggested branching it into 2 separate programs with one focused on relaxation and a second program dedicated to dynamic postures. We are investigating whether such an approach will improve on the feasibility and effectiveness we observed in the current study.

CONCLUSIONS

Our results demonstrate that a virtual yoga-based MBI for resident physicians is feasible and can have lasting positive effects on their mental health and wellbeing. Further research using a more robust study design and larger sample size is required to validate these findings.

ACKNOWLEDGEMENTS

The authors acknowledge Percipient Research & Consulting for assistance with language editing.

COLLABORATORS

None.

CONTRIBUTORS

MPB was involved in conceptualization, protocol development, data analysis and drafted the manuscript. GD was involved in conceptualization, protocol development, and manuscript editing. RF was involved in conceptualization and manuscript editing. All authors approved of the final version of the manuscript and agree to be accountable for all aspects of the work.

FUNDING

This work was supported by the Canadian Medical Association (CMA) and the Fond de Recherche du Québec – Volet Société Culture (FRQSC).

COMPETING INTERESTS

None declared.

PATIENT AND PUBLIC INVOLVEMENT

Patients and/or the public were not involved in the design, or conduct, or reporting or dissemination plans of this research.

PATIENT CONSENT FOR PUBLICATION

Not required.

ETHICS APPROVAL

This study was approved by the University of Quebec in Montreal Research Ethics Committee for Student Projects in November 2020.

PROVENANCE AND PEER REVIEW

Not commissioned; externally peer-reviewed.

DATA AVAILABILITY STATEMENT

Study data available upon request.

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FIGURE LEGENDS

Figure 1. Flow diagram showing participant selection and timepoints for assessment.

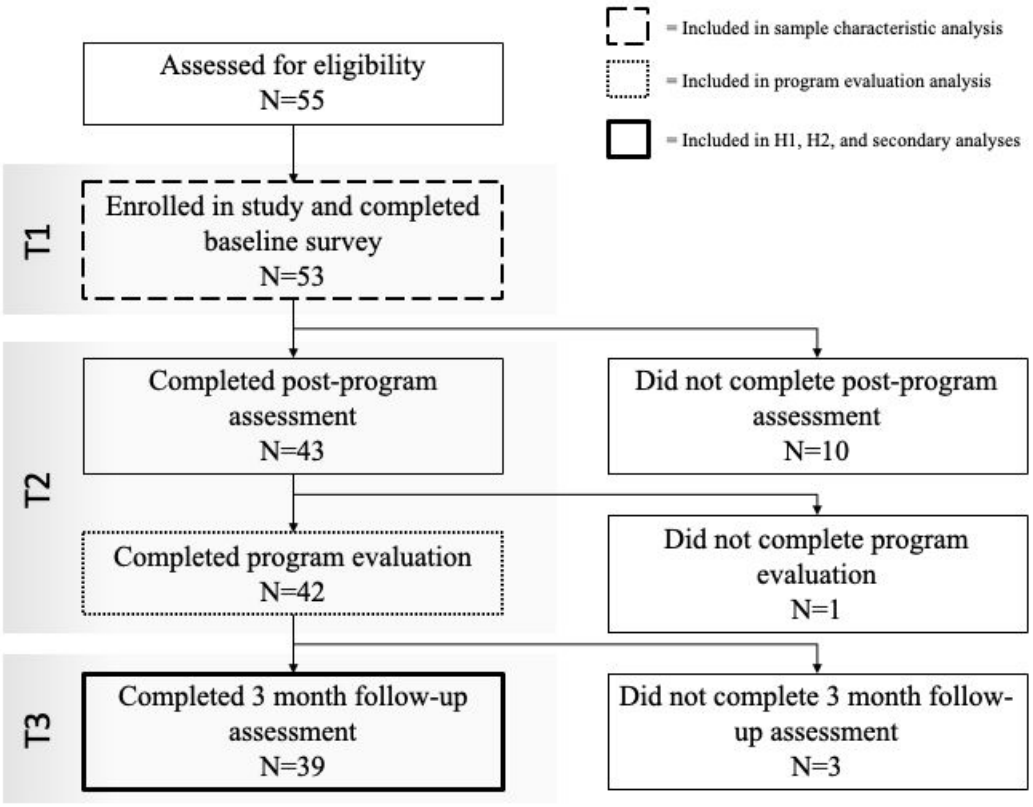
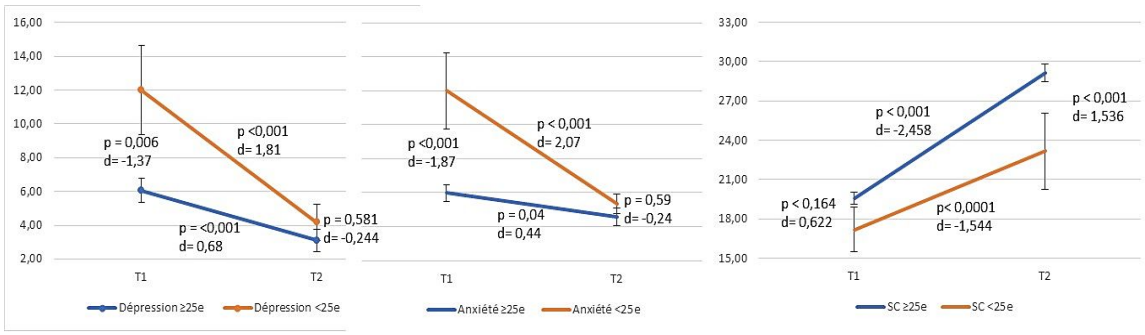


Figure 2. Comparison of mean scores for (A) depression, (B) anxiety, and (C) compassion satisfaction at baseline (T1) and upon PYB-R completion (T2) between residents with low QWL (<25th percentile) or good QWL (≥25th percentile]). CS, compassion satisfaction; PYB-R, Bali Yoga Program for Residents; QWL, quality of work life.



BMJ Open

An online yoga program for resident physicians in Québec: an evaluation of feasibility and impact on mental health. (Abbreviated title: An online yoga program for resident physicians in Québec)

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2023-082391.R1
Article Type:	Original research
Date Submitted by the Author:	12-Apr-2024
Complete List of Authors:	Bélisle, Marie-Pier; UQAM, psychology Dupuis, Gilles; UQAM Fleet, Richard; ULaval, Département de médecine familiale et de médecine d'urgence
Primary Subject Heading:	Mental health
Secondary Subject Heading:	Mental health, Public health, Evidence based practice, Complementary medicine
Keywords:	Burnout, Physicians, MENTAL HEALTH, Quality of Life, Anxiety disorders < PSYCHIATRY, Psychosocial Intervention

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TITLE: An online yoga program for resident physicians in Québec: an evaluation of feasibility and impact on mental health. (Abbreviated title: An online yoga program for resident physicians in Québec)

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WORD COUNT: 3991 words.

ABSTRACT

Objectives: To evaluate feasibility of the Bali Yoga Program for Residents (PYB-R), an 8-week virtual yoga-based intervention, and determine its impact on the mental health of resident physicians.

Design: Single-group repeated measures study.

Setting: Associations from the four postgraduate medical education programs in Québec, Canada.

Participants: Overall, 55 resident physicians were recruited to participate of which 53 (96.4%) completed the assessment pre-PYB-R. The post-intervention assessment was completed by 43 residents (78.2%) and 39 (70.9%) completed all phases (including 3-month follow-up). Most were in their first year (43.4%) or second year (32.1%) of residency. The majority were female (81.1%) with a mean age of 28±3.6 years.

Primary and secondary outcome measures: The primary outcome measure was feasibility as measured by participation in the PYB-R. Secondary outcomes measures were psychological variables (anxiety, depression, burnout, emotional exhaustion, compassion fatigue, and compassion satisfaction) and satisfaction with the PYB-R. Residents were further subgrouped based on quality of work life and number of PYB-R sessions attended.

Results: The attrition rate for program completion was 19%. Of the 43 residents that completed the PYB-R, 90.6% attended between 6-8 sessions. Repeated-measures Analysis of Variance (ANOVAs) at 3 time points (baseline, PYB-R completion, 3-month follow-up) confirmed a decrease in scores for depression and anxiety, and an increase in scores for compassion satisfaction. No changes were observed in the other psychological variables evaluated. ANOVAS also confirmed that a better quality of life at work helps develop

compassion satisfaction, a protective factor to compassion fatigue. Most participants (92.9%) indicated they were satisfied or very satisfied with the quality of the program.

Conclusions: A virtual yoga-based program is feasible and has lasting positive effects up to 3 months on the mental health of resident physicians. Further research is warranted to validate these findings using a larger, randomized sample of residents.

KEYWORDS: Yoga, depression, anxiety, compassion satisfaction, compassion fatigue, burnout, medical residents, physicians, mental health, selfcare, selfcompassion, quality of life, work environment, QOL, QWL.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- A yoga-based mind-body intervention was designed for resident physicians and led by a certified yoga instructor.
- The program was designed to be flexible regarding scheduling and modalities used in order to maximize participation.
- Data collected from residents was self-reported and thus susceptible to social desirability and expectancy bias.
- It was not possible to verify that residents viewed each video to completion.
- Lack of a control group limits our abillity to draw a causal link between participation in the program and the observed effects on mental health.

INTRODUCTION

There are growing concerns regarding the mental health of physicians and their Quality of Work Life (QWL) due to heightened levels of stress and burnout in the wake of the COVID-19 pandemic.[1] According to data from the Canadian Medical Association (CMA), the number of physicians experiencing burnout increased from 25% in 2018 to 53% in 2021.[2, 3] Pre-pandemic burnout rates were even higher among resident physicians (52%) and depression was common (18%);[2] these levels increased moderately by 2021.[3, 4] The systematic review and meta-analysis by Erschens et al. (2019) highlight that burnout rates among medical students are subject to substantial variation, influenced by the stage of their medical education and the nature of their work.[5] Factors associated with burnout include increase in patient care responsibilities that comes with the beginning of their resident role, the high pressure of acadmemic competition, long work hours, lack of autonomy, abuse of power, difficulty maintaining healthy social life, and development of professional cynicism.[5-9] The repercussions of physician burnout extend across three primary realms: the health and quality of work life (QWL) of physicians, the quality of patient care, and broader implications for the healthcare system and society. Burnt-out physicians are at a higher risk for depression, anxiety and suicide. [10] Furthermore, burnout compromises patient care, as evidenced by increased medical errors and diminished care quality. [11,12] Patients tended by burnt-out physicians often perceive a lack of compassion, leading to poorer symptom management, higher incidence of unexpected medical events, and more frequent complaints.[13] In Canada, the financial toll of physician burnout, manifested through reduced work hours, absenteeism, turnover, and early retirement, is estimated at $213 million annually.[14] Similarly, in the United States,

burnout incurs an estimated cost of $4.6 billion each year to the healthcare system.[15] These statistics underscore the multifaceted impact of burnout, emphasizing the need for comprehensive strategies to address its effects not only on individual physicians but also on the overall quality of healthcare delivery and societal well-being.

In addition to burnout and depression, resident physicians are also at risk for compassion fatigue (CF), which is characterized by emotional and physical exhaustion leading to a decreased ability to empathize or feel compassion for others. Given the caring aspect of their role, reliance on empathy and compassion is primordial to effective patient care. [16]

Despite the challenges linked to the profession, there is also the concept of compassion satisfaction (CS) to take into consideration, which refers to the positive feelings derived from helping others. While CF can have detrimental effects on healthcare provider's mental health and quality of patient care, fostering compassion satisfaction can serve as a protective factor. [16,17] Reducing triggers (e.g., poor working conditions, long shifts, stressful on-call duties, lack of appreciation, workplace bullying, etc.) and implementing adequate stress management programs including activities such as MBIs can help the enhancement of compassion satisfaction, self-compassion and sens of accomplishment, all of which directly impact physician well-being and performance. [18-23] Compared to meditation-based approaches, yoga adds a bodily aspect which promotes mind-body balance using three primordial elements: breathing exercises, postures and mindfulness exercises. [23] Empirical evidence supports yoga's regulatory effects on the autonomic nervous system; it dampens the hyperactivity of the sympathetic nervous

system, linked to both mental and physical problems, and promotes parasympathetic activity, thereby preempting stress-related health issues [24-26]

Few studies have investigated the effect of practicing yoga on the mental health of resident physicians;[27-29] these studies found yoga has beneficial effects on their burnout symptoms, anxiety, compassion satisfaction, and blood pressure. Evidence from systematic reviews of MBIs to improve physician wellbeing suggest more work is needed to determine the ideal context for implementing and evaluating these interventions.[30-33] Recent studies have underscored the necessity of virtual methods in delivering interventions, particularly for healthcare professionals like resident physicians, who often face barriers in accessing traditional in-person programs due to their demanding schedules. [28,30] While there is few evidence supporting the effectiveness of virtual reality and online mindfulness programs for physicians [34,35], the specific application of such virtual interventions for resident physicians remains unexplored to our knowledge. This gap highlights an opportunity to leverage technology in developing tailored, flexible, and accessible wellness programs for resident physicians, catering to their unique needs and constraints, as well as offering a viable solution for future natural events that would impose strict social distancing. The aim of this study was to evaluate the feasibility of the first virtual yoga program for residents physicians and to determine the impact of this program on the mental health and wellbeing of participants. We hypothesized that a virtual yoga program would be feasible in terms of attendance, home practice and overall satisfaction. Furthermore, we hypothesized that program completion would reduce the intensity of symptoms related to compassion fatigue (CF), burnout, anxiety and depression, that it would increase levels of compassion satisfaction (CS), and that these effect would be maintained for up to 3 months.

As secondary analyses, first, we evaluated if resident physicians with better QWL pre-intervention showed greater improvement in psychological variables after completing the virtual yoga program. Second, we evaluated whether regular yoga practice following program completion was associated with improvements in psychological variables at 3 months.

METHODS

Study design, population and setting

A single-group repeated measures study was conducted between January 10, 2021 and June 20, 2021. We recruited 55 participants. Anticipating an approximate drop out rate of 25%, this allows us to anticipate a final sample of around 40 participants. This number allow a power of 80% to detect a f of 0.20 (near medium which is 0.25; G*Power, assuming correlation of 0.5 between moments of measurement) at an alpha level of 0.05. [36,37]

Participants were recruited from associations from the four postgraduate medical education programs in the Canadian province of Québec (University of Montreal, McGill University, Laval University, University of Sherbrooke). The inclusion criteria were to be a resident physician working at a healthcare facility in Québec and to be able to understand French and write in french. Each participant received an individual email that included an anonymized Qualtrics link to complete the questionnaires and sign the consent form. Ethical approval was obtained from the University of Quebec in Montreal Research Ethics Committee for Student Projects in November 2020.

Survey instruments

Participants completed each of the following questionnaires: the Oldenburg Burnout Inventory (OLBI), the revised 21-item Professional Quality of Life (ProQOL-21) scale measuring CS and CF,[38] the General Anxiety Disorder 7-Item Assessment (GAD-7) measuring anxiety,[39] the Patient Health Questionnaire (PHQ-9) measuring depression,[40] and the Quality of Work Life Systemic Inventory (QWLSI©).[41] The QWLSI© is a tool for assessing QWL based on the perceived gap between the situation experienced in the present moment and the personal goals set in 34 different areas of professional life. Low QWL scores on the QWLSI© have been associated with burnout.[42] Finally, participants also completed two questionnaires developed in-house: a 16-question socio-demographic questionnaire and a satisfaction questionnaire (See supplemental material).

Intervention

We developed a virtual yoga program based on the Bali Method of Yoga with the assistance of a certified yoga instructor (Aura Wellness Center, yoga academy registered with the Yoga Alliance and the International Yoga Federation) who previously taught the Bali Method as part of two studies on attention-deficit/hyperactivity disorder (ADHD) in children.[43]. The Bali yoga consist of gentle Hatha asanas (yoga postures). [44] Its distinctive features include the importance given to the relaxation response during and between yoga poses, staying longer in each postures, the importance given to the visualization, and the psychoeducational content on the psychophysiological aspects of, in this case, yoga and stress linked to the resident physicians reality. Program for Residents (PYB-R) was offered as an 8-week program with one hour of group practice per week.

Participants had the option of performing the program offline if their work schedule precluded real-time attendance, using the recording of the session. A 15min yoga session had also been provided to them so they could do an extra practice on their own if they wanted to. The PYB-R was adapted from a program that has been used repeatedly for nearly a decade in different populations.[44-47] Each PYB-R session included a period of psychoeducation on mental health, instruction on yoga poses (see Supplemental Table 1), and a meditation session. Topics covered included the impact of everyday thoughts, pressure to perform, breathing as a tool, burnout, CF, setting limits, learning self-benevolence, learning self-care, and focusing on the present moment (see Supplemental Figure 1).

Statistical analysis

Descriptive statistics were used to provide a socio-demographic portrait of participants. The analysis included residents who participated in at least 50% of PYB-R sessions. T-tests were used to compare characteristics of participants retained for analysis with those excluded, and to compare participants who attended 6-8 sessions versus those who attended 5 or fewer. To determine feasibility we evaluated session attendance, individual practices, and program satisfaction using descriptive statistics. The effect of participation in the PYB-R on the mental health and wellbeing of resident physicians was assessed by performing repeated measures Analysis of Variance (ANOVAs) across three time points (T1 = baseline survey; T2 = completion of PYB-R at 8 weeks; T3 = 3-month follow-up assessment) for each psychological variable. We used post-hoc tests to explore pairwise differences

between levels of the repeated measures and corrected for multiple comparisons using the Bonferroni-Holm procedure.

To test whether residents with better QWL scores at baseline showed greater improvement in psychological variables after completing the program, a mixed-group ANOVA (low QWL [<25th percentile] vs. average-to-good QWL [≥25th percentile]) by time (T1, T2) was performed.[42]. A significant interaction led to the analysis of simple effects according to specific differences between the two groups at each time point and between groups over time. We also compared participant scores on the questionnaires between residents who practised yoga regularly (≥30 min/week) from T2 and T3 versus those that practiced yoga less frequently (<30 min/week) using repeated measures ANOVAs. We tested for association between resident age and session attendance (≥6 sessions vs. <6 sessions) using the Mann-Whitney test, and we tested the association of age with medical specialty and residency level using chi-square analysis. We also compared characteristics of those who did or did not complete the program to assess for potential bias. All analyses were performed using JASP (version 0.18.0).

RESULTS

Of 55 resident physicians recruited to participate, 53 (96.4%) completed the baseline questionnaire and the PYB-R program (See supplementary Figure 1). The post-intervention questionnaire was filled out by 43 residents (81.2%; 43/53), and 39 residents (from 11 different specialties) completed all three phases of the study including the 3-month follow-up assessment (73.6%; 39/53).

Table 1 compares characteristics of residents completing the baseline and post-intervention questionnaires (N=39) versus those only completing the baseline questionnaire (N=14). These groups were similar in age, gender, ethnicity, and years of residency. Residents completing the baseline and post-intervention questionnaires had a mean age of 28±3.1 years, the majority were female (84.6%; 33/39), and most were in their first year (38.5%; 15/39) or second year (30.8%; 12/39) of residency.

Table 1 Comparison of characteristics between residents that completed the pre- and post-intervention questionnaires versus those completing only the baseline

Characteristic	Completed baseline and post-intervention questionnaires	Completed baseline questionnaire only	p-value	Overall (N=53)
Age, mean	28±3.1	28±3.6	0.20	29±4.7
Sex			0.20	
Female	33 (84.6)	10 (71.2)		43 (81.1)
Male	6 (15.4)	4 (28.6)		10 (18.9)
Ethnicity			0.44	
Caucasian	34 (87.2)	11 (78.6)		45 (84.9)
Other	5 (12.8)	3 (21.4)		8 (15.1)
Residency level			0.15	
1	15 (38.5)	8 (57.1)		23 (43.4)
2	12 (30.8)	5 (35.7)		17 (30.8)
3	8 (20.5)	-		8 (15.1)
Missing	4 (10.3)	1 (7.1)		5 (9.4)
Specialty			0.54	
Family	10 (25.6)	5 (35.7)		15 (28.3)
Psychiatry	5 (12.8)	3 (21.4)		8 (15.1)
Physiatry	4 (10.3)	2 (14.3)		6 (11.3)
Other	20 (51.3)	4 (28.6)		24 (45.3)

No differences in mental health were observed between residents who completed the pre- and post-intervention questionnaires (N=39) versus those completing only the

baseline questionnaire (N=14) (see Supplemental Table 2). When we compared psychological variables between residents who participated in 6 to 8 yoga sessions (N=48) versus ≤5 sessions (N=5), no differences were observed (see Supplemental Table 3). All variables were normally distributed; however, large effect sizes were observed when comparing residents completing 6-8 sessions versus ≤5 sessions.

Regarding feasibility of the PYB-R in terms of participation, the attrition rate for program completion was 19% and the total attrition rate (including 3-month follow-up) was 26%. Among residents that completed the PYB-R, 91% attended 6-8 sessions; the average attendance was 6.9 sessions (median=8, SD=1.7). Over the course of the program, the mean synchronous attendance was 4.9 sessions (median=5, SD=2.4) and the mean asynchronous attendance was 2 sessions (median=1.0, SD=1.8). Nine participants attended all 8 sessions synchronously and 17 participants attended all 8 sessions via the hybrid option (mix of synchronous and asynchronous attendances). Weekly individual practice (excluding group sessions) was achieved on average by 60% of residents. Mean weekly individual practice time over the program duration was 70.8 minutes (SD=7.6, median=71.0), Resident satisfaction with the PYB-R was high with 85.7% of participants responding that the PYB-R met their needs and 92.9% indicating they were satisfied or very satisfied with the quality of the program (Table 2). 7% of participants felt the PYB-R was not the right program for them. The majority of residents reported being extremely or very satisfied with the components of the PYB-R including psychoeducation, postures, meditation and group practice (see Supplemental Table 4).

Table 2 Satisfaction of resident physicians with the Bali Yoga Program

Item (N=42)	Satisfied or very satisfied	Little or not satisfied
PYB-R met your needs	36 (85.7)	6 (14.3)
PYB-R has helped you	38 (90.5)	4 (9.5)
Quality of the PYB-R	39 (92.9)	3 (7.1)
PYB-R is a desirable tool	39 (92.9)	3 (7.1)
Overall satisfaction with the PYB-R	34 (81.0)	8 (19.0)

PYB-R, Bali Yoga Program for Residents.

The repeated-measures ANOVAs (T1-T2-T3) did show a decrease in scores for depression ($F_{2,76}$ = 14.08, p<0.001, η_p^2 = 0.33) and anxiety ($F_{2,76}$ = 14.14, p<0.001, η_p^2 = 0.27), and an increase in the scores for CS ($F_{2,75}$ = 185.44, p<0.001, η_p^2 = 0.83). No significant changes were observed across the three time points with respect to disengagement ($F_{2,76}$ = 1.39, p=0.28, η_p^2 = 0.03), emotional exhaustion ($F_{2,76}$ = 0.72, p=0.49, η_p^2 = 0.02), total burnout ($F_{2,76}$= 1.39, p=0.26, η_p^2 = 0.04) or compassion fatigue ($F_{2,76}$ = 1.27, p=0.85, η_p^2 = 0.03). Between T1 and T2, we observed a significant decrease in mean scores for depression, improved from low depressive symptoms to absence of symptoms (7.1±5.3 vs. 3.3±4.0; p<0.001), and anxiety, improved significantly but remained in the same category of low anxious symptoms (7.0±4.2 vs. 4.6±3.0; p<0.001), and an increase in mean scores for CS, improved from low CS to to the upper limit of the moderate level of CS (19.1±3.1 vs 28.5±5.2; p<0.001). There was no significant change on any psychological variables between T2 and T3 (See table 3).

Table 3 Mean scores for variables related to mental health at baseline, following program completion, and at 3-month follow up

Variable	Baseline (T1)	PYB-R Completion (T2)	p-value* (ES)#	3-Month Follow up (T3)	p-value** (ES)#
Depression	7.1±5.3	3.3±4.0	<0.001 (0.94)	4.2±3.3	0.16 (0.23)
Anxiety	7.0±4.2	4.6±3.0	<0.001 (0.67)	4.2±2.8	0.48 (0.12)
Disengagement	17.6±2.2	17.3±3.6	0.64 (0.08)	16.7±3.7	0.27 (0.18)
Emotional exhaustion	24.1±1.8	24.0±2.6	0.84 (0.03)	23.7±3.0	0.36 (0.15)
Burnout global score	41.7±3.2	41.3±5.7	0.68 (0.07)	40.3±6.3	0.24 (0.19)
Compassion fatigue	22.8±7.1	21.7±7.0	0.14 (0.24)	21.9±6.2	0.80 (-0.04)
Compassion satisfaction	19.1±3.1	28.5±5.2	<0.001 (-2.71)	28.4±5.5	0.96 ((0.01)

*Comparison between T1 and T2.
**Comparison between T2 and T3.
*** p-values are adjusted using the Bonferroni and Holm corrections.
#Effect size Cohen's d

We tested whether initial QWL was associated with improvement in psychological variables at T2 and observed significant changes in depression, anxiety, and CS. Group analysis (low QWL [<25th percentile] vs. good QWL [≥25th percentile]) by time (T1-T2) revealed a significant interaction ($F_{1,41}$ = 8.25, p=0.006, η_p^2 = 0.03) (See supplemental figure 2). At T1, scores for depression were significantly lower in the good QWL group (mean 6.0±4.4 vs. mean 12.0±6.4). Following completion of the PYB-R, the scores for depression were similar between the two groups. Regarding anxiety, the group-by-time interaction was significant ($F_{1,41}$ = 11.39, p=0.001, η_p^2 = 0.06). At T1, anxiety levels were significantly lower in the good QWL group (mean 6.0±3.1 vs. 12±5.5), but there was no difference observed at T2. Finally, the group-by-time interaction for CS was significant ($F_{1,40}$ = 4.90, p=0.03, η_p^2 = 0.02). The good and low QWL groups showed similar levels of

CS at T1. Although these levels increased in both groups after program completion, the mean score at T2 was significantly higher in the good QWL group (t(40)= 3.48, p (Holm)=0.003, d=-1.54). No interactions were observed between time (T2 to T3) and practice (≥30 min/week vs. <30 min/week in the 3 months following PYB-R completion) on symptoms of depression, anxiety, or CS.

DISCUSSION

Overall, our results demonstrate that implementing a virtual yoga intervention to enhance the mental health and wellbeing of resident physicians is both feasible and effective. We observed high participation rates with 90.6% of residents attending at least 6 of the 8 sessions. Furthermore, an average of 70 mins of yoga practice was achieved weekly which is noteworthy considering their busy work schedules and their other occupations. With the availability of a hybrid option, it was possible for 60% of residents to attend all 8 sessions. Lasting improvements in CS and reductions in symptoms of anxiety and depression were observed for up to 3 months, which could indicates that the participants continue benefiting from their learnings overtime. The fact that burnout, disengagement and FC scores remained the same may suggest that the PYB-R protected them from a worsening of their condition on these three variables despite the impact that the pandemic may have had on their work conditions. The vast majority of residents reported they were satisfied with the quality of the PYB-R and that the program met their needs.

Strengths and limitations

This study has several strengths and limitations to highlight. The first strengths of the PYB-R is that it was conducted virtually and was designed to be flexible with respect to scheduling and modalities to maximize participation among medical residents. These features make it possible to reach large numbers of individuals across different regions with minimal costs involved. Second, PYB-R was led by a certified yoga instructor and it was manualized, insuring the yoga teacher to follow a structured intervention protocol. Third, a 3-months follow-up was included in the study design, which provides beneficial information to the understanding of the program's effects, while it remains an unregular component in studies in the field. [32, 48] Despite these strengths, this study has limitations. While the findings of this study are encouraging, conducting a larger randomized study with a control group is warranted to validate the generalizability of our results. The lack of a control group also limits our ability to draw a causal link between the program and the observed effects on the mental health of residents. We acknowledge that participation in a yoga program may inherently attract individuals with a pre-existing interest in such practices, giving rise to selection bias. However, evidences show that receiving a preferred psychosocial mental health treatment is associated with a lower dropout rate, underscoring that this selection bias might not be detrimental in this case. [49] Another limitation is that it was not possible to verify if the videos were viewed to completion. Use of software to confirm viewership would have strengthened our results regarding PYB-R feasibility. Our findings are based on self-reported measures which are known to be potentially biased, notably through social desirability and expectancy bias.[50] There is evidence, however, that social desirability is not always correlated with self-reported well-being questionnaires, and that when it is, it has a limited effect on variance

(3% to 10%).[51] Evidence also suggests the psychological changes observed during MBIs are not associated with the initial expectations of individuals.[52] Thus, it is unlikely that social desirability and expectation bias had a large effect on the results of this study.

Strengths in relation to other studies

Participation in the PYB-R program was considerably higher than rates reported in other studies investigating MBIs which range from 33% to 68%.[27-29] In a recent randomized trial examining the feasibility of a yoga called RISE (resilience, integration, self-awareness, engagement), Loewenthal and colleagues observed improvements in multiple measures of psychological health in resident physicians including reduced levels of stress and burnout.[28] However, 6 weekly in-person sessions with suggested home practice was not feasible and participants suggested having the program online to increase feasibility, which is supported by the results of our study. Considering the complexity of their schedule and potential future pandemics or other natural event that may provoke important social distancing rules, the ability to engage virtually, as our initative propose, is a notable strength that enhance the feasibility of such a program. Unlike our study, Loewenthal et al. included a control group; this group showed no improvement in psychological health measures from baseline to post-program, suggesting that the effect of time had minimal impact on the sample.[28]

Comparison with the wider literature

There is growing evidence that MBIs can improve the wellbeing of physicians and other healthcare professionals at all levels of experience and training.[49] Our findings that

participation in the PYB-R reduced symptoms of anxiety and improved CS for up to 3 months following program completion is consistent with the literature on MBIs in healthcare.[27, 53-57] While we also observed improvements in symptoms of depression among PYB-R participants, previous studies of MBIs have reported no changes in depression post-intervention.[27, 28] Although self-reported levels of burnout did not change following completion of the PYB-R, others have demonstrated yoga-based interventions can effectively reduce symptoms of burnout.[29, 55-58] The lack of effect on burnout and CF we observed among PYB-R participants could be due to the fact that these variables are largely related to the work environment which was particularly disrupted and unstable during the winter of 2021 during the height of the COVID-19 pandemic. Although the PYB-R provides tools to help improve emotional regulation, these techniques may not be sufficient in a stressful context.[59]

Resident physicians who completed the PYB-R showed significant improvements in CS. Similar results were observed among healthcare professionals in Japan who participated in a MBI during the COVID-19 pandemic.[60] Compassion satisfaction is a protective element of burnout and CF, and is directly linked to self-compassion.[61-62] During the course of the pandemic, fear of infection likely increased stress levels and may have contributed to lower levels of CS among healthcare professionals.[63] Since, resident physicians generally work in competitive environments under difficult conditions, they are often trained to strive for self-improvement rather than CS and self-compassion.[64] As demonstrated in a recent study by Wang and colleagues,[65] self-compassion is essential to the development of CS. The PYB-R aims to teach self-compassion through a better understanding of its limits and an awareness of its psychological symptoms.

Discussing important differences in results

We found residents with better QWL had fewer symptoms of depression and anxiety at baseline compared to those with poor QWL. After completion of the PYB-R, these symptoms were reduced in both groups but to a much greater degree in the group with poor QWL, suggesting that participation in the program alleviated some of the difficulties experienced in the work environment. Similarly, we observed improvements in CS in both groups, but to a greater degree in the group with better QWL. A work environment that meets the physical and psychological needs of the professional facilitates the development and maintenance of self-compassion and CS.[66-68] Ultimately, it is the responsibility of the institution to provide this conducive working environment.

Implications of the study

Changes to the Canadian healthcare system during the COVID-19 pandemic have had, and will continue to have, serious consequences for the workforce.[1] A 2021 report from the CMA highlighted the need to raise awareness and destigmatize mental health among physicians, to enhance and expand the availability of specialized support services, and to better evaluate the effectiveness of these services.[3] Healthcare institutions must provide employees with the necessary tools to manage their emotions and cognitive flexibility in order to minimize anxiety, depression, CF, and burnout. The findings of this study highlight the value of the PYB-R as a preventive tool, not only for the psychological health of individual residents, but also for the performance of the healthcare system and the quality of care provided.

Unanswered questions and future research

Further research is required to determine how long the beneficial effects observed in PYB-R participants are maintained (6 months, 1 year, etc.) and to optimize how and when the program is offered to maximize participation. Additional research is also needed to investigate the impact of MBIs on the quality of care in terms of patient outcomes and satisfaction.

CONCLUSIONS

It has been shown that the current generation of resident physicians values their psychological well-being and is actively seeking solutions to address their challenges. .[3] It is time to offer them accessible solutions that meet their diverse needs. Our results demonstrate that a virtual yoga for resident physicians is feasible and can have lasting positive effects on their depressive and anxious symptoms, as well as enhancing their compassion satisfaction which is a protective factor to FC and burnout. Further research using a more robust study design and larger sample size is required to validate these findings. Research is also needed on the impact of such results on the quality of care and the health system. Generally speaking, wellbeing is a reflection of corporate culture; institutions that evaluate the QWL of their physicians and provide tangible mental health resources have observed improvements in the quality of care delivered.[69] Recognizing that an intervention may have greater effect on health professionals when its conducted directly by institutions, it would be interesting to make a global assessment of such an initiative as part of an organizational strategy. [33]

ACKNOWLEDGEMENTS

The authors acknowledge Percipient Research & Consulting for assistance with language editing.

COLLABORATORS

None.

CONTRIBUTORS

MPB was involved in conceptualization, protocol development, data analysis and drafted the manuscript. GD was involved in conceptualization, protocol development, and manuscript editing. RF was involved in conceptualization and manuscript editing. All authors approved of the final version of the manuscript and agree to be accountable for all aspects of the work.

FUNDING

This work was supported by the Canadian Medical Association (CMA) and the Fond de Recherche du Québec (#N/A) – Volet Société Culture (FRQSC). #289651

COMPETING INTERESTS

None declared.

PATIENT AND PUBLIC INVOLVEMENT

Patients and/or the public were not involved in the design, or conduct, or reporting or dissemination plans of this research.

PATIENT CONSENT FOR PUBLICATION

Not required.

ETHICS APPROVAL

This study was approved by the University of Quebec in Montreal Research Ethics Committee for Student Projects in November 2020. #2021-3451

PROVENANCE AND PEER REVIEW

Not commissioned; externally peer-reviewed.

DATA AVAILABILITY STATEMENT

Study data available upon request.

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Supplemental figures legend

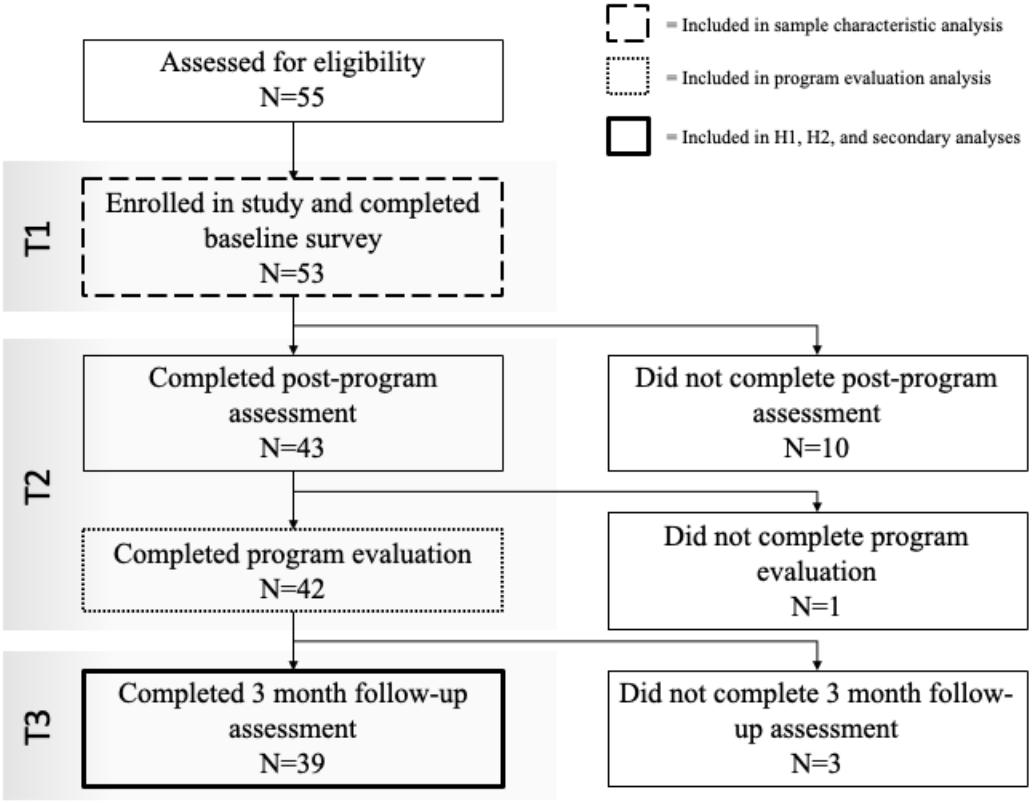
Supplemental Figure 1: Flow diagram showing participant selection and timepoints for assessment.

Supplemental Figure 2: Comparison of mean scores for (A) depression, (B) anxiety, and (C) compassion satisfaction at baseline (T1) and upon PYB-R completion (T2) between residents with low QWL (<25th percentile) or good QWL (≥25th percentile]). CS, compassion satisfaction; PYB-R, Bali Yoga Program for Residents; QWL, quality of work life.

Supplemental figures

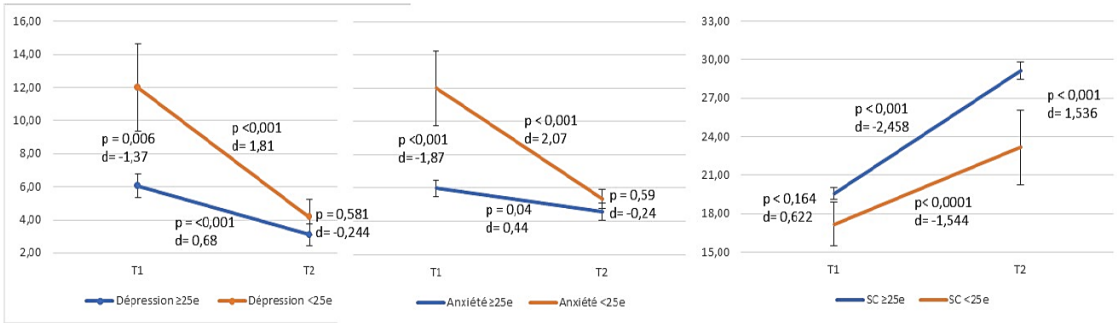
Supplemental Figure 1

Flow diagram showing participant selection and timepoints for assessment.



Supplemental Figure 2

Comparison of mean scores for (A) depression, (B) anxiety, and (C) compassion satisfaction at baseline (T1) and upon PYB-R completion (T2) between residents with low QWL (<25th percentile) or good QWL (≥25th percentile]). CS, compassion satisfaction; PYB-R, Bali Yoga Program for Residents; QWL, quality of work life.



Supplemental Table 1

Supplemental Table 1 Structure of the virtual Bali Yoga Program for medical residents : 60min	
Psychoeducation: 5min	
Yoga poses: 45min (gradual integration of the posture through the 8 weeks)	
1. Guided relaxation during corpse pose	11. Downward-facing dog
2. Straight legs raise, rotation, stretching and twist	12. Mountain pose
3. Rock, balancing left to right	13. Tree pose or Karate Kid
4. Bridge with ankle clasp, rocking left to right, circle hips	14. Warrior 2
5. Happy baby	15. Sleeping goddess
6. Boat	16. Crocodile
7. Eye of the needle pose	17. Cobra or Sphynx
8. Seated forward bend	18. Child's pose
9. Seated twisted spine	19. Corpse pose and final meditation
10. Cat cow	
Meditation: 10min	

Supplemental Table 2

Supplemental Table 2 Comparison of psychological variables between residents completing the baseline and post-intervention questionnaires versus those only completing the baseline questionnaire

Variable	Completed baseline and post-intervention questionnaires (N=39)	Completed baseline questionnaire (N=14)	T	p-value	Cohen's d
Anxiety	7.0±4.2	5.3±3.0	1.41	0.16	0.44
Depression[1]	7.1±5.3	5.9±3.1	0.77	0.44	0.25
Compassion satisfaction	19.0±3.1	19.4±3.7	-0.40	0.69	-0.12
Compasson fatigue	22.8±7.1	19.4±5.1	1.64	0.11	0.51
Disengagement[1]	17.6±2.2	18.6±2.7	-1.33	0.19	-0.43
Exhaustion[1]	17.6±2.3	18.6±2.7	-0.55	0.58	0.18
Burnout[1]	41.7±3.2	42.4±3.4	-0.64	0.52	-0.21

[1]Missing data from 1 resident who completed only the baseline questionnaire.

Supplemental Table 3

Supplemental Table 3 Comparison of psychological variables between residents that completed 6 to 8 yoga sessions versus residents that completed 5 or fewer sessions

Variable	Completed 6 to 8 sessions (N=48)	Completed ≤5 sessions (N=5)	T	p-value	Cohen's d
Anxiety	6.9±3.8	3.4±3.8	1.93	0.06	0.91
Depression[1]	7.1±4.9	3.8±3.9	1.49	0.14	0.70
Compassion satisfaction	18.9±3.2	21.4±2.7	-1.67	0.10	-0.79
Compasson fatigue	22.4±6.8	17.4±4.8	1.60	0.12	0.75
Disengagement[2]	18.0±2.2	15.7±3.9	1.91	0.06	1.00
Exhaustion[2]	24.1±1.9	23.2±0.5	0.85	0.40	0.44
Burnout global score[2]	42.1±3.1	39.0±3.6	1.91	0.06	1.00

[1]Missing data from 1 participant that completed 6 to 8 sessions.
[2]Missing data from 1 participant that completed ≤5 sessions.

Supplemental Table 4

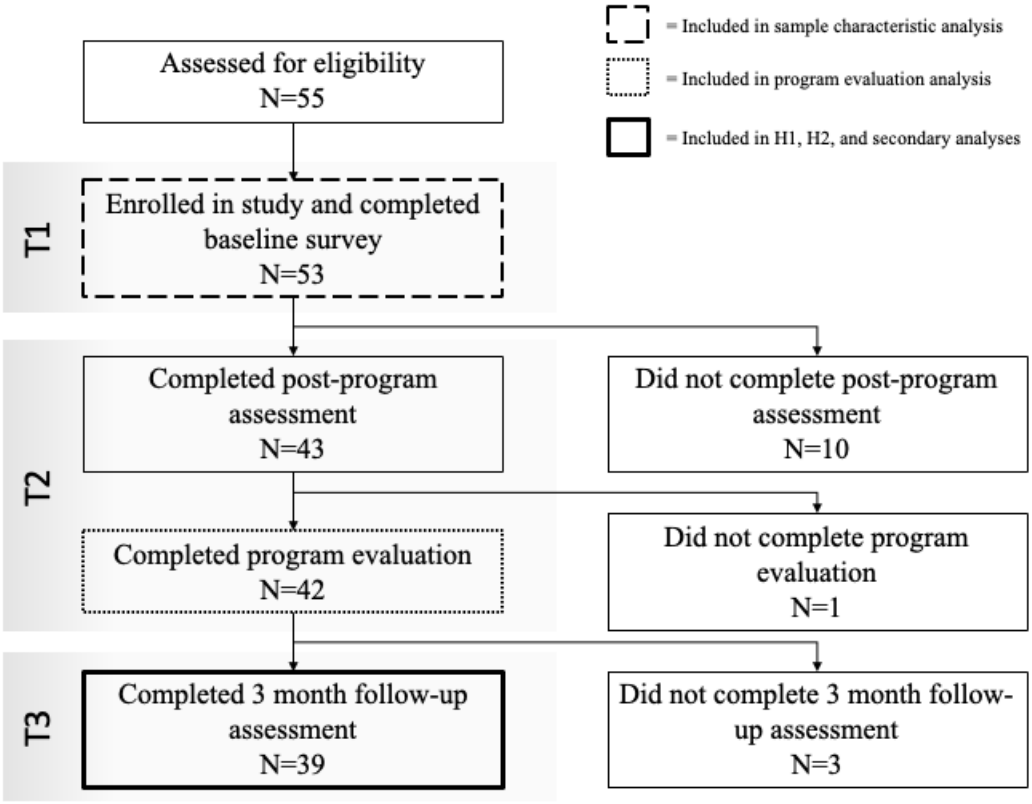
Supplemental Table 4 Assessment of resident satisfaction with various components of the Bali Yoga Program

Component (N=42)	Extremely or very	Moderate	A little or not at all
Psychoeducation	28 (66.7)	11 (26.2)	3 (7.1)
Postures	22 (52.4)	14 (33.3)	6 (14.3)
Meditation	30 (71.4)	6 (14.3)	6 (14.3)
Group practice	33 (78.6)	4 (9.5)	5 (11.9)
Individual practice	15 (35.7)	14 (33.3)	12 (28.6)

Data reported as n (%).

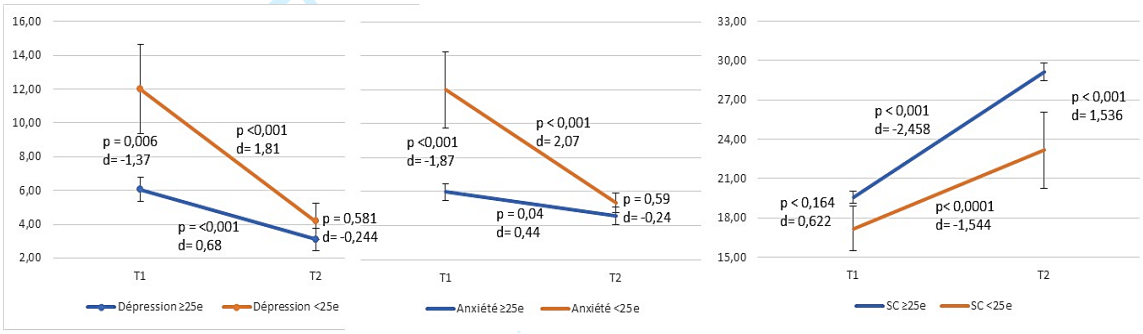
Supplemental Figure 1

Flow diagram showing participant selection and timepoints for assessment.



Supplemental Figure 2

Comparison of mean scores for (A) depression, (B) anxiety, and (C) compassion satisfaction at baseline (T1) and upon PYB-R completion (T2) between residents with low QWL (<25th percentile) or good QWL (≥25th percentile]). CS, compassion satisfaction; PYB-R, Bali Yoga Program for Residents; QWL, quality of work life.



Supplemental Material: Satisfaction Questionnaire (in French)

Satisfaction Globale du programme de yoga Bali pour les résidents (PYB-R)

#participant : _____

Pas du tout satisfait (1) Peu satisfait (2) Satisfait (3) Tout à fait satisfait (4)

1. Est-ce que le programme de yoga Bali offre le genre d'outils que vous désirez ? 1 2 3 4
2. Jusqu'à quel point le programme répond-t-il à vos besoins ? 1 2 3 4
3. Si un ami avait besoin du même type d'aide, recommanderiez-vous le PYB-R? 1 2 3 4
4. Quel est votre degré de satisfaction par rapport à la qualité du PYB-R ? 1 2 3 4
5. Est-ce que les séances que vous avez reçues vous ont aidé ? 1 2 3 4
6. De façon générale et globale : quel est votre degré de satisfaction ? 1 2 3 4
7. Si aviez encore besoin de soutien, reviendriez-vous participer au PYB-R ? 1 2 3 4
8. Êtes-vous satisfait de la qualité du programme que vous recevez ? 1 2 3 4

Voici les principales composantes du programme de yoga Bali que vous avez suivi.

Jusqu'à quel point les dimensions suivantes de la méthode vous ont été utiles ou ont été difficiles pour vous? ***(Écrivez dans la case correspondante)***

PAS DU TOUT	UN PEU	MOYENNEMENT	BEAUCOUP	EXTRÊMEMENT
0	1	2	3	4

	Utile	*Difficile*
▪ Les pratiques hebdomadaires de groupe	*1 2 3 4*	*1 2 3 4*
▪ La psychoéducation en début de séance	*1 2 3 4*	*1 2 3 4*
▪ L'apprentissage des postures	*1 2 3 4*	*1 2 3 4*
▪ L'apprentissage de la méditation	*1 2 3 4*	*1 2 3 4*

▪ Les techniques de respiration	*1 2 3 4*	*1 2 3 4*
▪ Les pratiques individuelles	*1 2 3 4*	*1 2 3 4*

Qu'avez-vous apprécié du programme yoga Bali adapté aux résidents de médecine?

Avez-vous des idées d'améliorations à nous suggérer pour une meilleure intégration du PYB-R dans votre milieu?

Quel est le pourcentage de chance que vous recommandiez cette méthode à des collègues? (Cochez la case appropriée.)

0%❑ 25%❑ 50%❑ 75%❑ 100%❑

Quel est le pourcentage de chance que vous recommandiez cette méthode à des collègues? (Cochez la case appropriée.)
0%q 25%q 50%q 75%q 100%q

BMJ Open

An online yoga program for resident physicians in Québec: an evaluation of feasibility and impact on mental health. (Abbreviated title: An online yoga program for resident physicians in Québec)

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2023-082391.R2
Article Type:	Original research
Date Submitted by the Author:	14-Aug-2024
Complete List of Authors:	Bélisle, Marie-Pier; UQAM, psychology Dupuis, Gilles; UQAM Fleet, Richard; ULaval, Département de médecine familiale et de médecine d'urgence
Primary Subject Heading:	Mental health
Secondary Subject Heading:	Mental health, Public health, Evidence based practice, Complementary medicine
Keywords:	Burnout, Physicians, MENTAL HEALTH, Quality of Life, Anxiety disorders < PSYCHIATRY, Psychosocial Intervention

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TITLE: An online yoga program for resident physicians in Québec: an evaluation of feasibility and impact on mental health. (Abbreviated title: An online yoga program for resident physicians in Québec)

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WORD COUNT: 3991 words.

ABSTRACT

Objectives: To evaluate feasibility of the Bali Yoga Program for Residents (PYB-R), an 8-week virtual yoga-based intervention, and determine its impact on the mental health of resident physicians.

Design: Single-group repeated measures study.

Setting: Associations from the four postgraduate medical education programs in Québec, Canada.

Participants: Overall, 55 resident physicians were recruited to participate of which 53 (96.4%) completed the assessment pre-PYB-R. The post-intervention assessment was completed by 43 residents (78.2%) and 39 (70.9%) completed all phases (including 3-month follow-up). Most were in their first year (43.4%) or second year (32.1%) of residency. The majority were female (81.1%) with a mean age of 28±3.6 years.

Primary and secondary outcome measures: The primary outcome measure was feasibility as measured by participation in the PYB-R. Secondary outcomes measures were psychological variables (anxiety, depression, burnout, emotional exhaustion, compassion fatigue, and compassion satisfaction) and satisfaction with the PYB-R. Residents were further subgrouped based on quality of work life and number of PYB-R sessions attended.

Results: The attrition rate for program completion was 19%. Of the 43 residents that completed the PYB-R, 90.6% attended between 6-8 sessions. Repeated-measures Analysis of Variance (ANOVAs) at 3 time points (baseline, PYB-R completion, 3-month follow-up) confirmed a decrease in scores for depression and anxiety, and an increase in scores for compassion satisfaction. No changes were observed in the other psychological variables evaluated. ANOVAS also confirmed that a better quality of life at work helps develop

compassion satisfaction, a protective factor to compassion fatigue. Most participants (92.9%) indicated they were satisfied or very satisfied with the quality of the program.

Conclusions: A virtual yoga-based program is feasible and has lasting positive effects up to 3 months on the mental health of resident physicians. Further research is warranted to validate these findings using a larger, randomized sample of residents.

KEYWORDS: Yoga, depression, anxiety, compassion satisfaction, compassion fatigue, burnout, medical residents, physicians, mental health, selfcare, selfcompassion, quality of life, work environment, QOL, QWL.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- A yoga-based mind-body intervention was designed for resident physicians and led by a certified yoga instructor.
- The program was designed to be flexible regarding scheduling and modalities used in order to maximize participation.
- Data collected from residents was self-reported and thus susceptible to social desirability and expectancy bias.
- It was not possible to verify that residents viewed each video to completion.
- Lack of a control group limits our abillity to draw a causal link between participation in the program and the observed effects on mental health.

INTRODUCTION

There are growing concerns regarding the mental health of physicians and their Quality of Work Life (QWL) due to heightened levels of stress and burnout in the wake of the COVID-19 pandemic.[1] According to data from the Canadian Medical Association (CMA), the number of physicians experiencing burnout increased from 25% in 2018 to 53% in 2021.[2, 3] Pre-pandemic burnout rates were even higher among resident physicians (52%) and depression was common (18%);[2] these levels increased moderately by 2021.[3, 4] The systematic review and meta-analysis by Erschens et al. (2019) highlight that burnout rates among medical students are subject to substantial variation, influenced by the stage of their medical education and the nature of their work.[5] Factors associated with burnout include increase in patient care responsibilities that comes with the beginning of their resident role, the high pressure of acadmemic competition, long work hours, lack of autonomy, abuse of power, difficulty maintaining healthy social life, and development of professional cynicism.[5-9] The repercussions of physician burnout extend across three primary realms: the health and quality of work life (QWL) of physicians, the quality of patient care, and broader implications for the healthcare system and society. Burnt-out physicians are at a higher risk for depression, anxiety and suicide. [10] Furthermore, burnout compromises patient care, as evidenced by increased medical errors and diminished care quality. [11,12] Patients tended by burnt-out physicians often perceive a lack of compassion, leading to poorer symptom management, higher incidence of unexpected medical events, and more frequent complaints.[13] In Canada, the financial toll of physician burnout, manifested through reduced work hours, absenteeism, turnover, and early retirement, is estimated at $213 million annually.[14] Similarly, in the United States,

burnout incurs an estimated cost of $4.6 billion each year to the healthcare system.[15] These statistics underscore the multifaceted impact of burnout, emphasizing the need for comprehensive strategies to address its effects not only on individual physicians but also on the overall quality of healthcare delivery and societal well-being.

In addition to burnout and depression, resident physicians are also at risk for compassion fatigue (CF), which is characterized by emotional and physical exhaustion leading to a decreased ability to empathize or feel compassion for others. Given the caring aspect of their role, reliance on empathy and compassion is primordial to effective patient care. [16]

Despite the challenges linked to the profession, there is also the concept of compassion satisfaction (CS) to take into consideration, which refers to the positive feelings derived from helping others. While CF can have detrimental effects on healthcare provider's mental health and quality of patient care, fostering compassion satisfaction can serve as a protective factor. [16,17] Reducing triggers (e.g., poor working conditions, long shifts, stressful on-call duties, lack of appreciation, workplace bullying, etc.) and implementing adequate stress management programs including activities such as MBIs can help the enhancement of compassion satisfaction, self-compassion and sens of accomplishment, all of which directly impact physician well-being and performance. [18-23] Compared to meditation-based approaches, yoga adds a bodily aspect which promotes mind-body balance using three primordial elements: breathing exercises, postures and mindfulness exercises. [23] Empirical evidence supports yoga's regulatory effects on the autonomic nervous system; it dampens the hyperactivity of the sympathetic nervous

system, linked to both mental and physical problems, and promotes parasympathetic activity, thereby preempting stress-related health issues [24-26]

Few studies have investigated the effect of practicing yoga on the mental health of resident physicians;[27-29] these studies found yoga has beneficial effects on their burnout symptoms, anxiety, compassion satisfaction, and blood pressure. Evidence from systematic reviews of MBIs to improve physician wellbeing suggest more work is needed to determine the ideal context for implementing and evaluating these interventions.[30-33] Recent studies have underscored the necessity of virtual methods in delivering interventions, particularly for healthcare professionals like resident physicians, who often face barriers in accessing traditional in-person programs due to their demanding schedules. [28,30] While there is few evidence supporting the effectiveness of virtual reality and online mindfulness programs for physicians [34,35], the specific application of such virtual interventions for resident physicians remains unexplored to our knowledge. This gap highlights an opportunity to leverage technology in developing tailored, flexible, and accessible wellness programs for resident physicians, catering to their unique needs and constraints, as well as offering a viable solution for future natural events that would impose strict social distancing. The aim of this study was to evaluate the feasibility of the first virtual yoga program for residents physicians and to determine the impact of this program on the mental health and wellbeing of participants. We hypothesized that a virtual yoga program would be feasible in terms of attendance, home practice and overall satisfaction. Furthermore, we hypothesized that program completion would reduce the intensity of symptoms related to compassion fatigue (CF), burnout, anxiety and depression, that it would increase levels of compassion satisfaction (CS), and that these effect would be maintained for up to 3 months.

As secondary analyses, first, we evaluated if resident physicians with better QWL pre-intervention showed greater improvement in psychological variables after completing the virtual yoga program. Second, we evaluated whether regular yoga practice following program completion was associated with improvements in psychological variables at 3 months.

METHODS

Study design, population and setting

A single-group repeated measures study was conducted between January 10, 2021 and June 20, 2021. We recruited 55 participants. Anticipating an approximate drop out rate of 25%, this allows us to anticipate a final sample of around 40 participants. This number allow a power of 80% to detect a f of 0.20 (near medium which is 0.25; G*Power, assuming correlation of 0.5 between moments of measurement) at an alpha level of 0.05. [36,37]

Participants were recruited from associations from the four postgraduate medical education programs in the Canadian province of Québec (University of Montreal, McGill University, Laval University, University of Sherbrooke), through their association facebook page and through emails sent by these associations. The inclusion criteria were to be a resident physician working at a healthcare facility in Québec, to be able to understand French and write in french and to be physically able to do yoga postures. The sole exclusion criterion was enrollment in another psychotherapeutic intervention, whether individual or group, concurrent with the program. Each participant received an individual email that included an anonymized Qualtrics link to complete the questionnaires and sign the consent form. Ethical approval was obtained from the University of Quebec in Montreal Research Ethics

Committee for Student Projects in November 2020.

Patient and Public involvement

Patients and/or the public were not involved in the design, or conduct, or reporting or dissemination plans of this research.

Survey instruments

Participants completed each of the following questionnaires: the Oldenburg Burnout Inventory (OLBI) (*internal consistency of 0.70 and a test-retest reliability of 0.81)*, the revised 21-item Professional Quality of Life (ProQOL-21) scale measuring CS and CF (*The CS subscale has an internal consistency of 0.92, and CF has 0.90)*,[38] the General Anxiety Disorder 7-Item Assessment (GAD-7) measuring anxiety (*internal consistency of 0.92 and a test-retest reliability of 0.83)*,[39] the Patient Health Questionnaire (PHQ-9) measuring depression (*internal consistency of 0.89 and a test-retest reliability of 0.84)*,[40] and the Quality of Work Life Systemic Inventory (QWLSI©) (*The internal consistency (Cronbach's alpha) of its eight subscales ranges from 0.60 to 0.82.* [5] *The overall internal consistency is 0.88, and the test-retest reliability is 0.85)*.[41] The QWLSI© is a tool for assessing QWL based on the perceived gap between the situation experienced in the present moment and the personal goals set in 34 different areas of professional life. Low QWL scores on the QWLSI© have been associated with burnout.[42] Finally, participants also completed two questionnaires developed in-house: a 16-question socio-demographic questionnaire and a satisfaction questionnaire with open questions that permitted to gatter qualitative data (See supplemental material).

Intervention

We developed a virtual yoga program based on the Bali Method of Yoga with the assistance of a certified yoga instructor (Aura Wellness Center, yoga academy registered with the Yoga Alliance and the International Yoga Federation) who previously taught the Bali Method as part of two studies on attention-deficit/hyperactivity disorder (ADHD) in children.[43]. The Bali yoga consist of gentle Hatha asanas (yoga postures). [44] Its distinctive features include the importance given to the relaxation response during and between yoga poses, staying longer in each postures, the importance given to the visualization, and the psychoeducational content on the psychophysiological aspects of, in this case, yoga and stress linked to the resident physicians reality. Program for Residents (PYB-R) was offered as an 8-week program with one hour of group practice per week, called synchronous practice. Participants had the option of performing the program offline (asynchronous practice) if their work schedule precluded real-time attendance, using the recording of the weekly session that was sent to them upon their request. A 15min yoga session had also been provided to them so they could do an extra practice on their own if they wanted to. It was a suggestion to do so and there were no minimum or maximum number of extra practices that were required. The PYB-R was adapted from a program that has been used repeatedly for nearly a decade in different populations.[44-47] Each PYB-R session included a period of psychoeducation on mental health, instruction on yoga poses (see Supplemental Table 1), and a meditation session. Psychoeducation topics covered included the impact of everyday thoughts, pressure to perform, breathing as a tool, burnout, CF, setting limits, learning self-benevolence, learning self-care, and focusing on the present

moment (see Supplemental Figure 1). *Each session began with a 5-minute psychoeducational segment that introduced the session's theme and provided key insights to enhance understanding and relevance. These concepts were then woven into the yoga practice, allowing participants to explore and apply them in a practical, experiential manner.*

Statistical analysis

Descriptive statistics were used to provide a socio-demographic portrait of participants. The analysis included residents who participated in at least 50% of PYB-R sessions. T-tests were used to compare characteristics of participants retained for analysis with those excluded, and to compare participants who attended 6-8 sessions versus those who attended 5 or fewer. To determine feasibility we evaluated session attendance, individual practices, and program satisfaction using descriptive statistics. The effect of participation in the PYB-R on the mental health and wellbeing of resident physicians was assessed by performing repeated measures Analysis of Variance (ANOVAs) across three time points (T1 = baseline survey; T2 = completion of PYB-R at 8 weeks; T3 = 3-month follow-up assessment) for each psychological variable. We used post-hoc tests to explore pairwise differences between levels of the repeated measures and corrected for multiple comparisons using the Bonferroni-Holm procedure.

To test whether residents with better QWL scores at baseline showed greater improvement in psychological variables after completing the program, a mixed-group ANOVA (low QWL [<25th percentile] vs. average-to-good QWL [≥25th percentile]) by

time (T1, T2) was performed.[42]. A significant interaction led to the analysis of simple effects according to specific differences between the two groups at each time point and between groups over time. We also compared participant scores on the questionnaires between residents who practised yoga regularly (≥30 min/week) from T2 and T3 versus those that practiced yoga less frequently (<30 min/week) using repeated measures ANOVAs. We tested for association between resident age and session attendance (≥6 sessions vs. <6 sessions) using the Mann-Whitney test, and we tested the association of age with medical specialty and residency level using chi-square analysis. We also compared characteristics of those who did or did not complete the program to assess for potential bias. All analyses were performed using JASP (version 0.18.0).

RESULTS

Of 55 resident physicians recruited to participate, 53 (96.4%) completed the baseline questionnaire (See supplementary Figure 1). The post-intervention questionnaire was filled out by 43 residents (81.2%; 43/53), and 39 residents (from 11 different specialties) completed all three phases of the study including the 3-month follow-up assessment (73.6%; 39/53).

Table 1 compares characteristics of residents completing the baseline and post-intervention questionnaires (N=39) versus those only completing the baseline questionnaire (N=14). These groups were similar in age, gender, ethnicity, and years of residency. Residents completing the baseline and post-intervention questionnaires had a mean age of 28±3.1 years, the majority were female (84.6%; 33/39), and most were in their first year (38.5%; 15/39) or second year (30.8%; 12/39) of residency.

Table 1 Comparison of characteristics between residents that completed the pre- and post-intervention questionnaires versus those completing only the baseline

Characteristic	Completed baseline and post-intervention questionnaires	Completed baseline questionnaire only	p-value	Overall (N=53)
Age, mean	28±3.1	28±3.6	0.20	29±4.7
Sex			0.20	
Female	33 (84.6)	10 (71.2)		43 (81.1)
Male	6 (15.4)	4 (28.6)		10 (18.9)
Ethnicity			0.44	
Caucasian	34 (87.2)	11 (78.6)		45 (84.9)
Other	5 (12.8)	3 (21.4)		8 (15.1)
Residency level			0.15	
1	15 (38.5)	8 (57.1)		23 (43.4)
2	12 (30.8)	5 (35.7)		17 (30.8)
3	8 (20.5)	-		8 (15.1)
Missing	4 (10.3)	1 (7.1)		5 (9.4)
Specialty			0.54	
Family	10 (25.6)	5 (35.7)		15 (28.3)
Psychiatry	5 (12.8)	3 (21.4)		8 (15.1)
Physiatry	4 (10.3)	2 (14.3)		6 (11.3)
Other	20 (51.3)	4 (28.6)		24 (45.3)

No differences in mental health were observed between residents who completed the pre- and post-intervention questionnaires (N=39) versus those completing only the baseline questionnaire (N=14) (see Supplemental Table 2). When we compared psychological variables between residents who participated in 6 to 8 yoga sessions (N=48) versus ≤5 sessions (N=5), no differences were observed (see Supplemental Table 3). All variables were normally distributed; however, large effect sizes were observed when comparing residents completing 6-8 sessions versus ≤5 sessions.

Regarding feasibility of the PYB-R in terms of participation, the attrition rate for program completion was 19% and the total attrition rate (including 3-month follow-up) was 26%. Among residents that completed the PYB-R, 91% attended 6-8 sessions; the average attendance was 6.9 sessions (median=8, SD=1.7). Over the course of the program, the mean synchronous attendance was 4.9 sessions (median=5, SD=2.4) and the mean asynchronous attendance was 2 sessions (median=1.0, SD=1.8), underlining that most participants attended more sessions synchronously than asynchronously. Nine participants attended all 8 sessions synchronously and 17 participants attended all 8 sessions via the hybrid option (mix of synchronous and asynchronous attendances). Weekly individual practice (excluding group sessions) was achieved on average by 60% of residents. Mean weekly individual practice time over the program duration was 70.8 minutes (SD=7.6, median=71.0), Resident satisfaction with the PYB-R was high with 85.7% of participants responding that the PYB-R met their needs and 92.9% indicating they were satisfied or very satisfied with the quality of the program (Table 2). 7% of participants felt the PYB-R was not the right program for them. The majority of residents reported being extremely or very satisfied with the components of the PYB-R including psychoeducation, postures, meditation and group practice (see Supplemental Table 4).

Table 2 Satisfaction of resident physicians with the Bali Yoga Program

Item (N=42)	Satisfied or very satisfied	Little or not satisfied
PYB-R met your needs	36 (85.7)	6 (14.3)
PYB-R has helped you	38 (90.5)	4 (9.5)
Quality of the PYB-R	39 (92.9)	3 (7.1)
PYB-R is a desirable tool	39 (92.9)	3 (7.1)

Overall satisfaction with the PYB-R	34 (81.0)	8 (19.0)

PYB-R, Bali Yoga Program for Residents.

The repeated-measures ANOVAs (T1-T2-T3) did show a decrease in scores for depression ($F_{2,76}$ = 14.08, p<0.001, η_p^2 = 0.33) and anxiety ($F_{2,76}$ = 14.14, p<0.001, η_p^2 = 0.27), and an increase in the scores for CS ($F_{2,75}$ = 185.44, p<0.001, η_p^2 = 0.83). No significant changes were observed across the three time points with respect to disengagement ($F_{2,76}$ = 1.39, p=0.28, η_p^2 = 0.03), emotional exhaustion ($F_{2,76}$ = 0.72, p=0.49, η_p^2 = 0.02), total burnout ($F_{2,76}$= 1.39, p=0.26, η_p^2 = 0.04) or compassion fatigue ($F_{2,76}$ = 1.27, p=0.85, η_p^2 = 0.03). Between T1 and T2, we observed a significant decrease in mean scores for depression, improved from low depressive symptoms to absence of symptoms (7.1±5.3 vs. 3.3±4.0; p<0.001), and anxiety, improved significantly but remained in the same category of low anxious symptoms (7.0±4.2 vs. 4.6±3.0; p<0.001), and an increase in mean scores for CS, improved from low CS to to the upper limit of the moderate level of CS (19.1±3.1 vs 28.5±5.2; p<0.001). There was no significant change on any psychological variables between T2 and T3 (See table 3).

Table 3 Mean scores for variables related to mental health at baseline, following program completion, and at 3-month follow up

Variable	Baseline (T1)	PYB-R Completion (T2)	p-value* (ES)#	3-Month Follow up (T3)	p-value** (ES)#
Depression	7.1±5.3	3.3±4.0	<0.001 (0.94)	4.2±3.3	0.16 (0.23)
Anxiety	7.0±4.2	4.6±3.0	<0.001 (0.67)	4.2±2.8	0.48 (0.12)
Disengagement	17.6±2.2	17.3±3.6	0.64 (0.08)	16.7±3.7	0.27 (0.18)

Emotional exhaustion	24.1±1.8	24.0±2.6	0.84 (0.03)	23.7±3.0	0.36 (0.15)
Burnout global score	41.7±3.2	41.3±5.7	0.68 (0.07)	40.3±6.3	0.24 (0.19)
Compassion fatigue	22.8±7.1	21.7±7.0	0.14 (0.24)	21.9±6.2	0.80 (-0.04)
Compassion satisfaction	19.1±3.1	28.5±5.2	<0.001 (-2.71)	28.4±5.5	0.96 ((0.01)

*Comparison between T1 and T2.
**Comparison between T2 and T3.
*** p-values are adjusted using the Bonferroni and Holm corrections.
#Effect size Cohen's d

We tested whether initial QWL was associated with improvement in psychological variables at T2 and observed significant changes in depression, anxiety, and CS. Group analysis (low QWL [<25th percentile] vs. good QWL [≥25th percentile]) by time (T1-T2) revealed a significant interaction ($F_{1,41}$ = 8.25, p=0.006, η_p^2 = 0.03) (See supplemental figure 2). At T1, scores for depression were significantly lower in the good QWL group (mean 6.0±4.4 vs. mean 12.0±6.4). Following completion of the PYB-R, the scores for depression were similar between the two groups. Regarding anxiety, the group-by-time interaction was significant ($F_{1,41}$ = 11.39, p=0.001, η_p^2 = 0.06). At T1, anxiety levels were significantly lower in the good QWL group (mean 6.0±3.1 vs. 12±5.5), but there was no difference observed at T2. Finally, the group-by-time interaction for CS was significant ($F_{1,40}$ = 4.90, p=0.03, η_p^2 = 0.02). The good and low QWL groups showed similar levels of CS at T1. Although these levels increased in both groups after program completion, the mean score at T2 was significantly higher in the good QWL group (t(40)= 3.48, p (Holm)=0.003, d=-1.54). No interactions were observed between time (T2 to T3) and practice (≥30 min/week vs. <30 min/week in the 3 months following PYB-R completion) on symptoms of depression, anxiety, or CS.

DISCUSSION

Overall, our results demonstrate that implementing a virtual yoga intervention to enhance the mental health and wellbeing of resident physicians is both feasible and effective. We observed high participation rates with 90.6% of residents attending at least 6 of the 8 sessions. Furthermore, an average of 70 mins of yoga practice was achieved weekly which is noteworthy considering their busy work schedules and their other occupations. With the availability of a hybrid option, it was possible for 60% of residents to attend all 8 sessions. Lasting improvements in CS and reductions in symptoms of anxiety and depression were observed for up to 3 months, which could indicates that the participants continue benefiting from their learnings overtime. The fact that burnout, disengagement and FC scores remained the same may suggest that the PYB-R protected them from a worsening of their condition on these three variables despite the impact that the pandemic may have had on their work conditions. The vast majority of residents reported they were satisfied with the quality of the PYB-R and that the program met their needs.

Strengths and limitations

This study has several strengths and limitations to highlight. The first strengths of the PYB-R is that it was conducted virtually and was designed to be flexible with respect to scheduling and modalities to maximize participation among medical residents. These features make it possible to reach large numbers of individuals across different regions with minimal costs involved. Second, PYB-R was led by a certified yoga instructor and it was manualized, insuring the yoga teacher to follow a structured intervention protocol.

Third, a 3-months follow-up was included in the study design, which provides beneficial information to the understanding of the program's effects, while it remains an unregular component in studies in the field. [32, 48] Fourth, even though the sample size of this study appears small, it was reaching our pilot project feasibility objectives. It is important to highlight that the 55 participants were recruited within a month, which is promising for the implementation of larger-scale projects. Despite these strengths, this study has limitations. While the findings of this study are encouraging, conducting a larger randomized study with a control group is warranted to validate the generalizability of our results. The small sample and the lack of a control group limits our ability to draw a causal link between the program and the observed effects on the mental health of residents. We acknowledge that participation in a yoga program may inherently attract individuals with a pre-existing interest in such practices, giving rise to selection bias. However, evidences show that receiving a preferred psychosocial mental health treatment is associated with a lower dropout rate, underscoring that this selection bias might not be detrimental in this case. [49] Another limitation is that it was not possible to verify if the videos were viewed to completion. Use of software to confirm viewership would have strengthened our results regarding PYB-R feasibility. Our findings are based on self-reported measures which are known to be potentially biased, notably through social desirability and expectancy bias.[50] There is evidence, however, that social desirability is not always correlated with self-reported well-being questionnaires, and that when it is, it has a limited effect on variance (3% to 10%).[51] Evidence also suggests the psychological changes observed during MBIs are not associated with the initial expectations of individuals.[52] Thus, it is unlikely that social desirability and expectation bias had a large effect on the results of this study.

Strengths in relation to other studies

Participation in the PYB-R program was considerably higher than rates reported in other studies investigating MBIs which range from 33% to 68%.[27-29] In a recent randomized trial examining the feasibility of a yoga called RISE (resilience, integration, self-awareness, engagement), Loewenthal and colleagues observed improvements in multiple measures of psychological health in resident physicians including reduced levels of stress and burnout.[28] However, 6 weekly in-person sessions with suggested home practice was not feasible and participants suggested having the program online to increase feasibility, which is supported by the results of our study. Considering the complexity of their schedule and potential future pandemics or other natural event that may provoke important social distancing rules, the ability to engage virtually, as our initative propose, is a notable strength that enhance the feasibility of such a program. Unlike our study, Loewenthal et al. included a control group; this group showed no improvement in psychological health measures from baseline to post-program, suggesting that the effect of time had minimal impact on the sample.[28]

Comparison with the wider literature

There is growing evidence that MBIs can improve the wellbeing of physicians and other healthcare professionals at all levels of experience and training.[49] Our findings that participation in the PYB-R reduced symptoms of anxiety and improved CS for up to 3 months following program completion is consistent with the literature on MBIs in healthcare.[27, 53-57] While we also observed improvements in symptoms of depression

among PYB-R participants, previous studies of MBIs have reported no changes in depression post-intervention.[27, 28] Although self-reported levels of burnout did not change following completion of the PYB-R, others have demonstrated yoga-based interventions can effectively reduce symptoms of burnout.[29, 55-58] The lack of effect on burnout and CF we observed among PYB-R participants could be due to the fact that these variables are largely related to the work environment which was particularly disrupted and unstable during the winter of 2021 during the height of the COVID-19 pandemic. Although the PYB-R provides tools to help improve emotional regulation, these techniques may not be sufficient in a stressful context.[59]

Resident physicians who completed the PYB-R showed significant improvements in CS. Similar results were observed among healthcare professionals in Japan who participated in a MBI during the COVID-19 pandemic.[60] Compassion satisfaction is a protective element of burnout and CF, and is directly linked to self-compassion.[61-62] During the course of the pandemic, fear of infection likely increased stress levels and may have contributed to lower levels of CS among healthcare professionals.[63] Since, resident physicians generally work in competitive environments under difficult conditions, they are often trained to strive for self-improvement rather than CS and self-compassion.[64] As demonstrated in a recent study by Wang and colleagues,[65] self-compassion is essential to the development of CS. The PYB-R aims to teach self-compassion through a better understanding of its limits and an awareness of its psychological symptoms.

Discussing important differences in results

We found residents with better QWL had fewer symptoms of depression and anxiety at baseline compared to those with poor QWL. After completion of the PYB-R, these

symptoms were reduced in both groups but to a much greater degree in the group with poor QWL, suggesting that participation in the program alleviated some of the difficulties experienced in the work environment. Similarly, we observed improvements in CS in both groups, but to a greater degree in the group with better QWL. A work environment that meets the physical and psychological needs of the professional facilitates the development and maintenance of self-compassion and CS.[66-68] Ultimately, it is the responsibility of the institution to provide this conducive working environment.

Implications of the study

Changes to the Canadian healthcare system during the COVID-19 pandemic have had, and will continue to have, serious consequences for the workforce.[1] A 2021 report from the CMA highlighted the need to raise awareness and destigmatize mental health among physicians, to enhance and expand the availability of specialized support services, and to better evaluate the effectiveness of these services.[3] Healthcare institutions must provide employees with the necessary tools to manage their emotions and cognitive flexibility in order to minimize anxiety, depression, CF, and burnout. The findings of this study highlight the value of the PYB-R as a preventive tool, not only for the psychological health of individual residents, but also for the performance of the healthcare system and the quality of care provided.

Unanswered questions and future research

Further research is required to determine how long the beneficial effects observed in PYB-R participants are maintained (6 months, 1 year, etc.) and to optimize how and when the

program is offered to maximize participation. Additional research is also needed to investigate the impact of MBIs on the quality of care in terms of patient outcomes and satisfaction.

CONCLUSIONS

It has been shown that the current generation of resident physicians values their psychological well-being and is actively seeking solutions to address their challenges. .[3] It is time to offer them accessible solutions that meet their diverse needs. Our results demonstrate that a virtual yoga for resident physicians is feasible and can have lasting positive effects on their depressive and anxious symptoms, as well as enhancing their compassion satisfaction which is a protective factor to FC and burnout. Further research using a more robust study design and larger sample size is required to validate these findings. Research is also needed on the impact of such results on the quality of care and the health system. Generally speaking, wellbeing is a reflection of corporate culture; institutions that evaluate the QWL of their physicians and provide tangible mental health resources have observed improvements in the quality of care delivered.[69] Recognizing that an intervention may have greater effect on health professionals when its conducted directly by institutions, it would be interesting to make a global assessment of such an initiative as part of an organizational strategy. [33]

ACKNOWLEDGEMENTS

The authors acknowledge Percipient Research & Consulting for assistance with language editing.

COLLABORATORS

None.

CONTRIBUTORS

The guarantor of the study is Marie-Pier Bélisle; She accepts full responsibility for the finished work and the conduct of the study, had access to the data, and controlled the decision to publish. MPB was involved in conceptualization, protocol development, data analysis and drafted the manuscript. GD was involved in conceptualization, protocol development, and manuscript editing. RF was involved in conceptualization and manuscript editing. All authors approved of the final version of the manuscript and agree to be accountable for all aspects of the work.

FUNDING

This work was supported by the Canadian Medical Association (CMA) and the Fond de Recherche du Québec (#N/A) – Volet Société Culture (FRQSC). #289651

COMPETING INTERESTS

None declared.

PATIENT CONSENT FOR PUBLICATION

Not required.

ETHICS APPROVAL

This study was approved by the University of Quebec in Montreal Research Ethics Committee for Student Projects in November 2020. #2021-3451

PROVENANCE AND PEER REVIEW

Not commissioned; externally peer-reviewed.

DATA AVAILABILITY STATEMENT

Study data available upon request.

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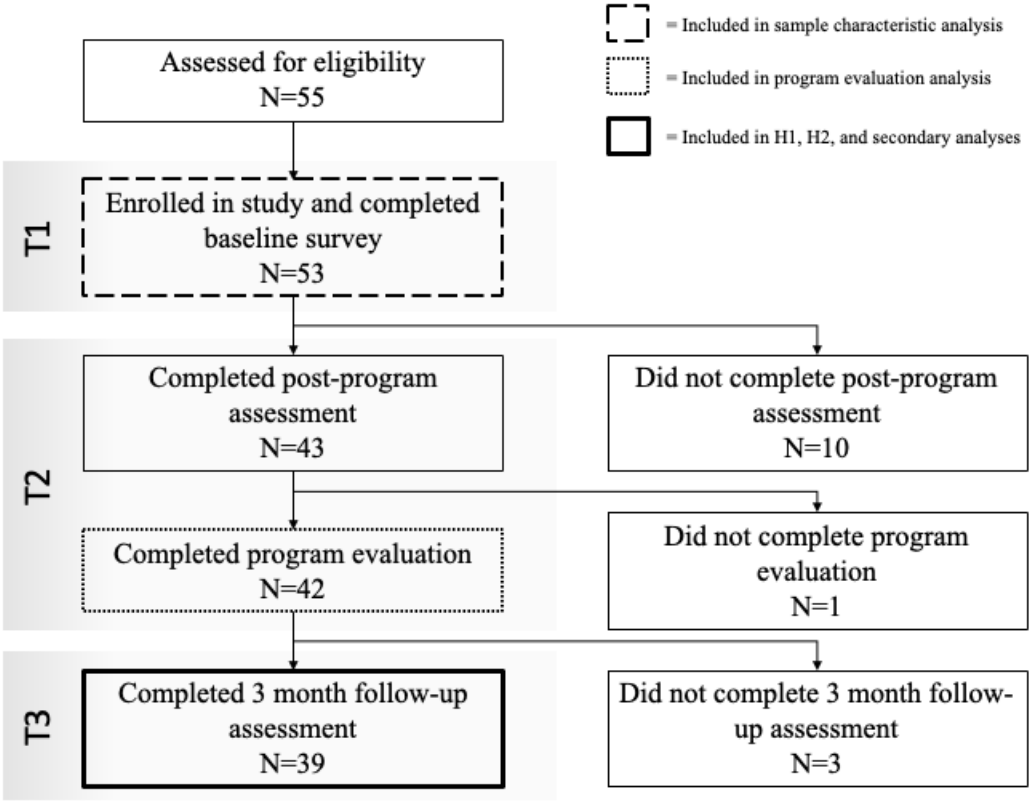
Supplemental figures legend

Supplemental Figure 1: Flow diagram showing participant selection and timepoints for assessment.

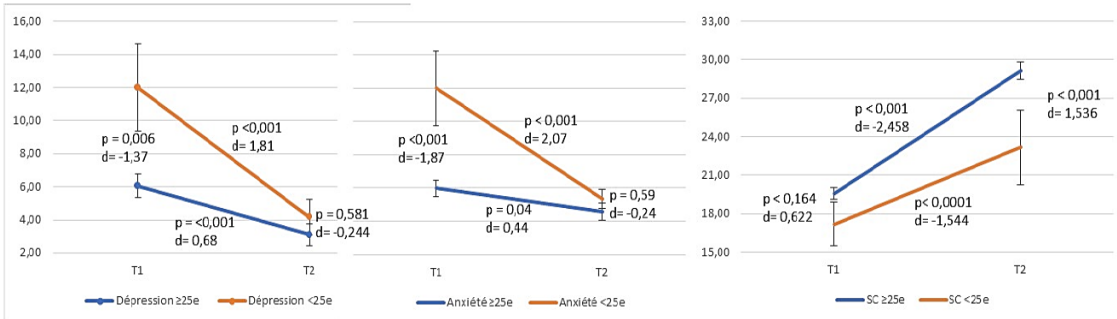
Supplemental Figure 2: Comparison of mean scores for (A) depression, (B) anxiety, and (C) compassion satisfaction at baseline (T1) and upon PYB-R completion (T2) between residents with low QWL (<25th percentile) or good QWL (≥25th percentile]). CS, compassion satisfaction; PYB-R, Bali Yoga Program for Residents; QWL, quality of work life.

Supplemental figures

Supplemental Figure 1
Flow diagram showing participant selection and timepoints for assessment.



Supplemental Figure 2
Comparison of mean scores for (A) depression, (B) anxiety, and (C) compassion satisfaction at baseline (T1) and upon PYB-R completion (T2) between residents with low QWL (<25th percentile) or good QWL (≥25th percentile]). CS, compassion satisfaction; PYB-R, Bali Yoga Program for Residents; QWL, quality of work life.



Supplemental Table 1

Supplemental Table 1 Structure of the virtual Bali Yoga Program for medical residents : 60min	
Psychoeducation: 5min	
Yoga poses: 45min (gradual integration of the posture through the 8 weeks)	
1. Guided relaxation during corpse pose	11. Downward-facing dog
2. Straight legs raise, rotation, stretching and twist	12. Mountain pose
3. Rock, balancing left to right	13. Tree pose or Karate Kid
4. Bridge with ankle clasp, rocking left to right, circle hips	14. Warrior 2
5. Happy baby	15. Sleeping goddess
6. Boat	16. Crocodile
7. Eye of the needle pose	17. Cobra or Sphynx
8. Seated forward bend	18. Child's pose
9. Seated twisted spine	19. Corpse pose and final meditation
10. Cat cow	
Meditation: 10min	

Supplemental Table 2

Supplemental Table 2 Comparison of psychological variables between residents completing the baseline and post-intervention questionnaires versus those only completing the baseline questionnaire

Variable	Completed baseline and post-intervention questionnaires (N=39)	Completed baseline questionnaire (N=14)	T	p-value	Cohen's d
Anxiety	7.0±4.2	5.3±3.0	1.41	0.16	0.44
Depression[1]	7.1±5.3	5.9±3.1	0.77	0.44	0.25
Compassion satisfaction	19.0±3.1	19.4±3.7	-0.40	0.69	-0.12
Compasson fatigue	22.8±7.1	19.4±5.1	1.64	0.11	0.51
Disengagement[1]	17.6±2.2	18.6±2.7	-1.33	0.19	-0.43
Exhaustion[1]	17.6±2.3	18.6±2.7	-0.55	0.58	0.18
Burnout[1]	41.7±3.2	42.4±3.4	-0.64	0.52	-0.21

[1]Missing data from 1 resident who completed only the baseline questionnaire.

Supplemental Table 3

Supplemental Table 3 Comparison of psychological variables between residents that completed 6 to 8 yoga sessions versus residents that completed 5 or fewer sessions

Variable	Completed 6 to 8 sessions (N=48)	Completed ≤5 sessions (N=5)	T	p-value	Cohen's d
Anxiety	6.9±3.8	3.4±3.8	1.93	0.06	0.91
Depression[1]	7.1±4.9	3.8±3.9	1.49	0.14	0.70
Compassion satisfaction	18.9±3.2	21.4±2.7	-1.67	0.10	-0.79
Compasson fatigue	22.4±6.8	17.4±4.8	1.60	0.12	0.75
Disengagement[2]	18.0±2.2	15.7±3.9	1.91	0.06	1.00
Exhaustion[2]	24.1±1.9	23.2±0.5	0.85	0.40	0.44
Burnout global score[2]	42.1±3.1	39.0±3.6	1.91	0.06	1.00

[1]Missing data from 1 participant that completed 6 to 8 sessions.
[2]Missing data from 1 participant that completed ≤5 sessions.

Supplemental Table 4

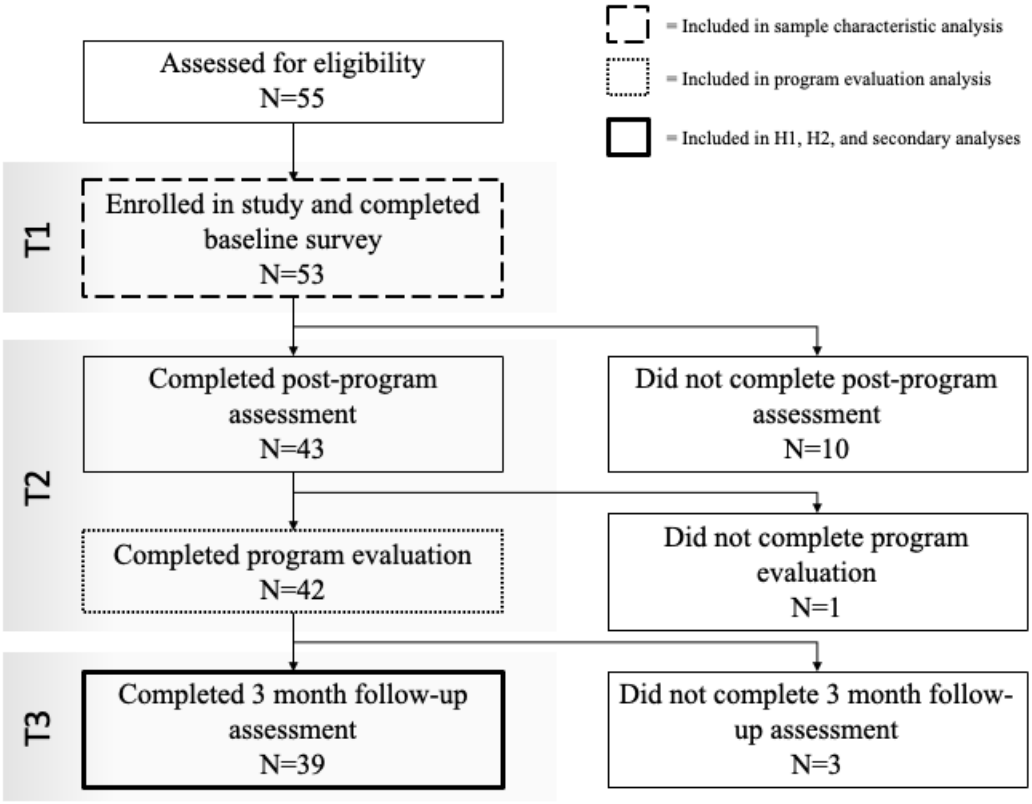
Supplemental Table 4 Assessment of resident satisfaction with various components of the Bali Yoga Program

Component (N=42)	Extremely or very	Moderate	A little or not at all
Psychoeducation	28 (66.7)	11 (26.2)	3 (7.1)
Postures	22 (52.4)	14 (33.3)	6 (14.3)
Meditation	30 (71.4)	6 (14.3)	6 (14.3)
Group practice	33 (78.6)	4 (9.5)	5 (11.9)
Individual practice	15 (35.7)	14 (33.3)	12 (28.6)

Data reported as n (%).

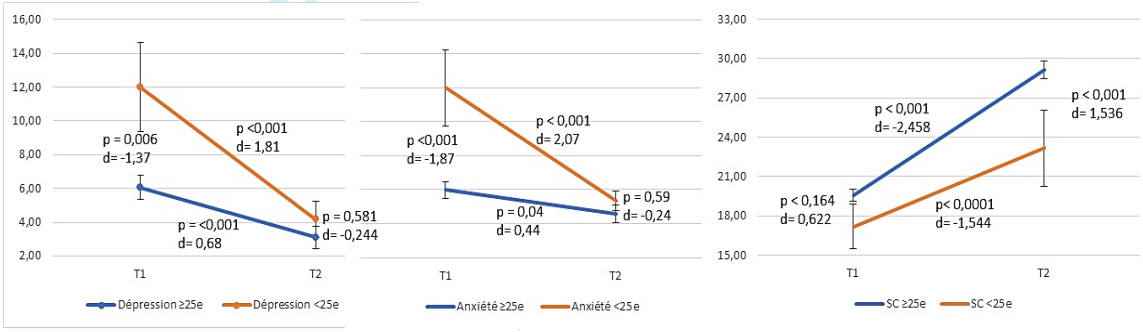
Supplemental Figure 1

Flow diagram showing participant selection and timepoints for assessment.



Supplemental Figure 2

Comparison of mean scores for (A) depression, (B) anxiety, and (C) compassion satisfaction at baseline (T1) and upon PYB-R completion (T2) between residents with low QWL (<25th percentile) or good QWL (≥25th percentile]). CS, compassion satisfaction; PYB-R, Bali Yoga Program for Residents; QWL, quality of work life.



Supplemental Material: Satisfaction Questionnaire (in French)

Satisfaction Globale du programme de yoga Bali pour les résidents (PYB-R)

#participant : _____

Pas du tout satisfait (1) Peu satisfait (2) Satisfait (3) Tout à fait satisfait (4)

1. Est-ce que le programme de yoga Bali offre le genre d'outils que vous désirez ? 1 2 3 4
2. Jusqu'à quel point le programme répond-t-il à vos besoins ? 1 2 3 4
3. Si un ami avait besoin du même type d'aide, recommanderiez-vous le PYB-R? 1 2 3 4
4. Quel est votre degré de satisfaction par rapport à la qualité du PYB-R ? 1 2 3 4
5. Est-ce que les séances que vous avez reçues vous ont aidé ? 1 2 3 4
6. De façon générale et globale : quel est votre degré de satisfaction ? 1 2 3 4
7. Si aviez encore besoin de soutien, reviendriez-vous participer au PYB-R ? 1 2 3 4
8. Êtes-vous satisfait de la qualité du programme que vous recevez ? 1 2 3 4

Voici les principales composantes du programme de yoga Bali que vous avez suivi.

Jusqu'à quel point les dimensions suivantes de la méthode vous ont été utiles ou ont été difficiles pour vous? ***(Écrivez dans la case correspondante)***

PAS DU TOUT	UN PEU	MOYENNEMENT	BEAUCOUP	EXTRÊMEMENT
0	1	2	3	4

	Utile	*Difficile*
▪ Les pratiques hebdomadaires de groupe	*1 2 3 4*	*1 2 3 4*
▪ La psychoéducation en début de séance	*1 2 3 4*	*1 2 3 4*
▪ L'apprentissage des postures	*1 2 3 4*	*1 2 3 4*
▪ L'apprentissage de la méditation	*1 2 3 4*	*1 2 3 4*

▪ Les techniques de respiration	*1 2 3 4*	*1 2 3 4*
▪ Les pratiques individuelles	*1 2 3 4*	*1 2 3 4*

Qu'avez-vous apprécié du programme yoga Bali adapté aux résidents de médecine?

Avez-vous des idées d'améliorations à nous suggérer pour une meilleure intégration du PYB-R dans votre milieu?

Quel est le pourcentage de chance que vous recommandiez cette méthode à des collègues? (Cochez la case appropriée.)

0%❑ 25%❑ 50%❑ 75%❑ 100%❑

Quel est le pourcentage de chance que vous recommandiez cette méthode à des collègues? (Cochez la case appropriée.)
0%q 25%q 50%q 75%q 100%q