

BMJ Open Sustained impacts of the COVID-19 pandemic on medical student learning and well-being in rural Australia: findings from a repeated national multicentre survey

Priya Martin ^{1,2} Matthew R McGrail ³ Jordan Fox,³ Zeldia Doyle,⁴ Remo Ostini,¹ Jessica Beattie ⁵ Lara Fuller,⁶ Penny Allen,⁷ Srinivas Kondalsamy-Chennakesavan¹

To cite: Martin P, McGrail MR, Fox J, *et al*. Sustained impacts of the COVID-19 pandemic on medical student learning and well-being in rural Australia: findings from a repeated national multicentre survey. *BMJ Open* 2024;**14**:e086359. doi:10.1136/bmjopen-2024-086359

► Prepublication history for this paper is available online. To view these files, please visit the journal online (<https://doi.org/10.1136/bmjopen-2024-086359>).

Received 12 March 2024
Accepted 29 October 2024



© Author(s) (or their employer(s)) 2024. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

For numbered affiliations see end of article.

Correspondence to

Dr Priya Martin;
Priya.Martin@unisq.edu.au

ABSTRACT

Objective The impact of COVID-19 on medical students has predominantly been assessed by one-off survey studies at the pandemic onset. This national study investigated the sustained impacts of the COVID-19 pandemic on medical students' rural clinical placement learning and well-being.

Design Repeated cross-sectional survey design.

Setting Annual Federation of Rural Australian Medical Educators (FRAME) survey across 2020 to 2022.

Participants Medical students completing an extended (mostly 12 months) rural placement.

Outcome measure A mixed-methods survey with closed-ended and open-ended question. Quantitative data were analysed using χ^2 and Kruskal-Wallis tests. Qualitative responses were analysed through content analysis.

Results Quantitative findings: in 2022 (43%), respondents were more likely to interact with COVID-19 patients in a clinical capacity compared with 2020 (26%) and 2021 (23%; $p < 0.001$). Respondents were more likely to be concerned about missed clinical learning in 2020 (58%) than in 2021 (40%) and 2022 (44%; $p < 0.001$). Respondents in 2020 (41%) and 2022 (39%) were more likely to feel that their performance on assessments was affected by COVID-19 compared with 2021 respondents (28%; $p < 0.001$). Respondents in 2022 (38%) and 2021 (31%) were more likely to report being exposed to an increased breadth of cases than 2020 respondents (13%; $p < 0.001$) and also reported more exposure to community-based placements (2022: 38%, 2021: 31%, 2020: 19%; $p < 0.001$).

Qualitative findings: three categories were developed from the data—mental health and well-being impacts, learning preferences at play, and concerns about flow-on effects.

Conclusions While the pandemic has now become the 'new normal', the mental well-being and learning concerns raised by students in rural Australia, and their concerns about sustained impacts into their internship cannot be ignored. Healthcare organisations need to ensure that when impacted students enter the workforce the practice context is supportive, with mechanisms such as effective clinical supervision in place.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ Study reports findings from a national dataset.
- ⇒ Mixed-methods survey provided both quantitative and qualitative data.
- ⇒ Repeated measures design enabled access to 3 years of pooled data.
- ⇒ Survey findings were not analysed for state differences.
- ⇒ Qualitative data were available for only two of the three included years.

BACKGROUND

The immediate impacts of the COVID-19 pandemic onset on medical and other health professional students' learning and mental well-being have been extensively documented. Several survey studies conducted with medical students, especially during the initial COVID-19 onset period in 2020 have been reported in the literature. For example Garcia and colleagues¹ survey of 315 medical students in the USA noted that the cohort transitioning to internship was a vulnerable group given the pandemic-induced disconnections, and a lack of mentorship, clinical exposure and networking; notably, more than half reported a significant negative impact of the pandemic on their academic productivity.¹ Another survey of 561 German medical students in 2021–2022 found that the scores on depression and anxiety measures increased after the COVID-19 outbreak compared with pre COVID-19.² Echoing these findings, a further 2021 COVID-19 survey of 2104 medical students from six medical schools in Jordan found that 88.4% and 47.4% of students, respectively had psychological distress and poor or just fair sleep quality.³

The COVID-19 pandemic has been classed as a clear example of an intersectional phenomenon.⁴ Intersectionality occurs when multiple structures of inequalities (eg, gender, age, class, ethnicity) lead to a multiplying effect when disadvantaged positions intersect in the same individual.⁴ A 2021 survey of 1555 respondents from 14 medical schools in the USA evaluated the impact of the pandemic on medical students from a low socioeconomic status (SES) compared with students from higher SES.⁵ This study highlighted the various barriers faced by students from low SES backgrounds including difficulty accessing remote learning resources, not being able to afford basic needs, greater loss of employment for their parents or guardians and the added pressures on them to seek employment to support themselves and their families.⁵ Another international survey of 1604 medical students from 45 countries in 2020 showed that 81.4% of respondents reported overall negative impact of the pandemic on their training. Specifically, being 21 years or younger, females, and those reporting a decline in conventional lectures and ward-based teaching were found to be more likely to report an overall negative impact on their training.⁶

Geographical and social isolation in rural locations can also be argued to contribute to intersectionality. Disadvantages faced by those in rural locations related to COVID-19 impacts have also been documented. For example, a recent study from the USA showed that rural counties had up to 51% more deaths per capita than most urban counties during the Delta-Omicron wave.⁷ Specific to medical students on placements in rural locations, our previously reported study outlined some of the disadvantages and barriers faced by this cohort, which included reduced learning opportunities and academic and social isolation.⁸ Hence, it is necessary to examine the impacts of the pandemic among this cohort specifically to ensure implementation of targeted solutions. Given most studies to date have reported surveys of a singular cohort, conducted predominantly at the pandemic onset, studies are needed that use pooled datasets spanning a broader timeframe to also allow for comparisons.

Rural medical student placements in Australia are facilitated by Rural Clinical Schools (RCSs) funded by the Australian Government Rural Health Multidisciplinary Training (RHMT) programme. The 19 Australian universities associated with the RCSs constitute the Federation of Rural Australian Medical Educators (FRAME). Each year, FRAME surveys rural medical students in their final year of placements across the RCSs. We previously reported on the findings of the FRAME 2020 survey of 464 students, in comparison to a prepandemic cohort from 2019.⁸ We found that students were concerned about the impact of the COVID-19 pandemic on the quality of their learning. Further, although students had concerns about missed clinical learning, they appreciated the higher levels of learning and mental well-being supports provided by their RCSs.⁸ Following subsequent FRAME surveys in 2021 and 2022, an opportunity arose to compare three

cohorts of medical students undertaking clinical placements across rural Australia, to investigate sustained impacts and recurring patterns in learning and mental health impacts reported by students. The addition of a free text question in the 2021 and 2022 surveys enabled collection of qualitative data to supplement the quantitative data obtained from closed-ended survey questions. Therefore, this follow-on study, using quantitative and qualitative data, aims to comprehensively investigate the sustained impacts and patterns observed in the learning and mental well-being of Australian medical students undertaking rural clinical placements in the context of the COVID-19 pandemic across 3 years.

METHODS

This study employed a repeated cross-sectional survey design. A survey with specific questions related to the COVID-19 impacts was administered each year from 2020 to 2022. While the 2020 survey was quantitative in nature, the 2021 and 2022 surveys used a mixed-methods approach through an additional open-ended question to further understand student experiences related to the impact of COVID-19 on their performance in assessments. Each university was responsible for local distribution of invitations and noting the number of eligible participants. Overall response rates were calculated assuming that all eligible participants in each university received an invitation. Participants were medical students who had completed an extended clinical training placement in a rural location of around 12 months (one academic year). Some may have completed consecutive years at an RCS but were only invited once. A complete copy of the 2020, 2021 and 2022 survey instruments can be found on the FRAME website.⁹ Survey respondents provided implied consent through survey completion. A summary of COVID-19 events in Australia from 2020 to 2022, aligning with the timeframes of the current study, has been provided in online supplemental appendix A.

Data analysis

Quantitative analysis

All analyses were conducted using SPSS V.28. Descriptive data are reported as frequencies and percentages and comparisons between all years of data were performed via χ^2 (dichotomous and categorical data) and Kruskal-Wallis tests (Likert scales). Where Kruskal-Wallis tests revealed a significant difference, Mann-Whitney tests were used for pairwise comparisons. Statistical significance was accepted where $p < 0.05$.

Qualitative analysis

All free text data were extracted from the survey responses, cleaned and analysed through an inductive content analysis approach¹⁰ by two researchers (PM and JF). Categories were developed for reporting and used to explain the quantitative findings.

Table 1 Participant demographics across all years of data

Variable	Response	2020 (n (%))	2021 (n (%))	2022 (n (%))
Gender	Female	267 (59.5)	306 (56.5)	298 (59.1)
	Male	182 (40.5)	236 (43.5)	206 (40.9)
Rural background*	No	206 (45.6)	297 (54.1)	269 (52.6)
	Yes	246 (54.4)	252 (45.9)	242 (47.4)
Aboriginal/Torres Strait Islander	No	440 (97.3)	535 (98.0)	499 (98.0)
	Yes	12 (2.7)	11 (2.0)	10 (2.0)
Already have a health professional qualification	No	382 (84.5)	479 (88.2)	450 (88.4)
	Yes	70 (15.5)	64 (11.8)	59 (11.6)
First in your family to attend university	No	382 (84.5)	474 (87.5)	418 (82.3)
	Yes	70 (15.5)	68 (12.5)	90 (17.7)
RCS year completed	First year	296 (65.3)	367 (66.8)	323 (63.3)
	>1 year	157 (34.7)	182 (33.2)	187 (36.7)

*Indicates significant ($p < 0.05$) difference between years of data.
RCS, Rural Clinical School.

Patient and public involvement

None.

RESULTS

Quantitative results

After removing data from participants who only completed the first page of the survey, the aggregate sample was reduced to 1515 respondents from 2020 ($n=453$; response rate (RR)=51% of eligible participants), 2021 ($n=549$; RR=59%) and 2022 ($n=513$; RR=63%); however, some respondents did not answer all questions. Demographics were similar across each year of data (table 1), except there were more rural background respondents in 2020 (54%) compared with 2021 (46%) and 2022 (47%) ($p=0.018$).

Data relating to the impact of COVID-19 across the 3 years are provided in table 2. In 2022, respondents were more likely to experience participation with COVID-19 patients in a clinical capacity (43%) compared with 2020 (26%) and 2021 (23%; $p < 0.001$). In 2020, respondents were least likely to report feeling safe during clinical training (88%) compared with 2021 (94%) and 2022 (92%; $p=0.003$). Respondents in 2020 were more concerned about missed clinical learning (58% agree/strongly agree) than those in 2021 (40%) and 2022 (44%; $p < 0.001$).

Respondents in 2022 (38%) and 2021 (31%) were more likely to agree/strongly agree that they had exposure to an increased breadth of cases compared with 2020 respondents (13%; $p < 0.001$). Similarly, respondents in 2022 (38%) and 2021 (31%) were also more likely to agree that they had more exposure to community placements compared with those in 2020 (19%; $p < 0.001$). Respondents in 2020 (41%) and 2022 (39%) were more likely to agree that COVID-19 adversely affected performance on assessments compared with those in 2021 (28%;

$p < 0.001$). Respondents in 2020 (36%) and 2022 (42%) were more likely to agree that they felt less well prepared for internship than those in 2021 (26%; $p < 0.001$).

Regarding RCS support, respondents in 2020 (69%) and 2021 (70%) were more likely to agree that they were well-supported financially compared with 2022 respondents (59%; $p < 0.001$). Respondents in 2020 (32%) and 2022 (31%) were more likely to report feeling academically isolated during their rural placement compared with 2021 respondents (28%; $p=0.035$).

Qualitative findings

While the question eliciting the free text response was specific to student perceptions of the impact of COVID-19 on their performance in assessments, data indicate that students used this opportunity to express overall concerns relating to their learning and well-being. Analysis of the free text data resulted in the development of three categories that illuminate some of the quantitative findings: mental health and well-being impacts, learning preferences at play and concerns about flow-on effects. Clearly, these categories overlap with each other reflecting the intersectionality of the factors at play. While qualitative data were largely similar between the two cohorts (ie, 2021 and 2022), the 2022 cohort appeared more concerned than the 2021 cohort about their well-being and learning impacts, aligning with the quantitative findings.

Mental health and well-being impacts

Students noted several mental health and well-being concerns including stress, isolation, anxiety, worry and uncertainty. These in turn were largely described as affecting their learning. 'Stress' and 'stressor' were noted 16 times in the dataset, while 'isolation' in the context of well-being was noted 12 times. These mental well-being concerns were linked to COVID-19 infections and associated social isolation of family members, other students

Table 2 Impact of COVID-19 across 3 years of data

Question	Response	2020 (n (%))	2021 (n (%))	2022 (n (%))	P value
Less well prepared for internship because of COVID-19?	No	197 (45.6)	278 (52.1)	185 (58.5)	<0.001
	Yes	157 (36.3)	139 (26.0)	131 (41.5)	
	Don't know	78 (18.1)	117 (21.9)	0 (0.0)	
Participation with COVID patients	No	292 (67.1)	380 (71.0)	253 (51.5)	<0.001
	Yes (administrative)	29 (6.7)	31 (5.8)	26 (5.3)	
	Yes (clinical)	114 (26.2)	124 (23.2)	212 (43.2)	
Felt safe in clinical training during the COVID-19 pandemic	No	51 (11.8)	30 (5.6)	41 (8.4)	0.003
	Yes	382 (88.2)	503 (94.4)	449 (91.6)	
Concerned about having missed specific clinical learning	Disagree	125 (28.8)	253 (47.4)	215 (44.0)	<0.001
	Neutral/don't know	58 (13.4)	69 (12.9)	61 (12.5)	
	Agree	251 (57.8)	212 (39.7)	213 (43.6)	
Exposure to an increased breadth of cases	Disagree	299 (68.9)	233 (43.6)	181 (36.9)	<0.001
	Neutral/don't know	78 (18.0)	134 (25.1)	125 (25.6)	
	Agree	57 (13.1)	167 (31.3)	184 (37.6)	
Exposure to new/different models of care	Disagree	67 (15.5)	77 (14.4)	57 (11.6)	0.193
	Neutral/don't know	55 (12.7)	78 (14.6)	96 (19.6)	
	Agree	311 (71.8)	379 (71.0)	337 (68.8)	
More exposure to community placements	Disagree	274 (63.3)	247 (46.3)	189 (38.7)	<0.001
	Neutral/don't know	78 (18.0)	121 (22.7)	114 (23.3)	
	Agree	81 (18.7)	165 (31.0)	186 (38.0)	
Placements/learning opportunities affected by travel restrictions	Disagree	186 (43.0)	228 (42.8)	223 (45.8)	0.077
	Neutral/don't know	42 (9.7)	71 (13.3)	57 (11.7)	
	Agree	205 (47.3)	234 (43.9)	207 (42.5)	
COVID-19 adversely affected performance in assessments	Disagree	107 (24.8)	221 (41.4)	146 (29.9)	<0.001
	Neutral/don't know	150 (34.7)	163 (30.5)	153 (31.3)	
	Agree	175 (40.5)	150 (28.1)	190 (38.9)	
Felt well supported academically by my RCS	Disagree	41 (9.2)	40 (7.4)	30 (6.1)	0.061
	Neutral	22 (4.9)	23 (4.3)	28 (5.7)	
	Agree	383 (85.9)	477 (88.3)	435 (88.2)	
Felt well supported financially by my RCS	Disagree	57 (12.7)	70 (13.0)	114 (23.8)	<0.001
	Neutral	83 (18.5)	93 (17.3)	81 (16.9)	
	Agree	308 (68.8)	374 (69.6)	284 (59.3)	
RCS informed me of health and counselling services	Disagree	59 (13.2)	74 (13.8)	75 (15.3)	0.865
	Neutral	80 (17.9)	104 (19.3)	79 (16.2)	
	Agree	308 (68.9)	360 (66.9)	335 (68.5)	
Felt well supported by my RCS	Disagree	31 (6.9)	30 (5.6)	29 (5.9)	0.218
	Neutral	32 (7.1)	35 (6.5)	35 (7.1)	
	Agree	385 (85.9)	474 (87.9)	428 (87.0)	
RCS placement impacted positively on my well-being	Disagree	36 (8.0)	44 (8.2)	46 (9.4)	0.043
	Neutral	51 (11.4)	46 (8.6)	47 (9.6)	
	Agree	361 (80.6)	445 (83.2)	396 (81.0)	
Rural-based clinician as a mentor	Disagree	90 (20.1)	90 (16.8)	82 (17.2)	0.076
	Neutral	69 (15.4)	73 (13.6)	63 (13.2)	
	Agree	289 (64.5)	373 (69.6)	332 (69.6)	

Continued

Table 2 Continued

Question	Response	2020 (n (%))	2021 (n (%))	2022 (n (%))	P value
Felt academically isolated during rural placement	Disagree	241 (53.8)	321 (59.4)	269 (55.0)	0.035
	Neutral	64 (14.3)	66 (12.2)	70 (14.3)	
	Agree	143 (31.9)	153 (28.3)	150 (30.7)	
Felt socially isolated during RCS placement	Disagree	228 (51.0)	279 (51.7)	273 (56.2)	0.287
	Neutral	52 (11.6)	69 (12.8)	61 (12.6)	
	Agree	167 (37.4)	192 (35.6)	152 (31.3)	

Likert scales are collapsed into agree, disagree and neutral in the table for ease of interpretation; bolded p value indicates significant ($p < 0.05$) difference.
RCS, Rural Clinical School.

they were sharing a house with or themselves. The 2021 cohort reported that travel restrictions limiting them from visiting their COVID-19 positive family members added to their worries. Students also commented on missing placements and social and peer interactions due to quarantine requirements. Students said:

Increased stress and financial implications from COVID plus reduced ability to take time out/see family had an indirect but real effect on my learning through affecting my wellbeing. (2021)

Time spent isolating when housemates had COVID-19 was incredibly frustrating and I feel it impacted my learning. I moved away from home to do RCS and to be stuck isolating away from family and friend was very difficult. (2022)

I think it made the years more mentally exhausting, and therefore just made it harder in general. (2022)

The link between mental health and learning was noted by another student:

My medical knowledge and mental health suffered during 2020 to 2021 due to isolation of having Zoom classes (and reduced classes) – as someone who thrives off collaborative and joined learning. I feel like university went from being enjoyable to being a very difficult slog. (2022)

The importance of receiving support and its positive impact on learning was summed-up well by this student:

I began performing better during COVID-19 as more time was spent at my family home where I had greater ongoing support. (2022)

Learning preferences at play

In both cohorts, students were split in their views of online learning. Some students reported this to be a less-preferred mode of learning that increased ‘book’ time and decreased ‘clinical and hands-on’ time. Having reduced access to patients, including for exam preparation, was noted as a key barrier to learning. The 2022 cohort especially expressed stronger views about the negative impacts

of online teaching and learning on their learning and exam skills now and into the future. Students said:

More time to do own study but missed out on formal teaching. Online tutorials are painful and useless. (2021)

2nd year had a negative impact with too much time on Zoom - difficult to stay engaged. 3rd year clinical school was minimally impacted by COVID-19 thanks to efforts of staff at [x] and the Clinical School. (2022)

No proper face-to-face OSCEs, which will impact my performance in further speciality training that require OSCEs. Less students allowed in hospital areas, therefore missing out on clinical time. (2022)

On the other hand, some students found online learning beneficial or at least equivalent to in-person teaching and learning. They were welcoming of the resulting increased time for self-directed study and the opportunity to exercise independence with their own learning:

Less clinical time meant more time for book study. (2021)

If anything I had more time to study due to less strenuous clinical placements. (2021)

In ways we have more time to study for some assessment, but less practical experience to learn with. (2021)

Appreciated the extra self-directed learning time in isolation. (2022)

Concerns about flow-on effects

Several students were concerned about the impacts of missed learning opportunities and reduced exposure to patients and clinical conditions especially at the onset of the pandemic. They were worried there would be flow-on effects of this lack of clinical exposure on their skills and competencies especially when they transition into the workforce. Students also reported playing catch-up from the previous year/s:

It has drastically affected clinical time and exposure which may disadvantage me in terms of exposure and

therefore potential cases I could have seen to become a more competent intern. (2021)

Having less clinical time last year which would have affected our baseline level of knowledge this year. (2021)

Time off with covid, stress, impact on teaching in pre-clinical years still effects my competency with physical exams. (2022)

Because of the loss of placement in my first clinical year, I have noticed being less confident and knowledgeable about the area of General Medicine...This was somewhat alleviated by this year being re-structured to allow for more clinical time in which I did two 4 week blocks of general medicine. However, I feel that I will need to revise this area of medicine during my intern year in order to be able to fulfil my duties to my employer. (2022)

DISCUSSION

This study analysed data collected over 3 years since the COVID-19 pandemic onset to understand the sustained impacts and patterns on medical student learning and well-being in rural Australian placement settings. Our findings indicate that students were still concerned about their mental well-being and learning as a result of completing their preclinical and/or clinical years during the height of the pandemic. Apart from the expected reported increase over time in exposure to a wider breadth of cases, community placements, and participation with COVID-19 patients, both the quantitative and qualitative data indicate that students in 2021 reported lesser pandemic impacts compared with the 2020 and 2022 cohorts (ie, a V-shaped pattern). Qualitative data provide some insights into this to indicate that there were more changes, often unplanned, in 2020 and 2022 compared with 2021. In 2020, students were experiencing abrupt changes from in-person to online learning and assessments, and in 2022, there was a transition back from online to more in-person learning and assessments. Also, as noted in online supplemental appendix A, 2022 was the year of peak deaths and reported cases, that likely impacted learning opportunities due to students and staff being affected by COVID-19. Changes and transitions can be a time of fear and anxiety, so students need to be well-supported through these.

A majority of students across the 3 years investigated felt well supported by their RCS, overall and academically as indicated by the quantitative data. While the qualitative data also reflected this positive support, some mental well-being challenges too were highlighted in the qualitative data. Students felt that COVID-19 restrictions made it stressful both with their academic endeavours and compromised social interactions with peers and family members. Several studies in the literature echo these findings with the pandemic negatively influencing student mental well-being, and not just in medicine. For example,

a study of over 1000 nursing students in 2019–2020 found that 70.9% of students had anxiety and 51.8% had sleep issues.¹¹ In another Russian study of 710 medical students surveyed in 2021–2022, 85% yielded an above-average vulnerability to stress due to COVID-19 restrictions, and 61% of respondents experienced severe anxiety related to online education.¹² Universities and institutions responsible for student education and their transition to the workforce need to monitor the continued psychological welfare of those impacted by the pandemic to provide longer-term supports as needed.

Another key finding of this study was student concerns around their work readiness given the pandemic-induced disruptions to their learning, including missing clinical learning opportunities. They noted that this impacted their confidence necessitating them to catch-up on missed learning. A recent study of interns' perspectives on impacts of the COVID-19 pandemic on the medical school to residency transition in the USA noted that 58% of 1463 survey respondents reported that pandemic responses impeded their preparation for intern year.¹³ Padley and colleagues¹⁴ developed a novel conceptual work readiness framework for medical graduates informed by a review of 70 studies. This framework represents the overlap of the three contributors of work readiness namely individual confidence, capability and contextual factors such as the education and training environment. This review further highlighted the importance of clinical supervision in enhancing work preparedness. Interestingly, other research confirms that clinical supervision of students and healthcare workers was compromised because of the COVID-19 pandemic.¹⁵ In this context, pragmatic solutions to reboot effective clinical supervision have been made available in the literature.¹⁶ Healthcare organisations have a key role to play in restoring effective clinical supervision practices that can better support students and healthcare workers including interns.

In response to the COVID-19 pandemic, medical education pivoted quickly from in-person to online teaching, learning and assessment. Qualitative findings from this study indicate that students were divided in their perceptions of online learning, most likely due to their learning preferences. A scoping review of 174 studies related to medical education during pandemics such as COVID-19, SARS and MERS found that studies were split in terms of student perceptions about and satisfaction with online learning methods. While this review found that there was no overall consensus on whether online learning was more preferable than the traditional classroom, some studies in the review indicated that a combination of both modes is desirable.¹⁷ A recent systematic review of 34 articles on the effectiveness of virtual teaching during the COVID-19 pandemic found virtual teaching to be effective. Further, it reported ongoing work in academic institutions to further develop these resources to improve student engagement and interactivity.¹⁸ While researches on the influence of learning styles (or preferences) on online learning are mixed, a narrative review by Santo¹⁹

concludes that learners' technological skills and level of motivation could be more influential. It may be worthwhile for curriculum developers to consider a mix of in-person and online learning experiences for learners while transitioning into the post-pandemic period.

Strengths and limitations

The strengths of this study lie in using data from a mixed-method repeated survey across a 3-year period, thereby adding crucial evidence on the sustained impacts of the pandemic and patterns of medical student learning. By examining a large dataset spanning across all Australian states and territories, findings have implications for a large number of academic and healthcare institutions. The study is limited by the absence of qualitative data from the 2020 survey. However, several students had reflected on the entire time period since COVID-19 onset in the available data, thereby also providing insights about their experiences in 2020. This study is also limited by not investigating differences between states given different states experiencing varying levels of impacts from COVID-19.

CONCLUSIONS

While COVID-19 responses have become the 'new normal', the mental well-being and learning concerns raised by students in rural Australia, and their concerns about sustained impacts into their internship cannot be ignored. Academic and healthcare institutions need to join forces to carefully evaluate the blend of online and in-person clinical learning and assessments offered. Healthcare institutions need to ensure that the practice context is supportive when these students enter the workforce, with mechanisms such as effective clinical supervision and support in place. Future research can investigate the actual impacts of the pandemic on work readiness of medical interns.

Author affiliations

¹Rural Clinical School, Faculty of Medicine, The University of Queensland, Toowoomba, Queensland, Australia

²School of Health and Medical Sciences, University of Southern Queensland, Toowoomba, Queensland, Australia

³Rural Clinical School, Faculty of Medicine, The University of Queensland, Rockhampton, Queensland, Australia

⁴The University of Notre Dame Australia School of Medicine, Lithgow, New South Wales, Australia

⁵School of Medicine, Deakin University, Warrnambool, Victoria, Australia

⁶Rural Community Clinical School, Deakin University Faculty of Health Medicine Nursing and Behavioural Sciences, Geelong, Victoria, Australia

⁷Rural Clinical School, University of Tasmania, Burnie, Tasmania, Australia

X Jessica Beattie @JessicaBeatti15 and Lara Fuller @larafuller00

Contributors Conceptualisation: PM, MRM, JF, ZD, RO, JB, LF, PA, SK-C. Formal analysis: PM, MRM, JF. Investigation: PM, MRM, JF, ZD, RO, JB, LF, PA, SK-C. Methodology: PM, MRM, JF. Project administration: PM. Validation: PM, MRM, JF, ZD, RO, JB, LF, PA, SK-C. Writing – original draft preparation: PM, MRM, JF. Writing – review and editing: PM, MRM, JF, ZD, RO, JB, LF, PA, SK-C. PM is responsible for the overall content as guarantor.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

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 applicable.

Ethics approval Ethics approval for this study was obtained through University of Notre Dame Human Research Ethics Committee (ref: 2020-196S). Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. Reasonable request to access the data can be made in writing to the corresponding author and is subject to approval from the ethics committee.

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iDs

Priya Martin <http://orcid.org/0000-0002-2092-6551>

Matthew R McGrail <http://orcid.org/0000-0002-6901-8845>

Jessica Beattie <http://orcid.org/0000-0003-3339-1418>

REFERENCES

- Garcia RM, Reynolds RA, Weiss HK, *et al*. Letter: Preliminary National Survey Results Evaluating the Impact of COVID-19 Pandemic on Medical Students Pursuing Careers in Neurosurgery. *Neurosurgery* 2020;87:E258–9.
- Halfmann M, Wetzel L, Castioni N, *et al*. The impact of COVID-19 pandemic on mental burden and quality of life in medical students - results of an online survey. *GMS J Med Educ* 2023;40:Doc21.
- Alnaser AR, Joudeh RM, Zitoun OA, *et al*. The impact of COVID-19 pandemic on medical students' mental health and sleep quality in Jordan: a nationwide cross-sectional study. *Mid East Curr Psychiatry* 2021;28:1–10.
- Maestripieri L. The Covid-19 Pandemics: why Intersectionality Matters. *Front Sociol* 2021;6:642662.
- Piersa AP, Rivas M, Li W, *et al*. How Did the COVID-19 Pandemic Impact Medical Students From Low- vs Higher-Socioeconomic Status Backgrounds? A Multicenter U.S. Survey Study. *Acad Med* 2022;97:S175.
- Wanigasooriya K, Beedham W, Laloo R. The perceived impact of the Covid-19 pandemic on medical student education and training - an international survey. *BMC Med Educ* 2021;21:566.
- Jones M, Bhattar M, Henning E, *et al*. Explaining the U.S. rural disadvantage in COVID-19 case and death rates during the Delta-Omicron surge: The role of politics, vaccinations, population health, and social determinants. *Soc Sci Med* 2023;335:116180.
- Martin P, McGrail M, Fox J, *et al*. Impact of the COVID-19 pandemic on student experiences during rural placements in Australia: findings from a national multi-centre survey. *BMC Med Educ* 2022;22:852.
- FRAME. n.d. Available: <https://ausframe.org/publications-and-resources>
- Hsieh HF, Shannon SE. Three approaches to qualitative content analysis. *Qual Health Res* 2005;15:1277–88.
- Çürük GN, Özgül E, Karadağ S. The effect of COVID-19 on fear, anxiety, and sleep in nursing students. *Ir J Med Sci* 2023;192:3125–31.
- Gardanova Z, Belaia O, Zuevskaya S, *et al*. Lessons for Medical and Health Education Learned from the COVID-19 Pandemic. *Healthcare (Basel) -> Healthc (Basel)* 2023;11:1921.
- Winn AS, Weaver MD, O'Donnell KA, *et al*. Interns' perspectives on impacts of the COVID-19 pandemic on the medical school to residency transition. *BMC Med Educ* 2021;21:330.



- 14 Padley J, Boyd S, Jones A, *et al.* Transitioning from university to postgraduate medical training: A narrative review of work readiness of medical graduates. *Health Sci Rep* 2021;4:e270.
- 15 Martin P, Tian E, Kumar S, *et al.* A rapid review of the impact of COVID-19 on clinical supervision practices of healthcare workers and students in healthcare settings. *J Adv Nurs* 2022;78:3531–9.
- 16 Martin P, Kumar S, Tian E, *et al.* Rebooting effective clinical supervision practices to support healthcare workers through and following the COVID-19 pandemic. *Int J Qual Health Care* 2022;34:mzac030.
- 17 Bughrara MS, Swanberg SM, Lucia VC, *et al.* Beyond COVID-19: the impact of recent pandemics on medical students and their education: a scoping review. *Med Educ Online* 2023;28:2139657.
- 18 Wilcha RJ. Effectiveness of Virtual Medical Teaching During the COVID-19 Crisis: Systematic Review. *JMIR Med Educ* 2020;6:e20963.
- 19 Santo SA. Relationships between Learning Styles and Online Learning. *Perf Improv Quart* 2006;19:73–88.