Peer review history for:

Bentley A, Roden LC, Davy JP, Iacovides S, Gómez-Olivé FX, Scheuermaier K, et al. Deterioration of sleep and mental health in individuals with insomnia during South Africa's COVID-19 lockdown. S Afr J Sci. 2025;121(5/6), Art. #16682. https://doi.org/10.17159/sajs.2025/16682

HOW TO CITE:
Deterioration of sleep and mental health in individuals with insomnia during South Africa's COVID-19 lockdown [peer review history]. S Afr J Sci. 2025;121(5/6), Art. #16682.
https://doi.org/10.17159/sajs.2025/16682/peerreview

Reviewer 1: Round 1
Date completed: 08 December 2023
Recommendation: Accept / Revisions required / **Resubmit for review** / Resubmit elsewhere / Decline / See comments
Conflicts of interest: None

Does the manuscript fall within the scope of SAJS?
Yes/No
Is the manuscript written in a style suitable for a non-specialist and is it of wider interest than to specialists alone?
Yes/No
Does the manuscript contain sufficient novel and significant information to justify publication?
Yes/No
Do the Title and Abstract clearly and accurately reflect the content of the manuscript?
Yes/**No**
Is the research problem significant and concisely stated?
Yes/No
Are the methods described comprehensively?
Yes/**No**
Is the statistical treatment appropriate?
Yes/No/Not applicable/**Not qualified to judge**
Are the interpretations and conclusions justified by the research results?
Yes/Partly/No
Please rate the manuscript on overall contribution to the field
Excellent/**Good**/Average/Below average/Poor
Please rate the manuscript on language, grammar and tone
Excellent/**Good**/Average/Below average/Poor
Is the manuscript succinct and free of repetition and redundancies?
Yes/No
Are the results and discussion confined to relevance to the objective(s)?
Yes/No
The number of tables in the manuscript is
Too few/**Adequate**/Too many/Not applicable

The number of figures in the manuscript is
Too few/**Adequate**/Too many/Not applicable
Is the supplementary material relevant and separated appropriately from the main document?
Yes/No/**Not applicable**
Please rate the manuscript on overall quality
Excellent/Good/**Average**/Below average/Poor
Is appropriate and adequate reference made to other work in the field?
Yes/No
Is it stated that ethical approval was granted by an institutional ethics committee for studies involving human subjects and non-human vertebrates?
Yes/No/Not applicable
If accepted, would you recommend that the article receives priority publication?
Yes/No
Are you willing to review a revision of this manuscript?
Yes/No
With regard to our policy on 'Publishing peer review reports', do you give us permission to publish your anonymised peer review report alongside the authors' response, as a supplementary file to the published article? Publication is voluntary and only with permission from both yourself and the author.
Yes/No
Comments to the Author: 1. Add local and period of study. 4. Methodology not clear enough. Which scale was used? This needs to be written in the Abstract. The conclusions of the study are not described in the Abstract, it needs to be. The abstract must contain all the important "things" for the reader to understand the study conducted. It must give a brief introduction/contextualization on the matter, giving the general scope of the study, must talk about the objective of the research, must talk succinctly about the methodology (type of study, target population, sampling and data collecting tool are the most important things, but you can include the program used for analysis), main general results and the main conclusion of the study. 9 – 13. You conducted a survey to 1048 participants, yet you talk about 835 of them (135 who reported insomnia, and 700 who did not), what happened to the other 213? This info is important to be in the abstract. 62. You can't talk about prevalence unless you conduct a community-based study and guarantee the external validity of your data, or have it precisely described about the population you are studying (the population on risk in which you identified those with the condition of interest). When talking about prevalence, you must include in your denominator the population in risk (which has to have a common characteristic between them). To talk about prevalence in this study you must specify the common characteristic of these 1048 participants, are they from a certain age group or city, what common characteristic do they have? For example, prevalence of insomnia among South African medical students, prevalence of STDs in rural Mozambican rural communities, etc. Instead, you can talk about 'frequency', therefore not being necessary to indicate the common characteristic of the denominator. For example, frequency of self-reported burnout among Zambian healthcare workers (this way you are not obligated to guarantee representativity). As said in 'limitations' (298 – 305) the data cannot be extrapolated, yet it is not clear about your target population, therefore you cannot talk about prevalence. 75 – 79. Recall Bias. You are asking for someone to remember things from 2 to 4 months anterior to the survey. 81. How did you do the sampling? Your eligibility criteria, for sure, gives you more than 1048 participants. 140. You say your significance level is 0.05, but later on you use '$p<0.001$' to establish significance, uniformize this.

Author response to Reviewer 1: Round 1

Comment 1. Add local and period of study.

AUTHOR: We have updated the title and abstract to note the location (South Africa) and lockdown period (Mar-April 2020) of the study.

Comment 2: P4. Methodology not clear enough. Which scale was used? This needs to be written in the Abstract. The conclusions of the study are not described in the Abstract, it needs to be. The abstract must contain all the important "things" for the reader to understand the study conducted. It must give a brief introduction/contextualization on the matter, giving the general scope of the study, must talk about the objective of the research, must talk succinctly about the methodology (type of study, target population, sampling and data collecting tool are the most important things, but you can include the program used for analysis), main general results and the main conclusion of the study.

AUTHOR: While we agree that the Abstract should contain a wealth of information, we are cognisant of the word limit (250 words). We have accordingly updated the Abstract to provide more of the critical information suggested (scales used, study type, groups analysed), but unfortunately could not make all these recommendations and still remain within the word limit (we are not at 260 words and ask the Editor to please consider this increase favorably). We trust that the new version of the Abstract addresses the most pressing of the concerns noted. We also respectfully note that our Abstract does indeed contain a specific study scope as well as a very clear study aim.

Comment 3: PP9 – 13. You conducted a survey to 1048 participants, yet you talk about 835 of them (135 who reported insomnia, and 700 who did not), what happened to the other 213? This info is important to be in the abstract.

AUTHOR: In the Methods (Participants section, PP9-10) we described that for this particular analysis we excluded any participants who reported suffering from multiple sleep disorders (n=213). We have now included this sentence in the Abstract too.

Comment 4: P62. You can't talk about prevalence unless you conduct a community-based study and guarantee the external validity of your data, or have it precisely described about the population you are studying (the population on risk in which you identified those with the condition of interest). When talking about prevalence, you must include in your denominator the population in risk (which has to have a common characteristic between them). To talk about prevalence in this study you must specify the common characteristic of these 1048 participants, are they from a certain age group or city, what common characteristic do they have? For example, prevalence of insomnia among South African medical students, prevalence of STDs in rural Mozambican rural communities, etc. Instead, you can talk about 'frequency', therefore not being necessary to indicate the common characteristic of the denominator. For example, frequency of self-reported burnout among Zambian healthcare workers (this way you are not obligated to guarantee representativity). As said in 'limitations' (298 – 305) the data cannot be extrapolated, yet it is not clear about your target population, therefore you cannot talk about prevalence.

AUTHOR: Thank you for this comment - which is quite correct. This was not a prevalence study and we cannot describe the prevalence of sleep disorders from our approach. Throughout the manuscript, we have removed all inappropriate reference to "prevalence", replacing it with more appropriate terms such as "frequency"; "... the number of people presenting with sleep disorders…"; "The observations of self-reported OSA…"; "The occurrence of insomnia …". We have also updated the legend for Figure 1 to reflect this change.

Comment 5: 75 – 79. Recall Bias. You are asking for someone to remember things from 2 to 4 months anterior to the survey.

AUTHOR: Yes, this is quite right. There is a risk of recall bias - and we acknowledge this as a study limitation (see Limitations section, p18). The reason we are confident in asking people to recall behaviours over this 2-4 month period, however, is based on:

1. We asked people to report on habitual behaviours - an approach routinely used in research, and which allows for a degree of flexibility as habitual behaviour is understood to fluctuate - and therefore represent approximate norms.
2. The extreme changes imposed in response to the COVID-19 pandemic crisis and ensuing lockdown created an unprecedented "date-stamping" such that people were remarkably aware of changes in behaviour related to lockdown.

3. Our pre-lockdown period was January - March 2020, which fortunately coincides with the first part of the new year. As such, asking people to reflect back over what is essentially the first term / quarter of a new year was helpful as it is a period marked by defined features (i.e. first term at a new university year, first weeks of work after a December holiday etc).

Comment 6: 81. How did you do the sampling? Your eligibility criteria, for sure, gives you more than 1048 participants.

AUTHOR: This study is sub-analysis of a larger observational study (referenced in the Study design and setting section (p9). In the parent study (Davy et al 2021) the sample strategy was described as follows: "The survey, which was in English and took approximately 20 minutes to complete, was initially circulated on formal academic mailing lists and platforms, as well as various social media networks, an approach that was similar to that adopted in similar studies during this time (Korman et al., 2020).3,8,14 Participants were also encouraged to pass on the survey through their own networks. Thus, this study adopted a combination of convenience and snowball sampling strategies in the interests of disseminating the survey rapidly.

We have now clarified that this sampling strategy was described in the parent study by updating our "Study design and setting section" (p9). It should also be noted that we applied a strict cut-off for participation in this study (between 12 May - 15 June 2020) - which corresponded with lockdown Alert Levels 4 and then 3 in South Africa. This was intentional - as we were asking people to reflect on behaviours pre-lockdown and during the preceding lockdown Alert level 5. Thus we closed enrollment as soon as we moved to Alert level 2. This was also described in the parent study (Davy et al 2021).

Comment 7: 140. You say your significance level is 0.05, but later on you use 'p<0.001' to establish significance, uniformize this.

AUTHOR: Our significance level in this study was p<0.050 (as per our Data and statistical analyses section, p12). We are consistent throughout the results section in that (i) we always provide the precise significant p-value to three decimal places (e.g. p=0.023) or, (ii) as is common convention, we use p<0.001 to indicate significance rounded off to three decimal places.

Reviewer 2: Round 1
Date completed: 19 December 2023
Recommendation: Accept / Revisions required / **Resubmit for review** / Resubmit elsewhere / Decline / See comments
Conflicts of interest: None

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Yes/No

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Are the methods described comprehensively?
Yes/No

Is the statistical treatment appropriate?
Yes/No/**Not applicable**/Not qualified to judge

Are the interpretations and conclusions justified by the research results?
Yes/**Partly**/No

Please rate the manuscript on overall contribution to the field
Excellent/**Good**/Average/Below average/Poor

Please rate the manuscript on language, grammar and tone
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Is the manuscript succinct and free of repetition and redundancies?
Yes/No
Are the results and discussion confined to relevance to the objective(s)?
Yes/No
The number of tables in the manuscript is
Too few/**Adequate**/Too many/Not applicable
The number of figures in the manuscript is
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Is the supplementary material relevant and separated appropriately from the main document?
Yes/No/**Not applicable**
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Is appropriate and adequate reference made to other work in the field?
Yes/No
Is it stated that ethical approval was granted by an institutional ethics committee for studies involving human subjects and non-human vertebrates?
Yes/No/Not applicable
If accepted, would you recommend that the article receives priority publication?
Yes/No
Are you willing to review a revision of this manuscript?
Yes/No
With regard to our policy on 'Publishing peer review reports', do you give us permission to publish your anonymised peer review report alongside the authors' response, as a supplementary file to the published article? Publication is voluntary and only with permission from both yourself and the author.
Yes/No
Comments to the Author: Review: Worsening insomnia and mental health in self-identified insomniacs during COVID-19 quarantine This article aimed to compare the impact of the COVID-19 lockdown in South Africa on the sleeping patterns, depression and anxiety of individuals with and without self-identified insomnia. The study is well thought-out and the paper is written well. Below are some minor revisions to be considered. General comments Be consistent: No insomnia vs No-insomnia Title Please review title; study was conducted during lockdown and not quarantine Please add place and time to title A strength of the study is the comparison between the insomnia and no-insomnia groups; however, the title does not allude to any comparison. From the title, it seems that the study only focuses on people with insomnia. Abstract L11 – 13: What period was used for the participants to self-identify sleep disorder symptoms? (was it for the period before or during the COVID-19 lockdown? L15: What symptoms are being referred to? L16: Be specific. What insomnia? Did not meet the criteria to be added to the insomnia group? L19-20: I feel that the last sentence is unnecessary. Relate the findings back to the research question (summarize conclusion) L22: Add lockdown to keywords

Significance
L26. Please change quarantine to lockdown

Introduction
Perhaps it will be helpful to briefly summarize the different lockdown levels in South Africa, as the survey took place in lockdown 3 and 4.
L42 – 44: Results are generally not presented in the introduction

Materials and Methods
Study design and setting
L75: How was the online survey distributed?
Participants
L83: Be specific. What restrictions are you referring to?
Survey
L99: How was insomnia defined?
L102: How was "current" defined? I.e. was current during lockdown 4 and 3, when they survey was conducted?
L102 – 103 / 108 - 110: I am a bit confused. Were the participants asked about their depression and anxiety symptoms and was this used in the result or was the PHQ2 and GAD-7 scale used?

Results
L146: Please add the frequency for insomnia participants
L151 – 154: What was the denominator used for these calculations? It seems that 1 048 was used; I think 348 will be more relevant, as you are reporting for those with a sleep disorder.
Figure 1: What is being presented; frequency of percentage? (y-title)
L167: "Fewer" people? I think it's supposed to be more
L178 – 179: Data not presented in the table?
L181: Please provide "n" for participants in the insomnia group on sleep-promoting medication
Figure 3: It is hard to see the group median and IQR, especially in the No-insomnia group. Can a different style be used?
Should the data for the PHQ score, Insomnia group not be presented by dots?

L218 / Figure 4: Is it "no clinical insomnia" (L218) or "no insomnia" (as per figure 4)

Discussion
L240 – 241: How is there an increased vulnerability if they had no or subthreshold insomnia symptoms?
L256: Please see comment for L99. It would have helped to define insomnia (perhaps you can add this as part of the limitations)
L257 – 258: I don't think it is accurate to make this assumption. The question that grouped them into the Insomnia or No-insomnia group asked whether they have been diagnosed with insomnia or if they currently suffer from insomnia; so participants who had insomnia (regardless of current symptoms) had to answer in the affirmative.
L262 – 263: Relevance of this sentence?
L290 – 291: Please see comment for L257 – 258 above

Author response to Reviewer 2: Round 1

Comment: Be consistent: No insomnia vs No-insomnia

AUTHOR: We thank Reviewer 1 for highlighting the lack of consistency. We have now checked every single reference to the No-Insomnia group in the text and have corrected when necessary. We now only refer to the No-Insomnia group throughout the manuscript.

Comment: Please review title; study was conducted during lockdown and not quarantine

AUTHOR: We have changed the title and running head accordingly and removed any reference to quarantine and replaced it with lockdown throughout the manuscript.

Comment: Please add place and time to title

AUTHOR: The new title is now: "Worsening insomnia and mental health in self-identified insomniacs compared to non-insomniacs during the 2020 COVID-19 lockdown in South Africa"

Comment: A strength of the study is the comparison between the insomnia and no-insomnia groups; however, the title does not allude to any comparison. From the title, it seems that the study only focuses on people with insomnia.

AUTHOR: The title is now: "Worsening insomnia and mental health in self-identified insomniacs compared to non-insomniacs during the 2020 COVID-19 lockdown in South Africa"

Comment: L11 – 13: What period was used for the participants to self-identify sleep disorder symptoms? (was it for the period before or during the COVID-19 lockdown?

AUTHOR: The question was: "Do you suffer from or have you been diagnosed with any of the following sleep-related disorders or conditions?" so there was no reference to before or during lockdown. In the abstract, we mention "participants who identified a current or previous diagnosis of insomnia". We hope this reflects accurately the way we had phrased the question.

Comment: L15: What symptoms are being referred to?

AUTHOR: We now specified which symptoms we were referring to: "Symptoms of insomnia ($p<0.001$), depression ($p=0.001$) and anxiety ($p=0.001$) worsened in all participants during lockdown, compared to pre-lockdown measures."

Comment: L16: Be specific. What insomnia? Did not meet the criteria do be added to the insomnia group?

AUTHOR: We used the self-reported diagnosis of insomnia from the question "Do you suffer from or have you been diagnosed with any of the following sleep-related disorders or conditions?" however we also could gauge the severity of insomnia through the Insomnia severity index (ISI). Some participants self-identified as insomniacs and we kept them in the insomnia group as it was our criteria for classifying them in the insomnia group. However, when examining the results of the ISI which reports on symptoms of insomnia (severity of difficulties initiating sleep, staying asleep, and early morning awakenings, satisfaction with current sleep pattern, interference with daily functioning, noticeability of impairment attributed to the sleep problem, and degree of distress or concern caused by the sleep problem), some of those participants did not seem to report symptoms of insomnia. However, we agree this may seem confusing in the abstract and thus we have altered the text in the abstract to be more specific, and we elaborate on that aspect in our results (Figure 4 and text related to Figure 4 on pages 12-13 of the manuscript re:'no clinical insomnia' based on ISI).

Comment: L19-20: I feel that the last sentence is unnecessary. Relate the findings back to the research question (summarize conclusion)

AUTHOR: We have now changed this sentence to "This highlights vulnerability to mental health-altering situations in individuals with self-identified insomnia, and thus the necessity to provide mental health support for this patient population."

Comment: L22: Add lockdown to keywords

AUTHOR: 'Lockdown' has been added to the keywords.

Comment: L26. Please change quarantine to lockdown

AUTHOR: 'Quarantine' has been changed to 'lockdown'.

Comment: Perhaps it will be helpful to briefly summarize the different lockdown levels in South Africa, as the survey took place in lockdown 3 and 4.

AUTHOR: A brief summary of the lockdown levels was added into the introduction to provide some context.

"Alert Level 4 lasted the month of May and was characterised by a restricted exercise period between 6-9am. Individuals could walk, jog or cycle individually during this time, but national parks, where people typically exercise, remained closed during this time. Alert Level 3 was implemented in June 2020 and represented an easing of these restrictions."

Comment: L42 – 44: Results are generally not presented in the introduction

AUTHOR: We have modified the sentence but not removed it. Those previous studies (of which results

were presented) showed how lockdowns worldwide were associated with lower sleep quality, more anxiety and depression, which led directly to our research question targeting specially people with insomnia.

"Several studies in South Africa and worldwide1-3, showed lockdown-induced increases in sleep duration, a delay in sleep timing, and increases in symptoms of insomnia, depression and anxiety.4"

Comment: L75: How was the online survey distributed?

AUTHOR: we have now added the following information (in bold): "The online survey was distributed during Alert Levels 4 and 3 between 12 May and 15 June 2020 through academic online platforms with participants being further encouraged to pass on the survey through their own networks. Ninety percent of the sample was enrolled between 15 and 31 May 2020 during Alert Level 4."

Comment: L83: Be specific. What restrictions are you referring to?

AUTHOR: "Restrictions" has been replaced with the word "lockdown".

Comment: L99: How was insomnia defined?

AUTHOR: As described in our methods in the survey paragraph, it was defined as responding "insomnia" to the question: "Do you suffer from, or have you been diagnosed with, any of the following sleep-related disorders or conditions?". Hence, 'having insomnia' was self-identified. We intentionally did not define the symptoms of the sleep disorders described, because we wanted to understand how individuals with self-identified disorders experienced routine, mood and anxiety-related symptoms.

Comment: L102: How was "current" defined? I.e. was current during lockdown 4 and 3, when they survey was conducted?

AUTHOR: As shown in the way our question was phrased, we did not use the word 'currently' we only asked "Do you suffer from, or have you been diagnosed with any of the following sleep-related disorders or conditions? Select all that apply." In our manuscript text, we interpret the use of the present tense in our question as 'currently' but we never used the term itself in the survey.

Comment: L102 – 103 / 108 - 110: I am a bit confused. Were the participants asked about their depression and anxiety symptoms and was this used in the result or was the PHQ2 and GAD-7 scale used?

AUTHOR: Thanks for pointing out our lack of clarity. In the same way as we had them self identify as having insomnia but also asked them to fill in the ISI, we also asked them to identify if they had been diagnosed with any of a list of health conditions: "Do you suffer from or have you been diagnosed with any of the following chronic conditions (current or past)? Select all that apply." Amongst disorders listed (like asthma, heart disease, cancer), they could also choose depression and anxiety. We have now added this information in that paragraph.

Comment: L146: Please add the frequency for insomnia participants

AUTHOR: We added the count of insomnia participants "(n=197; 18.8% of the 1048 participants)".

Comment: L151 – 154: What was the denominator used for these calculations? It seems that 1 048 was used; I think 348 will be more relevant, as you are reporting for those with a sleep disorder.

AUTHOR: There is very little prevalence data in South Africa reporting on the frequencies of sleep disorders. Although our sample does not represent the South African population as a whole, it is useful, as a broad brush-stroke, to report on the prevalence of insomnia in the sample, as a crude indicator of insomnia prevalence in a demographic portion of South Africans. Hence we reported insomnia percentage as a percentage of the 1048 participants. The next sentences focus only on those with sleep disorders.

Comment: Figure 1: What is being presented; frequency of percentage? (y-title)

AUTHOR: The figure caption states: "Figure 1. Prevalence of self-reported sleep disorders among all participants (n=1048). RLS: Restless legs syndrome, CRD: Circadian rhythm disorder, PLM: Periodic limb movement disorder, OSA: Obstructive sleep apnea, CSA: Central sleep apnea.", which indicates that the frequency is a percentage of the whole sample.

Comment: L167: "Fewer" people? I think it's supposed to be more

AUTHOR: We didn't make a mistake, but the sentence is indeed maybe a bit awkward. It is indeed fewer people who had no clinically significant insomnia during lockdown than before lockdown. We have now bolded the no in 'no clinically significant insomnia' as it can easily be missed.

Comment: L178 – 179: Data not presented in the table?

AUTHOR: We have now added the use of sleep medication in Table 1. We also added a sentence in the text

on the absence of differences in terms of alcohol or caffeine consumption and exercise levels between the Insomnia and No-Insomnia groups.

Comment: L181: Please provide "n" for participants in the insomnia group on sleep-promoting medication

AUTHOR: We had the n in the text "(n=19, 14.1%)".

Comment: Figure 3: It is hard to see the group median and IQR, especially in the No-insomnia group. Can a different style be used?

AUTHOR: We have now changed this figure to show violin plots, which we hope show better the median IQR.

Comment: Should the data for the PHQ score, Insomnia group not be presented by dots?

AUTHOR: Yes apologies, the dots became lines as PHQ-9 takes only discrete values. We hope the new violin plots show better the PHQ-9 distribution in the Insomnia and No-Insomnia groups, before and during lockdown. We have redrawn all graphs of Figure 3 (ISI, PHQ-9 and GAD-7) with violin plots.

Comment: L218 / Figure 4: Is it "no clinical insomnia" (L218) or "no insomnia" (as per figure 4)

AUTHOR: It is 'no clinical insomnia' in the ISI category grouping. Thank you for highlighting this discrepancy. We have now corrected in Figure 4.

Comment: L240 – 241: How is there an increased vulnerability if they had no or subthreshold insomnia symptoms?

AUTHOR: It is possible that those participants who self-identified as having or having had insomnia were better (ie without active insomnia symptoms) before lockdown started. However during lockdown the 'priming' of having had insomnia, even only subclinical, may have led them to being more impacted by the negative mood/sleep effects of lockdown.

Comment: L256: Please see comment for L99. It would have helped to define insomnia (perhaps you can add this as part of the limitations)

AUTHOR: As mentioned previously in response to comment 15 above, we opted for self-identification of insomnia, not via a standardized definition, but rather via self-perception or previously given diagnosis. The ISI then was an actual measurement of the intensity of the symptoms. But we purposefully administered it after this self-identifying questions to avoid bias of interpretation. Thus we cannot really list this as a limitation, as it was an intentional omission.

Comment: L257 – 258: I don't think it is accurate to make this assumption. The question that grouped them into the Insomnia or No-insomnia group asked whether they have been diagnosed with insomnia or if they currently suffer from insomnia; so participants who had insomnia (regardless of current symptoms) had to answer in the affirmative.

AUTHOR: We now modified the sentence as such: "It may be that South Africans in this particular cohort misunderstand the meaning and criteria for a diagnosis of insomnia, or that participants who had previously had insomnia but did not currently suffer from it also answered in the affirmative. This may imply they had an insomnia identity or that they just remembered having had insomnia at some point in their lives."

Comment: L262 – 263: Relevance of this sentence?

AUTHOR: We have removed the sentence.

Comment: L290 – 291: Please see comment for L257 – 258 above

AUTHOR: We still believe we can't exclude that there may be an insomnia identity. We have left this sentence as it was only suggesting this hypothesis.

" Firstly, individuals may have an insomnia identity that they align to, even if they are not currently experiencing insomnia symptoms. 22 Additionally, or alternatively, based on their previous insomnia experience, they may be vulnerable to insomnia when stressful experiences present themselves (that is, show sleep reactivity10)."

Reviewer 1: Round 2

Date completed: 08 October 2024

Recommendation: Accept / Revisions required / Resubmit for review / Resubmit elsewhere / Decline / See

comments
Conflicts of interest: None

Does the manuscript fall within the scope of SAJS?
Yes/No
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Is appropriate and adequate reference made to other work in the field?
Yes/No
Is it stated that ethical approval was granted by an institutional ethics committee for studies involving human subjects and non-human vertebrates?
Yes/No/Not applicable
If accepted, would you recommend that the article receives priority publication?
Yes/No
Are you willing to review a revision of this manuscript?
Yes/No
With regard to our policy on 'Publishing peer review reports', do you give us permission to publish your anonymised peer review report alongside the authors' response, as a supplementary file to the published article? Publication is voluntary and only with permission from both yourself and the author.
Yes/No
Comments to the Author: Well done on the revision! The topic is of great contribution to the scientific community.

Reviewer 2: Round 2
Date completed: 28 October 2024
Recommendation: Accept / **Revisions required** / Resubmit for review / Resubmit elsewhere / Decline / See comments
Conflicts of interest: None

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Yes/No/Not applicable
If accepted, would you recommend that the article receives priority publication?
Yes/**No**
Are you willing to review a revision of this manuscript?
Yes/No
With regard to our policy on 'Publishing peer review reports', do you give us permission to publish your anonymised peer review report alongside the authors' response, as a supplementary file to the published article? Publication is voluntary and only with permission from both yourself and the author.
Yes/No

Comments to the Author:

Overall

- It will give more power to your manuscript if you can add in more characteristics of your population (occupation etc.) in your table 1
- Please indicate how insomnia was defined in the study (sleep difficulty for x number of days etc.
- In the methods and results, please indicate specifically what statistical test was used for what analysis as this is not clear in the article.
- Consider adding in the confidence intervals for your statistical tests
- Please be consistent with terms. Subthreshold vs subclinical symptoms

Abstract
Methods
Please indicate when the survey was conducted.

"Immediately before": I don't think this is the correct term to use. As you didn't assess symptoms "right" before lockdown (you assessed whether they've ever had insomnia).

Introduction
Line 69: Please be specific as to what population is referred to.

Materials and methods
Study design and setting
Line 92: Please add what academic platforms were used. Please add more information about the sampling strategy in your article (as the sampling strategy is important for the correct interpretation of your results). Please also add in the target population.

Participants
L101: Add in the lockdown period that you are referring to

Data and statistical analyses
L152-153: Please indicate specifically what test was used
L156: Please indicate specifically what test was used

Results
Figures: You are indicating frequency (%). Frequency is not the same as percentage. You can either present the frequency or the percentage (which is what you are presenting at the moment), not both

L199: "to report chronic medical conditions" – Were depression and anxiety included in this reporting?
L204: Are you referring to mean or median? Under table 1, it is stated that the median is presented
L217 – 219: ease add in the numbers to the text. It's hard to keep track to what you are referring to in the last sentence. Add in p-values as well for the "significantly increased"

Table 2
Please add overall sample size to title [N=]

L223: Is it changes in symptoms or changes in the "score"?
L225-236: Please indicate what tests were used to determine significance
Figure 3 Title: Remove "vertical". Please rephrase the last sentence as I'm not sure what it refers to
L272: You presented median age of participants, not the mean
L272 – 273: "limited awareness of sleep disorders" Add reference
L281: If you say unexpectedly high, what high was expected?
L284 – 285: But this is what the question asked? If they suffer from or have been diagnosed with the sleep

disorder?
L305 – 306: Add reference

[See Appendix 1 for Reviewer 2's comments made directly on the manuscript]

Author response to Reviewer 2: Round 2

1. It will give more power to your manuscript if you can add in more characteristics of your population (occupation etc.) in your table 1.

AUTHOR: We thank the reviewer for pointing out that the sample characteristics could be fuller. We note that characteristics of the sample have been published in a different paper (Davy et al 2021) and that it is not advisable to replicate results in different publications. We now make reference to the previous publication in the note to Table 1, to help readers access the full sample characteristics if they would like to.

2. Please indicate how insomnia was defined in the study (sleep difficulty for x number of days etc.

AUTHOR: We note that the survey was not designed to diagnose insomnia according to the formal criteria which define the disorder as a difficulty with sleep initiation or maintenance occurring for at least 3 nights a week, for 3 months or longer, and with the disorder not explained by other conditions, according to the Diagnostic and Statistical Manual of Mental Disorders (5th ed., text rev.; DSM-5-TR; American Psychiatric Association, 2022). We refer to participants' insomnia as self-identified and define this according to our survey question: "Do you suffer from, or have you been diagnosed with any of the following sleep-related disorders or conditions" with insomnia as an option amongst several sleep disorders (L111-112). We also note that we measure and report on participants' insomnia symptoms, which are measured for the time periods before and during lockdown.

3. In the methods and results, please indicate specifically what statistical test was used for what analysis as this is not clear in the article.

AUTHOR: We note that Table 1 specifies the analytic techniques used for continuous data (Mann Whitney) and categorical data (Chi-squared), and Table 2 specifies that sleep characteristics of those identifying with and without insomnia are analysed using mixed effects linear regression. We have now included the statistical tests used in Table 3 and to the legends of Figures 2 and 3.

4. Consider adding in the confidence intervals for your statistical tests

AUTHOR: We note that throughout the manuscript we include standard deviations and interquartile ranges, which, like confidence intervals, describe the extent to which there is variability in the data (either through dispersion or a range of true values). We respectfully consider that adding CIs will not provide too much additional information, but will increase difficulties with readability (the tables, for example, are already busy).

5. Please be consistent with terms. Subthreshold vs subclinical symptoms

AUTHOR: We have edited the use of "subclinical" in L335 to "subthreshold".

6. Please indicate when the survey was conducted.

AUTHOR: Added to L8 of the revised manuscript.

7. "Immediately before": I don't think this is the correct term to use. As you didn't assess symptoms "right" before lockdown (you assessed whether they've ever had insomnia).

AUTHOR: We thank the reviewer for pointing out this ambiguity. Participants endorsed previous or current insomnia in a single question (self-identification of having insomnia), but evaluated their symptoms of insomnia, depression and anxiety according to a before lockdown and during lockdown timepoint. We have amended the abstract on L8-11 to reflect this.

8. Line 69: Please be specific as to what population is referred to.

AUTHOR: We have amended the text to specify that we are referring to individuals with insomnia on L67

9. Line 92: Please add what academic platforms were used. Please add more information about the

sampling strategy in your article (as the sampling strategy is important for the correct interpretation of your results). Please also add in the target population.

AUTHOR: We have added the types of academic platforms used as requested, and note that the full sampling strategy was described in our previous publication (Davy et al 2021), which is clearly referenced in the manuscript. Our initial target population of the parent study was simply adults with a primary place of residence in South Africa prior to, and during, the period of COVID-19 restrictions. We have included a phrase in the Methods to note the target population and justification: Given the lack of data on sleep disorders among South Africans, we specifically left the inclusion criteria very broad for this analysis (Aim 1). Our participants included in the Analysis for Aim 2 are clearly described in the Methods, as a subset of those from the parent study comprising adults reporting (i.e. those self-reporting suffering from insomnia and those who did not report suffering from any sleep disorder).

10. L101: Add in the lockdown period that you are referring to

AUTHOR: We note that this sentence is highlighting that participants were required to reside in South Africa during the study period, which is defined a few lines prior in L91-92. We have not restated the time period to avoid repetition, since it is stated in close proximity to the sentence in L101.

11. L152-153: Please indicate specifically what test was used
12. L156: Please indicate specifically what test was used

AUTHOR: Response to 11&12: The exact tests are listed under the notes to tables 1-3 and Figures 2-3.

13. Figures: You are indicating frequency (%). Frequency is not the same as percentage. You can either present the frequency or the percentage (which is what you are presenting at the moment), not both.

AUTHOR: We note that we present "frequency (%)" in Table 3 and not in the figures. In Table 3 the frequency (number of participants from the group) is presented with the percentage shown in parentheses.

14. L199: "to report chronic medical conditions" – Were depression and anxiety included in this reporting?

AUTHOR: This was a general question, that did not specify categories or types of medical conditions. It likely may have included depression and anxiety, but we cannot separate out endorsement of these conditions from others. Separately, we measured symptoms of depression and anxiety.

15. L204: Are you referring to mean or median? Under table 1, it is stated that the median is presented

AUTHOR: The comparison of sleep duration between participants with insomnia who took or did not take sleep promoting medication is not presented in Table 1. This comparison was based on mean data.

16. L217 – 219: [Pl]ease add in the numbers to the text. It's hard to keep track to what you are referring to in the last sentence. Add in p-values as well for the "significantly increased"

AUTHOR: We have added line numbers for readability.

17. Please add overall sample size to title [N=]

AUTHOR: We have added this to Tables 1-3

18. L223: Is it changes in symptoms or changes in the "score"?

AUTHOR: The reviewer is astute in noticing that a change in score may not necessarily reflect change in symptoms. However, each question in each questionnaire asks about a distinct symptom, so a change in score does reflects a change in symptoms.

19. L225-236: Please indicate what tests were used to determine significance

AUTHOR: As noted in the legend for Table 2, these analyses reflect mixed effects linear regression.

20. Title: Remove "vertical". Please rephrase the last sentence as I'm not sure what it refers to.

AUTHOR: We thank the reviewer for noticing this error and have amended the text.

21. L272: You presented median age of participants, not the mean

AUTHOR: Thank you for noticing this – we have corrected this.

22. L272 – 273: "limited awareness of sleep disorders" Add reference

AUTHOR: These are speculative reasons, hence we have rephrased the sentence to indicate this.

23. L281: If you say unexpectedly high, what high was expected?

AUTHOR: We have rephrased this to say "unexpectedly higher", as it was not the absolute number of people self-reporting insomnia symptoms that was unexpected, but rather the ratio of those reporting insomnia who did not in fact score high on the ISI was unexpected.

24. L284 – 285: But this is what the question asked? If they suffer from or have been diagnosed with the sleep disorder?

AUTHOR: Yes – but it is still possible that among those who responded yes to "suffering from insomnia", there are individuals who do not understand the clinical definition of insomnia.

25. L305 – 306: Add reference

AUTHOR: We have added the reference.

Reviewer 2: Round 3
Date completed: 24 April 2025
Recommendation: Accept / **Revisions required** / Resubmit for review / Resubmit elsewhere / Decline / See comments
Conflicts of interest: None

Have the authors adequately addressed the concerns raised in the previous review?

Yes/No

Is the manuscript publishable in its current revised form?

Yes/No

If yes, do you recommend priority publication?

Yes/No

Comments to the Author:
Thank you for the opportunity to review the manuscript again. Please see below a few comments for you to consider.
Please do another read through of the manuscript, to check for spelling and grammatical errors (L77: nation-wide should be nationwide, some referencing numbers in the text is not superscripted)

Materials and methods

1. L94: Consider changing the term "sample" to "participants". You didn't present a sample size in this manuscript and it might be confusing to readers.

Results

1. L165: "Figure 1 displays the frequency of the various. The frequency is not presented in the graph. Percentages are presented in the graph. Please consider replacing the term frequency with percentage. (The frequency for insomnia is 197; the percentage is 18.8%).
2. The above statement also relates to comment 13 in the previous review. You are using the y-axis title "Frequency (%)" on your figures (figure 1, 2 and 4). You are only presenting Percentage (not both). Please consider changing the axis title to only Percentage. This also applies to the figure 1 title: please change frequency to percentage
3. L201: Please consider adding the "n" to the insomnia group on sleep-promoting medication (Insomnia group on sleep-promoting medication (7.0 ±1.3h))
4. L238: Percentages are being presented on figure 4, not frequency. Please consider changing frequency to percentage
5. Previous comment 15: Thank you for the clarification and please accept my apologies. I read this sentence as being a continuation from table 1.
    - L204: Are you referring to mean or median? Under table 1, it is stated that the median is presented. Response: The comparison of sleep duration between participants with insomnia who took or did not take sleep promoting medication is not presented in Table 1. This comparison was based on mean data.
6. Previous comment 18: Thank you for the clarification. Figure 3 is presenting the scores for the different screening tools and not the symptoms. I think it will be appropriate to refer to the L221 as the change in "ISI categories".
    - L223: Is it changes in symptoms or changes in the "score"? Response: The reviewer is astute in noticing that a change in score may not necessarily reflect change in symptoms. However, each question in each questionnaire asks about a distinct symptom, so a change in score does reflects a change in symptoms.

Figures and tables

7. Please see comment 2. This applies to figures 1,2 and 4
8. Figure 3 title. It seems that there is an unfinished sentence? (Categories for each variable (this part is all the same)
9. Figure 4: Consider using the same term for the label above the bar graph that is used in the notes below the graph and in the manuscript text (no clinical insomnia, subthreshold insomnia, clinical insomnia)

Author response to Reviewer 2: Round 3

1. L94: Consider changing the term "sample" to "participants". You didn't present a sample size in this manuscript and it might be confusing to readers.

AUTHOR: Sample has been changed to participate throughout.

1. L165: "Figure 1 displays the frequency of the various. The frequency is not presented in the graph. Percentages are presented in the graph. Please consider replacing the term frequency with percentage. (The frequency for insomnia is 197; the percentage is 18.8%).

AUTHOR: Thank you for the comment; this has been changed throughout.

2. The above statement also relates to comment 13 in the previous review. You are using the y-axis title "Frequency (%)" on your figures (figure 1, 2 and 4). You are only presenting Percentage (not both). Please consider changing the axis title to only Percentage. This also applies to the figure 1 title: please change frequency to percentage.

AUTHOR: Amended as required.

3. L201: Please consider adding the "n" to the insomnia group on sleep-promoting medication (Insomnia group on sleep-promoting medication (7.0 ±1.3h)).

AUTHOR: This has been added (it is the same n as stated in the previous sentence as it is the same subgroup).

4. L238: Percentages are being presented on figure 4, not frequency. Please consider changing frequency to percentage

AUTHOR: Amended throughout.

5. Previous comment 15: Thank you for the clarification and please accept my apologies. I read this sentence as being a continuation from table 1.

AUTHOR: No problem at all.

6. Previous comment 18: Thank you for the clarification. Figure 3 is presenting the scores for the different screening tools and not the symptoms. I think it will be appropriate to refer to the L221 as the change in "ISI categories".

AUTHOR: The word 'categories' has been added.

Please see comment 2. This applies to figures 1,2 and 4

AUTHOR: This has been amended.

2. Figure 3 title. It seems that there is an unfinished sentence? (Categories for each variable (this part is all the same)

AUTHOR: This has been corrected.

3. Figure 4: Consider using the same term for the label above the bar graph that is used in the notes below the graph and in the manuscript text (no clinical insomnia, subthreshold insomnia, clinical insomnia)

AUTHOR: This has been amended.

Appendix 1: Reviewer 2's comments on manuscript (Round 2)

Sleep and mental health changes in people with insomniainsomniacs during COVID-19 lockdownquarantine

Worsening insomnia and mental health in individuals with self-identified insomnia compared to those with no insomnia ~~non-insomniacs~~ during the 2020 COVID-19 lockdown in South Africaquarantine

Abstract

Objectives. Sleep and mental health difficulties have been observed in response to COVID-19 pandemic-induced lockdowns, but few studies described the impact of lockdown on individuals with self-reported insomnia. The purpose of this study was to compare the impact of lockdown on changes in symptoms of insomnia, depression and anxiety between persons with and without self-identified insomnia.

Method. 1048 adults sampled from the general South African population took part in this retrospective observational study. They completed an online survey assessing self-reported sleep disorders and symptom profiles of insomnia (Insomnia Severity Index), depression (Patient Health Questionnaire-2) and anxiety (Generalized Anxiety Disorder 7-item scale), immediately before and during a 5-week lockdown (March-April 2020). Comparative analyses were conducted between participants who identified a current or previous diagnosis of insomnia (n=135, Insomnia group, irrespective of whether they had current symptoms or not) and those reporting no sleep disorders (n=700, No-Insomnia group). Participants who reported multiple sleep disorders were excluded from the analyses (n=213).

Results. Symptoms of insomnia ($p<0.001$), depression ($p=0.001$) and anxiety ($p=0.001$) worsened in all participants during lockdown, compared to pre-lockdown measures. Time-by-group interaction effects were observed for measures (all $p<0.001$) such that the Insomnia group reported larger increases in insomnia ($p<0.001$), depression ($p<0.001$) and anxiety ($p<0.001$) scores compared to the No-Insomnia group during lockdown.

Conclusions. Participants with self-reported insomnia, even if currently asymptomatic, were more vulnerable to worsening insomnia, depressive and anxiety-related symptoms during lockdown, compared to those with no insomnia. This highlights vulnerability to mental health-altering situations in individuals with self-identified insomnia, and thus the necessity to provide mental health support for this patient population.

Key words: insomnia diagnosis, depressive symptoms, anxiety symptoms, vulnerability, lockdown

Significance

Individuals that self-identified themselves as insomniacs, even if they had minimal clinical symptoms of insomnia before COVID-19 associated lockdown quarantine, experienced worsening of sleep initiation and maintenance, as well as symptoms of depression and anxiety during lockdownquarantine. These findings suggest that these individuals either identify with an insomnia identity or are vulnerable to sleep and mental health difficulties in stressful contexts.

Introduction

The COVID-19 pandemic led to many changes in countries across the globe including the introduction of 'lockdowns' aimed at limiting the spread of viral infection. South Africa's first hard lockdown (Alert Level 5) lasted for five weeks (27th March – 30th April 2020). With the exception of essential workers, people were only allowed to leave home for medical treatment or essential services during this period. Work activities were modified to take place at home, and exercise was limited to the home environment. Alert Level 4 lasted the month of May and was characterised by a restricted exercise period between 6-9am. Individuals could walk, jog or cycle individually during this time, but national parks, where people typically exercise, remained closed during this time. Alert Level 3 was implemented in June 2020 and represented an easing of these restrictions. Theis lockdown periods provided a unique opportunity to examine the impact of changes in enforced routine-oriented behaviors on sleep disorders and sleep parameters, on a background of limited data describing the frequency prevalence of sleep disorders in the South African population.

Several studies in South Africa andIn an online survey done shortly after lockdown Alert Level 5 in 1048 adults, we like other studies worldwide[1-3], showed lockdown-induced increases in sleep duration, a delay in sleep timing, and increases in symptoms of insomnia, depression and anxiety.[4] The general increase in anxiety and depressive symptoms that occurred during lockdown described in many countries across the globe[5-7] including South Africa[4, 8] are presumed to be contributing factors to pandemic-related sleep difficulties. Stress is a well-described trigger for acute insomnia.[9] People who have previously experienced stress-induced insomnia may have an increase in sleep reactivity, described as a vulnerability for future insomnia with other stressful events.[10] The additional stress induced by lockdown measures

may therefore worsen the sleep of patients with insomnia, even if not currently symptomatic, more than those with no insomnia.

Other reasons for worsened insomnia could include changes in sleep patterns induced by lockdowns. Extensions and delays in bedtime and wake up time as reported in this population previously[4] may worsen sleep efficiency with longer times spent awake in bed. [2] Sleep extension is a key perpetuating factor for chronic insomnia[11] and sleep restriction is a key component of cognitive behavioral therapy for treatment of insomnia. [12] Thus, multiple factors may induce worsened sleep during lockdown in people with pre-existing insomnia compared to those without insomnia. Very few studies have investigated how these sleep and psychological changes in response to lockdown impacted people who had insomnia prior to lockdown.

Thus, our first aim was to report on the frequencyprevalence of sleep disorders in South African adults who responded to a nation-wide survey of lifestyle changes in response to the COVID-19 lockdown. Our second aim was to compare lockdown-induced changes in sleep and symptoms of insomnia, depression and anxiety between persons who identified as having insomnia to those who did not. We hypothesized that participants with self-reported insomnia would be impacted more severely by the pandemic-induced lockdown than those without insomnia.

Materials and methods

Study design and setting

We present a sub-analysis of data collected as part of a larger observational study[4] designed to assess routine-oriented lifestyle behaviors (work, sleep, physical activity, screen time, meal timing, caffeine and alcohol consumption) as well as symptoms of depression, anxiety and insomnia in South African adults before and during the 5-week COVID-19 pandemic national Alert Level 5 lockdown.

The online survey was distributed during Alert Levels 4 and 3 between 12 May and 15 June 2020 through academic online platforms, with participants being further encouraged to pass on the survey through their own networks. The full sampling strategy of this study was described previously4. Ninety percent of the sample was enrolled between 15 and 31 May 2020 during Alert Level 4. ,R and respondents were required to answer questions for two time points: before lockdown (defined as the three months prior to lockdown, i.e., Jan, Feb and Mar 2020) and during lockdown (defined as the five weeks of Level 5 lockdown, i.e., 27 Mar to 30 Apr 2020).

Participants

Persons older than 18 years of age, with a primary place of residence in South Africa before and during the period of COVID-19 restrictions lockdown were eligible to participate in the parent study. All participants (n=1048) gave informed consent prior to completing the survey. Ethical clearance was obtained from the [anonymised by journal administrator] Human Ethics Committee (review reference [institution anonymised by journal administrator]) and the Department of Psychology Ethics Committee at the [institution anonymised by journal administrator]. Data from all participants were used to report on the frequencyprevalence of sleep disorders (Aim 1). For Aim 2, we compared those participants who self-identified as suffering from insomnia but did not report suffering from any other sleep disorder (Insomnia

group, n=135) to those individuals who did not report suffering from any sleep disorder (No-Insomnia group, n=700). For this set of analyses, we therefore excluded all participants with any other or multiple sleep disorders (n=213).

Survey

Full details of the survey (including demographic, medical history, work, sleep, physical activity questions) have been published previously.[4] Customized questions about sleep disorders were asked as follows: “Do you suffer from, or have you been diagnosed with any of the following sleep-related disorders or conditions? Select all that apply.” Possible sleep disorders were listed as: **insomnia**, obstructive sleep apnea (OSA), central sleep apnea, snoring, narcolepsy, restless legs syndrome (RLS), periodic limb movement disorder (PLMD), sleep-related rhythmic movement disorder, bruxism, circadian rhythm disorders, parasomnias, other. Participants who indicated that they either currently suffer from insomnia, or have been diagnosed with it in the past, formed the Insomnia group. In a similar manner, we asked “Do you suffer from or have you been diagnosed with any of the following chronic conditions (current or past)? Select all that apply.” Amongst disorders listed (like asthma, heart disease, cancer), participants could select depression and anxiety. Pparticipants, thus, could indicated that they currently experienced, or were previously diagnosed with, depression and anxiety. Additionally, participants were asked to detail their usual bedtimes, wake-up times, total sleep times and use of sleep medications.

Symptoms of insomnia, depression and anxiety were assessed using the Insomnia Severity Index (ISI) [13], the Patient Health Questionnaire-2 (PHQ-2) [14] and the Generalized Anxiety Disorder 7-item (GAD-7) scale[15], respectively. The ISI was used to measure self-reported insomnia symptoms. It comprises seven items assessing the perceived severity of difficulties initiating sleep, staying asleep, and early morning awakenings, satisfaction with current sleep

pattern, interference with daily functioning, noticeability of impairment attributed to the sleep problem, and degree of distress or concern caused by the sleep problem. Scores range from 0-28, with higher scores indicating a higher degree of insomnia severity. Scores of 0–7 indicate "No clinically significant insomnia", 8–14 "Subthreshold insomnia", 15–21 "Clinical insomnia (moderate severity)" and 22–28 "Clinical insomnia (severe)". [16]

The PHQ-2 was used to assess the frequency of depressed mood and anhedonia. Scores range from 0-6, with higher scores indicating greater levels of depression and scores of 4 or more indicating likelihood of a depressive disorder. [14] The GAD-7 scale was included to screen for generalized anxiety disorder. Scores range from 0-21, with higher scores indicating greater levels of anxiety. [15]

Data and statistical analyses

Data are presented as mean with standard deviation (SD), median with interquartile range (IQR) or frequency (percentage). The Shapiro-Wilk test was used to assess normality. We created an ISI clinical category (>15 points) by combining ISI severity categories of moderate (15-21 points) and severe clinical insomnia (22-28 points) due to small numbers in the severe category. The total ISI scores, individual items within the ISI, GAD-7 and PHQ-2 scores were treated as non-parametric data and analysed accordingly. Between group comparisons were made using independent t-tests, Mann-Whitney U, Chi-squared or Fisher's Exact tests. Post hoc comparisons of categorical data were done using Fisher's Exact test, correcting for multiple comparisons. Comparisons between the before and during lockdown timepoints were made using mixed effects linear regression models, Wilcoxon Sign Rank test, McNemar's test or Bowker's test of symmetry. In addition to our primary analyses, we explored worsened and improved insomnia symptoms in the Insomnia and No-Insomnia groups, to examine how

lockdown changed the profile of symptoms within each group. We conducted this analysis using Fisher's exact test. Data were analyzed using Stata v15.1 (StataCorp, Texas, USA) and Graphpad Prism v5.02 (Graphpad.com). Statistical significance was accepted at $p<0.05$.

Results

Frequency*Prevalence* of self-reported sleep disorders in all participants

Of the 1048 participants, 348 (33.2%) indicated that they suffered from a sleep disorder. Figure 1 displays the frequencyprevalence of the various self-reported sleep disorders in this study. Insomnia was the most common sleep disorder reported (n=197; 18.8% of the 1048 participants) with 135 (12.9% of the 1048) participants reporting insomnia as the only sleep disorder.

Nearly three quarters of people with a sleep disorder reported having only one sleep disorder (n=246, 70.7%), a fifth reported having two sleep disorders (n=70, 20.1%), and 7.2% (n=25), 1.4% (n=5), 0.3% (n=1) and 0.3% (n=1) reported three, four, five or six sleep disorders respectively. The most commonly co-occurring sleep disorders were insomnia and snoring (n=23, 2.2%), insomnia and a parasomnia (n=19, 1.8%), insomnia and restless legs syndrome (n=17, 1.6%), insomnia and a circadian-related disorder (n=17, 1.6%), snoring and restless legs syndrome (n=12, 1,1%), circadian-related sleep disorder and a parasomnia (n=12, 1.1%) and insomnia and bruxism (n=11, 1.0%). Only 3% (n=31) of the population was taking medication to sleep including Amitriptyline, Clobazam, Zolpidem, Zopiclone, Quetiapine and melatonin.

[Insert Fig 1 here]

Changes in self-reported insomnia symptoms in all participants

The ISI scores in the whole sample worsened during lockdown compared to before lockdown. The total ISI score increased from a median of 4 (IQR: 2-8) before lockdown to 10 (4-15) during lockdown ($p<0.001$). The distribution of the proportions of the population in each of the three ISI severity categories was different before lockdown compared to during lockdown (Figure 2, $p<0.001$). Post hoc analyses showed that there were significantly more participants in the subthreshold ($p<0.001$) and clinical insomnia ($p<0.001$) categories during lockdown compared to before lockdown. Correspondingly, fewer people were categorized as having **no** clinically significant insomnia during lockdown than before lockdown ($p<0.001$).

[Insert Figure 2 here]

Comparisons between the Insomnia and No-Insomnia groups

The general characteristics of these two groups before lockdown are presented in Table 1. Compared to the No-Insomnia group, participants in the Insomnia group were significantly more likely to be women ($p=0.023$), to report chronic medical conditions ($p<0.001$), have higher insomnia ($p<0.001$), depressive ($p=0.002$) and anxiety ($p<0.001$) scores. The Insomnia group also containedincluded more individuals who self-reported a history of depression ($p<0.001$) and anxiety ($p<0.001$) and more participants in the Insomnia group (n=19, 14.1%) were taking medication to sleep compared to those in the No-Insomnia group (n=14, 2.0%, $p<0.001$). The mean total sleep time of those participants in the Insomnia group on sleep-promoting medication (7.0 ±1.3h) was not different to those who were taking other medications (n=31; 7.0 ± 0.8h) or those who did not supply any medication use information (n=85; 7.1 ± 1.1h, $p=0.965$). Finally, there were no differences between the Insomnia and No-Insomnia groups for self-reported alcohol or caffeine consumption, and exercise levels.

[Insert table 1 here]

The sleep characteristics of both groups before and during lockdown are shown in Table 2. There was a main effect of time for all variables indicating that the participants went to bed later, woke-up later, spent more time in bed and increased total sleep time during lockdown compared to before lockdown. There was no group main effect for any of the variables but there was a time-by-group interaction effect for wake-up time ($p=0.038$) and total sleep time ($p=0.042$). Specifically, the delay in wake-up time during lockdown was greater in the Insomnia group compared to the No-Insomnia group and only the No-Insomnia group had significantly increased total sleep time during lockdown compared to before lockdown.

[Insert table 2 here]

Figure 3 shows changes in symptoms of insomnia (ISI) (A), anxiety (GAD-7) (B) and depression (PHQ-2) (C) in response to lockdown for the Insomnia and No-Insomnia groups. ISI ($p<0.001$), GAD-7 ($p=0.001$) and PHQ-2 ($p=0.001$) scores increased significantly for all participants during lockdown compared to before lockdown. A time-by-group interaction effect was observed for ISI, GAD-7 and PHQ-2 (all $p<0.001$). Specifically, post hoc analyses indicate that the Insomnia group reported greater increases in ISI ($p<0.001$), GAD-7 ($p<0.001$) and PHQ-2 ($p<0.001$) scores compared to the No-Insomnia group during lockdown.

[Insert Figure 3 here]

The self-reported ISI severity categories of the two groups before and during lockdown are presented in Table 3. In all cases there were significant changes when comparing during

lockdown with before lockdown (all p<0.001) except for the participants with subthreshold insomnia in the Insomnia group (p=0.201).

[Insert table 3 here]

Figure 4 compares the frequency of participants in the Insomnia and No-Insomnia groups whose ISI symptoms got worse, better or remained unchanged during lockdown. Getting worse was defined as moving from a lower to higher ISI category (e.g., moving from the subthreshold group to the clinical group) while getting better was defined as moving from a higher to a lower category. Within the ISI-defined "No clinical insomnia" category before lockdown, more people in the Insomnia group reported worsening of insomnia symptoms during lockdown compared to the No-Insomnia group (80% vs 44.6%; p<0.001). More participants in the No-Insomnia group (53.4%) remained unchanged compared to the Insomnia group (20.0% p<0.001). Likewise, in the ISI-defined "Subthreshold insomnia" category before lockdown, more people in the Insomnia group (57.7%) got worse during lockdown compared to the No-Insomnia group (26.5%; p<0.05) and more of those in the No-Insomnia group got better (29.9%) compared to the Insomnia group (33.8%, p<0.05 post hoc tests on Chi^2; overall p<0.001). Of participants classified as having ISI-defined "Clinical insomnia" before lockdown, no differences in the number of participants who got worse, were unchanged or got better were observed between the Insomnia and No-Insomnia groups (p=0.474).

[Insert Figure 4 here]

Discussion

In this online survey of sleep and lifestyle behaviors before and during stringent Alert Level 5 lockdown (March 25th to May 1st, 2020) in South Africa, a third of participants reported having a sleep disorder, most commonly insomnia, with an overall worsening of insomnia symptoms in the whole population during lockdown when compared to before lockdown. Participants with self-reported insomnia before lockdown were more likely to have worse insomnia during lockdown compared to those with no self-reported sleep disorder. This was particularly true for those who, despite self-identifying insomnia, endorsed no or subthreshold insomnia symptoms on a standardized insomnia questionnaire, indicating an increased vulnerability to the circumstances of lockdown in these participants.

The number of people presenting with prevalence of sleep disorders in our sample (33%) was similar to that found in other studies done on South Africans although in older age groups. [17, 18] The observationsprevalence of self-reported OSA and RLS were lower than expected in our study, but this may be due to the mean low age of respondents and the limited awareness of sleep disorders in the South African population. Two studies using South African data have estimated the prevalence of moderate to severe OSA in middle-aged and older South Africa to be over 25%.[19, 20] The occurrence prevalence of insomnia (18.8%) was lower than that found in a previous study across many countries including South Africa (45%)[17] and higher than a study on South African students (7.5%).[21] More population studies are required for more accurate prevalence data of all sleep disorders in South Africa.

We observed discrepancies in insomnia symptoms when comparing the No-Insomnia and Insomnia Groups. There was an unexpectedly high proportion of participants with self-reported insomnia who did not have an ISI score greater than 14. It may be that South Africans in this particular cohort misunderstand the meaning and criteria for a diagnosis of insomnia, or that participants who had previously had insomnia but did not currently suffer from it also answered

in the affirmative. One possibility is that these participants have an insomnia identity, [22] or simply, that they just remembered having had insomnia at some point in their lives.This would imply they had an insomnia identity. [22] Despite this inconsistency, the Insomnia group overall had higher mean ISI scores compared to the No-Insomnia group. A high proportion of asymptomatic patients with previous insomnia in the Insomnia group may explain why there was no difference in most of the sleep measures between the Insomnia and No-Insomnia groups before lockdown. The normal sleep duration was also not due to taking medication as there was no increase in sleep time for that subgroup.

There was an increase in the severity of insomnia symptoms and severity categories in the whole population during lockdown compared to before lockdown consistent with other studies. [23] Most previous studies did not differentiate between patients with sleep disorders and those without. Our data shows that in a group of individuals where other sleep disorders have been specifically excluded, there is a worsening of insomnia, depression and anxiety scores during lockdown when compared to pre lockdown scores. The association between poor sleep health and an increase in anxiety and depression during the pandemic has been shown across multiple countries and studies. [24, 25] Lockdown and the pandemic itself would have exacerbated anxiety for various reasons including, fear of contracting the virus, separation from loved ones, worries about the economy, potential job losses and financial hardship.

Participants in the Insomnia group were significantly more likely to be women and have chronic conditions, especially depression and anxiety, similar to patients with insomnia worldwide. This finding confirms the strong and consistent association between sleep problems and self-reported anxiety and depression. [25] When compared to the No-Insomnia group during lockdown, the Insomnia group had more severe changes in insomnia, depression and anxiety symptoms indicating an increased vulnerability to a stressful situation. We had anticipated such findings as

both anxiety and depression have bi-directional relationships with poor sleep. [25] The association found does not, however, imply a causative mechanism. It is unclear whether this vulnerability will lead to chronic insomnia, anxiety and depression post lockdown as shown in some studies[26] or whether this worsening is acute and self-limiting as in intermittent acute insomnia. [27] Our data showed that individuals who self-reported current or previous insomnia, but who had no or subthreshold insomnia symptoms before lockdown, were disproportionately likely to experience worsening symptoms during lockdown, in comparison to those who did not self-identify insomnia. Two possible explanations may account for these findings. Firstly, individuals may have an insomnia identity that they align to, even if they are not currently experiencing insomnia symptoms. [22] Additionally, or alternatively, based on their previous insomnia experience, they may be vulnerable to insomnia when stressful experiences present themselves (that is, show sleep reactivity[10]). Both of these mechanisms independently predict an increased likelihood of worsening of sleep under stressful conditions in people who have had previous episodes of insomnia.

Limitations

This survey was mainly answered by younger adults (mean age: 27 years) with access to the internet, and thus the data cannot be extrapolated to an older or the general population in South Africa. The population was limited to the social media networks of the researchers and their professional societies and the student populations which, while unavoidable due to lockdown, limited the reach of the survey. We acknowledge that there may have been a recall bias of our participants when asked to evaluate their symptoms prior to lockdown. The study also relied on self-reported data for insomnia, depression and anxiety diagnoses, which participants may report inaccurately.

Conclusion

In this sample South Africans experienced worsening of insomnia, depression and anxiety during lockdown. These effects were more pronounced worse in individuals who self-identified as suffering from insomnia, either currently or previously. Furthermore, participants withwho self-identifyiedng insomnia, but who reported either no or subclinical insomnia symptoms before lockdown, were more likely to experience worsened insomnia during lockdown, in comparison with those who did not identify with current/previous insomnia. This highlights higher vulnerability to mental health-altering situations in individuals with self-identified insomnia, and thus the necessity to provide mental health support for this patient population.

Finally, there is also a need for bBetter prevalence data and more insight into the understanding of sleep disorders by the South African population are required.

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TABLES

Table 1. General characteristics of the Insomnia and No-Insomnia groups.

	Insomnia (n=135)	No-Insomnia (n=700)	p-value
Age (y)	27 (21, 43)	27 (21, 40)	0.064
No. of women, n (%)	108 (81.8%)	500 (72.4%)	**0.023**
Employment status (employed: not employed: student), n (%)	60:10:65 (45:7:48%)	334:46:320 (48:6:46%)	0.771
Chronic medical condition, n (%)	98 (72.6%)	324 (46.3%)	**<0.001**
ISI score	9 (5-12)	2 (1-6)	**<0.001**
PHQ-2 score	2 (0, 2)	1 (0, 2)	**0.002**
GAD-7 score	6 (3, 8)	4 (1,6)	**<0.001**
Self-reported history of:			
Depression n (%)	55 (40.7%)	141 (20.1%)	**<0.001**
Anxiety n (%)	64 (47.4%)	167 (23.9%)	**<0.001**
Alcohol (units/day)	2 (0, 4)	1 (0, 4)	0.636
Caffeine (units/day)	2 (1, 3)	2 (1, 3)	0.909
Exercise (MVPA min/wk)	180 (0, 360)	180 (30, 360)	0.959
Use of sleep promoting medications	19 (14.1%)	14 (2.0%)	<0.001

Note. Data are presented as median (interquartile range) or count (%). ISI: Insomnia Severity Index; PHQ-2: Patient Health Questionnaire 2-item, GAD: Generalized Anxiety Disorder 7-item scale; MVPA: moderate and vigorous intensity physical activity. P-values were determined using, Mann-Whitney U and Chi-squared tests as appropriate.

Table 2. Self-reported sleep characteristics of the Insomnia and No-Insomnia groups before and during lockdown.

	Insomnia (n=135)		No-Insomnia (n=700)		p-values		
	Before	**During**	**Before**	**During**	**Time effect**	**Group effect**	**Interaction effect**
Bedtime (hh:mm)	22:49 ±1:35	24:23 ±2:35	22:33 ±1:10	23:47 ±2:05	<0.001	0.076	0.055
Wake-up time (hh:mm)	06:30 ±1:24	08:36 ±2:34	06:17 ±1:02	8:02 ±2:01	<0.001	0.135	0.038
Time-in-bed (h)	7.74 ±1.26	8.21±1.87	7.70±1.18	8.24±1.51	<0.001	0.779	0.957
Total sleep time (h)	7.04±1.06	7.08±1.92	7.28±1.06	7.65±1.57	<0.001	0.058	0.042

Note. Data are presented as mean ± standard deviation). *p*-values were determined using mixed effects linear regression models covarying for age.

Table 3. ISI severity categories for the Insomnia and No-Insomnia groups before and during lockdown.

	Insomnia (n=135)		No-Insomnia (n=700)	
	Before	During	Before	During
ISI 0-7: No clinical insomnia	60 (44%)	18 (13.3%)	350 (50.0%)	560 (80.0%)
ISI 8-14: Subthreshold insomnia	52 (38.5%)	41 (30.4%)	222 (31.7%)	117 (16.7%)
ISI >15: Clinical insomnia	23 (17%)	76 (56.3%)	128 (18.3%)	23 (3.2%)

Note. Data are presented as frequency (%). ISI – Insomnia Severity Index.