

Sports participation volume and psychosocial outcomes among healthy high school athletes

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Sports Participation Volume and Psychosocial Outcomes Among Healthy High School Athletes
Journal of Clinical and Translational Research

Dear Dr. Howell,

Reviewers have now commented on your paper. You will see that they are advising that you revise your manuscript. If you are prepared to undertake the work required, I would be pleased to reconsider my decision.

For your guidance, reviewers' comments are appended below.

If you decide to revise the work, please submit a list of changes or a rebuttal against each point which is being raised when you submit the revised manuscript. Also, please ensure that the track changes function is switched on when implementing the revisions. This enables the reviewers to rapidly verify all changes made.

Your revision is due by Jul 12, 2020.

To submit a revision, go to <https://www.editorialmanager.com/jctres/> and log in as an Author. You will see a menu item call Submission Needing Revision. You will find your submission

record there.

Yours sincerely

Nicholas G Murray, Ph.D.
Editorial Board Member/Associate Editor
Journal of Clinical and Translational Research

Reviewers' comments:

Reviewer #1: Well written manuscript on a topic relative to mental health and sport. Comments are focused around expansion of literature and clarification in introduction and results and methods. Please see line comments below.

Graphical Abstract

I think an infographic or "poster presentation-like" graphic may be more beneficial for explaining so it can include the participants, setting, and the non-significant variables.

Abstract

Line 14: In methods refer to them as participants then in Line 26, replace adolescents with high school athletes just for consistency.

26: correct to "participated in this study" to make a complete sentence.

34: I would add suggest adding in a sentence at the end of results that there was no association with other variables of PROMIS since the title and objective is the outcomes and not just depression.

36: Reword so it reads that hours were associated with depressive symptoms. Adding the non-significant variables may be beneficial.

Introduction

The term adolescence needs to be more defined in your introduction. The first mentioning is children and adolescents, then the second paragraph refers to adolescents. Are these high school aged as well? Are these 8-13 year olds? 14-18?

Additional background literature on PROMIS may be necessary in the introduction as well.

Methods

Page 5, Line 52-59: General geographic location is important too. Is this school district a title I school or non? How many high schools? Is 1 school district 1 school? 3 schools? A little bit more information about the school would be beneficial here.

Page 6, Line 4-5: Were participants excluded if they were currently diagnosed or seeking treatment for mental health issues? Athletes may be returned to participation but actively seeking treatment or therapy for anxiety, depression, etc.

Why concussion and not injury in general due to multifaceted psychosocial complications?

Line 24: write out PROMIS here and then abbreviate since this is first mention aside from abstract.

Line 29 and 36: gender or sex? If scaled as biological sex (male or female) then sex needs to be used. If using social identity then gender is appropriate term here.

Line 29-38: What is the justification for controlling for gender and BMI? It would be important to see sex differences between males and females in the analyses.

Line 31: Was there any length of time that was required to be deemed as a sport played in their life? If an athlete participated in youth soccer for a week before quitting, is that a sport played? 1 practice of football, but does that constitute as having played football?

Results

Page 9, Line 28: Stick with high school athletes over adolescents as it is more direct towards your population since you recruited from a school district of HS athletes and not the general community.

Line 55: State these other PROMIS scores and p values for reader.

Discussion

Page 10, Line 26: What is the age range of this group.

Page 11, Line 36: Clarify these unique aspects of the community. Is this an SES factor? Geographic factor?

Same with environmental factors? It is unclear as to what these are which may limit the entire generalizability of your sample's results to other samples not relative to who was studied.

Reviewer #2: Overall the manuscript is in great shape and provides insightful findings for researchers and clinicians to be aware of. Below I provide a general statement about each section of the manuscript, followed by specific line items to consider and revise where possible. Please note that the line numbering provided for review doesn't always line up perfectly with the text, so ranges may be given to "highlight" the sentence or statement being discussed.

Title: Consider reporting (and stating this in the methods) the manuscript in accordance with the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) guidelines (link here: <https://www.strobe-statement.org/index.php?id=strobe-home>). These consensus checklists ensure authors provide critical details in the manuscript, one of which is explicitly stating the study design either in the title or abstract (please pick which you feel best fits).

GRAPHICAL ABSTRACT: Though a figure displaying each participant and the relationship between depression and hours/week is impactful, it might not fully capture the message your text abstract provides. Consider a more "infographic" designed graphical abstract (please look through previous journal issues for examples). As is, this figure does not fully highlight the problem, population, tools used, or the significance of the results.

ABSTRACT: Overall the abstract provide a well-rounded explanation of the study. Minimal edits provided below.

Page 3, lines 26-29: Consider removing "After adjusting for the independent effect of age and varsity team status," from lines 26-29, and state these confounding variables being hinted at on page 3, line 24. The main reason for this suggestion is 1) it will reduce text without sacrificing meaning so that 2) the other important, but non-significant findings can be discussed (i.e. the other PROMIS domains).

Page 3, lines 31-34: Consider also providing the R² value for your models here in the abstract, as well as in the results section and tables.

INTRODUCTION: Succinctly describes the background/importance of the study without going beyond the scope of the paper. Minimal edits are suggested.

Page 4, lines 16-17: Instead of stating "positively influence" consider providing a more direct statement (e.g. "greatly reduce"). This may help with readers immediately understand the direction of the relationship.

METHODS: Overall the methods convey the majority of needed information, however the delivery could be more direct. Additional details are also warranted to provide full disclosure to readers. The sub-headers of IV, DV, and Covariates are a bit redundant with the Study Design and Participants paragraph above. Consider reformatting the material so that there is a Study Design and Setting section (indicating very briefly the study/PPE protocol employed), and then a Instrumentations and Procedures section with detail the specifics of the main outcomes. I believe the content provided is appropriate, but the reformatting will help provide flow and clarity.

Page 5, lines 51-52: Please provide greater detail about consent. As is, there is no statement that clearly indicates participants provided both assent and consent before data collection.

Page 6, line 7: What about excluding those with a history or anxiety, depression, or any other diagnosed psychological disorder? These would likely be a significant confounder to these findings. Please describe if individuals were screened for these.

Page 6, line 14: It appears the hours/week of sport participation are self-reported prior to any structured sport participation. Further reading in the discussion confirms this (please specifically address the time period/difference in data collection here in the methods). This may be influential, especially among new/freshman participants who may not be aware of the hours/week demand of high school sports. Was academic standing (e.g. freshman/first year) captured? If so, it may be important to 1) add these details to the demographic table. Further, this may be substantially influenced by recall bias if sport participant did not occur since ~3 months-1 year before the next season. Please consider these factors and address in the limitation if you are in agreement.

Page 6, lines 24-26: Note here and throughout: I normally would not make grammatical corrections as this is minor factor for copyediting to handle, but this journal publishes online in the raw format, and therefore I will provide corrections. Please detail what "PROMIS" and "QOL" stand for here to help readers who may just be learning about this topic area.

Page 6, lines 41-46: The wording of this question seems odd (would expect it to say "you" rather than "athlete"). Did the athlete themselves complete the survey, or did a parent/coach/etc do so? If it was "you", that is fine, just verifying the survey item.

Page 6, line 49: Consider providing a summary of cases where the range was averaged (i.e. ##/###; #%) so readers can better understand how frequent of an issue this was. If a significant % of cases did this, then this could be another concern for readers to the precision captured from a self-reported estimate of hours/week of sport activity.

Page 7, lines 16-19: Please move the statement, "(i.e. zero equals "with no trouble" or "never", four equals "not able to do" or "almost always") up to page 7, lines 9-11 when describing the item response range.

Page 7, lines 21-23: Is the survey also reliable? Please specify both reliability and validity separately as they both important psychometric properties to consider.

Page 7, lines 29: Please change gender to sex (as indicated earlier in the manuscript) here and throughout since the biological appears to have been assessed.

Page 8, lines 46-51: As is, the FAS is somewhat vague and not clear how it is scored. Please provide greater detail and/or an example scoring. Greater detail provided on the FAS coupled with methods reformatting should provide readers with greater/direct understanding of the study protocol.

Page 8, line 55: alpha should be = 0.05, not < since it is a set threshold value.

Page 9, line 26: Please provide a reference for $p < .20$ as a cutoff for variables being included in the model, if possible.

Page 9, lines 26-28: Please specify what exactly the model assumptions were. By specifying

exactly was assessed, the reader can then understand better what exactly occurred.

RESULTS: Overall the results are straight forward and appropriate. The major consideration is to provide more specific descriptions of the beta values and how to interpret (i.e. describe the magnitude/direction as a 1-unit change resulted in a increase/decrease in X).

Page 9: Please provide descriptives for the PROMIS outcome scores either in the results text, or in one of the Tables so other researchers/readers can understand the observed scores of this cohort.

Page 9, lines 48-52: The results paragraph is very succinct, however, it may be important here to describe one of the models and interpretation of the beta values. For example, "For every one hour/week increase in sport participation, PROMIS depression symptoms decreased by -0.074 (95% CI: -0.138, -0.010)". Most researchers/readers will understand this, but it is important for manuscripts to be clear to both new and experienced researchers/clinicians.

DISCUSSION: Overall this discussion is well written/balanced, but similar to the results, believe it needs more direct interpretation of the findings. No specific values are provided in the discussion, which is fine, but believe they should be discussed more directly. For example, depression symptoms on PROMIS was statistically significantly associated with sport participation, but is this clinically meaningful? Is a 0.074 decrease in depressive symptoms for every hour/week of sport valuable (i.e. 13 hours/week needed to decrease depressive symptoms by 1 point) impactful? What is the reliable change index or minimal clinically important difference for the PROMIS? Consider focusing more of the discussion on how this translates to clinical practice, and if this beta value is clinically meaningful or more so statistically significant. Since this journal focuses on translating research to clinical practice, this will likely be critical for the readers.

Page 10, lines 36-56: The overall point raised about the discussion will likely be best addressed here. Overall the findings are in line with other work, but it is still important to look at the statistical findings through a clinical applicability lens. I believe doing so will provide greater insights and may actually change the overall take home of the manuscript. My immediate interpretation is that this may not actually be a clinically meaningful relationship observed. This does not mean 1) the findings here are not important or 2) that sport participation isn't important to psychosocial factors, but rather that in a sample of only high school athletes, the hours/week participating might not be as important as just being a high school athlete and being physically active. Please note my interpretation may differ from the authors, and they do not need to align if there is disagreement.

Page 11, lines 16-19: as noted earlier, please indicate that these data were collected in during the May prior to sport participation in the methods. This is an important factor for readers to know when interpreting the work, and often times discussions are not thoroughly read.

Page 12, lines 4-9: Since this was a HS age group, were students 1) still in classes in May when completing the surveys/PPEs, 2) are they required to complete PE courses or PA as part of their

curriculum? If so, this may be an important limitation to consider and address.

TABLES 1, 2, and 3: Please consider providing the R² value for each univariable and multivariable model. Also consider providing the degrees of freedom for each model (if all models for a given table are identical, consider making a superscript legend indicating this).

FIGURE 1: To the discretion of the authors, this figure should either be improved or removed. As is, it does not provide more insight beyond the tables provided, except that it highlights the zero inflated count of PROMIS (but this is already noted/understood in the statistical analysis section).

If the authors chose to keep the figure, consider adding the following to it make it more informative (since figures are often stripped from manuscripts and used in presentations):

- Statistical model parameters (beta, r², p-value)
- Consider making the dots partially transparent to allow easier view of overlapping participants.
- Consider plotting the 95% CI for beta as well.

Consider placing the sample size either in the figure or in the figure legend.

Author's response

Manuscript ID: JCTRes-D-20-00048

Title: Sports Participation Volume and Psychosocial Outcomes Among Healthy High School Athletes

We sincerely thank the reviewers for their thoughtful and helpful critiques of our manuscript submitted to Journal of Clinical and Translational Research. We have carefully revised the manuscript based on the critiques of the reviewers and responded to each of the points raised in bold font within this document. As a result, the quality of the manuscript has improved substantially. All changes within the revised manuscript have been noted in yellow highlighted text, and all line numbers refer to the revised manuscript, unless otherwise noted.

Reviewer #1:

Well written manuscript on a topic relative to mental health and sport. Comments are focused around expansion of literature and clarification in introduction and results and methods. Please see line comments below.

Graphical Abstract

Reviewer comment: I think an infographic or "poster presentation-like" graphic may be more beneficial for explaining so it can include the participants, setting, and the non-significant variables.

Author response: Thank you for this comment, we have revised the graphical abstract and included the image in the revised main document (page 2, line 6).

Abstract

Reviewer comment: Line 14: In methods refer to them as participants then in Line 26, replace adolescents with high school athletes just for consistency.

Author Response: The abstract has been edited accordingly, thank you. We now refer to the study participants as “participants” in the methods section and “high school athletes” in the results section of the abstract (page 3, line 17 and line 23).

Reviewer comment: 26: correct to "participated in this study" to make a complete sentence.

Author Response: We appreciate this edit, the abstract now reads, “A total of 230 high school athletes participated in this study (mean=15.4±1.2 years of age)” (page 3, lines 17-18).

34: I would add suggest adding in a sentence at the end of results that there was no association with other variables of PROMIS since the title and objective is the outcomes and not just depression.

Author response: We agree it is important to present balanced results. We added, “Sports participation was not significantly associated with any other psychosocial domain scores on the PROMIS questionnaire” to the end of the results section of the abstract (page 3, lines 19-21).

Reviewer comment: 36: Reword so it reads that hours were associated with depressive symptoms. Adding the non-significant variables may be beneficial.

Author response: The sentence now reads, “More hours of sports participation was significantly associated with lower depressive symptoms, but no other psychosocial domain” (page 3, lines 22-23).

Introduction

Reviewer comment: The term adolescence needs to be more defined in your introduction. The first mentioning is children and adolescents, then the second paragraph refers to adolescents. Are these high school aged as well? Are these 8-13 year olds? 14-18?

Author response: We agree it is important to clarify the age group. We used the World Health Organization definition for adolescence, which includes ages 10-19 years of age. Thus, we have added “ages 10-19 years old” in parentheses at the end of the first sentence of the Introduction (page 4, line 28).

Reviewer comment: Additional background literature on PROMIS may be necessary in the introduction as well.

Author response: Thank you for this comment; we have revised the introduction to expand the scope of literature we cite and include a statement on the previous use of the PROMIS, “We hypothesized that more time spent participating in sport would be associated with fewer adverse health symptoms in each of the aforementioned psychosocial and physical domains assessed on the Patient Reported Outcomes Measurement Information System (PROMIS) Pediatric Profile 25 Quality of Life (QoL) questionnaire. This questionnaire has been validated for pediatric and adolescent populations, and previously used specifically to study psychosocial outcomes in young athletes (Pilkonis et al., 2014; Potter et al., 2020)” (page 5, lines 63-69).

Methods

Page 5, Line 52-59: General geographic location is important too. Is this school district a title I school or non? How many high schools? Is 1 school district 1 school? 3 schools? A little bit more information about the school would be beneficial here.

Author response: Thank you for this comment, we agree it is important to provide this information. We have added, “Students were from multiple schools within a single school district of the greater Denver-metro area, between the ages of 13-18 years, and received full clearance to participate in sports at the time of examination” (page 6, lines 74-77).

Reviewer comment: Page 6, Line 4-5: Were participants excluded if they were currently diagnosed or seeking treatment for mental health issues? Athletes may be returned to participation but actively seeking treatment or therapy for anxiety, depression, etc.

Author response: Thank you for requesting this clarification as we believe it will benefit readers. Athletes were not excluded from participation for mental health issues. This is now clarified in the manuscript, “Participants were not excluded on the basis of past or current mental health conditions” (page 6, lines 78-79).

Reviewer comment: Why concussion and not injury in general due to multifaceted psychosocial complications?

Author response: Thank you for raising this question - students were not allowed to participate in sports until all symptoms of a concussion subsided according to school rules. This is in line with our inclusion criteria that they must have received full clearance to participate in sports at the time of assessment, thus ensuring that they were healthy and mitigating the effect of concurrent injuries on our outcomes of interest.

Reviewer comment: Line 24: write out PROMIS here and then abbreviate since this is first mention aside from abstract.

Author response: Thank you for pointing this out, we now have the name written in the Introduction (page 5, lines 65-66) and abbreviate the questionnaires in the methods section.

Reviewer comment: Line 29 and 36: gender or sex? If scaled as biological sex (male or female) then sex needs to be used. If using social identity, then gender is appropriate term here.

Author response: Thank you for this recommendation, we have revised the manuscript to report “gender” throughout.

Line 29-38: What is the justification for controlling for gender and BMI? It would be important to see sex differences between males and females in the analyses.

Author response: We wish to point out that we did not control for gender and BMI in our analysis. In this description, (page 7, lines 116-118), we explain the potential confounding variables that we obtained and considered as covariates in our analysis, but did not necessarily control for them until after we determined the univariable association with hours/week in sport (Table 1). In our statistical analysis section, we note that covariates were included if they demonstrated a univariable relationship with hours/week in sports ($p < 0.20$ in order to include a broad set of potentially contributing variables). Based on our results (Table 1), we therefore included age and competition level as covariates, consistent with this a-priori threshold approach.

Related to the gender difference question posed by the reviewer specifically, we did not find an association between gender and hours/week in sport (Table 1: p value = 0.90), and therefore there was not adequate justification to control for gender in our multivariable model, as it would not have added any significant effect to the model.

Reviewer comment: Line 31: Was there any length of time that was required to be deemed as a sport played in their life? If an athlete participated in youth soccer for a week before quitting, is that a sport played? 1 practice of football, but does that constitute as having played football?

Author response: Thank you for this question, as it is an important point to consider. We specifically asked participants to list the organized sports (structured time with a coach present) that they participated in their life- this is specified on page 8, lines 139141, of the revised manuscript. However, we did not put a time limit on this. We acknowledge this is a limitation of our study on page 13, lines 250-252, of the revised manuscript, “Also, we did not ask about the length of time participants were engaged in various sports or physical education or activity classes leading to potential variability in the magnitude of this factor.”

Results

Reviewer comment: Page 9, Line 28: Stick with high school athletes over adolescents as it is more direct towards your population since you recruited from a school district of HS athletes and not the general community.

Author response: We have replaced “adolescents” with “high school athletes” throughout the manuscript where appropriate.

Reviewer comment: Line 55: State these other PROMIS scores and p values for reader.

Author response: We agree that the specific PROMIS domains that were not significantly associated with hours/week in sport should be called out for the reader to avoid misinterpretation, and we have modified so that this is now included (page 10, lines 174-175). The p values are included in Table 3. In line with convention to

avoid duplication between the tables and the text, we have elected to point the reader to Table 3 at the end of providing the information about the data we obtained, maintain the p values in the table, and not specifically list them in the text (page 10, lines 172-177).

Discussion

Reviewer comment: Page 10, Line 26: What is the age range of this group.

Author response: The age range is reported in Table 1 (12.5 – 18.1 years old). We have added this to the discussion, “Among our cohort of high school athletes (ages 12.5 – 18.1 years old), more hours per week of in-season participation in their primary sport was significantly associated with lower self-reported depressive symptom ratings, even after accounting for age and competition level” (page 10, line 184-186).

Reviewer comment: Page 11, Line 36: Clarify these unique aspects of the community. Is this an SES factor? Geographic factor? Same with environmental factors? It is unclear as to what these are which may limit the entire generalizability of your sample's results to other samples not relative to who was studied.

Author response: Thank you for this comment, we have more directly addressed unique aspects of the community. “These environmental factors, possibly including socioeconomic status, weather, and geography unique to the greater Denver-metro area, may influence the psychological and physical domains measured by the PROMIS questionnaire” (page 12, lines 221-222).

Reviewer #2:

Reviewer comment: Overall the manuscript is in great shape and provides insightful findings for researchers and clinicians to be aware of. Below I provide a general statement about each section of the manuscript, followed by specific line items to consider and revise where possible. Please note that the line numbering provided for review doesn't always line up perfectly with the text, so ranges may be given to "highlight" the sentence or statement being discussed.

Reviewer comment: Title: Consider reporting (and stating this in the methods) the manuscript in accordance with the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) guidelines (link here: <https://www.strobe-statement.org/index.php?id=strobe-home>). These consensus checklists ensure authors provide critical details in the manuscript, one of which is explicitly stating the study design either in the title or abstract (please pick which you feel best fits).

Author response: We have revised the title of our manuscript accordingly on Page 1, lines 1-2, “Sports Participation Volume and Psychosocial Outcomes Among Healthy High School Athletes: A cross-sectional study.”

Graphical Abstract

Reviewer comment: Though a figure displaying each participant and the relationship between depression and hours/week is impactful, it might not fully capture the message your text abstract provides. Consider a more "infographic" designed graphical abstract (please look through previous journal issues for examples). As is, this figure does not fully highlight the problem, population, tools used, or the significance of the results.

Author response: Thank you for this recommendation, we agree and have created an improved graphical abstract accordingly on page 2, line 6.

Abstract

Reviewer comment: Overall the abstract provides a well-rounded explanation of the study. Minimal edits provided below.

Reviewer comment: Page 3, lines 26-29: Consider removing "After adjusting for the independent effect of age and varsity team status," from lines 26-29, and state these confounding variables being hinted at on page 3, line 24. The main reason for this suggestion is 1) it will reduce text without sacrificing meaning so that 2) the other important, but non-significant findings can be discussed (i.e. the other PROMIS domains).

Author response: Thank you for this edit, we agree and have revised the manuscript accordingly (Page 3).

Reviewer comment: Page 3, lines 31-34: Consider also providing the R² value for your models here in the abstract, as well as in the results section and tables.

Author response: Thank you for this suggestion. Given our use of a negative binomial regression model due to the zero-inflated nature of the PROMIS scores, we feel the R² statistic will be misinterpreted. This is because this model does not provide a traditional R² statistic, such as with a OLS regression. Instead, we can calculate McFadden's pseudo R² statistic. Given the discrepancy with how R² statistics are viewed in the traditional sense (the proportion of variance for the response variable explained by the predictor variables), convention suggests not including it as a standalone statistic, or providing extensive caution with interpretation, which we feel is outside the scope of the paper. If the reviewer and editors feel this is a necessary addition to the quality of our work, we will gladly provide a more robust explanation alongside the values presented in a subsequent version of the manuscript.

Introduction

Reviewer comment: Succinctly describes the background/importance of the study without going beyond the scope of the paper. Minimal edits are suggested.

Reviewer comment: Page 4, lines 16-17: Instead of stating "positively influence" consider providing a more direct statement (e.g. "greatly reduce"). This may help with readers immediately understand the direction of the relationship.

Author response: We appreciate this recommendation, we have revised the manuscript to read, "reduce" instead of "positively influence" on page 4, line 31.

Methods

Reviewer comment: Overall the methods convey the majority of needed information, however the delivery could be more direct. Additional details are also warranted to provide full disclosure to readers. The sub-headers of IV, DV, and Covariates are a bit redundant with the Study Design and Participants paragraph above. Consider reformatting the material so that there is a Study Design and Setting section (indicating very briefly the study/PPE protocol employed), and then a Instrumentations and Procedures section with detail the specifics of the main outcomes. I believe the content provided is appropriate, but the reformatting will help provide flow and clarity.

Author response: We have revised the Methods section to include only the sub headers, "Study Design and Participants" and "Instrumentation and Procedures", as suggested by the reviewer.

Reviewer comment: Page 5, lines 51-52: Please provide greater detail about consent. As is, there is no statement that clearly indicates participants provided both assent and consent before data collection.

Author response: We agree this is important to include and have revised the manuscript accordingly, “Informed consent, and assent for participants under 18 years of age, was obtained prior to completion of any study documents” (page 6, lines 79-80).

Reviewer comment: Page 6, line 7: What about excluding those with a history or anxiety, depression, or any other diagnosed psychological disorder? These would likely be a significant confounder to these findings. Please describe if individuals were screened for these.

Author response: Participants were not excluded based on current or previous mental health conditions. We have revised the manuscript to address this as a limitation to our study in the discussion, “Finally, participants were not screened for current or previous mental health conditions, which may confound our outcome variables” on page 13, line 252-254.

Reviewer comment: Page 6, line 14: It appears the hours/week of sport participation are self-reported prior to any structured sport participation. Further reading in the discussion confirms this (please specifically address the time period/difference in data collection here in the methods). This may be influential, especially among new/freshman participants who may not be aware of the hours/week demand of high school sports. Was academic standing (e.g. freshman/first year) captured? If so, it may be important to 1) add these details to the demographic table. Further, this may be substantially influenced by recall bias if sport participant did not occur since ~3 months-1 year before the next season. Please consider these factors and address in the limitation if you are in agreement.

Author response: We agree this is an important limitation to address. We have revised the methods section on page 7, line 98-102 to read, “Of note, this self-reported expected time commitment was recorded in May near the end of the school year and athletes were not necessarily currently participating in their primary sport. As well, new/younger athletes were asked to report their expected participation prior to the start of their first high school season.”

In addition, we have revised the Discussion section (page 13, line 245-248) to read: “In addition, the questionnaires were administered in May near the end of the school year, and thus data was susceptible to recall error for athletes not currently participating in their primary sport and young or new athletes may provide a less accurate estimation of their likely participation volume for the upcoming season.” However, we did include age and varsity team status as variables we controlled for in the analysis, which we feel may have mitigated this limitation to some degree.

Reviewer comment: Page 6, lines 24-26: Note here and throughout: I normally would not make grammatical corrections as this is minor factor for copyediting to handle, but this journal publishes online in the raw format, and therefore I will provide corrections. Please detail what "PROMIS" and "QOL" stand for here to help readers who may just be learning about this topic area.

Author response: Thank you for pointing this out, we have revised the manuscript accordingly throughout both the abstract and main text. We have now detailed what “PROMIS” and “QoL” stand for on page 5, line 66.

Reviewer comment: Page 6, lines 41-46: The wording of this question seems odd (would expect it to say "you" rather than "athlete"). Did the athlete themselves complete the survey, or did a parent/coach/etc do so? If it was "you", that is fine, just verifying the survey item.

Author response: Thank you for this inquiry. For this question, the athlete selfreported the number of hours of sports participation to an athletic trainer who recorded the range. The question in the main text is worded exactly as presented on the questionnaire.

Reviewer comment: Page 6, line 49: Consider providing a summary of cases where the range was averaged (i.e. ###/###; #%) so readers can better understand how frequent of an issue this was. If a significant % of cases did this, then this could be another concern for readers to the precision captured from a self-reported estimate of hours/week of sport activity.

Author response: We agree this would have been useful, but unfortunately, we do not have this information available in the dataset. We have revised the manuscript to include this as a limitation on page 13, lines 28-250, “Another limitation to our study is that some athletes reported a range of hours for which the average was recorded in the database rather than the exact number of participation hours.”

Reviewer comment: Page 7, lines 16-19: Please move the statement, "(i.e. zero equals "with no trouble" or "never", four equals "not able to do" or "almost always") up to page 7, lines 9-11 when describing the item response range.

Author response: The manuscript is revised accordingly to read, “Each question has five response options, ranging from 0-4 and each of the aforementioned domains includes 4 questions (i.e. zero equals “with no trouble” or “never”, four equals “not able to do” or “almost always”)” on page 7, lines 107-110.

Reviewer comment: Page 7, lines 21-23: Is the survey also reliable? Please specify both reliability and validity separately as they both important psychometric properties to consider.

Author response: We have revised the manuscript that the PROMIS Pediatric 25 QoL is both valid and reliable, on page 7, line 112-1115, “Each domain included on the PROMIS Pediatric Profile 25 QoL, with exception to pain interference, is validated and reliable (marginal reliability = 0.88) in the pen and paper format for individuals 8-17 years of age (Forrest et al., 2018; Kratz et al., 2013; Varni et al., 2014).”

Reviewer comment: Page 7, lines 29: Please change gender to sex (as indicated earlier in the manuscript) here and throughout since the biological appears to have been assessed.

Author response: Thank you for this recommendation, however, we assessed gender (participants self-reported their gender on the intake form) rather than sex. We have revised the manuscript to replace “sex” with “gender” throughout.

Reviewer comment: Page 8, lines 46-51: As is, the FAS is somewhat vague and not clear how it is scored. Please provide greater detail and/or an example scoring. Greater detail provided on the FAS coupled with methods reformatting should provide readers with greater/direct understanding of the study protocol.

Author response: We have now referenced a paper by Hobza et al., which describes the FAS scoring process. We believe this scoring is best described in Hobza et al. and include this reference to point readers to the primary source. However, we are happy to expand our description of the FAS scale if the reviewers would still prefer we do.

Reviewer comment: Page 8, line 55: alpha should be = 0.05, not < since it is a set threshold value.

Author response: Thank you for this clarification. We agree, and have changed to $\alpha = 0.05$ on page 9, line 149.

Reviewer comment: Page 9, line 26: Please provide a reference for $p < .20$ as a cutoff for variables being included in the model, if possible.

Author response: Thank you for this suggestion. We have provided a reference, and added additional explanation on page 9, lines 157-161 regarding the rationale for $p < .20$ as a cutoff for inclusion in our model (Ranganathan et al.).

Reviewer comment: Page 9, lines 26-28: Please specify what exactly the model assumptions were. By specifying exactly what was assessed, the reader can then understand better what exactly occurred.

Author response: Thank you for pointing this out. On page 9 lines 161-163 we now include that we assessed for conditional mean and conditional variance equality, via the dispersion parameter in order to assure that we selected the appropriate model for this analysis (negative binomial).

Results

Overall the results are straight forward and appropriate. The major consideration is to provide more specific descriptions of the beta values and how to interpret (i.e. describe the magnitude/direction as a 1-unit change resulted in a increase/decrease in X).

Author response: We have added that for the PROMIS depressive symptom score, the expected log count of the number of hours/week in sport decreases by 0.073 (95% CI: -0.137, -0.010) on page 10, lines 177-179.

Reviewer comment: Page 9: Please provide descriptive for the PROMIS outcome scores either in the results text, or in one of the Tables so other researchers/readers can understand the observed scores of this cohort.

Author response: Thank you for this suggestion. We have added the median [interquartile range] data to Table 2, to provide descriptive PROMIS outcome score descriptions.

Reviewer comment: Page 9, lines 48-52: The results paragraph is very succinct, however, it may be important here to describe one of the models and interpretation of the beta values. For example, "For every one hour/week increase in sport participation, PROMIS depression symptoms decreased by -0.074 (95% CI: -0.138, -0.010)". Most researchers/readers will understand this, but it is important for manuscripts to be clear to both new and experienced researchers/clinicians.

Author response: Given our use of a negative binomial model, the interpretation includes expected log count information, rather than a straightforward increase of X units, Y units decrease. We have included this information in our revised results on page 10, lines 177-179, as we agree with the reviewer that this information helps provide adequate clarity.

Discussion

Reviewer comment: Overall this discussion is well written/balanced, but similar to the results, believe it needs more direct interpretation of the findings. No specific values are provided in the discussion, which is fine, but believe they should be discussed more directly. For example, depression symptoms on PROMIS was statistically significantly associated with sport participation, but is this clinically meaningful? Is a 0.074 decrease in depressive symptoms for every hour/week of sport valuable (i.e. 13 hours/week needed to decrease depressive symptoms by 1 point) impactful? What is the reliable change index or minimal clinically

important difference for the PROMIS? Consider focusing more of the discussion on how this translates to clinical practice, and if this beta value is clinically meaningful or more so statistically significant. Since this journal focuses on translating research to clinical practice, this will likely be critical for the readers.

Author response: Thank you for bringing up this point, we wholly agree in the importance of discussing clinical value and have revised the manuscript accordingly. Given the use of log counts rather than specific hours and due to the cross-sectional nature of our study, we do not feel it is appropriate to make a specific hours/week recommendation. As such, we have revised our discussion on page 11, lines 188-191 to now state: “Despite statistical significance, it is difficult to assess clinical significance in this finding. Although statistically significant, the association was weak. More robust research is required to reliably assess the clinical impact of increased sports participation volume.”

Reviewer comment: Page 10, lines 36-56: The overall point raised about the discussion will likely be best addressed here. Overall the findings are in line with other work, but it is still important to look at the statistical findings through a clinical applicability lens. I believe doing so will provide greater insights and may actually change the overall take home of the manuscript. My immediate interpretation is that this may not actually be a clinically meaningful relationship observed. This does not mean 1) the findings here are not important or 2) that sport participation isn't important to psychosocial factors, but rather that in a sample of only high school athletes, the hours/week participating might not be as important as just being a high school athlete and being physically active. Please note my interpretation may differ from the authors, and they do not need to align if there is disagreement.

Author response: Thank you raising this very important and interesting point. We agree in the importance of considering clinical importance and have revised the manuscript to address the lack of our ability to make a reliable determination of what clinical impact. The discussion section on page 11, lines 188-191, now includes, “Despite statistical significance, it is difficult to assess clinical significance in this finding. Although statistically significant, the association was weak. More robust research is required to reliably assess the clinical impact of increased sports participation volume.”

Reviewer comment: Page 11, lines 16-19: as noted earlier, please indicate that these data were collected in during the May prior to sport participation in the methods. This is an important factor for readers to know when interpreting the work, and often times discussions are not thoroughly read.

Author response: We have revised the Discussion section on page 13, lines 245-248, of the manuscript to read, “In addition, the questionnaires were administered in May near the end of the school year, and thus data was susceptible to recall error for athletes not currently participating in their primary sport and young or new athletes may provide a less accurate estimation of their likely participation volume for the upcoming season.”

Reviewer comment: Page 12, lines 4-9: Since this was a HS age group, were students 1) still in classes in May when completing the surveys/PPEs, 2) are they required to complete PE courses or PA as part of their curriculum? If so, this may be an important limitation to consider and address.

Author response: We have revised the manuscript to state that students attended the PPE days in May near the end of the school year. Unfortunately, we do not have information on PE or PA requirements in each student's schedule and have revised the manuscript to include this as a limitation on page 13, lines 250-252, “Also, we did not

ask about the length of time participants were engaged in various sports or physical education or activity classes leading to potential variability in the magnitude of this factor.”

Reviewer comment: TABLES 1, 2, and 3: Please consider providing the R² value for each univariable and multivariable model. Also consider providing the degrees of freedom for each model (if all models for a given table are identical, consider making a superscript legend indicating this).

Author response: Thank you for this suggestion. Given our use of a negative binomial regression model, we feel the R² statistic will be misinterpreted. This is because this model does not provide a traditional R² statistic, such as with a OLS regression. Instead, we can calculate McFadden’s pseudo R² statistic. Given the discrepancy with how R² statistics are viewed in the traditional sense (the proportion of variance for the response variable explained by the predictor variables), convention suggests not including it as a standalone statistic, or providing extensive caution with interpretation, which we feel is outside the scope of the paper.

Each univariable model contained one degree of freedom (one predictor variable, one outcome variable), and each multivariable model contained three degrees of freedom (three predictor variables, one outcome variable). We have added this information to Tables 1-3.

Reviewer comment: FIGURE 1: To the discretion of the authors, this figure should either be improved or removed. As is, it does not provide more insight beyond the tables provided, except that it highlights the zero inflated count of PROMIS (but this is already noted/understood in the statistical analysis section). If the authors chose to keep the figure, consider adding the following to it make it more informative (since figures are often stripped from manuscripts and used in presentations):

- Statistical model parameters (beta, r², p-value)
- Consider making the dots partially transparent to allow easier view of overlapping participants.
- Consider plotting the 95% CI for beta as well.

Consider placing the sample size either in the figure or in the figure legend.

Author response: Thank you for the suggestion. We believe that within a significant correlation, as we found between hours/week playing sports and depressive symptoms, it is imperative to provide individual data points so that readers can fully understand our data, and so that our data is presented in the most transparent way possible. However, we appreciate the specific suggestions from the reviewer, and have incorporated them into our revised Figure 1 (sample size, coefficient, 95% CI, and partially transparent dots).

2nd Editorial decision
8-Jul-2020

Ref.: Ms. No. JCTRes-D-20-00048R1
Sports Participation Volume and Psychosocial Outcomes Among Healthy High School Athletes: A Cross-Sectional Study
Journal of Clinical and Translational Research

Dear author(s),

Reviewers have submitted their critical appraisal of your paper. The reviewers' comments are appended below. Based on their comments and evaluation by the editorial board, your work was FOUND SUITABLE FOR PUBLICATION AFTER MINOR REVISION.

If you decide to revise the work, please itemize the reviewers' comments and provide a point-by-point response to every comment. An exemplary rebuttal letter can be found on at <http://www.jctres.com/en/author-guidelines/> under "Manuscript preparation." Also, please use the track changes function in the original document so that the reviewers can easily verify your responses.

Your revision is due by Aug 07, 2020.

To submit a revision, go to <https://www.editorialmanager.com/jctres/> and log in as an Author. You will see a menu item call Submission Needing Revision. You will find your submission record there.

Yours sincerely,

Nicholas G Murray, Ph.D.
Editorial Board Member
Journal of Clinical and Translational Research

Reviewers' comments:

Reviewer #1: Thank you for considering and making the requested revisions. I believe the manuscript is more clear and in depth. Lone comment is to state the results in the new graphical abstract. I like the change but would prefer to see one more level to include the results.

Reviewer #2: Thank you for providing clear line-by-line revisions. Overall there are very minimal edits needed, and are described below:

GRAPHICAL ABSTRACT: Consider adding a conclusion/take home message at the bottom of the graphic. As is, it only states the research question and brief methods without any information about the general findings.

Lines 66-69: This sentence describing the validation of PROMIS would be better suited in the methods section where PROMIS is described.

Author's response

Manuscript ID: JCTRes-D-20-00048

Title: Sports Participation Volume and Psychosocial Outcomes Among Healthy High School Athletes

We sincerely thank the reviewers for their additional review of our manuscript submitted to Journal of Clinical and Translational Research. We have carefully revised the manuscript based on the critiques of the reviewers and responded to each of the

points raised in bold font within this document. All changes within the revised manuscript have been noted in yellow highlighted text, and all line numbers refer to the revised manuscript, unless otherwise noted.

Reviewer #1: Thank you for considering and making the requested revisions. I believe the manuscript is more clear and in depth. Lone comment is to state the results in the new graphical abstract. I like the change but would prefer to see one more level to include the results.

Author Response: Thank you for pointing this out, we agree and have revised the graphical abstract accordingly as depicted on Page 2, Line 4.

Reviewer #2: Thank you for providing clear line-by-line revisions. Overall there are very minimal edits needed, and are described below:

GRAPHICAL ABSTRACT: Consider adding a conclusion/take home message at the bottom of the graphic. As is, it only states the research question and brief methods without any information about the general findings.

Author Response: Thank you for pointing this out, we agree and have revised the graphical abstract accordingly as depicted on Page 2, Line 4.

Lines 66-69: This sentence describing the validation of PROMIS would be better suited in the methods section where PROMIS is described.

Author Response: We agree this sentence fits better in the methods section and have revised the manuscript accordingly by moving the sentence to Page 6, Lines 85-87.

3rd editorial response
9-Jul-2020

Ref.: Ms. No. JCTRes-D-20-00048R2
Sports Participation Volume and Psychosocial Outcomes Among Healthy High School Athletes: A Cross-Sectional Study
Journal of Clinical and Translational Research

Dear authors,

I am pleased to inform you that your manuscript has been accepted for publication in the Journal of Clinical and Translational Research.

You will receive the proofs of your article shortly, which we kindly ask you to thoroughly review for any errors.

Thank you for submitting your work to JCTR.

Kindest regards,

Nicholas G Murray, Ph.D.
Editorial Board Member

Journal of Clinical and Translational Research

Comments from the editors and reviewers:

Dear authors - thank you for re-submitting your work to JCTRes. You have completed all the comments as requested by the reviewers.