General Review

Dear authors,

I have read your preprint with interest, I found that the subject is intriguing and the analyzing of large-scale networks can offer substantial evidence to the understanding of the subject. However, I have some substantial concerns that I would like to address before considering the manuscript for publication.

First of all, I was surprised to read an unfinished manuscript. I expected all sections to be present, but I found that the Discussion and Conclusion were missing and instead there is some proposal for future analysis. I don't know if this is a standard practice for preprint journals, I believe the manuscript should be complete before submission.

Second, I found the Methods and Results sections confusing. Many details were omitted from the Methods sections, to only be found or understood when reading the Results section. This implies that the reader needs to go back and forth between the two sections to understand the analysis, which is time-consuming and not optimal. I suggest that you be more explicit and specific in the Methods, with all relevant elements being clearly stated. I provide more specific details in the following parts of my reviews.

Thirdly, another significant issue concerns the operationalization of the predictor variables. This paper is about the discrepancies between perceived and received social support, but the measurement of received (or enacted) support seems to be instead the perception of "providing supports" to others. As far as I know, enacted supports is generally measured during specific stressful events (e.g., death of a close relative) (see Birditt, Antonucci and Tighe, 2012) or within a time frame (e.g., last month), for instance using the ISSB questionnaire (Barrera, Sandler and Ramsay, 1981). Another used approach is to use daily diaries, or similar tools such as EMA, to collect information about supportive interactions when they happen (e.g., Neff, Nguyen and Williamson (2020)). Instead, the only information collected in the survey is about the perception of receiving ("Who will help you when you are sad or something is bothering you [...]") providing ("Which classmates do you help when they are sad of something is bothering them [...]") support (see page 6 for SOCIALBOND). It may be argued that the perception of providing support is a proxy for enacted support, but this is not the same thing as stating that we are actually measuring it. This is a major issue, as the authors are actually comparing two perceptions of social support, and not the discrepancies between perceived and received social support. Therefore, the results are not conclusive for the research question.

Fourth, the introduction, at some extent, is too broad and omits key details which could help the reader to understand the study's context more clearly. For example, the author provides a really general definition of social support (see page 2) that does not reflect the more specific conceptualization used in this paper; "emotional support" is a form of support often used in the literature and

that derives from a categorial view of support (see Cohen and Wills (1985)). Similarly, "mental health" and "loneliness" are introduced as outcomes, but also with broad definitions. While the authors chose to approach mental health from the perspective of depression, emotional well-being and psychological distress could provide a more profound understanding of the subject and the actual use of mental health in this paper. Indeed, mental health is measured through the MHI-5 scale of the SF-36, which is a proxy for depression, but also an actual measure of emotional well-being (i.e., the balance between positive and negative emotions through time) (see Dieiner, Sapyta and Suh, 1998). Also, the authors used the GHQ-12 in Net4Health, which is a measure of psychological distress, and not necessarily depression. I understood the depression was used to fit the Beck cognitive theory of depression, and its theoretical link with discrepancies between perceived and received social support. Still, a broader perspective may help understand the associations between mental health, loneliness and social relationships (Buttle and Sbarra, 2013; Cacciopo and Cacciopo, 2014; Cacciope and al, 2000; Hawkley and Cacciopo, 2010). Moreover, highlighting the relations between mental health and loneliness may help explain the similar effect sizes found in the nested regressions with either loneliness or mental health as outcomes as they are most likely to be correlated. Further, it would help to provide a clear definition of loneliness and how it fits in a theory of mental health (see the multiple papers of Cacciopo on the subject).

Five, and closely related with the previous point, there is a missing discussion in the introduction about the relations between social relationships, loneliness and mental health. Here we are interested how mental health and loneliness explain perception about the social networks, still, the inverse relation is also important to understand the full picture. There is substantial literature showing that the presence and quality of social relationships change the person perceptions about its social environments, mainly if it is somewhat "secure" or "distressful". Ultimately, this perception, may influence a person mental health, with extensive studies on potential inflammatory process underlying this link (See Leschak and Eisenberger, 2019; Slavich, 2020). This more recent understanding of the role of social perception on health needs to be taken into account when exploring this subject.

Lastly, a more methodological concern, I am a bit surprised about the discussion on merging the two networks for QAP regression (yet it is not clear from reading the method if it is really what was done). My concern is that mental health, loneliness, but also age, are not measured the same way. How did the authors manage this issue? Also, missing data were not treated similarly for the two networks, which can lead to biased results. We would need more information about the imputation process in the Net4Health network, but also how the authors managed these multiple discrepancies.

Specific Points by Sections

Here are my notes page by page on each subsection. In some cases it will overlap with the more general previous comment, but it can help pinpoint where change can be made.

Introduction:

- Page 2:
  - The definition of social support is really general and does not reflect the conceptualization used in this paper.
  - On "both through a direct positive influence of social support and through a buffering effect on the negative effects of everyday stressors". The papers cited for this point are discussion about those hypotheses on how social relationships may influence health. Yet they do not provide clear evidence of these pathways. Therefore, it should be rephrased to reflect the uncertainty of theses hypothesis.
  - Emotionnal support needed to be introduced.
  - It is confusing to have the research objective so soon, followed by more information about the context of the study.
- Page 3:
  - Objective social embeddedness is not defined. As quantity and quality of social relationships?
- Page 4:
  - It would help to have a "current paper" section, to help the reader to understand the context of the study. The general objective on page 2 could be here followed by the hypothesis, with a clear restatement of the literature gap.

Methods

- Page 5:
  - Complete social networks. Do you mean sociocentric network?
  - There should globally be more information about the SOCIALBOND and Net4Health networks. Links to website can be broken with times, as they are not published with a specific DOI.
- Page 6:
  - It is not clear what is the transposed matrix here. Are the discrepancy matrices are binary square matrices of provided/received support between all alters? If so transposition of a square matrix should be equivalent? I think I'm missing the point here, and it should be more explicit.
  - Also, table 1 show 4 categories of dyads, which could be simply identified using edges lists, and not a matrix. So it further questions what is the previous discussion about transposed matrix.
- Page 7:

  - Give more information about the MHI-5. How many questions for positive/negative emotions. On which period (4 weeks if I remember)? Do you use the standardized Z score (as it is expected)? Which translation (is it published and validated)?
  - What are the reported gender used?
  - Socioeconomic background: To what extent an children's access to money is a good proxy of its socioeconomic background? Parents may or may not give money to their children. Is their literature on to validate this measure?
- Page 8-9:
  - Socioeconomic background: What is "economic self-assessment" means?
  - Missing data: Is leastwise deletion meaning removing dyads on the edge lists? Simply complete case analysis would be more coherent with missing data terms. More over, why not using multiple amputations as in Net4Health.
  - What is the complete procedure of missing data in Net4Health? How can we be sure that the imputation is valid? Maybe an appendix if too long for the main text.
  - Please better explain MRQAP models as they are not common outside network analysis. Maybe explaining that it is an extension of the mantel test with multiple covariance matrices.
  - Also how did you manage to generate the multiple covariate / outcomes matrices from the individual level variables? We see later your "diff." measures, but they need to be defined before.
  - To what extent observations are not independent? As far as I understand the data, there is no dyadic measures that could influence other dyads, like for example an eigenvector centrality that would be associated with for a specific node, to the eigenvector centrality of its neighbours. In your cases, it would be important the dyads are independent, as it is a requirement for the MRQAP model. Moreover, permutations as far as I know is done to manage data with unknown distribution, not dependent data. Here it is not clear why you used permutations. Moreover, is there any assessment of heteroscedasticity? If so, is MRQAP robust to variance heterogeneity?
  - Permutations of nodes should be clearly stated, as opposed to edges permutation. Why choose nodes instead of edges?
  - Here we understand what are the outcome matrices. To understand how it is unclear, I expected mental health/loneliness, and not discrepancy matrices. Moreover, I also figure out their specific structure, namely binary matrices. Their missing may information in previous sections.
  - How meta-regressions are managed? How the information from the AIC and BIC used? Is there some kind of leastwise deletion for the included variables? If so, why using AIC/BIC, as they mostly inform on predictive power of the model, and not on the relevance

of the predictors. A better aproach for correlation study is to use a stepwise regression, with a specific criterion for inclusion/exclusion of the predictors based on the correlation coefficient. Also, these steps should be displayed in an appendix.

Results

- Page 9:
  - Why use mean and std.dev as network data are generally skewed? Median and IQR would be more appropriate.
- Page 10-11:
  - What is T after outdegree provided support in descriptive results?
  - Table 4: The fact that the variables are not clearly explained previously make the table hard to understand. Also, for categorial variables, state the reference state. Also, the p-value significance level should be stated previously in the method, not as a note in the table.
- Page 12:
  - What about unintentional support? This should be in the discussion.
- Page 12 - end
  - The rest of the discussion about effect size and statistical power seems to be more appropriate in an appendix, with a more general presentation of "what will be done" in the method section.
  - Inference criteria: Not sure why using the word inference here when discussing p-value threshold for significance. Also, it is said to be at 0.10, while using 0.05 in table 4. And why using 0.10 instead of 0.05? It is not clear based on two-tailed effect.
  - Reliability and Robustness | Exploratory analysis: Are you present "what will be done in the future". For myself, I don't follow why it is here in this manuscript. As stated earlier, I'm not familiar with preprint, but I would prefer to read only completed information.

References

Barrera, M., Sandler, I. N., & Ramsay, T. B. (1981). Preliminary development of a scale of social support: Studies on college students. American Journal of Community Psychology, 9(4), 435–447. doi:10.1007/bf00918174

Birditt, K. S., Antonucci, T. C., & Tighe, L. (2012). Enacted support during stressful life events in middle and older adulthood: An examination of the interpersonal context.Psychology and Aging, 27(3), 728–741. https://doi.org/10.1037/a0026967

Butler EA, Sbarra DA. Health, emotion, and relationships. Journal of Social and Personal Relation- ships. 2013;30(2):151-4. Available from: https://doi.org/10.1177/0265407512453425.

Cacioppo JT, Hawkley LC, Ernst JM, Burleson M, Berntson GG, Nouriani

B, et al. Loneliness within a nomological net: An evolutionary perspective. Journal of Research in Personality. 2006;40(6):1054-85. Available from: https://doi.org/10.1016/j.jrp.2005.11.007.

Cacioppo JT, Cacioppo S. Social relationships and health: The toxic effects of perceived social isolation. Social and Personality Psychology Compass. 2014;8(2):58-72. Available from: https://doi.org/10. 1111/spc3.12087.

Diener E, Sapyta JJ, Suh E. Subjective well-being is essential to well-being. Psychological Inquiry. 1998;9(1):33-7. https://doi.org/10.1207/s15327965pli0901_3.

Hames JL, Hagan CR, Joiner TE. Interpersonal processes in depression. Annual Review of Clinical Psychology. 2013;9:355-77

Leschak CJ, Eisenberger NI. Two distinct immune pathways linking social relationships with health: inflammatory and antiviral processes. Psychosomatic Medicine. 2019;81(8):711. Available from: https://doi.org/10.1097/PSY.0000000000000685.

Neff, L. A., Nguyen, T. T. T., & Williamson, H. C. (2021). Too Stressed to Help? The Effects of Stress on Noticing Partner Needs and Enacting Support. Personality and Social Psychology Bulletin, 47(11), 1565-1579. https://doi.org/10.1177/0146167220974490

Slavich GM. Social Safety Theory: A Biologically Based Evolutionary Perspective on Life Stress, Health, and Behavior. Annual Review of Clinical Psychology. 2020;16:265-95. Available from: https: //doi.org/10.1146/annurev-clinpsy-032816-045159.