

## INTRODUCTION

Real-world hearing aid outcomes are commonly measured using standard questionnaires at the end of the field trial, providing a comprehensive measure of different outcomes. Ecological momentary assessment (EMA) is another method that allows measuring outcomes in the field multiple times a day throughout the trial using repetitive surveys. Responses to EMA surveys reflect the listener's experience in real-time and in-situ, whereas responses to a questionnaire at the end of the trial require the listener to recall and summarize his/her experience across the trial. Given that both methods are valid measures of outcomes in the field, the utility in comparing the two methods on the same outcome domain appears to hold significant value. In addition, because of the retrospective manner of standard questionnaires, how listeners recall and summarize their experience could be impacted by a recency effect (the tendency to remember the most recent experience best) is still unclear.

The purposes of this preliminary analysis are:

- (1) to demonstrate the relationship between assessing real-world aided speech understanding performance with one question in an EMA survey and with the speech subscale of the Speech, Spatial and Qualities of Hearing Scale (SSQ)
- (2) to assess whether the strength of this correlation increases toward the end of the field trial.

## METHODS

- Participants: 25 experienced hearing aid users
  - Age: 22~79 (M=63.8, SD=14.3)
  - Female: N=12
- Hearing aid fitting:
  - Hearing aids: Starkey Halo2 RIC 13
  - Aided response matched to that of own devices in order to minimize the impact of acclimatization
  - Dome selection based on degree of hearing loss
- Procedures:
  - Each pair of hearing aids was wirelessly connected to an Android phone.
  - Each participant wore bilateral hearing aids for a period of one week.
  - Sampling protocol: An interval contingent prompting strategy was used. A 14-item survey (see Xu et al., 2020) was initiated by a mobile app about every 45 minutes during the active hours of each participant (a phone ringtone). If a survey was not able to answer, the participant was allowed to skip or snooze that survey occurrence for 30 minutes.
  - At the end of the trial, each participant filled out the [SSQ \(v.5.6\)](#) (Gatehouse & Noble, 2004).

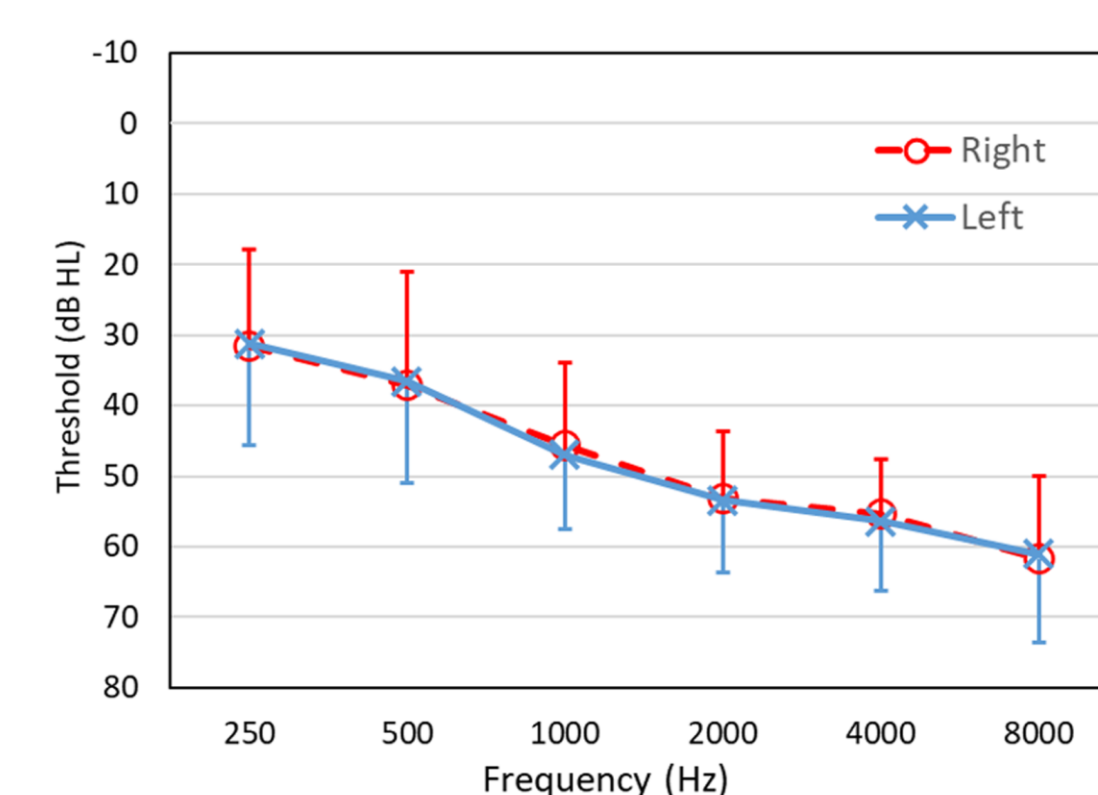


Figure 1. Mean hearing threshold (Error bars represent  $\pm 1$  SD)

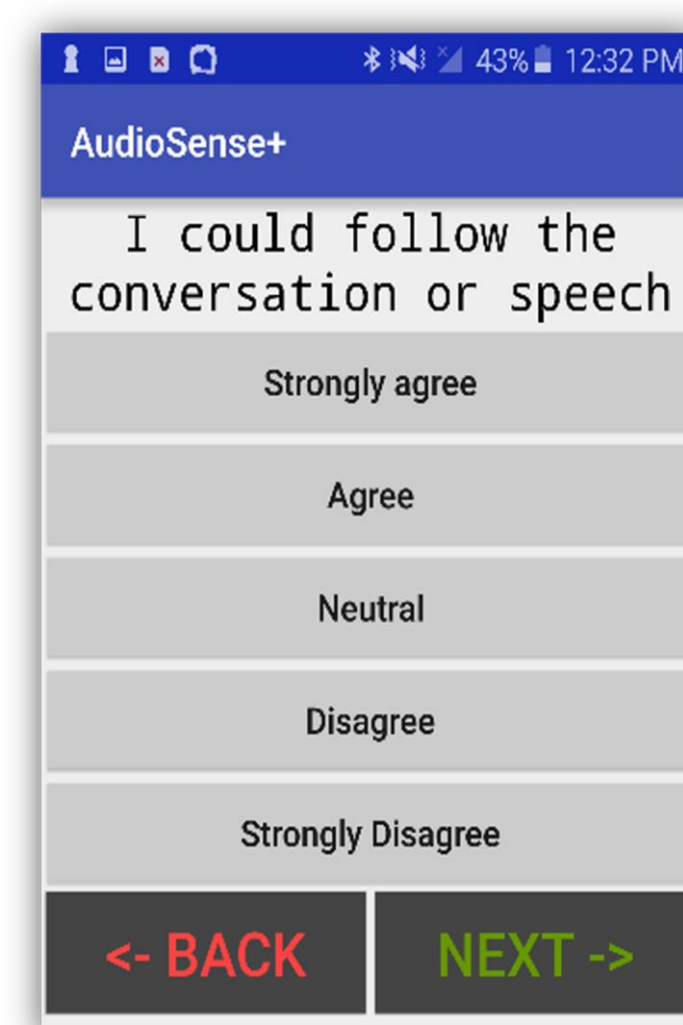


Figure 2. An example screen of the EMA app interface: Speech understanding

## RESULTS

- In total, the participants completed 1766 EMA surveys
  - Average number of completed survey per day = 8.8 (SD = 4.5)
- Ratings for the EMA survey question that assessed speech understanding performance were used for data analysis (Figure 2). Coding of the EMA responses: (Strongly agree = 0; Agree = 1; Neutral = 2; Disagree = 3; Strongly disagree = 4)
- SSQ ratings are between 1 (worse performance) and 10 (best performance)
- Distributions of the EMA data (entire trial) and SSQ data are shown in Figure 3.

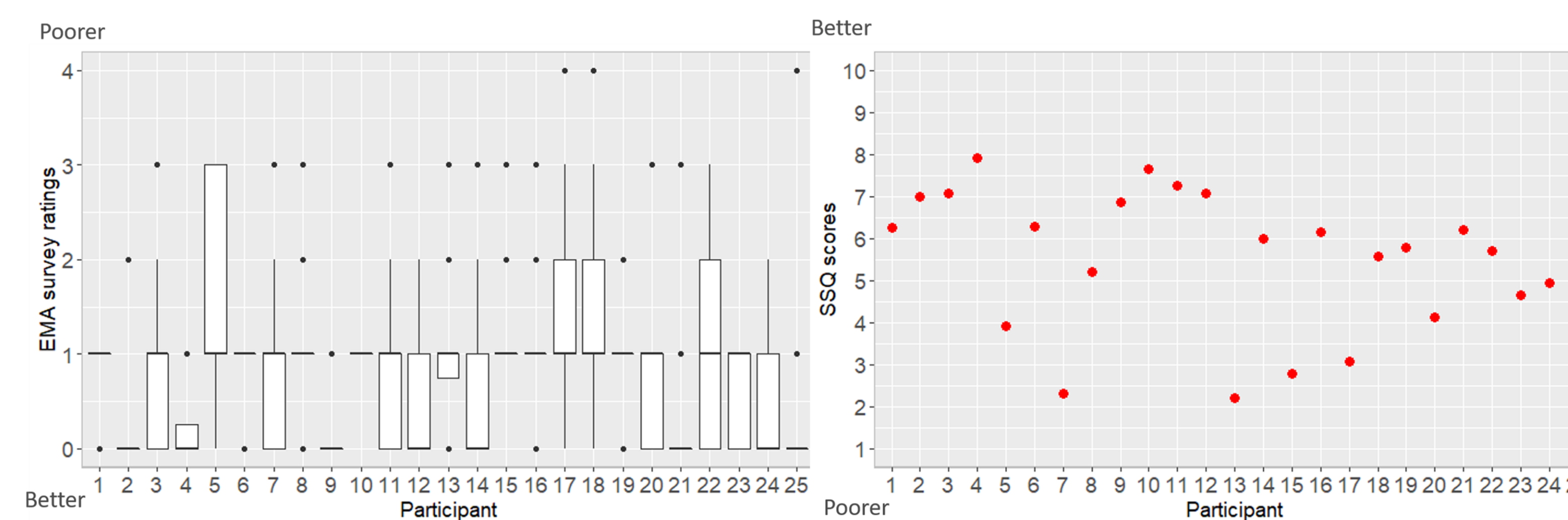


Figure 3. Distribution of the EMA ratings (left) and the SSQ-Speech scores (right)

- 87.5% the EMA ratings are indicating having no difficulties in understanding speech (ratings of 0 and 1).
- To answer the first research question, the EMA ratings were averaged for each participant across the trial. The overall mean EMA ratings and the SSQ-Speech scores were moderately correlated (Spearman's  $\rho = -0.41$ ,  $p = 0.04$ ).
- To determine if there is a recency effect (stronger correlations between EMA ratings and SSQ-Speech scores towards the end of the trial), the EMA speech understanding ratings were averaged for each participant within each day of the trial. The correlations between EMA and SSQ were then examined day by day (Figures 4 and 5).

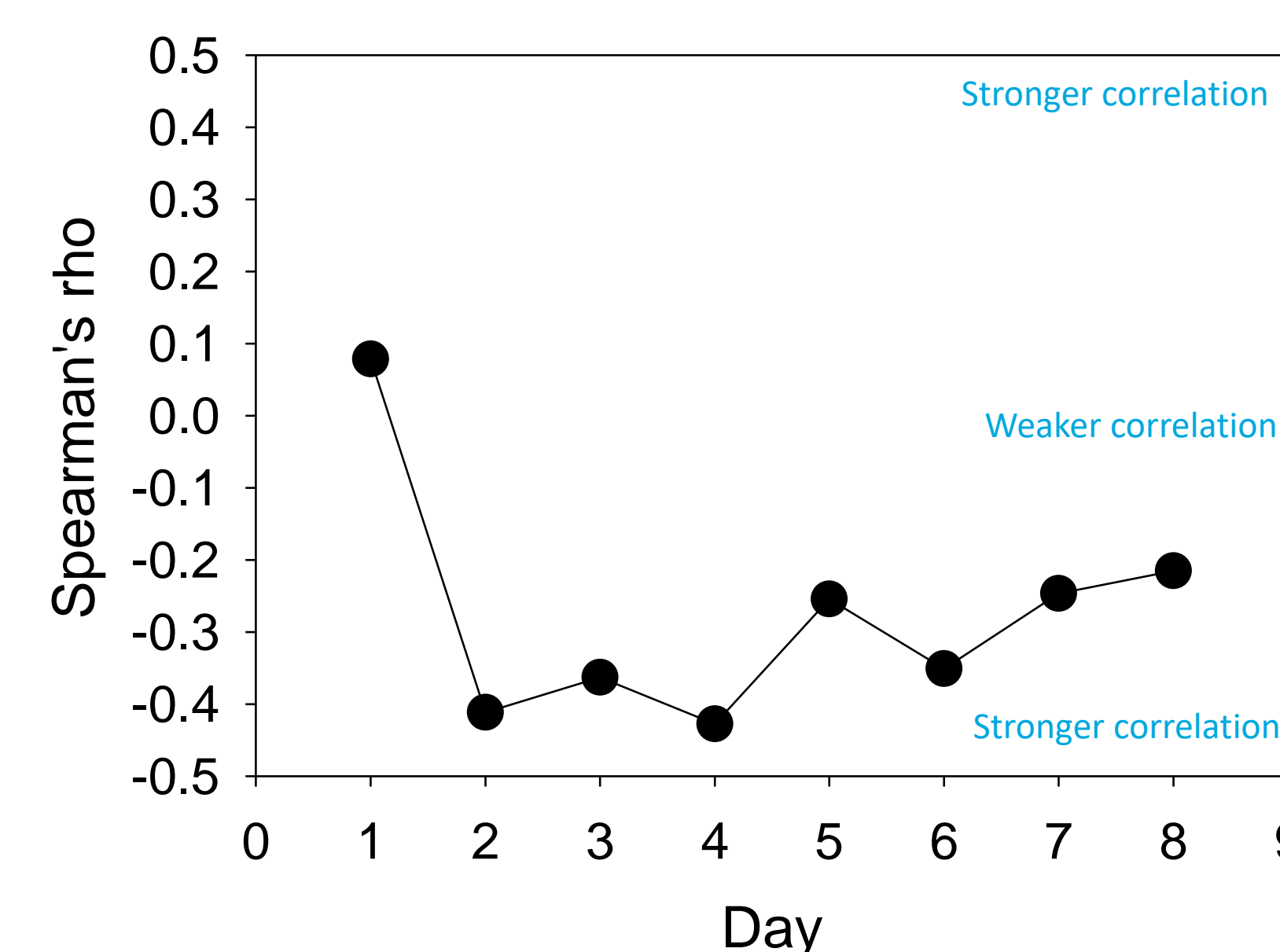


Figure 4. Correlation coefficient as a function of day in the field

## RESULTS (CONT.)

### Relationship between SSQ and EMA for each day

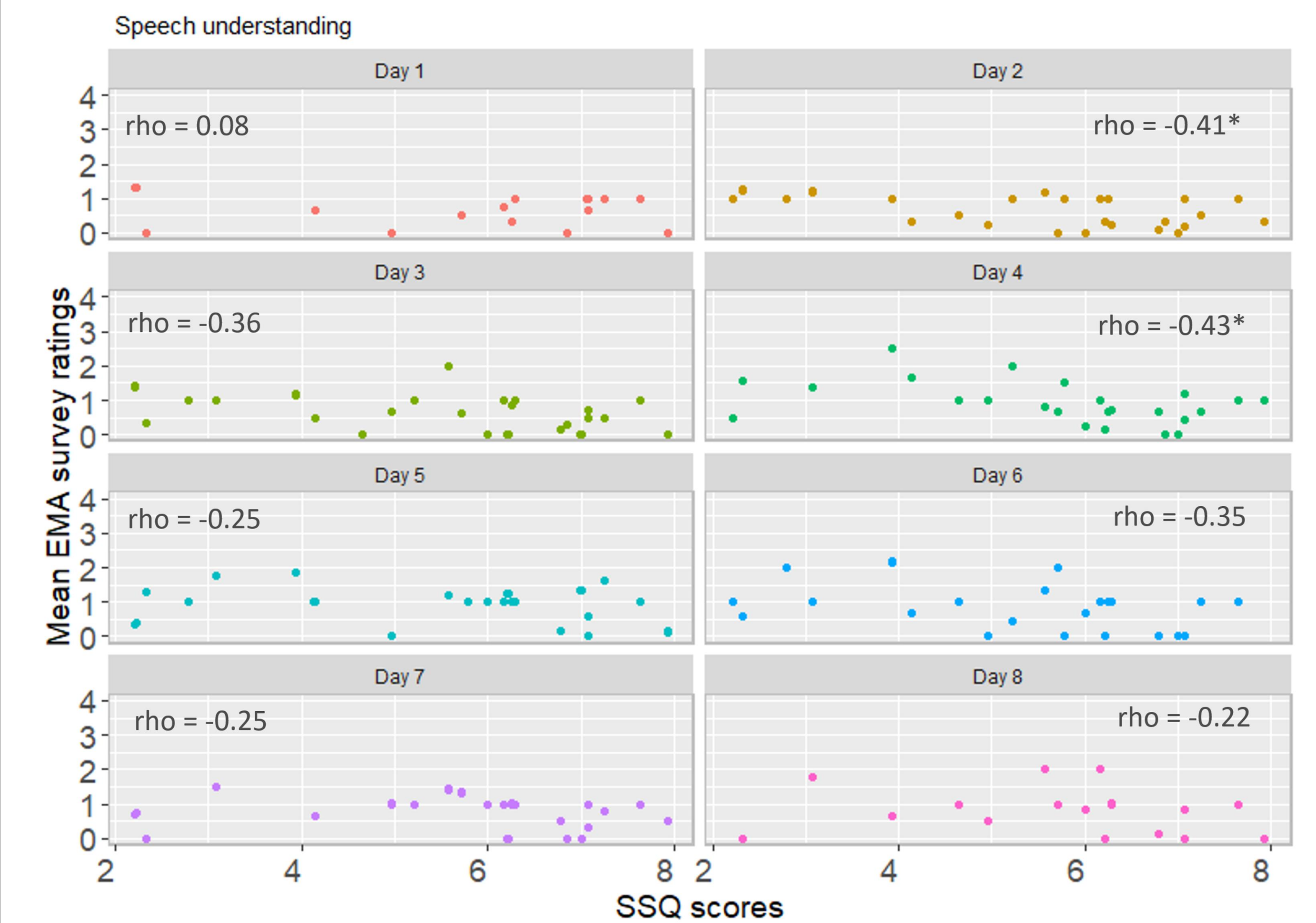


Figure 5. Relationship between the EMA ratings and the SSQ-Speech scores for each day in the field. \*  $p < 0.05$

## DISCUSSIONS & CONCLUSIONS

- The EMA question and questions in SSQ use different wording. The EMA question is a general statement whereas the SSQ questions are scenario specific (e.g., watching TV, conversations in a restaurant, conversations in reverberation).
- The EMA ratings are mostly showing having no difficulties in understanding speech, which is similar to findings from previous EMA research (Hasan et al., 2014). This, to some extent, contributes to the weak to moderate correlation obtained from the present study (Spearman's  $\rho$  between 0.08 and -0.43).
- The day-by-day correlations did not show a clear trend for recency effect.
- These two measures may assess similar but different aspects of outcomes in the field.
- Future research with a longer trial period and using other EMA questions or standard questionnaires is needed to further explore this relationship.

## REFERENCES

- Gatehouse, S., & Noble, W. (2004). The Speech, Spatial and Qualities of Hearing Scale (SSQ). *International journal of audiology*, 43, 85-99.
- Hasan, S. S., et al. (2014). Evaluating Auditory Contexts and Their Impacts on Hearing Aid Outcomes with Mobile Phones. In *In Proceedings of the 8th International Conference on Pervasive Computing*. (pp. 126-133). Oldenburg, Germany: ICST.
- Xu, J., et al. (2020). Using Smartphone-Based Ecological Momentary Assessment in Audiology Research: The Participants' Perspective. *American Journal of Audiology*, 29(4), 935-943.
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