

Methodological Implications for Linking Speech Characteristics with Measures of Psychosis: A Meta-Analysis

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Introduction

- There is substantial and increasing interest in using speech characteristics to assess psychosis symptom severity (e.g., Cohen et al., 2014; Parola et al., 2020).
- Three recent examples illustrate the utility of speech-based approaches for assessing psychosis:
 - Speech characteristics derived from Positive and Negative Syndrome Scale (PANSS; Kay, Fiszbein & Opler, 1987) interviews were associated with schizophrenia symptom severity (Worthington et al., 2025).
 - Speech from open-ended conversations was associated with symptom severity assessed using the PANSS (Ciampelli et al., 2026).
 - Speech generated during picture description tasks differentiated clinical samples that included participants with psychosis from healthy controls (Mülfarth et al., 2026).
- These findings highlight the potential for speech-derived variables to advance clinical trial assessment methodology through more objective approaches to symptom measurement. Notably, the studies employed three distinct speech elicitation methods (clinical interviews, open-ended conversation, picture description).
- Historically, assessment methods have been evaluated according to core psychometric principles, including standardization, reliability, validity, and availability of normative reference data (AERA, APA, & NCME, 2014).
- As research on speech-derived measures continues to evolve, it is increasingly important to understand how methodological influences the strength of observed associations between speech characteristics and symptoms of psychosis.

Different speech elicitation methods may yield different estimates of the relationship between speech characteristics and symptoms of psychosis.

Conclusions

Results from this study offer several insights into the growing body of literature on speech characteristics and psychopathology:

- Given that there are several previous meta-analyses related to speech characteristics and symptoms of psychosis, it is noteworthy that our search (which was limited to only papers available after inclusion time periods of previous reviews) yielded a sizable number of papers. This demonstrates that interest in this area of work continues to increase.
- Methodological features, namely paradigms for how speech is generated and what characteristics of speech are measured, play important roles in this body of work. Broadly, speech generation that limits variability in various characteristics of speech (linguistic and acoustic) appears to attenuate the strength of relationship that can be established with symptomatology.

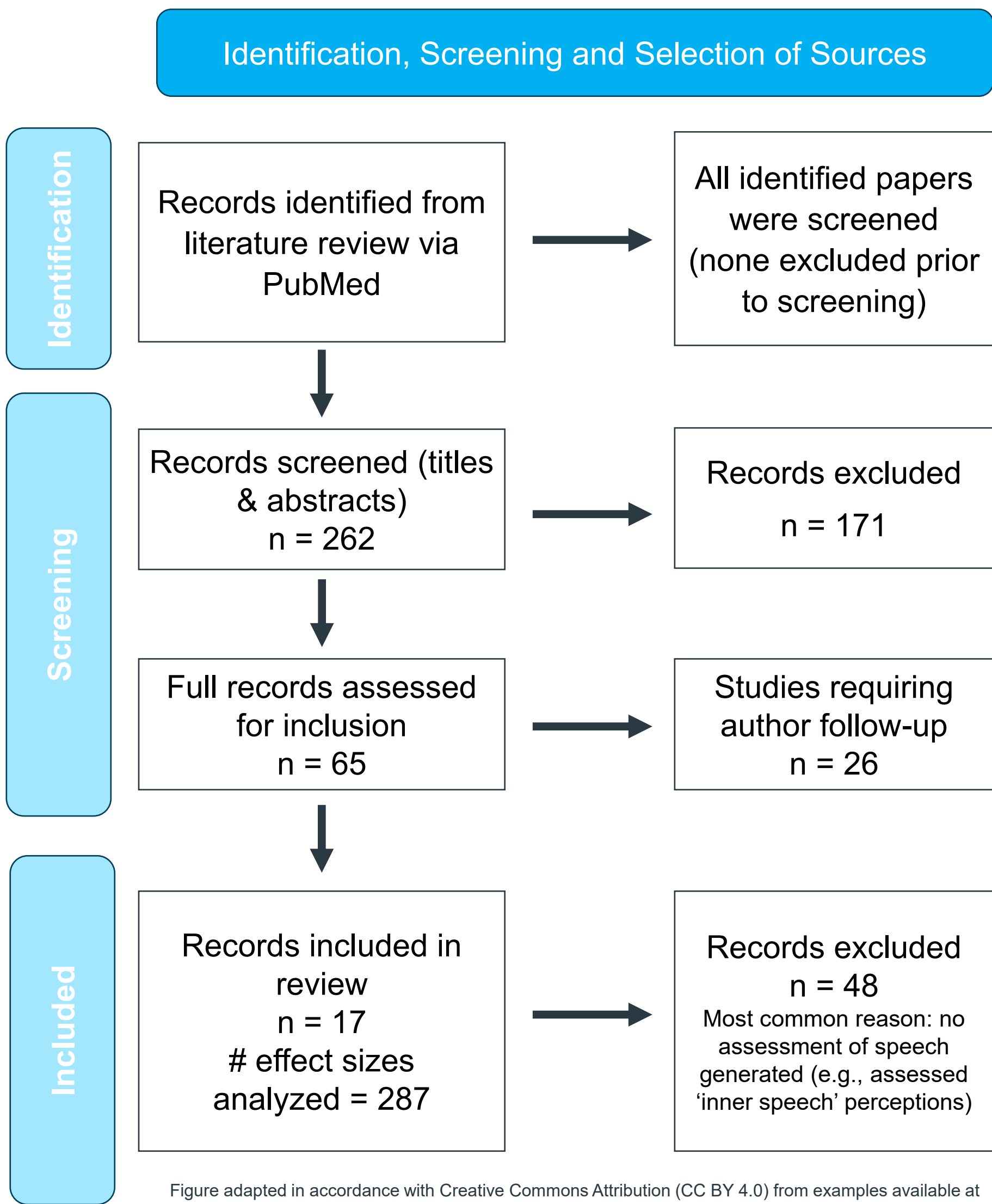
As speech characteristics continue to be of interest for the possibility of measuring psychopathology, methodological features of study design require careful attention. Our findings suggest that methodological standardization may be important for realizing the promise of speech-based measures in assessments of symptomatology. Future research should move beyond asking whether speech characteristics relate to psychopathology and focus on the identification of elicitation paradigms and analytic approaches that maximize clinical sensitivity and interpretability.

Methods

- We conducted a systematic review of studies examining associations between speech characteristics and symptoms of psychosis. The search strategy was informed by prior reviews (e.g., Cohen et al., 2014; Low et al., 2020; Parola et al., 2020) and was limited to papers available after the inclusion period covered by the most recent review. The initial PubMed search and screening were aided by an AI tool designed for this purpose (IQVIA, 2026). Full pre-registered protocol is available via PROSPERO: Registration # CRD420261337184.
- Search results based on strategy described in protocol are presented in Figure 1 (exception: present results do not include study quality or publication bias assessments). The data extracted from available studies were coded as follows:
 - Speech Elicitation:** We coded methods for eliciting speech samples in the original research reports into one of the following categories: samples obtained via reading tasks, descriptions of pictures, free speech following a prompt, semi-structured interviews, electronic health records, cognitive testing procedures, and naturalistic speech sampling
 - Speech Characteristics:** We characterized speech characteristics that were measured into 6 domains, informed by literature in this field (e.g., Change et al., 2022):
 - Linguistic-Lexical (word-level)
 - Linguistic-Semantic (meaning)
 - Linguistic-Syntactic (structure/grammar)
 - Linguistic-Pragmatic (coherence)
 - Acoustic-Prosodic/Temporal
 - Acoustic-Other

Literature Search & Statistical Results

Figure 1. PRISMA flow diagram



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Using the 287 available absolute values of effect sizes, significant heterogeneity was observed, $Q(df = 286) = 504.41, p < .0001$. This aligned with our hypothesis that variability in effect sizes may be associated with methodological features, which were subsequently examined as moderators. A mixed-effects meta-regression significantly explained heterogeneity, $QM(df = 23) = 156.23, p < .0001$, accounting for a substantial proportion of variance between effect sizes (62.4%) (See Figure 2). Notably, there was statistically significant variability remaining, $QE(df = 263) = 305.47, p = .037, I^2 = 22.65\%$.

Figure 2. Heat map illustrating magnitude of effect sizes as a function of methodological features.

