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The Effects of Altered Auditory Feedback (AAF) on Fluency in Adults Who Stutter: A Systematic Review

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Background

- Stuttering affects 70 million people worldwide, approximately 1% of the population.
- Altered auditory feedback (AAF) has been used to reduce the frequency of stuttering since the 1950s.
- AAF involves the electronic alteration of an auditory speech signal to temporarily increase the fluency of a person who stutters.
- AAF is known to increase fluency during oral reading and monologue tasks.
- Studies on the effects of AAF during spontaneous and conversational speech tasks have revealed mixed results.

Objectives

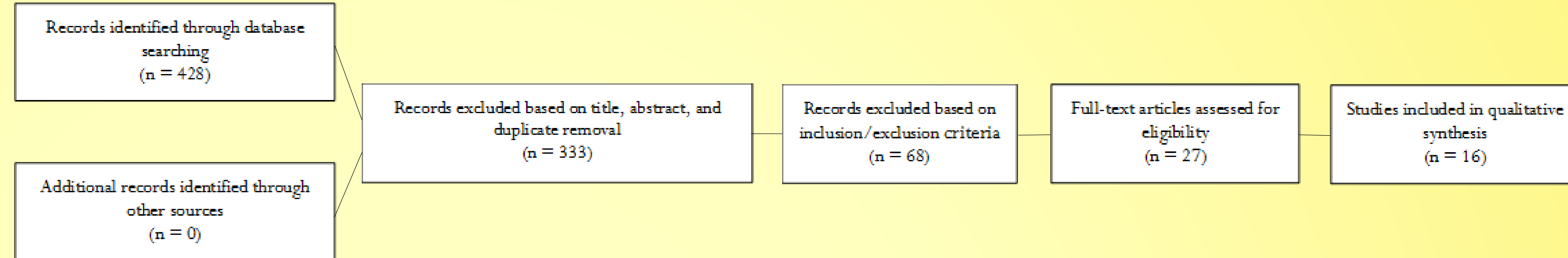
To determine whether AAF enhances fluency in adults who stutter.

Methods

- **Data sources:** Ovid MEDLINE, PubMed, PsychINFO (ProQuest), CINAHL
- **Search Terms** (Subject headings, Mesh headings, and Keywords): “stuttering,” “AAF,” “altered auditory feedback,” “feedback,” “sensory,” “auditory,” “delayed,” “feedback,” “frequency,” “fluency disorders,” “stutter*”
- **Inclusion criteria:** Adults ages ≥ 18 years old who stutter, comparison of altered auditory feedback forms and/or no altered auditory feedback forms in the treatment of stuttering, use of DAF and/or FAF, outcomes related to aspects of stuttering or people who stutter (e.g., fluency level, speech naturalness, speech rate), experimental research
- **Exclusion criteria:** Prior history with any form of AAF for any participant, studies only including adults who do not stutter, any original format of articles not in English
- **Intervention:** Altered Auditory Feedback
- **Outcome:** Fluency
- **Measurements:** Stuttering severity (e.g., *SSI-4*), Overall stuttering frequency (e.g., %SS), Frequency of stuttering type (e.g., repetition), Duration of individual stutters, Stuttering probability, Speech rate, Speech Naturalness
- **Study Quality:** Appraisal via the *Assessing the Quality and Applicability of Systematic Reviews (AQASR)* checklist completed and cross-checked between 3 graduate student reviewers
- **Data Extraction:** Study Characteristics/Results Table created and completed based on most applicable study characteristics as judged by 3 graduate student reviewers

Results

Flow Chart of Included Studies



Clinical Features of Studies

Authors (Year)	Study Design	Number of Participants	Age Range	Type of Speech Assessed	Outcomes	Measurement	Significant Results	Conclusion (Efficacy)
Armson & Kieft (2008)	SS	31 PWS (20 males, 11 females)	18-51	R, M (DAF + FAF combo device)	1. ↓ stuttering freq. 2. Speech rate 3. ↑ speech naturalness	1. %SS 2. # syllables/duration (sec.) 3. Rating scale	1. R vs. M, device use 2. R vs. M, device use 3. Device use	1. Yes 2. Yes 3. Yes
Foundas et al. (2013)	QE	24 males (14 PWS, 10 PNS)	20-46	R, M, C (DAF + FAF combo device)	1. ↓ stuttering freq.	1. # stutters/100 syllables	1. Device use, R task, ear placement (C task), baseline stuttering rate	1. Yes
Geetha et al. (2017)	QE	50 males (25 PWS, 25 PNS)	18-30	SP (DAF, FAF)	1. Speech naturalness	1. Rating scale	1. Diff. b/w groups (all conditions)	1. No
Hargrave et al. (1994)	SS	14 PWS (12 males, 2 females)	18-52	R (FAF levels)	1. ↓ stuttering freq.	1. %SS	1. FAF levels vs. NAF	1. Yes
Hudock & Kalinowski (2014)	SS	9 PWS (8 males, 1 female)	21-72	R (DAF + FAF combos)	1. ↓ stuttering freq.	1. %SS	1. Combos vs. NAF, COMBO-4 vs. COMBO-2	1. Yes

*Abbreviations: C=conversation/dialogue; DAF=delayed auditory feedback; FAF=frequency altered feedback; M=monologue; NAF=non-altered auditory feedback; PNS=people who do not stutter; PWS=people who stutter; QE=quasi-experimental; R=reading aloud; SP=spontaneous speech; SS=single-subject; %SS=percentage syllables stuttered

Conclusions

- The overall quality of the articles assessed was ‘moderate.’
- AAF was generally effective at reducing stuttering frequency, with most benefit apparent during reading tasks.
- Fluency enhancement was variable across participants, with notable dependence on their stuttering severity level.
- The evidence to support improved speech naturalness is inconsistent.

Recommendations

- The results imply that clinical effectiveness is highly variable and that AAF is not a ‘one size fits all’ intervention.
- AAF is likely most effective when used in conjunction with traditional speech therapy.
- Effectiveness of AAF is limited to more structured speaking tasks, such as oral reading.
- Further research is needed to better understand the relationship between AAF and stuttering.