

## Background

Adults with moderate-to-profound sensorineural hearing loss who obtain little benefit from other forms of amplification are candidates for cochlear implants (Dillon et al., 2013). Adult cochlear implant (CI) recipients have a wide range of outcomes which may result from inherent factors affecting variability (Blamey et al., 2013). Factors affecting cochlear implantation outcomes may include: age at implantation, age at onset of deafness, length of device use, and others. As more factors are studied we may gain insight as to what criterion will strongly impact a CI candidate's outcomes. (Oh et al., 2009). To measure improvements and outcomes of CI recipients, a variety of speech perception testing is used at routine intervals. Understanding the various interactions of patient factors and outcomes is crucial to predicting success with a CI, as well as, improve our abilities to provide appropriate counseling and set realistic expectations for patients. This systematic review aims to assess current research regarding the specific patient factor of length of time a person has used a CI and how it impacts their speech perception abilities.

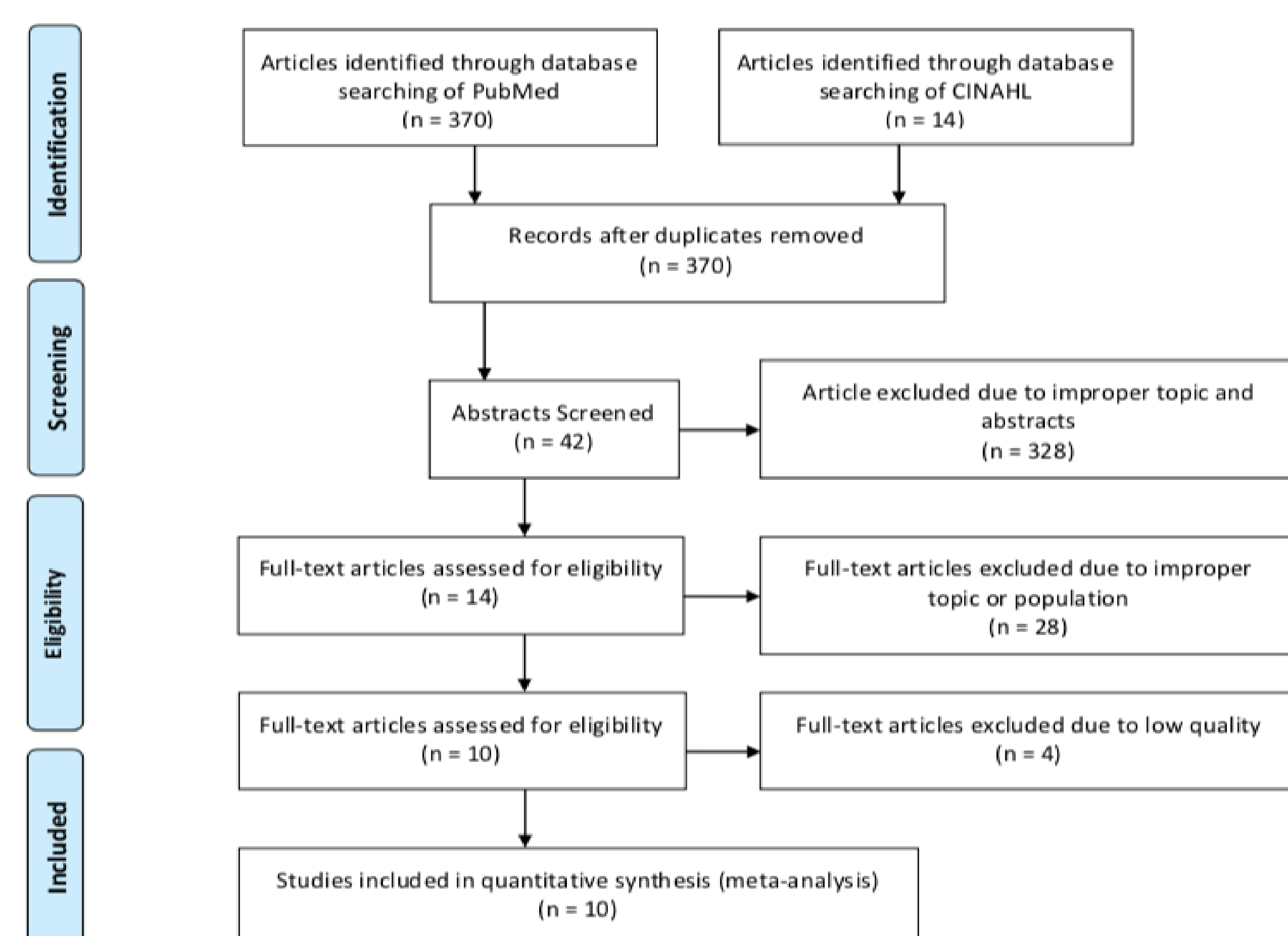
## Research Question

In adults, how does the duration of cochlear implant device use impact speech perception?

## Methods

A literature search was conducted in two databases to identify how the duration of CI device use impacts speech perception abilities in adults. The inclusion criteria included: cochlear implants, adults, speech perception or speech understanding, and duration of cochlear implant use. The exclusion criteria consisted of: under age 19 years, case studies, pediatric cochlear implant studies, bimodal cochlear implant studies. For each step above, at least 20% of articles were checked for inter-rater reliability and each reviewer was blinded to reduce internal bias.

## Prisma Chart



## Results

The inter-rater reliability was calculated for each step of the systematic review process. For the abstract review, the reviewers achieved 94% reliability. During the full-text review 90% reliability was achieved across the reviewers. For quality appraisals, 90% reliability was achieved across all reviewers. Data extraction was completed for the remaining articles that fit the inclusion and exclusion criteria used in this review ( $n = 10$ ). A description of the selected studies and their results are outlined in the following table.

Author	Study Type	Speech Perception Materials	Interval(s) Tested	Findings
Blamey et al. (2013)	Retrospective Multicenter Study	CNC words, disyllabic words, and sentences	Two post-operative speech measures after implantation.	Performance increased up to 3.5 years of implant experience.
Budenz et al. (2011)	Retrospective Study	CNC words, CNC phonemes, CUNY in quiet, and CUNY in noise	Preoperatively and 2-years post-initial activation.	Both young and old CI users demonstrated significant improvement during first 2 years of listening experience.
Chang et al. (2010)	Retrospective Longitudinal Study	CNC words	Preoperatively, 1-, 3-, 6-, and 12-months post-initial activation and annually thereafter.	All patients showed improvement over first 12 months of listening experiences with largest improvement at the 6-month interval.
Dillon et al. (2013)	Retrospective Analysis	CNC words and HINT sentences	6-month, 1-, 5-, and 10-year post-initial activation.	CNC word scores and HINT scores in quiet and noise were stable 6 month to 1 year and 5 to 10 years with significant improvement from 1 to 5 years.
Garcia-Iza et al. (2018)	Retrospective Cohort Study	Disyllabic words and sentences of Navarra language	1-, 5-, and 10-month post-initial activation.	No significant difference between older and younger adults. Both groups had most significant improvement within the first year and stable performance in the following years.
Hamzavi et al. (2003)	Longitudinal Study	Freiburger numbers, Freiburger monosyllables, and Innsbrucker Sentence Test	Preoperatively, and 1-, 3-, 6-, and 12-months post-initial activation and annually thereafter.	Majority of patients reached stable performance at 12-months of listening experience, however, individual improvements seen up to 72 months.
Jolink et al. (2016)	Retrospective Cohort Study	Dutch CVC Lists	Three consecutive speech audiograms after 6-months of listening experience.	Speech recognition in elderly and young adult population is stable overtime and not significantly different.
Oh et al. (2009)	Retrospective Cohort Study	K-CID test	3- and 6- months, 1-, 2-, 3-, and 4-years post-initial activation.	Results plateaued after 2 years of listening experience.
Rak et al. (2017)	Retrospective Longitudinal Study	Freiburger numbers, Freiburger monosyllables, HSM sentence test in quiet, HSM sentence test in noise	10-22 months (short-term) and more than 9.5 years (long-term) post-initial activation.	Trend towards higher scores after longer CI use and stable long-term speech perception up to 20 years.
Ruffin et al. (2007)	Retrospective Longitudinal Study	NU-6 words and CNC words	Preoperatively, and 1-, 3-, 6-, 12-, and 18-months post-initial activation and annually thereafter.	Indicated 24 month asymptote for all age groups as no significant growth or decline found after this point.

## Discussion

The current research on the impact of duration of device use on speech perception in CI users suggest improved performance with device use overtime. Further, research found that patients are reaching their plateau, or best performance, between 12 and 24 months of listening experience. The research examined also demonstrated that older and younger adults could achieve significant benefit from a CI; however, one article suggested that older adults may take longer to reach their plateau. This research is impactful for counseling patients on appropriate timeline for speech perception abilities and realistic expectations. Future directions of research on this topic may include further investigating differences in length of time to reach plateau between older and younger adults, as well as, looking at the impact of daily device use on speech perception abilities.

## Limitations

This systematic review did not include grey literature, nor did it include research from before January 1st of 2000. The analysis of the scholarly articles was also limited due to variable speech perception measures used.

## References and Disclosures

References available upon request.  
No disclosures to report.