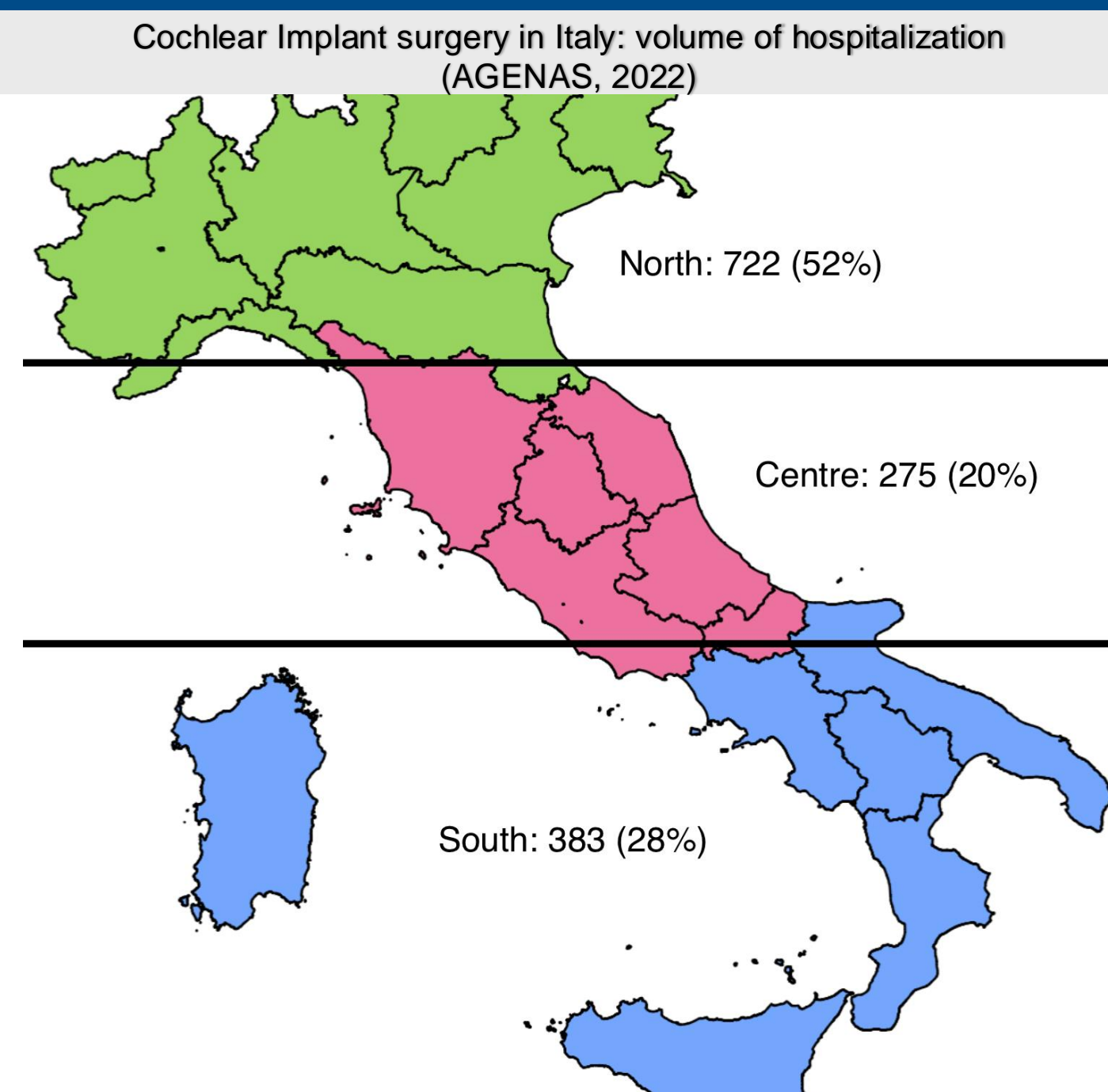


Background

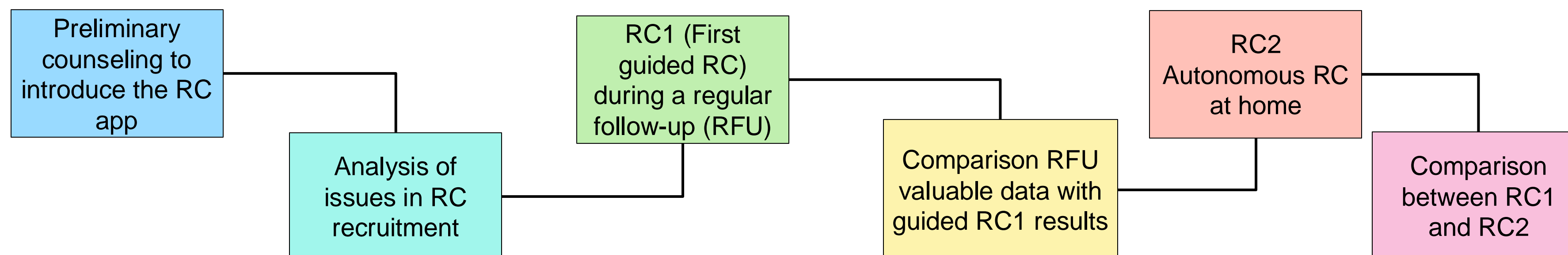


While traditional in-person visits remain the gold standard for follow-up and rehabilitation, tele-audiology may present several advantages in pediatric cochlear implant (CI) care (e.g., travel, time off work for parents).

This observational study aimed to assess whether asynchronous remote CI monitoring (Remote Check, RC) could serve as an effective and feasible solution for providing audiological services to children and their families. In fact, in Italy, recipients and their caregivers often have to travel significant distances to specialized healthcare centers for both surgery and follow-up appointments, creating a considerable burden on families.

Methods

We enrolled 54 young CI recipients (mean age: 7 years, range: 1–18 years), each with at least 3 months of CI experience, who followed the following procedure:



Non clinical issues in RC recruitment

- 25 out of 54 CI recipients/families encountered non-clinical issues in RC recruitment due to:
- Privacy policy consent (1/54)
 - Correct account registration of the CI manufacturer (10/54)
 - Possibility of installing the application from the smartphone App store (7/54)
 - Possibility of streaming from the device of the parents of the young patients (7/54), not excluded from the study
- Because of the above-mentioned problems, 36/54 CI recipients were included in the data analysis.

Results in 36 participants

Completeness of RC1 and RC2 and matching of RCs and RFU activities are shown on the following table:

	RC1 activity completed	matching RC1-RFU	RC2 activity completed	matching RC1-RC2
Questionnaire	36/36		36/36	31/36
Impedance	36/36	35/36	36/36	35/36
Aided Threshold Test (ATT)	10/17*	7/10	10/17*	5/10
Digit Triplets Test (DTT)	10/17*		10/17*	6/10
Photograph of implant area	25/36		26/36	23/25
Data logging	21/36	6/21	25/36	18/21
Hardware problems	29/36		27/36	27/29

* ATT and DTT tests were administered only to children over the age of 6, whose parents had a compatible smartphone capable of streaming audiometry directly to their cochlear implants (17/36).

- Matching criteria for the records were:
- Questionnaires: if at least one item differed from the other
 - Impedance: cumulative difference <5 KOhm of the impedance across the 22 electrodes.
 - Aided Threshold Tests (ATT): audiometric thresholds < 5 dB in at least 2 frequencies.
 - Digit Triplets Test (DTT): SRT difference between RC1 and RC2 < 1dB.
 - Photograph of the implant area: visibility and clearness assessed by the clinician.
 - Data logging: difference in use < 3 hours per day.
 - Hardware: Hardware alarms reported by the speech processors.

Except for the audiometry data (recommended for children over 6 y.o.) the RC1 (Logistic Regression Chi-Square = 2.3358 df = 2 p-value = 0.3110) and RC2 (Logistic Regression Chi-Square = 1.3407 df = 2 p-value = 0.5115) completeness of activities was not significantly affected by age of the CI recipients, age at implant or time of follow-up.

Conclusions

Few shortcomings have been detected:

- The correspondence between **Datalogging** during RFU and RC clinical report presented some issues; we found significant discrepancies in 71.43% of patients. This is likely due to the fact that the app only captures data when the smartphone is within Bluetooth range of the processor. As a result, data collection can be inconsistent, especially for school-aged children who may not always have the smartphone of the caregiver nearby during daily activities, leading to gaps in monitoring.
- **ATT test** performed via app resulted better than RFU free field thresholds by mean is 2.25 dB (pooled standard deviation 3.89). On the contrary the comparison between ATT in RC1 and RC2 showed no significance difference, confirming the replicability of streaming testing.

In conclusion, while further research is needed to refine the optimal use of RC as a substitute for in-person follow-ups, the application already shows potential as a valuable tool for clinicians to perform rapid triage, even ahead of in-person RFU appointments, helping to optimize evaluation times in the clinic.

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