

# Trend of Educational Placements in Hearing Impairment Students in Taiwan

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## OBJECTIVE AND BACKGROUND

Cochlear implantation (CI) is not only clinically effective but also cost-effective from payer's perspective. In fact, the real cost benefits of CI are beyond the healthcare sector. The purpose of this study is to investigate the educational placement and its estimated cost saving after more students with hearing impairment (HL) receiving CI in Taiwan.

In Taiwan, after a private foundation donated CIs in 1999, the number of CI began to rise. Also, free universal newborn hearing screen was implemented since 2012, and unilateral CI became reimbursable by National Health Insurance in 2017. As a result, early identification and early implantation for severe to profound HL children can be realized. The education system for disabilities is divided into centralized special classes, decentralized resource rooms, itinerant resource programs, and regular classes. Different classes are advised according to the degree of disability. Students in centralized special classes spend all day in a specialized environment tailored to their needs, while students in decentralized resource rooms spend most of their time in regular classes, with some additional support. Itinerant tutoring can provide support in various settings, including homes, institutions, or regular classes by itinerant tutors. Taiwan has promoted inclusive education in the 1990s and reached a remarkable 90% coverage in 2009.

## METHODS AND MATERIALS

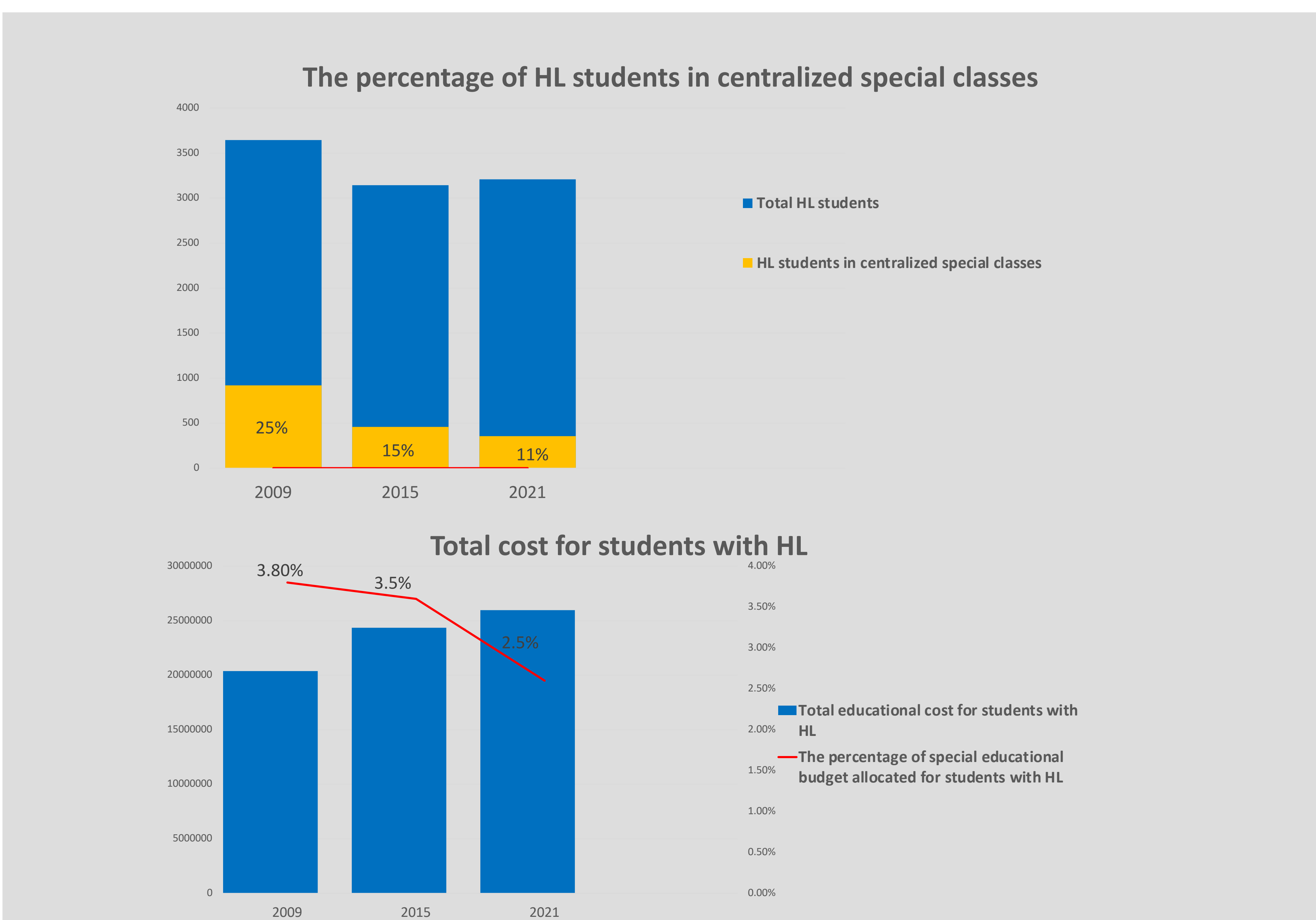
### Methods

Secondary data source from government was used to calculate the change of the educational placements and the average cost per student with HL. The number of HL students with different types of class placements, including centralized special classes, decentralized resource rooms, itinerant resource programs, and regular classes from 2001 to 2021 were retrieved. On the basis of the budget of Ministry of Education for special schools and mainstream schools, the annual cost for each disabled student with different type resources of the mainstream schools and special schools was calculated according to the number of the students and the ratio of teachers per student. The average costs per student with disabilities in different classroom setting is multiplied by total HL students to obtain total cost allocated for students with HL. All costs were inflated to 2021 dollars using the Consumer Price Index.

### Results

We select 2009, 2015, and 2021 school year to represent the period of hearing devices in students with severe to profound HL shift from bilateral hearing aids (HA) to unilateral CI, then to bilateral CIs. The decline in the percentage of attending special classes from 2009 to 2021 resulted in cost saving. The percentage of the special educational budget allocated to students with HI decrease from 3.8% in 2009 to 3.5% in 2015, and further down to 2.5% in 2021.

## RESULTS



## DISCUSSION AND CONCLUSIONS

The longitudinal nationwide data demonstrated the migration of the educational placements after more students with severe to profound HL receiving CI. As bilateral CI increase, the percentage of the students with HL attending regular classes were increasing, from 68% in 2009 to 84% in 2021, and the students with severe to profound HL attending centralized special classes were decreasing. We estimated that by moving just 1% students with HL, roughly 30 individuals, from centralized special classes to decentralized resource rooms, the potential cost saving would be approximately \$270,000 per year. The decrease educational cost allocated for HL students is evident due to widespread use of bilateral CI. There are several other factors that can also influence the education placements, including age of onset and age of identification of HL, additional disabilities, the family's preference, and the policies of the government. Our study has some limitations. First, the utilization rate of hearing aid and cochlear implants is not accessible through nationwide database. Secondly, characteristics of students, such as etiology, severity of HL, were lacking. Lastly, we could not evaluate the students' school performance. Despite these limitations, our study represents the first attempt to analyze educational trends and the associated costs for students with HL in Taiwan. The use of a nationwide data helps omit selection bias. Further long-term follow up is necessary to ascertain the sustained impact of CI.

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