



The COVID-19 pandemic and upgrades of CI speech processors for children: part I—procedure of speech processor upgrade

Anita Obrycka¹ · Artur Lorens¹ · Adam Walkowiak¹ · Elzbieta Wlodarczyk¹ · Beata Dziendziel¹ · Piotr Henryk Skarzynski^{1,2,3} · Henryk Skarzynski¹

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Abstract

Purpose To demonstrate the feasibility of upgrading speech processors during the COVID-19 pandemic.

Methods Adopting concepts from “lean thinking”, we optimized hospital workflows to allow speech processors to be upgraded despite the obstacles arising from national guidelines for COVID-19 prevention. The study involved 297 children, aged from 7.3 to 18.0 years, whose processors were upgraded on five consecutive Saturdays during a time of peak COVID-19 in Poland.

Results The optimized workflow allowed us to conduct speech processor upgrades during a time of peak COVID-19 in Poland. The upgrades were conducted as scheduled, patient flow was smooth, appropriate social distancing was kept, and no reports of COVID-19 infection in our patients in the 2 weeks after their visit were received.

Conclusion Upgrading of speech processors in children is still feasible under coronavirus conditions.

Keywords Cochlear implant · Pediatric · Upgrade · COVID-19

Introduction

On January 30, 2020, the novel coronavirus COVID-19 (2019nCoV) was recognized by the World Health Organization (WHO) as a public health emergency of international concern (PHEIC) [1]. The COVID-19 pandemic has also been recognized as a disaster/mass casualty incident (MCI), defined as “an event that overwhelms the local healthcare system, where the number of casualties vastly exceeds the local resources and capabilities in a short period of time” [2, 3].

In many countries, the available hospital resources have been rapidly exhausted, not only for the COVID-19 MCIs but also for normal day-to-day clinical tasks. Thus, preserving financial and human resources is crucial, and clinical

appliances and staff must be well allocated. To minimize resource exhaustion, good organization and preventive strategies are necessary. Resource use should be carefully planned, and routine scheduled procedures should be reconsidered in terms of materials, staff, devices, care beds, etc. Guidelines are urgently needed to prioritize procedures based on the risk versus benefit of performing them.

The foremost priority is to maintain the health and safety of the health care providers. If they become unwell, the health care system cannot function. By rigorously following safety guidelines, essential health care can be safely delivered to patients.

For cochlear implant (CI) centers, the coronavirus pandemic has caused massive changes in working procedures. In many centers, following so-called lockdowns, CI surgeries have been canceled or postponed, outpatient services have been reduced, and rehabilitation programs shut down or severely curtailed [4, 5].

When national guidelines call for the cancellation of all elective procedures, unique challenges arise for the health care system. Whereas cases of elective interventions and emergency surgery (fracture, trauma, etc.), are clear-cut, pediatric CI interventions form an uncharted middle ground. Unlike adults, children are anatomically dynamic

✉ Anita Obrycka
a.obrycka@ifps.org.pl

¹ Institute of Physiology and Pathology of Hearing, ul. Mokra 17, Kajetany, 05-830 Nadarzyn, Poland

² Heart Failure and Cardiac Rehabilitation Department of the Medical University of Warsaw, Warsaw, Poland

³ Institute of Sensory Organs, Kajetany, Poland

and neural networks for speech discrimination are still developing. Delaying what seems like an elective procedure can affect the already vulnerable health of a deaf child by further impairing their neurocognitive development, hearing function, and potential long-term health. Professor Helen Cullington, Chair of the British Cochlear Implant Group, sent an open letter to the National Health Service hospitals asking for cochlear implantation in children to be treated as a neurolinguistic emergency [6].

It also worth noting that CI issues can cause additional burdens on parents. For example, 79% of parents of a CI child report that a breakdown of their child's speech processor has affected auditory communication. Importantly, only a few CI users have ready access to a spare CI processor [7]. All of these add to the anxiety of both parents and children. The literature documents how a breakdown of the CI processor, or a temporary suspension in its use, strongly correlates with poorer outcomes in CI children [8]. To minimize breakdowns, it is advisable to replace old processors and upgrade them to newer versions.

Cochlear implantation in pre-lingual children with sensorineural hearing loss is considered an elective procedure, and a delay of up to 3 months is currently considered acceptable. Notably, exchange of old processors has been put on hold. To date, there have been no studies of speech processor upgrades under COVID-19 conditions.

Nevertheless, some guidelines exist on how to safely deliver services to implanted patients and recommendations have been made on how to perform urgent and priority procedures. According to the guidelines, the priority must be to provide the patient with audibility in at least one ear [5]. Accordingly, upgrading of a speech processor in the case of a legacy processor failure is classified as an urgent procedure in a unilateral CI user; likewise, in a bilaterally implanted child, with long interimplant delay, upgrading a leading processor makes it a priority issue [5].

The aim of the present paper is to demonstrate the feasibility of upgrading speech processors during the COVID-19 pandemic and report on safety considerations. The study was designed and conducted in accordance with the principles stated in the Declaration of Helsinki.

Methods

Due to the ongoing COVID-19 health pandemic, for the benefit of the patient, it is crucial to optimize workflows as much as possible. For this purpose, concepts from “lean thinking”, such as value stream maps (VSMs) and process flow charts, were used. Our focus was to minimize barriers to speech processor upgrading caused by anti-COVID national safety guidelines while at the same time maintaining high-quality patient care. Although lean thinking originally began in the

automotive industry to minimize waste without sacrificing quality, it has recently gained popularity in healthcare settings, including otorhinolaryngology [9] and large cochlear implant programs [10]. Sladen and colleagues [10] demonstrated that applying lean thinking to a large CI program was effective for improving some, although not all, services.

To apply lean thinking to our problem solving, staff from different departments of the Institute of Physiology and Pathology of Hearing, Warsaw/Kajetany, were invited to discuss various aspects of upgrading during a pandemic, focusing on the risks and challenges. To facilitate discussion, four separate meetings were organized, centered on: (1) constructing a VSM of upgrading, (2) evaluating upgrade schedules, (3) mapping of patient flow through the hospital, and identifying delays and efficiencies in the workflow, and (4) considering safety and hygiene according to pandemic guidelines. The CI program director and medical director, four ENT doctors, eight CI audiologists, two speech therapists, two administrative assistants, and schedulers participated in the meetings.

Meeting one—value stream map

During the first meeting, the team constructed a VSM. The VSM captured the movement of patients through the CI upgrade process, starting from the moment they were first considered for an upgrade through to the upgrade visit. The VSM was used to assess which steps added value to the patients, and which should be eliminated due to waste. The team examined the entire upgrade process including the content of each step (sub-processes) and the movements between the sub-processes. The team then agreed on which points in the process did, or did not, add value.

Meeting two—scheduling

In Poland, fitting of a new speech processor can be reimbursed only if the old processor it is at least 5 years old. To conserve financial resources, meeting members decided that speech processors should be upgraded only if it was necessary from a technical point of view rather than automatically after 5 years. According to our clinical routine, speech processors undergo technical evaluation at each follow-up visit. Usually four aspects are evaluated: general system output, condition of external parts (e.g., transmitter, battery pack), connections between system components, and microphones. Based on medical history, only patients with processors not properly and reliably functioning qualify for an upgrade. Second, due to funding restrictions and a national health policy that prioritizes children, it was decided to restrict upgrades to the pediatric population. Third, a telephone consultation was conducted with the parents of qualified children to confirm the current status of the speech processor.

Meeting three—workflow

The meeting members identified considerable workflow obstacles relating to pandemic safety regulations, mainly those which limit the number of patients who can gather in one specific area. They agreed to modify the processes and devised several ways by which the workflow could be improved. It was decided that upgrades were to be done on Saturdays, when there are no other patients in the clinic (except for hospital patients in a separate level of the building). It was agreed that 60 patients could be accommodated on each Saturday during the months of February and March. Only one adult could accompany each patient into the clinic.

Meeting four—safety considerations

To maintain the health and safety of personnel, as well as patients, new speech processors could only be provided if personnel were vaccinated against COVID-19. Institute employees were obliged to use personal protective equipment—at least a three-layer surgical mask, gloves, and extra gowns.

The Institute's physical layout allowed patient flow to be divided into two different streams with separate entrances, reducing the number of patients at each location to 30. Moreover, based on the VSM and the time needed for each consultation/assessment (including the time needed to clean the room after each patient), the appointment time for each patient was set such that the number of patients in the Institute simultaneously was reduced, ensuring appropriate social distancing. At each entrance, patients were provided with written instructions with information on the sequence of movements. Floor signs helped to keep appropriate social distancing, and hand sanitizers were available at multiple places. Patients and accompanying persons were obliged to wear a mask, and if they did not have an appropriate one, they were provided with a three-layer surgical mask.

Materials and results

The optimized workflow, as described above, allowed us to conduct 297 upgrades on five consecutive Saturdays during a time of peak COVID-19 in Poland in early 2021 (27.02.2021 to 27.03.2021). Upgrades were conducted in patients aged from 7.3 to 18.0 years. The range of legacy processor age varied from 6.3 to 16.1.

During team meetings, described above, a final VSM with a sequence of sub-processes was created to optimize patient workflow (Fig. 1). The goal was to remove barriers and improve access for individuals seeking processor upgrades during COVID-19. The general aim was to increase the number of upgrades. Additionally, based on medical history, and

a telephone consultation with the parents of qualified children a technical evaluation of a speech processor was conducted. It showed that there was total failure of the speech processor in 3% of cases. In the remaining 97% of cases, there were two or three reasons for a decline in audibility. In 81%, damage to external parts was identified, in 72%, connections between components were unstable, and in 16%, there was a reduction in microphone sensitivity.

Two weeks after the upgrade, patients were telephoned for counseling and troubleshooting, and asked whether, since the upgrade visit, they had been diagnosed with COVID-19. No reports of COVID-19 infection were received.

Discussion

The COVID-19 pandemic has had a considerable impact on CI children's access to hearing health services [4]. Parents and their CI children feel distress at a lack of access to services and breakdowns in communication. There is clear evidence of a strong link between COVID-19 lockdowns and a reduction in children's access to spoken communication, access which is essential for psychosocial, academic, and language development [11]. Moreover, consistency in device use is important for building speech and sound proficiency, and so a technical problem with a speech processor can interrupt a child's access to spoken language and in turn compromise their language development.

The coronavirus pandemic has revealed a number of critical issues and bottlenecks in CI care. To deal with the unique challenges to the health care system that arose after national pandemic guidelines were issued, we have adopted some "lean tools" to increase our efficiency and maintain high quality and safety during our speech processor upgrade program. The aim was to make changes to our clinical procedures so as to be able to deliver new speech processors to children during the pandemic.

Results from the current study show how speech processor upgrades can be continued during the coronavirus crisis, thereby providing children with the opportunity to replace worn or failing speech processors and facilitating consistent use. We believe that continuation of speech processor upgrades is of paramount importance during the COVID-19 crisis.

Conclusion

This study shows how the delivery of new processors to CI children can be continued during the COVID-19 pandemic. The upgrades were conducted as scheduled, patient flow was smooth, appropriate social distancing was kept, and we didn't receive any reports of COVID-19 infection

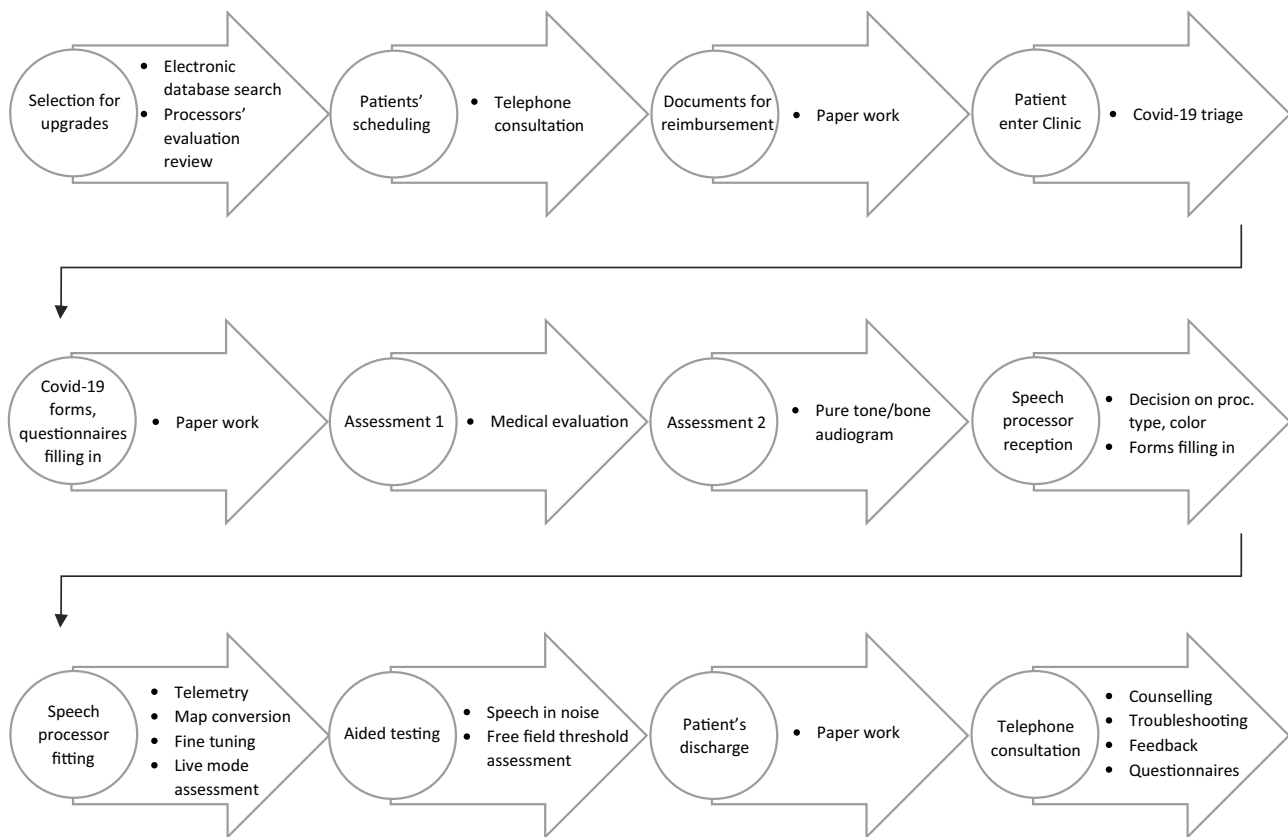


Fig. 1 The value stream map (VSM) for CI upgrading

in our patients in the 2 weeks after their visit. With careful planning, speech processor upgrades in the pediatric population are still feasible during the coronavirus pandemic.

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Code availability Not applicable.

Declarations

Conflict of interest The authors declare no potential conflicts of interest with respect to the research, authorship, and publication of this article.

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