

Achieving effective hearing aid fitting within one month after identification of childhood permanent hearing impairment

Completare l'adattamento degli apparecchi acustici entro 1 mese dall'identificazione dell'ipoacusia di un bambino

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SUMMARY

Diagnosis of child permanent hearing impairment (PHI) can be made with extreme timeliness compared to the past thanks to improvements in PHI identification through newborn hearing screening programmes. It now becomes essential to provide an effective amplification as quickly as possible in order to restore auditory function and favour speech and language development. The early fitting of hearing aids and possible later cochlear implantation indeed prompts the development of central auditory pathways, connections with secondary sensory brain areas, as well as with motor and articulatory cortex. The aim of this paper is to report the results of a strategic analysis that involves identification of strengths, weaknesses, opportunities and threats regarding the process of achieving early amplification in all cases of significant childhood PHI. The analysis is focused on the Italian situation and is part of the Italian Ministry of Health project CCM 2013 "Preventing Communication Disorders: a Regional Program for Early Identification, Intervention and Care of Hearing Impaired Children".

KEY WORDS: Childhood hearing impairment • Early hearing aid fitting • Hearing aid professionals • Interdisciplinary collaboration • SWOT analysis

RIASSUNTO

Grazie al perfezionamento delle procedure diagnostiche e alla diffusione dei programmi di screening uditivo neonatale, la diagnosi di ipoacusia può essere posta con estrema tempestività rispetto ad un passato non troppo lontano. Diventa pertanto fondamentale giungere dalla diagnosi alla corretta applicazione dell'apparecchio acustico in tempi rapidi, in modo da ripristinare la funzione uditiva e consentire lo sviluppo del linguaggio. L'intervento abilitativo precoce di protesizzazione acustica o l'eventuale successiva applicazione dell'impianto cocleare offrono l'opportunità di un regolare sviluppo delle vie uditive centrali e delle aree cerebrali deputate alla ricezione dell'informazione sonora nonché delle relative connessioni con le aree motorie e articolatorie. L'obiettivo di questo articolo è presentare i risultati di un'analisi strategica che prenda in considerazione i punti di forza, i punti di debolezza, le opportunità e i rischi del percorso clinico da seguire per ottenere un'amplificazione precoce in tutti i casi di ipoacusia bilaterale permanente dell'età pediatrica. L'analisi è centrata sulla realtà italiana ed è parte del progetto CCM 2013 finanziato dal Ministero della Salute "Programma regionale di identificazione, intervento e presa in carico precoci per la prevenzione dei disturbi comunicativi nei bambini con deficit uditivo".

PAROLE CHIAVE: Ipoacusia infantile • Protesizzazione acustica precoce • Audioprotesisti • Collaborazione interdisciplinare • Analisi SWOT

Acta Otorhinolaryngol Ital 2016;36:38-44

Introduction

Early amplification in childhood is aimed at giving access to auditory environment and hence lessen the effects of auditory deprivation related to permanent hearing impairment (PHI). Early hearing aid (HA) fitting and eventual cochlear implantation prompts the development of central auditory pathways connections. The HA rehabilitation process that is implemented during sensitive periods has therefore the objective to prevent the effects of PHI

on the plasticity of the entire central nervous system^{1,2}. Maturation of auditory pathways is indeed closely linked to auditory stimulation. Restoring auditory function and fostering speech and language development during sensitive periods makes the central nervous system more effective in adapting to external inputs³. Thanks to availability of universal newborn hearing screening (UNHS) programmes the identification of PHI can be made with greater timeliness compared to the past. The improvements in audiological diagnosis (which is

analysed elsewhere in this series of papers), aims at identifying the characteristics of PHI^{4,5}. This step is the prerequisite to define HA candidacy and selection⁶. At a later stage, some time is required to achieve HA fitting and verification⁶.

The hearing care professional (HCP), according to diagnostic and prescriptive audiological data, selects the appropriate HA and earmould, and defines the technical features and HA signal processing. Management of administrative aspects and family counseling are very important in this phase and require the collaboration of several professionals.

In the framework of the Italian Ministry of Health project CCM 2013 “Preventing Communication Disorders: a Regional Program for Early Identification, Intervention and Care of Hearing Impaired Children”, a multidisciplinary team of professionals undertook a strategic analysis to highlight the strengths and weaknesses of the current assets in early childhood amplification. The specific aim was the following: “to achieve an optimal HA fitting in case of significant bilateral PHI within one month after audiological diagnosis”.

Materials and methods

A group of 24 professionals tertiary care referral centres for childhood PHI was asked to complete a survey (Table I). Asked to report at least 2 strengths, weaknesses, opportunities and threats strategic planning. Same analysis was also extended to 10 Italian HCP experienced in early childhood care who were contacted by mail.

This phase was conducted with the principles of SWOT analysis. The acronym SWOT stands for Strength (S), Weaknesses (W), Opportunities (O) and Threats (T), and corresponds to what the comments of the participants have pointed out. The responses were reviewed by the specialists responsible for. To generate recommendations from the SWOT analysis, a TOWS matrix was used to match the external threats and opportunities with internal weaknesses and strengths of the organisation or programme. The detailed description of the SWOT and TOWS matrix analysis procedure can be found elsewhere in this issue. The study and the survey was focused on this specific aim: achieve an optimal HA fitting in case of significant bilateral PHI within one month after audiological diagnosis.

Results

In this article, we present the main results of the SWOT analysis and, based on the results, the subsequent TOWS matrix. Overall, professionals identified 78 items in the strength category, 87 items in the weaknesses category, 74 items in the opportunities category, and 86 items in the threats category, accounting for a total of 325 responses. Based on these responses, several specific themes were generated for each category (Table II).

Table I. Number and qualification of operators who participated in the SWOT analysis.

	N
ENT/Audiologist	10
Audiometrist	3
Speech therapist	2
Psychologist/counselor	1
Paediatrician	1
Neonatologist	1
Hearing aids specialist	1
Cochlear implant specialist	3
Parents/Associations	2
Total	24

Strength key points analysis

The five most frequently cited strengths were (Table IIa): having a HCP working in the structure or having a close collaboration with the audiological centre (frequency 42%), systematic and standardised follow-up (22%), accurate audiological prescriptions/indications (18%), presence of a HCP trained and experienced in paediatric issues (14%) and capillarity of efficient acoustic centres (4%).

Having a HCP in the structure or having a close collaboration with an audiological centres

In this group, we gathered all the answers that refer to the possibility of including the HCP inside the team of the reference centre (III level), as an internal figure who works in the structure, or as an external figure who works in conditions of close collaboration with the team (n = 18).

This cooperation has a positive effect on the interdisciplinary approach in terms of efficiency of HA and following adjustments (n = 11); multidisciplinary meetings also strengthen the harmony with the family and the possibility to act in synergy with it (n = 2). In addition, the opportunity to have HA replacement in the structure facilitates initial assistance and counseling with families (n = 2).

Systematic and standardised follow-up

In this group, we collected all the answers that refer to an efficient follow up, with the possibility of control-verification of HA in the structure. It is very important to have the possibility to use advanced HAs with ‘data logging’, using monitoring and personalised effective counseling (n = 10).

Finally, we gathered the answers that refer to good organisation of the follow-up in medium/long term, effective in ensuring an easy access to the structure and the continuity and effectiveness of the follow-up, as well as to improve the trust relationship between family and professionals (n = 7).

Table II. Main key points extrapolated from the questionnaires.**Table IIa.** *Strengths.*

Strength key points	Frequency % (n)
Having a HCP in the structure, or a close collaboration with audiological centre	42% (33)
Systematic and standardised follow-up	22% (17)
Accurate audiological prescriptions/indications	18% (14)
Presence of HCP trained and experienced in paediatric issues	14% (11)
Capillarity of efficient acoustic centres	4% (3)
Total	100% (78)

Table IIb. *Weaknesses.*

Weakness key points	Frequency % (n)
No Italian guidelines and protocols	26% (23)
Not having a HCP in the structure or a close collaboration with audiological centre	25% (22)
Ineffective communication/lack of interdisciplinarity	14% (12)
HCP and clinicians with limited experience in early childhood care	14% (12)
Support and training to the family ineffective	10% (9)
Logistical difficulties/inadequate environments	6% (5)
High cost of HA	5% (4)
Total	100% (87)

Table IIc. *Opportunities.*

Opportunity key points	Frequency % (n)
Implementation of the HA assistance in the hospital	42% (31)
Continuous and specific training for HCP and clinicians	34% (25)
Guidelines, protocols and efficacy trials	22% (16)
School sensitisation	2% (2)
Total	100% (74)

Table IId. *Threats.*

Threats key points	Frequency % (n)
Economical aspects	27% (23)
Training and technology are not cutting-edge, efficacy trials	24% (21)
Organizational delays	15% (13)
Not having a HCP in the structure	13% (11)
Social and cultural aspects	13% (11)
Limited interdisciplinary approach	8% (7)
Total	100 (86)

Table II (a, b, c, d). Frequency of themes within each SWOT category (Total = 325).

Accurate audiological prescriptions/indications

In this group all the answers that refer to an accurate audiological diagnosis and a consequent instruction and prosthetic prescription are included, as prerequisites proper selection and setting of HA (n = 14).

Presence of HCP trained and experienced in paediatric issues

In this group we gathered all the answers that refer to the presence of HCP experienced in paediatric care, who is able to handle with accuracy and competency the specific features of the acoustic prosthesis, from the first year of life, and counseling to families (n = 11).

Capillarity of efficient acoustic centres

In this group, considering the problems reported in the previous group, we gathered all the answers that refer to the territorial capillarity of efficient acoustic centres, which are able to ensure both rapid and efficient technical assistance, and professionalism in performing the service (n = 3).

Weakness key points analysis

The seven most frequently cited weaknesses were (Table IIb): no Italian guidelines and protocols (frequency 26%), not having a HCP, or not having a close collaboration with audiological centre (25%), communication/interdisciplinary (14%), HCP ineffective and clinicians with limited experience in early childhood care (14%), ineffective support and training to the family (10%), logistical difficulties/inadequate environments (6%), HA (5%).

No Italian guidelines and protocols

In this group we gathered all the answers that refer to the lack of Italian guidelines and protocols (n = 17): this shortage makes the activity of audiologists inhomogeneous with also the risk of not respecting the appropriate time for the realisation and delivery of HA (n = 2). Some answers also referred to the lack of importance that is attributed to moderate PHI, unilateral PHI, or conditions such as auditory neuropathies (n = 4). In these cases, the lack of early management can have very important implications on language and cognitive development of the child.

No HCP or lack of close collaboration with the audiological centre

In this group we gathered all the answers that refer to the lack of HCP inside the audiological centres of reference or working closely with them (n = 22). This theme appears in Strengths and in Weaknesses, as it depends on both specific operational situations and administrative criteria, being subjected to changes in different areas.

The recurrence of this theme testifies, however, the importance of this type of collaboration for achieving the objective of this analysis and, therefore, the need to be subjected to appropriate regulation and discipline.

Communication/interdisciplinary inadequacy

In this group we gathered all the answers that refer to difficulties of communication and collaboration between different professionals: no shared language, inhomogeneous ap-

proaches and operating procedures, difficulties in reporting plain and comprehensive information to the family (n = 12).

HCP and clinicians inexperienced in paediatric HA

In this group we gathered all the answers that refer to the lack or deficiency of audiologists trained and specialised in paediatric HA (n = 7). Also in this case, if present, this same subject appears in strengths. In the same group we included the responses that concern more specifically the lack of knowledge of the bimodal approach (HA and contralateral cochlear implant) (n = 7) and requires specific knowledge and training (n = 2).

Poor training and family support

The answers that refer to the difficult taking care of a family, especially from an emotional standpoint, when faced are included with the problem of the HA of the young patient, manage a possible refusal of the HA and, more generally, stake resources to tackle the critical time in audiological taking charge of the child (n = 5).

Inadequate locations/logistical difficulties

In this group we gathered all the answers that refer to the places where HCP welcome children and their families who are often inadequate in size and noise or unsuitable to raise the appreciation of small children (n = 4). In addition, the hearing centres often are located far away from III level clinics, which makes collaboration with other operators or the accessibility by the families difficult (n = 1).

High costs of HA

Finally, in this group we gathered all the answers that refer to costs, often high, of the HA of good quality and advanced technology. This is a very critical topic if we consider that these technical/technology features are recommended to ensure the accuracy and flexibility typically required in paediatric HA (n = 4).

Opportunity key points analysis

The four most frequently cited Opportunities were (Table IIc): activation of the HA assistance in the structure (42%), continuous and specific training of HCP and clinicians (34%), guidelines, protocols and efficacy trials (22%), school sensitisation (2%).

Activation of the HA assistance in the structure

The opportunity to fit the HA in the structure would lead to significant clinical advantages (see the previous discussion regarding the Strengths and Weaknesses) (n = 16). In this context, the opportunity is the possibility to overcome obstacles to implementation of this form of collaboration (n = 15), with institutional support (of the hospital and local authorities).

Continuous and specific training of HCP and clinicians

Maintaining regular and specific training opportunities

addressed clinicians and HCP would achieve a high level and quality of specific training dedicated to child HA, with important implications favourable the homogeneity of behaviour, information and care arrangements (n = 25). Communication between professionals and the family could have a common language and be mediated by an interdisciplinary tight-knit team.

Guidelines, protocols and efficacy trials

The possibility to create and to have guidelines and protocols diffusely and uniformly applicable on a regional or nationale scale (n = 8) could bridge the adverse effects described in the related item in Weaknesses, to ensure effective taking over that relies on the precocity and the effectiveness of the intervention (n = 8).

School sensitisation

This opportunity must be considered, in our interpretation, as an extension of the living environment and of socialisation of the child where the awareness of the needs of the young patient with PHI is crucial (n = 2). Sensitisation in these areas of school staff, social workers and family, understood in a broad sense, refers to, however, phases of the habilitation program subsequent to that identified by the objective of this analysis.

Threats key points analysis

The six most frequently cited threats were (Table II d): economic aspects (27%), training and technology is not cutting-edge, efficacy trials (24%), burocratic and organisational delays (15%), not having a HCP in the structure (13%), social and cultural aspects (13%) and limited interdisciplinary approach (8%).

Economic aspects

In this group we gathered all the answers that refer to the high cost of HA of present technology and to the limited resources available for care intervention (n = 19). A high risk is represented by an inadequate coverage by the National Health Service (NHS) for the provision of HA with adequate performance and by the difficulty to obtain the highest quality of assistance service/fitting. This aspect is exacerbated by the risk of conflict of interest, present in the figure of the HCP, who plays a dual role: the caring role of selector/adapter, and the commercial supplier of the HA. The current tariff nomenclature, dating back to 1999, does not consider the technological progress and indicates economic values, recognised today by the NHS, which are far removed from the actual value of HA suitable for the needs of the young patient and appropriate to indications (digital/conductive HA) (n = 4).

Training and technology is not cutting-edge, efficacy trials

In this category we gathered all the answers that refer to the lack of evidence of efficacy of technological and informat-

ics developments in HA (n = 8) and to the low level of specialisation in childhood HA previously described (n = 13).

Burocratic and organisational delays

In this group we included all the answers that refer to factors that can slow down HA programme. In particular, we point to the difficulties to quickly reach clear and definitive diagnosis in very young children (n = 4), the time required to achieve perfect fitting (n = 5) and, not least, the bureaucratic and administrative paths that the family often has to deal with (n = 4).

Not having a HCP in the structure

In this category we enclosed all the answers that refer to legislative and normative impediments that make difficult, if not impossible, the presence of the HCP in the structure (n = 7). The possible positive effects of this presence have been described in previous parts of this analysis.

Social and cultural aspects

In this category we gathered all the answers that refer to the influences of different cultures that makes it difficult to accept the audiological condition and the HA (n = 2), and communication between healthcare professionals and family, up to limiting the effectiveness of counseling, even when in the presence of a cultural mediator (n = 6).

Limited interdisciplinary approach

In this category we gathered all the answers that refer to the difficult communication (n = 5) and collaboration between the various structures and production/distribution companies of HA (n = 2).

Discussion

Based on the answers to the SWOT analysis, we processed the TOWS matrix to define possible “strategies” of intervention for the achievement of the specific objective. Strengths are combined with Opportunities (S-O strategy), Strengths with Threats (S-T strategy), Weaknesses with Opportunities (W-O strategy) and Weaknesses with Threats (W-T strategy). Through the TOWS matrix (Table III), we identified 11 strategies that, through a process of selection and considering what was discussed during SWOT analysis, we further reduced to five main strategies. These strategies are considered useful to complete the HA fitting and verification within one month from the definition of the audiometric characteristics of PHI ≥40 dB HL in the better ear.

The first strategy consists of approaching early amplification systematically through the work of a multidisciplinary team that includes all competent professionals and based on a constant and effective interaction with the family. This approach is the requisite for a fast and responsible audiological process, through diagnosis to prescription, fitting, verification and outcomes measures, until the correct management of practical aspects and control of the psychological and relational issues of the HA are achieved.

The role of the HCP becomes essential. The HCP participating in the “paediatric amplification network” should in ideal conditions belong to the audiologic centre itself or alternatively be in close collaboration as an external advisor. Interaction should always be straightforward and effective.

Prescribing and dispensing HA is a complex process in Italy. It involves coordination of a flow of information

Table III. TOWS matrix (see text for explanation).

		Internal	
		Strength (S)	Weakness (W)
External	Opportunities (O)	<p>SO strategy</p> <ol style="list-style-type: none"> 1. Involve (with direct collaboration) HCPs competent in childhood HA by adopting guidelines enclosing protocols and systematic follow-up based on the multidisciplinary approach 2. Regulate HCP activity in legislative and normative aspects, and in technical procedures, to achieve effectiveness and homogeneity 3. Support and promote training and continuing education of the operators 	<p>WO strategy</p> <ol style="list-style-type: none"> 1. Defining common tracks to facilitate the access of HCP to clinics and interdisciplinary collaboration 2. Definition of guidelines and protocols adapted and widely applicable to the Italian situation 3. Promote opportunities for specific and shared training, to improve interdisciplinary collaboration, uniformity of training and behaviour, and the presence of a network of paediatric HCPs
	Threats (T)	<p>ST strategy</p> <ol style="list-style-type: none"> 1. Limit constraints between technical and commercial aspects in childhood HA and help to identify specific audiological skills and certified providers. 2. Multidisciplinary approach with the presence of HCP to reduce technical and burocratic delays and to reduce difficulties in communication with the family and those related to extraterritoriality and multiculturality 	<p>WT strategy</p> <ol style="list-style-type: none"> 1. Supporting the definition of legal and administrative paths for the certification of companies and HCPs, in accordance with guidelines and protocols developed by referral audiological centres and establishing lists of authorised HCPs 2. Overcome organisational difficulties (secretary, connections with families and territory) caused by bureaucratic and economic limitations 3. FAD courses or guidance - formative material with basic structure common to all the operators involved in the qualifying process (including the family) suggested at the time of audiological indication

about therapeutic, technical and administrative activities done by physicians, HCPs, supplier companies and administrative staff of local health organisations, all involving the child and his family.

The application of the HA must take place only by a qualified technician (the HCT) in suitable seats equipped with full instrumentation for HA fitting and verification. The supplier and the HCT do not belong to the NHS, but are affiliated with the local authority in charge of public health (ASL). The HCP can apply the HA only with a prescription made by an ENT specialist or a Physician in Audiology and Phoniatrics. Specialty the prescription and verification test of the HA (with or without the expenditure from the regional health system) is done by the MD specialist and is regulated by a official document of the NHS named "Nomenclatore tariffario delle Protesi". The possible price difference of the HA is paid by the family only after the formal positive testing done by the prescriptive centre.

The recruitment of a HCP as an external advisor of the team may not be easy, especially in large urban centres. If the patient lives far from the hospital, which is a common condition for referral centres, connections becomes challenging. It would be useful to create a network of HCP that are formally qualified, distributed over large areas, in order to obtain effective coverage throughout the country and to guarantee an appropriate HA assistance to all children with PHI, even in locations far away from the referral audiological centre.

A second strategy, which is also related to the working methods of the audiological centre, is the optimisation of procedures and contacts with the family and with the professionals/institutions for external collaboration (family paediatrician, territorial healthcare professionals, school staff). This is a concrete need for all the phases of the habilitation programme, but especially in the initial phase. Regarding this SWOT analysis, these needs are particularly important to ensure efficacy and timeliness in HA fitting and in counseling the family. Pursuing this strategy means having the availability of economic and institutional resources to obtain appropriate instruments and a dedicated staff.

The third strategy is identified in defining and adopting standardised protocols by scientific societies and professional groups, which promote quick, easy and uniform pathways in the different phases and in different aspects (clinical, technical, burocratic/administrative) of the paediatric amplification⁶.

Although there are often interesting and accurate reports on various aspects of childhood hearing care by Italian authors⁴⁻⁷, few official documents have been published by the Italian Society of Otolaryngology, Head & Neck Facial Pathology⁸. Indications are, however, extremely synthetic on the topics of amplification, especially in childhood. The availability of specific and accurate guidelines, as already

issued in other countries^{3-6,9}, would be extremely useful to all healthcare workers and their patients/clients, and also for institutions for legal and administrative implications.

The fourth strategy concerns the specific training regarding issues related to paediatric amplification, which represents a critical issue for healthcare professionals in general, but in particular for the HCP involved in HA fitting and amplification.

An adequate, certified and interdisciplinary competence in paediatric amplification is needed to potentiate skills in managing selection, fitting, counseling and outcome verification¹⁰. Training entrusted audiologic tertiary centres in hospitals and universities, i.e centres that can handle the training supply and ensure training capability, is needed. Interdisciplinary training courses should be promoted in collaboration with professional associations and HA distribution/production companies. A first positive experience in this direction has been established by the University of Padova and University of Modena e Reggio Emilia, although limited to HA technician graduates.

The participants to the SWOT analysis considered it helpful to set up a "registry" of HCPs with certified paediatric HA competency, technical skills, experience and ethical issues according to criteria established by as many as possible III level audiological centres in Italy, in collaboration with HCP associations.

In close relationship with the previous topic, the fifth strategy would be to revise and improve the regulatory issues and policies related to the management of HA, which often has an impact on the time needed to begin the (re) habilitation programme.

The process which involved the steps of prescription - budget elaboration - approval - delivery - fitting - verification should be faster. Several HA companies have the practice of giving a 'test period', which can reduce the period of time that occurs from PHI identification to the effective HA delivery to 10 to 15 days starting from the first contact with the family.

There remains, however, the need for a redefinition of the legal and administrative rules in order to optimise this process, which often varies in time for each local public health authority.

An adequate definition of the legal and administrative aspects could also help to resolve the current problem of the discrepancy between the financial support provided by the NHS and the effective economic requirements for an efficient early intervention programme that includes the complete coverage of "state of art" HA costs.

Conclusions

UNHS programmes and improvements in audiological assessments procedures have made earlier PHI diagnosis a real fact. Restoring auditory function and implementing speech and language acquisition through the process of

amplifications should start as early and quickly as possible. As a result of SWOT analysis performed by 24 professionals involved in early paediatric amplification, five main recommendations have been developed: building a interdisciplinary network approach during all phases of the HA habilitation process; optimising procedures and mechanisms of contact with the family, adopting standardised protocols by scientific societies; having a specific interdisciplinary training on paediatric amplification issues; obtaining an adequate definition of the legal and administrative aspects. This approach is endorsed by the current international guidelines on paediatric audiology.

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Received: October 26, 2015 - Accepted: November 30, 2015

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