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How could the service delivery process of dynamic arm supports be optimized?

Background: The service delivery process of dynamic arm support (DAS) is complex. Obtaining an optimal match between user and DAS depends on a variety of interrelated factors, different professionals are involved, and the market of available solutions is evolving.

Objective: To determine how the service delivery process of DAS could be optimized.

Methods: Interviews with DAS users that retrospectively focused on the experienced service delivery process, which was compared to the 'general Dutch prescription framework'. Results were presented in a focus group session to seven DAS consultants, and subsequently verified by a member-check.

Results: Sixteen people who considered the Gowing (a DAS new on the market) as a solution and seven DAS consultants participated. Aspects that can be optimized in the current service delivery process included an improved cooperation between clients, professionals and consultants, increased knowledge of DAS in professionals, an embedded user evaluation, and timely delivery.

Conclusions: It is recommended that the service delivery process is optimized by developing a DAS specific prescription framework. The issues identified in this study should be addressed in this framework. For this additional knowledge on how to optimally match persons and DAS is needed.

Keywords: assistive technology, dynamic arm supports, service delivery process

1. Introduction

Dynamic arm supports (DAS) are a class of assistive technology used to support the performance of crucial activities of daily living (ADL) in people who suffer from limitations in upper extremity function [1-3]. Several types of DAS are commercially available in the Netherlands. It appeared, however, that the benefit of procured DAS is not in all cases large and evident [2, 4, 5]. When people do not benefit from their obtained device it is assumed that the match between user and chosen DAS is not optimal [6, 7].

This is considered a problem as difficulties in ADL experienced by clients are solved insufficiently. Additionally, a suboptimal match often goes with a decreased level of use [6-8], which is considered a waste of resources.

Obtaining an optimal match between user and DAS is a complex process due to the individual character of use. DAS are used by a highly heterogeneous population with respect to the user's diagnosis, limitations, restrictions, impairments and contextual factors [2, 4, 6]. Much is still unknown regarding how and which factors affect use and benefit. All relevant factors are ideally addressed in the selection process which is part of a larger service delivery process starting when there is a first contact with the service delivery system until follow-up of the procurement [9]. A qualitatively good service delivery process is essential to achieve the desired outcome [9]. The service delivery process is complex as several professionals (occupational therapists, rehabilitation physicians, several suppliers) are involved. All fulfill different roles, but are required to have a certain level of knowledge regarding DAS. Research has shown that there is room and need for new DAS on the market [10]. So new DAS, with different functionalities compared to the existing DAS enter the market almost every year. This adds to the complexity of the service delivery process as it requires professionals who are always up to date. Moreover insight into the benefits of new devices is continuously needed, also in relation to existing DAS. Addressing the factors that affect the use and benefit of DAS is essential for selecting the most appropriate device. This is for example described in the generic Matching Person and Technology model [11].

This study focusses on the entire service delivery process, during which ideally persons in need of AT due to their upper extremity limitations are directed to the correct professionals, information with respect to different types of DAS (and adjacent solutions) is accessible for everybody involved, the

selection and testing is done appropriately, users are trained in using their DAS, the delivery is followed and evaluated [9]. These aspects are captured in the 'general Dutch prescription guideline' (RiFA). This generic framework is developed to serve as a basis for the optimization of the service delivery process of specific types of AT and describes all activities in the service delivery process of assistive technology, from the detection of a problem to the evaluation of the obtained assistive device divided into 7 steps [12] (figure 1). The functional problem of the client is central in this framework and in every step several actions of the professional and client are proposed.

Comparing the current service delivery process of a newly developed DAS as a case to the 'ideal' situation described in the RiFA framework will show which parts of the service delivery process of DAS could be improved and how these could be improved. Implementation of the required changes in daily practice will subsequently lead to an improved service delivery process of DAS and ultimately increased use and perceived benefit of DAS. Therefore the goal of this study is to determine how the service delivery process of DAS could be optimized.

2. Methods

A DAS that is recently brought on the Dutch market served in this study as a case to systematically investigate how the service delivery process of DAS is organized and how it could be optimized. The Gowing (figure 2), developed and distributed by Focal Meditech [13], entered the market in 2014. This device supports movements of the arm following the 'assist as needed' principle as well as actively. The amount of gravity the device compensates for can be adjusted and rotations of various axes can be blocked. The alignment of the device with respect to the gravity in the horizontal plane can be adjusted. The Gowing is commonly mounted on an electric wheelchair, but can also be attached to a working chair or mobile base.

This qualitative study involved an interview eliciting the users' experiences regarding the service delivery process, followed by a comparison of the interview data with the RiFA process framework, and a focus group session with Focal's DAS consultants. Member checking was done by asking one of Focal's consultants to review the outcomes. During this study also factors that affect the benefit of the Gowing DAS were investigated. The study was approved by the medical ethical committee Atrium Orbis Zuyd (15-N-99).

Sample

The sample consisted of people living in the Netherlands who were referred to or contacted Focal because they searched for a solution that could support their arm function. People included in the study were visited maximal seven months prior to this study by one of Focal's consultants. During this visit several solutions were considered among which was the Gowing. People included in the study were advised to opt for the Gowing, another type of dynamic arm support, an eating device, or a robotic manipulator. People from 12 years of age were included in the study, as below this age people rarely use DAS. People with memory problems were excluded due to the retrospective character of parts of the data-collection method.

Anonymized Client records were screened to identify people who met the inclusion criteria. These persons were contacted by phone by Focal and asked whether they would like to receive information about the study. People who were interested received the information letter and informed consent form. One week later they were contacted, the procedure was explained again, also to a parent in case people were younger than 18 years. In case they were willing to participate an appointment for the home-visit was made.

Data-collection and data-analysis

A semi-structured interview was conducted after informed consent was obtained. The interview guide included questions regarding the different solutions that were tried or considered, people involved, the decision making process, available information, delivery and instruction. Furthermore, participant characteristics such as age, diagnosis, wheelchair use, specific type of DAS, attachment of the device, and frequency of use were asked. The interviews were recorded digitally and summarized in written form (on average three pages per interview). Data were analyzed using directed content analysis [14]. The 'general Dutch prescription guideline' (RiFA framework) (figure 1) formed the basis of the coding scheme.

Subsequently a focus group session was conducted with the consultants of Focal to discuss the interview results and to fill in the identified gaps. Main outcomes of the interviews including the knowledge gaps were presented to the consultants and discussed, guided by a PowerPoint presentation. The session lasted for 1,5 hour and was also recorded digitally, summarized in written form and analyzed using the RiFA framework. Finally data were verified by means of a member check of one of the consultants.

3. Results

3.1 Participants

Forty-six people were identified for whom the Gowing was considered in the period January till June 2015. Of those, 13 were willing to participate and three did not want to participate but were willing to provide information over the phone. Reasons why people did not participate (N=12) included a lack of energy, that they deceased, and parents who did not want their children to participate. Nine persons could not be contacted and six of the identified people had chosen not to receive an assistive device. Two of these participated, however. Average age of the participants was 34,8 years (sd 18,2). Eight men and eight women participated. Participants were diagnosed with diseases such as Duchenne Muscular Dystrophy, Multiple Sclerosis (MS), Amyotrophic Lateral Sclerosis (ALS), Spinal Cord Injury (SCI), Guillain–

Barré syndrome, and other (neuro)muscular dystrophies. Of the 16 people involved in this study six received a Gowing, six received another type of dynamic arm support, two received an eating device, and two decided not to receive a solution at the moment. Seven consultants participated in the focus group session.

3.2 Service delivery process

The service delivery process the participants went through is described according to the steps defined in the 'general Dutch prescription guideline' (RiFA framework). This framework consists of seven steps (figure 1). In the first step the client acknowledges that there is a problem and contacts a care professional, and in the last (7^{th}) step client satisfaction with the obtained device and goal attainment are assessed. The content of these steps according to the RiFA framework and the five steps in between are described in more detail below, as well as the activities identified that were conducted for the participant involved.

The RiFA proposes steps which are to be successively conducted. In this study the division between steps is less strict and steps are not always performed in this sequence due to the involvement of different professionals. Few activities were identified for step 2 'formulate a care plan'. In general, care professionals such as occupational therapists (OT) and rehabilitation physicians play a major role in the first steps (1 to 3) until "formulate a care plan" and identifying that a DAS might be a solution. Subsequently their role diminishes as participants are visited by a consultant from Focal who in general simultaneously conducts some activities in step 2 and has a major role from step 3 on.

3.2.1. Step 1. Identify a problem. This step concerns the demand for care. A client consults a professional and a route to find a solution is determined.

It appeared that there are several ways a problem is identified. 1) People who consult a rehabilitation physician or OT regularly are encouraged by them to try a DAS for example due to further deterioration. 2) People experience a problem in ADL and subsequently go to an OT (often this involves problems with eating or overstraining). 3) Some people seem to have skipped this step as they have independently searched for a solution without intervention of a care professional. The focus group session added to the aforementioned options cases in which a problem in arm and hand function is identified when consultants of Focal visit a client for a different problem.

3.2.2. Step 2. Formulate a demand for care. This demand is formulated based on the impairments, activity limitations and participation restrictions, the contextual factors, and the prognosis.

This step assumes that the demand for care is formulated without looking at potential solutions. This includes an anamnesis to identify impairments, disabilities, participation restrictions, contextual factors, and prognosis. These aspects should be considered when searching for the most appropriate solution (in this step i.e. assistive technology, surgery, home adaptations). In this anamnesis, preferred and valued activities of the client play a large role. It did not become clear from the interviews how the demand for care was identified, who was involved, and what activities were undertaken, and which tools and instruments were used. The focus group session revealed that the OT should be concerned with this task. The information collected during this step (i.e. prognosis, impairments, limitations) should be sent to the consultants of Focal. In practice, however, parts of this step are repeatedly done by consultants of Focal during the home visit, simultaneously with steps 3 and 4. Currently, consultants of Focal ascertain relevant aspects by primarily addressing their tacit knowledge. The member check revealed that the consultants are supported by documented information regarding the possibilities of DAS with respect to intended use.

3.2.3. Step 3a. Care plan: type of solution. In this step the goals with respect to DAS are determined.

At the end of this step it is decided whether a DAS is expected to be an appropriate solution. In most cases participants are sent to Focal by an OT or rehabilitation physician. It did not become fully clear from the interviews how care professionals decide that a DAS would be a potential solution. Remaining questions are: how are the goals set, how is human related intended use determined, which instruments are used and by whom? It became clear that professionals who bring their clients into contact with Focal are required to communicate information regarding the goals set with respect to DAS. This, however, seemed difficult in some cases as not every care professional is aware of the possibilities of DAS, probably leading to unrealistic goals. For this reason consultants of Focal partly refined goal setting and defined the human related intended use during the try-out at home. This process is supported by documented questions regarding, among other aspects, cognitive capabilities. Insufficient knowledge of professionals regarding the possibilities of DAS might also lead to not considering devices in cases where they might be beneficial.

During the interviews participants indicated that not often other solutions (for example eating devices) were considered when DAS seemed an appropriate solution. Also national reimbursement rules affect the choice for a type of solution as (prior) home adaptations or other procured assistive devices affect the possibility to obtain a DAS. The ability to obtain a DAS and to get also a home adaptation or other (dedicated) assistive device reimbursed are limited.

3.2.4. Step 3b. Care plan: requirement analysis. In this step the human related intended use (needs and whishes regarding the technology) is translated into requirements (product related intended use).

Step 3 and 4 are in practice performed simultaneously. From the focus group session it appeared that the consultants conduct this step by addressing their tacit knowledge (some types of DAS are for example not usable by people with quickly deteriorating diseases due to the needed learning curve). The member check showed that this is partly documented in a protocol based on the ICF and ISO9999 (i.e. investigating cognitive capabilities, upper extremity function). This protocol addresses also components of step 3a. Furthermore, Dutch health insurance policy imposes the rule that the most simple and adequate solution is procured. Additionally, client's health insurance company do not always procure each type of DAS.

3.2.5. Step 4. Selection, trying and deciding.

The RiFA model describes that the requirements defined in step 3b could be used to determine which solutions best fit the needs and wishes of the client. These could subsequently be tried. If an appropriate solution is found the consultant determines which adaptations (wheelchair, attachment) are required and which control option is possible. Try-outs happen according to this procedure, and the protocol as described above is used to document the procedure (tested device and reasons for absent effects and outcome).

Some people actively search for information on DAS/dedicated devices prior to the try-out, for example on the internet or a fair, in some cases helped by an OT. During the try-out itself one or more specific types of DAS are tried, mostly in one session lasting about half an hour in the presence of an OT. The devices tried according to clients' records and recalled by participants were not always in line. During the focus group session, the fact that people try several devices in a short period of time, receive a lot of information, and the fact that clients are tired while a decision is made at the end of the try-out are put forward as explanations for this difference between what clients remember and what is recorded.

Several participants indicated in the interviews that they had preferred to try the device for a certain period of time in real life before having to decide whether or not to obtain the device. A reason for this, derived from the member check, included that there are insufficient financial resources available to facilitate this.

Participants recalled that during the try-out they moved with the device, and/or were asked to perform some activities, in some cases simulated, they hoped that device would help them with. This is not fully in line with outcomes of the focus group session that showed that the most important activities are always tried. Not everybody whose major problem concerned eating independently tried an eating device. The focus group session revealed that if these people are able to eat with a DAS, a DAS is advised instead of an eating device due to its wider range of possibilities.

Most people indicated that the decision was made in cooperation between them, the professional and consultant. However, several people also indicated that they were not fully convinced that they had a sufficiently active role in selecting the type of DAS and indicated that their only choice was whether they wanted to receive the proposed solution or not. The focus group session revealed that the wish to be involved and the involvement of clients in the decision-making process differs. The member check also revealed that relatives can strongly impede independent decision making, especially parents of children.

3.2.6. Step 5. Delivery and instruction. The device is delivered in this step including an instruction regarding how to use the device and maintenance.

In general, between two to five months after the try-out the device is delivered. In some cases a working chair needs to be obtained first to which the DAS needs to be attached subsequently. The cooperation between different companies/institutions is sometimes problematic and frustrating for users. Mistakes

in the requesting procedure and processing time are mentioned as explanations in the focus group session.

3.2.7. Step 6. Use

Many users indicate that problems arise related to the installation of the DAS and its environment. Examples are a wheelchair control out of reach and difficulties with movable backrest of the wheelchair. Many people fix issues themselves, but in other cases people keep using a device that works not optimally. The member check confirmed that users actively need to seek support in order to get issues solved that may arise weeks until months after the delivery. Another issue that appeared in the focus group session is the fact that people with progressive disorders might deteriorate between the try-out and delivery of the device. Instructions regarding how to use DAS, supplemented by written instructions, are provided. Training is currently not part of the service. It was mentioned in the focus group session that next to suppliers OTs could play a role in training people in using devices and monitoring adequate use.

3.2.8. Step 7. Evaluation and follow-up assessment

Evaluation and follow-up were not conducted in the cases studies. Some participants perceived this as a limitation. An argument against the introduction of a standardized evaluation is the ratio between time investment and solvable problems, which is expected to be small and will result in high costs. In case evaluations would be introduced the role of the OT and digital evaluations should be considered. During the focus group session it appeared that the need to adapt devices during the period of use also depends on the type of device. Newer devices such as the Gowing can be adapted by the end-user to a great extent, in comparison to older products such as the Sling [15]. A summary of the aspects that could be optimized in the service delivery process of DAS can be found in table 1.

4. Discussion

The goal of this study was to determine how the service delivery process of DAS could be optimized. We compared the actual process for a newly developed DAS in 16 cases with the 'general Dutch prescription framework'. The current service delivery process of DAS would benefit from improved cooperation between the different care professionals involved, paying parties, the consultants and clients. Currently clients' involvement in the decision making process is limited as they are often not aware what exactly happened, and/or they do indicate that their choice was limited. It appeared that goals set by professionals often did not match the possibilities of DAS, or professionals do not consider DAS as a potential solution. Additionally, care professionals such as OTs are only to a small extent involved in the actual selection of a DAS. OTs are specifically trained to advise in the choice of AT in relation to individual needs [16]. They could very well estimate the benefit of a DAS in daily living situations, based on the clients' life goals on the longer term, home adaptations, and other contextual factors, as well because people who opt for a DAS often have their own OT whom they visit on a regular basis. So, the provision of DAS would benefit from a partnership approach [9] in which the selection of a DAS is teamwork in which users have a central role supported by their care professional, working together with the consultants that have highly specialized knowledge regarding the technology, attachment, adaptations and user experiences. Improved cooperation requires increased knowledge of professionals, which is often not present as this concerns a complex and specific form of assistive technology [9]. Additionally, professionals are currently not facilitated to thoroughly consider various solutions.

Support could be provided in each of the steps defined in the RiFA framework and for this reason generic tools are proposed in the framework. During this study it appeared that no instruments or tools are used for the goalsetting with respect to DAS. The RiFA framework proposes the Individually

Prioritized Problem Assessment (IPPA) to structurally investigate problematic activities that need to be solved [17]. An advantage of systematically investigating problematic activities is that it could bring focus to the selection process itself. It could also be used as a basis for evaluating DAS during a try-out; does it match the need? It would also force the team (client, professional, consultant) to solely focus on solutions that contribute to this need, which could for example also lead to dedicated eating or drinking devices, which are considered to be more effective in supporting that specific activity than a generic device. As several users primarily use DAS for eating this is essential to consider [2].

A tool like the IPPA can also be used to evaluate the procurement. The latter currently does not happen standard after each provision, but is essential to timely solve technical issues, find additional required solutions, and allow people to re-enter the service delivery process in cases of dissatisfaction or disappointing effects. Evaluation is not necessarily a task for the supplier, but might also be done by an OT involved or by the health insurance company.

Matching persons to the correct type of DAS remains a complex process resulting in minor or no benefits when the match is not optimal [6, 7]. During this study it appeared that the consultants who are concerned with this task do this primarily by addressing their tacit knowledge. Insight into this tacit knowledge would help to optimize the process, make it more transparent, allow the consideration of DAS together with other stakeholders than consultants alone (i.e. OTs), and increase the ability to communicate in the same, uniform terminology. Knowledge regarding factors affecting use and benefit has increased in literature, but is still insufficient to match human related intended use to the product related intended use [18]. This includes insight into aspects located in the various RiFA steps. This increased level of knowledge would support the cooperation between professionals, consultants and clients in matching person and DAS.

A timely delivery of DAS was a point of attention in several cases. Overall devices were delivered between two to five months, which several clients perceived as too long. Underlying issues include time required by the insurance companies, especially an issue when the device is to be attached to a working chair which also needs to be procured. DAS often need to be adapted and fitted to electric wheelchairs equipped with other assistive solutions, which imposes technical challenges and resulting recurring reparations. This is a point of attention since powered wheelchairs still lack standardization regarding electronics and interfacing. Long waiting times are unwanted as they contribute to dissatisfaction with DAS [19] and, more importantly, they limit people who have to cope with serious limitations in daily life to function optimally. Especially for people with progressive disorders fast delivery is essential.

The aforementioned aspects that should be optimized in the service delivery process of DAS include aspects in the various steps of the RiFA framework. The same 'general Dutch prescription guideline' (RiFA) is a framework that could be adapted to support the service delivery process of all sorts of assistive technology. Therefore, it is proposed that the RiFA framework is developed together with involved parties (companies, clients, professionals) for DAS, taking into account the outcomes of this study.

Study limitations

Participants who tried a Gowing at the latest seven months were invited to participate. Originally the plan had been to invite people who tried the Gowing at the latest six months ago, but as it appeared difficult to involve participants, the time span was extended. Although people were able to recall the overall process well, details such as specific devices tried might be blurred. This study showed aspects that can be improved, but a prospective study is suggested in the future to thoroughly investigate the outcomes, benefits and factors that affect this benefit by observing this process closely. This will increase knowledge needed to appropriately match persons and specific DAS, and ultimately improve

the matches made. As this study primarily focused on the selection of DAS activities conducted in the first steps of the process by the occupational therapists might have received less attention. It therefore is suggested that when the service delivery process is optimized professionals involved in these first steps are extensively involved. The findings of this study might not be generalizable to the entire Dutch system as in this study only one company who is concerned with the delivery/manufacturing of DAS was involved. However, the aspects found in this study that could be optimized could also be considered by other companies, but also outside the Netherlands despite the fact that there are differences in the variety of devices on the market [10], the role of professionals and suppliers, and financing structures.

5. Conclusions

Improved cooperation between care professionals, end-users, and suppliers' consultants is recommended because several clients feel insufficiently supported and care professionals possess essential expertise which is not used to the fullest. Professionals should be facilitated and supported by practical tools. Other proposed improvements are the use of a standardized evaluation of DAS procurement and reduced waiting times between deciding and the delivery. It is proposed to transform this generic framework into a DAS specific prescription guideline. This should be done together with involved parties (companies, paying parties, clients, professionals). Further, a prospective study is suggested in the future to improve the ability to match persons with an appropriate type of DAS.

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TABLES

Table 1 Summary of aspects that could be optimized in the service delivery process of DAS.

Step 1. Identify a problem
Step 2. Formulate a demand for care
• Unknown what information is collected by professionals such as OTs, but little information is shared with professionals in later steps (consultants)
Step 3. Formulate a care plan
• Unrealistic goal setting by professionals (due to limited knowledge)
• Not considering DAS as a potential solution by professionals
• National reimbursement rules affecting abilities to obtain DAS in combination with other AT/home adaptations
• Lack of documented knowledge regarding how to match person with DAS
Step 4. Selecting, trying, and deciding
• Clients receive a lot of information during a short period of time in the try-out resulting in the fact that they are not fully aware what happened
• Clients do not feel sufficiently involved in the selection process
• Relatives (parents) impede independent decision making of children
• Preferred activities are not always tried in daily life situations
• Inability of trying a DAS for a longer period of time in real life
• National reimbursement rules affecting abilities to obtain
Step 5. Delivery
• Relatively long waiting times between try-out and delivery
• Problematic cooperation between different companies/institutions involved
• There is no standard training
Step 6. Use
• Unsolved issues in the device when people do not actively contact the supplier
• Deterioration of arm function during try-out and delivery
Step 7. Evaluation and follow-up assessment
• No standard evaluation or follow-up

FIGURE CAPTIONS

Figure 1. The general Dutch prescription guideline (RiFA) [12].

Figuur 2 A Gowing user

FIGURES

Figure 1.

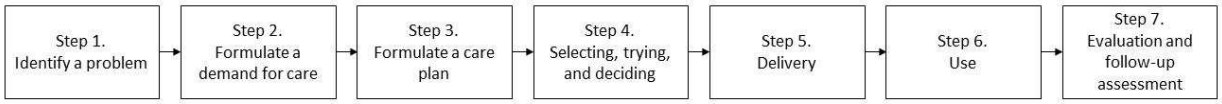

Figure 2.