Cost of individual assistive technology programme: a population study

Renzo ANDRICH[a] [1], Antonio CARACCIOLO[b]
[a] *Polo Tecnologico, Fondazione Don Carlo Gnocchi Onlus, Milano Italy*
[b] *DAT, Fondazione Don Carlo Gnocchi Onlus, Milano Italy*

Abstract. Based on a survey of 31 individual AT (Assistive Technology) programmes, an attempt has been made to infer social cost indicators for various categories of AT equipment. Cost analysis was carried out by means of the SCAI (Siva Cost Analysis Instrument). The first finding is that – not surprisingly – most AT solutions, though very expensive in terms of initial purchase price, lead to considerable savings in social costs, due to the reduced assistance burden: in some cases, the savings detected in social costs were in the range 150,000 euros over five years. The second major finding is the marked variation in the social costs of different individual cases where similar AT solutions were implemented, suggesting difficulty in establishing repeatable social cost figures for a given device: such figures also depend on the individual context of the implemented AT solution, and on its inter-relationship with the other AT solutions composing the whole programme. The findings also shed light on four critical issues needing investigation 1) the actual maintenance cost of AT devices 2) the determinants of the assistance burden associated to an AT device 3) the discounting criteria to be used for cost actualisation and 4) the estimate of the "non-intervention" costs, in severe cases where this is not a realistic option.

Keywords. Assistive technology. Cost analysis. Socio-economic assessment.

Introduction

Studies on cost analysis of assistive technology began to appear in the literature only recently [1] [2] [3]. One instrument available nowadays for cost analysis is the SCAI (Siva Cost Analysis Instrument), whose first release was published in 2001 [4]. SCAI focuses on the *additional social costs* of individual AT programmes, i.e. the sum of all resources spent by all actors involved (hence the term *social*) as a consequence of the decision to adopt one specific AT solution rather than another one (hence the term *additional*). It helps clinicians and clients estimate the economical impact of an individual AT programme; and compare the costs involved when different AT options are available to solve a specific problem.

This paper reports a first attempt to use the SCAI for aggregated cost analyses over a population of individual cases. The findings are promising; they depict possible cost trends

1 Corresponding Author: Renzo Andrich, Polo Tecnologico Fondazione Don Carlo Gnocchi Onlus, via Capecelatro 66, 20148 Milano, Italy. E-mail: renzo.andrich@siva.it

of some widespread assistive technologies, and are quite informative with regard to the social cost of such technologies.

Before proceeding, it is worth to clarify what the term *additional social cost* stands for. Within an individual AT programme, different costs are borne by the different actors: the user, the family, the municipality, health services etc. However, in order to have an overall economic indicator of the AT programme, the sum of all the resources mobilised by all the actors taking part in the process must be considered: this is the so-called *social cost*. Social cost can include *direct costs* – i.e. resources mobilised as a direct consequence of the chosen AT solution (e.g. purchasing and fitting the equipment, training the user, maintenance) – and *indirect costs* – i.e. resources mobilised as an indirect or unintended or unexpected consequence [5].

What's more, cost analysis can be extended to include *fixed costs* (e.g. the cost of the assessment process leading to the decision about a certain AT programme) or restricted to just *marginal costs* (i.e. the additional resources mobilised to obtain one additional result i.e. the implementation of the AT programme decided in the assessment) [2] [3].

The *marginal cost* of the *intervention* has little meaning in itself, unless compared with the cost of *non-intervention*. For instance, rebuilding a bathroom to improve the user's independence (*intervention*) may require considerable amount of money; however the alternative decision, that of keeping the bathroom as it is (non-intervention), also brings about costs (more assistance by a helper in the bathroom) as using the bathroom cannot be avoided. Hence, the useful economic indicator is the *additional cost of intervention Vs non-intervention*, rather than the marginal cost of the intervention in itself. In other words, what is important to know is the additional cost of changing from an initial situation (without intervention) to a final situation (with intervention), just as effectiveness analysis measures the impact of change (initial situation Vs final situation) in the person's life.

Method

Thirty-one individual AT programmes were selected from a sample population documented in the Theses of the AT Postgraduate Course of the Milano Catholic University [6]. Each *case history* included clinical information on the user involved, technical details of the AT programme, the outcome assessment and eventually the cost analysis. The AT equipment used in these cases ranged greatly within the ISO 9999 classification for AT devices.

Cost parameters were re-calculated through the SCAI as shown in table 2, according to a set of uniform assumptions and actualised to 2006 values. The time span of the cost analysis was set at 5 years and no yearly discount rate was used.

Cost item	valuation	Note
Equipment	Case by case	Purchase costs refer to the 2006 average market prices; for equipment falling in the Ministry of Health's List of price-controlled equipment (Min.Decree 332/99), the 1999 price list was used, plus the 9% upgrade decided by most Italian Regional Governments. In the case of equipment no longer on the market, the estimate was applied to similar equipment that, in good practice, would today be provided for the same case
Maintenance	Case by case	An annual maintenance cost was estimated for each device as a percentage of its 2006 purchase cost. This percentage was set to 6% for devices where the purchase price was

		less than 8000 euros, to 3% for devices of higher purchase price, and to 0% independently of the purchase price for devices requiring no maintenance. These percentages were inferred by averaging the estimates made by the authors of the Theses, and by directly asking some manufacturers how much they would charge if all-inclusive yearly maintenance contracts were required.
Assistance Level A	16 €/hour	Average Market price according to trade union contract for basic carer (Ausiliare Socio Assistenziale)
Assistance Level B	18 €/hour	Average Market price according to trade union contract for trained carer (Operatore Socio Sanitario or Operatore Servizi Assistenza Domiciliare)
Assistance Level C	25 €/hour	Average Market price according to trade union contract for nurses
Resident assistant	900 €/month	Average market price for assistants living at home with the client, ensuring basic assistance during the day

Table 1. Valuation criteria used in the population study.

Results

Table 2 shows an example of the data generated by a case history, while Table 3 provides a global picture of the results.

Matteo Age55; Amyotrophic Lateral Sclerosis *Assistive solution provided*	*Main ISO code*	*Purchase cost*	*Cost of intervention*	*% equipment*	*Cost of non-intervention*	*Additional cost (interv. Vs non-interv)*	*Overall additional cost*
Ankle foot orthosis (Molle di Codivilla)	06.12.06	123	652	94%	0	652	
Walking stick (unspecified)	12.03.03	68	152	80%	0	152	
Mobile stairclimber (TGR Jolly)	18.30.12	4,215	20,099	13%	32,400	-12,301	
Manual wheelch. (Meyra Eurochair1850)	12.21.06	994	2,088	86%	0	2,088	
Bathtub seat (unspecified)	09.33.03	120	216	100%	28,800	-28,584	
Electrically adjustable bed (unspecified)	18.12.10	1,020	377	68%	7,680	-7,303	
Commode chair (unspecified)	09.12.03	210	1,008	3%	2,160	-1,152	
Antidecubitus mattress (unspecified)	18.12.18	361	2,974	2%	5,760	-2,786	
Electric hoist (KSP N9603)	12.36.03	681	13,212	1%	25,920	-12,708	
Pushchair (Breezy 341)	12.21.03	986	23,296	1%	0	23,296	-38,646

Table 2. Example of the findings from one individual case. All cost figures are in euros.

	Purchase cost of equipment	*Cost of intervention*	*% equipment*	*Cost of non intervention*	*Additional cost (int.Vs non-int.)*	*Overall additional cost*
Maximum value	*45,000*	*173,243*	*100%*	*154,800*	*173,243*	*172,261*
Minimum value	*25*	*13*	*1%*	*0*	*-129,803*	*-152,857*
Average	*3,258*	*14,022*	*38%*	*22,474*	*-7,044*	*-24,801*
Standard dev.	*5,409*	*19,947*	*34%*	*26,685*	*29,259*	*65,732*

Table 3. Global picture of the population sample surveyed in the study. All cost figures are in euros.

The first findings that merit discussion are those in the *additional cost* of the whole programme in the right end-column of table 2 and table 3. This is an overall economic indicator of the individual AT programme – i.e. the difference between the social cost

borne over 5 years as a consequence of AT intervention, and the social cost that would have occurred had there been no intervention (for the same 5-year period).

In the surveyed sample, this additional cost ranges from –152,857 (the "minus" sign stands for a cost saving) to 172,261 euros, with 24,801 as average saving. The great variation in the cases makes it impossible to infer reliable correlations between a given clinical condition (age, pathology, case history) and the cost of the related AT programmes. This comes as no surprise as the literature already documents [8] [9] that the clinical condition is just one determinant in the choice of AT solutions, the others being the human and physical context where the person lives, the individual personality, the lifestyle and the activities involved. The overall conclusion here is:

- most individual AT programmes not only bring about positive changes in life quality, but also lead to considerable *savings* in terms of social cost
- *investments* usually indicate severe situations requiring complex AT solutions with little room for alternatives
- *high savings* usually indicate situations that, in principle, might be solved in a different manner, but have been solved very efficiently thanks to AT.

On looking at each AT solution, what appears at first glance is the disparity between the cost of equipment and the overall intervention cost (1% to 100% , average 38%). Indeed it can be seen that the purchase price of the equipment weights little on the overall cost of the intervention, revealing that the initial purchasing cost seldom plays a major role in the overall intervention cost.

Assistive solution provided	*Purchase cost of equipment*	*Cost of intervention*	*% equipment*	*Cost of non int.*	*Additional cost (int. Vs non-int.)*
Manual wheelchair (Meyra Eurochair1850)	1,789	2,088	86%	0	2,088
Manual whc (OffCarr Children) + seating system (JayFit backrest+cushion)	3,924	9,901	40%	0	9,901
Manual whc with tilting frame (AluRehab Netti III)	3,595	9,473	38%	0	9,473
Manual whc with tilting frame (AluRehab Netti III) + seating syst. (Jay2 DeepContour)	3,904	9,876	40%	0	9,876
Manual whc (OffCarr Elegant)	1,391	1,808	77%	0	1,808
Manual whc (Progeo Exelle)	2,158	7,606	28%	0	7,606
Lightweight manual whc (Kuschaal ChampionCarbon) + seating syst. (Jay Back2)	3,969	9,959	40%	40,800	-30,841
Manual whc (Quickie RXS)	1,007	1,309	77%	325	984
Manual whc (Meyra Eurochair) + seating syst. (Jay2+ Back2)	2,453	7,988	31%	20,400	-12,412
Manual whc (Quickie RXS) + seating syst. (Jay 2+Back2)	2,998	8,697	34%	10,800	-2,103
Manual whc (Quickie RXS) + seating syst. (Jay 2)	2,998	42,297	7%	0	42,297
Manual whc (Etac Cross)	1,962	2,551	77%	0	2,551
Maximum value	*3,969*	*42,297*	*86%*	*40,800*	*42,297*
Minimum value	*1,007*	*1,309*	*7%*	*0*	*-30,841*
Average	*2,778*	*11,988*	*51%*	*8,702*	*6,425*
Standard deviation	*1,037*	*10,922*	*25%*	*12,655*	*16,829*

Table 4 Comparative analysis for equipment falling within ISO category 12.21.06 (manual wheelchairs)

Even within homogeneous clusters of comparable AT solutions, there is no stable correspondence between purchase price and overall cost of the intervention. Table 4, for instance, offers a comparative overview of the AT solution that appeared most frequently in the population surveyed (*manual wheelchairs with seating systems*). Although the standard deviation is more contained than in the global picture, the purchasing cost of the equipment within a homogeneous set of items varied greatly within the overall cost of intervention.

Conclusions

This findings of the study were greatly informative. The method seems mature for implementation in service delivery practice. However, some of the assumptions made for this study may need further investigation:

- *Maintenance cost* of the devices: in this study, such costs were evaluated through the subjective estimates of manufacturers, end-users and health care professionals, rather than on the basis of a systematic monitoring of the products in real use;
- *Human assistance burden* required by an AT device: although the estimates made in this study can be considered precise enough in that they are based on daily observations, there are some determinants of the assistance set-up (had the user and his/her helper been trained adequately? Was the assistance correctly organised etc.) that greatly influence the social cost of assistance.
- *Discounting*: this study intentionally did not include discounting for three reasons: 1) to keep the calculations simple; 2) because the point in time when various costs will be incurred is often unknown; 3) our focus was on cost inter-relationships (various AT solutions for the same problem, or various individual AT programmes) rather than on their absolute values. In the event of absolute values coming to the fore in researcher interest, discounting becomes important and a more refined cost model is called for.
- *Cost of non-intervention*, in cases (mainly related to severe disabilities) where such an alternative is unrealistic or ethically unacceptable.

References

[1] Brodin H, Persson J. Cost-utility analysis of assistive technology in the European Commission's TIDE program. International Journal of Technology Assessment in Health Care 1995; 11(2): 276-283

[2] Andrich R, Ferrario M, Moi M. A Model of Cost-Outcome Analysis for Assistive Technology. Disability and Rehabilitation, 1998; 20:1.

[3] Harris F, Springle S. Cost analyses in assistive technology research. Asst Technol 2003; 15:16-27

[4] Andrich R. The SCAI instrument: Measuring costs of individual assistive technology programmes. Technology and Disability 2004; 14:95-99

[5] Drummond M F, Stoddart G.L, Torrance G W. Methods for the economic evaluation of health care programmes. Oxford Medical Publications, 1989

[6] Andrich R: Certification of assistive technology practitioners: the examination issue. In: Marincek C, Buhler C, Knops H, Andrich R (eds): AT: added value to quality of life. (pp. 535-539). Amsterdam: Iospress, 2001

[7] Philips B, Zhao H. Predictors of assistive technology abandonment. Assistive Technology, 1993; 5: 36-45

[8] Scherer M. Matching person and technology. Webster: IMPT, 1998

[9] Cook A, Hussey S. Assistive Technology – principles and practice. Elsevier 2006