International Journal of Hospital-Based Health Technology Assessment
2020, 1:2-11 http://dx.doi.org/10.21965/IJHBHTA.2020.001

Open Access Full Text Article

RESEARCH ARTICLE

Cost analysis of a mind–body intervention compared to usual hospital-based outpatient visits in HIV-infected individuals: a feasibility study

[Analyse de coûts d'une intervention corps-esprit en comparaison aux visites ambulatoires habituelles en milieu hospitalier chez des personnes infectées par le VIH: une étude de faisabilité]

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Article received:
21 December 2019

First response:
15 January 2020

Article accepted:
29 January 2020

Abstract: This study compared the costs of a mind–body intervention with usual care for individuals infected with HIV (Human Immunodeficiency Virus). Further, consequences on labour market attachment were explored. The cost analysis was nested in a randomized controlled trial conducted in 2015 at the Department of Infectious Diseases at Aarhus University Hospital, Denmark. A total of 30 patients were randomized to one of two arms. The intervention consisted of a group intervention facilitated by an educated coach. Usual care consisted of standard outpatient visits alone. Total healthcare and patient costs were estimated over a twelve-month period at individual level from a societal perspective. Costs of resource used in primary and secondary health sectors were included as well as patient costs. To explore uncertainty one-way sensitivity analysis was performed. Total costs were found to be on average €14,549 less per patient compared to usual care. However, this difference was not statistically significant. Number of working hours and proportion of persons employed per year in the two groups were similar. The sensitivity analysis showed that the absolute difference in costs observed was due to one control patient with an extremely high use of hospital resources. The absolute difference in costs was similar to the base case when using two-year follow-up. This small feasibility study indicate that it is possible to deliver an extra service for HIV-infected individuals in the form of a mind–body intervention at roughly similar costs compared with standard outpatient visits alone.

Keywords: Cost analysis; Economics; HIV; Mind–body; Randomised controlled trial.

Résumé : Cette étude a comparé les coûts d'une intervention corps-esprit aux soins habituels pour les personnes infectées par le VIH (virus de l'immunodéficience humaine). Les conséquences sur le maintien sur le marché du travail ont aussi été explorées. L'analyse des coûts a été incluse dans un essai contrôlé randomisé mené en 2015 au département des maladies infectieuses de l'hôpital universitaire d'Aarhus, au Danemark. Au total, 30 patients ont été randomisés dans l'un des deux bras. L'intervention a consisté en une intervention de groupe animée par un coach formé. Les soins habituels consistaient en des consultations externes standards. Le coût total des soins de santé et des patients a été estimé sur une période de douze mois au niveau individuel d'un point de vue sociétal. Les coûts d'utilisation des ressources dans les secteurs de la santé primaire et secondaire ont été inclus ainsi que les coûts pour les patients. Pour explorer l'incertitude, une analyse de sensibilité unidirectionnelle a été réalisée. Le coût total s'est avéré être en moyenne de 14 549 € de moins par patient par rapport aux soins habituels. Cependant, cette différence n'était pas statistiquement significative. Le nombre d'heures de travail et la proportion de personnes employées par an dans les deux groupes étaient similaires. L'analyse de sensibilité a montré que la différence absolue de coûts observée était due à un patient témoin avec une utilisation extrêmement élevée des ressources hospitalières. La différence absolue des coûts était similaire au scénario de base lors de l'utilisation d'un suivi sur deux ans. Les résultats de cette étude de faisabilité indiquent qu'il est possible de fournir un service supplémentaire aux personnes infectées par le VIH sous la forme d'une intervention corps-esprit à des coûts à relativement similaires aux seules consultations externes standards.

Mots clés : Analyse de coûts; HIV; Corps-esprit; Essai contrôlé randomisé.

Introduction

The introduction of antiretroviral therapy in 1996 considerably reduced human immunodeficiency virus (HIV)-related mortality, which peaked in 2005 [1]. However, HIV still constitutes serious added socioeconomic problems and is a priority for health authorities worldwide [2]. Hence, the World Health Organisation strategy calls for person-centered chronic care for people living with HIV [1], implicitly acknowledging that viral suppression is not today the ultimate goal of treatment [3]. Instead a new quality of life frontier is advocated, since HIV-infected individuals with successful viral suppression are still faced with other major challenges such as serious non-communicable diseases, depression, anxiety, financial worries, and experiences of or apprehension about HIV-related discrimination [3]. Thus, a mind–body intervention was developed aimed at enhancing coping self-efficacy and improving mental health among HIV infected individuals in Denmark [4].

To our knowledge, data are scarce on the economic consequences of interventions aiming at enhancing quality of life for people living with HIV. A systematic review of interventions integrating HIV and mental health services concluded that studies evaluating and comparing long-term outcomes and cost-effectiveness are needed [5]. A systematic review of the economic impact of HIV in five European countries called for studies to include non-medical costs of HIV, including productivity loss. Hence, a cost analysis with a societal perspective and long follow-up was performed to study the economic consequences of the mind–body intervention for both the healthcare sector and patients with HIV.

The Danish healthcare system is primarily tax-financed and five regional authorities are politically and administratively responsible for organisation and payment of hospital health service deliveries, including hospital pharmaceuticals. With limited financial resources to cover increasing health care costs, it is necessary to obtain the best value for the money. Results of a cost analysis of a mind-body intervention can thus be used by both Danish and international healthcare providers to support the decision on whether to implement the intervention as a supplement to the medical treatment for HIV.

Objective

On this background, this study compared the costs of a mind–body intervention with usual care for individuals infected with HIV. Further, consequences on labour market attachment were explored. The cost analysis was piggybacked on a randomised controlled trial comparing the costs of a mind–body intervention with standard treatment (control) among HIV-infected individuals. The following three steps were included in the analysis:

1. Calculation of average use of resources and average costs using a restricted societal perspective
2. Descriptive statistics regarding consequences for labour market attachment
3. Sensitivity analysis.

Methods

Study design

The cost analysis was nested in a randomized controlled trial using stratified randomization. Inclusion criteria were as follows: age 18 years or older, understanding and speaking Danish, psychologic problems (e.g., depression, anxiety, stress, loneliness), and motivated for working on personal challenges. Exclusion criteria: non treated mental illness. To ensure transparency of results, this study was conducted in accordance with international guidelines for health economic evaluation of health interventions as stated by the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) [6].

Study perspective: It is recommended to use a societal perspective including all relevant costs, regardless of who covers the costs [7]. A restricted societal perspective was used in this study, and costs of resource use in the primary and secondary health care sector were thus included as well as patient costs due to changes in medication and time spent on the intervention. However, productivity changes are reported separately as recommended by a task force from the International Society for Pharmacoeconomics and Outcomes Research [8] and a Danish guideline on cost analyses [9]. Time horizon: Comparing costs in the two groups, a follow-up period of twelve months was used. This was similar to the maximum length of follow-up in the clinical study, which was nine months after the intervention was completed [4], corresponding to twelve months from baseline. Choice of health outcomes and measurement of clinical effectiveness: Primary outcomes in the clinical study were change in risk of depression and level of coping self-efficacy and secondary outcomes were change in levels of stress and personal growth. However, this study only analyse changes in costs.

The mind–body intervention

Setting and location: The clinical study was conducted at Department of Infectious Diseases at Aarhus University Hospital, Denmark [4] from the 16th of January 2015 and the total length of the intervention was three months. Comparators: The intervention consisted of a group intervention facilitated by an educated coach; usual care consisted of standard outpatient hospital-based visits alone. The content of the intervention was based primarily on a native American philosophy of life with the following components, tools and techniques: 1) Warrior or victim behavior; various tools and principles that focus on whether a person chooses a warrior or victim behavior when facing challenges in his/her daily life, 2) Personal limits and boundaries; mix of teaching/reflection within the group, two and two, individual, 3) Techniques to address fear/stress management; guided meditation, physical exercises: walk in the nature, yoga. The framework was a three-day residential course plus two eight-hour follow-up events.

The aim of the intervention was to increase resilience among participants by enhancing coping self-efficacy and thus improve mental health among HIV-infected individuals. The intervention offered various tools to improve coping of life balance skills of each individual (stable mental or psychological health and emotional stability), making each person conscious of own behaviour and how to activate own resources thereby increasing self-management and self-care. Details of participants and an elaborate description of the intervention are reported elsewhere [4].

Cost and resource estimation

Resource use and costs were estimated including the following elements: 1) investment and running costs of the intervention, 2) admissions at somatic hospitals, 3) outpatient visits at somatic hospitals, 4) visits to the general practitioner, 5) use of prescription drugs, and 6) patients time costs. Element one was based on interviews with staff and project management whereas elements 2-5 were identified for individual patients in national health administrative databases. Element 6 was based on a description of the intervention and through a national labour market attachment database.

Costs were valued in 2019 prices and DKK (Danish kroner) were converted into EURO (€) using the exchange rate €1 EURO = 7.5 DKK[10] and a discount rate of 3% per annum in accordance with Drummond et al.[11] Average salaries from the university hospital were used for valuing staff time assuming 1481 effective working hours per year, i.e. public holidays, sick days, etc. were deducted from a full-time equivalent of 1924 working hours.[12] Thus, an hourly wage for nurses of € 37.2 was used. The value of direct patient time used on the

intervention was € 31.8 estimated from the average national earned income for employees from Statistics Denmark [13] assuming 1481 effective working hours. Further, the labour market attachment analysis was used to assess how many patients were in the workforce in 2015 and thus may experience changes in productivity. Labour market attachment was described with the employment classification module (AKM) from Statistics Denmark [14]. In AKM, employment status is based on source of income and each individual is classified according to their primary source of income in a given year. Employment was defined as self-employed incl. assisting spouses or employees. Not employed was defined as unemployed, receiving unemployment benefits, retired or student. Number of (employee) working hours per year was defined as a person's total number of working hours per year from employee jobs.

Data on hospital services (e.g. inpatient and outpatient activity) were extracted from the Danish National Patient Register [15], which holds data on all hospital encounter for all Danish citizens. Each hospital service is assigned a standardised cost (in the Danish reimbursement system) and cost estimates were based on the number of encounters recorded in the above-mentioned register multiplied by the ascribed standardised DRG/DAGS rate [16]. Data on general practitioner activities were drawn from the National Health Insurance Service Register and fee-for-service rates were used to reflect average costs [17]. Information about patient use of prescription drugs was retrieved from the Danish National Prescription Registry (DNPR). The DNPR contains individual-level data on all prescription drugs sold in Danish community pharmacies [18]. Pharmacy purchase prices were used to reflect costs of prescription drugs.

Statistical and analytical methods

Data were analysed using Stata version 15 [19]. The two patient groups were compared using relevant statistical tests to test differences in costs. Thus, the t-test was used for normally distributed continuous data, the χ^2-test for categorical data and the non-parametric Mann-Whitney test for non-normally distributed data. Statistical significance was set at $p<0.05$. Analyses were performed on means for all variables included in the cost analysis while descriptive statistics illustrated characteristics of patients and labour market attachment. Imputations: Pharmacy purchase prices were used to reflect costs of prescription drugs, and in the few cases where this information was unavailable sales prices were used.

In accordance with Drummond et al. [11], the estimation of costs was varied using one-way sensitivity analysis. To test the robustness of the results, i.e. test the resulting impact on total costs, two parameters were varied: 1) a two-year follow-up instead of one and 2) leaving out a patient with a very high use of hospital resources. No subgroup analysis was performed.

Results

Data description and baseline statistics of participants

The clinical study was based on data from 30 individuals [4]. Due to lack of consent, data on four patients were not included in the economic analysis. Hence, the analysis of costs and labour market attachment was carried out on individual-level data from a total of 26 patients (13 in each group). Apart from costs for prescription drugs, variables were 100% complete and no imputation was needed.

Descriptive statistics, including sociodemographic characteristics, at baseline for the 26 patients are shown in Table 1. No statistically significant differences exist between the two groups on any of the tested variables. Average healthcare care costs per patient one year *before* inclusion in the study were calculated and showed no statistically significant differences between the two groups.

Table 1. Descriptive statistics at baseline of participants in the intervention and the control group, respectively

Variables	Intervention, N=13	Control group, N=13	P-value
Average age	51 [40 – 60]	44 [31 – 60]	
Gender:			
Male	62 %	62 %	
Female	38 %	38 %	
Developmental stage of disease:			
Mean disease duration of HIV	14.8 years [2 – 23]	10.4 years [2 – 32]	
Mean lymphocyte count (CD 4 count)	525	717	
Self-reported health:			
Excellent, very good or good	7	7	
Fair or poor	6	6	
Education:			
• No education or short term higher education	6 (47 %)	8 (61 %)	
• Medium or long term higher education	7 (53 %)	5 (38 %)	
Proportion of persons employed:			
• Self-reported at baseline (January 2015)	7 (54 %)	4 (31 %)	
• Register data (employed in 2014)	9 (69 %)	5 (38 %)	0.12
Number of employee working hours in 2014	1121	681	0.23
Average costs per patient 1 year before:			
• Admissions	€ 227	€ 1521	0.12
• Outpatient visits	€ 2400	€ 2481	0.90
• Prescription drugs	€ 72	€ 212	0.48
• General practitioner visits	€ 454	€ 238	0.33

Data source: background questionnaire and register data for 2014. Self-reported health was measured with the question: In general, would you say your health is: Excellent, very good, good, fair or poor. Range are in brackets.

Average resource use and average costs

Table 2 reports average resource use in the two groups. No statistically significant differences were seen. However, there seems to be a clinically relevant difference in average number of hospital admissions between the two groups of 0.6 admissions per patient.

Unit costs were multiplied by the quantities in Table 2 to calculate total costs. Table 3 shows that with a societal perspective, the total costs per patient treated were €14,549 lower than in the control group; this was due to the much lower admission costs in the intervention group. This difference was, however, not statistically significant. The direct cost of the intervention was €1424 comprising investment and programme costs.

Labour market attachment

As recommended, productivity changes are reported separately from the cost analysis and in natural units. Table 4 shows no statistically significant difference in number of working hours or proportion of persons employed per year in the two groups. Hence, no differences were observed regarding labour market attachment due to the intervention.

However, there are absolute differences in proportion of persons employed per year in the two groups and the magnitude of the differences are reduced over time from approximately 30 percentage points in 2015 and to 15 percentage points concerning employment status in 2017. This reduction was caused by a positive development in the control group.

Table 2. Average use of resources *per* patient in the two groups

Type of costs	Mean use *per* patient (12-month follow-up)				P-value
	Intervention, N=13		Control, N=13		
Staff hours used on the intervention					
Inclusion in study	1		-		-
*Staff time used on the three-day residential course + two eight-hour follow-up events	6.9		-		-
Use of other healthcare resources					
Number of outpatient visits	7.8	CI: 4.6 – 11.1	9.4	CI: 3.4 – 15.3	0.9
Number of hospital admissions	0.1	CI: -0.1 – 0.2	0.7	CI: -0.5 – 1.9	0.3
Number of contacts to general practitioner or emergency doctor	18.2	CI: 5.2 – 31.3	16.7	CI: 10.6 – 22.7	0.4
Patients' use of other resources					
Number of prescription drug packages	8.8	CI: 0.6 – 16.9	10.2	CI: -0.7 – 21.0	0.6
Hours used by patients on intervention:					
Introduction (info. meeting + study inclusion)	2.5		-		-
Residential course (five days)	37		-		-

Differences in use of resources were tested with the Mann-Whitney test. *Two nurses attended each course (three days of 12 hours + two days of 8 hours) equivalent to 6.9 hours per course participant. In the future, this level of staffing is not necessary and one or no nurse is a more realistic estimate. CI: Confidence interval.

Sensitivity analysis

Table 5 presents two different sensitivity analyses: S1 and S2. The first row, S0, shows the results from the main analysis reported above.

In S1, we excluded one patient with an extremely high use of hospital resources. The result was highly sensitive to this change and reversed the results making an intervention patient more costly than a control patient on average. S2 investigated the effect on costs of using two-year instead of one year follow-up. The result was not very sensitive to this change. However, the costs were doubled in the intervention group as expected, but not at all in the control group. This supports the idea in S1 that the control patient was indeed unusual with a short period of extremely high use of hospital resources.

Discussion

Total costs were found to be on average €14,549 less per patient compared to usual care. However, this difference was not statistically significant and further sensitivity analyses showed that the absolute difference in costs observed was due to one control patient with an extremely high use of hospital resources. Number of working hours and proportion of persons employed per year in the two groups were similar.

Although results showed no statistically significant differences in number of working hours and proportion of persons employed per year in the two groups, absolute differences are seen. While productivity was unchanged in the intervention group in absolute terms, a positive development was observed over time in the control group. Thus, there is no support for the hypothesis of a positive effect of the intervention on patients' productivity.

The clinical study found statistically significant improvements in risk of depression and personal growth mean values in the intervention group from

Table 3. Average treatment costs per patient in the two groups (€, 2019 prices)

Type of costs	Mean cost per patient (12 months follow-up)				P-value
	Intervention, N=13		Control , N=13		
***Investment in the mind–body intervention**					
Education of two nurses (1,5 hours each)	€ 4		-		-
A) Total investment costs	**€ 4**		-		-
Running costs					
Programme costs (three-day residential course + two 8-hour follow-up events):					
Accommodation, catering + salary coach	€ 1126		-		-
Staff time used on the intervention	€ 294		-		-
Other healthcare costs:					
Outpatient visits (DAGS value)	€ 2222	CI: 1323 – 3121	€ 2428	CI: 1575 – 3281	0.6
Hospital admissions (DRG value)	€ 327	CI: -385 – 1038	€ 16580	CI: -18109 – 51270	0.3
Prescription drugs	€ 107	CI: -23 – 237	€ 192	CI: -116 – 500	0.3
General practitioner visits	€ 293	CI: 83 – 504	€ 306	CI: 173 – 438	0.4
B) Total running costs	**€ 4369**		**€ 19506**		
Time costs – patients					
**Cost of days used on intervention (introduction + three-day residential course and two follow-up events)	€ 584		-		-
C) Total time costs - patients	**€ 584**		**-**		-
Total costs (A+B+C)	**€ 4957**		**€ 19506**		

Differences in costs were tested with Mann-Whitney test. * This element is the initial investment costs needed for running the intervention and it is divided by the total number of RCT patients (30). Regarding development of the intervention, e.g. producing course or guideline material, this component was included in the salary for the coach. ** According to Table 4, 46.5% of patients in the study population on average were in the workforce in 2015 and thus incurred lost time costs.

Table 4. Development in labour market attachment in the intervention and control group, respectively

	Intervention, N=13		Control group, N=13		P-value
Average number of (employee) working hours per year					
2015 **(year of intervention)**	1027	CI: 501 – 1552	645	CI: 98 – 1191	0.28
2016	1043	CI: 510 – 1577	777	CI: 220 – 1333	0.46
2017	974	CI: 404 – 1543	834	CI: 288 – 1381	0.70
Proportion of persons employed (%)					
2015 **(year of intervention)**	62		31		0.12
2016	62		38		0.24
2017	*62*		*46*		0.43

Difference in average number of working hours was tested with the t-test and proportion of persons employed was tested with the chi-test.

Table 5. Two one-way sensitivity analyses on total costs per patient in the intervention and control group, respectively

	A) Mean costs per patient in the intervention group	B) Mean costs per patient in the control group	Difference (A – B)
S0: Main analysis	4957	19506	-14549
S1: Excluding most expensive patient	4957	3334	1623
S2: Two-year follow-up	9851	23162	-13311

Note: Full tables on costs for the sensitivity analyses are provided in supplemental data.

baseline to six-month follow-up [4]. However, the clinical effects declined over time and the statistically significant improvement between the intervention group and control group disappeared at subsequent follow-ups. According to the results from the clinical and the cost study, it therefore seems possible to deliver an extra service to HIV-infected individuals in the form of a mind–body intervention at roughly similar costs compared with standard outpatient visits alone.

Strengths and limitations

The cost analysis used a societal perspective as recommended,[7] had a long follow-up and to ensure transparency was analysed and reported in accordance with international guidelines for the conduct of health economic evaluation of health interventions.[6] Further, the potential economic impact in terms of productivity losses was investigated. A systematic review of the economic impact of HIV in five European countries concluded that: 1) few studies have estimated the non-medical costs of HIV, including productivity losses, 2) there are relatively few studies of HIV costs in European countries compared to other diseases, and 3) the methodology used in many of the studies carried out leaves ample room for improvement, e.g. perspective and the year used for price calculations was not provided.[2] Our study constitutes a step in the right direction regarding all three issues raised by the above review.

The small size of this study decreases the statistical power of the analysis and increases the likelihood of bias. Cost estimates for hospital and general practitioners were calculated using the ascribed standardised DRG/DAGS rate and fee-for-service to approximate average costs; this is another source of bias, since these tariffs also contain a proportion of the fixed costs, e.g. overheads, which may result in an overestimation of the above-mentioned cost components. No adjustments were made to approximate to the true marginal costs. The conclusion that the cost of an intervention patient is comparable to that of a control patient may seem counter-intuitive given the major difference in total costs in absolute terms. However, our findings may reflect that the study was designed as a clinical study to detect a change in risk of depression, and not differences in costs. The data variability is likely to be much higher for the cost of outpatient or inpatient visits than for the risk of depression, limiting the possibility of identifying statistically significant changes. Uncertainty was explored by simple one-way sensitivity analysis but probabilistic sensitivity analysis (e.g. bootstrap) could have been considered.

Future studies could benefit from a larger population such as a multicentre study. Moreover, data on self-reported quality of life could be used. We included costs from somatic hospital contacts and not psychiatric hospital contacts. However, it could be relevant to include resource use in connection with mental illnesses as the intervention aims to improve mental health among HIV-infected individuals, potentially

by alleviating the risk of depression. The generalizability of the results to other kinds of settings in which HIV-infected individuals receive care is unknown and given that this intervention was conducted in a western country, further research may be needed in other settings/cultures. Despite the above-mentioned weaknesses, this study uses a sound methodology and contributes with new evidence to an area with little existing research.

Conclusion

Large-scale research in the area of the costs (and cost-effectiveness) of mind–body interventions in HIV-infected individuals is recommended. However, results from this feasibility study indicate that it is possible to deliver an extra service to HIV-infected individuals in the form of a mind–body intervention at roughly similar costs compared with outpatient visits alone.

Acknowledgements

We thank Lars Oestergaard from Aarhus University Hospital for his contribution and assistance with conducting the overall project. Also, the authors are grateful to all participants, without whom this work would not have been possible. We thank HTA consultant Maja Kjær Rasmussen from Centre for Innovative Medical Technology, Odense University Hospital, for providing excellent comments on earlier drafts of the paper and active engagement during the entire project period. Further, Mette Bliddal from OPEN (Odense Patient Explorative Network) provided initial feedback on the possible data sources for the cost analysis. From Statistics Denmark Karin Elwert resolved data problems speedily and given the small study population made sure that sensitive data were reported correctly.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: Grant from Gilead Sciences Denmark ApS and funding from the Novo Nordisk Foundation. The funders had no part in study design, data collection, analysis, interpretation of data, and the writing of the article. Ethics: The study was performed according to the Declaration of Helsinki II. The study was approved by the Aarhus Health Human Research Ethics Committee and the Danish Data Protection Agency.

Conflicts of interest

The authors declare that they have no conflicts of interest.

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