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Original Article

Economic Assessment and Budgetary Impact of a Telemedicine Procedure and Spirometry Quality Control in the Primary Care Setting☆

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ABSTRACT

Objective: To evaluate the economic impact of a telemedicine procedure designed to improve the quality of lung function testing (LFT) in primary care in a public healthcare system, compared with the standard method.
Materials and Methods: The economic impact of 9039 LFTs performed in 51 health centers (2010–2013) using telespirometry (TS) compared to standard spirometry (SS) was studied.
Results: TS costs more per unit than SS (€47.80 vs €39.70) (2013), but the quality of the TS procedure is superior (84% good quality, compared to 61% using the standard procedure). Total cost of TS was €431 974 (compared with €358 306 for SS), generating an economic impact of €73 668 (2013). The increase in cost for good quality LFT performed using TS was €34 030 (2010) and €144 295 (2013), while the costs of poor quality tests fell by €15 525 (2010) and 70 627€ (2013).
Conclusion: The cost-effectiveness analysis concludes that TS is 23% more expensive and 46% more effective. Healthcare costs consequently fall as the number of LFTs performed by TS rises. Avoiding poor quality, invalid LFTs generates savings that compensate for the increased costs of performing LFTs with TS, making it a cost-effective method.

Evaluación económica e impacto presupuestario de un procedimiento de telemedicina para el control de calidad de las espirometrías en atención primaria

Palabras clave:
Espirometría
Telemedicina
Calidad de la espirometría

RESUMEN

Objetivo: Evaluar el impacto económico de un sistema de telemedicina en un sistema público de salud para la mejora de la calidad de las espirometrías (espirometrías forzadas [EF]) en atención primaria.
Material y métodos: Se ha evaluado el impacto económico de 9.039 EF realizadas en 51 centros de salud (2010-2013) mediante teleespirometría (TE) comparándose con el sistema habitual.
Resultados: El sistema de TE encarece el coste unitario de la EF (47,8 € vs 39,7 €) (2013), pero logra una mejora en la calidad de las mismas (un 84% con buena calidad, frente a un 61% mediante el procedimiento habitual). El coste total de la TE ha sido de 431.974 € (358.306 € por sistema habitual), lo que supone un impacto económico de 73.668 € (2013). El aumento de gasto para EF de buena calidad realizadas con TE fue de 34.030 € (2010) y de 144.295 € (2013), mientras que para las pruebas con mala calidad fue de −15.525 € (2010) y de −70.627 € (2013).

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Conclusión: Del análisis coste-efectividad se concluye que la TE es un 23% más costosa y un 46% más efectiva. Asimismo, el gasto sanitario es menor a medida que el número de EF realizadas mediante TE aumenta. La no realización de EF de mala calidad, no válidas, supone un ahorro que compensa el aumento del gasto por la realización mediante TE, siendo un sistema coste-efectivo.

Introduction

Lung function testing (LFT) is a first-line procedure for diagnosing patients with respiratory symptoms.[1–3] Its success depends largely on the skills of the technician performing it, and some quality control issues have been detected since it was introduced into the primary care setting.[4–7] Several studies have confirmed that the quality of LFTs performed in the primary care setting can be less than desirable, underlining the importance of ongoing training programs for technicians, if reliable results are to be obtained.[8–15] Recently published strategies recommend the use of remote monitoring for ensuring LFT quality in various settings.[16,17] Burgos et al.[18] showed how these telemedicine systems could be applied in primary care. Their results were subsequently confirmed in a study which used the same computer application in greater numbers of spirometries analyzed over longer periods of time.[19]

The main aim of this study was to perform an economic analysis to estimate the cost of introducing a telemedicine procedure for LFT quality assurance in the primary care sector of a public health system. Our secondary objective was to use a cost-effectiveness analysis to justify the generalized use of this initiative as a quality control system in this healthcare setting.

Materials and Methods

Our group participated in the development of a computerized telemedicine tool for monitoring spirometries (e-Spiro, Linkare: Tecnología Sanitaria, S.L).[19,20] Nurses performing LFTs in health centers log on to this online computer system, known as telespirometry. They submit their LFTs to a central laboratory and receive an evaluation of the quality of these tests.

In an initial 9-month phase, we evaluated the effectiveness of the telespirometry application for improving spirometry quality and the costs of these activities in the primary care health centers of the Basque Health Service located in Ezkerraldea-Enkarterri, Uribe and Bilbao (northern Spain). The reference values of the Lung Function Laboratory of the Hospital Universitario Cruces (Barakaldo, Spain) were used for evaluating LFT quality.

The economic analysis was performed according to the tariffs of the funding agency of the Basque Health Service. A cost-effectiveness analysis was performed, comparing the telespirometry procedure with the standard procedure.

Effectiveness was determined from data obtained during a 9-month, controlled, longitudinal, multicenter study, performed in the Respiratory Medicine Department of the Hospital Universitario Cruces and 15 primary care centers[20] (Table 1). Quality was graded according to the criteria of the European Respiratory Society-American Thoracic Society.[12,13,19] Effectiveness was calculated from the percentage of Grade A and B LFTs performed in each center at the start of the study.

We calculated the specific direct costs of procedures, human resources and training costs for the telespirometry procedure. To this, we added the costs of the platform software (Table 2). Human resources costs (a pulmonologist and a nurse) for both training and managing and operating the system were calculated on the basis of LFT costs for 2010 and 2011, retrieved from the tariffs of the Basque Health Service lists for health and teaching services for those years (Table 2).

Table 1
Effectiveness of Study Procedures, Years 2010 and 2013.

	Effectiveness	
	Year 2010 (%)	Year 2013 (%)
Telespirometry procedure		
Good quality LFT (A or B)	83	84
Poor quality LFT (C, D or F)	17	16
Standard procedure		
Good quality LFT (A or B)	57	61
Poor quality LFT (C, D or F)	43	39

LFT, lung function test.

The equivalent annual cost of the computer platform was calculated on the assumption that its useful lifespan was 5 years and its residual value was zero. The rate of discount applicable in the calculation of the equivalent annual cost was 3%.[21,22] The cost and incremental effectiveness of both procedures was also determined and the incremental cost-effectiveness ratio was deduced (Table 3).

The data obtained in this initial phase were used to evaluate the economic impact of incorporating telespirometry into the public health system. This constituted the second phase of the study, conducted over a 3-year period (2010–2013).

In this second phase, after the program was implemented in the public health system, we evaluated the overall costs of its progressive introduction compared to the traditional system. Data were analyzed in the centers that at the end of 2013 had performed LFT with telespirometry for a period of at least 9 months.

We based our analysis of the effectiveness of the telespirometry procedure for the period 2010–2013 on data obtained by Marina et al.[19] For the standard procedure, we assumed for 2013 the same effectiveness as that recorded at the beginning of 2010.

The same amount of time dedicated to training and management of the platform was assigned for 2010 and 2013. Human resources costs (a pulmonologist and a nurse) in 2013 were calculated using figures from 2010 updated with the 5.6% official inflation rate between December 2010 and December 2013, according to National Labor Institute figures.

Finally, the direct cost of the test itself for the year 2013 was retrieved from the tariffs of the Basque Health Service lists for health and teaching services.

Table 2
Comparison of Lung Function Test Costs, in 2010 and 2013.

	Costs per LFT (€)	
	2010	2013
Telespirometry procedure		
Cost of spirometry	37.9	39.7
Cost of computer platform		
Cost of software	4.4	0.8
Cost of implementation and maintenance	0	2
Cost of personnel for managing computer platform		
Administrator	0.02	0.02
Coordinator	2.7	2.9
Technician	1.3	1.3
Cost of training	1.3	1.1
Total	47.7	47.8
Standard procedure		
Total	37.9	39.7