

A Tutorial on Activity-Based Costing of Electronic Health Records

Marie H. Federowicz; Mila N. Grossman; Bryant J. Hayes; Joseph Riggs

[AQ2]

As the American Recovery and Restoration Act of 2009 allocates \$19 billion to health information technology, it will be useful for health care managers to project the true cost of implementing an electronic health record (EHR). This study presents a step-by-step guide for using activity-based costing (ABC) to estimate the cost of an EHR. ABC is a cost accounting method with a “top-down” approach for estimating the cost of a project or service within an organization. The total cost to implement an EHR includes obvious costs, such as licensing fees, and hidden costs, such as impact on productivity. Unlike other methods, ABC includes all of the organization’s expenditures and is less likely to miss hidden costs. Although ABC is used considerably in manufacturing and other industries, it is a relatively new phenomenon in health care. ABC is a comprehensive approach that the health care field can use to analyze the cost-effectiveness of implementing EHRs. In this article, ABC is applied to a health clinic that recently implemented an EHR, and the clinic is found to be more productive after EHR implementation. This methodology can help health care administrators assess the impact of a stimulus investment on organizational performance.

With \$19 billion allocated to health information technology in the American Recovery and Restoration Act of 2009, it will be beneficial for health care managers to project the true cost of implementing an electronic health record (EHR).¹ Activity-based costing (ABC) is a cost accounting method that enables managers to identify inefficiencies and assess the effect of management actions to correct these inefficiencies. Health care managers can benefit by using ABC to analyze the effects of EHR investments on productivity and efficiency. To inform health care managers of the advantages and process of ABC, this study presents background information on ABC and a step-by-step process guide on how to use ABC to estimate the cost of implementing an EHR.

HISTORY OF THE USE OF ABC

ABC as a defined subject matter was first introduced by Robert Kaplan and Robin Cooper in their 1987 book, *Accounting and Management: Field Study Perspective*.² Currently, ABC is used considerably in manufacturing and other industries.^{3–11} However, the use of ABC in the health care field is limited at this time.^{12–16} Furthermore, literature concerning the use of ABC for EHRs is nonexistent.

Author Affiliations: Georgetown University, Washington, DC.

Corresponding Author: Marie H. Federowicz, 3200 Brunton Dr, Glenshaw, PA 15116 (mhf8@georgetown.edu).

This article was completed under the supervision of Farrokh Alemi, PhD, as part of undergraduate “Information Systems” course in the School of Nursing and Health Studies at Georgetown University.

This article was made possible also by the contributions and guidance from the staff of the University of Wisconsin Medical Foundation.

Key words: activity-based costing, electronic health record, health information technology

ABC AS A COST ACCOUNTING METHOD

ABC is a cost accounting method to estimate the cost of a project or service within an organization.¹⁷ As such, ABC can be used to estimate the cost of an EHR. This approach starts from the “top” by looking at the organization’s complete budget and calculates the total cost of the information technology from the budget of the organization. Then, ABC distributes the cost to various activities within the organization according to cost drivers and resources used for each activity.¹⁸

OTHER COST ACCOUNTING METHODS

Besides ABC, other cost estimation methods include statistical analysis and unit costs for quantities. Statistical analysis of cost is a method that collects expenditure data for a particular activity across organizations. This method then creates a regression model and a production cost curve with the collected information, indicating the standard cost of a particular activity.¹⁹ The unit cost for quantities method works from the “bottom-up” and calculates the total cost of an activity by multiplying the unit price by the quantities consumed. The unit cost for quantities method is currently the most common method used in EHR implementation.²⁰

Unlike the other methods, ABC includes all of the organization’s expenditures and is less likely to miss hidden costs. For example, other methods include the costs of training staff members on a new EHR, such as by including the cost of hiring trainers and purchasing training materials. However, ABC goes further and also accounts for the cost of the staff members participating in the training instead of working. Compared with other methods, ABC offers an approach that is less likely to miss costs and thereby more likely to produce an accurate assessment of the cost-effectiveness of implementing an EHR.

STEP-BY-STEP GUIDE

The case study is a 3-physician clinic in the Midwest. This clinic fully implemented an EHR in March

Table 1

LIST OF ACTIVITIES

Activities
Personnel
Executive management
Human resource and finance
Building
Supplies
Electronic health record
Other operating expenses

2006. For the analysis, fiscal year 2006 (FY06) is a “before” picture of the clinic without the EHR, and FY07 is an “after” picture of the clinic with the EHR. Complete clinic information for the study was available for only 1 quarter of each fiscal year. Therefore, each fiscal year reflects data from only 1 quarter of the respective fiscal year.

Step 1: Determine a list of activities into which the total cost of operation will be allocated (Table 1).

Step 2: Allocate the appropriate amount of expenditure into each activity (Table 2).

The expenditures for the following activities are taken directly from the financial statements: personnel, supplies, and other operating expenses.

The costs of human resource and finance functions of the clinic are estimated to be 5% of the revenue of the clinic.

Table 2

EXPENSES FOR ACTIVITIES

Expense category	FY06	FY07
Personnel	716 755	702 274
Executive management	36 806	38 611
Human resource and finance	61 344	64 351
Building	180 189	179 294
Supplies	203 183	255 927
Electronic health record	...	24 733
Other operating expenses	126 749	124 789

Abbreviations: FY06, fiscal year 2006; FY07, fiscal year 2007.

The executive management expense is found by allocating the total executive-level compensation for the health system into the health clinic based on the proportion of the executive management's time spent managing the health clinic. For this clinic, the executive management is 3% of the revenue of the clinic.

The building expense represents the opportunity cost of rent for the square footage of the building. The building expense is found by multiplying the square footage of the building by the market price for rent per square foot.

The EHR expense is found by first dividing the total organization-wide investment cost of the EHR over the period for implementation. This number is then divided by the total number of physicians the EHR is intended to support. This number is finally multiplied by the number of full-time equivalent physicians in the clinic.

To account for inflation, the raw values for the FY06 expense categories were each increased by 3.5%, which was the clinic's overall pay increase from FY06 to FY07.

Step 3: Calculate the total costs for each period (Table 3).

The total cost is the sum of the costs in the expense categories.

Step 4: Determine the number of patient appointments for each period (Table 4).

Table 3

TOTAL EXPENSES

Expense category	FY06	FY07
Personnel	716 755	702 274
Executive management	36 806	38 611
Human resource and finance	61 344	64 351
Building	180 189	179 294
Supplies	203 183	255 927
Electronic health record	...	24 733
Other operating expenses	126 749	124 789
Total expenses	1 325 027	1 389 979

Abbreviations: FY06, fiscal year 2006; FY07, fiscal year 2007.

Table 4

APPOINTMENTS PER FISCAL YEAR

	FY06	FY07
No. of patient appointments	3828	4168

Abbreviations: FY06, fiscal year 2006; FY07, fiscal year 2007.

The number of patient appointments is taken from the clinic's schedule of records.

Step 5: Calculate cost per appointment for each period (Table 5).

The cost per appointment is calculated by dividing the total expenses by the number of patient appointments.

Step 6: Compare the total cost per appointment before and after EHR implementation and draw conclusions.

The following equation is used to determine the percentage change in the total cost per appointment after EHR implementation:

$$\begin{aligned}
 &\% \text{ Change in cost per appointment} \\
 &= (\text{Cost After} - \text{Cost Before}) / (\text{Cost Before}) \times 100\% \\
 &= (\$333.49 - \$346.14) / (\$346.14) \times 100\% \\
 &= -3.65\%
 \end{aligned}$$

If the percentage change is negative, the clinic is more productive with the EHR, and if the percentage

Table 5

COST PER APPOINTMENT

	FY06	FY07
Total expenses	1 325 027	1 389 979
No. of patient appointments	3828	4168
Cost per appointment	346.14	333.49

Abbreviations: FY06, fiscal year 2006; FY07, fiscal year 2007.

change is positive, the clinic is less productive with the EHR.

Therefore, with a percentage change of -3.65% , the clinic is more productive with the EHR. The cost per appointment is about \$13 less with the EHR.

DISCUSSION

ABC is an effective cost accounting method that health care managers can use to accurately assess the costs of implementing an EHR. This example has illustrated that ABC is a useful approach to analyze costs because it prevents costs from being missed. This approach is also unique as it uses market prices for cost estimations, such as the market price for rent.

ABC is particularly useful when an organization wishes to assess the effect of an expected change, such as an EHR.

The traditional approach for estimating the cost of an EHR is not serving us well. Many health care organizations have underestimated the costs of an EHR by using the traditional cost accounting methods. An increased use of ABC for the implementation of an EHR can assist the health care field in making realistic decisions regarding the costs and benefits of EHRs.

REFERENCES

1. Blumenthal D. Stimulating the adoption of health information technology [published ahead of print March 25, 2009]. *New Engl J Med*. 2009;360(15):1477–1479.
2. Kaplan R, Cooper R. *Accounting and Management: Field Study Perspective*. Boston, MA: Harvard Business School Press; 1987.
3. Briers M, Chua WF. The role of actor-networks and boundary objects in managing accounting change: a field study of an implementation of activity-based costing. *Account Organ Soc*. 2001;26:3:237–269.
4. Cagwin D, Bouwman MJ. The association between activity-based costing and financial performance. *Manag Account Res*. 2002;13(1):1–39.
5. Malmi T. Activity-based costing diffusion across organizations: an exploratory empirical analysis of Finnish firms. *Account Organ Soc*. 1999;24(8):649–672.
6. Anderson SW, Hesford JW, Young SM. Factors influencing the performance of activity based costing teams: a field study of ABC model development time in the automobile industry. *Account Organ Soc*. 2002;27(3):195–211.
7. Krumwiede KR. The implementation stages of activity-based costing and the impact of contextual and organizational factors. *J Manag Account Res*. 1998;10:239–278.
8. Ittner CD, Lanen WN, Larcker DF. The association between activity-based costing and manufacturing performance. *J Account Res*. 2002;40(3):711–726.
9. Innes J, Mitchell F, Sinclair D. Activity-based costing in the UK's largest companies: a comparison of 1994 and 1999 survey results. *Manag Account Res*. 1999;11:349–362.
10. Kee R, Schmidt C. A comparative analysis of utilizing activity based costing and the theory of constraints for making product-mix decisions. *Int J Prod Econ*. 2000;63:1–17.
11. Kee R. Integrating activity-based costing with the theory of constraints to enhance production-related decision-making. *Account Horiz*. 1995;9(4):48–61.
12. Canby JB. Applying activity-based costing to healthcare settings. *Healthc Financ Manage*. 1995;49(2):50–56.
13. Chan YL. Improving hospital cost accounting with activity based costing. *Health Care Manage Rev*. 1993;18(1):71–77.
14. Ridderstolpe L, Johansson A, Skau T, Rutberg H, Ahlfeldt H. Clinical process analysis and activity-based costing at a heart center. *J Med Syst*. 2002;26:309–322.
15. Asadi MJ, Baltz WA. Activity-based costing for clinical paths: an example to improve clinical cost & efficiency. *J Soc Health Syst*. 1996;5:1–7.
16. Lievens Y, Van Den BW, Kesteloot K. Activity-based costing: a practical model for cost calculation in radiotherapy. *Int J Radiat Oncol Biol Phys*. 2003;57:522–535.
17. Cooper R. The rise of activity-based costing, I: what is an activity-based cost system? *J Cost Manag*. 1998;2(2):45–54.
18. Udpa S. Activity cost analysis: a tool to cost medical services and improve quality of care. *Manag Care Q*. 2001;9(3):34–41.
19. Hillestad R, Bigelow J, Bower A, et al. Can electronic medical record systems transform health care? Potential health benefits, savings, and costs. *Health Aff (Millwood)*. 2005;24(5):1103–1117.
20. Xu S. Advancing return on investment analysis for electronic health record investment. *J Healthc Inf Manag*. 2007;21(4):32–39.

[AQ4]

[AQ3]

Title: A Tutorial on Activity-Based Costing of Electronic Health Records

Authors: Marie H. Federowicz, Mila N. Grossman, Bryant J. Hayes, and Joseph Riggs

Author Queries

AQ1: Please check whether the running head is OK as set.

AQ2: Please provide the highest academic degrees (already earned) for all the authors.

AQ3: Ref 1 has been updated per PubMed. Please check. Provide the doi for this article.

AQ4: Ref 19 has been updated per PubMed. Please check.