Introduction to Patient Safety Research

Presentation 16 - Evaluating Impact: Cost Identification Analysis

Better Knowledge for Safer Care

2: Introduction: Study Details

- **Full Reference**
  - **Khan MM, Celik Y. Cost of nosocomial infection in Turkey: an estimate based on the university hospital data. Health Services Management Research, 2001, 14:49-54**

Link to Abstract (HTML)   Link to Full Text (PDF)

Cost of nosocomial infection in Turkey: an estimate based on the university hospital data.

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Nosocomial infections significantly affect the resource needs of hospitalized patients. They increase the mortality and morbidity of affected individuals and expose hospital staff to increased risk of infection. To estimate the additional resources needed in the hospital sector to deal with such infections, a sample of infection cases was selected from the Hacettepe University Hospital in Ankara, Turkey. Each case of nosocomial infection was matched with a noninfected case after controlling for age, sex, clinical diagnosis etc. of the patients. The empirical results indicate that hospital infection increases the average hospital stay by about four days. Total cost of an infected case, on average, was found to be $442 higher than that for a matched noninfected case. Using this incremental cost estimate, projections for Turkey implies that the hospital sector had to spend an additional $48 million in 1995 for medical management of nosocomial infections. The benefit: cost ratio for a hospital-based infection control programme is found to be about 4.6. Clearly, a programme for preventing nosocomial infections will not only pay for itself but also will generate other direct and indirect benefits to patients and society as a whole.

PMID: 11246784 [PubMed - indexed for MEDLINE]

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Introduction

Infections originating in hospitals — nosocomial infections — represent an important public health problem for both developed and developing countries of the world. Such infections increase the length of hospital stay and add considerably to the original cost of hospital intervention (Green et al., 1982). The resources spent to manage hospital-acquired infections could be used to produce other healthcare services. Moreover, nosocomial infection increases the mortality and morbidity of patients imposing additional economic, social and nonpecuniary costs (Konsielski and Maglacas, 1984). Given the scarcity of funds in preventive and promotive health activities in developing countries, failure to control high-cost nosocomial infections appears ethically unacceptable and represents a gross misuse of available healthcare resources (Farrauti, 1991).

In 1997, Turkey spent about 4% of its gross national product (GNP) on healthcare. The public sector's contribution to national healthcare expenditure was about 71% and the Minis-

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3: Introduction: Patient Safety Research Team

- **Collaborating researcher – M. Mahmud Khan, PhD**
  - Professor, School of Public Health and Tropical Medicine
  - Tulane University in New Orleans, Louisiana, USA
  - Field of expertise: healthcare management, health economics
- **Other team member: Yusuf Çelik, PhD**
  - Associate Professor, School of Health Administration
  - Hacettepe University in Ankara, Turkey

4: Background: Opening Points

- **Definition of nosocomial infection:**
  - **An infection originating in a hospital**
- **Nosocomial infections represent an important public health problem for both developed and developing countries**
- **Nosocomial infection increases the mortality and morbidity of patients, imposing additional economic and social costs**
  - **Such infections increase the length of hospital stay and add considerably to the original cost of hospital intervention**
  - **Controlling nosocomial infection reduces direct medical costs, shortens waiting times and provides additional social benefits**

5: Background: Study Rationale

- **The University Hospital was concerned about nosocomial infections and wanted to reduce the incidence of infection cases**
  - **Dr. Celik considered nosocomial infections as one of the most important concerns in Turkey**
  - *"Our initial thought was that the research would be able to indicate how costly nosocomial infections are and how many resources the system could save by avoiding infections."*

6: Background: Setting Up a Research Team

- **Finding collaborators**
  - In Turkey, Dr. Celik contacted the hospital and hospital infection control program and received a list of personnel involved in the area of nosocomial infections
  - Literature review was conducted to identify researchers interested in this area in Turkey
- **Obtaining funding**
  - No specific funding available for the project
  - Although research assistants were used, nurses in the hospital voluntarily provided advice and suggestions to the project

7: Background: Hospital Policy

- **Hospital infection control committee devised policies and procedures for dealing with nosocomial infection**
  - **In-service training provided to nurses to reduce the probability of hospital-based infection**
    - Instruction on sterilization, isolation, hand washing, intravenous therapy, urinary instrumentation, etc.
  - **Two nurses responsible for identifying and monitoring infected patients and keeping records**
  - **Microbiology tests requested for suspected cases to identify if there was a nosocomial infection, the microorganisms responsible and their antibiotic sensitivity**
- **Once a case was confirmed, patient brought under the infection management service of the hospital**

8: Methods: Study Design

- **Design: case control study / cost identification analysis**
  - Costs of nosocomial infections were estimated through chart reviews of patients found to have had such infections
  - Costs then compared to the medical costs of matched control patients
- **Objective:**
  - To estimate the potential cost savings that could be achieved through the control of nosocomial infection among hospitalized patients in Turkey

9: Methods: Study Population and Setting

- <u>Setting</u>: Hacettepe University Hospital in Ankara, Turkey
  - Teaching hospital with secondary and tertiary acute-care services
  - In 1994, 871 beds with an occupancy rate of 74%
  - 18 000 patients admitted to this hospital in 1994
- <u>Population</u>: all patients admitted from March to May 1994
  - 82 cases selected based on presence of infection and adequate data in hospital records (quantity of services, supplies and drugs used)
  - Using the matching variables, only 56 cases of nosocomial infections matched with 56 non-infected hospitalized cases (control)
  - Cost estimates based on 51 cases (5 cases were dropped due to missing cost data)

10: Methods: Data Collection

- **Patient information obtained from detailed records kept by the infection control clinic kept during this three-month period**
- **A control case-match approach was adopted to compare cases of nosocomial infections with non-infected cases**
  - Matching variables included age, sex, intensive care unit and principal diagnosis
  - Diagnosis and age were grouped into broad categories due to matching limitations

11: Methods: Data collection (2)

- **Costs associated with hospital-acquired infection estimated from patient bills or charges**
  - Since patients often required to buy drugs from the market, costs estimated from the prescribed drugs listed in the medical record
  - To minimize price variability, study evaluated all prescribed drugs at a fixed price: average price of specific drugs over the period of July 1994 to February 1995
- **Cost and resource use by categories were estimated from patient files**
  - Categories included cost of hospital bed, medical procedures, laboratory and radiology tests, antibiotics and other supplies

12: Methods: Data Analysis and Interpretation

- Calculated nosocomial infection distributions and average costs
- Calculated differences in the mean values between patient categories (t-test)
  - If the mean values differed significantly from each other, the category-specific average costs were reported
  - If the t-values are low, the overall mean is used as the group-specific average

13: Results: Key Findings

- **78 nosocomial infections identified in 56 patients**
  - **Urinary tract infection** was by far the most common type of infection, accounting for one third of all nosocomial infections
  - **Nearly one third of patients experienced more than one infection**

Table **1** *Distribution of nosocomial infection by types of infection among hospital patients in Hacettepe University Hospital, Turkey*

Infection type	Number of cases	Percentage of total
One infection only	38	67.8
Urinary tract	19	33.9
Respiratory tract	8	14.3
Bacteraemia	4	7.1
Surgical wound	3	5.4
Skin	2	3.6
Others	2	3.6
Multiple infections	16	28.6
Urinary tract and respiratory tract	2	3.5
Urinary tract and others	8	14.3
Other multiple infections	6	16.7
Unknown infections	2	3.6
Total	56	100.0

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14: Results: Cost Analysis

- **Average length of stay** for an infected patient (21.4 days) four days longer than for a non-infected patient (17.5 days)

- On average, total cost of stay for an infected case ($2243) was 22% higher, and for multiple infected case ($3395) was 72% higher, than for a non-infected case ($1977)

Table 3   *Additional cost of nosocomial infection by cost categories in US dollars*

| | Average for the category by infection status | | | |
Length of stay and cost items	Not infected	Infected	One infection	Multiple infections
Length of stay (days)	17.5	21.4	19.2	26.5
Cost of hospital bed	170.00	231.67	195.00	275.30
Cost of procedures	281.90	281.90*	281.90*	281.90*
Laboratory costs				
Bacteriology	12.00	20.00	17.80	24.50
Haematology	37.80	56.00	51.20	64.20
Chemistry	218.00	296.30	268.30	357.30
Infection-related costs	4.00	8.10	7.80	8.80
Other laboratory costs	176.30	176.30*	176.30*	176.30*
Radiology costs	120.30	182.00	183.20	168.50
Antibiotic costs	782.30	925.40	587.80	1796.7
Supplies	174.84	241.46	241.46*	241.46*
Total cost	1977	2243	2011	3395

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15: Conclusion: Main Points

- **Potential cost savings from the control of nosocomial infection in Turkey are quite substantial**
  - **Investment in strategies to avert infection necessary to achieve these savings**
  - **Hospital administrators should emphasize prevention of multiple infections because of higher cost and resource utilization**
  - **Due to high prevalence, significant benefit could be achieved by reducing urinary track infections**
- **About 75% of nosocomial infections cases could be prevented by adopting simple steps in the hospital setting**
  - **Promote regular reporting of infection cases and in service training for infection control measures**

16: Conclusion: Discussion

- **University hospital considered better than average in terms of service quality**
  - Estimated that more than 6% of patients at University Hospital develop nosocomial infection
  - Estimated prevalence of about 10% for the rest of Turkey
- **Potential cost savings for other hospitals in Turkey could be even more significant. Based on a 10% prevalence rate:**
  - If only half of these cases of nosocomial infections were prevented, hospitals in Turkey could save more than US $48 million a year
  - If hospitals prevented multiple infections (without affecting overall prevalence), the savings would be about US $20 million a year

17: Conclusion: Discussion (2)

- **Study limitations**
  - Process of data collection was quite time consuming. Although the researchers completed the study as planned, it was realized that ideally the study should collect data on a prospective basis
- **Ethical approval**
  - Study adopted strict policy of not identifying the individual cases: researchers decided to go back to older records (four to five year old) to avoid more recent cases
  - No identifying information was transferred and none of the files were borrowed or removed from the hospital record department
- **Required competencies**
  - Ability to interpret hospital records, identify cost items and value cost items

18: Conclusion: Study Impact

- **Academic impact**
  - Demonstrated that cost of nosocomial infection at the hospital level can be estimated from hospital records
  - Demonstrated that hospital acquired infections are very costly
- **Practice impact**
  - *"Most infections are due to few interventions in the hospital. In general, nurses involved in the program knew about the major sources of nosocomial infections. but the study provided them with a quantitative measure."*
- **Policy impact:**
  - *Preventing nosocomial infections is highly cost-effective. The practitioners and the nurses understood the importance of prevention and the study may have improved their practices, although no specific policy was adopted based on the results of the study.*

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19: Author Reflections: Lessons and Advice

- **If you could do one thing differently in this study, what would it be?**
  - *"It would be to try to increase the sample size. We could have increased the sample size but hospital record review was found to be very time consuming.*
  - *Given that the study did not had any specific funding source other than real resources and time of the researchers, the sample size was kept small."*
- **Importance of long term perspective**
  - *"This type of study should take a longer-term perspective. Prior to the start of the study, it is important to discuss with hospital administrators and health care providers to ensure adoption of a good tracking system for patients with nosocomial infections."*

20: Author Reflections: Lessons and Advice (2)

- **Would this research be feasible and applicable in developing countries?**

  - *"Yes. However, every country and its health system have their own characteristics. Please keep this fact in mind."*

- **What message do you have for future researchers from developing countries?**

  - *"In developing countries, patient's files are not updated and some patients may have multiple files. It is important to make sure that the patient files are accurate."*

21: Author Reflections: Overcoming Barriers

- **Involving multiple stakeholders**
  - *"This type of study is extremely sensitive, especially to hospital administrators and the health care providers. Try to get them involved in all stages of the study and seek their advice and suggestions."*
- **Demonstrating the value of research**
  - *"One of the most crucial hurdles was convincing the hospital management and infection control commitee that the research would be useful in demonstrating the benefits of controlling nosocomial infections and that it should not be viewed as an effort to measure the quality of care provided by the hospital."*

22: Author Reflections: Ideas for Future Research

- **Repeat the study with an increased sample size**
- **Conduct a prospective study, if feasible**
  - *"Otherwise, retrospective review of files should identify a method of identifying nosocomial infection cases."*
- **Seek external funding to properly track and evaluate files**
  - *"Funds will also allow hiring individuals with specific medical knowledge in this area, specially interpreting some of the entries in the files (need help from individuals who read these files regularly or make entries)."*