

The Role of Clinical Practice Guidelines in Reducing Laboratory Healthcare Expenditure in a Developing Country

W.A. Hayajneh, M.S. Miqdady, N.J. Shatnawi,
H. Jdaitawi, W.K. Suliman, Y.A. Hayajneh and Y.S. Miqdady
Department of Pediatrics, Faculty of Medicine,
Jordan University of Science and Technology, P.O. Box 3030, Irbid, 22110, Jordan

Abstract: A significant portion of hospitals health care expenditure in Jordan is spent on laboratory testing. This study aimed to assess the validity of certain clinical practice guidelines (for common pediatric diseases) in a Children's Hospital in North Jordan and to estimate the possible reduction in laboratory healthcare expenditure upon applying these guidelines. This prospective descriptive study included children admitted with common diagnoses. Necessary clinical and diagnostic data were analyzed. A panel of experts, guided by a set of selected practice guidelines, decided the appropriateness of the ordered laboratory investigations. Two hundred and seventy eight patients completed the study, 3,526 tests were performed and 47.8% of these were considered unjustified which accounted for 39% of the total laboratory expenditure. Chemistry tests were both the most frequent 60.2% and the most unjustified 63%. Justified tests tended to yield more abnormal results ($p = 0.002$). Local validity of international clinical practice guidelines was acceptable. Adherence to these guidelines regarding tests ordering may result into significant reduction of laboratory utilization and significant expenditure saving 39%. More studies are needed to identify other aspects of inappropriate laboratory utilization and to develop and validate community-based guidelines.

Key words: Practice guidelines, laboratory management, inappropriateness, healthcare expenditure, hospitals

INTRODUCTION

In recent years, the cost of health care and its quality became the major challenges facing the health sector around the world (Plebani, 2003). While much of the debate on health spending and reform has focused on developed countries, these issues are even of greater importance to developing countries, whose significantly higher disease burdens and limited human and technical resources pose serious challenges (Schieber *et al.*, 2007). Jordan, with its limited resources, is also facing an increasing health care expenditure. In the year 2003, 10.4% of Jordan Gross Domestic Product (GDP) was spent on health care and 42% of this expenditure was covered by public sector (World Bank, 2003). The World Bank has also estimated (2003) that hospitals share of this expenditure in Jordan reached 76.2% of the total health care expenditure in 2003, compared to 21% in Germany (Schnurrer *et al.*, 2001). It is also alarming that Ministry of Health spending on curative increased to 70% of its budget in 2003, compared to 51% in 1998 (World Bank, 2003; Annual Statistics Book, 2004).

Therefore, more attention has been directed toward cost containment in hospitals (Franklin, 2003; Welch and Kleiner, 1995). In the year 2000, laboratory charges made up 20, 4, 5.2 and 7-10% of total hospital care accounts in United States, United Kingdom, Australia and Canada, respectively, (Plebani, 2003). We don't know how much laboratory expenditure in Jordan contributes to the total hospital care expenditure. In response to such worries and others, the concept of Disease Management (DM) has emerged in order to minimize the unreasonable or unjustifiable health care expenditures. DM is a cost-effective approach to optimize patient outcomes and minimize the costs associated with any disease state (Almarsdottir and Traulsen, 2005). Major elements of DM are the Clinical Practice Guidelines (CPG) along with Laboratory Medicine Practice Guidelines (LMPGs). CPGs have proven clearly (with embedded LMPGs) that they are the most effective approaches to achieve appropriateness in laboratory field (Grimshaw and Russel, 1993; Van Wijk *et al.*, 2001). LMPGs simply mean Ordering the right test for the right patient (Van Walraven, 2002).

Corresponding Author: Wail A. Hayajneh, Department of Pediatrics, Faculty of Medicine,
Jordan University of Science and Technology, P.O. Box 3030, Irbid, 22110, Jordan
Tel: +962-2-7201000 23789 Fax: +962-2-7095010

This study was conducted to assess the validity of certain clinical practice guidelines (for common pediatric diseases) in a Children's Hospital in North Jordan and to estimate the possible reduction in laboratory healthcare expenditure upon applying these guidelines.

MATERIALS AND METHODS

Setting: This is a prospective descriptive study and was conducted at Princess Rahma Pediatric Teaching Hospital (PRPTH) in North Jordan, from first of June, 2005 till 30th of September 2005. Its capacity is 109 beds with an occupancy rate around 85% around the year. This hospital receives and treats most children in North Jordan.

Inclusion criteria: We included children aged 0-12 years who presented with one or more of the following symptoms:

- Respiratory or cardiovascular symptoms including; cough, difficulty of breathing, wheezing, stridor, noisy breathing, nasal discharge, tachypnea, bluish discoloration and other symptoms related to respiratory or cardiovascular systems
- Vomiting, diarrhea, abdominal pain or distension
- Fever
- Skin rash
- Neurological symptoms
- Urinary tract symptoms

These inclusion criteria were selected to assure inclusion of patients with the most commonly encountered diagnoses in the study hospital. Two hundred and seventy eight inpatient children met these predefined criteria during the determined study period and completed the study.

Exclusion criteria: Children with immunodeficiency or chronic disorders were excluded. Examples of chronic disorders are; cystic fibrosis, thalassemia and chronic lung disease.

Data collection: Data collection process was organized prospectively and carried out using special forms. These data included demographic data, date of admission, chief complaint, suspected or initial diagnosis, initial physical examination, final or discharge diagnosis, date of patients' discharge, laboratory and radiology investigations. Clinical follow-up was done daily for all eligible children until discharge. Ordering a certain test was judged to be justified (appropriate) if its performance was in accordance with pre-selected, authenticated and widely accepted disease management guidelines and reviews published in reliable, peer-reviewed and indexed journals

(King *et al.*, 2003; Bordley *et al.*, 2004; Brook *et al.*, 2000; Kumar and Mckean, 2004; McCracken, 2000; Saéz-Llorens and McCracken, 2003; Smith, 2004; Tunkel *et al.*, 2004). This agreement between test performance and published guidelines was judged by a panel of pediatricians that included:

- A pediatric infectious diseases physician
- A pediatric gastroenterology physician
- A general pediatrician who works with Ministry of Health at PRPTH

These guidelines were chosen by the panel and made available to all panel members in advance. All panel members were blinded to the tests results. A test ordering was considered justified (appropriate) if at least two out of three panel members decided that it was so. Normality of laboratory investigations was assigned based on the test normal range in the commonly used The Harriet Lane handbook for pediatric laboratory investigation (Hopkins *et al.*, 2002) and was decided by an independent health care personnel. The normality status of radiological tests was assigned according to available radiological reports or the treating physician interpretation if reports are not available. Validity of guidelines was tested based on comparing normality of tests and their appropriateness decisions. A test ordering trend would be collectively valid if there were statistically significant more abnormal results within those tests judged to be appropriate. This was based on assumption that knowing these abnormal results would reflect positively on patients care.

Ethical considerations: Research objectives and methodology were explained to all patients' legal guardians and consents were obtained. All accumulated data were kept confidential. Identifying information were removed and used only for research purposes.

Data processing and statistical analysis: All gathered data were processed using the statistical package for social science software (SPSS, version 10, Chicago. Inc.) and Microsoft office excel 2004. Probability values were calculated using Chi-square. The hospital charge fee of each laboratory or radiology test was obtained from the Ministry of Health official pricing list (These fees were in general less than the real cost).

RESULTS AND DISCUSSION

Sociodemographic characteristics: Two hundred and seventy eight patients met the inclusion criteria and completed the study. Most patients were below 2 years of age, insured and accompanied by non-working mothers (60.4, 86 and 94%, respectively).

Clinical presentations and diagnoses: Admission and final diagnoses were concordant in 93% of the patients. Meningitis was the final diagnosis for 34.17% followed by gastroenteritis and pneumonia (Table 1).

Laboratory and radiology tests: There were 55 different types of diagnostic tests and were classified into 5 major test categories in accordance with Jordanian Ministry of Health classification. The total number of tests performed during the study period was 3526 tests (Table 2). Chemistry tests were the most frequently performed tests while serology tests were the least. Chest radiogram was the most frequent performed radiological test.

Appropriateness of test ordering: Appropriateness of each test was determined if all or at least two of the panel members decided that the test was justified or not. Out of 3526 tests, 1722 (48.8%) test were considered justified, with the remaining 1804 (51.2%) tests considered unjustified (Table 2). Complete inter-rater agreement was achieved for 1092 (63.4%) justified tests. On the other hand, inter-rater agreement was less (50.8%) for unjustified tests. Overall, chemistry tests were the most abused tests where hematology tests, specifically complete blood counts, were the least abused

(63 vs. 29%). When matched to admission diagnoses and compared to hematology and microbiology tests, chemistry tests continued to be the most relatively abused tests in all types of diagnoses. Actually, more than 90% of chemistry tests were unjustified in cases of pneumonia and bronchiolitis. Performance of chemistry tests was more justified in gastroenteritis cases (50%) and this is consistent with clinical practice guidelines (Almarsdottir and Traulsen, 2005). Radiology tests were unjustified in 45% of the situations. Actually they were unjustified in most of cases of gastroenteritis, meningitis and urinary tract infections (85, 73 and 67%, respectively). It is clear that radiology tests; particularly chest radiograms, add no value for the diagnosis of such diseases (Grimshaw and Russel, 1993; Tunkel *et al.*, 2004; Saéz-Llorens and McCracken, 2003).

Normality of tests and validity: Normality rates were matched and compared with appropriateness rates of performed tests to get a simple sense regarding the validity of appropriateness decisions made by the panel. To achieve this, we calculated Chi-square and p-values to identify possible significant statistical differences between appropriateness and normality rates for the 5 major tests categories. In general, the panel decisions were significantly valid ($p = 0.002$) when their decisions were matched to normality rates and more abnormal tests were reported in the justified cohorts. This statistical significance was also consistently evident for individual sub-cohorts (chemistry, radiology, microbiology and serology) (p -values of = 0.001, 0.001, 0.037 and 0.032, respectively). However, appropriateness decisions regarding hematology tests did not reflect on the normality rates and they seemed to be invalid ($p = 0.837$).

Table 1: Frequency and percentage of final (discharge) diagnoses

Final diagnosis	No. of patients (%)
Meningitis	97(34.9)
Gastroenteritis	55(19.8)
Pneumonia	34(12.2)
Possible sepsis	26(9.4)
Wheezing of uncertain etiology	19(6.8)
Urinary tract infection	17(6.1)
Undiagnosed fever	11(4.0)
Bronchiolitis	7(2.5)
Newly diagnosed asthma	5(1.8)
Others	7(2.5)

Table 2: Validity analysis of major tests categories

Test group	No. of normal tests	No. of abnormal tests	Abnormal tests (%)	Unjustified tests (%)	p-value
Chemistry					
Justified	435	346	44	63	≤ 0.001
Unjustified	866	477	36		
Microbiology					
Justified	438	52	11	31	0.037
Unjustified	212	13	6		
Hematology					
Justified	124	178	59	29	0.837
Unjustified	51	70	58		
Radiology					
Justified	63	50	44	45	0.001
Unjustified	71	21	23		
Serology					
Justified	20	16	44	39	0.032
Unjustified	19	4	17		
Total					
Justified	1080	642	37	51	0.002
Unjustified	1219	585	32		

Table 3: Expenditure analysis of justified and unjustified tests

Tests group	Charges of justified tests	Charges of unjustified tests
Chemistry		
JD#	1255	1954
Percent	39	61
Microbiology		
JD	1739	680
Percent	72	28
Hematology		
JD	1271	0
Percent	100	0
Radiology		
JD	386	395
Percent	49	51
Serology		
JD	72	46
Percent	61	39
Total		
JD	4723	3075
Percent	61	39

Jordanian Dinars

This invalidity of hematology guidelines was clearly secondary to the fact that hematomograms were abnormal in more than two thirds of the tests (either low hemoglobin or low mean corpuscular volume). This important finding suggests that international practice guidelines used by our study panel to decide appropriateness of hemoglobin and red blood indices testing might not be valid for our particular pediatric patients with high prevalence of anemia. Accordingly, number of justified tests was recalculated to be 1683 (47.8% of all performed tests).

Reduction of expenditure: Unjustified tests accounted for 39% of the laboratory total expenditure (Table 3). In comparing charges of unjustified tests, chemistry tests charges were the largest, followed by microbiology, radiology, serology and hematology, respectively. In comparing the relative expenditure charges of unjustified tests, chemistry tests charges percentage continued to be the largest (61% of total chemistry tests charges). It was estimated that the charges of laboratory tests performed at Princess Rahma Hospital in 2004 was 1,530,014 Jordanian Dinars (\$2,154,949) (Annual Statistical Book, 2004). Applying practice guidelines used in this study could have resulted in an absolute expenditure saving of 596,706 Jordanian Dinars (\$ 840,431).

CONCLUSION

Tested clinical practice guidelines were generally valid except for hematology guidelines. About one half of the tests were considered unjustified. Overall, chemistry tests were the most abused tests while hematology tests, specifically complete blood counts, were the least abused. Radiology tests were unjustified in 45% of all situations especially in cases of gastroenteritis, meningitis and

urinary tract infections (85, 73 and 67%, respectively). Applying these guidelines could have resulted in 39% expenditure saving. However, effort should be made to develop, validate, promote and implement modified community-based clinical practice guidelines. More studies are needed to identify other aspects of inappropriate laboratory utilization.

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