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Exploring Lab Tests Over Utilization Patterns Using Health Analytics Methods

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Abstract. Healthcare resources are over utilized contributing more to the growing costs of care. Although laboratory testing is essential, yet it can be expensive and excessive. King Faisal Specialist Hospital and Research Center, Saudi Arabia studied lab tests utilization patterns using health analytics methods. The objective was to identify patterns of utilizing lab tests and to develop recommendations to control over utilization. Three over utilization patterns were identified; using expensive tests for many patients as routine, unnecessarily repeating lab test and a combined one. Two recommendations were suggested; a user approach, modifying user behavior through orientation about the impact of over utilization on the cost effectiveness of healthcare, and a system approach, implementing system alerts to help physicians check the results and identify the date of the last lab tests done with information about appropriate frequency of ordering such lab test and medically significant intervals at which such test should be repeated.

Keywords. Lab Tests, Over Utilization, Health Analytics, Hospitals.

Introduction

Many healthcare resources, including laboratory tests, are over utilized in different healthcare settings. The control of lab tests over utilization is becoming more important in the management of the rapidly growing healthcare costs [1]. Laboratory testing of patients, although essential, can be expensive and sometimes insignificant and excessive. Attempts to reduce lab tests over utilization have been difficult to implement and sustain [2].There are widely variable test ordering patterns at different healthcare settings even for similar patient populations. There are variations in individual healthcare professional test ordering patterns especially when it comes to deciding on the number of tests necessary for diagnosis or treatment [3]. In addition to that, it is difficult to reach to a consensus about what describes appropriate lab testing [4].Lab tests ordering patterns have been analyzed extensively in many studies, the inappropriate test ordering found to be a primary reason for increased lab use. Over utilization could be a result of lack of knowledge, inexperience or non-utilization of evidence based guidelines [5].Some professionals fail to check previous lab results due to huge or messed-up patient files or due to non-user-friendly interfaces of hospital information systems [6].Advising doctors about rational use of clinical laboratory is effective but not sufficient [7]. Training efforts to change professional practices have clearly demonstrated a 25% decrease in lab test ordering, although such decreases are mostly transient [8]. Changes in lab test ordering requisition or screen design have had

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a more durable effect but are difficult to implement and require dedicated subspecialty expertise [9].Challenges include mainly setting criteria to identify, evaluate and highlight over utilization patterns; having no direct positive impact on patient outcomes. We need to set standards for proper testing and proper frequency of repeating tests, based on specialty and on patient's clinical condition and severity [10]. It is essential to plan new approaches to manage such over utilization of lab tests, mainly by using health informatics and analytics applications and clinical decision support systems [11].

1. Methods

Due to the continuous and unjustified increase in the total number of hospital lab tests over the last few years; with 30% increase over the last year only, from 1.11 to 1.45 million lab tests comparing 2014 to 2015, the Medical and Clinical Affairs at King Faisal Specialist Hospital and Research Center, Jeddah, Saudi Arabia studied lab tests utilization patterns using descriptive health analytics methods. The main objective was to identify and analyze patterns of lab tests ordering that could be responsible for the over utilization, especially for expensive lab tests and those being frequently ordered without a true medical necessity, to save expenses that could have been directed to more important healthcare operations and higher priority patient needs. As a sample, the researchers selected Vitamin D test, which is used mainly to diagnose and monitor the treatment of bone weakness, bone disease and parathyroid gland dysfunction, and in the same time, as is identified as an expensive lab test that costs the hospital $57 each. Since Vitamin D levels do not show clinically significant changes over less than 90 days of treatment or monitoring, frequent testing, more than once every 3 months, is considered an overutilization and clinically insignificant [12]. Researchers retrieved data from the data warehouse system of the hospital to study test orders over ten months' duration; January to October 2015, including mainly patient name, physician name, department and date of ordering each test. The goal was to study the patterns and frequency of ordering such expensive lab test and to identify accordingly best recommendations to control any explored over utilization patterns.

2. Results

During the 10 months; from Jan to Oct 2015, a total of 6,375 Vitamin D tests have been ordered, with an average of 638 tests per month. 307 physicians have ordered these 6,375 tests for 5,441 patients, with an average rate of 2.1 tests per physician per month. Only 17 physicians ordered more than 10 tests in the 10 months and were responsible for ordering 4,423 tests; about 70% of the total workload with an average of 26 tests per physician per month. One patient was tested 9 times and another 2 patients were tested 7 and 6 times. 1.1% of tests were done more than 3 tests per patient, 21% of tests were done 2 tests per patient and the remaining 73% of tests were done one test per patient. If we considered more than 2 tests per patient in the 10 months as an increased rate, then this would target 6.1% of tests. Table 1 shows patients testing frequencies and relative percentages. Table 2 shows the patients who had more than 3 tests during the 10 months and the duration, in days, over which these tests were ordered and the average days between each 2 successive tests (e.g. The first patient had 9 tests done over 239 days with an average frequency of one test done every 27 days).

Table 1. Patients Vitamin D Testing Frequency Analysis.

No of Tests	No of Patients	Sum of Tests	% of Tests	Cumulative No	Cumulative %
9	1	9	0.1%	9	0.14%
7	1	7	0.1%	16	0.25%
6	1	6	0.1%	22	0.35%
5	2	10	0.2%	32	0.50%
4	9	36	0.6%	68	1.07%
3	107	321	5.0%	389	6.10%
2	666	1,332	20.9%	1,721	27.0%
1	4,654	4,654	73.0%	6,375	100.0%
Total	**5,441**	**6,375**	**100.0%**	**6,375**	**100.0%**

Table 2. Patients with more than three tests and their testing frequency.

S/N	Patient Name	No of Tests	Duration in Days	One test Every/Days	Frequency as per Guidelines	Unnecessary Tests
1	Patient 1	9	239	27	3	6
2	Patient 2	7	232	33	3	4
3	Patient 3	6	140	23	2	4
4	Patient 4	5	251	50	3	2
5	Patient 5	5	262	52	3	2
6	Patient 6	4	213	53	2	2
7	Patient 7	4	170	42	2	2
8	Patient 8	4	101	25	1	3
9	Patient 9	4	217	54	2	2
10	Patient 10	4	145	36	2	2
11	Patient 11	4	210	53	2	2
12	Patient 12	4	238	60	3	1
13	Patient 13	4	203	51	2	2
14	Patient 14	4	6	1	0	4
*	**Total**	**68**	**300**	**90**	**30**	**38**

3. Discussion and Conclusion

Studying patients who had more than 3 tests during the 10 months and showing how many of these tests were ordered by the same physician; patient 1 had 8 of his 9 tests ordered by the same physician; patient 4 had all of his 5 tests ordered by the same physician, while patient 2 had 7 tests ordered by 6 different physicians. In the first two cases, there is clearly a high frequency utilization pattern. We can describe three patterns of over utilization here; 1) Some physicians are highly utilizing the test but are not repeating it very frequently for the same patients, but they are ordering it for too many patients; just like a routine test. They need to be oriented about the cost of the test and to be directed to ordering it only when it is medically necessary. 2) Other physicians repeat the test very frequently for the same patients. These need to be reminded with the results and dates of the last tests, since it might not be clinically significant to repeat the test that frequent. 3) Some physicians combine both patterns. Considering the fact that Vitamin D testing does not show clinically significant changes over less than 90 days of treatment or monitoring [12]; overutilization was calculated showing 38 unnecessary tests among the 68, ordered more than 3 times per patient, with a 56% over utilization rate, and 577 unnecessary tests among 1,721, ordered more than 1 time per patient, with a 34% over utilization rate, with an estimated annual avoidable costs of $43,200 for Vitamin D test only.

4. Recommendations

Two main approaches can be recommended to control lab tests over utilization. The first is a user approach; modifying users' behavior regarding ordering lab tests generally and expensive tests specifically. Identified target users, with high utilization patterns, should be approached for orientation and education about the importance of controlling lab tests over utilization and its impact on the cost benefit of healthcare, which proved effective is many studies [13]. The second is a system approach; implementing clinical decision support interventions and system alerts to help physicians, at the time of placing new orders for lab tests, to easily check the results and identify the date of the last same type lab test done with information about appropriate frequency of ordering such lab test and medically significant intervals at which such test should be repeated, since the implementation of such interventions and alerts can significantly control over utilization of lab tests [14].

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