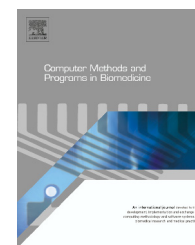




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Critical laboratory result reporting system in cancer patients

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ABSTRACT

Hypothesis: Automatic transmission of computer-generated Critical Laboratory Result Reports (CLRRs) to physicians can improve the care of advanced cancer patients by improving the communication efficacy of important medical information.

Method: We followed a cohort of 2012 cancer patients from diagnosis to five years or to death if it occurred before five years from diagnosis. The incidence and number of CLRRs and their association with diagnosis, age, gender, tumor size, and clinical staging were evaluated. The CLRRs that were reported included for example: glucose < 40 or > 500, hemoglobin < 6.0. (Appendix 1)

Results: Two thousand, twelve patients with cancer were included in the study; 45.6 percent had one or more critical laboratory results that required a CLRR. Older patients greater than or equal to 75 years of age had more CLRRs than younger patients. Patients with colorectal, liver, and lung cancer had a significantly higher number of CLRRs. More CLRRs were also seen in late-staged cancers. These conditions also have higher mortality rates.

Conclusion: Critical values are common in patients with cancer, especially older patients with advanced disease. They occur more commonly with some cancers of liver and lung cancers. Our data demonstrate that critical laboratory values can be transmitted successfully to physicians. The impact of this system promises to improve the care of these individuals' serious illnesses. A prospective study to demonstrate the benefit of this system is being planned.

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1. Introduction

Improving the quality and safety of the care delivered to patients with cancer requires a detailed understanding of the factors that influence health outcomes in general [1–3].

A recent report from the Institute of Medicine [4] addresses the need for improved cancer care [5–7]. The use of clinical information systems is becoming more common to assure and enhance high quality and safe patient care for patients with cancer [8]. Patients with cancer, especially those undergoing treatment, have a high incidence of critical laboratory results

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Table 1 – Number of critical laboratory results reports related to present characteristics.

Characteristics\CLRR	CLRR = 1 (N = 192)		CLRR = 2 (N = 154)		CLRR = 3 (N = 99)		CLRR ≥ 4 (N = 472)	
	n	%	n	%	n	%	n	%
Tumor								
Cervical	9	4.69	3	1.95	3	3.03	8	1.69
Colorectal	54	28.13	33	21.43	19	19.19	91	19.28
Liver	44	22.92	42	27.27	23	23.23	107	22.67
Lung	52	27.08	50	32.47	36	36.36	169	35.81
Breast	22	11.46	18	11.69	12	12.12	63	13.35
Head and neck	11	5.73	8	5.19	6	6.06	34	7.20
Diagnosis age								
≤44	18	9.38	14	9.09	11	11.11	36	7.63
45–64	59	30.73	47	30.52	35	35.35	155	32.84
≥75	115	59.90	93	60.39	53	53.54	281	59.53
Gender								
Female	104	54.17	87	56.49	51	51.52	270	57.20
Male	88	45.83	67	43.51	48	48.48	202	42.80
Tumor size								
Small	13	6.77	7	4.55	3	3.03	19	4.03
Medium	56	29.17	50	32.47	34	34.34	128	27.12
Large	49	25.52	37	24.03	14	14.14	106	22.46
Cannot measure	74	38.54	60	38.96	48	48.48	219	46.40
Stage								
Early stage	69	35.94	47	30.52	23	23.23	134	28.39
Late stage	121	63.02	103	66.88	74	74.75	326	69.07
	2	1.04	4	2.60	2	2.02	12	2.54

that require immediate action by the physician and health care team [9]. The need for a mechanism to effectively and efficiently transmit these values to the appropriate care giver in a timely manner is critical for the delivery of high quality care [10,11].

2. Methods

The study cohort comprised all patients with cancers of the breast, liver, lung, head and neck, colon or rectum, and cervix (N = 2012) who visited a large academic, tertiary-care regional medical center in Taipei, Taiwan for this cancer diagnosis (International Classification of Diseases, 9th Revision, Clinical Modification Codes of cervical (180), colorectal (153,154), liver (155), lung (162), Breast (174), and head and neck cancer

(140–149), exclude 142,147 as the major cancers population) from January 2004 to December 2009. De-identified data were obtained through the quality improvement program of the hospital and included demographic data, cancer registry data (TNM staging and treatments) and clinical laboratory data [12]. Because the dataset used in this study consists of de-identified secondary patient information, this study was exempt from full review by the Institutional Review Board. All ambulatory care visits and inpatient hospital stays from diagnosis to death or for 5 years of follow-up were evaluated [13]. The critical values reported by the CLRR reporting system are shown in Appendix 1.

The SAS statistical package (SAS System for Windows, Version 8.2) was used to perform data analyses. Logistic regression tests were performed to examine the differences among groups [14]. The survival in the five-year follow-up study was

Table 2 – Cancer patient with CLRR Cox proportional regression analysis.

CLRR\HR	Total N	Deaths	%	Non-adjusted HR (95% C.I.)	Adjusted HR (95% C.I.) [‡]
CLRR					
No	1095	272	24.84	1.00	1.00
1	192	101	52.60	2.65 (2.11–3.33) ^{***}	1.70 (1.35–2.14) ^{***}
2	154	92	59.74	3.59 (2.83–4.55) ^{***}	1.91 (1.50–2.43) ^{***}
3	99	65	65.66	4.06 (3.10–5.33) ^{***}	1.88 (1.43–2.47) ^{***}
≥4	472	293	62.08	3.89 (3.29–4.59) ^{***}	2.00 (1.69–2.38) ^{***}

HR.: hazard ratio, C.I.: confidence interval.

^{***} $p < 0.001$.

[‡] Based on Cox proportional regression with adjustment for CLRR, tumor, diagnosis age, gender, tumor size, and stage.

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