Effect of Computer-based Clinical Reminder System to Colorectal Cancer Screening

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Abstract

This paper is focused on the effect of computer-based clinical reminder system to colorectal cancer screening. The reminder system with five DB modules was developed. The paper investigated a total of 541 patients who had been visited health examination center in two hospitals. In this work, 62.1-96.0% was satisfied with the reminder system. The present research showed that a reminder effort of computerized system in mailing was significantly effective for colorectal cancer screening. In order to maintain the reminder effect, computer-based clinical system should be supported by policy maker and need for monitoring the feedback from stakeholders.

Keywords: *Effect, Computer-based clinical reminder system, Colorectal cancer, Screening*

1. Introduction

Colorectal cancer is the third most common cancer in Korea. It is associated with high mortality rate in Korea [1, 2]. Colorectal cancer has emerged as a serious health issue in Korea because of a wide-spreading Westernalized eating pattern and lifestyle in the past decade [3, 4, 5]. Therefore, it seems a necessity to strengthen communication campaigns and activities about colorectal cancer to promote health in society. WHO indicated that a first of the total deaths caused by cancer can be reduced by early detection. In light of this Korea established the national cancer control program which provides the public with free cancer screening in 2011. However, Korea's cancer screening rate, which is around 60-70%, is lower than those of the developed countries [1, 6, 7]. Prevention through regular repeat screening and early detection is very important to decrease the mortality rate. However, most studies have focused on one-time screening rather than repeat adherence until now and most people are not having regular screening at recommended intervals [8, 9, 10]. For the purpose of developing interventions to encourage routine screening, this research sought to develop computer-based clinical reminder system and evaluate the effect of it on the change of screening rate. Therefore it is important to develop effective intervention and communication strategies. Focusing on this situation, the reminder system play important roles in the prevention, detection, and treatment of colorectal cancer. It can also help doctors to manage a huge amount of data encountered in taking care of cancer patients and can improve the quality of medical care for cancer patients by supporting decision making as well as providing databases.

The mean objective for the determination of in this study is to increase the perceived usefulness and the usability of the reminder system by supporting cancer screening. Thus, this paper was aimed to perform the developing of computer-based clinical reminder system and evaluating the effects on the promotion of colorectal cancer screening. According to the information mode, these perceptions will be the key factors that lead to the successful adoption and utilization of cancer information technology.

2. Materials and Methods

2.1 Materials

This paper developed early reminder system with five DB modules to improve colorectal cancer screening: subjects DB, screening DB, result DB, evaluation DB, follow-up DB. It was evaluated the change of colorectal cancer screening rate between before and after intervention. It was conducted through 6 phases [Figure 1]. Phase1. analyzing the work flow and defining the basic input data file, Phase 2: designing and developing the software, Phase 3: collecting and inputting data, Phase 4: testing the program and system, Phase 5: working with and without program simultaneously, Phase 6: evaluating the colorectal cancer screening rate of reminder system with control group(mail group, telegraphic group, both group and control group).

This research was examined the current status for cancer information through reviewing the existing literatures, advanced foreign cases, and questionnaire to the specialists [6, 11, 12]. After development of computer-based clinical reminder system, this paper was evaluated to apply the results of its effectiveness through the development of the reminder system. This paper investigated a total of 541 patients who had been visited health examination center in two hospitals located in Metropolitan. The experimental group with reminder system was composed of 298 people while the control group was 243 people without reminder system to evaluate the colorectal cancer screening rate. The survey was carried out through mailing, calling, and interview from September 12 to November 12, 2011 by trained researchers [Figure 2]. And then it estimated colorectal cancer screening rate to evaluate these positive changes if it was properly maintained or improved at the time of 4 weeks follow-up.

2.2 Methods

General characteristics and health behavior of study subjects were analyzed by descriptive statistics. Chi-square test was carried out to see if the background variables made any significant differences. Logistic regression was performed to identify the differences by the screening rate of colorectal cancer according to reminder system. On the other hand, satisfaction associated with reminder system was analyzed using the chi-square test.

3. Results

3.1 General Characteristics of Study Subjects

Table 1 presents general characteristics of study subjects. Male was 52.1% among a total of 541 patients while 47.9% of them was female. Age was the highest in their fifties with 56.0%. With regards to age, it showed significant differences depending on the use of reminder system(X^2=22.8, p=.04). Regarding their educational levels, 79.3% of the subjects was over high school. With regards to education level, the groups were significant differences(X^2=11.9, p=.01).

Table 1. General Characteristics of Study Subjects

Variables	Total N=541	Experimental group Mailing N=96	Calling N=113	M+C* N=89	Control group N=243	X^2	P
Gender							
Male	282(52.1)	56(58.3)	60(53.1)	42(47.2)	124(51.0)	1.07	.92
Female	259(47.9)	40(41.7)	53(46.9)	47(52.8)	119(49.0)		
Age							
-49	42(7.8)	6(6.3)	3(2.7)	18(20.2)	15(6.2)	22.8	.04
50-59	303(56.0)	62(64.6)	70(61.9)	37(41.6)	134(55.1)		
60-69	170(31.4)	25(26.0)	34(30.1)	29(32.6)	82(33.7)		
70-	26(4.8)	3(3.1)	6(5.3)	5(5.6)	12(4.9)		
Spouse							
Yes	413(76.3)	89(92.7)	108(95.6)	79(88.8)	217(89.3)	8.17	.06
No	128(23.7)	7(7.3)	5(4.4)	10(11.2)	26(10.7)		
Education							
<High school	112(20.7)	15(15.6)	26(23.0)	31(34.8)	40(16.5)	11.9	.01
≥High school	429(79.3)	81(84.4)	87(77.0)	58(65.2)	203(83.5)		

* M+C : Mailing and Calling

3.2 Factors Related to Health Behavior of Subjects

Table 2 showed that it was more in group with healthy subjects(77.1%) compared to unhealthy subjects(22.9%). There were significant differences among groups(X^2=7.29, p=.00). On the other hand, with regard to worry of cancer incidence, it showed a higher rate in the experimental group(63.7%) with compare to control group(51.9%) in calling among subjects with high worry of cancer incidence.

Table 2. Factors Related to Health Behavior of Subjects

Variables	Total N=541	Experimental group Mailing N=96	Calling N=113	M+C* N=89	Control group N=243	X^2	P
Smoking							
Non-smoking	432(79.9)	84(87.5)	89(78.8)	73(82.0)	186(76.5)	1.69	.52
Smoking	109(20.1)	12(12.5)	24(21.2)	16(18.0)	57(23.5)		
Drinking							
Non-drinking	224(41.4)	39(40.6)	45(39.8)	42(47.2)	98(40.3)	4.73	.68
Drinking	317(58.6)	57(59.4)	68(60.2)	47(52.8)	145(59.7)		
Exercise							
Non-exercise	341(63.0)	57(59.4)	73(64.6)	70(78.7)	141(58.0)	6.81	.05
Exercise	200(37.0)	39(40.6)	40(35.4)	19(21.3)	102(42.0)		

Health							
Healthy	417(77.1)	80(83.3)	89(78.8)	61(68.5)	187(77.0)	7.29	.00
Unhealthy	124(22.9)	16(16.7)	24(21.2)	28(31.5)	56(23.0)		
Worry of cancer							
Low	241(44.5)	44(45.8)	41(36.3)	39(43.8)	117(48.1)	3.41	.40
High	300(55.5)	52(54.2)	72(63.7)	50(56.2)	126(51.9)		

* M+C : Mailing and Calling

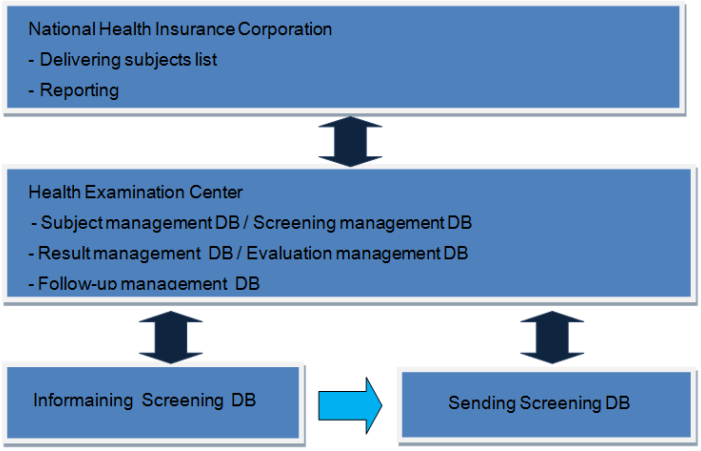

Figure 1. Structure of Computer-based Clinical Reminder System

3.3 Effect of Clinical Reminder System on Colorectal Cancer Screening

Table 3 presents the effect of clinical reminder system on colorectal cancer screening. The result of colorectal cancer screening rates appeared to be higher in subjects (27.2%) conducting early reminder system than subjects (25.9%) who didn't perform early reminder system. On the other hand, mailing was the highest (33.3%) according to the use of reminder system. Odds ratio was 1.37(95% Cl=1.29-4.75). There was significant difference in the mailing.

Table 3. Effect of Reminder System on Colorectal Cancer Screening

Reminder	Total	Colorectal Cancer Screening		Adjusted OR
		Yes	No	(95% Cl) ¶
No	243(44.9)	63(25.9)	180(74.1)	1.00
Yes	298(55.1)	81(27.2)	217(72.8)	1.09(0.32-2.18)
Mailing	96(32.2)	32(33.3)	64(66.7)	1.37(1.29-4.75)
Calling	113(37.9)	37(32.7)	76(67.3)	0.51(0.07-2.16)
M+C*	89(29.9)	20(22.5)	69(77.5)	1.28(1.05-4.37)

* M+C : Mailing and calling ¶ Cl : Confidence interval

† Adjusted by age, spouse, education, exercise, perceived health

3.4 Satisfaction on Reminder System of Colorectal Cancer Screening

Table 4 showed that satisfaction of reminder system of colorectal cancer screening. With regard to level of satisfaction, neutrality (62.1%) was the highest followed in the order by satisfaction(33.9%), and unsatisfaction (4.0%). On the other hand, according to different kinds of reminder information, satisfaction showed that mailing and calling was the highest(37.1%), calling(33.6%), and mailing(31.3%) in order. There were significant differences between reminder system and satisfaction(X^2=1.68, p=.04).

Table 4. Satisfaction on Reminder System of Colorectal Cancer Screening

Variables	Total	Reminder system			X^2	P
		Mailing	Calling	M+C*		
Satisfaction	101(33.9)	30(31.3)	38(33.6)	33(37.1)	1.68	.04
Neutrality	185(62.1)	62(64.6)	69(61.1)	54(60.7)		
Unsatisfaction	12(4.0)	4(4.2)	6(5.3)	2(2.2)		

* M+C : Mailing and calling

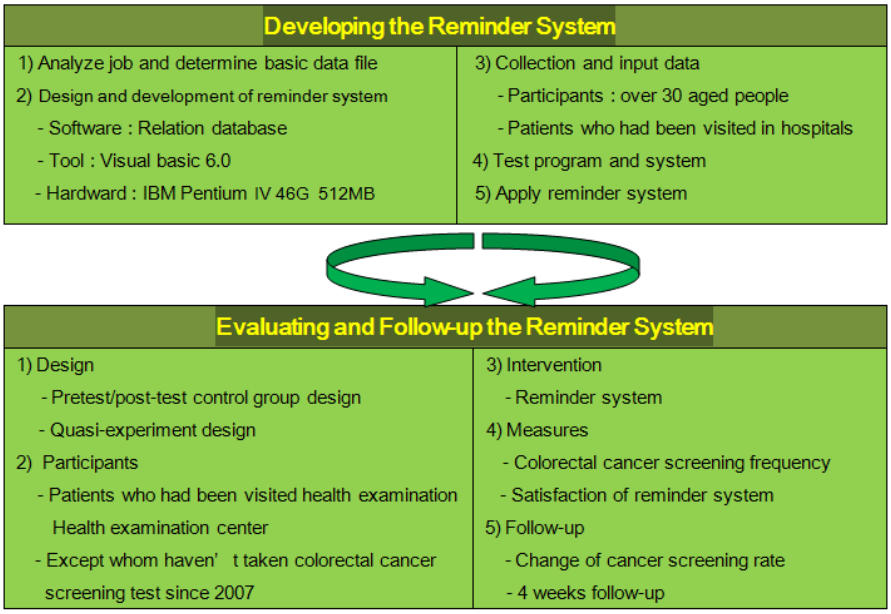

Figure 2. Developing and Evaluating the Computer-based Clinical Reminder System

4. Discussion

The aim of this is to develop a integrated information system with computer-based clinical reminder system and evaluate it's effect in terms of change of colorectal cancer screening, satisfaction and follow-up.

Thus, clinical reminder system with five DB modules was developed to improve colorectal cancer screening rate. The result of this research showed statistically significant change after applying computerized reminders for colorectal cancer screening. On the other hand, in this work, 62.1-96.0% was satisfied with the reminder information. It is to meet people's needs for cancer information quantitatively and qualitatively through building an infrastructure of evidence-based, comprehensive standardized cancer information and supporting national cancer control policy [13,14].

Reminder system is an essential data model to exchange clinical data among existing information systems and enhance consistency of necessary data, in terms of its meaning and reusability, however, there has not been a domestic case where such colorectal reminder system is developed till present. This study is based on determing principles of developing clinical information model which is a specified model and attempts to identify information contents with various types based on information development.

The present research showed that a reminder effort of computer-based clinical system in mailing was significantly effective for colorectal cancer screening. This finding was consistent with the result of earlier studies on tuberculosis screening [15, 16]. This can be explained as the result of the changes in the pattern of screening. Thus, as adopting these cancer reminder system, it will have usefulness and usability particularly when making medical diagnoses. On the other hand, it can also improve the medical quality by supporting medical process. The data related to patients stored in the database will provide useful information for medical problems in colorectal cancer patients. This paper showed that studies for empirical validation of these cancer reminder system in actual medical practice are very significance.

The present research showed significant difference in the level of satisfaction on computer-based clinical reminder system of colorectal cancer screening. This was consistent with previous cardiovascular disease studies [8, 17]. Through this paper, a computerized reminder system contributed more to demonstrate positive effects on colorectal cancer screening rate. These positive changes were maintained or improved at the time of 4 weeks follow-up. However, it is noted that the evaluation interval was too short to find a difference in cancer screening rate. Thus, future work should be performed additional longer prospective follow-up studies. In order to maintain the reminder effect, prevention through regular repeat screening is so important. Thus, computer-based clinical reminder system should be supported by policy maker and need for monitoring the feedback from stakeholders.

5. Conclusion

The present work elucidated through the outcome according to this research development and evaluation as follows : 1) colorectal cancer screening is maximized by information sharing technology and organic integration model of clinical document information and bio-information 2) the linkages suggestion of Korea Center for Disease Control Prevention Research Department Cancer Information and Clinical Practice System 3) standardization development and leading by object model and information system construction of oncology based on integrational standards. 4) standard of clinical reminder system based on model of cancer information. Therefore, when we adopted the computer-based clinical reminder system of colorectal cancer, these cancer information system will increase the usefulness and usability of those systems and improve the quality of medical care by facilitating and supporting screening processes for colorectal cancer patients.

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