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Actual Analysis of the Interrelationship between Evaluation Indicators of Communicable Disease Control and Prevention Activities and Communicable Disease Incidence Data

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법정감염병 발생자료와 감염병관리사업 평가지표와의 관계 실증분석

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Abstract This study examined the interrelationship between the evaluation indicators of communicable disease control and prevention activities, and the communicable disease incidence data. This study analyzed the incidence data of communicable disease in local governments of south Korea and evaluated the data of communicable disease control and prevention activities by the Ministry of Health of the central government in South Korea during 2004-2005. Frequency analysis was carried out to understand the character of the participant, t-test to compare the mean value between the two groups and stepwise multiple regression analysis to understand the significance between the dependent and independent variables. In this study, the finance related to communicable diseases (group I diseases in both city and rural center), keep rate of periodic reports on notifiable communicable diseases based on the law for communicable disease control and prevention (group II in city), the level of education on personal hygiene (group II in rural center), level of education on AIDS prevention and the reporting rate of cases of tuberculosis (group III in city), and reporting rate of incident cases of tuberculosis (tuberculosis and Hansen disease in both rural and city) were significant indicators. The level of education on AIDS prevention and the reporting rate of the cases of tuberculosis (in city), and number of adverse reactions after immunization (in rural area), reporting rate of cases of tuberculosis (in total center) were significant indicators in total communicable disease and all types of public health centers. The authors verified core evaluation indicators as actual proof. This study provides useful data for a summative evaluation, standardization, and guidelines on communicable disease control and prevention activities of public health centers and local government.

요 약 이 연구는 감염병 발생자료와 감염병 관리사업 평가지표와의 관계를 실증적으로 분석함으로써 감염병 관리사업의 평가지표의 타당성을 실증적으로 분석함을 목적으로 하였다. 자료는 2004년과 2005년 2개년간의 시군구(보건소) 감염병 환자 발생 수 합계와 2005년도 감염병관리사업 평가지표 등 이었다. 자료의 분석은 빈도분석, 분산분석, 다중회귀분석 등을 이용하였다. 보건소 유형 및 법정감염병 각 군별로 각기 상이한 지표들이 도출되었으며, 각 군로도 특이한 지표 보다는 다양한 분야의 지표들이 혼재되어 있는 양상으로 도출되었다. 특히, 교육실적 등이 발생건수와 유의한 관계를 보이는 경우가 많아 발생건수는 신고건수 즉, 사업의 성과의 결과로 판단하는 것이 더욱 타당할 것으로 판단된다. 전체적인 지표의 개선이 필요하거나 사업의 투입시간 및 추이를 본 후 재평가가 필요할 것으로 생각되며, 각 사업별로 분리하여 특이한 평가지표를 생산할 필요가 있어 보인다. 감염병관리사업의 평가지표 개발은 기초자치단체별 감염병관리사업 종합평가체계를 구축하는데 핵심적인 역할을 할 것이며, 감염병관련업무 표준화를 촉진하고 관련지침을 개정에 활용될 것이며, 향후 보건사업 및 보건의료조직의 계량적인 성과 평가에 활용될 것이다. 또한 시군구 보건소에서 수행한 성공적인 감염병 관리 사업의 사례를 발굴, 제시함으로써 보다 성공적인 감염병관시업의 접근이 가능케 할 것이다.

Key Words : Evaluation indicators, Communicable disease control and prevention, Public health center, Local government

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1. Introduction

In Korea, we did not recognized seriousness of communicable diseases because of decreasing trend of communicable diseases incidence after 1980. However, new and re-emerging communicable diseases like malaria, SARS, and avian influenza were increasing trend with global warming and increasing trade and transport international after 1990s. This phenomenon is very important issues in both health and economic aspects also.

The law for communicable disease control and prevention in Korea had been amended to cope with emerging and re-emerging infectious diseases in 2000. And also, electronic reporting system was developed for enabling the establishment of national database of reported cases. KNIH(Korea National Institute of Health) reformed into KCDC(Korea Center for Disease Control and Prevention) for reinforcing communicable disease control and prevention in 2004. KCDC revised statutory communicable diseases and introduction of communicable disease surveillance system.

Importance of evaluation, monitoring, and research on communicable disease control are gradually increased[1]. The framework of evaluation or evaluation indicator are useful tool for identifying, evaluating on the process, impact, and outcomes of communicable disease control and prevention activities in each other countries[2]. However, there were rare studies of evaluation on communicable disease control and prevention activities. So that had caused "haven't evaluation planning", "not evidenced based", "not considered related variables", and "did not analyzed on belief and attitude of evaluator and health worker". And there were a lack of analysis on theoretical, methodological, and administrative principle based on the objectives and process evaluation[3].

The purpose of this study was to investigate the interrelationship between evaluation indicators of communicable disease control and prevention activities and communicable disease incidence data, to screen and develop the significant evaluation indicators of process and activities.

2. Methods

Dependent variable was a incidence(report cases per 100,000) of communicable diseases in 2004-2005 by basic local government. Author reclassified 5 group of disease(group Ⅰ, Ⅱ, Ⅲ, Ⅳ, and tuberculosis & Hansen disease) based on the law for communicable disease control and prevention. Tuberculosis and hansen disease were analyzed separately because two diseases have different characteristics of control and management, epidmiological characteristics. Local government was classified with city(Si, Gu) and rural(Gun) type by the population and administrative regulation of south Korea. Independent variables were evaluation indicators that were consist with input and activities' variables[Table 1]. Governmental committee group (n=30 person) who were professor, professional expert, and officer in the sector of communicable disease control and prevention evaluated local government activities.

Author analyzed incidence data of communicable disease in local government of south Korea and evaluation data of communicable disease control and prevention activities by ministry of health of central government in south Korea during 2004-2005.

Author carried out frequency analysis to understand character of participant, Mann-Whitney U-test or t-test to compare mean value between two group, X^2-test to verify significance between two variables, and multiple regression analysis to understand significance between dependent and independent variables by SPSS.

[Table 1] Final evaluation indicators of communicable disease control and prevention activities in public health center, south Korea

Class	Subclass	Item number	Name of indicator	Score
Input	Manpower & Organization	Input-01	Number of winner prize of education during 3 years	0-3
		Input-03	Experience of bio-terrorism preparedness education	0, 2
		Input-04	Experience of tuberculosis education	0-4
		Input-06	Experience of AIDS education	0-4
		Input-07	Experience of communicable disease information management education	0-4
	Finance	Input-10	Finance related with communicable disease	0-4
	Plan	Input-11	Write plan proposal for communicable disease control and prevention	0-4
		Input-12	Self-evaluation for communicable disease control and prevention	0-4
		Input-13	Specified programme of communicable disease control and prevention	0, 2, 4
		Input-14	Write plan proposal for immunization programme	0-4
	Information	Input-16	Deliver information of communicable disease control and prevention in internet homepage of public health center	0-4
		Input-17	Analysis and feedback activities on the incidence data of communicable diseases	0-4
		Input-18	Status of operating information system	0-4
	Subtotal	n=13		0-49
Activity	Disinfection & Hygiene	Activity-01	Number of PR on the personal hygiene (Hand washing)	0-4
		Activity-02	Number of education on the personal hygiene (Hand washing)	0-4
		Activity-03	Number of PR on autumnal febrile diseases	0-5
		Activity-04	Number of education on autumnal febrile diseases	0-4
		Activity-06	Number of education on AIDS prevention	0-4
		Activity-07	Number of delivered of condom	0-4
		Activity-10	Implementation of disinfection on effective time	0-4
	Immunization	Activity-12	Influenza immunization rate (≥65) in public health center	0-4
		Activity-13	Participate rate of immunization registry of private medical organization	0-4
		Activity-14	Registered proportion of immunization registry of immunization record in public health center	1-4
		Activity-15	Achievement rate of immunization objectives	0-4
		Activity-17	Number of adverse reaction after immunization	0-4
		Activity-18	Number of self PR related with immunization	0-4
		Activity-19	Keep and operate pre-physical examination before vaccination	0-4
		Activity-21	Newly registration rate of vertical transmission of type B hepatitis	0-4
	Surveillance	Activity-22	Operation of monitoring network for disease information	0-4
		Activity-23	Report rate of incident cases of tuberculosis	0-4
		Activity-24	Keep rate of periodic report on notifiable communicable diseases based on the law for communicable disease control and prevention	0-4
		Activity-25	Data accuracy of reported communicable diseases	0-4
		Activity-26	Administer and management of sentinel surveillance organization	0-4
	Subtotal	n=20		1-81
	Total	n=33		1-130

3. Results

Group III of communicable diseases were most incident in notifiable communicable disease(169.2 per 100,000 persons). Most incident diseases in group III were tuberclosis, scrub typhus, and malaria. Secondary incident notifiable communicable disease was group II(11.6 per 100,000 persons). In group I, typhoid fever was more incident in city(0.8 per 100,000 persons) than rural area(0.7 per 100,000 persons), but bacillary dysentry was more incident in rural area(3.3 per 100,000 persons) than city(0.8 per 100,000 persons). In group II, chicken pox was more incident in rural area(6.4 per 100,000 persons) than city(2.8 per 100,000 persons), but mump was more incident in city(8.0 per 100,000 persons) than rural area(6.2 per 100,000 persons). In group III, tuberculosis was more incident in city(150.5 per 100,000 persons) than rural area(110.1 per 100,000 persons), however malaria, scrub typhus, and hemorrhagic fever with renal syndrome were more incident in rural area than city[Table 2].

Author compare individual indicator's score of

[Table 2] Number of communicable disease and incidence (per 100,000 person) by type of public health center during 2004-2005

Unit : Number of patients, Number of patients per 100,000 person

Group of disease	Name of disease	City(n=101)		Rural(n=145)		Total(n=246)	
		No.	Incidence	No.	Incidence	No.	Incidence
Group I	Cholera	24	0.1	2	0.0	26	0.1
	Typhoid fever	252	0.8	112	0.7	364	0.7
	Paratypus	51	0.2	25	0.2	76	0.2
	Bacillary dysentry	275	0.8	529	3.3	804	1.7
	EHEC	131	0.4	30	0.2	161	0.3
	Subtotal	733	2.2	698	4.4	1,431	2.9
Group II	Pertusis	12	0.0	5	0.0	17	0.0
	Tetanus	6	0.0	16	0.1	22	0.0
	Measles	14	0.0	9	0.1	23	0.0
	Mump	2,616	8.0	991	6.2	3,607	7.4
	Rubella	21	0.1	6	0.0	27	0.1
	JBE	2	0.0	4	0.0	6	0.0
	Chicken pox	905	2.8	1,029	6.4	1,934	4.0
	Subtotal	3,576	11.0	2,060	12.8	5,636	11.6
Group III	Malaria	1,019	3.1	1,212	7.6	2,231	4.6
	Tuberculosis	49,108	150.5	17,664	110.1	66,772	137.4
	Leprosy	62	0.2	19	0.1	81	0.2
	Scarlet fever	94	0.3	73	0.5	167	0.3
	Meningococcal maningitis	12	0.0	3	0.0	15	0.0
	Legionellosis	10	0.0	6	0.0	16	0.0
	Vibrio	66	0.2	48	0.3	114	0.2
	Boutonneuse fever	21	0.1	33	0.2	54	0.1
	Scrub typhus	3,872	11.9	7,607	47.4	11,479	23.6
	Leptospirosis	49	0.2	175	1.1	224	0.5
	Brucellosis	22	0.1	183	1.1	205	0.4
	Rabies	1	0.0	0	0.0	1	0.0
	Hemorrhagic fever with renal syndrome	226	0.7	622	3.9	848	1.7
	Subtotal	54,562	167.2	27,645	172.3	82,207	169.2
Group IV	Dengu fever	40	0.1	10	0.1	50	0.1
	Babesiosis	0	0.0	1	0.0	1	0.0
	Cryptococosis	0	0.0	1	0.0	1	0.0
	Leishmaniasis	1	0.0	0	0.0	1	0.0
	Botulism	3	0.0	0	0.0	3	0.0
	Subtotal	44	0.1	12	0.1	56	0.1
Total		58,915	180.5	30,415	189.6	89,330	183.8

evaluation on the communicable disease control and prevention activities between city and rural area of public health center. There were significant difference in input-04(Experience of tuberculosis education), input-06(Experience of AIDS education), input-10 (Finance related with communicable disease), input-11 (Write plan proposal for communicable disease control and prevention), input-17(Analysis and feedback activities on the incidence data of communicable diseases), input-18(Status of operating information system), activity-01(Number of PR on the personal hygiene(Hand washing), activity-02 (Number of PR on autumnal febrile diseases), activity-03(Number of education on autumnal febrile diseases), activity-04(Number of education on AIDS prevention), activity-06(Number of delivered of condom), activity-07(Implementation of disinfection on effective time), activity-10(Implementation of disinfection on effective time), activity-12(Influenza immunization rate (≥65) in public health center), activity-14(Registered proportion of immunization registry of immunization record in public health center), activity-17(Number of adverse reaction after immunization), activity-18(Number of self PR related with immunization), activity-19(Keep and operate pre-physical examination before vaccination), activity-21(Newly registration rate of vertical transmission of type B hepatitis), activity-22 (Operation of monitoring network for disease information) between city and rural area($p<0.05$ or $p<0.01$)[Table 3].

[Table 3] Comparison individual indicator's score of evaluation on the communicable disease control and prevention activities between city and rural area of public health center

Unit : mean±SD

Indicators	City(n=101)	Rural(n=145)	Total(n=246)
Input-01	0.41±0.62	0.45±0.73	0.43±0.68
Input-03	1.79±0.62	1.79±0.62	1.81±0.58
Input-04**	2.35±1.16	2.78±1.04	2.74±1.04
Input-06*	1.89±1.12	2.20±1.04	2.16±1.08
Input-07	1.70±0.99	1.72±1.00	1.72±0.99
Input-10**	1.73±1.05	2.65±0.90	2.45±0.88
Input-11**	2.42±1.44	2.86±0.92	2.90±0.94
Input-12	1.11±1.32	1.11±1.34	1.21±1.34
Input-13	0.36±0.87	0.26±0.67	0.31±0.77
Input-14	1.43±1.06	1.39±0.88	1.52±0.91
Input-16	2.10±1.37	2.34±1.26	2.42±1.18
Input-17*	1.14±1.34	1.61±1.43	1.54±1.41
Input-18**	2.53±1.51	3.04±1.12	3.04±1.10
Activity-01**	2.18±1.34	2.69±0.96	2.68±0.95
Activity-02**	1.56±1.27	2.63±1.03	2.35±1.14
Activity-03**	1.57±1.05	2.39±0.93	2.22±0.92
Activity-04**	0.95±1.09	2.19±1.17	1.80±1.25
Activity-06**	1.11±1.13	2.03±1.28	1.78±1.25
Activity-07**	1.30±0.99	2.28±0.96	2.03±0.98
Activity-10*	1.67±1.31	1.99±1.16	2.01±1.16
Activity-12**	1.39±1.02	2.57±0.91	2.24±0.99
Activity-13	0.93±1.33	0.72±1.26	0.86±1.31
Activity-14**	2.90±1.08	2.21±1.08	2.49±1.14
Activity-15	1.86±1.23	2.01±1.11	2.11±1.06
Activity-17**	0.91±1.32	0.45±0.97	0.69±1.18
Activity-18**	2.35±1.15	2.67±0.70	2.73±0.63
Activity-19**	3.30±1.51	3.90±0.59	3.95±0.39
Activity-21**	0.71±0.43	1.54±0.41	1.24±0.58
Activity-22**	0.95±0.94	1.73±1.32	1.52±1.22
Activity-23	1.84±1.23	1.88±0.78	2.01±0.86
Activity-24	2.46±1.13	2.71±1.28	2.61±1.23
Activity-25	2.99±1.04	3.24±1.15	3.15±1.12
Activity-26	2.13±1.39	2.14±1.14	2.32±1.14

* $p<0.05$, ** $p<0.01$

Author would like to investigate actual contributing evaluation indicator of communicable disease control and prevention activities on the communicable disease incidence. There was no significant indicators in group I of city type of public health center. But input-10(finance related with communicable disease) was significant indicator in group I of rural area and total public health center. Activity-24(keep rate of periodic report on notifiable communicable diseases based on the law for communicable disease control and prevention) was only significant indicators in group II of city type of public health center. However, activity-02 (number of education on the personal hygiene- hand washing) was significant in group II of rural area, activity-02 was significant indicators in group II of rural area and total public health center. Activity-06(number of education on AIDS prevention) and activity-23(report rate of incident cases of tuberculosis) were significant indicators in group III of city type of public health center. Activity-23 was significant indicators in group III of total public health center. In group IV, there was no significant indicator

in total public health center. In tuberculosis and hansen disease, activity-23(Report rate of incident cases of tuberculosis) was only significant indicator in city, rural, and all of public health center. In city public health center, activity-6(number of education on AIDS prevention) and activity-23(Report rate of incident cases of tuberculosis) were significant indicators. In rural public health center, activity-17(number of adverse reaction after immunization) was significant indicator[Table 4].

[Table 4] Stepwise multiple regression on the incidence of communicable diseases by group of communicable disease and type of public health center*

Type of public health center	Group of communicable disease	Study variables (indicators)	B	Standard error	Beta	t	p-value
City	Group II	Activity-24	4.16	1.95	0.27	2.13	0.04
	Group III	Activity-06	33.06	13.23	0.30	2.50	0.01
		Activity-23	87.67	11.86	0.87	7.39	0.00
	TB+ Hansen	Activity-23	85.83	11.92	0.85	7.20	0.00
	Subtotal	Activity-06	30.84	13.71	0.28	2.25	0.03
		Activity-23	87.55	12.29	0.86	7.12	0.00
Rural	Group I	Input-10	3.98	1.83	0.23	2.18	0.03
	Group II	Activity-02	9.67	3.66	0.35	2.65	0.01
	TB+Hansen	Activity-23	42.45	5.54	0.60	7.67	0.00
	Subtotal	Activity-17	24.88	11.32	0.23	2.20	0.03
Total	Group I	Input-10	2.39	1.09	0.21	2.19	0.03
	Group II	Activity-02	4.79	2.25	0.25	2.13	0.03
	Group III	Activity-23	54.41	8.43	0.48	6.45	0.00
	TB+Hansen	Activity-23	64.39	6.03	0.67	10.68	0.00
	Subtotal	Activity-23	54.43	8.72	0.47	6.24	0.00

* No significant indicators were analyzed in group I of city public health center, in group of city, rural, and total public health center

4. Discussion

It was very important that evaluation indicators should secure it's reliability and validity[4]. Author practically analyzed incidence data of communicable disease in local government of south Korea and evaluation data of communicable disease control and prevention activities by ministry of health of central government in south Korea during 2004-2005.

In this study, finance related with communicable diseases was unique significant indicator of group I of communicable disease in both city and rural public health center.

Keep rate of periodic report on notifiable communicable diseases based on the law for communicable disease control and prevention was a significant indicator of group II in city type of public health center, but number of education on the personal hygiene (hand washing) was a significant indicator of group II in rural public health center. Number of education on AIDS prevention and report rate of incident cases of tuberculosis were a significant indicator of group III in city type of public health center. In group of tuberculosis and Hansen disease, report rate of incident cases of tuberculosis was a significant indicator in all type of public health center.

Evaluation define that it measures the extent to which its objectives are being reached. At least, process of evaluation consist with objective formation, criteria for success, level of success, recommendation for further activities[5]. Methods of evaluation were the process evaluation, qualitative evaluation, formative evaluation, evaluation research, and program evaluation[6]. World Health Organization developed the framework of monitoring and evaluation system on communicable disease surveillance and preparedness[7-8]. Stage of surveillance and response systems were plan to monitor surveillance and response systems, prepare to monitor, monitor surveillance and response systems, and dissemination and use of monitoring results. WHO suggest that the component of monitoring and evaluation system were target diseases, structure of surveillance system, core function of surveillance system, assisted function, quality of surveillance system. WHO classified input, process, output, outcomer, and impact indicators based on the logic model.

Good indicator should be relevant, understandable, useful, specific, measurable, achievable, relevant), and time-bound[9]. The contents of evaluation were direct service interventions, community mobilization efforts, research initiatives, surveillance systems, policy development activities, outbreak investigations, laboratory diagnostics, communication campaigns, infrastructure-building projects, training and educational services, and administrative systems. And evaluation indicator provide a basis for collecting credible evidence that is valid and reliable for evaluation, describes progress in achieving its objectives, tells us what to measure to determine whether the objective has been achieved[9].

Author tried to secure validity through framework development of communicable disease control and prevention activities by the experts in communicable disease control and prevention.

Monitoring and evaluating activity should be decided as an obvious consistence between the entire framework and standardized indicators. In selecting indicators, it is necessary to adopt local epidemiological situations and support status in health care sectors[10].

In this study, author evaluated subjective's core competency of public health center. Improvement on the core competency of public health center would be related with the policy, laws, organization, manpower, facilities and equipment, systemic planning, evaluation and feedback, and participation of private sectors, recognition of patients and peoples, and priority of health policy. Evaluation is one of the process components. New program of communicable disease control and management will be feedback to capacity rebuilding through evaluation process. For this point, there will be needs continuous improvement and effort.

The results of this study developed evaluation indicators based on comprehensive summative evaluation of communicable disease control and prevention activities in all of public health centers in Korea. So this study measured objectively and quantitatively the capacity of communicable disease control and management, and prepared rational and scientific infrastructure of evaluation.

Author proposed some point of utilization of this results. First, we can definite core activities of public health center and local government for communicable disease control and prevention. It will be possible that we can do more rational, measurable setting the mission and core function for communicable disease control and prevention acvtivities of public health center and local government.

Secondly, It will facilitate improvement, standardization, and electronic information for communicable disease control and prevention activities. Operational definition was renewed based on evaluation indicators for target peoples, scope, and methods. Comparison between public health centers was impossible without standardization of activities. And also, improvement of electronic information for efficiency will be difficult without standardization of activities.

Thirdly, we can use the result of this study for correcting and improving the guideline of communicable disease control and prevention activities. Development of guideline was established by practical evidence and feasibility of adaptability.

Fourthly, This result can be use in incentive system of public health center and local government through rational and objective evaluation indicators.

Author have verified core evaluation indicators as actual proof. It is useful data for summative evaluation, standardization, and guidelines on communicable disease control and prevention activities of public health center and local government.

This study could limit its broad application and generalization because of a old data from a single year. And also, the data of this study was produced from subjective evaluation works. Therefore, the result of this study should be further examined in different larger data.

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