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Statistical evaluation and comparison of operational indices and analyzing cost-benefit of different regions of Iranian program of screening for congenital hypothyroidism

Ali Mohammadzadeh K. H.^{1*}, Yarahmadi S. H.², Tabibi S. J.¹ and Ebrazeh A.¹

¹Department of Health Services Management, Science and Research Branch, Islamic Azad University, Tehran, Iran.

²Centers for Disease Control (CDC), Ministry of Health and Medical Education of Iran, Iran.

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The screening program prevents the main complication of the disease that is, mental retardation by diagnosing the disease (most often in the 2nd up to 3rd week of birth) and immediate treatment. The aim of this study is conducting a comparison between percentage of screened recalled newborns, percentage of recognized patients among the recalled newborns, and analyzing cost-benefit of different regions of screening in Iran. In this descriptive-sectorial study, indices related to performance of the program have been taken from data of standard forms of the screening in 41 Universities of Medical Sciences and Health Services, the plan executors of 2008 Performance indices and cost-benefit of the plan have been compared and analyzed in 15 regions as the 1st group (the regions under appropriate coverage with high incidence rate) and in 12 regions as 2nd group (the regions with appropriate coverage with low incidence rate). Excel software have been used to analyze data and to draw tables and figures. Ratio of cost-benefit of the first to 3rd scenarios in the regions under coverage of first group varied from 50.35, 92.34 and 71.34 in Kashan to 22.71, 41.64 and 32.17 in South Khorasan (Birjand). This ratio varied in the regions under coverage of the second group from 8.24, 15.11 and 11.67 in North Khorasan (Bojnord) to 16.94, 31.06 and 24 in Iran University of Medical Sciences and Health Services. As ratio of cost-benefit of the screening program in different regions of Iran is effected by incidence of the disease.

Key words: Newborn screening program, congenital hypothyroidism (CH), percentage of recognized patients, rate of incidence, ratio of cost-benefit of the program.

INTRODUCTION

Rate of incidence of congenital hypothyroidism (CH) is various in different countries of the world. CH involves almost 1 per 4000 newborns, 85% of which are resulted from abnormal thyroid formation (Smallridge and Ladenson, 2001). Iran and United Arab Emirates show the most incidence rate between Asian countries with a rate of 1 per 421 and 1 per 568, respectively (Ali Mohammadzadeh 2010; Delavari et al., 2005). CH is one of the most prevalent treatable causes of mental retardation. Non-treatment of CH may be resulted in

mental retardation, growth deficiency, and other psychoneural complications (Meyers and Haering, 2008). Screening programs are effective on recognition and treatment of this disease (Lafranchi, 2008). Primary test in the program of screening for CH in Iran is TSH which is most often conducted in 3 to 5 day of life by sampling from heel (Ministry of Health and Medical Education, 2005). Several years experiences showed that this method can recognize many cases of transient CH (Dhondt et al., 2007). In this program, TSH <5 mU/L shows that the newborn is healthy and newborns with TSH >5 mU/L shall be recalled again. Definite recognition of CH in the recalled newborns shall be obtained through measurement of sera TSH and T4. In neonatal period

*Corresponding author. E-mail: Dr_khalil_AMZ@yahoo.com.

(the 1st to 4th weeks of life), $T4 < 6.5 \mu\text{g/dl}$ and $TSH > 10 \text{ mu/L}$ show involvement to CH and propose to use Levothyroxine and newborns with transient type of CH and with permanent type of the disease should respectively use Levothyroxine pills at least for 3 years and for whole life (Delavari et al., 2006).

Patients recognized and treated at the beginning days of life (12 to 30 days after birth) has more IQ than newborns treated after 30 day of life (Raymond and LaFranchi, 2010). CH is an important worldwide disease which is usually considered in the screening program before all other items (Dhondt et al., 2007). On time recognition and treatment of this disorder is the main factor to inform government, parents and society about wide effects of this disease (Hanon and Tril, 1998). Screening programs, regardless their probable benefits for people and their healthcare information provide conditions to attract people attention and test of healthcare personnel (Park and Park, 1997). Cost-benefit calculation and its analysis, can detect sub-resources during execution of the plan by gathering systematic information and separating direct and real costs of any process, and helps to make more appropriate decisions to continue the work, in addition to its application in providing services. To analyze cost-benefit ratio of this study like study of Dhondt et al. (1991), cost of providing a service for whole the life (cost of recognition and medical cares of CH patients) has been compared with its alternative that is, non-providing those services (cost of education and cares of mental retarded non-treated patients) (Dhondt et al., 1991). The present study informs the plan executors and returns to start point and studies about methods of sampling the newborn's blood by healthcare personnel in order to measure TSH and the precision of laboratory to express the result. It is clear that performance improvement in these processes not only decrease total cost of recognizing patient (total cost of diagnosis confirmatory tests+ cost of physicians' visits for recalled newborns) in the program but also shall affect on ratio of cost-benefit along with probable increase of detected patients.

The aim of this study is statistical evaluation in order to improve quality of the program and its continuation through studying status of coverage percentage indices, percentage of recalled screened newborns, and percentage of recognized patients between the recalled newborns and also calculation of cost-benefit ratio in the regions with appropriate coverage and "high incidence rate" and "low incidence rate" in order to find the most effective index of increase or decrease of benefits resulted from the program.

MATERIALS AND METHODS

Operation indices of the program of screening for CH in Iran including cover percentage (screened newborns/births under one year old), rerecall percentage (number of recalls/screened

newborns), percentage of recognized patients (number of recognized patients/number of recalls) and incidence rate (new cases of the disease per 1000 live births) have been taken from data of standard forms of blood sampling, screening and reports of suspicious cases conducted by 41 Universities of Medical Sciences and Health Services, the plan executors in the state in 2008 and have been calculated through the mentioned formulas. Cost-benefit calculation has been conducted based on the table of needs and tariff of necessary services for the screening or non-screening and formula of the program direct costs variables and its benefits and also ratios of benefit to cost in different regions covered by the program have been taken from previous studies of the author (Ali, 2010) and for whole the life and with annual discount rate of 3% and considering 3 scenarios of benefit including education and care of mental retarded patients in public-daily sector, in private-daily sector and 50% in public sector-50% in private sector (daily). Among 41 Universities of Medical Sciences and Health Services, data of the regions under coverage of 14 universities have been omitted because of inappropriate coverage (Inappropriate coverage means coverage less than average coverage percentage of National Screening Program in Iran in 2008) (92.6%).

The remaining 27 executor universities have been divided into the 1st group of "regions with appropriate coverage (Appropriate coverage means coverage more than average coverage percentage of National Screening Program in Iran in 2008 (92.6%) and with high incidence rate (High incidence rate shows incidence more than average of incidence rate of National Screening Program in Iran in 2008)(2.20 to 2.38 per 1000 live births) and the 2nd group of "regions with appropriate coverage with low incidence rate (low incidence rate, shows incidence less than average of incidence rate of National Screening Program in Iran in 2008) (2.20 to 2.38 per 1000 live births). In the first group, regions were under coverage of 15 Universities of Medical Sciences including Kashan, Ilam, Zanjan, Markazi, Kurdistan, Jahrom, West Azarbayjan, Lorestan, Esfahan, Hamedan, Chaharmahal Bakhtiari, Semnan, Rafsanjan, Khuzestan, South Khorasan (Birjand). Specifications of these regions are appropriate coverage of the program and low incidence rate of the disease in those regions. Regions under coverage of 12 Universities of Medical Sciences of North Khorasan (Bojnord), Mazandaran, Shahrood, Babol, Fars, Ardabil, Fasa, Gonabad, East Azarbayjan, Guilan, Yazd, and Iran University of Medical Sciences are classified as the second group and their specifications are appropriate coverage of the program and low incidence rate of the disease in those regions. These two groups have been compared and analyzed from operational main indices viewpoint, mentioned previously and based on cost-benefit variables and ratio of cost-benefit according to the mentioned 3 scenarios. All figures in this study are in Rial. 10000 Rls. equals to one dollar and 1,000,000 Rls. equals to 100\$. Excel software have been used to analyze data and to draw tables and figures.

RESULTS

Results of this study are presented in 4 tables. Tables 1 and 2 show main performance indices of the program of screening for CH in the first and second groups. Tables 3 and 4 show present value of cost variables including cost of screening, total cost of recognizing patients, total cost of medical cares during the first 3 years of the patients life, total cost of medical cares from 4 to 70 years old and total cost of screening, recognizing and medical cares of patients, and also benefit variables including total cost of education and care of mental retarded patients as

Table 1. Performance of screening program of CH in the first group of "regions with appropriate coverage and high incidence rate of the disease" in Iran, 2008.

Name of the University	the executor	Births under one year old	Screened newborns	Percentage of coverage	Number of recalls	Recall Percentage	Recognized patients	Percentage of recognized patients	Rate of incidence (per 1000)
Kashan		6616	6670	>100	373	5.6	47	12.6	7.04
Ilam		8990	9090	>100	227	2.5	42	18.5	4.63
Zanjan		17900	17370	97	688	4	72	6.10	4.15
Markazi		20900	21079	>100	843	2.7	82	9.72	3.9
Kurdistan		2562	24722	96.3	989	3.1	88	8.9	3.56
Jahrom		2336	3182	95.4	26	0.8	11	42.3	3.46
West Azarbaijan		55652	54688	98.3	2747	5	183	6.66	3.34
Lorestan		29968	29286	97.7	1171	4.6	90	7.66	3.07
Esfahan		60990	63744	>100	3130	4.9	193	6.17	3.03
Hamedan		27980	27643	98.8	1106	3.1	79	7.14	2.86
Charmahal Bakhtiari		17245	17059	98.9	459	2.7	47	10.24	2.75
Semnan		6088	5634	92.6	247	4.4	15	6.07	2.66
Rafsanjan		5449	5444	99.9	218	2.9	14	6.42	2.57
Khuzestan		88112	83568	94.8	4792	5.7	209	4.36	2.5
South Khorasan (Birjand)		11923	11939	>100	306	2.6	29	9.48	2.43
Total		386811	381118	98.5*	17322	3.6*	1201	6.93*	3.5*

The figures with sign of (*) are mentioned as average.

100% in public-daily sector, as 100% in private-daily sector and 50% in public sector-50% in private sector (daily) and also ratio of cost-benefit of 3 determined scenarios based on the regions under supervision of the first and second groups Universities of Medical Sciences and Health Services. In the regions under coverage of first group, coverage percent was varied from 92.6 in Semnan University of Medical Sciences and Health Services to more than 100% in Kashan, Ilam, Markazi, Esfahan, and South Khorasan Universities of Medical Sciences and Health Services. Recall percentage of screened newborn of this group was varied from 0.8 in Jahrom University of Medical Sciences and Health Services to 5.7 in Khuzestan University of Medical

Sciences and Health Services. Percent of patient recognized among the recalled newborns of first group was varied from 42.3 and 18.5 in Jahrom and Ilam Universities of Medical Sciences and Health Services to 4.36 and 6.10 in Khuzestan and Zanjan Universities of Medical Sciences and Health Services, respectively. Rate of disease incidence in this group was varied from 7.04 per 1000 live births in the regions under coverage of Kashan University of Medical Sciences and Health Services to 2.4 in South Khorasan (Birjand) (Table 1). Average of coverage percent, recall percent, percentage of recognized patients and rate of the disease incidence in the first group were 98.5, 3.6, 6.93, and 3.5, respectively (Figure 1). In the regions under coverage of the second

group, percent of coverage was varied from 93.4 in Guilan University of Medical Sciences and Health Services to more than 100% in Mazandaran, Babol, Ardabil, Yazd and Iran Universities of Medical Sciences and Health Services. Recall percentage of screened newborns of this group was varied from 1 and 1.2 in Yazd and Fars Universities of Medical Sciences and Health Services to 6.5 and 6 in Shahrood and Iran Universities of Medical Sciences and Health Services. Percentage of patients recognized from the recalled newborns of the second group was varied from 12.29, 9.8 and 9.3 in Fars, Fasa, and Ardabil Universities of Medical Sciences and Health Services to 2.12 in Shahrood and Iran Universities of Medical Sciences and Health

Table 2. Performance of the program of screening for CH in the second group of "regions with appropriate coverage and low incidence rate of the disease" in Iran, 2008.

Name of the executor University	Births under one year old	Screened newborns	Percentage of coverage	Number of recalls	Recall Percentage	Recognized patients	Percentage of recognized patients	Rate of incidence (per 1000)
North Khorasan (Bojnord)	15850	15291	96.5	306	2	12	3.92	0.78
Mazandaran	39600	39753	>100	1590	2.8	45	2.83	1.13
Shahrood	3700	3642	98.4	236	6.5	5	2.12	1.37
Babol	7348	7414	>100	297	2.6	10	3.27	1.35
Fars	72092	70485	97.8	814	1.2	100	12.29	1.42
Ardabil	22100	22198	>100	344	1.5	32	9.3	1.44
Fasa	3510	3462	98.6	51	1.5	5	9.8	1.45
Gonabad	2100	2067	98.4	50	2.4	3	6	1.45
East Azarbaijan	58230	57798	99.3	1947	3.4	90	4.62	1.56
Guilan	29352	27427	93.4	1097	3	44	4.01	1.61
Yazd	18100	18377	>100	735	1	31	4.21	1.69
Iran	84124	84517	>100	5039	6	146	2.9	1.73
Total	356106	352431	99*	12506	3.5*	523	4.18*	1.4*

The figures with sign of (*) are mentioned as average.

Table 3. Cost-benefit of the program of screening for CH in the first group of "regions with appropriate coverage and high incidence rate of the disease", 2008.

Name of the executor university	Screening cost	Total cost of recognizing patient	Total cost of medical cares during the first 3 years of life of patients	Total cost of medical cares from 4 to 70 years old	Total cost of screening, recognizing and medical care's of patients	Total cost of education and care of mental retarded patients as 100% in public- daily sector (Scenario I)	Total cost of education and care of mental retarded patients as 100% in private-daily sector (Scenario II)	Total cost of education and care of mental retarded patients as 50% in public-50% in private-daily sector (Scenario III)	Cost-benefit ratio (Scenario I)	Cost-benefit ratio (Scenario II)	Cost-benefit ratio (Scenario III)
Kashan	175	26	67	46	314	15816	29001	22408	50.35	92.34	71.34
Ilam	239	35	60	41	375	14133	25916	20025	37.68	69.10	53.39
Zanjan	457	67	103	70	697	24228	44428	34328	34.77	63.75	49.26
Markazi	554	81	117	80	833	27593	50598	39096	33.13	60.76	46.94
Kurdistan	650	96	125	86	957	29612	54300	41956	30.94	56.73	43.84
Jahrom	84	12	16	11	122	3702	6788	5245	30.24	55.45	42.85
West Azarbaijan	1438	211	261	179	2089	61580	112920	87250	29.48	54.05	41.76
Lorestan	770	113	128	88	1100	30285	55534	42910	27.54	50.51	39.02
Esfahan	1676	246	275	188	2386	64945	119091	92018	27.21	49.90	38.56
Hamedan	727	107	113	77	1024	26584	48747	27665	25.97	47.62	36.80
Charmahal Bakhtiari	449	66	67	46	627	15816	29001	22408	25.21	46.22	35.71
Semnan	148	22	21	15	206	5048	9256	7152	24.51	44.94	34.72

Table 3. Contd.

Rafsanjan	143	21	20	14	198	4711	8639	6675	23.81	43.66	33.74
Khuzestan	2198	323	298	204	3023	70329	128963	99646	23.27	42.66	32.96
South Khorasan (Birjand)	314	46	41	28	430	9759	17894	13826	22.71	41.64	32.17
Total	10022	1472	1712	1173	14381	404141	1002076	572608	28.1*	54.62*	39.8*

Total costs are in million Rials and are estimated with annual discount rate of 3% and are equaled to the present value. The figures with sign of (*) in the column of ratio of cost-benefit of table are mentioned as average.

Table 4. Cost-Benefit of the program of screening for CH in the 2nd group of "regions with appropriate coverage and low incidence rate of the disease", 2008.

Name of the executor university	Screening cost	Total cost of recognizing patient	Total cost of medical cares during the first 3 years of life of patients	Total cost of medical cares from 4 to 70 years old	Total cost of screening, recognizing and medical cares of patients	Total cost of education and care of mental retarded patients as 100% in public-daily sector (Scenario I)	Total cost of education and care of mental retarded patients as 100% in private-daily sector (Scenario II)	Total cost of education and care of mental retarded patients as 50% in public-50% in non private-daily sector (Scenario III)	Cost-benefit ratio (Scenario I)	Cost-benefit ratio (Scenario II)	Cost-benefit ratio (Scenario III)
North Khorasan (Bojnord)	402	59	17	12	490	4038	7405	5721	8.24	15.11	11.67
Mazandaran	1046	154	64	44	1307	15143	27767	21455	11.58	21.24	16.41
Shahrood	96	14	71	5	122	1683	3085	2384	13.81	25.32	19.56
Babol	195	29	14	10	248	3365	6170	4768	13.59	24.92	19.25
Fars	1854	272	143	98	2366	33650	61705	47677	14.22	26.08	20.15
Ardabil	584	86	46	31	746	10768	19746	15257	14.43	26.45	20.44
Fasa	91	13	7	5	116	1683	3085	2384	14.45	26.50	20.47
Gonabad	54	8	4	3	70	1010	1851	1430	14.51	26.61	20.56
East Azarbayjan	1520	223	128	88	1960	30285	55534	42910	15.45	28.34	21.9
Guilan	721	106	63	43	933	14806	27150	20978	15.87	29.10	22.48
Yazd	483	71	44	30	629	10432	19129	14780	16.59	30.42	23.51
Iran	2223	327	208	142	2900	49129	90089	69609	16.94	31.06	24
Total	9269	1362	745	511	11887	175992	322716	249353	14.8*	27.2*	21*

Total costs are in million Rials and are estimated with annual discount rate of 3% and are equaled to the present value. The figures with sign of (*) in the column of ratio of cost-benefit of scenarios are mentioned as average.

Services. Rate of incidence of the disease in this group was varied from 0.78 and 1.13 in North Khorasan (Bojnord) and Mazandaran Universities of Medical Sciences and Health Services to 1.73 and 1.69 in Iran and Yazd Universities of Medical

Sciences and Health Services (Table 2). Average of the coverage percent, recall percentage, percentage of recognized patients and rate of the disease incidence of the second group were 99, 3.5, 4.18, and 1.4, respectively (Figure 1). Total

cost of screening, patient recognition, and medical cares of the patients born in 2008, in the regions under coverage of the first group in Khuzestan, Esfahan and West Azarbayjan Universities of Medical Sciences and Health Services,

respectively were more than the other regions of this group and in Jahrom, Rafsanjan and Semnan Universities of Medical Sciences and Health Services were respectively less than the others. Cost of recognition of a CH patient through screening program was varied from 4,300,000 RIs. (430\$) in Kashan to 12,400,000 RIs. (1240 \$) in South Khorasan (Birjand).

In the first group, total cost of education and care of mental retarded patients according to all of 3 scenarios in Khuzestan, Esfahan and West Azarbayjan Universities of Medical Sciences and Health Services respectively were more than the others and in Jahrom and Rafsanjan Universities of Medical Sciences and Health Services respectively were less than the other. Cost-benefit ratio of all of 3 scenarios in the first group in Kashan University of Medical Sciences and Health Services was 50.4, 92.3 and 71.3, respectively which were more than the others and in South Khorasan (Birjand) University of Medical Sciences and Health Services was 22.7, 41.6 and 22.2 respectively which were less than the other regions of this group (Table 3). The average of cost-benefit ratio of all of 3 scenarios in the regions under coverage of the first group respectively was 28.1, 54.62 and 39.8 (Figure 2).

Total cost of screening, recognizing patient, and medical cares of patients born in 2008, in the regions under supervision of the second group in Iran, Fars, East Azarbayjan, and Mazandaran Universities of Medical Sciences and Health Services respectively was more than the other regions of this group and Gonabad and Shahrood Universities of Medical Sciences and Health Services was respectively less than the others. Cost of recognition of CH patient in the screening program was varied from 38,000,000 RIs. (3800 \$) in North Khorasan (Bojnord) to 22,000,000 RIs. (2200\$) in Iran University of Medical Sciences and Health Services. In this group, total cost of education and cares of mental retarded patients according to all of 3 scenarios in Iran, Fars, and East Azarbayjan Universities of Medical Sciences and Health Services respectively was more than the other regions of this group and in Gonabad, Fasa and Babol respectively was less than the other regions of two groups.

Cost-benefit ratio of all of 3 scenarios in the second group in North Khorasan (Bojnord) University of Medical Sciences and Health Services was 8.2, 15.1 and 11.7 times less than the other regions of two groups and in Iran Universities of Medical Sciences and Health Services was respectively 16.9, 31 and 24 times than the other regions of this group (Table 4). Average of cost-benefit ratio of all of 3 scenarios in the regions under coverage of the second group is respectively calculated as 14.8, 27.2, and 21 (Figure 2). From 2745 CH patients recognized in Iran program of screening for births of 2008, 1201 persons equaled to 44%, were classified in the first group and 523 persons equaled to 19% were classified as the second group and 63% of the patients were totally

included in two groups. It is interesting that 381118 and 352431 persons live in these groups, respectively and totally 63% of 1156169 of the state screened newborns live in the regions (Figure 3).

Conclusions

Average of the program coverage in each group is more than 98.5% and is about 6% more than the state average. This coverage is obtained maximum during 4 years screening in Iran while coverage of 94.2% is obtained in South Korea from 1991 through 2001 and during more than 10 years (Dhondt et al., 2007). It is clear that full coverage of the program in the regions under supervision of two groups and its continuation shall affect on probable increase of recognized patients. Recall percentage of both groups, varied from 0.8 in Jahrom to 6.5 in Shahrood, need more studies. Certainly stopping education and skills of healthcare personnel in sampling blood and sending the samples through express post, using kits, and precision of laboratory to express the results of primary test of screening (TSH) in some parts of the regions should be considered because any one of newborns recalled for diagnosis confirmatory tests (TSH and T4) imposes costs of about 51400 RIs, 155000 RIs. and 24500 RIs. in public and private sectors respectively and in lieu of physicians visits. Regardless the above mentioned, medical researches in this field are important to find answer of this question that if it is possible that at the beginning days of life, newborns show TSH more than 10 and 5 mU/L during primary tests of screening (TSH) up to diagnosis confirmatory test (T4-TSH) and then immediately their TSH decreases? By the way it is proposed to improve precision and skills of healthcare and laboratory personnel and to use high quality progressed and prompt laboratory instruments and equipments. Proper control of this process probably shall result in increase of recognized patients in addition to decrease of total costs of patient recognition.

Comparison of recognized patients percentage (from recalled newborns) in any region with recalled newborns percentage (from screened newborns) of that region shows that recall percentage has no direct relation with percentage of recognized patient but sometimes this ratio is completely inverse. For example in the first group, Jahrom and Ilam with recall percent of 0.8 and 2.5, have the most percent of recognized patients f 42.3 and 18.5, respectively. The same status is true in the second group. Fars after Yazd shows the least recall percentage (1.2) but it's percentage of recognized patients is more than the other regions of the group (12.29). This status is seen in the regions under coverage of Fasa and Ardabil Universities of Medical Sciences and Health Services, these two universities with recall percentage of 1.5 have shown 9.8 and 9.3% of recognized patients of their group, respectively. Universities with lower recall percent

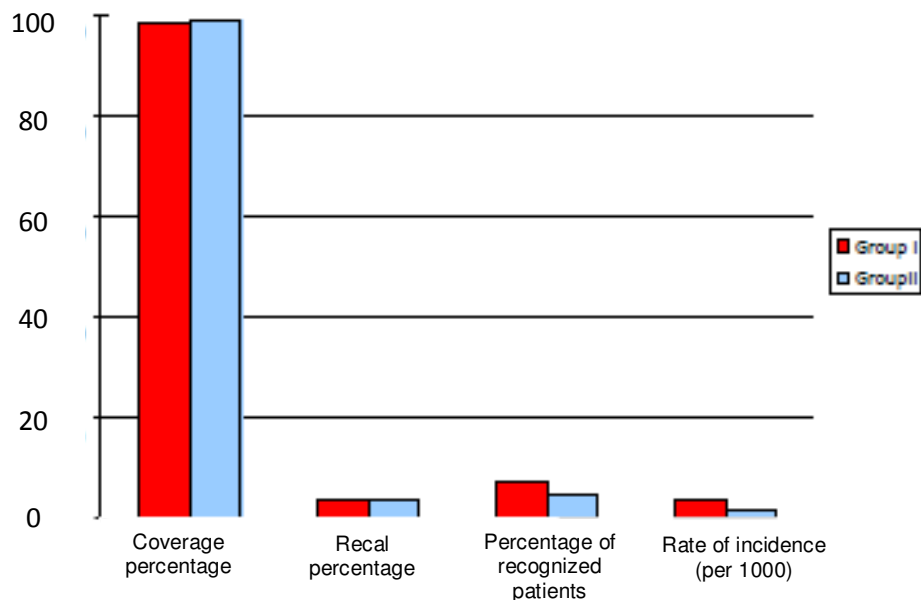


Figure 1. Average of coverage percent, recall percentage, and percentage of recognized patients and rate of incidence (per 1000) in the regions under coverage of first and second groups in the program of screening for CH in Iran, 2008.

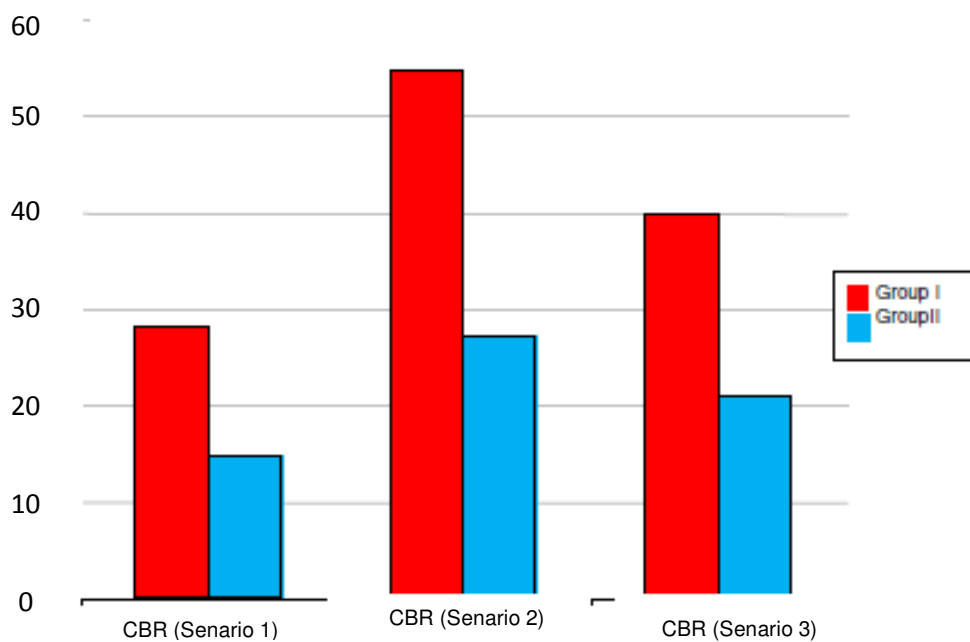


Figure 2. Average of cost-benefit ratio (CBR) of the 3 scenarios in the regions under supervision of 1st and 2nd group in the program of screening for CH in Iran, 2008.

and more recognized patients show more precise and better performance. The disease incidence rate is various in different regions of Iran and needs more studies and

necessary actions. For example rate of incidence of CH in South Khorasan (Birjand) is more than 3 times of North Khorasan (Bojnord) and its causes shall be interesting

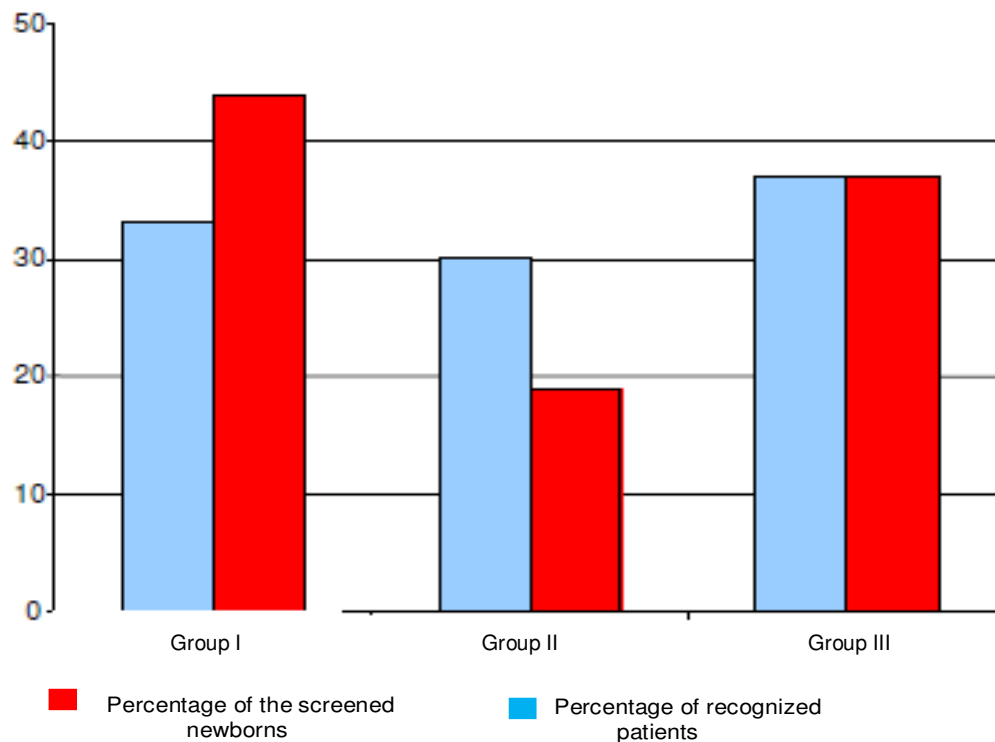


Figure 3. Percentage of the screened newborns and percentage of recognized patients in the regions under supervision of 1st, 2nd and 3rd group in the program of screening for CH in Iran, 2008.

considering that these two regions are next to each other. Analysis of the results related to cost-benefit of different regions of screening in both groups shows that the more patients of each region, the less cost of recognizing patient shall be devoted to that region for example average cost of a CH patient recognition by the screening program is 9,600,000 RIs. (equaled to 960\$) in the first group and is 203,300,000 RIs. (equaled to 2030 \$) in the 2nd group. In study of Lade et al (1979) present value of cost of a CH case recognition is 9300 \$ (Layde et al., 1979).

In studies of Maniatis et al. (2006), cost of each recognized CH case by the first and 2nd supplementary turn of screening is estimated as 9730 \$ (Maniatis et al., 2006). In addition, cost-benefit ratio is affected by incidence rate of the disease more than any other indices, that is, any region with more recognized patients, shows more cost-benefit ratio. For example cost-benefit ratio of conducting the program according to all of 3 scenarios in Kashan (with 7 CH patients per 1000 newborns) is about 2 times of the group average. Inverse matter is true too. Cost-benefit ratio of the screening program in North Khorasan (Bojnord) with the least incidence rate (07.8 per 1000) in the regions under coverage of both groups, is about half of this group average. Considering high cost-benefit ratio, it is proposed to pay more attention to regions with high incidence rate from view point of development and legal distribution of medical and laboratory facilities, resources

supply and program needs and reference systems reinforcement. As this study evaluates and analyzes status of 63% of screened newborns and recognized patients of the state in 2008, in the regions under coverage of two groups, the third group that is 14 omitted regions include the remaining 37% of screened newborns and also recognized patients of the same year. So the third group is nearly the same as the first group. Then full coverage of the program is important according to high rate of incidence and affects on increase of the program cost-benefit rate.

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