

Real-world Big Data analysis and CRC screening

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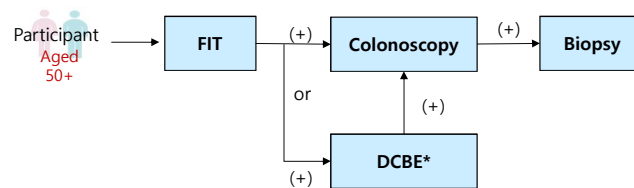
History of the NCSP in Korea

YEAR	History
1999	The National Cancer Screening Program is launched for stomach, breast, and cervical cancer free-of-charge. Target population; MAP recipients.
2002	Target population; expanded to lower 20% of NHIS beneficiaries.
2003	Target population; expanded to lower 30% of NHIS beneficiaries
2004	Colon cancer screening is added.
2005	Target population; expanded to lower 50% of NHIS beneficiaries.
2012	Screening periods are unified (screening intervals for CRC; 1 year)

NCSP, National Cancer Screening Program; MAP, Medical Aid Program;
NHIS, National Health Insurance Service.

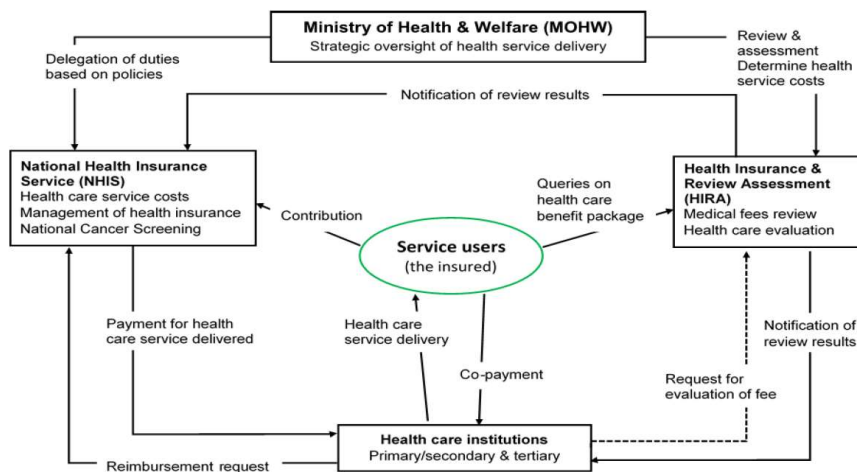
Colorectal Cancer Screening Program

- Target Population : 50 & over, men and women
- Eligible for CRC Screening is generated at the NHI
- Frequency : every one year (every two year before 2012)
- Test : Fecal Immunochemical Test (FIT)
- Process from 2004



- DCBE : Double contrast barium enema
- NHI : National Health Insurance

Financing and operational structure of NHIS

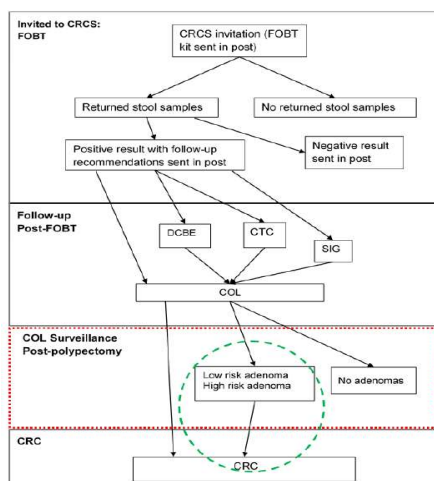


Rates of participation & confirmatory colonoscopy attendance vary

National Health Insurance System, Korea, unpublished

YEAR	Target No	No of FIT Attendance	Participation rate	No of FIT +	FIT + rate	No of 2 nd test	2nd test atten. rate	No. of CSP	CSP atten. rate
2011	8,315,181	2,891,693	34.8	188,095	6.5	63,209	33.6	59,276	31.5
2012	13,751,002	3,705,933	26.9	214,678	5.8	103,187	48.1	99,146	46.2
2013	13,121,035	4,028,968	30.7	233,651	5.8	106,435	45.6	103,547	44.3
2014	13,386,816	4,348,293	32.5	259,188	6.0	116,259	44.9	113,596	43.8
2015	14,077,599	4,820,442	34.2	297,969	6.2	126,081	42.3	123,982	41.6
2016	14,601,843	5,207,733	35.7	248,479	4.8	116,983	47.1	115,565	46.5

Ideal & Reality gaps in the current CRC Screening



- no formal program to confirm a FU measure.
- no recommendations on the management of people with high risk.
- CRC patients continue with an annual invitation of FIT.

Big data resource; NHIS

- covers entire population of Korea (> 51M).
- contains all forms of health services including
 - demographic characteristics
 - care history; hospitalization, ambulatory care
 - principal diagnosis and comorbidity using ICD-10
 - prescriptions of pharmaceutical services
 - procedures including both general health check-up and NSCP.

Two studies using population-based big data

- Association between type of screening tests and colorectal cancer risk:
A population-based, case-control study.
- Characteristics and outcomes of post-colonoscopy colorectal cancer:
First population-based study from the Asia.

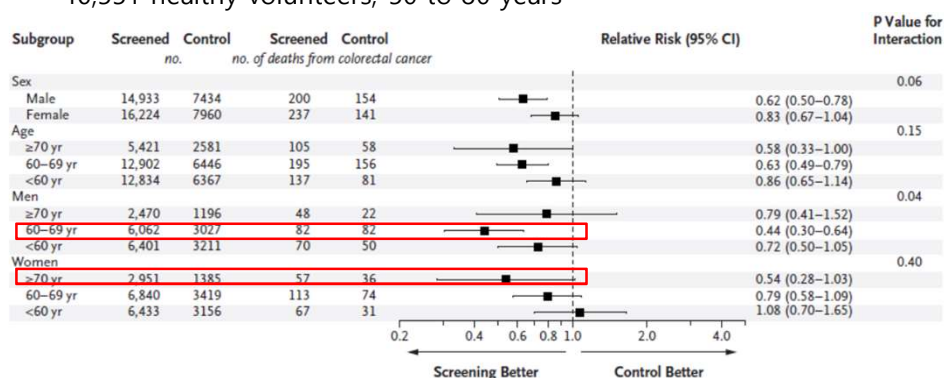
Evidence for colonoscopy efficacy

	CRC incidence RR, 95% CI, per-protocol	CRC mortality RR, 95% CI, per-protocol
Colonoscopy		
• Meta anal of 6 obs ²	0.31 (0.12-0.77)	0.32 (0.23-0.43)
	Distal CRC Mortality (RR, 95%CI)	Proximal CRC Mortality (RR, 95%CI)
Colonoscopy		
Meta anal. of 6 obs.	0.18 (0.10-0.31)	0.47 (0.29-0.76)

1. Holme et al. JAMA 2014
2. Brenner et al. BMJ 2014

Screening effects of FIT are different according to Age & Gender

- The Minnesota Colon Cancer Control Study
- 46,551 healthy volunteers, 50 to 80 years



N Engl J Med 2013;369:1106-14.
DOI: 10.1056/NEJMoa1300720

AIMS

- TO evaluate the association of type of CRC screening tests (CSP or FIT) with CRC risk.
- TO determine the association strengths according to
 - cancer location (distal vs. proximal),
 - endoscopists specialty (Gastros vs. non-Gastros)
 - type of previous CSP (Diagnostic or Therapeutic)
 - cumulative frequency of FITby calculating odds ratios for CSP or FIT exposure in a case-control design.

METHODS

- National Health Insurance Service (NHIS) Database;
- Case identified
 - Diagnosed from Jan. 2009 through Dec. 2013 using V193 code.
 - Definite cancer treatment and received CSP within 6 mos of CRC Dx.
- 1:5 controls selected without any cancer for each case.
- 4 matched parameters
 - Age/sex, Socioeconomic status, Smoking history
- Primary exposure of CSP & FIT
 - CSP; from Jan. 2002 through 6 mos before Dx./ referent date
 - FIT; national screening dataset from Jan. 2004 through 12 mos before Dx. Date

Characteristics; Cases-Controls

Characteristics	Cases (n = 61,221)		Controls (n = 306,099)	
	No.	%	No.	%
Age, years, mean	65		65	
≤ 49 years	6,228	10.2	31,140	10.2
50 to 64 years	24,246	39.6	121,230	39.6
65 to 74 years	20,334	33.2	101,670	33.2
≥ 75 years	10,413	17.0	52,059	17.0
Women	23,356	38.2	116,777	38.2
Socioeconomic status				
Quintile 1	9,232	15.1	46,157	15.1
Quintile 2	8,503	13.9	42,515	13.9
Quintile 3	9,858	16.1	49,287	16.1
Quintile 4	13,735	22.4	68,675	22.4
Quintile 5	19,893	32.5	99,465	32.5
Smoking history				
Ever	30,051	49.1	150,255	49.1
Never	29,452	48.1	147,260	48.1
Unknown	1,718	2.8	8,584	2.8

Characteristics; Cases-Controls

	Cases (n = 61,221)		Controls (n = 306,099)	
	n	%	n	%
Cancer location at diagnosis				
Proximal	12,488	20.4		
Distal	41,313	67.5		
Unknown	7,420	12.1		
Any CSP	5,686	9.3	77,476	25.3
CSP by Gastro. Dept.	858	1.4	12,935	4.2
CSP by non-Gastro. Dept.	4,828	7.9	64,541	21.1
Type of CSP performed				
Diagnostic	3,840	6.3	57,245	18.7
One polypectomy	804	1.3	10,217	3.3
>=2 polypectomies/EMR	1,042	1.7	10,014	3.3
Any screening FIT_12 mos before Dx./referent date	15,402	25.2	98,941	32.3

Summary1

- Compared with controls, cases were less likely to have undergone CSP (OR, 0.29) or screening FIT (OR, 0.74)
- The association of CSP or FIT with CRC risk was stronger for distal CRC than proximal CRC.
- The stronger associations of CSP with a reduced risk of CRC were found in the cases with 50-74 years, male, specialty of gastroenterology, and previous diagnostic CSP.
- As the frequency of cumulative FIT has increased during the past decade, association of FIT exposures with CRC prevention becomes stronger.

Characteristics and survival of post-colonoscopy colorectal cancer: A population-based study

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BACKGROUNDS; PCCRC

- Recently, there is increasing recognition of the potential post-colonoscopy CRC (PCCRC) and 5-9% of CRC patients were diagnosed after 6-36 mos. of index colonoscopy.
- In a population-based study from Ontario and England, PCCRC were associated with worse overall survival, whereas survival was not worse in other studies from Denmark and Canada.

Pabby A et al. GIE 2005;61:385. Govindarajan A et al. Gut 2016;65:971-976.
Cheung D et al. GIE 2016;84:287-295. Erichsen R et al. AJG 2013;108:1332-1340.
Singh H et al. AJG 2010;105:2588-2596.

Backgrounds and Aim

- Little is known about characteristics and survival of PCCRC according to the interval from colonoscopy to the CRC diagnosis from Asian countries.
- This study was conducted to compare the characteristics and outcomes of PCCRC patients with those of sporadic CRC patients using a population-based database in Korea.

Methods-1

- NHIS billing claims DB; 2009-2013.
- CRC case was defined as
 - Newly diagnosed from 2009 through 2013 using V193 code.
 - Definite cancer treatment (Ca. surgery, CTX, or RTX)
- Sporadic CRC; defined as those who were examined by prior CSP within 12 months of CRC diagnosis.
- PC-CRC; defined as those with 1 or more exams > 12 months before their CRC diagnosis.
- Based on time interval between index colonoscopy and diagnosis of CRC, PC-CRC cases were further categorized as three groups;
 - PC-CRC1 (CSP performed 1-3 yrs before CRC diagnosis)
 - PC-CRC3 (CSP performed 3-5 yrs before CRC diagnosis)
 - PC-CRC5 (CSP performed > 5 yrs before CRC diagnosis)

Methods-2

- Study variables extracted from coding included
 - demographic characteristics,
 - smoking, alcohol, socioeconomic status (SES),
 - tumor location (proximal, distal or unspecified),
 - type (Dx. or Tx.) of index colonoscopy done in PCCRC groups
- Uni- and multi-variable analyses were performed to study interval-dependent characteristics of PC-CRCs according to variables.
- Overall survival was estimated among groups of CRC.

Results; PCCRC characteristics-1

- Overall, 78,247 CRC patients were identified.
- PCCRC cases; 6,217 (7.9 %)/78,240

	PCCRC1	PCCRC3	PCCRC5	All PCCRC	SY-CRC	SC-CRC
Total No, %	2,661 (3.4%)	1,644 (2.1%)	1,912 (2.4 %)	6,217(7.9)	52,980(67.8)	19,050(24.3)
Mean age, yrs SD	64.27 10.48	64.83 10.47	65.57 11.18	64.82 11.56	62.97 12.54	65.84 8.26
Age group						
≤ 49 yrs	241	136	164	541(8.7)	8872(16.7)	94
50 to 64 yrs	1108	657	685	2450(39.4)	19028(35.9)	8649
65 to 74 yrs	895	584	664	2143(34.5)	15411(29.1)	7627(40.0)
≥ 75 yrs	417	267	399	1083(17.4)	9669(18.3)	2680(2.9)
Sex, No, %				51.9	47.4	42.9
Male	1696	951	1170	3,817(61.4)	31,481(59.5)	12,050(63.2)
Female	965	693	742	2,400	21,470	6,999
Location at Dx.						
Right	834	589	651	2074(33.4)	11144(21.0)	4058(21.3)
Left	1534	887	1060	3481	36517	13194
Unknown	293	168	201	662	5319	1798

SUMMARY2

- Among 78,240 CRC cases, the PC-CRC rate was 7.9%.
- The risk of PCCRC was associated with older age, male sex, proximal tumor location, higher SES and non-smoker
- Overall survival of PC-CRC was worse with old age over 65 years, male sex, and proximal location.
- Annual increase of PC-CRC rate over the study period reinforces the critical importance of improving the quality of colonoscopy in detecting CRC in Korea.