Propensity score-matching methods for nonexperimental causal studies

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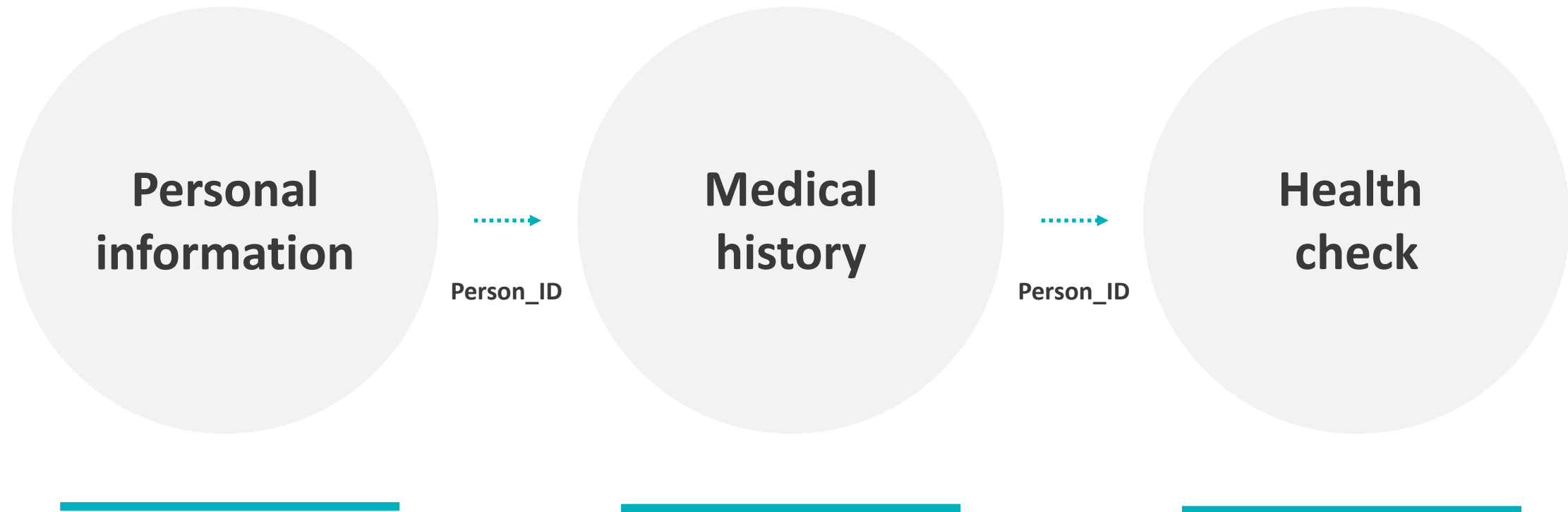
The causality between smoking and pulmonary disease

01. The data

Health check cohort DB (National Health Insurance Corporation)

Personal information → Person_ID → Medical history → Person_ID → Health check

01. The data

Covariates

PERSON_ID	Personal discrimination number
SEX	1 : Male
	2 : Female
AGE_GROUP	Age in standard year
SIDO	City, Province
CTRB_PT_TYPE_CD	Income quintile

Personal Information

- ....➤ **The percent of smoking: M > F**
  - Not matched
  - except the sex variable

- ....➤ **quality in health care**

- ....➤ **Income level**

01. The data

Medical history

- **Past history: Cancer('C'code)**
             Pulmonary disease ('J'code)

- **Outcome: Pulmonary disease ('J'code)**

Covariates

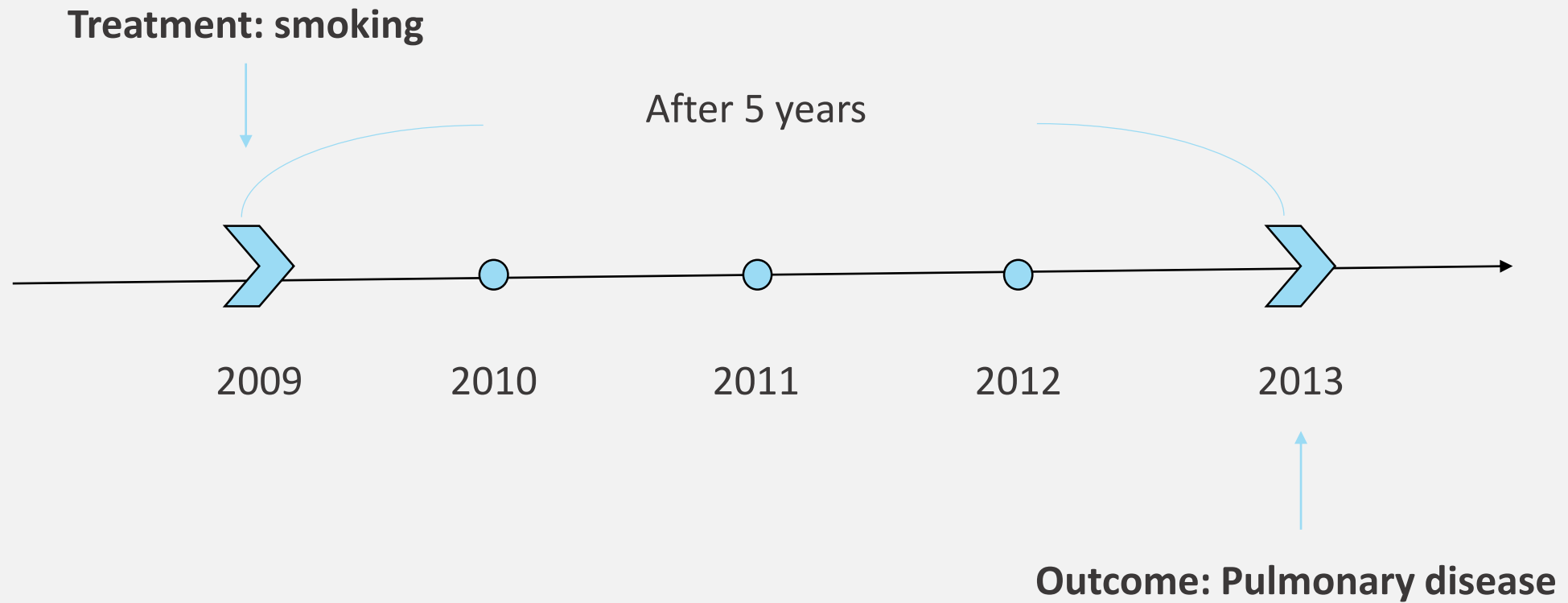| PERSON_ID	Personal discrimination number
MAIN_SICK	Main diagnosis
	Korean Standard Classification of Diseases
SUB_SICK	Sub diagnosis
	Korean Standard Classification of Diseases

01. The data

Health check

Covariates

PERSON_ID	Personal discrimination number
HEALTH_CKECK_YEAR	Health check year ┄┄► **2009 ~ 2013**
HCHK_ETCDSE_PMH_YN	Family history
FMLY_CANCER_PATIEN_YN	Past history
SMK_STAT_TYPE_RSPS_CD	* Smoking status 1: none smoker ┄┄► **Control group** 2: former smoker 3: current smoker ┄┄► **Treatment group**

MOV20_WEK_FREQ_ID	Exercise 20 minutes a week 1: 0day 2: 1day 3: 2days
MOV30_WEK_FREQ_ID	Exercise 30 minutes a week 4: 3days 5: 4days 6: 5days
WLK30_WEK_FREQ_ID	Walk 30 minutes a week 7: 6days 8: 7days

02. Study design

: Nonexperimental study

: 4 different matching methods

Matching methods

Without replacement（paired matching）

With replacement

Matching with caliper

Penalty = 500

Matching with caliper

Penalty = 1,000
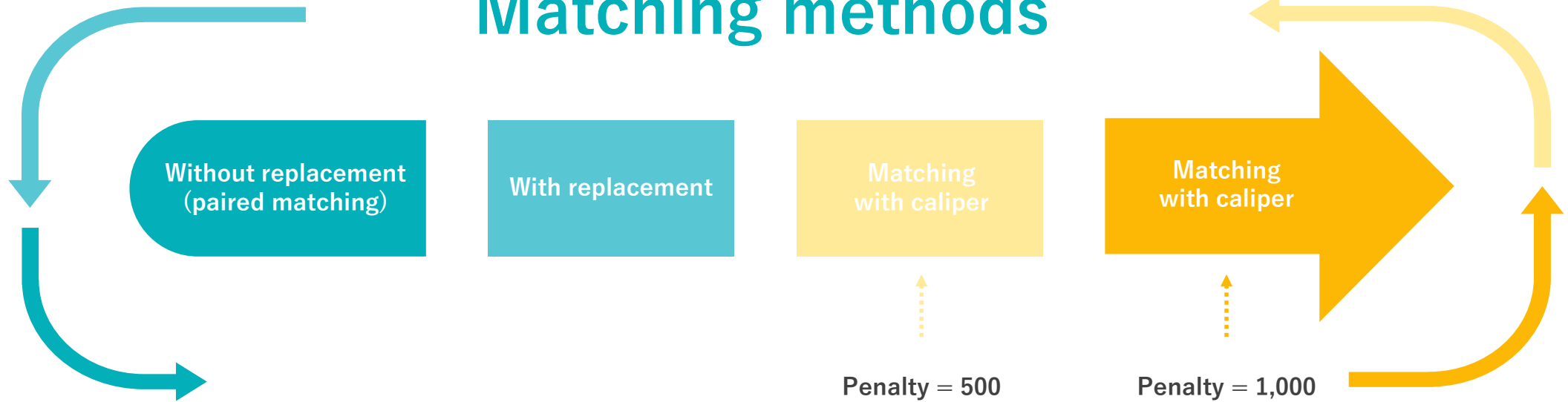
03. Matching

: Strata in area
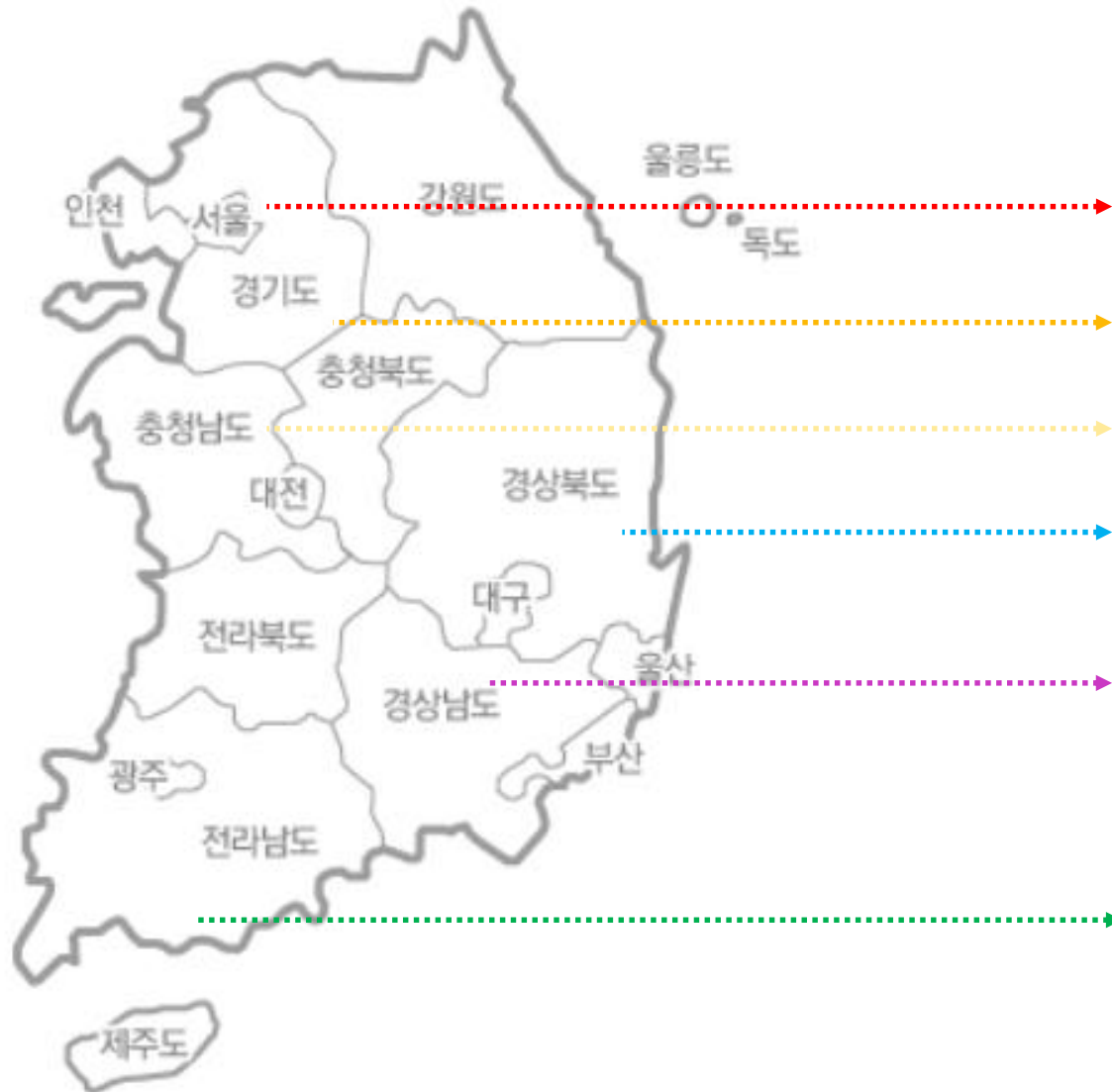
Strata 1 _ Seoul

Strata 2 _ Gyeongin

Strata 3 _ Chungcheong

Strata 5 _ Gyeongbuk / Gangwon

Strata 6 _ Gyeongnam

Strata 4 _ Honam / Jeju

3-1. Without replacement

: Seoul / Gyeongin

Seoul

`	Before	After
BMI	-0.182	-0.071
PAST1	0.034	0.052
FMLY1	0.089	0.048
MOV20_WEK	-0.163	-0.065
MOV30_WEK	-0.147	-0.015
WLK30_WEK	-0.062	0.021
AGE	-0.179	**0.114**
CTRB_PT2	-0.014	-0.082
CTRB_PT3	-0.068	-0.025

Gyeongin

`	Before	After
BMI	-0.226	-0.024
PAST1	-0.022	0.000
FMLY1	-0.046	-0.067
MOV20_WEK	-0.151	-0.022
MOV30_WEK	-0.214	-0.045
WLK30_WEK	-0.050	-0.011
AGE	-0.282	-0.034
CTRB_PT2	0.022	-0.044
CTRB_PT3	-0.109	-0.007

3-1. Without replacement

: Chungcheong / Honam / Jeju

Chungcheong

`	Before	After
BMI	-0.188	-0.063
PAST1	0.069	**0.123**
FMLY1	-0.031	-0.066
MOV20_WEK	-0.141	0.008
MOV30_WEK	-0.097	0.089
WLK30_WEK	-0.013	-0.018
AGE	-0.298	-0.029
CTRB_PT2	0.130	0.054
CTRB_PT3	-0.179	-0.009

Honam / Jeju

`	Before	After
BMI	-0.209	0.021
PAST1	0.033	0.099
FMLY1	-0.075	-0.038
MOV20_WEK	-0.270	-0.072
MOV30_WEK	-0.297	-0.073
WLK30_WEK	-0.270	**-0.177**
AGE	-0.267	-0.031
CTRB_PT2	0.097	-0.022
CTRB_PT3	-0.102	0.069

3-1. Without replacement

: Gyeongbuk / Gangwon / Gyeongnam

Gyeongbuk / Gangwon

`	Before	After
BMI	-0.212	-0.074
PAST1	-0.101	-0.031
FMLY1	0.164	**0.106**
MOV20_WEK	-0.072	0.046
MOV30_WEK	-0.212	-0.005
WLK30_WEK	-0.139	-0.070
AGE	-0.271	-0.027
CTRB_PT2	-0.029	-0.038
CTRB_PT3	-0.219	**-0.143**

Gyeongnam

`	Before	After
BMI	-0.226	**-0.125**
PAST1	-0.171	**-0.122**
FMLY1	0.066	0.000
MOV20_WEK	-0.186	-0.081
MOV30_WEK	-0.219	-0.031
WLK30_WEK	-0.048	0.033
AGE	-0.245	**0.101**
CTRB_PT2	0.170	**0.184**
CTRB_PT3	-0.125	-0.098

3-2. With replacement

: Seoul / Gyeongin

Seoul

`	Before	After
BMI	-0.182	0.007
PAST1	0.034	-0.034
FMLY1	0.089	0.019
MOV20_WEK	-0.163	-0.045
MOV30_WEK	-0.147	0.017
WLK30_WEK	-0.062	0.014
AGE	-0.179	0.024
CTRB_PT2	-0.014	-0.061
CTRB_PT3	-0.068	-0.006

Gyeongin

`	Before	After
BMI	-0.226	0.034
PAST1	-0.022	**-0.161**
FMLY1	-0.046	**-0.178**
MOV20_WEK	-0.151	-0.025
MOV30_WEK	-0.214	0.045
WLK30_WEK	-0.050	-0.066
AGE	-0.282	-0.082
CTRB_PT2	0.022	0.044
CTRB_PT3	-0.109	0.017

3-2. With replacement

: Chungcheong / Honam / Jeju

Chungcheong

`	Before	After
BMI	-0.188	**-0.144**
PAST1	0.069	**0.123**
FMLY1	-0.031	0.000
MOV20_WEK	-0.141	-0.035
MOV30_WEK	-0.097	0.035
WLK30_WEK	-0.013	0.015
AGE	-0.298	0.037
CTRB_PT2	0.130	-0.018
CTRB_PT3	-0.179	0.056

Honam / Jeju

`	Before	After
BMI	-0.188	**-0.144**
PAST1	0.069	**0.123**
FMLY1	-0.031	0.000
MOV20_WEK	-0.141	-0.035
MOV30_WEK	-0.097	0.035
WLK30_WEK	-0.013	0.015
AGE	-0.298	0.037
CTRB_PT2	0.130	-0.018
CTRB_PT3	-0.179	0.056

3-2. With replacement

: Gyeongbuk / Gangwon / Gyeongnam

Gyeongbuk / Gangwon

`	Before	After
BMI	-0.226	**-0.136**
PAST1	-0.171	**-0.115**
FMLY1	0.066	0.091
MOV20_WEK	-0.186	**-0.165**
MOV30_WEK	-0.219	**-0.195**
WLK30_WEK	-0.048	-0.066
AGE	-0.245	**-0.416**
CTRB_PT2	0.170	-0.008
CTRB_PT3	-0.125	-0.001

Gyeongnam

`	Before	After
BMI	-0.226	**-0.102**
PAST1	-0.171	-0.037
FMLY1	0.066	0.052
MOV20_WEK	-0.186	-0.037
MOV30_WEK	-0.219	0.044
WLK30_WEK	-0.048	0.042
AGE	-0.245	0.068
CTRB_PT2	0.170	**0.204**
CTRB_PT3	-0.125	-0.034

3-3. Matching with caliper (penalty = 1,000)

: Seoul / Gyeongin

Seoul

`	Before	After
BMI	-0.182	-0.058
PAST1	0.034	**0.172**
FMLY1	0.089	**0.115**
MOV20_WEK	-0.163	0.010
MOV30_WEK	-0.147	0.032
WLK30_WEK	-0.062	0.047
AGE	-0.179	0.035
CTRB_PT2	-0.014	-0.014
CTRB_PT3	-0.068	-0.006

Gyeongin

`	Before	After
BMI	-0.226	-0.051
PAST1	-0.022	0.080
FMLY1	-0.046	0.039
MOV20_WEK	-0.151	-0.008
MOV30_WEK	-0.214	-0.037
WLK30_WEK	-0.050	0.021
AGE	-0.282	-0.017
CTRB_PT2	0.022	-0.007
CTRB_PT3	-0.109	-0.038

3-3. Matching with caliper (penalty = 1,000)

: Chungcheong / Honam / Jeju

Chungcheong

`	Before	After
BMI	-0.188	-0.066
PAST1	0.069	**0.172**
FMLY1	-0.031	0.013
MOV20_WEK	-0.141	0.021
MOV30_WEK	-0.097	0.057
WLK30_WEK	-0.013	0.035
AGE	-0.298	0.035
CTRB_PT2	0.130	0.036
CTRB_PT3	-0.179	-0.093

Honam / Jeju

`	Before	After
BMI	-0.209	-0.046
PAST1	0.033	**0.148**
FMLY1	-0.075	0.038
MOV20_WEK	-0.270	-0.029
MOV30_WEK	-0.297	-0.017
WLK30_WEK	-0.270	-0.034
AGE	-0.267	0.041
CTRB_PT2	0.097	-0.011
CTRB_PT3	-0.102	-0.046

3-3. Matching with caliper (penalty = 1,000)

: Gyeongbuk / Gangwon / Gyeongnam

Gyeongbuk / Gangwon

`	Before	After
BMI	-0.212	**-0.108**
PAST1	-0.101	0.047
FMLY1	0.164	**0.174**
MOV20_WEK	-0.072	-0.010
MOV30_WEK	-0.212	-0.036
WLK30_WEK	-0.139	-0.083
AGE	-0.271	-0.006
CTRB_PT2	-0.029	-0.070
CTRB_PT3	-0.219	-0.095

Gyeongnam

`	Before	After
BMI	-0.226	-0.078
PAST1	-0.171	-0.049
FMLY1	0.066	0.059
MOV20_WEK	-0.186	-0.045
MOV30_WEK	-0.219	-0.021
WLK30_WEK	-0.048	0.075
AGE	-0.245	0.038
CTRB_PT2	0.170	**0.110**
CTRB_PT3	-0.125	-0.093

3-4. Matching with caliper (penalty = 500)

: Seoul / Gyeongin

Seoul

`	Before	After
BMI	-0.182	-0.062
PAST1	0.034	**0.155**
FMLY1	0.089	0.095
MOV20_WEK	-0.163	0.003
MOV30_WEK	-0.147	0.031
WLK30_WEK	-0.062	0.049
AGE	-0.179	0.040
CTRB_PT2	-0.014	-0.014
CTRB_PT3	-0.068	-0.006

Gyeongin

`	Before	After
BMI	-0.226	-0.062
PAST1	-0.022	0.080
FMLY1	-0.046	0.045
MOV20_WEK	-0.151	-0.012
MOV30_WEK	-0.214	-0.033
WLK30_WEK	-0.050	0.032
AGE	-0.282	-0.010
CTRB_PT2	0.022	-0.007
CTRB_PT3	-0.109	-0.038

3-4. Matching with caliper (penalty = 500)

: Chungcheong / Honam / Jeju

Chungcheong

`	Before	After
BMI	-0.188	-0.069
PAST1	0.069	**0.172**
FMLY1	-0.031	0.000
MOV20_WEK	-0.141	0.024
MOV30_WEK	-0.097	0.060
WLK30_WEK	-0.013	0.040
AGE	-0.298	0.029
CTRB_PT2	0.130	0.045
CTRB_PT3	-0.179	-0.093

Honam / Jeju

`	Before	After
BMI	-0.188	-0.069
PAST1	0.069	**0.172**
FMLY1	-0.031	0.000
MOV20_WEK	-0.141	0.024
MOV30_WEK	-0.097	0.060
WLK30_WEK	-0.013	0.040
AGE	-0.298	0.029
CTRB_PT2	0.130	0.045
CTRB_PT3	-0.179	-0.093

3-4. Matching with caliper (penalty = 500)

: Gyeongbuk / Gangwon / Gyeongnam

Gyeongbuk / Gangwon

`	Before	After
BMI	-0.212	**-0.106**
PAST1	-0.101	0.047
FMLY1	0.164	**0.174**
MOV20_WEK	-0.072	-0.007
MOV30_WEK	-0.212	-0.043
WLK30_WEK	-0.139	-0.080
AGE	-0.271	-0.001
CTRB_PT2	-0.029	-0.064
CTRB_PT3	-0.219	**-0.102**

Gyeongnam

`	Before	After
BMI	-0.226	-0.074
PAST1	-0.171	-0.049
FMLY1	0.066	0.059
MOV20_WEK	-0.186	-0.039
MOV30_WEK	-0.219	-0.016
WLK30_WEK	-0.048	0.073
AGE	-0.245	0.036
CTRB_PT2	0.170	**0.105**
CTRB_PT3	-0.125	-0.089