

3.02 The retrospective matched controls design: matching methods general principles

NHS-R workshop no. 4 | February 2019



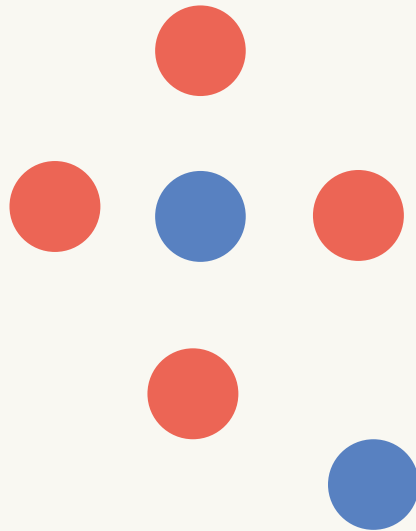
Midlands and Lancashire
Commissioning Support Unit

// Despite the large and multidisciplinary literature on matching methods, there is no consensus on how matching should be executed or evaluated.

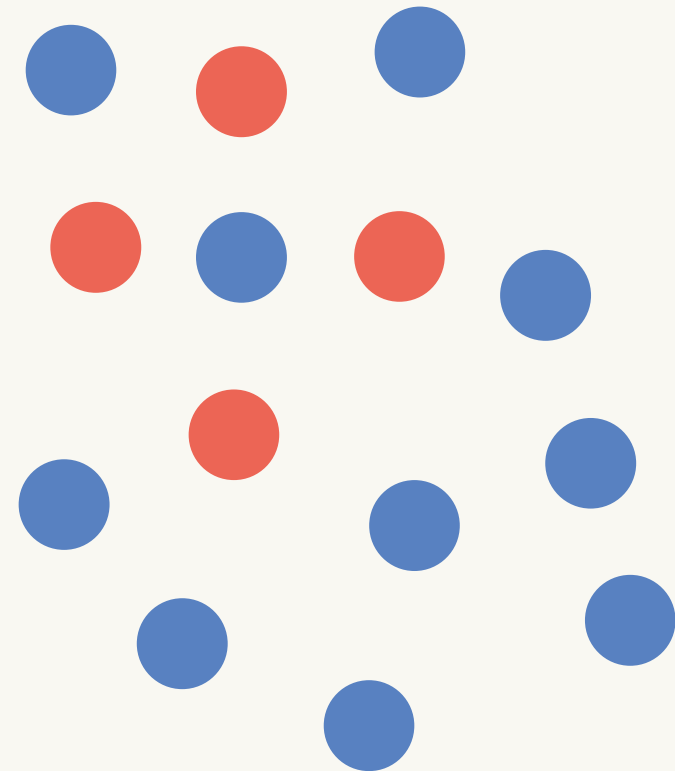
Colson K, Rudolph K, Zimmerman S, Goin D, Stuart E, Laan M *et al.* Optimizing matching and analysis combinations for estimating causal effects. *Scientific Reports*. 2016;6(1).
doi.org/10.1038/srep23222

Single covariate

Treated

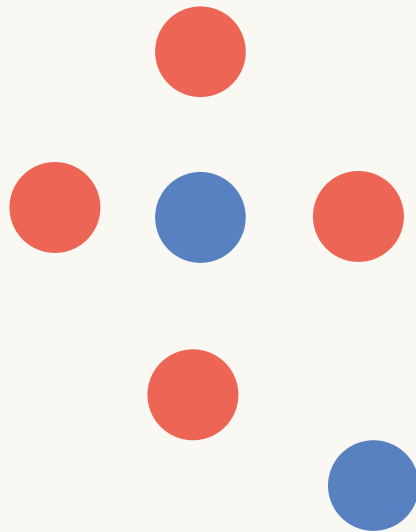


Control



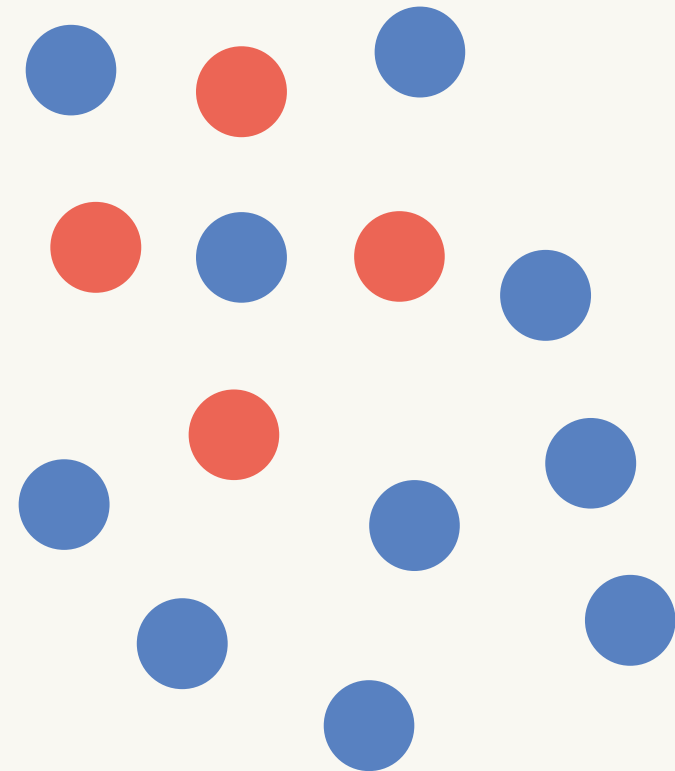
Single covariate

Treated



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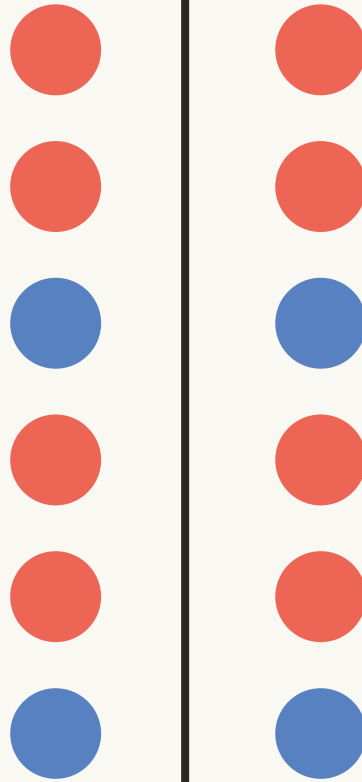
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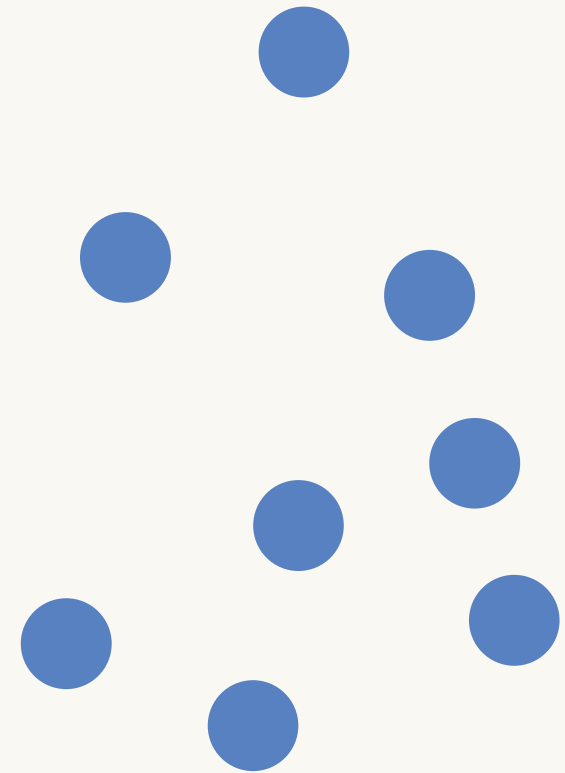
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Single covariate

Treated



Control



Single covariate

Treated



67% red

Control



67% red

BEWARE THE CURSE OF
DIMENSIONALITY!

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... the introduction of a new balancing covariate increases the minimum necessary number of observations in the sample geometrically

Steps in matching methods

1. Define “closeness” (distance measure for determining whether an individual is a good match for another)

There are two main aspects to determining the measure of distance (or “closeness”) to use in matching. The first involves which covariates to include, and the second involves combining those covariates into one distance measure.

Which covariates to include?

The key concept in determining which covariates to include in the matching process is that of strong ignorability—the assumption that there are no unobserved differences between the treatment and control groups, conditional on the observed covariates.

It is important to include in the matching procedure all variables known to be related to both treatment assignment and the outcome. Variable selection should be done blind of observed outcomes, and choice based on previous research and scientific understanding.

The impact of providing enhanced support for care home residents in Rushcliffe

The Improvement Analytics Unit examined whether the enhanced support affected the hospital use of care home residents, including the number of A&E attendances and emergency hospital admissions. The use of hospital care by Principia residents was compared with a “control” group of individuals, matched on a range of factors.

Cases—588 residents from 23 care homes that participated in the enhanced support programme.

? What variables do you think it • would be important to match on

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Care home characteristics

- Whether the care home supplied nursing care in addition to residential care
- Whether the care home was recorded as specialising in providing care to other groups besides older people, and which groups.
- The number of beds in the care home
- Whether the care home was located in a rural or urban setting (this was dichotomous variable, based on the urban/rural classification at LSOA level from the 2011 census)
- Socioeconomic deprivation deciles, based on the IMD 2015, available at LSOA level.

Resident characteristics

- Demographics – age, gender, ethnicity (white/non-white).
- Prior hospital activity in the year prior to the study start: number of emergency admissions, potentially avoidable emergency admissions, hospital bed days, A&E attendances, elective admissions, outpatient appointments.
- Emergency admissions and potentially avoidable emergency admissions in the year before the year prior to the study start.

Resident characteristics

- The Charlson Index, which is an aggregate measure of the burden of disease.
- Diagnosed conditions that are consistent with frailty—anxiety or depression; functional dependence; falls & significant fracture; incontinence; mobility problems; pressure ulcers; and cognitive impairment (a composite of delirium, dementia or senility).
- Other comorbidities identified (through other research) as strong predictors of future readmissions, e.g. chronic pulmonary disease, congestive heart failure and dementia.

Table A.4. Baseline resident characteristics before and after matching

	Potential controls	Matched controls	Principia
Total number of residents	2957	588	588
Total number of people	2957	422	588
Age	86.6 (7.2)	86.6 (6.7)	85.9 (7.5)
Female	66.2%	62.4%	62.1%
White	85.1%	90.5%	88.9%
Charlson index, based on recorded comorbidities in prior 2 years	2.1 (1.8)	2.2 (1.8)	2.3 (1.8)
Number of frailty comorbidities recorded in prior 2 years	1.9 (1.4)	2.0 (1.6)	2.1 (1.6)
Anxiety or depression in prior 2 years	17.0%	14.8%	16.7%
Cognitive impairment in prior 2 years	49.7%	51.9%	54.6%
Functional dependance in prior 2 years	13.4%	21.4%	24.5%
Fall or significant fracture in prior 2 years	46.5%	51.2%	52.4%
Incontinence in prior 2 years	10.6%	11.9%	14.1%
Mobility problems in prior 2 years	23.6%	21.1%	25.2%
Pressure ulcers in prior 2 years	13.5%	8.5%	8.5%

Comorbidities predictive of hospital readmission			
Metastatic cancer with solid tumour in prior 2 years	4.1%	5.6%	5.6%
Other malignant cancer in prior 2 years	12.4%	13.9%	16.3%
Chronic pulmonary disease in prior 2 years	18.2%	15.8%	17.5%
Congestive heart failure in prior 2 years	18.3%	15.0%	16.3%
Dementia in prior 2 years	46.1%	52.7%	52.7%
Diabetes with chronic complications in prior 2 years	1.6%	1.9%	2.2%
Hemiplegia or paraplegia in prior 2 years	4.2%	2.9%	3.2%
Moderate or severe liver disease in prior 2 years	0.4%	freq <10	freq <10
Other liver disease in prior 2 years	1.7%	freq <10	2.6%
Peripheral vascular disease in prior 2 years	6.7%	4.4%	6.8%
Renal disease in prior 2 years	0.4%	freq <10	freq <10

Previous hospital use (prior to entering care home)			
Emergency admissions in prior 2 months	0.5 (0.7)	0.5 (0.6)	0.4 (0.6)
Emergency admissions in prior year	1.9 (1.5)	1.8 (1.5)	1.7 (1.5)
Emergency admissions in year before prior year	0.7 (1.1)	0.6 (0.9)	0.7 (1.2)
Potentially avoidable emergency admissions in prior 2 months	0.2 (0.4)	0.1 (0.4)	0.1 (0.4)
Potentially avoidable emergency admissions in prior year	0.6 (0.9)	0.5 (0.8)	0.5 (1.0)
Potentially avoidable emergency admissions in year before prior year	0.2 (0.5)	0.1 (0.4)	0.1 (0.5)
Hospital bed days in prior year	38.5 (43.0)	38.6 (40.0)	38.4 (42.6)
A&E attendances in prior year	2.2 (1.9)	2.0 (1.9)	1.7 (1.6)
Elective admissions in prior year	0.4 (2.3)	0.3 (0.8)	0.4 (1.1)
Outpatient appointment in prior year	3.5 (6.1)	3.1 (6.1)	4.2 (6.2)
<i>Numbers presented are either mean (standard deviation) or percentage</i>			
<i>Percentages were suppressed where there was an underlying frequency of less than 10</i>			

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