Variations in healthy aging: the role of different risk factors

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SES variations in unhealthy ageing

- Persons with a lower education:
  - loose several years of life expectancy
  - loose even more years in good health
  - spend more years with health problems

  as compared to peers with a high education

- Differences are persistent

- Healthy ageing of high SES as an achievable target for society and a benchmark for research

This presentation

1. How large are educational disparities in life expectancy (LE) and disability-free life expectancy (DFLE) in Europe in the 21st century?

2. **What is the contribution of specific risk factors on LE and DFLE and on educational disparities in LE and DFLE?**
   - **1 risk factor: low fruit & vegetable intake (F&V)**
   - **focus on how to assess contribution of risk factors**

Lifepath project: new data for DFLE by education

	Mortality		Disability	
	Period	Source	Period	Source
Austria	2011-2013	Census follow up	2010-2014	EU-SILC
Belgium	2006-2011	Census follow up	2008-2011	EU-SILC
Finland	2011-2014	Census follow up	2010-2014	EU-SILC
Italy	2010-2012	Survey follow up	2010-2014	EU-SILC
Lithuania	2011-2014	Census follow up	2010-2014	EU-SILC
Spain	2007-2011	Census follow up	2008-2011	EU-SILC

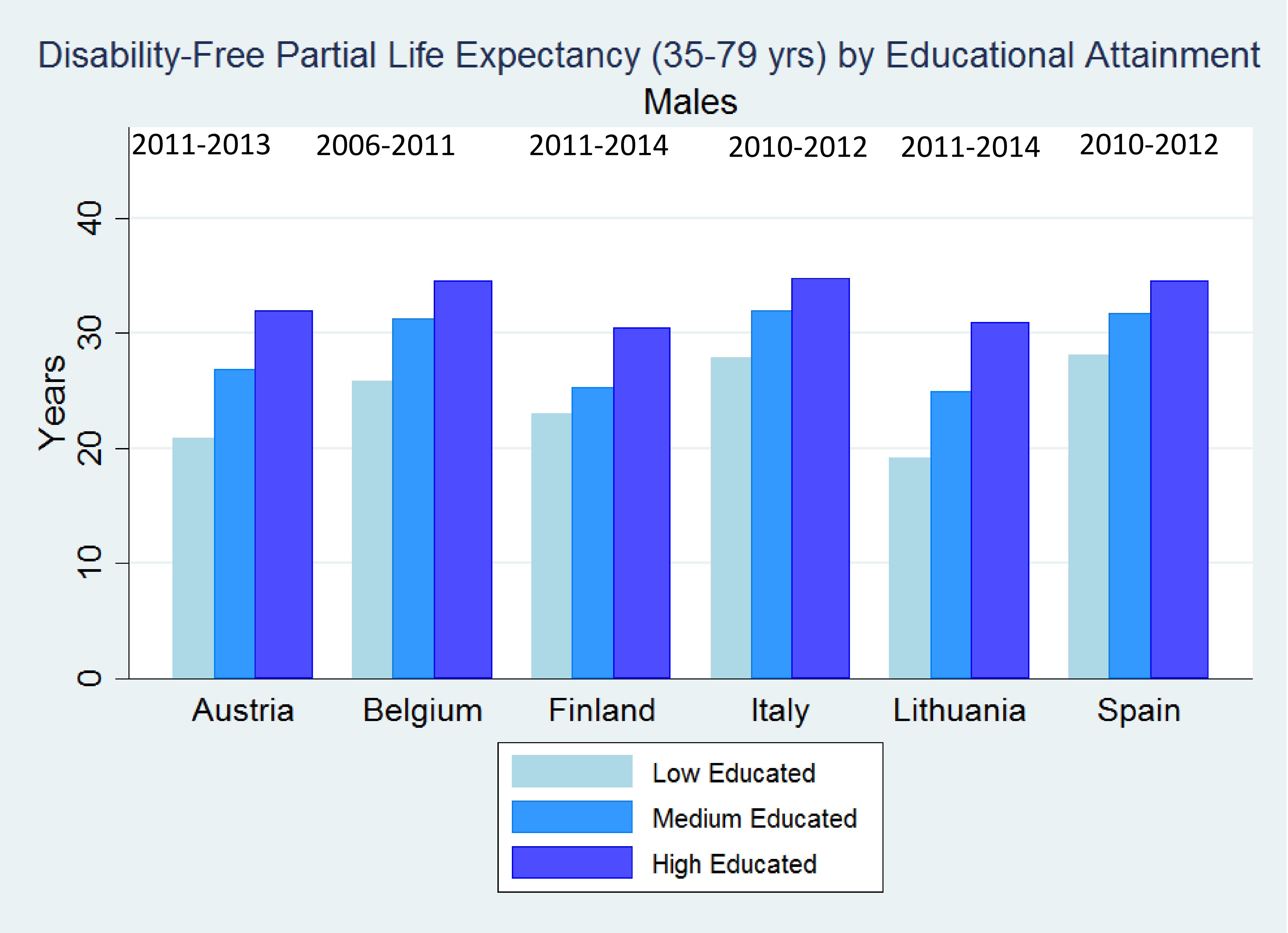
*EU-SILC harmonized questionnaire since 2008

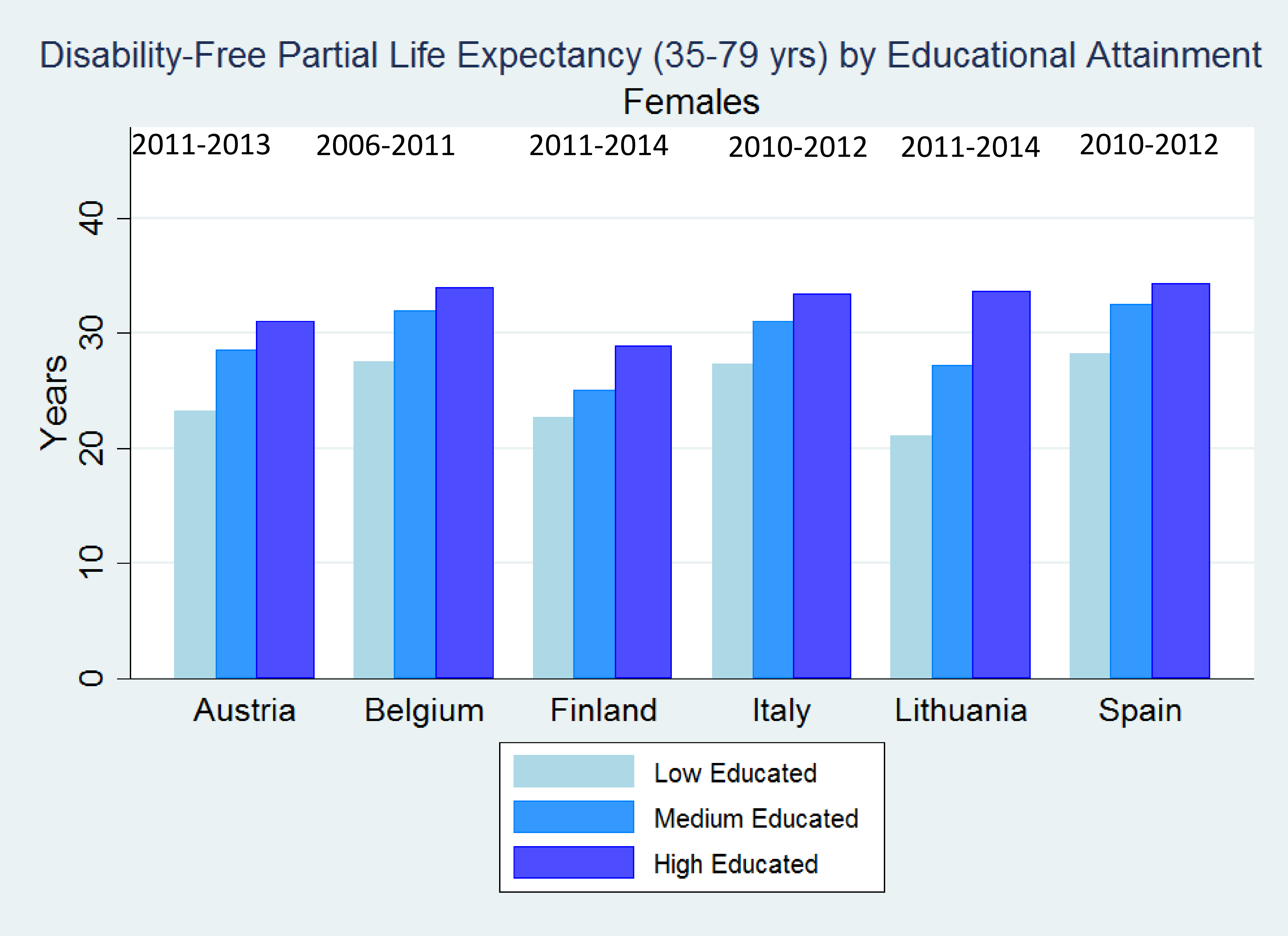
More countries to follow

Standard methods for DFLE

From	How	To
Census/survey follow up	Deaths /PY	Mortality rates by age, sex and education
Survey	Disabled/N	% with disability by age, sex and education
Mortality rates % with disability	Sullivan life table method	Partial DFLE and LE with disability

- Partial life expectancies: between ages 35 and 79 years
- GALI limitations: for the past 6 months or more, limited or strongly limited in activities people usually do because of a health problem
- 3 education groups:
  - Low = ISCED 0-2;
  - Medium = ISCED 3-4;
  - High = ISCED 5-6


Disability-Free Partial Life Expectancy (35-79 yrs) by Educational Attainment
Males
2011-2013
2006-2011
2011-2014
2010-2012
2011-2014
2010-2012
Years
0
10
20
30
40
Austria
Belgium
Finland
Italy
Lithuania
Spain
Low Educated
Medium Educated
High Educated



Disability-Free Partial Life Expectancy (35-79 yrs) by Educational Attainment
Females
2011-2013
2006-2011
2011-2014
2010-2012
2011-2014
2010-2012
Years
0
10
20
30
40
Austria
Belgium
Finland
Italy
Lithuania
Spain
Low Educated
Medium Educated
High Educated

Contribution of risk factors

What is the contribution of life style factors to educational disparities in DFLE?

Focus on Fruit and Vegetable intake (F&V)

Two counterfactual scenarios:

1. complete elimination of low F&V intake
2. less than high educated has same F&V intake as high educated: high SES as benchmark

-> both scenarios no inequalities in F&V intake

Data: disability and F&V intake

	Fruit & Vegetable intake
Austria	ESS 2014
Belgium	EHIS 2008/09
Finland	ESS 2014
Italy	
Lithuania	ESS data End of May, not yet included
Spain	EHIS 2008/09

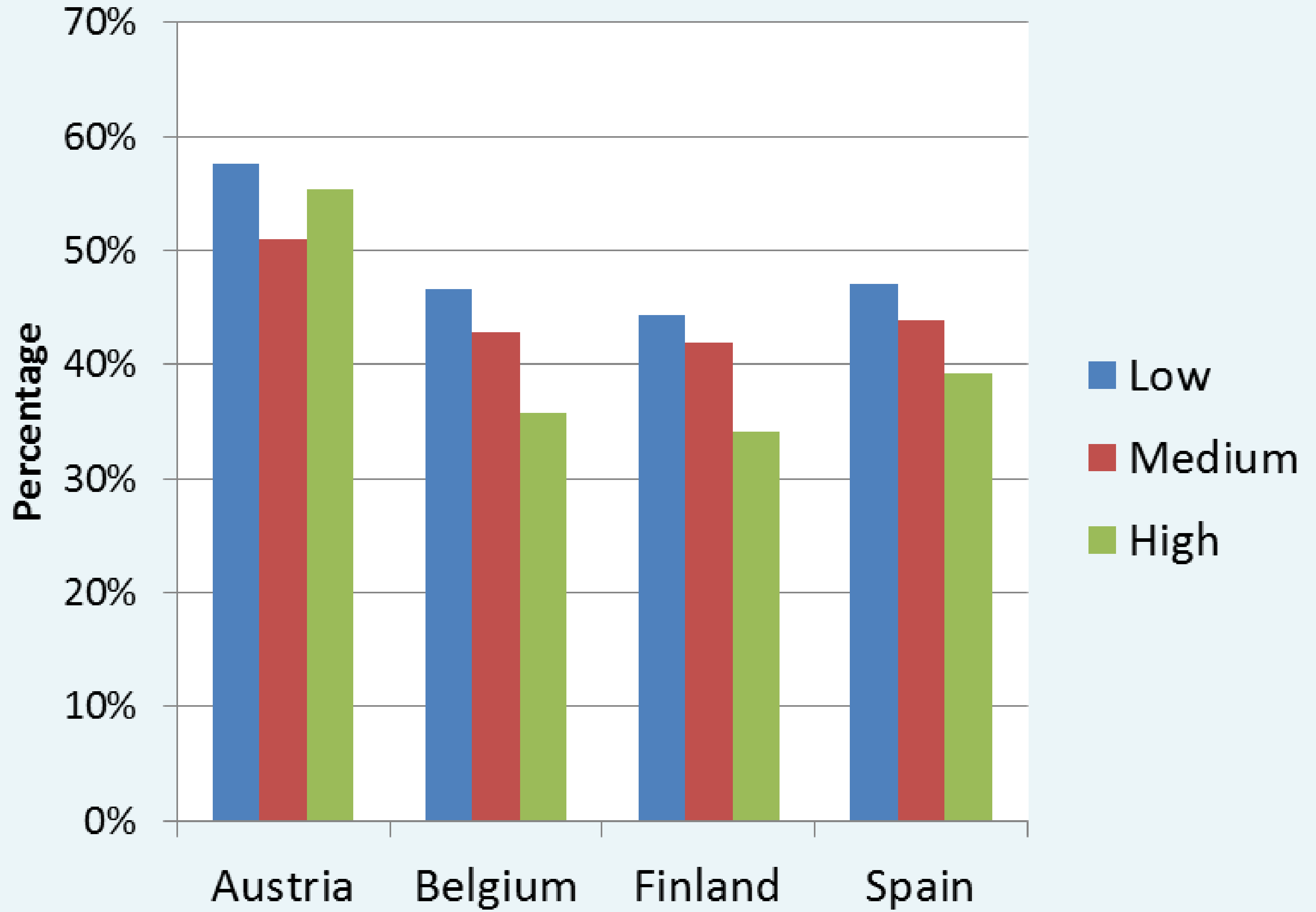
- Low in F&V: less than once a day fruit and vegetable intake

PAF approach

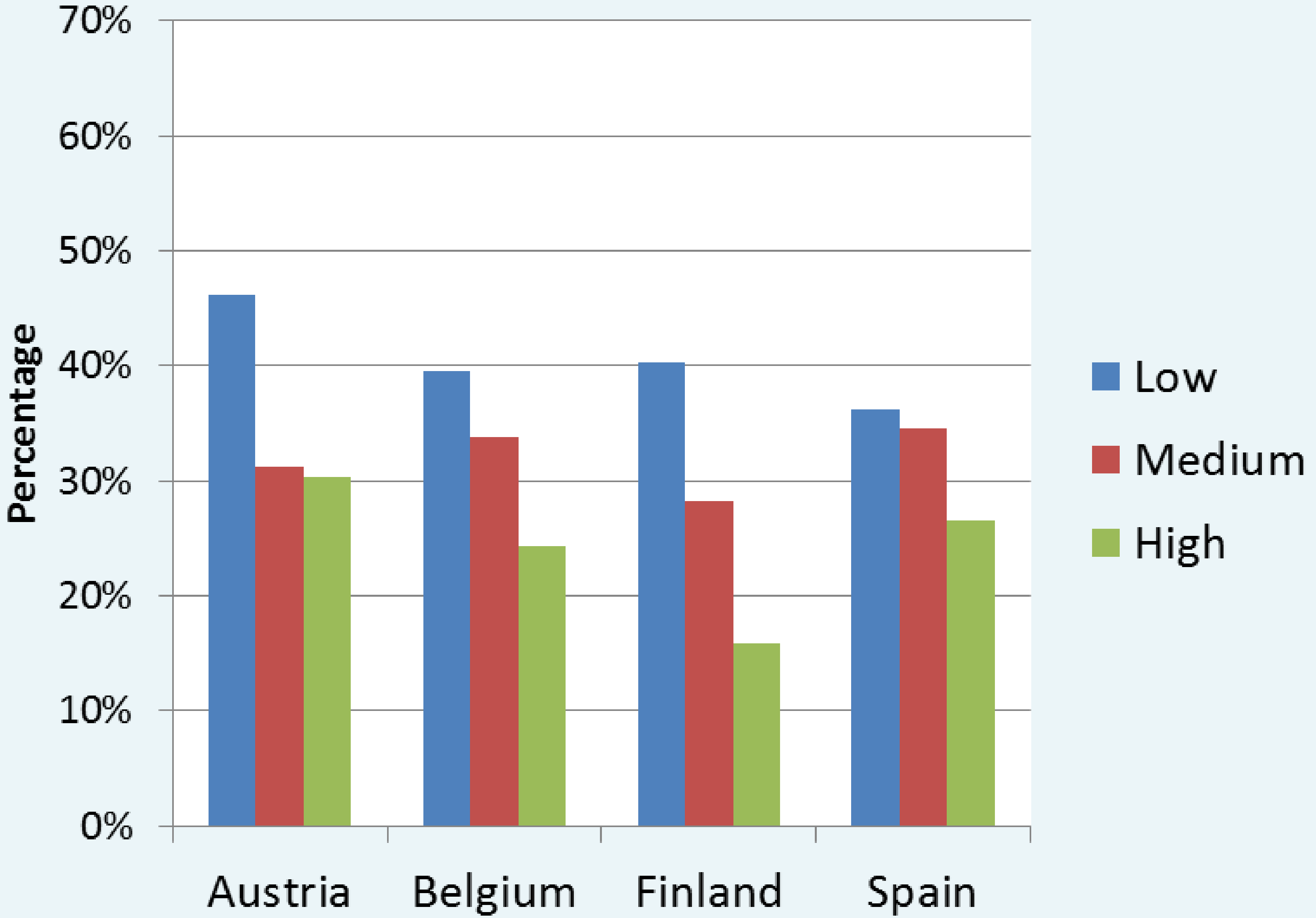
$$PAF = \frac{prevalence*(RR-1)}{(prevalence*(RR-1))+1}$$

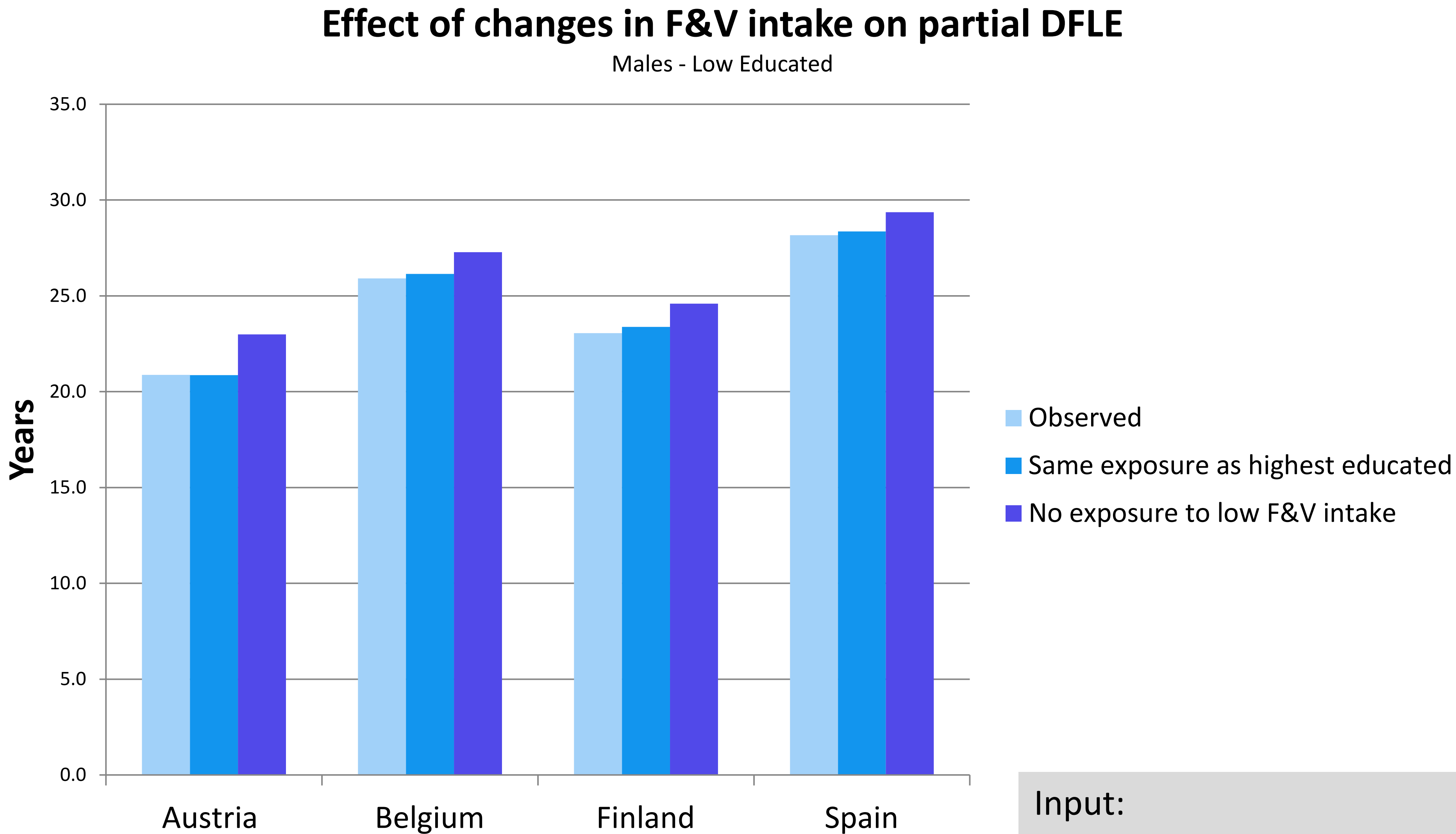
Survey (ESS, EHIS)	% low in F&V by age, gender and education
Meta-analyses Wang et al, 2014	RR F&V -> mortality: 1.17
Cohort study Artaud et al, 2013	HR F&V -> disability: 1.20
RR mortality % low in F&V	PAF mortality (% low F&V =0) PIF mortality (% low F&V = high SES)
HR disability % low in F&V	PAF disability (% low F&V =0) PIF disability (% low F&V = high SES)
(Sullivan) life table + PAFs	LE, DFLE elimination of low F&V
(Sullivan) life table + PIFS	LE, DFLE with all SES groups F&V exposure of highly educated

Prevalence of low F&V intake
Males



Prevalence of low F&V intake
Females

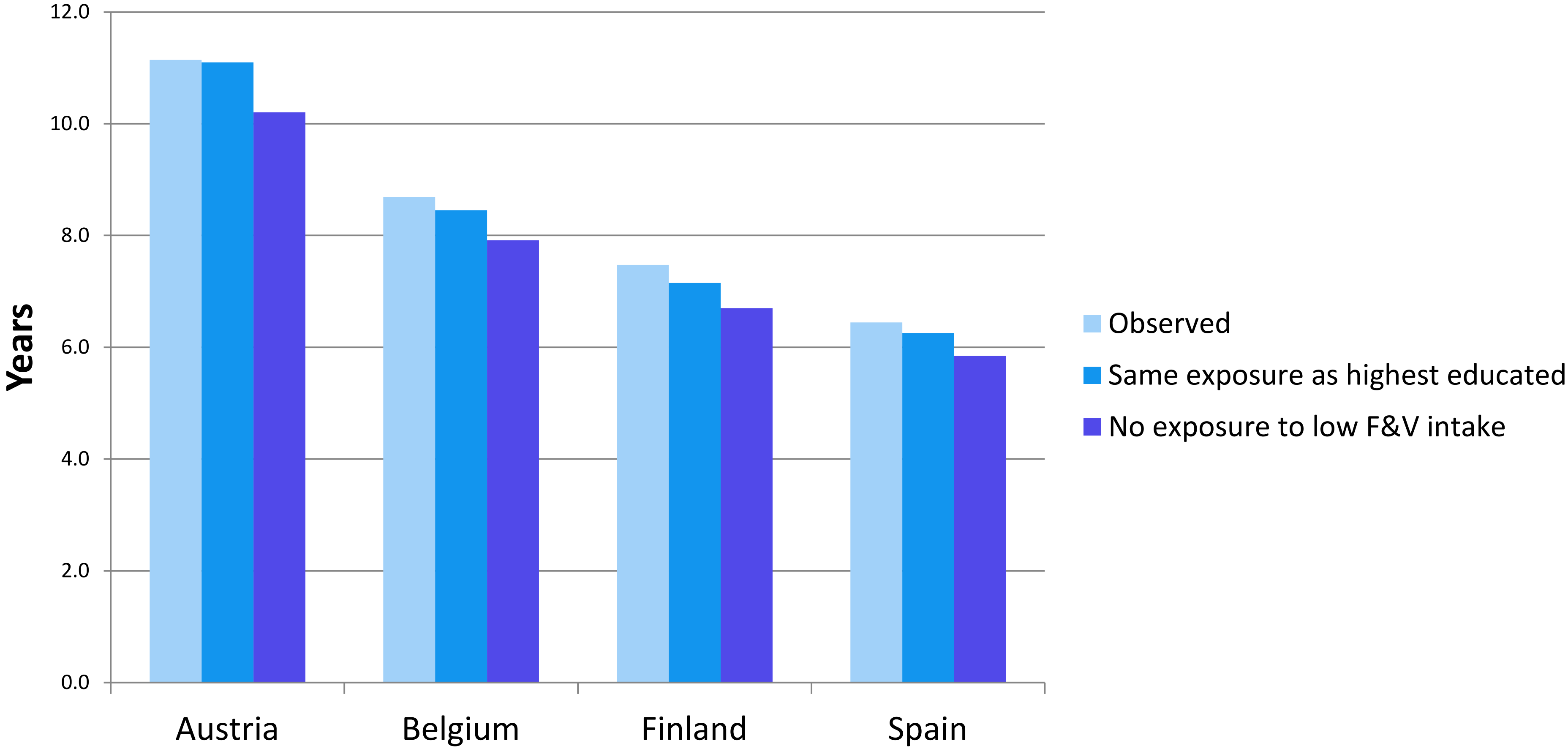




Input:
- RF Prevalence
- RR mortality: 1.17
- HR disability: 1.20

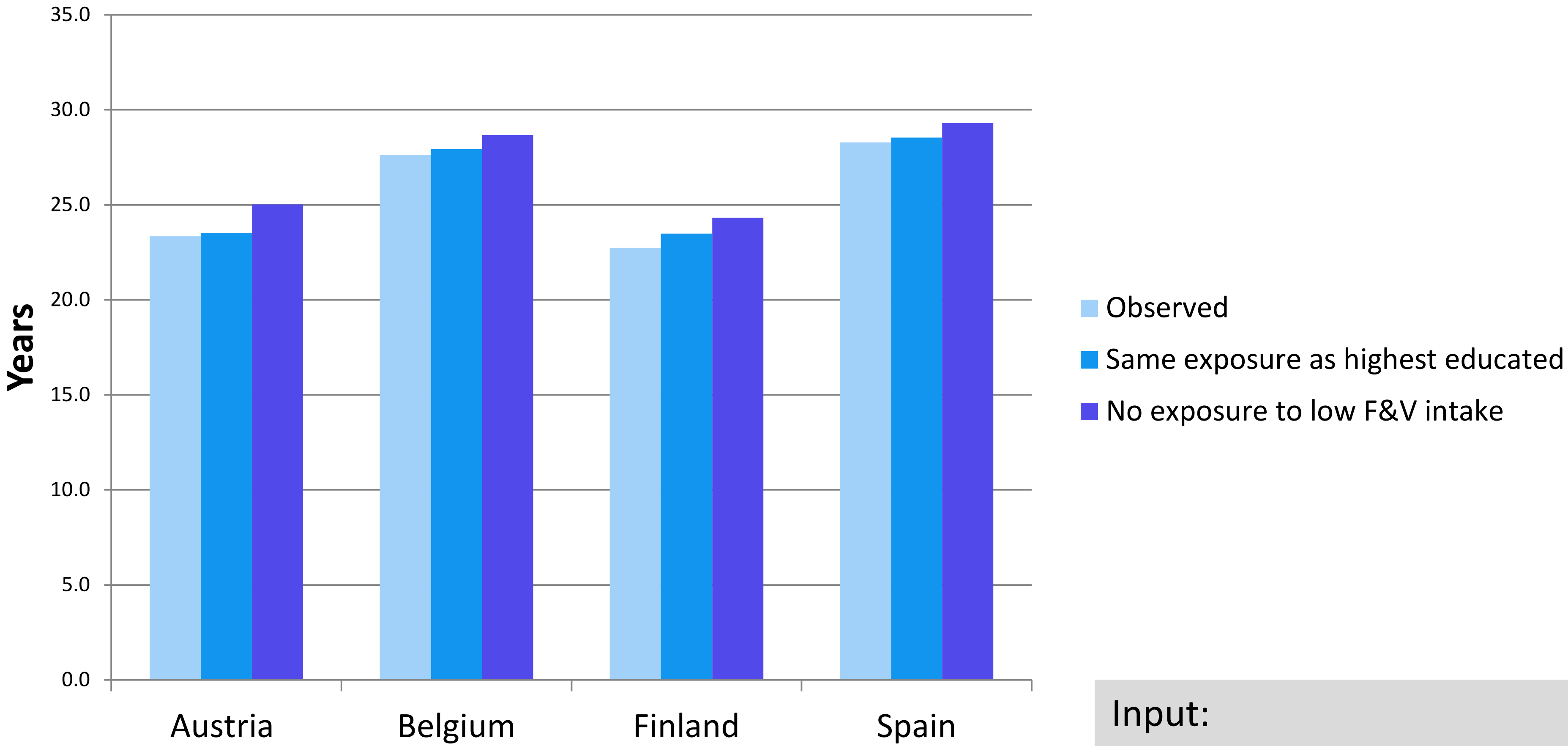
Effects of changes in F&V intake on educational disparities in DFLE (High vs low)

Males



Effect of changes in F&V intake on partial DFLE

Females - Low Educated



Input:
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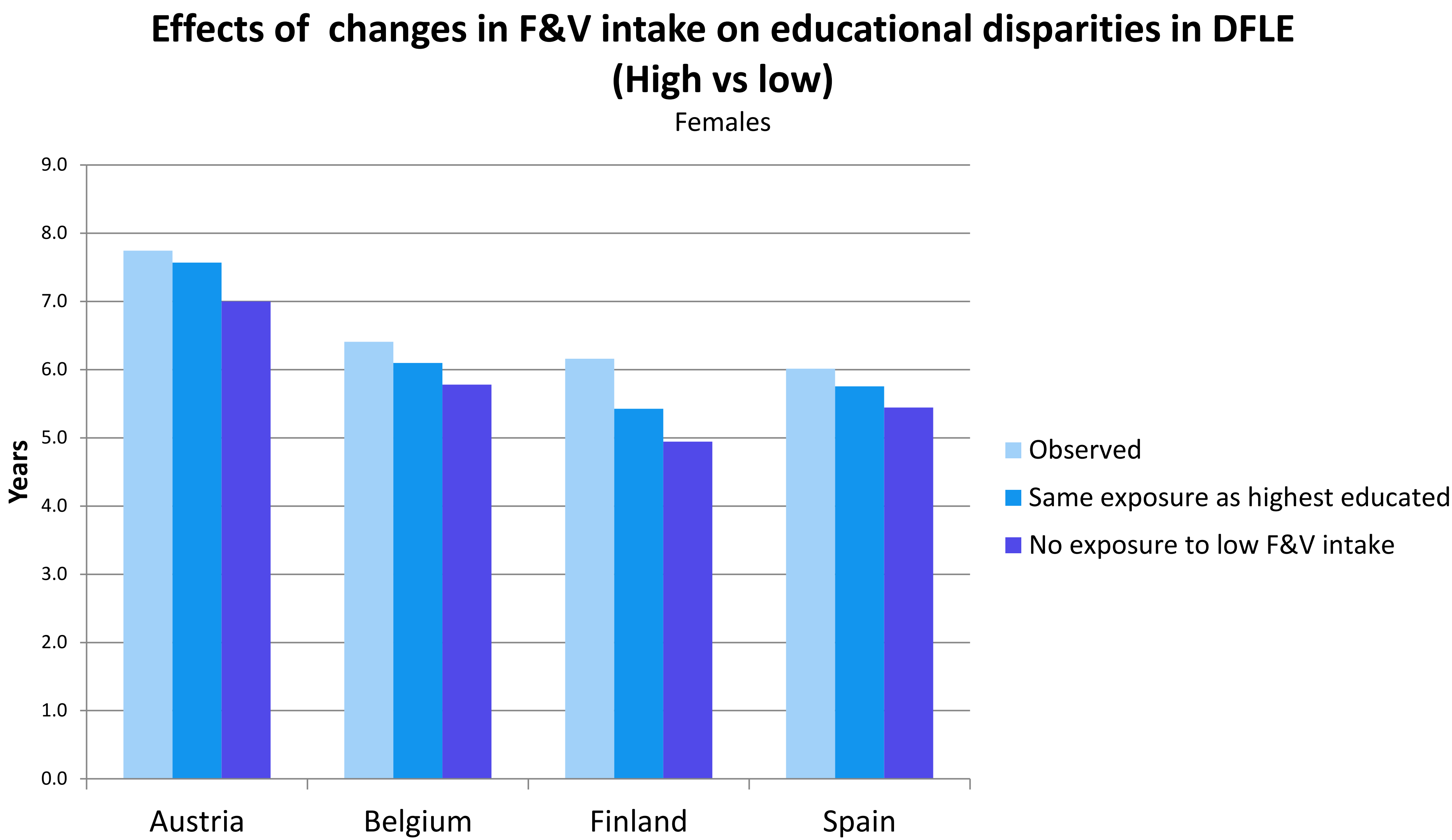
- HR disability: 1.20


Effects of changes in F&V intake on educational disparities in DFLE
(High vs low)
Females
Years
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Austria
Belgium
Finland
Spain
Observed
Same exposure as highest educated
No exposure to low F&V intake

Wrapping up

- Approach seems to work
- Preliminary analyses suggest that:
  - F&V intake varies by education and there is some contribution of inequalities in F&V intake to inequalities LE and DFLE
  - Educational disparities in LE, DFLE and F&V intake and the potential impact of changing F&V intake vary by gender and country

Challenges PAF

RRs linking exposure to disability

1. Different disability measure than in HE
2. Different exposure measure than for prevalence in the studied population
3. RRs for disability are scarce and based on a single study
4. RR for disability generally not published by age, gender and SES
5. RR for disability for some risk factors are absent

Alternative: fractions based on attribution method

- Attribution method to attribute disability to diseases using cross-sectional data (Nusselder & Looman, 2014)

- Disability due to a disease (cause) is determined by:
  (1) prevalence of the disease
  (2) disabling impact of the disease (cause) estimated with additive rate model)

- Method takes into account that:
  - People specified diseases (causes) can be disabled (background risk)
  - More than 1 disease (cause) can be present

- hazard for disability = sum of background hazard + disease hazards
- probability =(1-exp(- hazard for disability)).

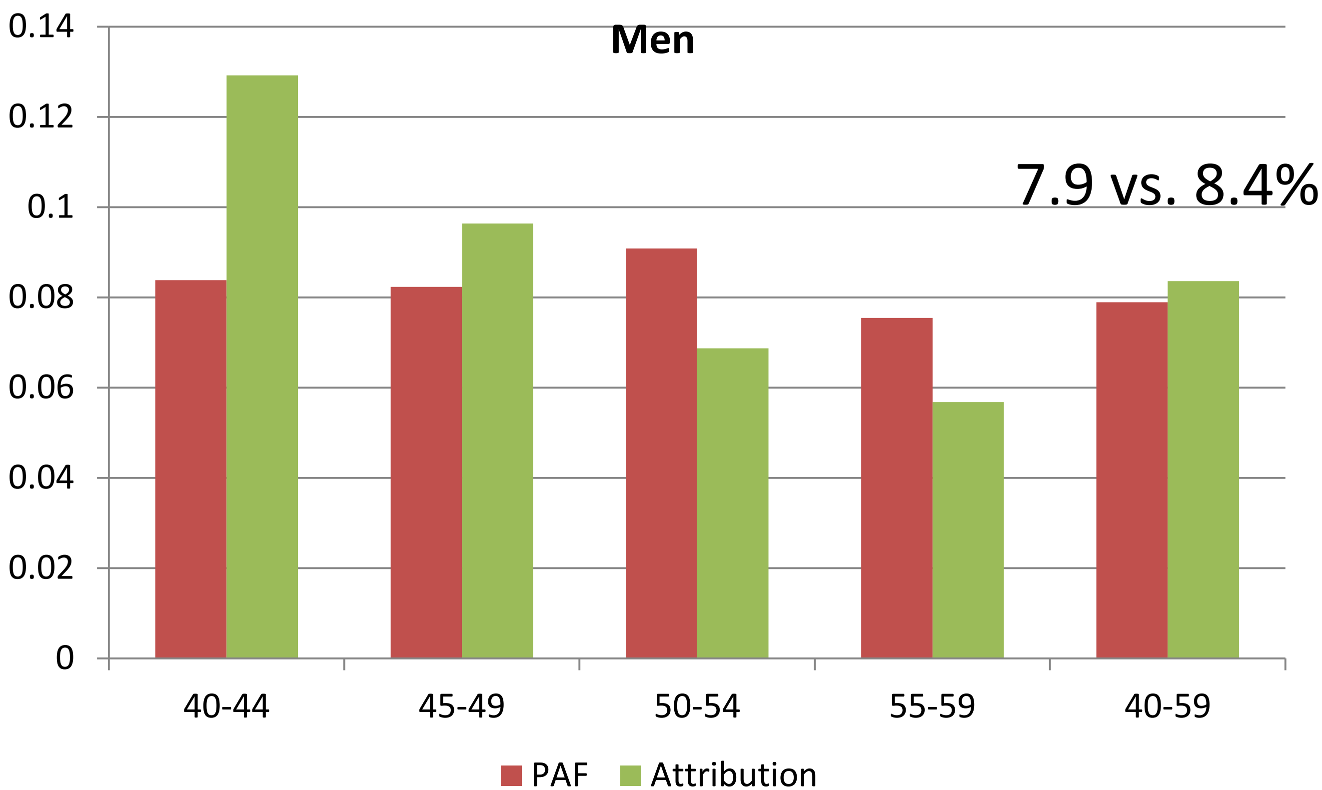
Alternative: fractions based on attribution tool (2)

- Use risk factors instead of diseases as causes of disability in attribution method
- Use cross-sectional individual data on risk factors, disability, age, and sex
- % prevalence of disability due to specific risk factor
- Similar interpretation as PAF

Comparison of approaches

- EHIS wave 1, Belgium, ages 40-59 years
- Risk factor = Fruit and vegetable intake (F&V intake)
- PAF: RR from authors study Artaud, 2013 for ages 60+: 1.20
  - PAF: same RR for both genders and all ages
- Attribution method: F&V, smoking, physical activity, overweight
  - Background and disabling impact can vary by age
- PAF and attribution method: F&V prevalence based on same selection in EHIS

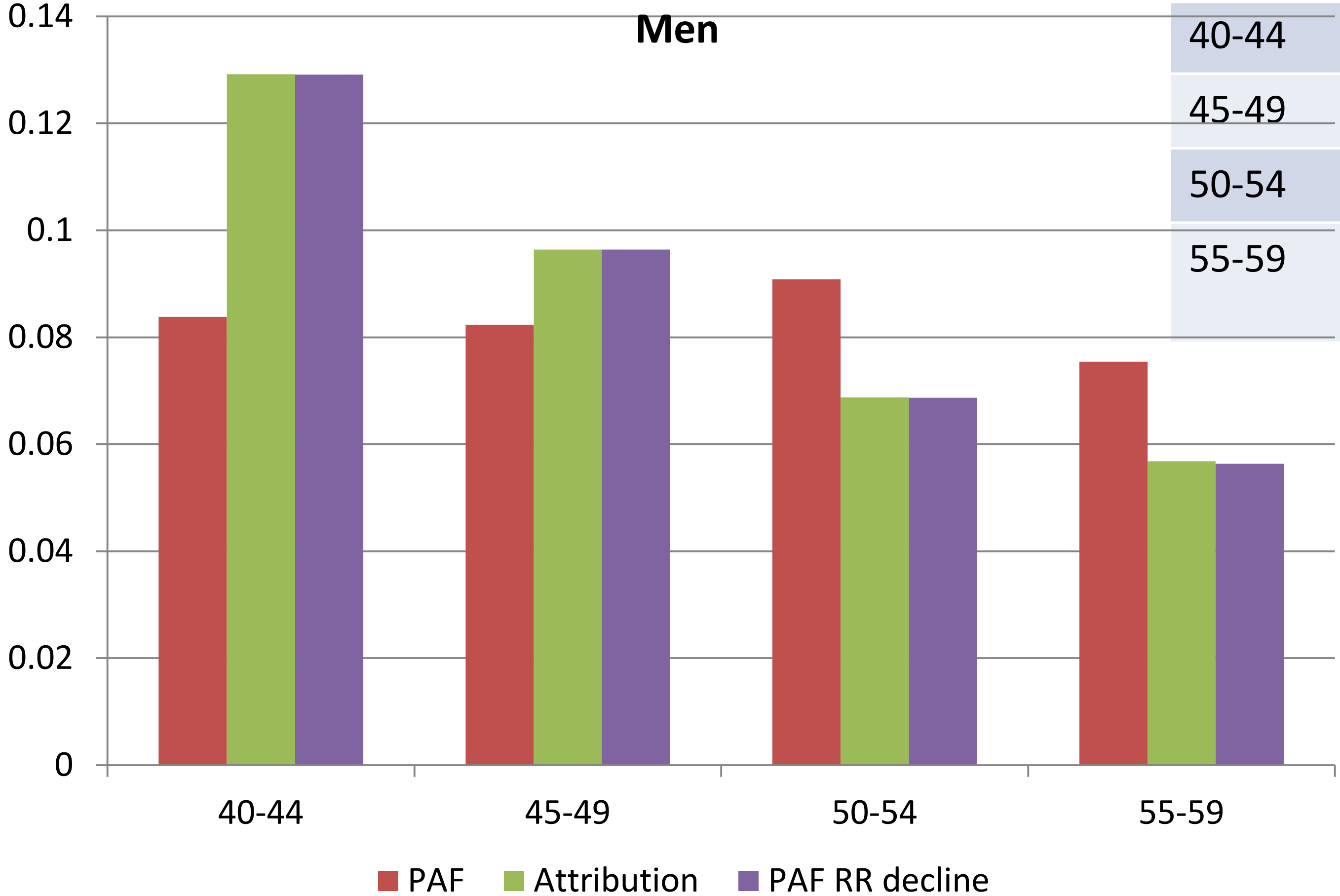
% disability due to lack of F&V intake based on PAF and attribution



PAF:
- RF Prevalence
- RR mortality: 1.17
- RR disability: 1.20

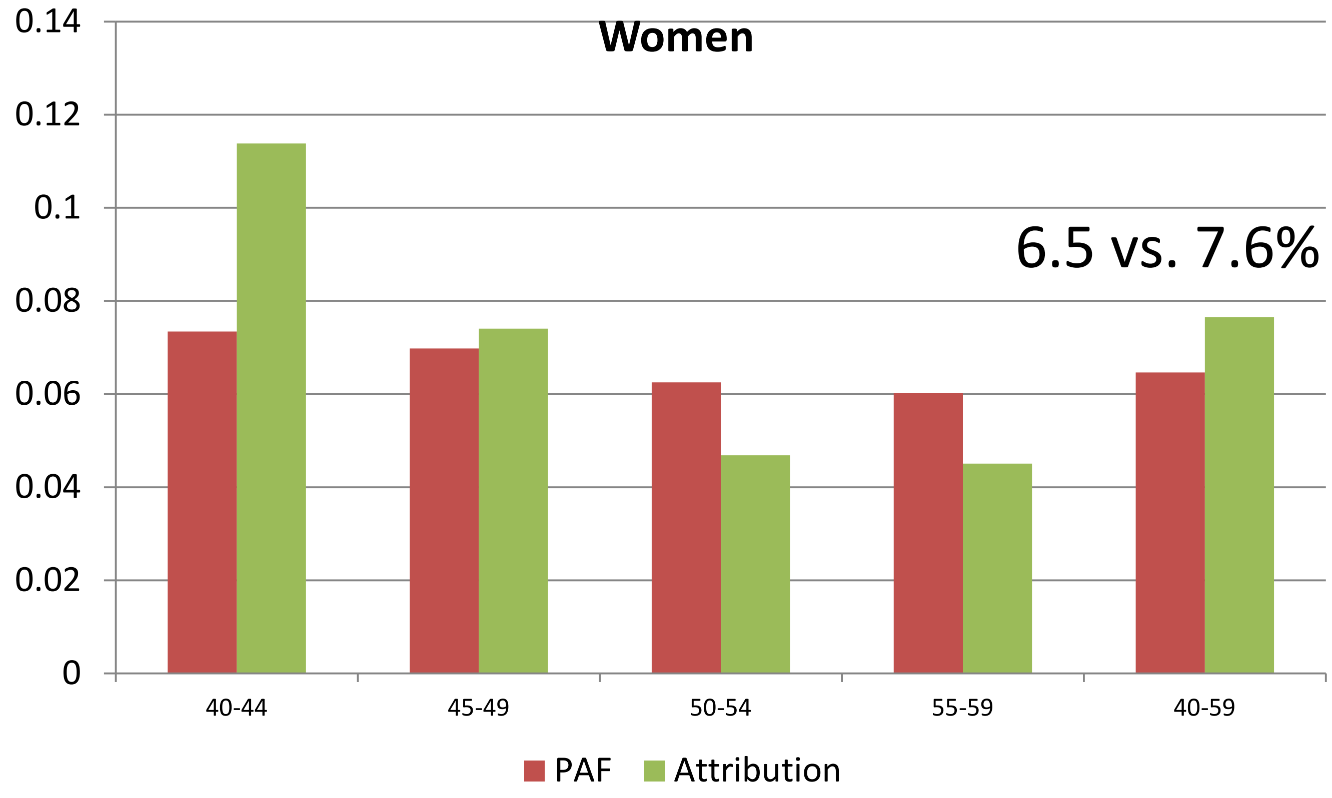
Attribution:
- Background 5 yr age group
- F&V, ever smoking, BMI, PA
- Background and RF effects same both gender

Effect of assumption constant RR for all ages in PAF



Age	RR in PAF	RR to get same as attribution
40-44	1.2	1.32
45-49	1.2	1.24
50-54	1.2	1,15
55-59	1.2	1.15

% disability due to lack of F&V intake based on PAF and attribution



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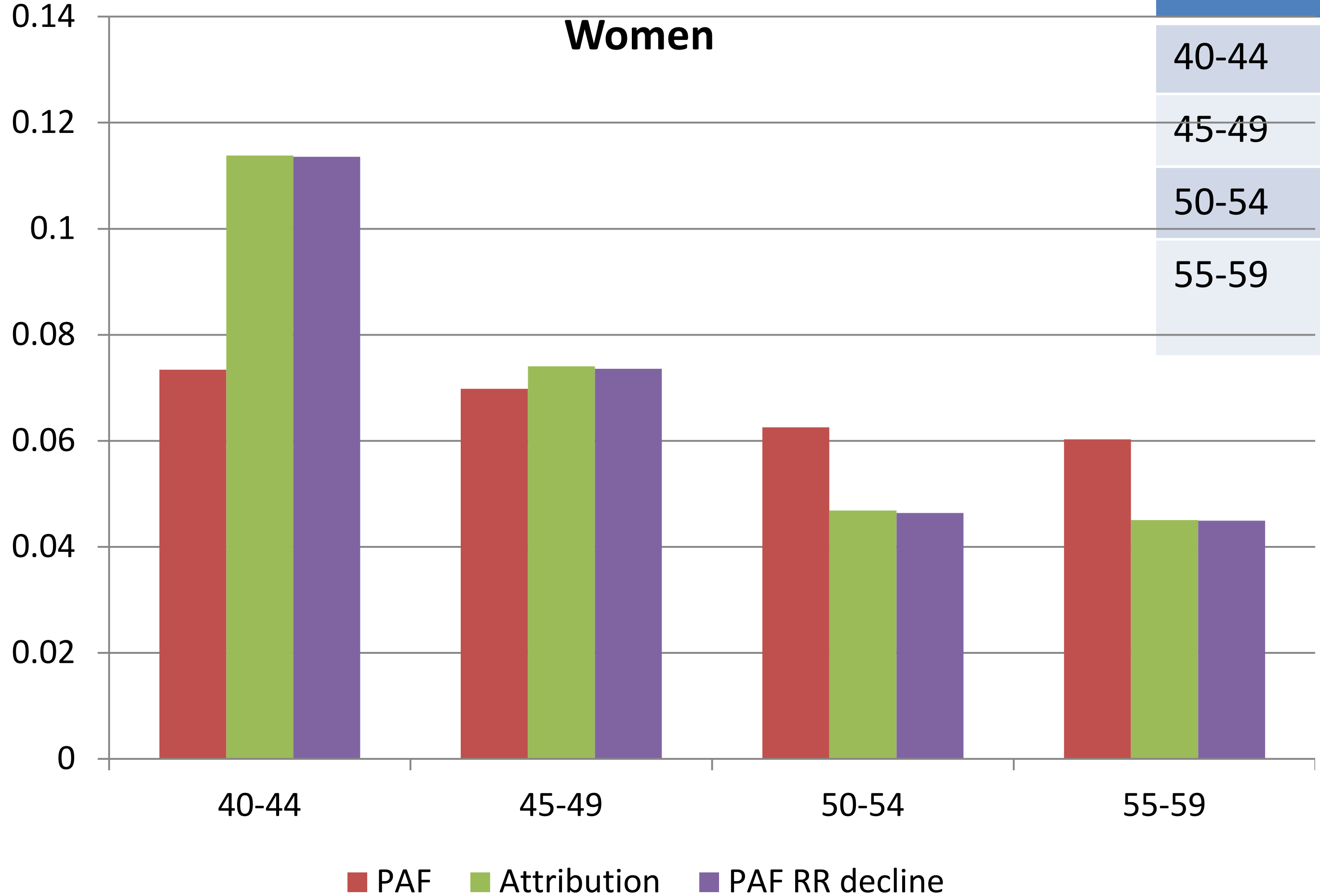
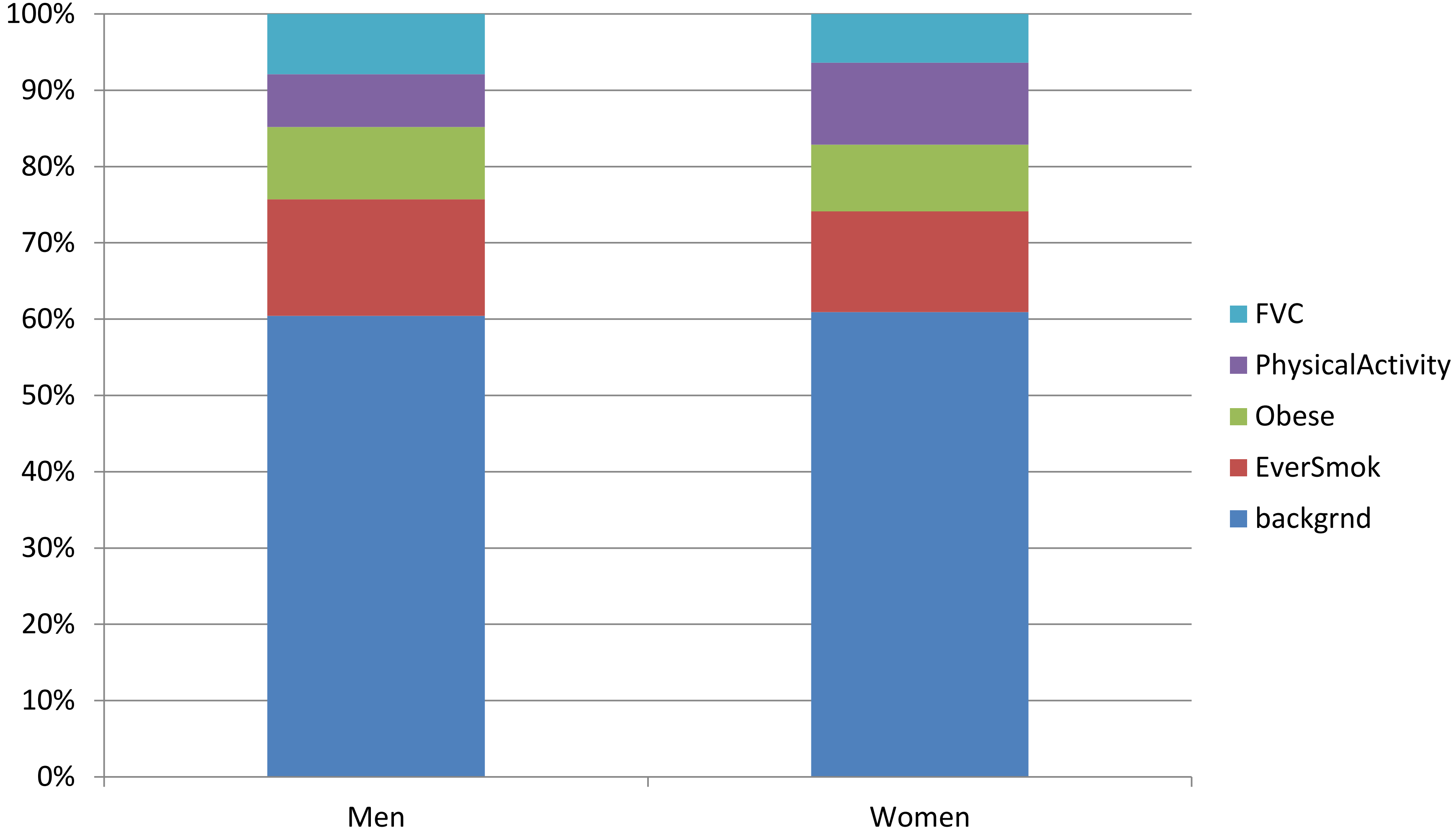


Attribution: more risk factors



Differences and similarities?

	PAF	Attribution
F&V intake	Daily vs. nondaily F&V intake	Daily vs. nondaily F&V intake
Disability	GALI based on health surveys	GALI based on health surveys
Link RF- disability	Direct link (immediate effect)	Direct link (immediate effect)
Causal effect	Ideally: RR meta-analyses Here: RR 1 observational study, corr. for other risk factors & excl. first years of FU	No causal effect from cross-sectional data
Competing risks	Not taken into account Sum >100%	Yes, here: smoking, BMI, PA, and "background"
Variations age, gender	Possible, limiting factor is published RR Here: single RR all ages and both genders	Possible, limiting factor is sample size Here background by age, no significant differences by sex
SES	Possible, limiting factor is absence of RR by SES	Possible (limiting factor is sample size)

Pros and cons PAF approach

Strong points:

- RR can be derived from best available (meta) meta-analyses
- Exposure can be obtained from best available data source
- More exposure categories possible
- Transparent approach

However:

- Limited evidence on RR linking risk factors to disability
- Definition of exposure in RR and population prevalence differs
- Definition of outcome in RR and in health expectancies differs
- RR by SES hardly available (same applies for age and gender)
- No competing risk factors taken into account: more risk factors, then attribution > 100%

Pros and cons attribution approach

Strong points:

- Consistent data on exposure and outcome in entire approach
- Data are available by country, sex and SES
- Takes into account competing risk factors

However:

- Cross sectional data cannot be used to infer causal effects
- High risk of reverse causation
- Assumptions proportionality of hazards violated if people jump between risk factor states
- Presence vs. absence of risk factor

No final conclusions

Only one risk factor, one age group, one country

Next steps:

- Extend to other age groups (small sample size)
- Extend to other risk factors
- Pooling multiple countries and/or multiple surveys

Conclusions on usefulness of each approach, general or for specific risk factors

Acknowledgements

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- We thank collaborative partners of LIFEPATH for providing data on mortality by education
- We thank Eurostat by providing access to the EU-SILC and EHIS dataset.
  - *EUSILC UDB 2008 – version 7 of March 2015*
  - *EUSILC UDB 2009 – version 7 of March 2015*
  - *EUSILC UDB 2010 – version 6 of March 2015*
  - *EUSILC UDB 2011 – version 5 of March 2015*
  - *EUSILC UDB 2012 – version 1 of January 2016*
  - *EUSILC UDB 2013 – version 3 of January 2016*
  - *EUSILC UDB 2014 – version 1 of January 2016*
  - *EHIS Wave 1 – 2006/09*

  The responsibility for all conclusions drawn from the data lies entirely with the author(s)

Thank you for your attention

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