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The effect of socioeconomic inequalities: Modeling the population health impact of introducing reduced-risk tobacco products in Germany

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Reduced-Risk Products (RRPs)

"Reduced-Risk Products*" or "RRP" is the term PMI uses to refer to products that present, are likely to present, or have the potential to present less risk of harm to smokers who switch to these products versus continued smoking.

Our study considers E-CIG and HnB



- ☐ What is the impact on population health of introducing reduced-risk products (RRP) in Germany?
- ☐ Does it differ because of socioeconomic (SE) inequalities?



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...estimated

☐ Does it differ because of socioeconomic (SE) inequalities?

...yes, it does



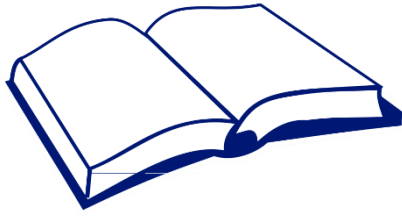
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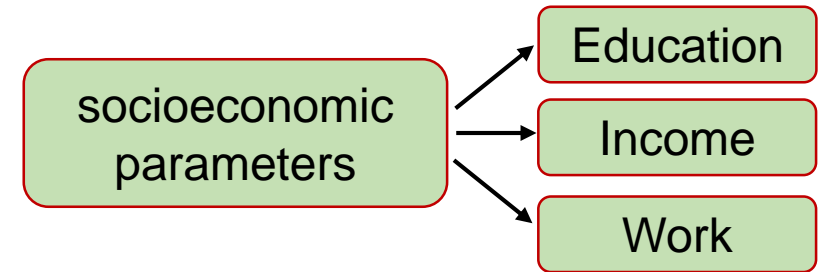
...yes, it does

- ☐ To generate the prevalence for binary socioeconomic status (SES) in the population for current, former, and never smokers as well as for RRP users

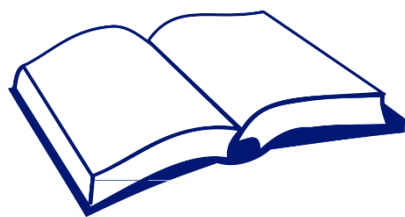


What was known before our study?

The differences in tobacco product usage can be explained by



Smoking prevalence and SES



What was known before our study?

The differences in tobacco product usage can be explained by

socioeconomic
parameters

Education

Income

Work

The SES of individuals is an important parameter for describing and understanding smoking prevalence in a population:

Low SES
(SES = B)



Smoking prevalence



Exposure to smoking environment



Success in quitting smoking



High SES
(SES = A)



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Socioeconomic inequalities

SES is defined (*Foreman et al., 2018*) on the basis of the sociodemographic index (*SDI*):

Z_1 (post-government income, log space) and Z_2 (education, mean years per capita)
are scaled 0 to 1 by using the smallest and largest values in each survey wave

$$SDI = \sqrt{Z_1 Z_2}$$

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Population split for low (B) and high (A) SES groups by the median of SDI:

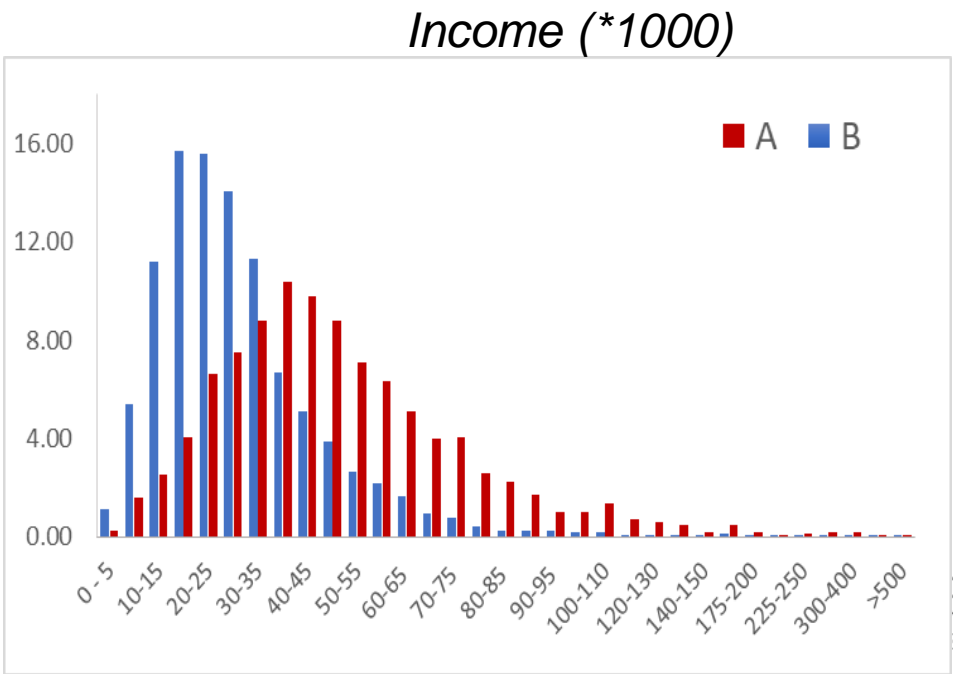
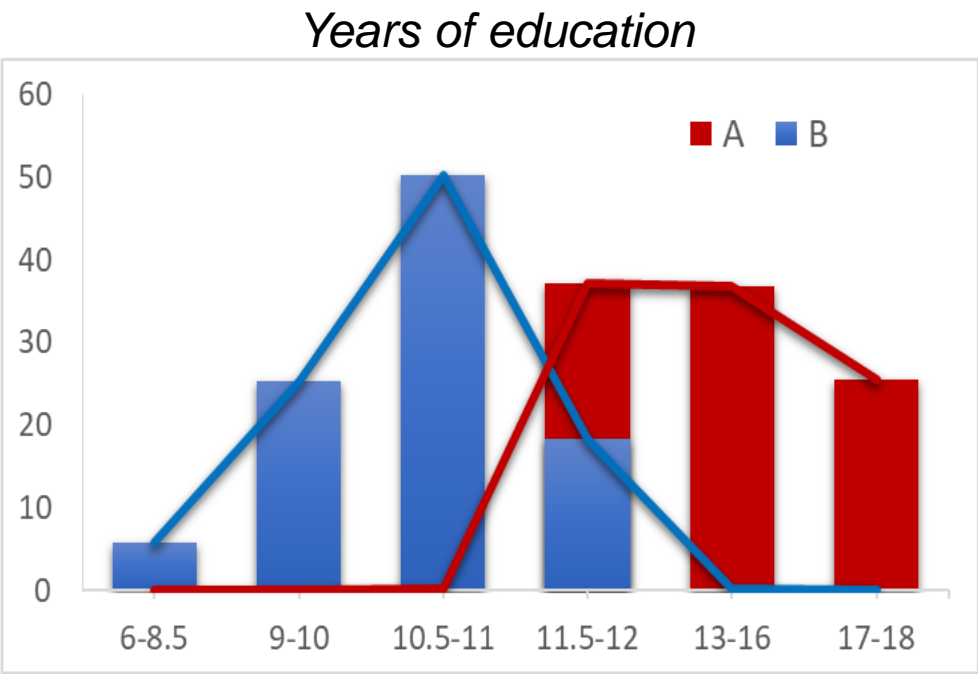


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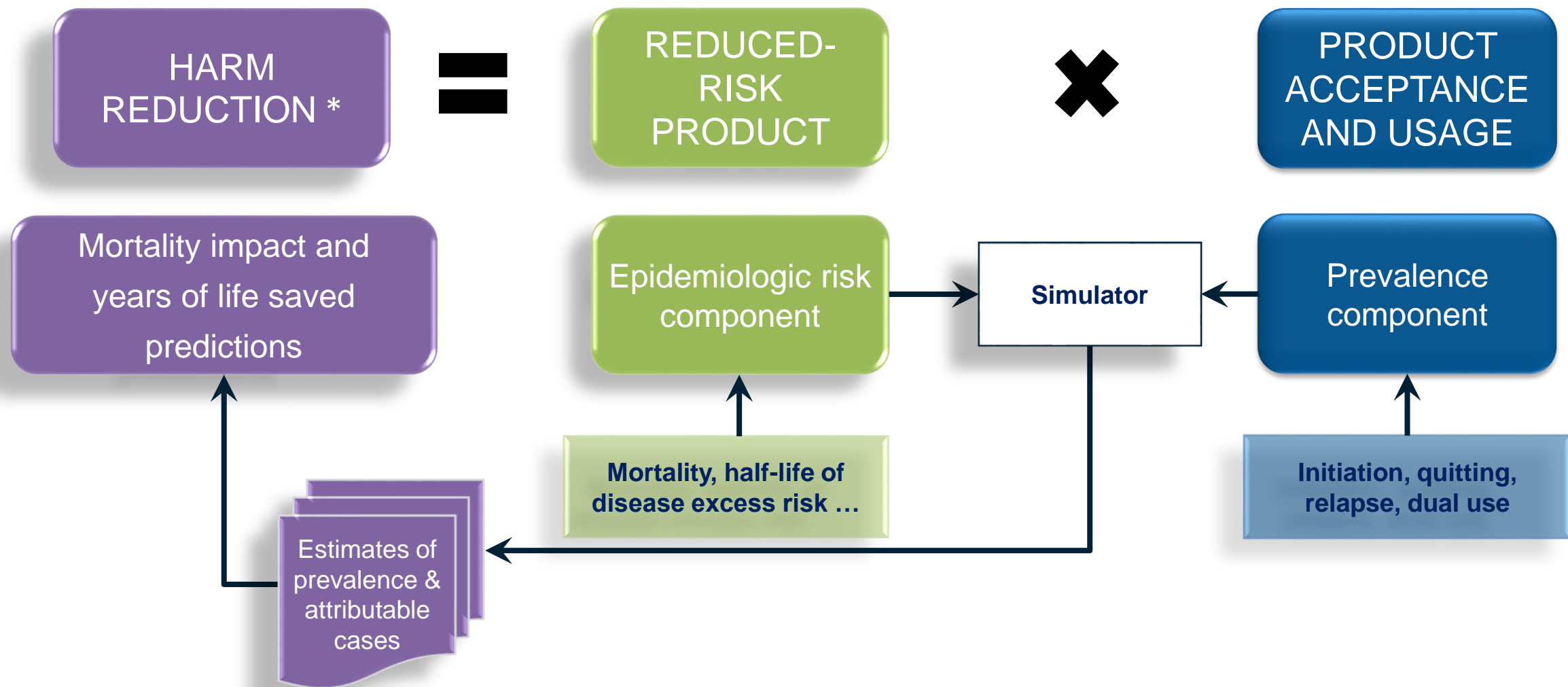
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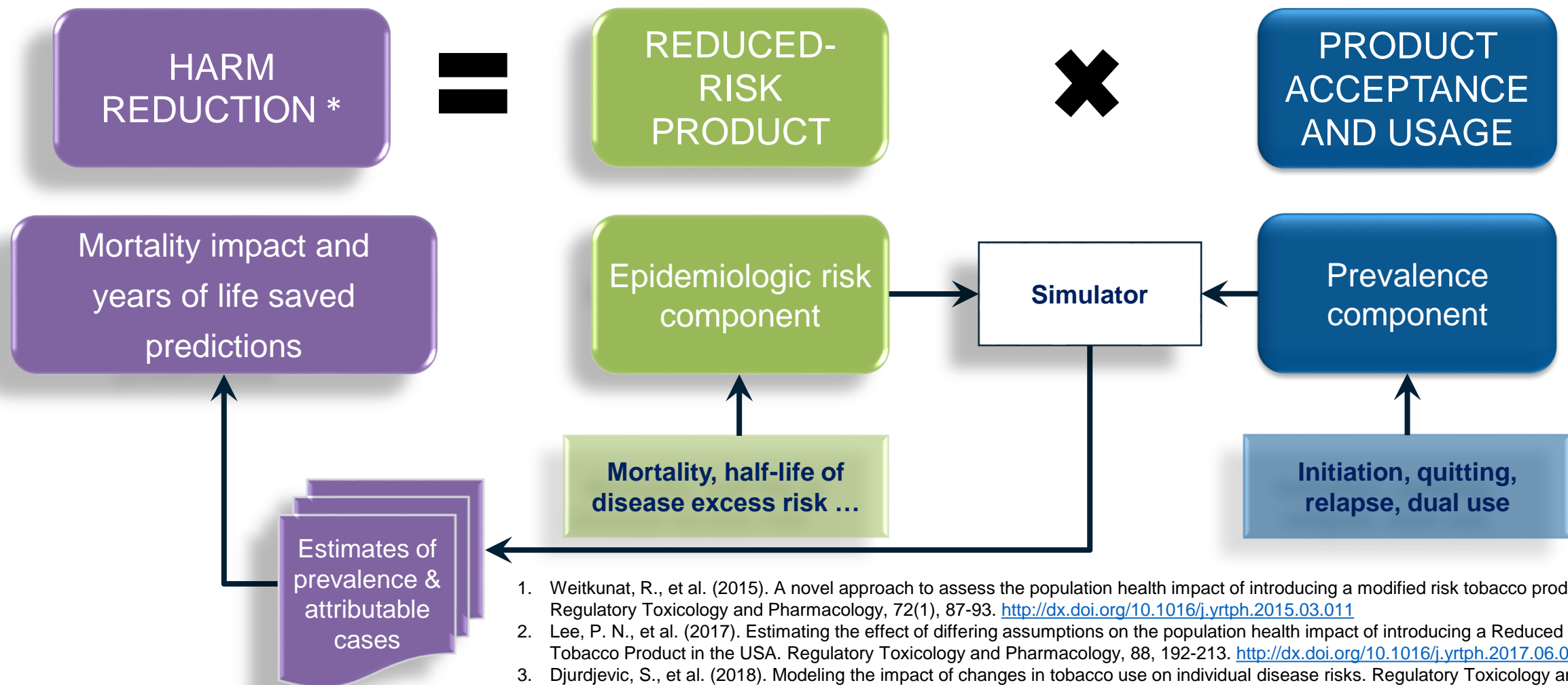
Methodology: Population Health Impact Model (PHIM)



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1. Weitkunat, R., et al. (2015). A novel approach to assess the population health impact of introducing a modified risk tobacco product. *Regulatory Toxicology and Pharmacology*, 72(1), 87-93. <http://dx.doi.org/10.1016/j.yrtph.2015.03.011>
2. Lee, P. N., et al. (2017). Estimating the effect of differing assumptions on the population health impact of introducing a Reduced Risk Tobacco Product in the USA. *Regulatory Toxicology and Pharmacology*, 88, 192-213. <http://dx.doi.org/10.1016/j.yrtph.2017.06.009>
3. Djurdjevic, S., et al. (2018). Modeling the impact of changes in tobacco use on individual disease risks. *Regulatory Toxicology and Pharmacology*, 97, 88-97. <https://doi.org/10.1016/j.yrtph.2018.06.001>
4. Djurdjevic, S., et al. (2018). Modeling the Population Health Impact of Introducing a Modified Risk Tobacco Product into the US Market. *Healthcare* 6 (2), 47. <https://doi.org/10.3390/healthcare6020047>
5. Djurdjevic, S., et al. (2018). Estimating the population health impact of introducing a reduced-risk tobacco product into Japan. The effect of differing assumptions, and some comparisons with the U.S.. *Regulatory Toxicology and Pharmacology*, 100, 92-104. <https://doi.org/10.1016/j.yrtph.2018.10.010>

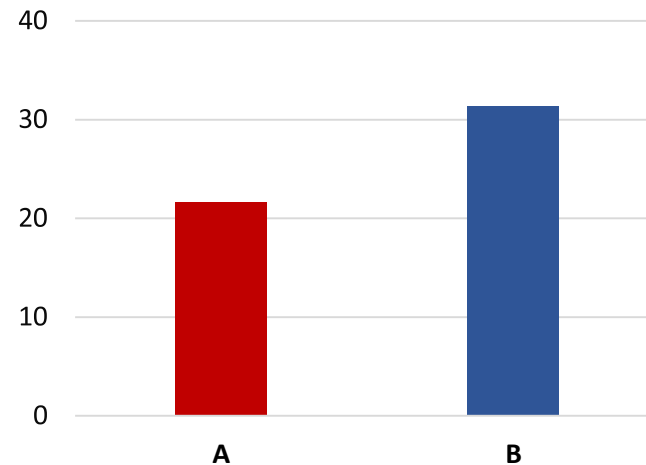
Data:

The datasets split by SES at the population level for years 2002 and 2012 have been used for SE modeling in PHIM: current, former, and never smoking prevalence data; quit time distribution (longitudinal data from the German Socio-Economic Panel (SOEP) described in working paper*); and population as well as mortality data for all causes and for four smoking attributable diseases, namely Lung Cancer, Chronic Obstructive Pulmonary Disease, Ischemic Heart Disease and Stroke

*https://www.uni-saarland.de/fileadmin/user_upload/Professoren/fr12_ProfKaul/Research/2019_05_13_Quitting_Smoking.pdf

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current smoking prevalence for two SE groups in year 2012

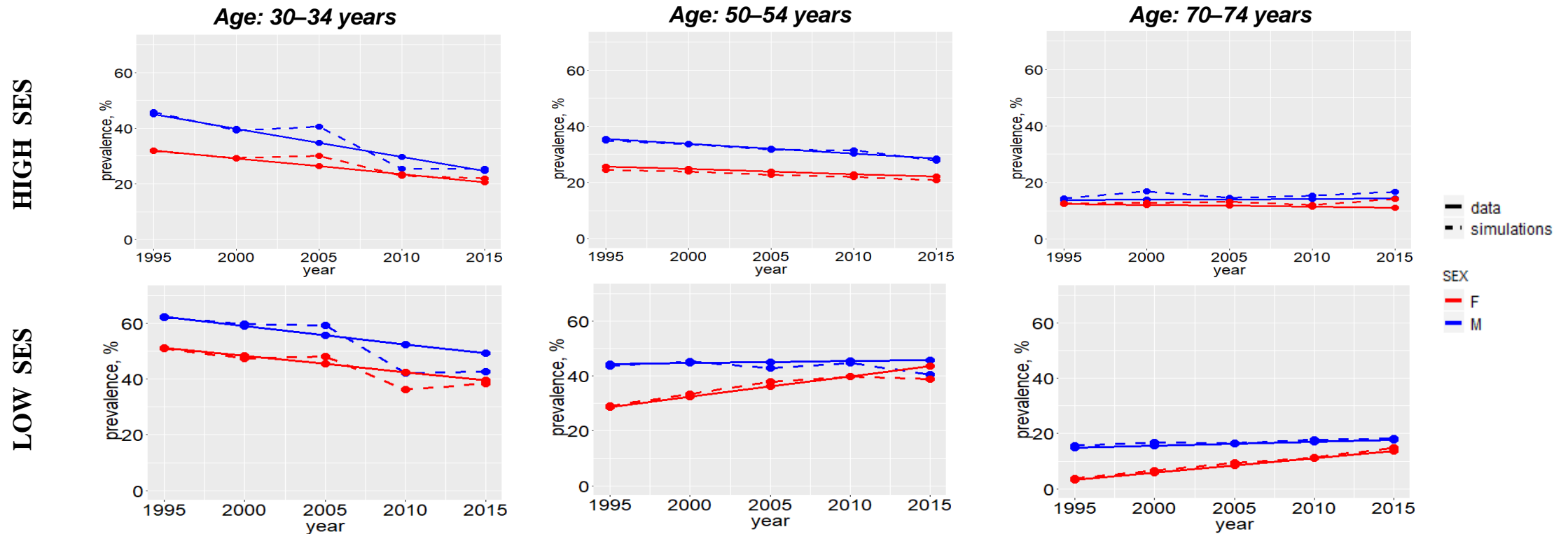
Hypothesis:

The effect of introducing RRP's on population health in Germany will be greater for the low SE group (B) than for the high SE group (A).

*https://www.uni-saarland.de/fileadmin/user_upload/Professoren/fr12_ProfKaul/Research/2019_05_13_Quitting_Smoking.pdf

The model was tested under the Null Scenario

Distribution of current smoking habits among men and women as given by real data compared with estimates from the PHIM using the set of TTPs developed for the Null Scenario*.



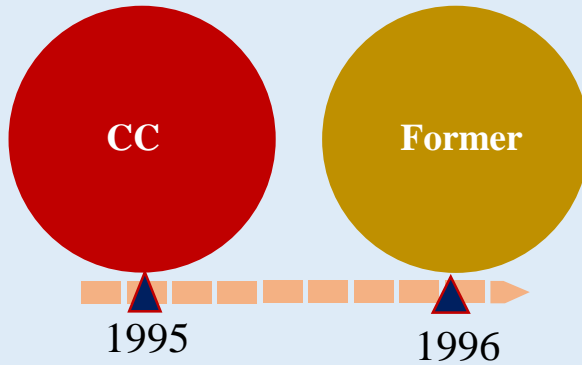
Conclusion:

Overall, the assumptions for the PHIM were a reasonable fit with actual current smoking prevalence for the age groups of 30–34, 50–54, and 70–74 years in the German market over the duration of the tested simulations.

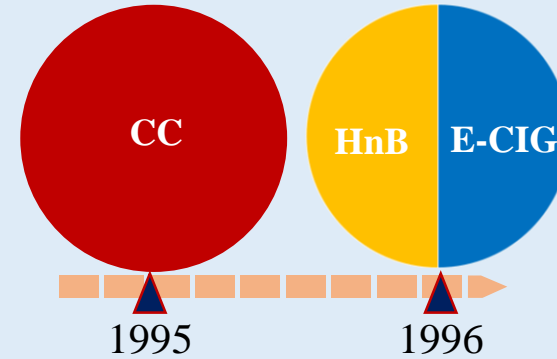
The model was tested under four RRP scenarios for Germany

EXTREME

All quit

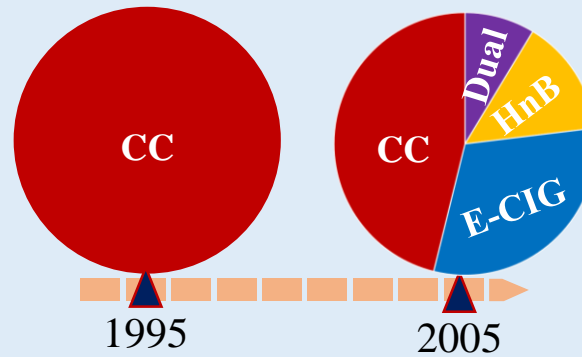


All switch to RRP: 50% HnB/50% E-CIG

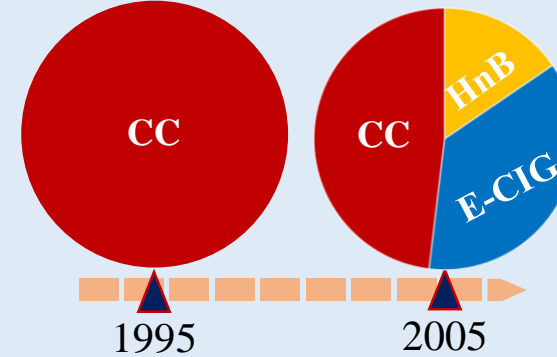


“REALISTIC”

Conversion: 15.5% HnB/36.4% E-CIG
(84% conversion rate)

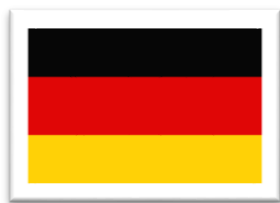


Full Conversion: 15.5% HnB/36.4% E-CIG
(100% conversion rate)



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RRP scenarios results: Prevalence

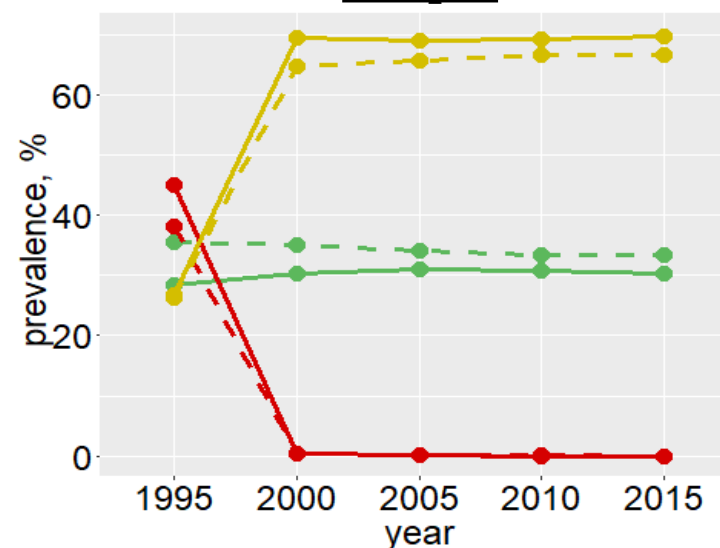


Scenarios*

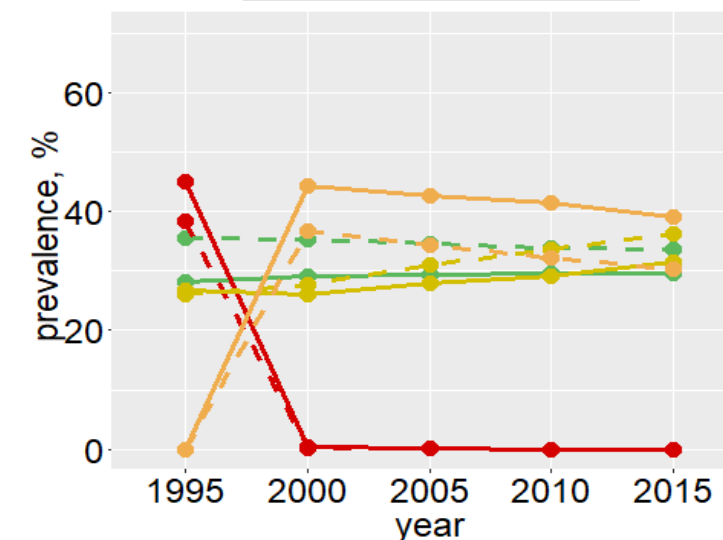
1. All quit
(all stop smoking after one year)
2. All switch to RRP
(exclusive RRP use after one year)
3. RRP business case: conversion
scenario (HnB uptake of 15.5% and E-
CIG 36.4%, with 84% being exclusive
RRP use and 16% dual use after 10
years)
4. RRP business case: full conversion
scenario (HnB uptake of 15.5% and E-
CIG 36.4%, with full conversion rate
after 10 years)

*Presented only results for men

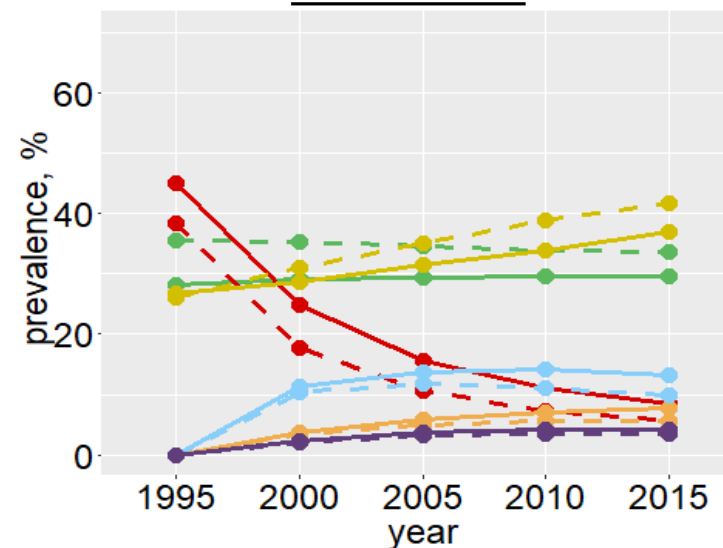
All quit



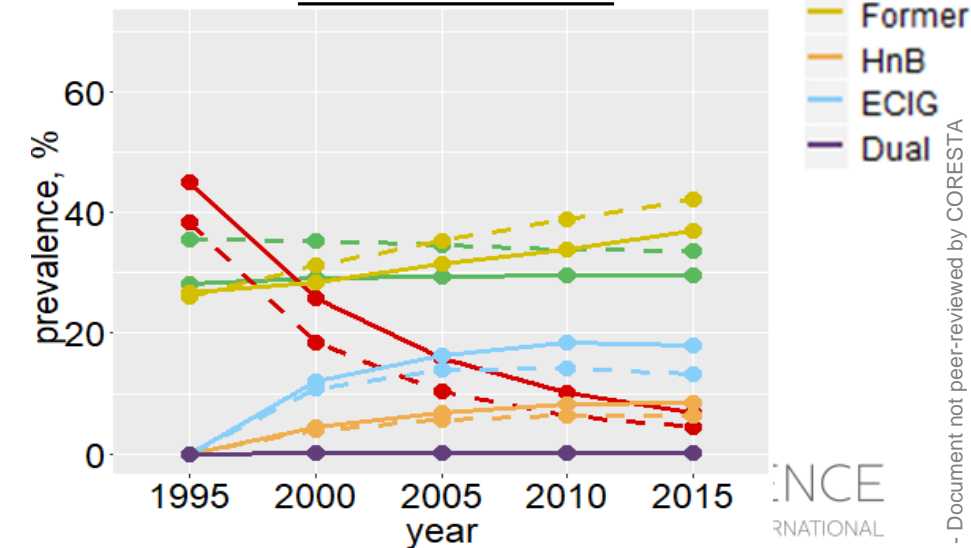
All switch to RRP



Conversion



Full conversion


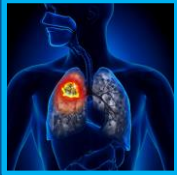





SES
- - A
- B

Never
CC
Former
HnB
ECIG
Dual

INCE
RNATIONAL

RRP scenarios results: Reduction of SADs and YLS*

Scenario	SES	Reduction in lung cancer deaths	Reduction in IHD deaths	Reduction in stroke deaths	Reduction in COPD deaths	Reduction in cumulative attributable deaths (all 4 diseases)	Years of life saved 75 years (life expectancy) (all 4 diseases)
							
All quit	A	26252	43294	9311	6943	85,802	1,363,403
	B	43571	61175	14086	13709	132,543	1,588,261
All switch to RRP	A	20219	34457	7640	5659	67,978	1,073,849
	B	33954	49228	11590	11220	105,994	1,256,371
Conversion scenario (HnB uptake of 15.5% and E-CIG 36.4%, with 84% being exclusive RRP use)	A	8434	15668	3581	2661	30,344	461,055
	B	13787	21222	5235	5064	45,309	513,172
Full conversion scenario (HnB uptake of 15.5% and E-CIG 36.4%)	A	9058	16779	3808	2843	32,490	491,930
	B	14809	22580	5575	5413	48,378	546,095

*YLS: Years of life saved; SAD: Smoking attributable deaths

A significant positive effect of introducing RRP's on population health in Germany has been estimated: The conversion scenario resulted to a cumulative total of 75,653 fewer SADs over the 20-year period, if 51.9% of the smoking population move away from cigarettes (15.5 % switch to HnB and 36.4% to E-CIG).

The effect of socioeconomic inequalities based on education and income was quantified: The reduction in smoking-attributable deaths over the 20-year period is 1.49 (1.54) times higher for low SES group than that for high SES group in the conversion scenario ("All quit" scenario)

Manuscript for submission: "The effect of socio-economic inequalities: modeling of population health impact of introducing reduced-risk tobacco products into Germany"

Rytsar R., Djurdjevic S., Nussbaum A., Kaul A. and Bennewitz E.

Thank you for your attention.

Any questions?

