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Understanding the relationships between substance use disorders and other health outcomes, with a special focus on cancer

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Background

- Alcohol consumption, smoking, and excess weight independently increase the risk of morbidity / mortality
- Some of these outcomes are the same, e.g. liver disease, cancer, dementia, CVD, diabetes etc.
- Most epidemiological research looks at the independent association between a risk and an outcome, e.g. alcohol but not smoking, smoking but not alcohol
- In reality – risks co-occur! (11.2 million adults in England have 2+ risks)
- It is helpful to explore joint-risk relationships

A note on statistical interaction

- Two risks may act independently or interact
- **Interaction:** the extent to which the joint association differs from the independent associations (additive, multiplicative)

Synergistic interaction is when the risk from two exposures results in a greater risk than the sum of each exposure on its own

Risk of **smoking without alcohol** OR = 2.0
Risk of **alcohol without smoking** OR = 2.0
Risk from **both smoking and alcohol** OR > 4.0

- Synergistic interaction implies that the number of cases of disease attributable to the combined effect of two risks > the sum of the number of cases of disease that would be caused by each risk on its own

Aim and design

- **Aim:** To quantify the independent and joint associations of alcohol, smoking, and excess weight across a range of health outcomes and to identify whether these associations are synergistic
- **Design:** Systematic review and meta-analysis of published observational studies
- **Outcomes:** morbidity / mortality, ICD-10 code or established clinical marker of disease [today I will talk about head and neck cancers and liver disease]

Public Health 226 (2024) 39–52

Contents lists available at ScienceDirect

Public Health

journal homepage: www.elsevier.com/locate/puhe

Review Paper

The independent and joint risks of alcohol consumption, smoking, and excess weight on morbidity and mortality: a systematic review and meta-analysis exploring synergistic associations

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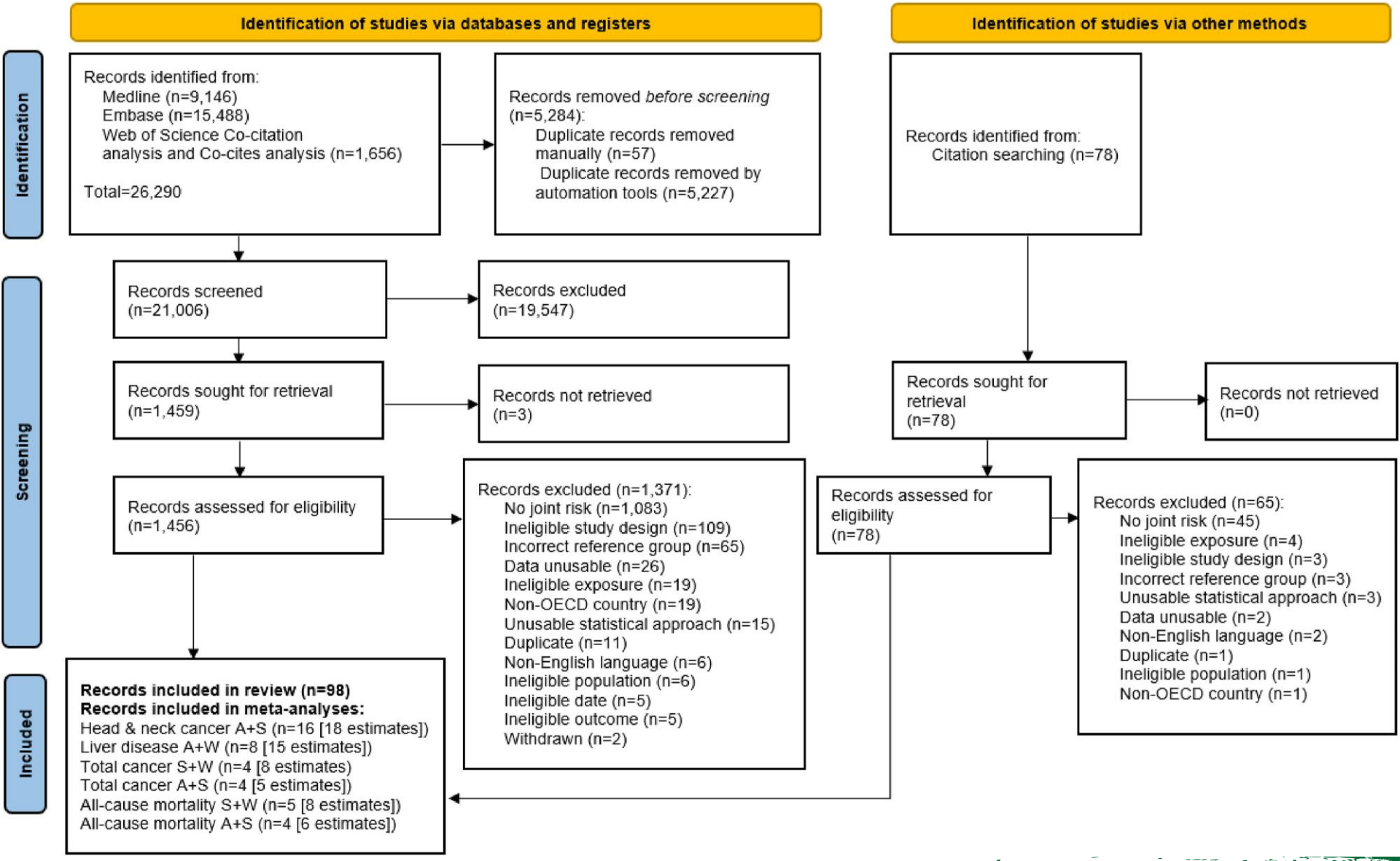
Methods - SRMA

- Pre-registered (PROSPERO CRD42021231443)

Criteria	Included	Excluded
Participants	Adults 18+ years	Children <18 years, atypical populations such as prisoners, pregnant women etc
Exposure	Alcohol consumption, smokable tobacco, excess weight	E-cigarettes and non-smokable tobacco
Comparator	No alcohol consumption, smokable tobacco, normal weight	-
Outcomes	Incidence, prevalence, death (ICD-10 code, or an established clinical marker of disease, e.g. liver serum tests)	No ICD-10 code or not an established clinical marker of disease (e.g. non-validated questionnaire measuring low mood)
Study design	Observational - cross-sectional, case-control, cohort	Not observational design
Country	OECD country	Non OECD country
Language	English	Non-English
Publication date	2010-2022	<2010

Burton et al (2024) The independent and joint risks of alcohol consumption, smoking, and excess weight on morbidity and mortality: a systematic review and meta-analysis exploring synergistic associations. *Public Health 226:39-52*



Burton et al (2024) The independent and joint risks of alcohol consumption, smoking, and excess weight on morbidity and mortality: a systematic review and meta-analysis exploring synergistic associations. *Public Health 226:39-52*

The Synergy Index (SI)

- For every study, we extracted the independent and joint risk associations
- Using these estimates, we calculated the Synergy Index (SI) for each study, so we had a common unit of measurement for interaction to use in the meta-analysis

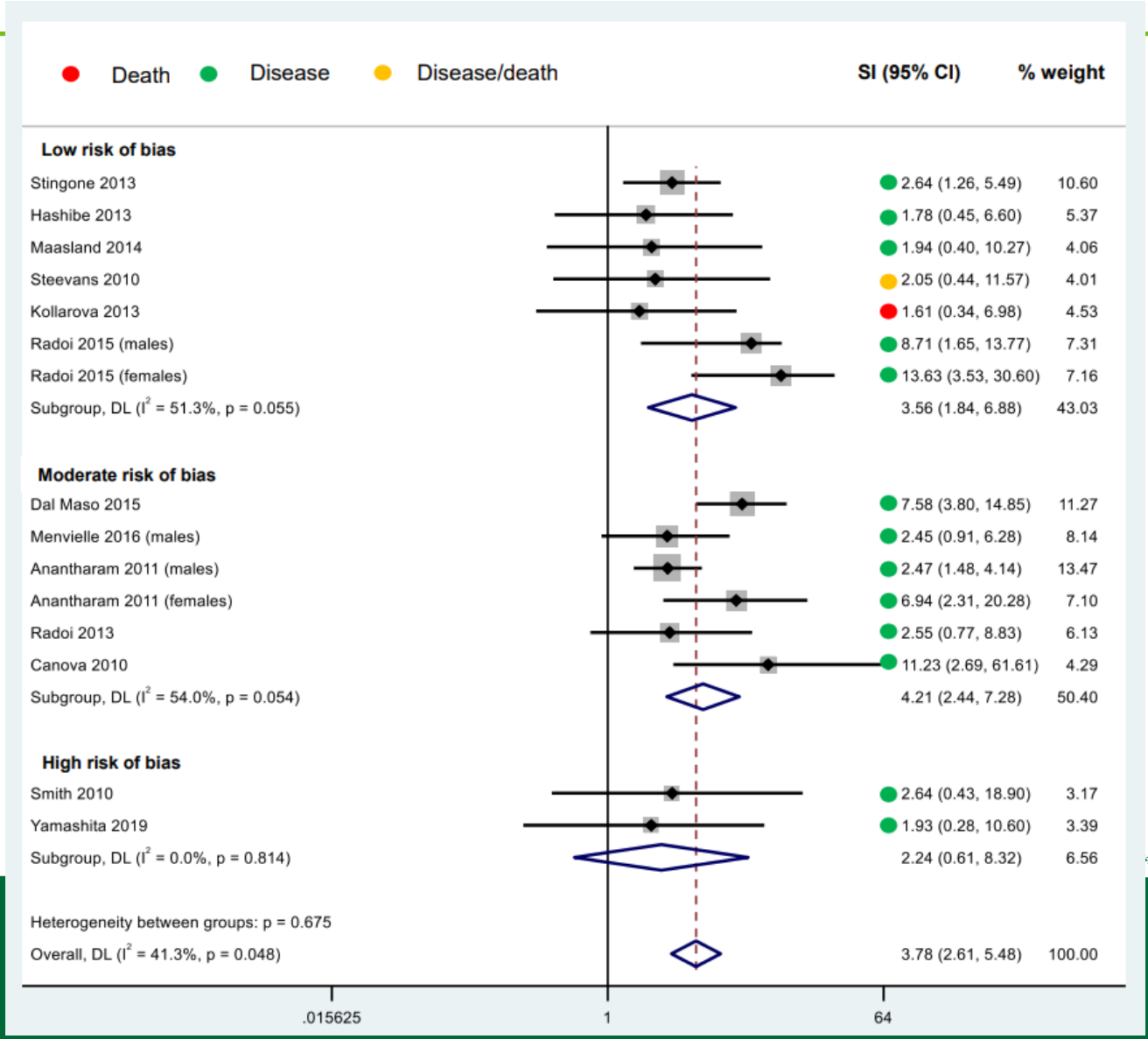
$$SI = \frac{RR_{A+B+} - 1}{(RR_{A+B-} -) + (RR_{A-B+}) - 1}$$

SI = is the excess risk from exposure to both exposures when there is interaction relative to the excess risk from exposure to both exposures without interaction

- To obtain CIs for the SI, we used Monte Carlo simulation techniques using the measure of association and 95% CIs to establish an error distribution
- We ran 20,000 simulations for each estimate (where estimates converged) and selected the 2.5th and 97.5th percentiles

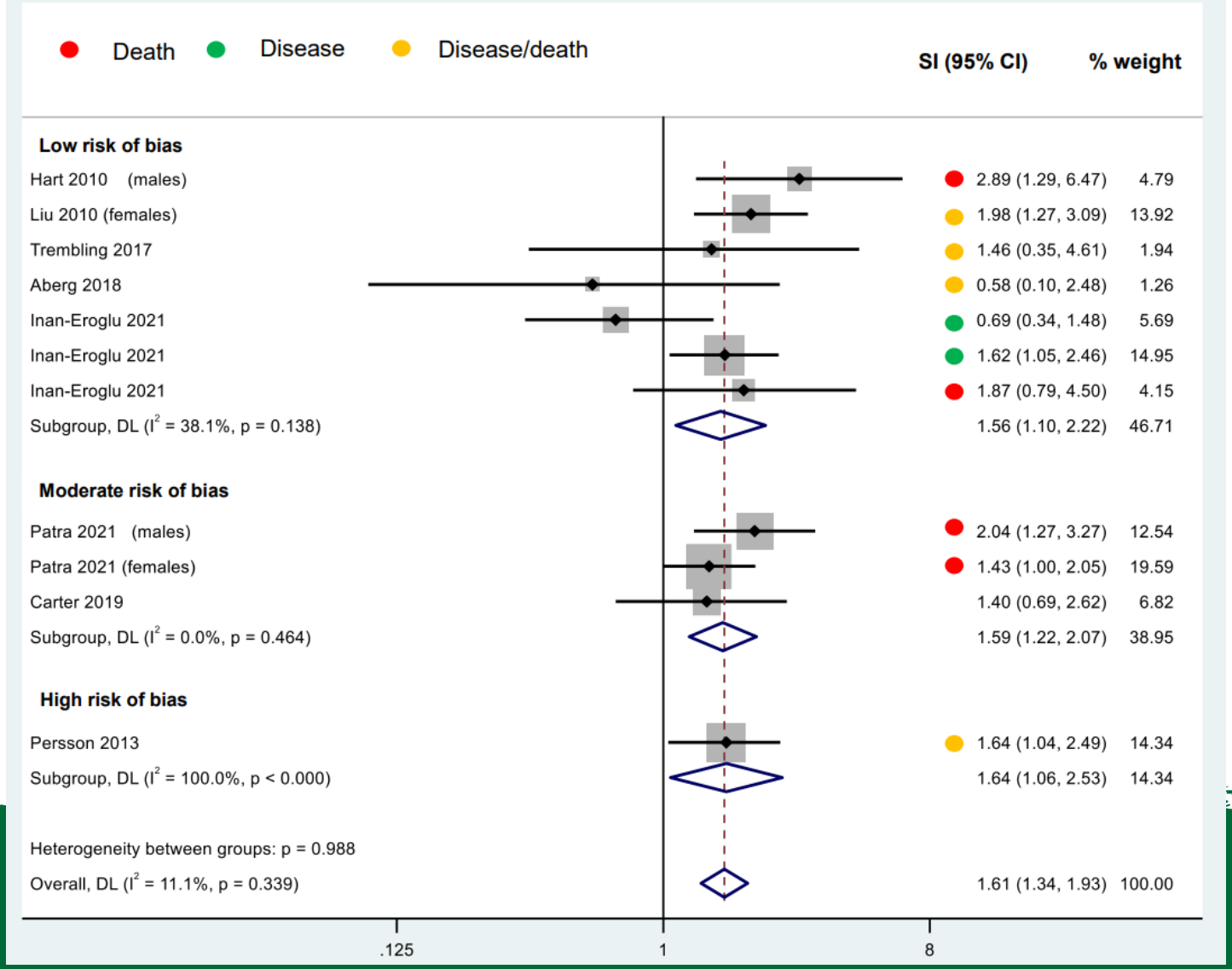
The combined effect of smoking and alcohol on head and neck cancers was 3.8 times greater than the additive effect of each exposure on its own

(n=138,130)



The combined effect of alcohol and excess weight on liver disease was 1.6 times greater than the additive effect of each exposure on its own

(n=2,603,939)



Non-synergistic joint risk relationships could be large

Compared to neither risk:

- A + S increased the risk of colorectal cancer up to 10.7 times
- A + S increased the risk of periodontitis up to 9.8 times
- S + W increased the risk of pancreatic cancer up to 4.7 times
- S + W increased the risk of ischemic stroke up to 3.6 times
- S + A increased the risk of all-cause death up to 3.5 times

What do these findings mean?

- Clustered risks have **clinical consequences** – we are underestimating the population at-risk:
  - Liver disease: 6.9 million adults drink at-risk levels and have excess weight
  - Head and neck cancers: 2.9 million adults drink at-risk levels and smoke
- People who drink and smoke would experience a greater absolute risk reduction from an alcohol intervention compared to people who only drink (and vice versa)
- Certain risks are more likely to **co-occur**
- Multiple risks are **more prevalent in the most deprived**
- So why aren't we **thinking about these risks together?**

Prevalence of multiple health risks - 2021

Risk 1	Risk 2	Number of adults in England
Increasing and higher risk drinking	Overweight / obese	6.9 million
Smoking	Overweight / obese	4.3 million
Increasing and higher risk drinking	Smoking	2.6 million
Increasing and higher risk drinking	Obese	2.6 million
Smoking	Obese	1.8 million
Higher-risk drinking	Overweight / obese	1.3 million
Higher-risk drinking	Smoking	678k
Higher-risk drinking	Obese	518k
Overweight / obese	At-risk gambling	439k
Smoking	At-risk gambling	239k
Increasing and higher risk drinking	At-risk gambling	279k
Obese	At-risk gambling	199k
Higher-risk drinking	At-risk gambling	80k

Burton et al (2023) The prevalence and clustering of alcohol consumption, gambling, smoking, and excess weight in an English population. *Preventive Medicine 175 : 107683*

Clustering of multiple health risks (2021)

Risks	POR (95 % CI)
	2.68 (2.31, 3.11)
	2.66 (1.76, 4.01)
	2.20 (1.68, 2.88)

Risks	POR (95 % CI)
	1.33 (1.01, 1.76)
	0.99 (0.85, 1.15)
	0.83 (0.76, 0.91)

Age and sex adjusted

Burton et al (2023) The prevalence and clustering of alcohol consumption, gambling, smoking, and excess weight in an English population. *Preventive Medicine 175 : 107683*

Multiple risks are more prevalent and cluster in the most deprived

The odds of having two or more risks:

- highest among men and women between 45 and 64 years
- Increased with decreasing highest level of qualification (from degree or equivalent through to no qualification)
- Increased with decreasing IMD quintile
- Highest among unemployed
- Stronger associations for all sociodemographic variables were seen in men compared to women

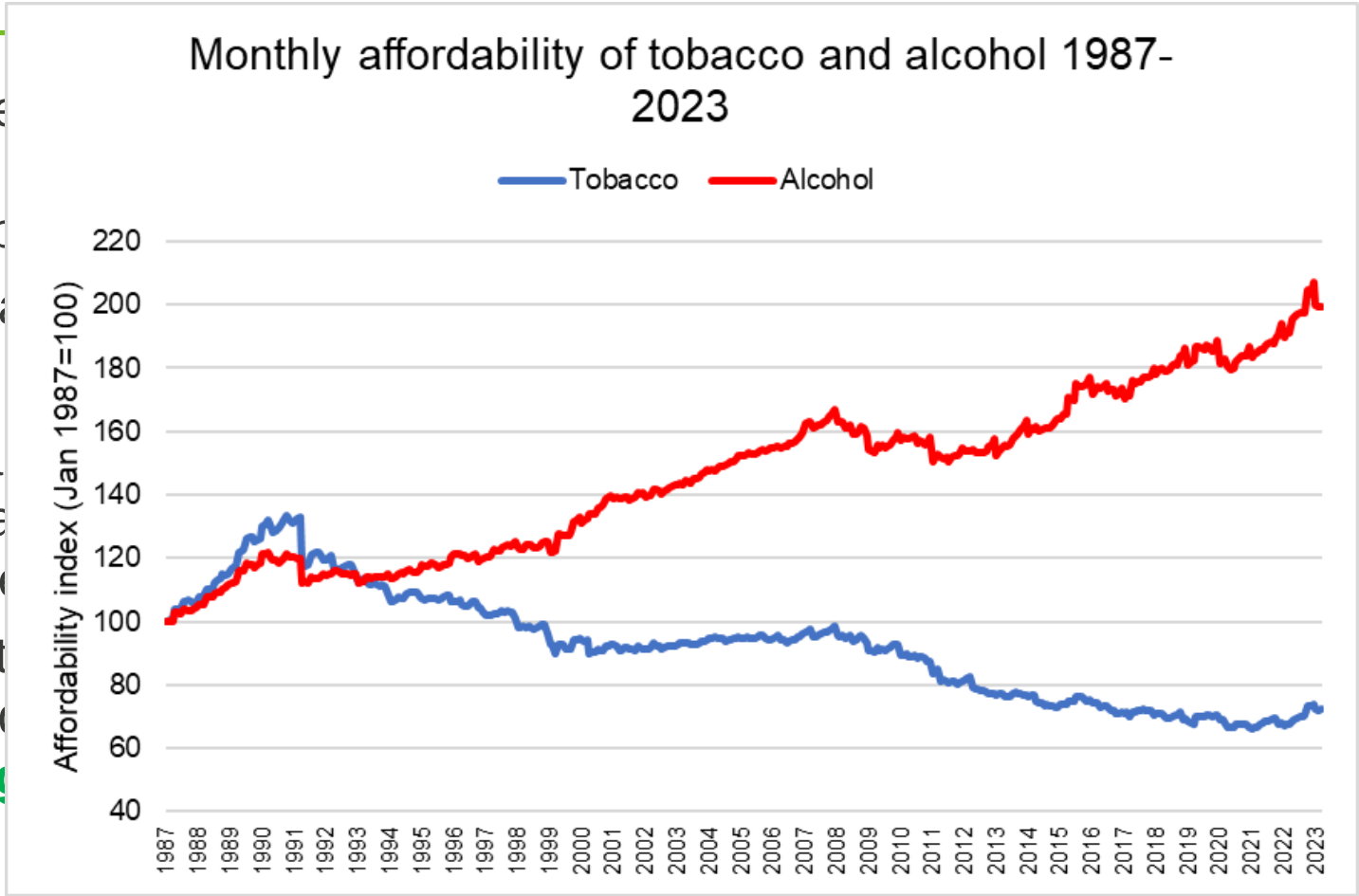
Burton et al (2023) The prevalence and clustering of alcohol consumption, gambling, smoking, and excess weight in an English population. *Preventive Medicine 175 : 107683*

There are behavioural synergies and clinical synergies…

…but what about policy synergies???

Are we working in silos?

- The … tions on … up app…
- Hea… s
- Fin… asis
- Ma… dical aca… dis…
- But… evi… e lar…



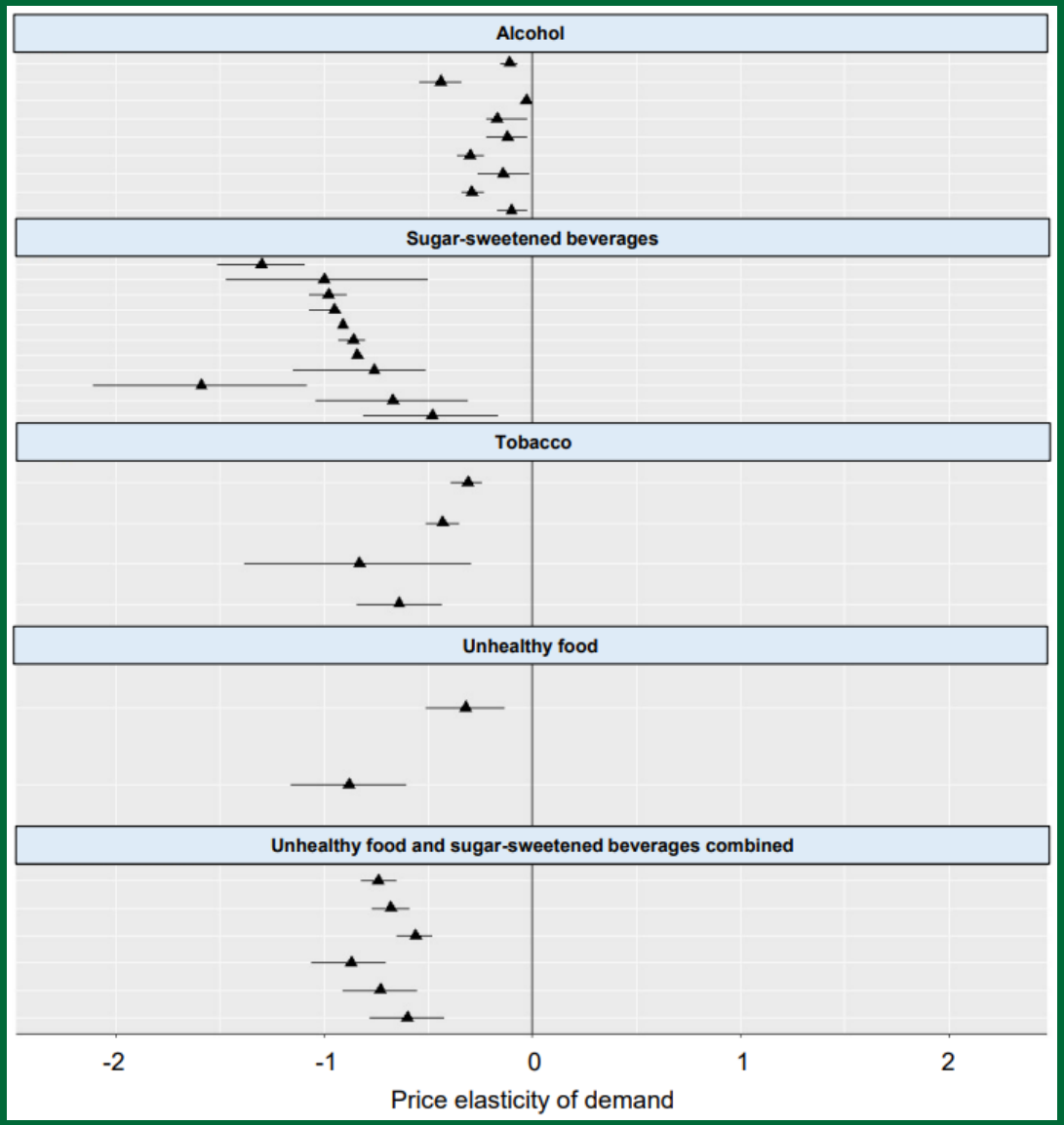
What are the most effective levers?

P **Price** – increase product price, e.g. taxation, minimum prices

P **Promotion** – restrict marketing and advertising, e.g. watershed bans, complete bans

P **Place** – limit where and when products can be sold, and who can buy them, e.g. hours/days of sale, density of outlets, minimum age restrictions

P **Product** – regulate aspects of the product, e.g. warning labels, nutritional and calorie information



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- An inverse association between price and demand was consistently seen across all outcomes
- A 10% increase in product price was associated with a median reduction in demand of:
  - 9% for SSBs
  - 6% for unhealthy food
  - 5% for tobacco
  - 1% for alcohol

Burton et al (2024) The relationship between the price and demand of alcohol, tobacco, unhealthy food, sugar-sweetened beverages, and gambling: an umbrella review of systematic reviews. *BMC Public Health 24: 1286*

Taxing one commodity can affect demand of another

- **USA study (Young-Wolff 2014):** increases in cigarette tax were associated with decreases in alcohol consumption among smokers

- **UK study (Moore 2022):** the PED for alcohol reduced from -0.56 to -0.26 when the price of food was included in the analysis. Alcohol pricing policies may be undermined if retailers offset an increase in alcohol price by decreasing the price of food, or if consumers have more disposable income due to the reductions in food price which can be spent on alcohol

- **UK study (Quirmbach 2018):** price increases in medium-sugar drinks were associated with reductions in alcohol purchasing but increases in the price of high-sugar drinks were associated with an increase in purchasing of lager

A policy win for one could be a loss for another…

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F1: tobacco out, alcohol in

A policy win for one could be a loss for another…

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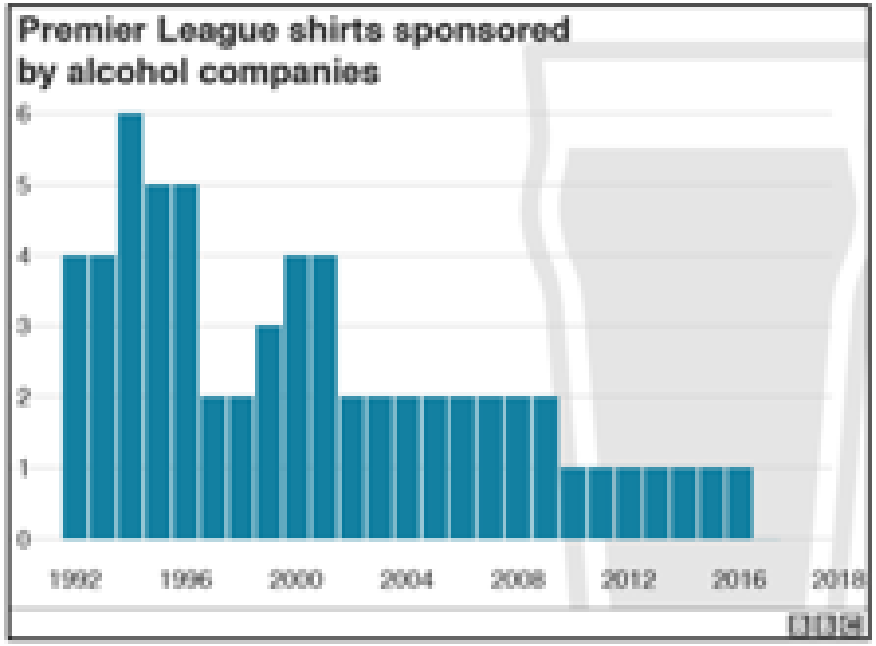
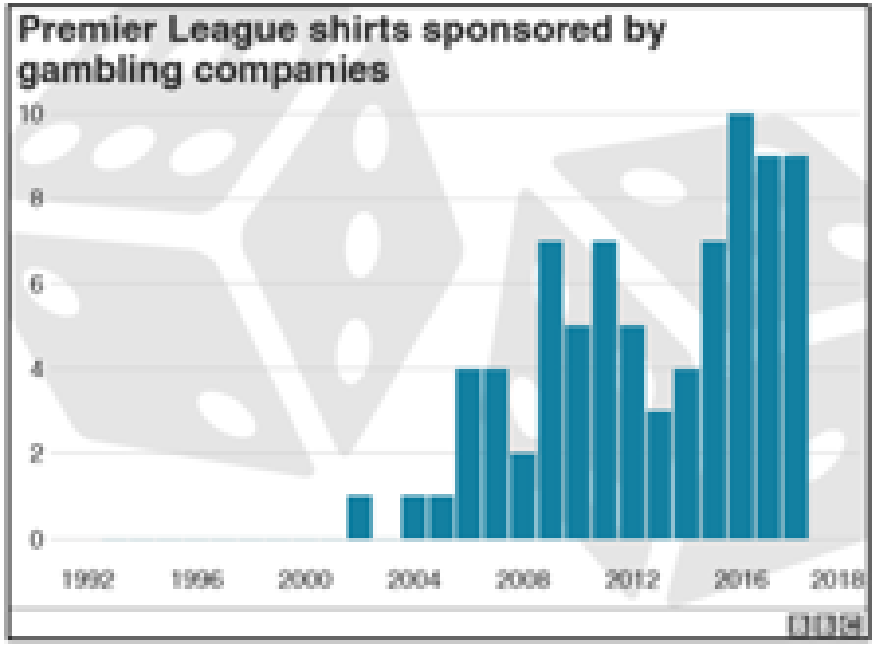
Football: alcohol wanes, gambling gains





A policy win for one could be a loss for another…

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End-of-aisle: crisps cut, beer's back

Riding on the coattails…

…benefit from someone else's success

Thank you!

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