Impact of vaping introduction on cigarette smoking among young adults in four high-income countries– An interrupted time series analysis

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Agenda

- Background
- Research Question and Hypotheses
- Methodology
- Results
- Limitations and Implications of study

Background

- Use of electronic nicotine delivery systems (ENDs), particularly e-cigarettes, commonly known as “vaping” has become popular in many high-income countries from around 2013, especially among youths and young adults
- E-cigarettes mimic the look and feel of conventional cigarettes, as they generate an aerosol containing flavorings, with or without nicotine, creating sensations similar to smoking
- There has been a long standing debate on the role of vaping as a “gateway” to smoking among youths and young adults

Research Question and Hypotheses

Q: Does vaping introduction reduce or increase the sex-specific prevalence of smoking among young adults in Canada sub-nationally (where regulations vary across provinces), and at the national level in UK, Japan, and Australia?

H: Introduction of vaping reduced sex-specific prevalence of smoking among young adults in the four countries

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Methodology

- Country selection: Canada, UK, Japan, and Australia selected based on:
  - ✓ Availability of data on smoking prevalence, by age and sex
  - ✓ Availability of data on cigarettes sales (or consumption)
  - ✓ Varied approaches to regulation of vaping
    - Maximum nicotine level permitted in vaping products-

      Canada: 66 mg/mL UK: 20 mg/mL

      Japan: nicotine levels in HNB is comparable to that in cigarettes;

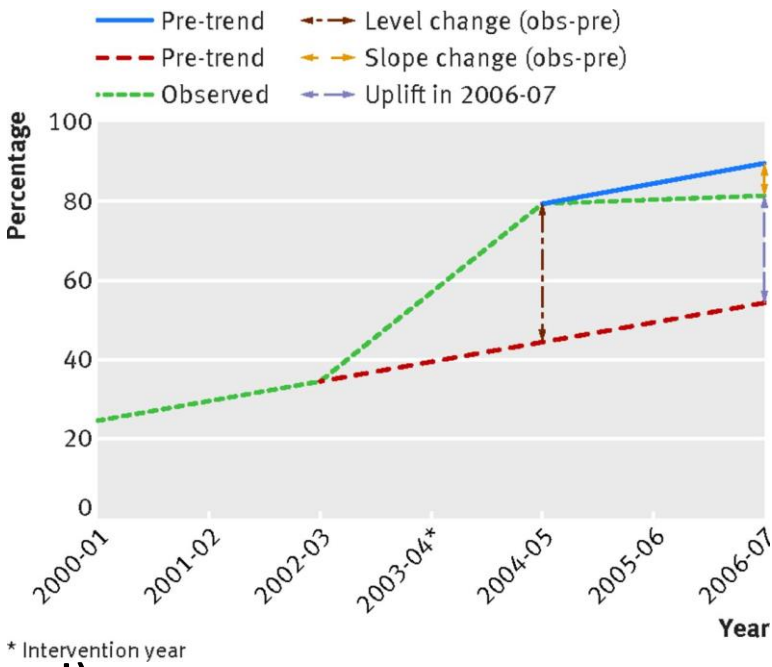
      Australia: nicotine is not permitted in e-cigarettes
    - E-cigarette taxation policies
- Measures of smoking:
  - ➢ Prevalence of smoking among young adults, defined as individuals aged 18 to 30+ years, stratified by sex
  - ➢ Annual cigarette sales (consumption) per adult aged 18+ years

Data Sources

Country	Prevalence data source	Age group(s) analyzed	Consumption data source
Canada	Canadian Community Health Survey	18- 34 years	Health Canada
UK	Opinions and Lifestyle Survey	16-24 years, 25-34 years	Euromonitor
Japan	National Health and Nutrition Survey	20-29 years, 20-39 years	International Smoking Statistics (upto 2015), Cummings et al. (2020) for 2016 to 2018
Australia	National Health Survey, National Drug Strategy and Household Survey (conducted every 2-3 years; data interpolated to obtain annual prevalence)	15 (16)-17 years, 18-24 years, 25-34 years	Average spending on cigarettes and other tobacco products per capita

Analysis

- Interrupted time series analysis (ITS)
- Intervention: Uptake of e-cigarettes
- Intervention point
  - ➢ No fixed intervention point
  - ➢ We used the first year when national surveys included questions on the use of e-cigarettes (2016 for Japan when Ploom Tech and glo were introduced)
- Unit of analysis:
  - ➢ Province for Canada
  - ➢ Country for UK, Japan, and Australia
- Model is adjusted for cigarette tax/price as a potential confounder

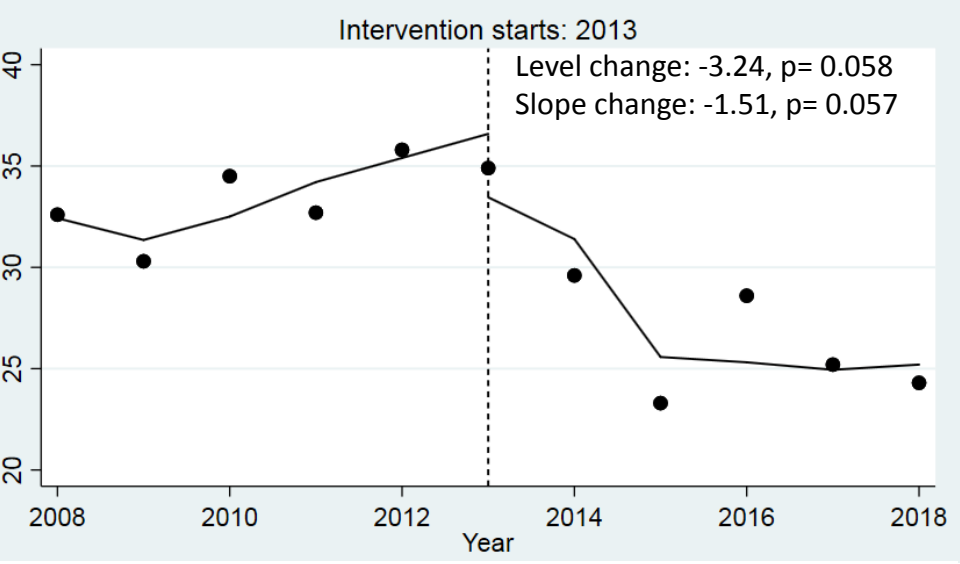


RESULTS

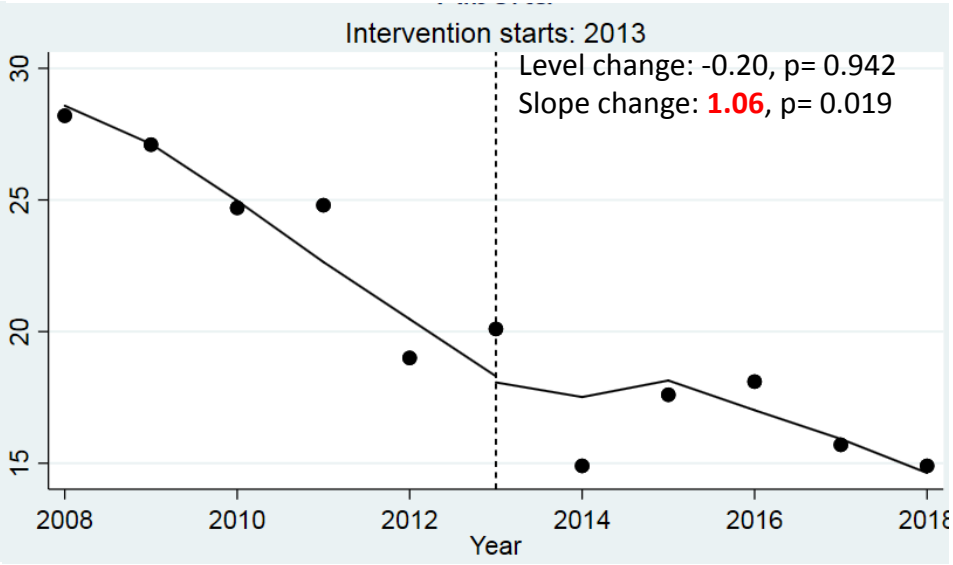
Alberta, Canada

Smoking prevalence

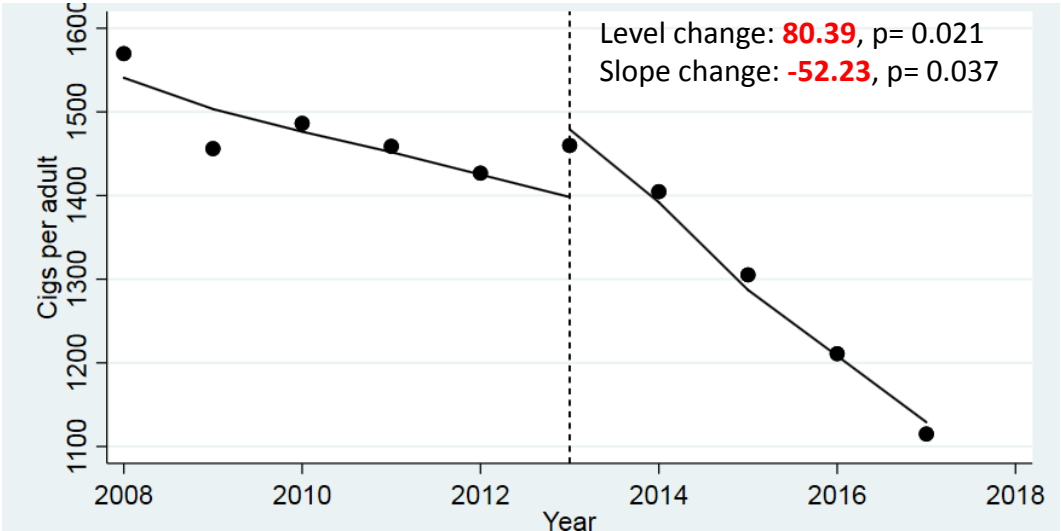
Males aged 18-34 years



Females aged 18-34 years



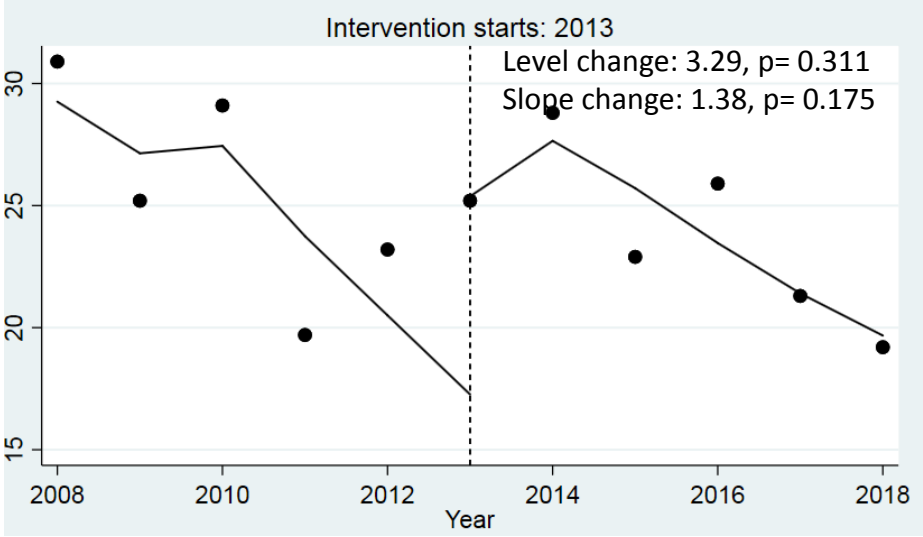
Cigarette consumption (sales) per adult



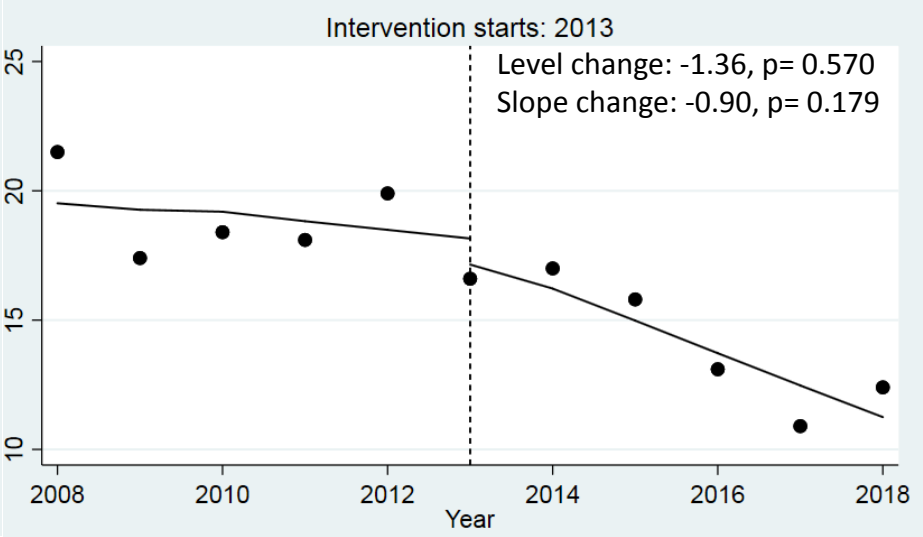
British Columbia, Canada

Smoking prevalence

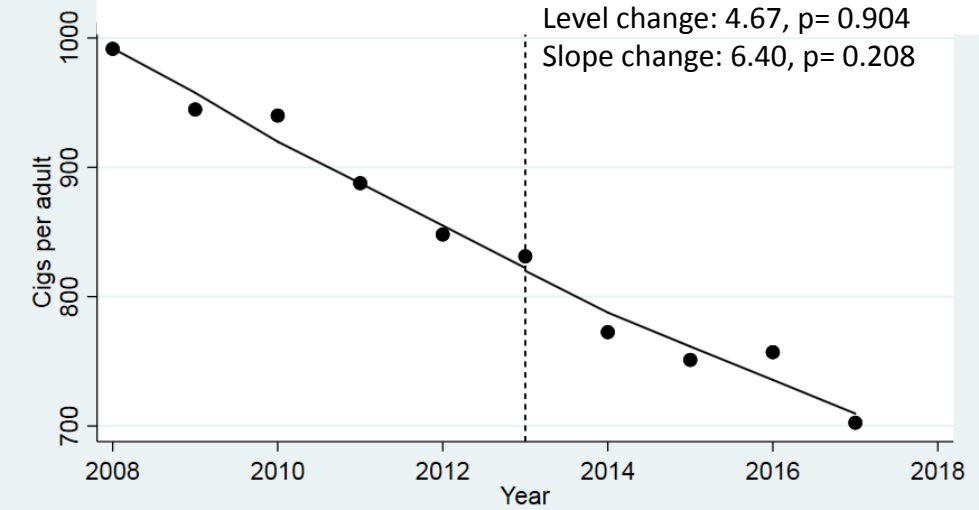
Males aged 18-34 years



Females aged 18-34 years



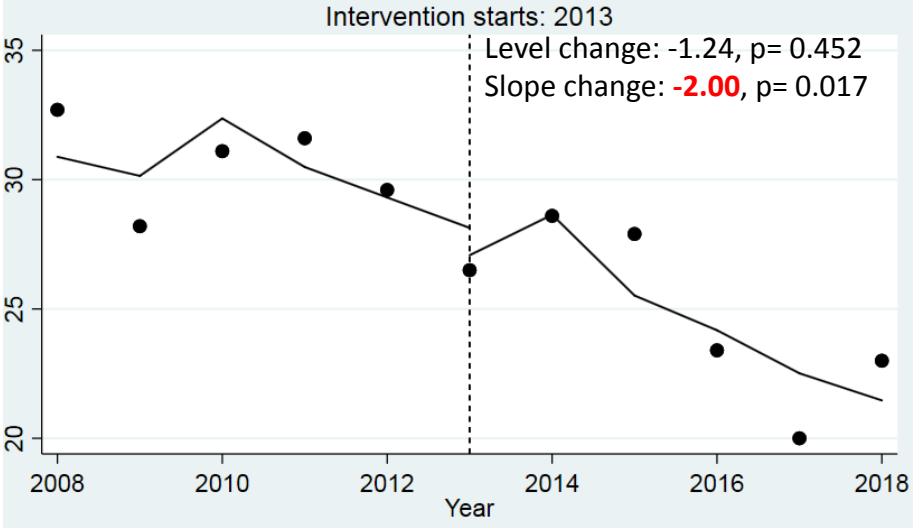
Cigarette consumption (sales) per adult



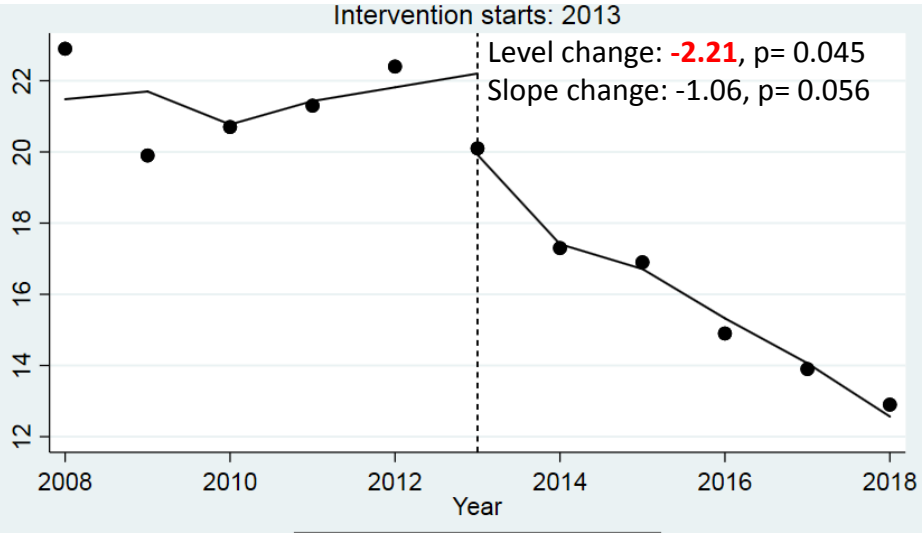
Ontario, Canada

Smoking prevalence

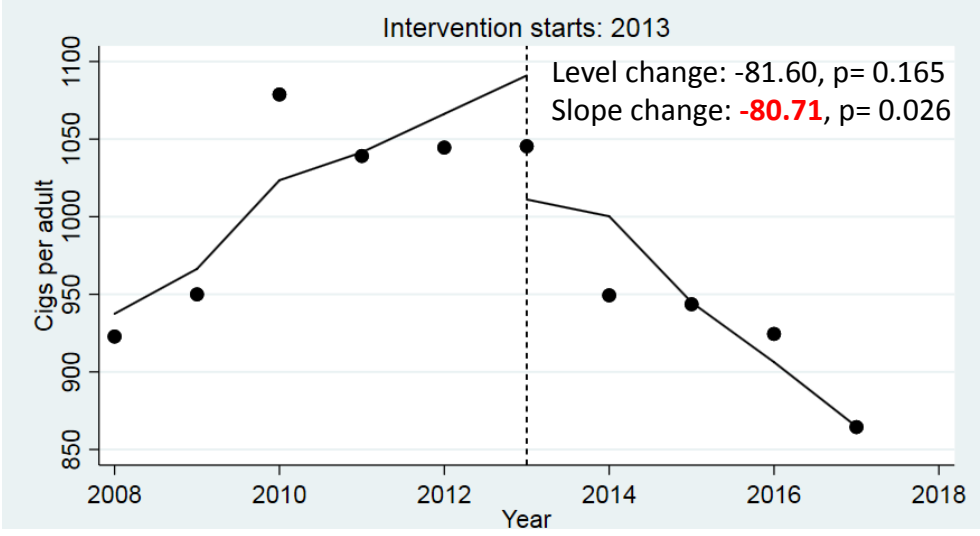
Males aged 18-34 years



Females aged 18-34 years



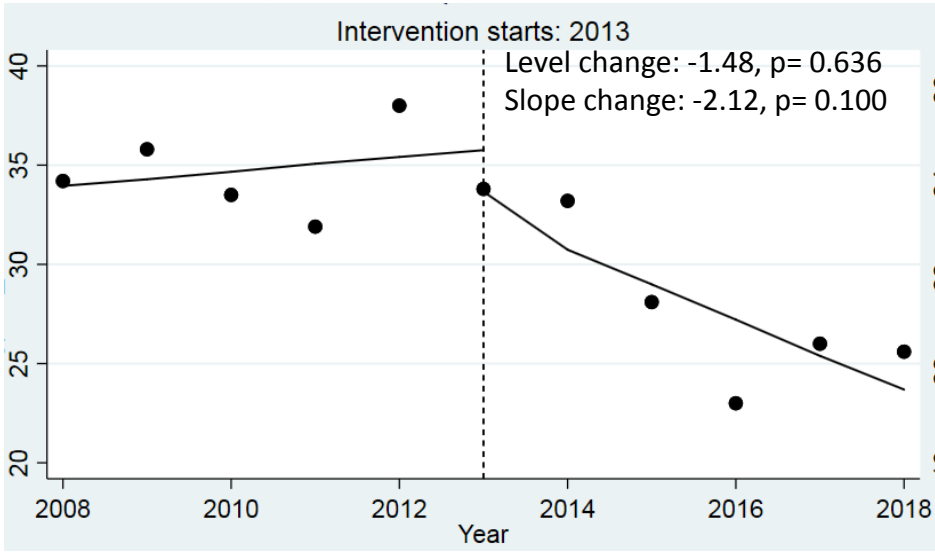
Cigarette consumption (sales) per adult



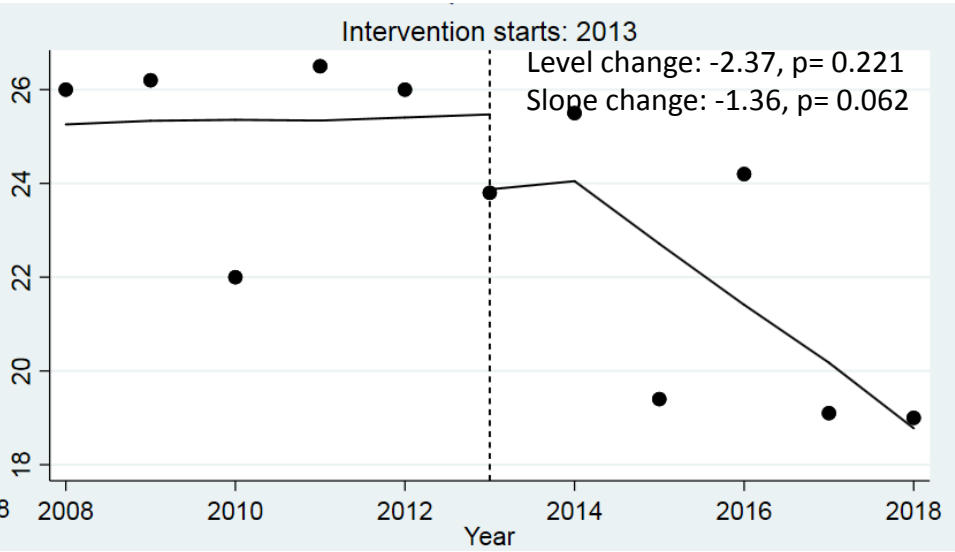
Quebec, Canada

Smoking prevalence

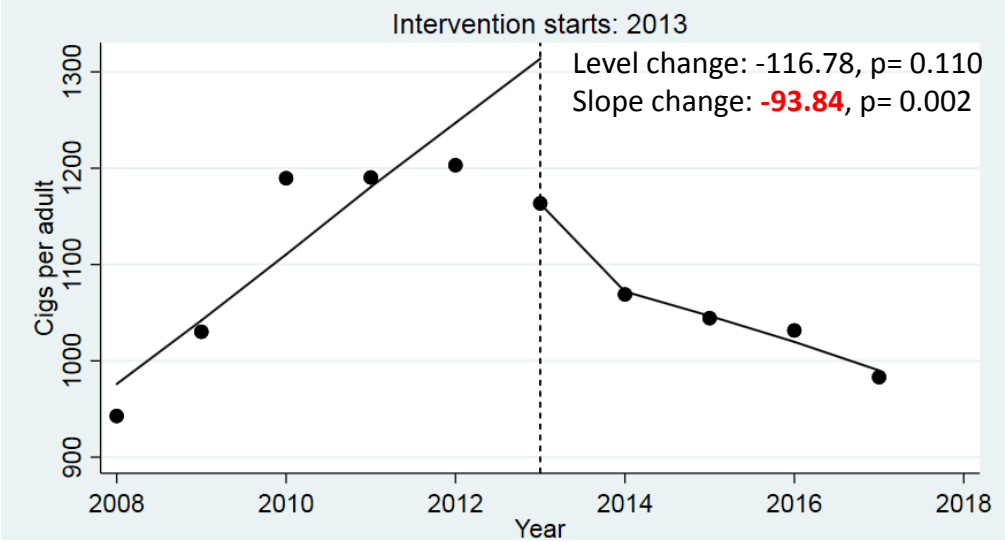
Males aged 18-34 years



Females aged 18-34 years

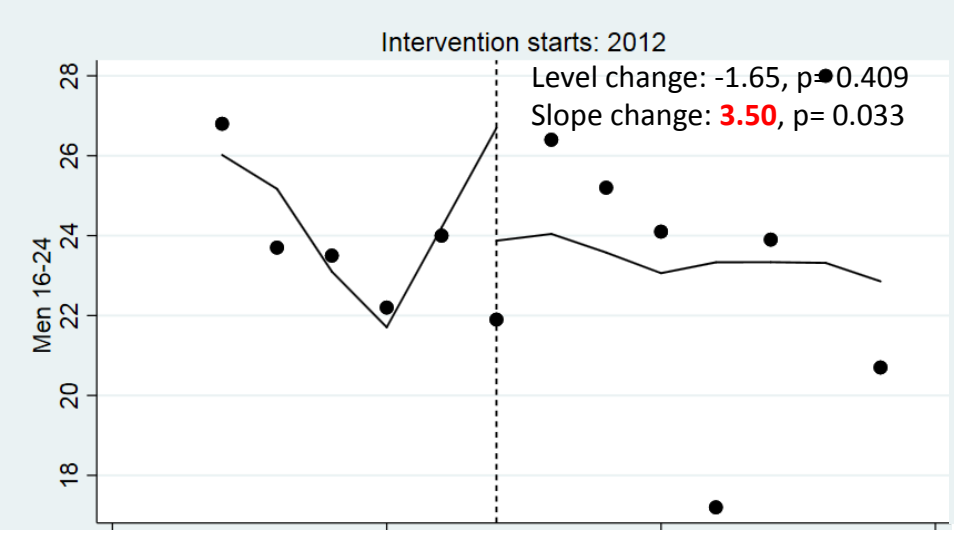


Cigarette consumption (sales) per adult



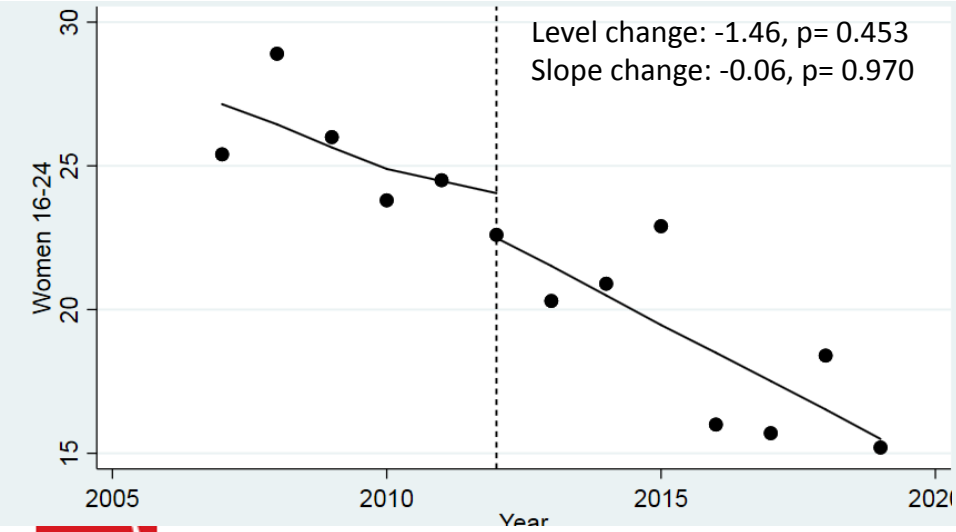
Impact on smoking prevalence in UK, by sex

Males: 16-24 years

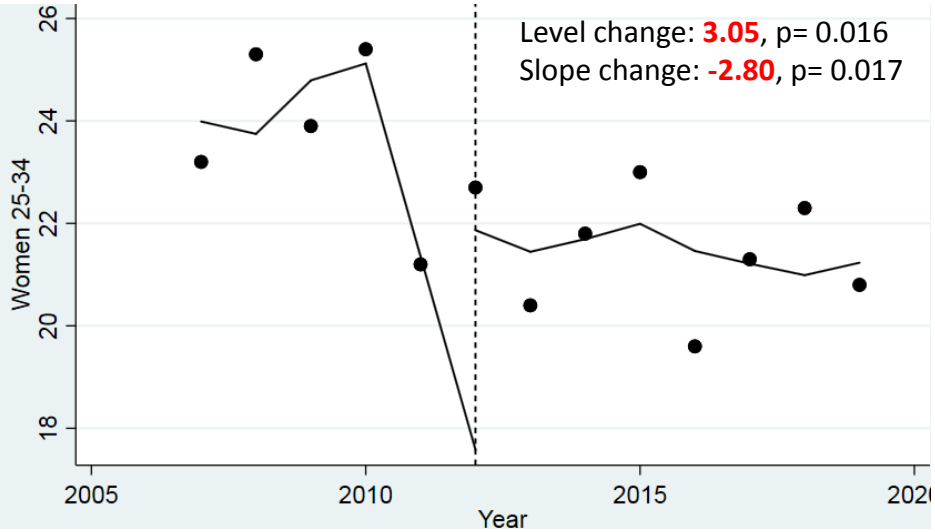


25-34 years

Females: 16-24 years

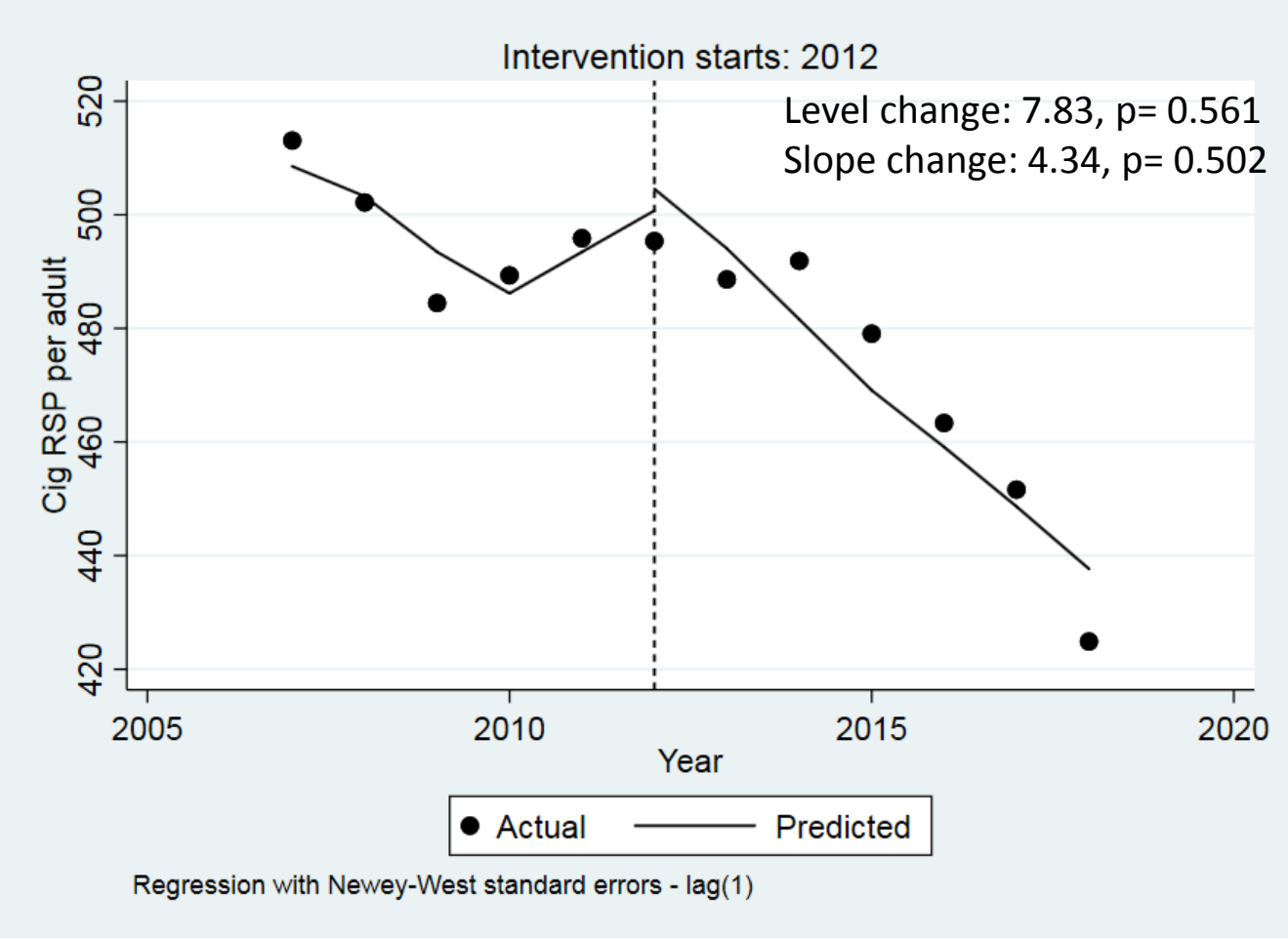


25-34 years



Adjusted for price (constant 2018 GBP)

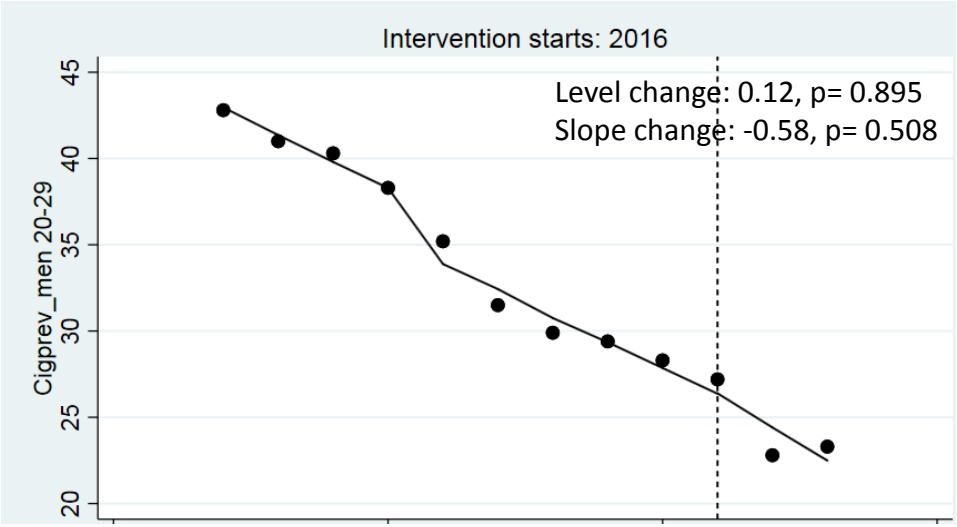
Impact on cigarette consumption per adult (retail value) in UK



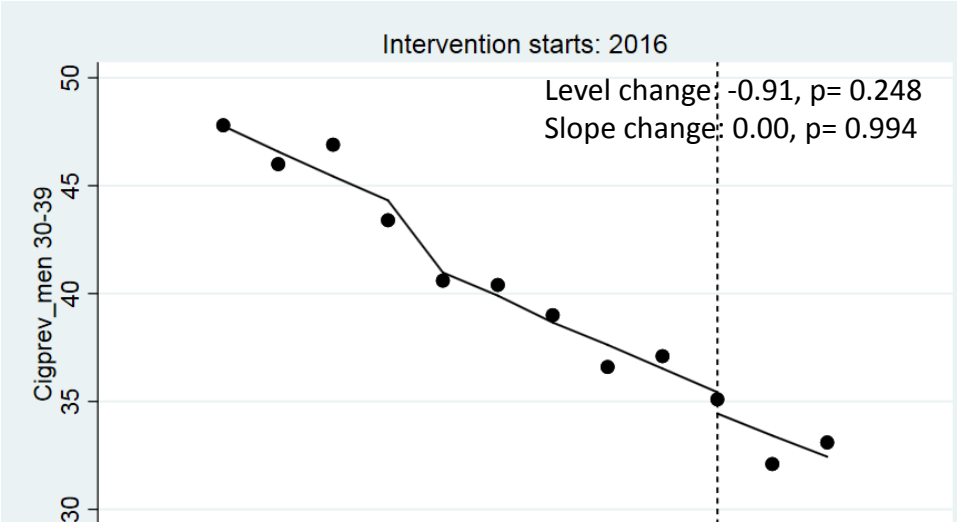
Retail value (RSP) in constant 2018 USD

Impact on smoking prevalence in Japan, by sex

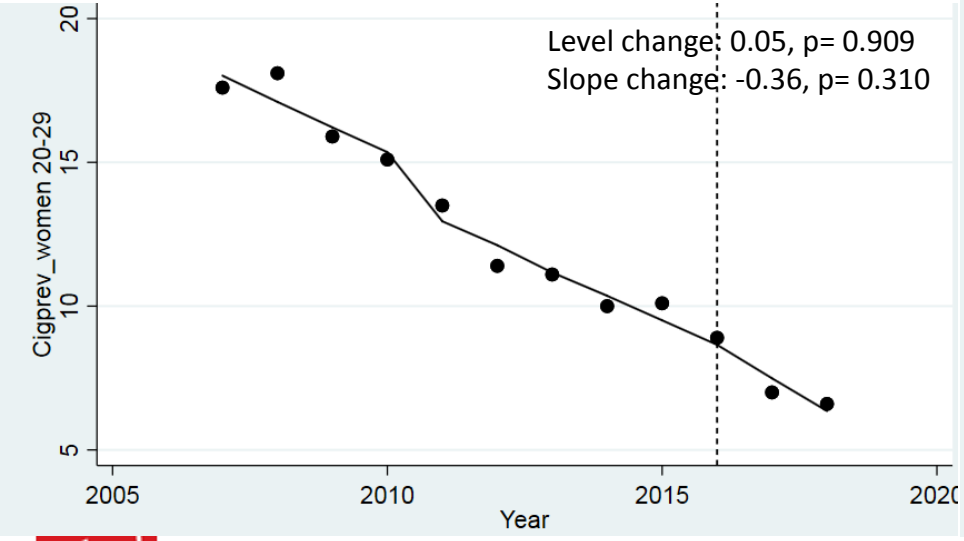
Males: 20-29 years



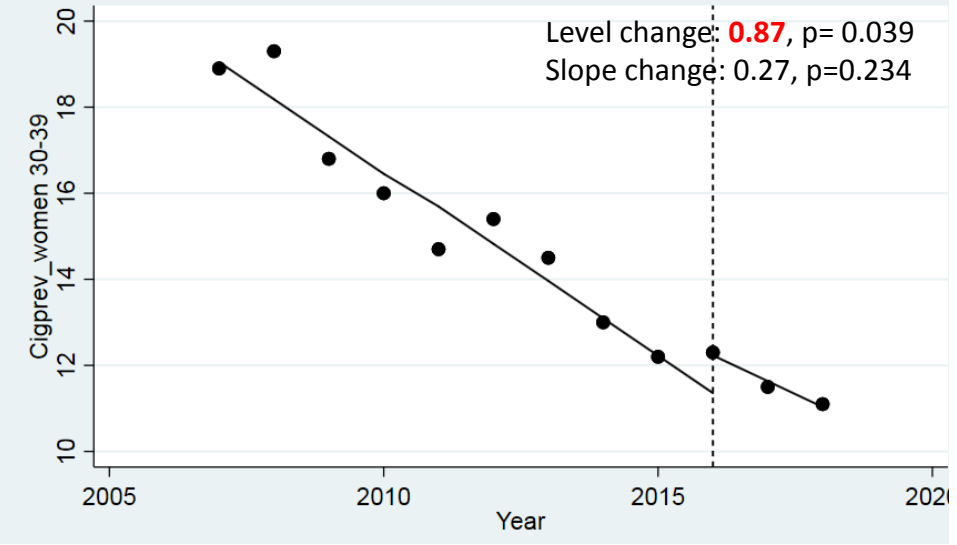
30-39 years



Females: 20-29 years



30-39 years



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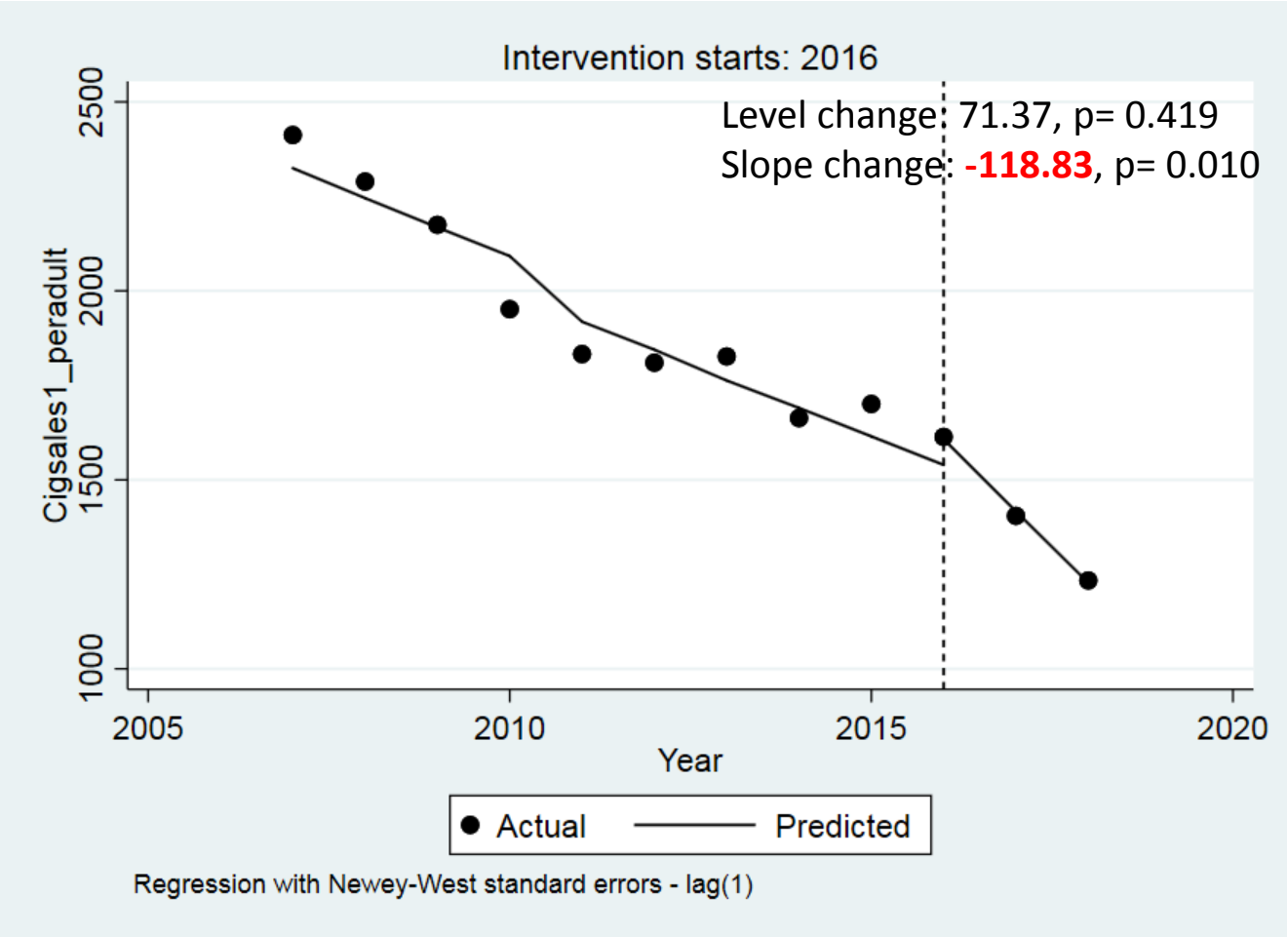
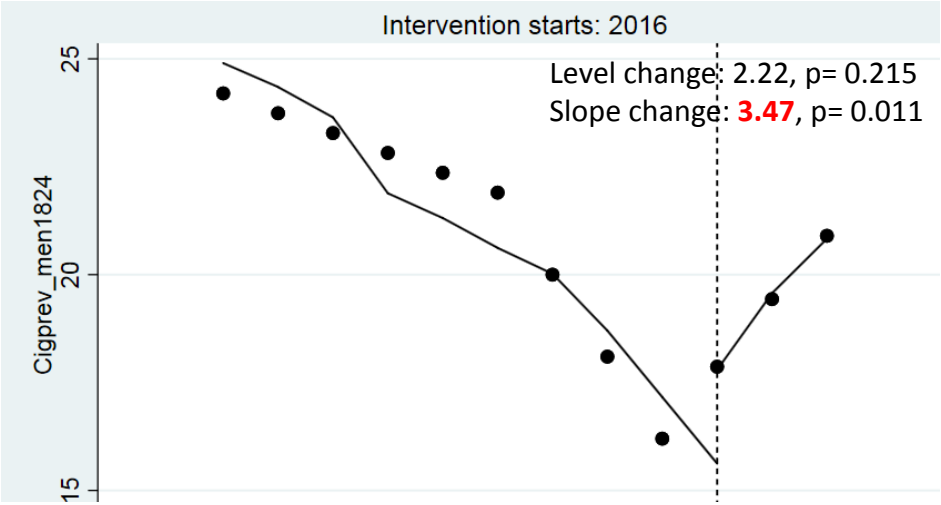
Adjusted for price (constant 2018 JPY)

Impact on smoking consumption per adult (number of sticks) in Japan

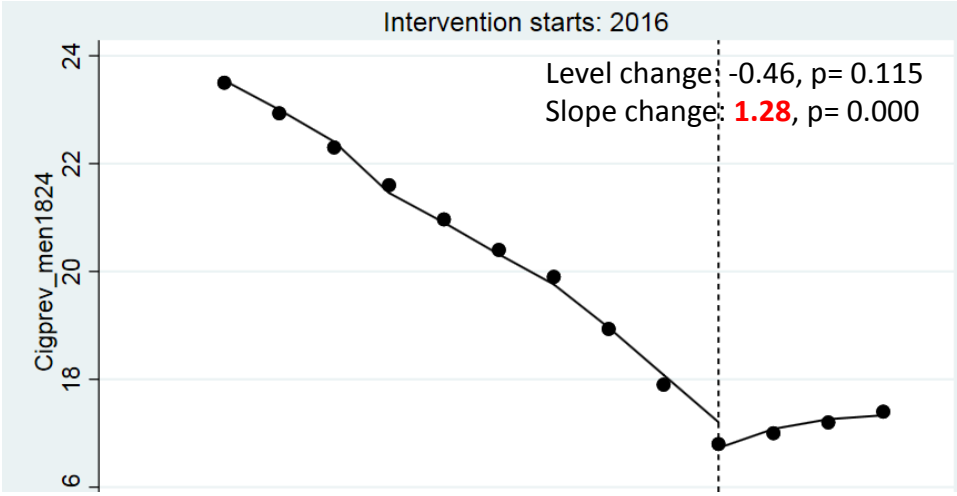


Impact on smoking prevalence in Australia among young adults aged 18-24 years, by sex

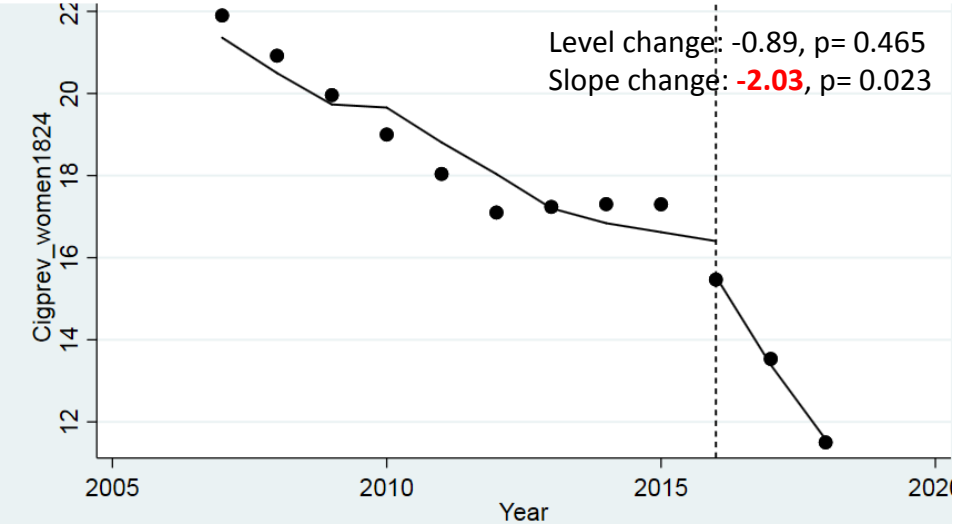
Males: AHS



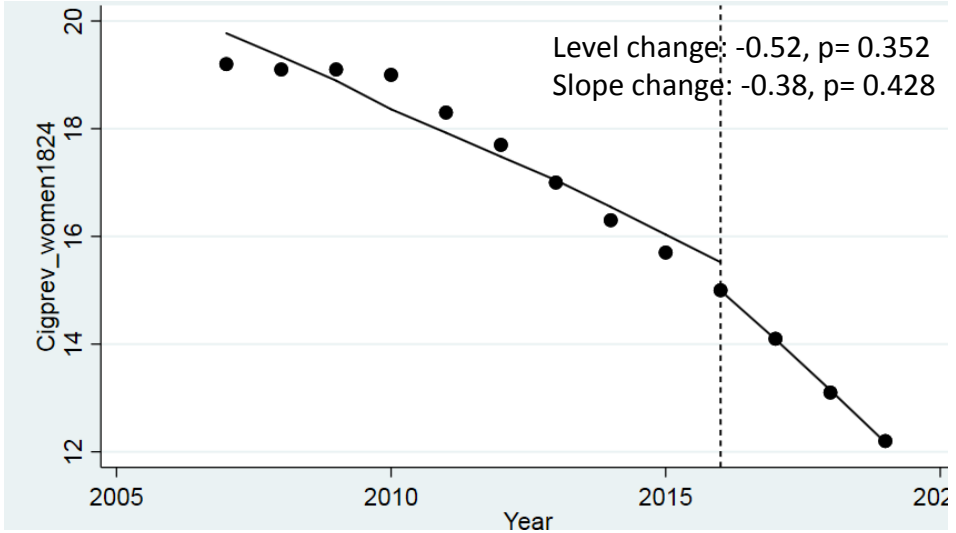
NDSHS



Females: AHS

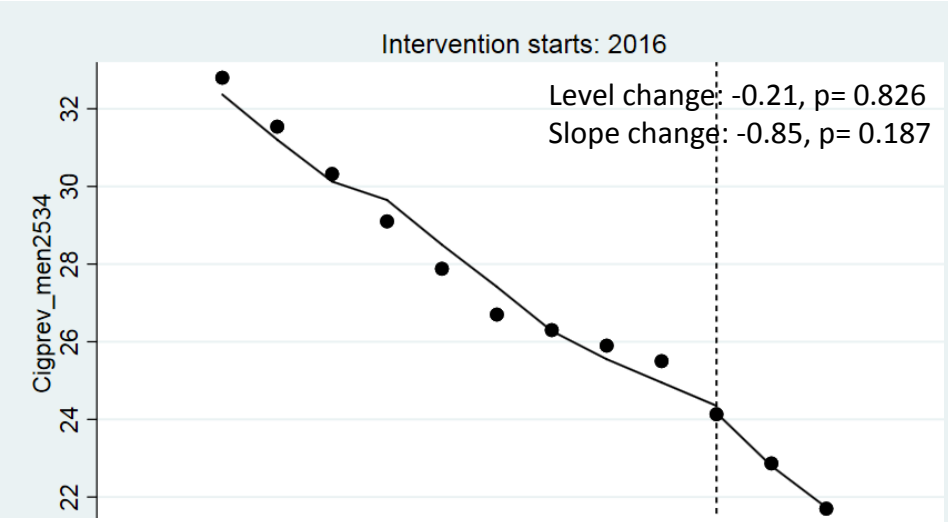


NDSHS

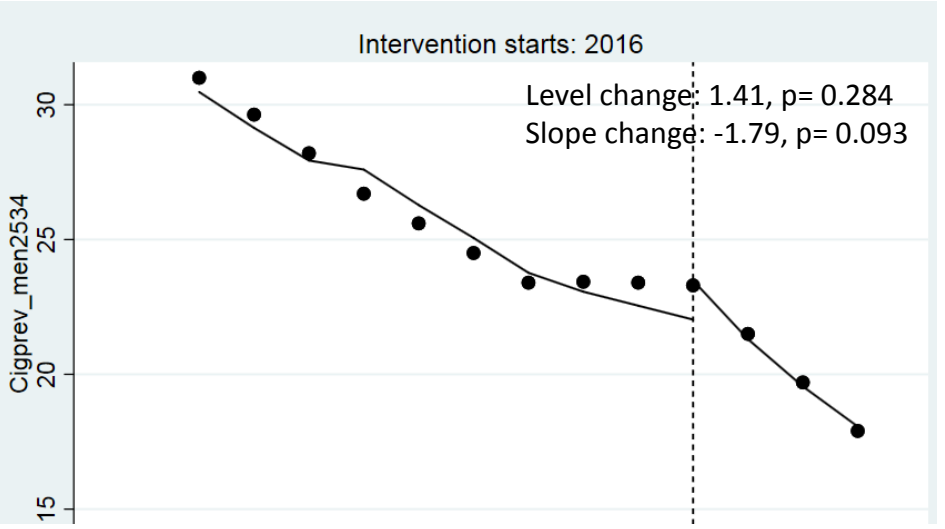


Impact on smoking prevalence in Australia among young adults aged 25-34 years, by sex

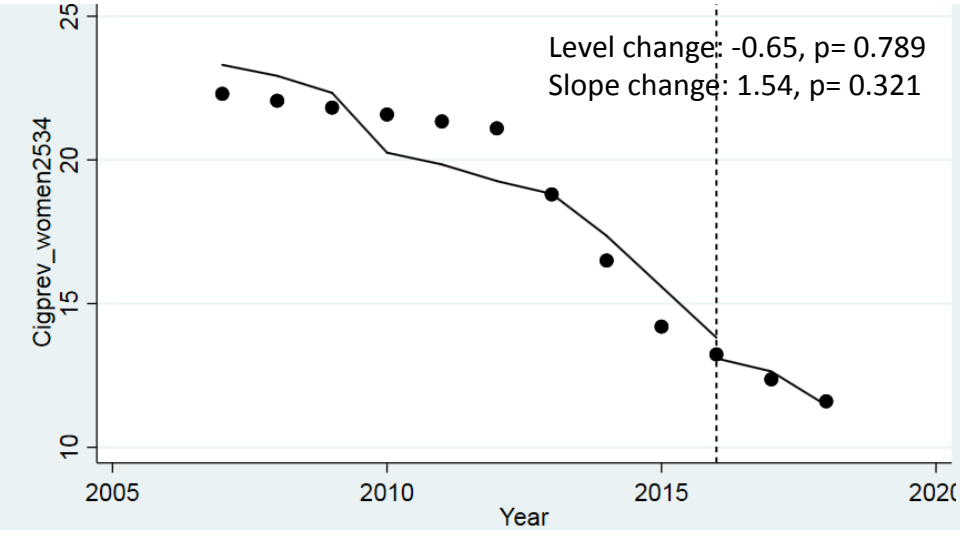
Males: AHS



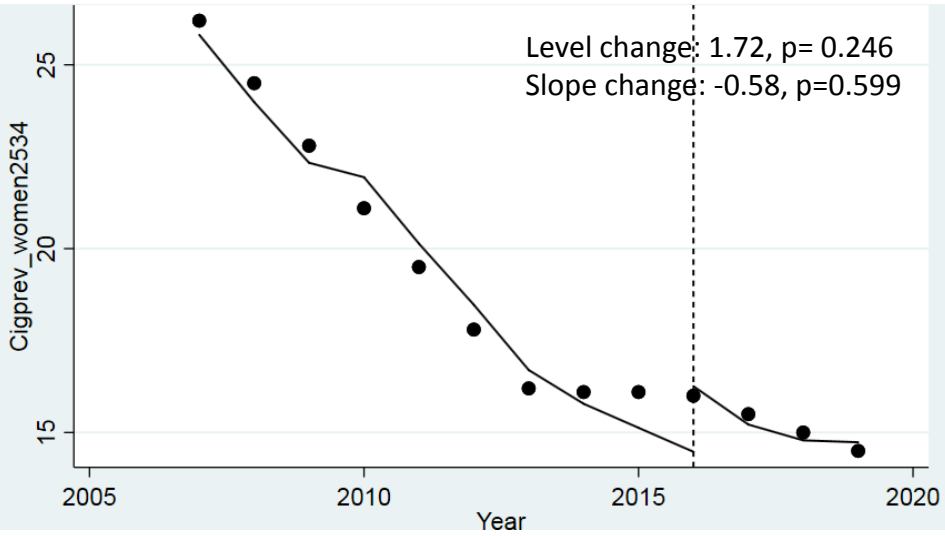
NDSHS



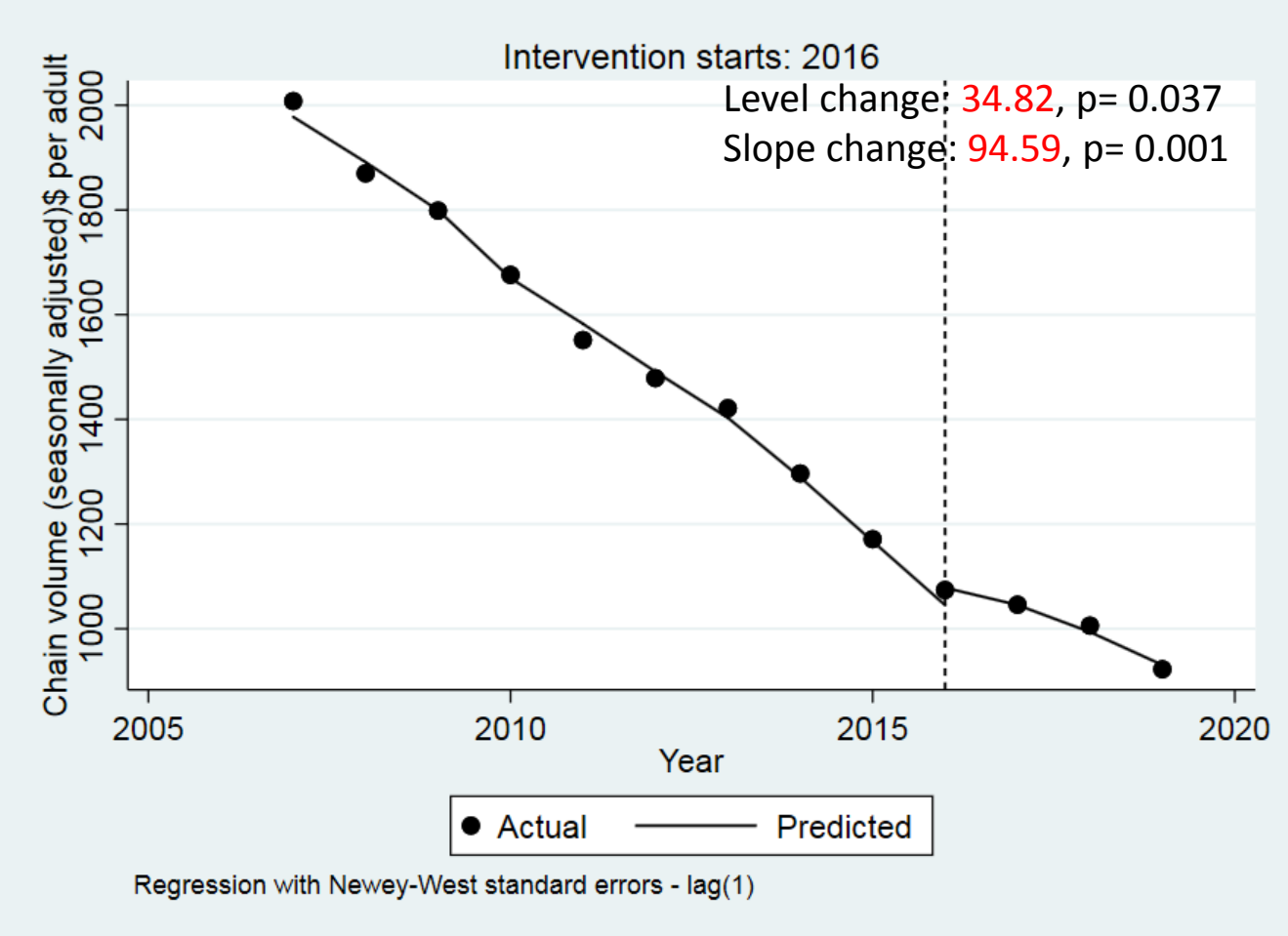
Females: AHS



NDSHS



Impact on cigarette consumption per adult (chain volume) in Australia



Chain volume in constant 2018 AUD

Vaping regulations, by country

Province/ country	Maximum nicotine level permitted in vaping products	Vaping policies 
Alberta (CA)	66 mg/mL	No provincial legislation
British Columbia (CA)		Not permitted where smoking is not allowed; sales are banned where tobacco sales are banned; promotions in stores are banned
Ontario (CA)		Sales are banned where tobacco sales are banned
Quebec (CA)		Similar to BC
UK	20 mg/mL	Restricted promotions; 20% VAT
Japan	Similar to cigarettes (HNB)	No regulations on HNB use in public places
Australia	0	Advertising, promotion, and sponsorship is banned

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Summary of findings

Province/ country	Age group	Impact of vaping introduction on smoking					
		Male smoking prevalence		Female smoking prevalence		Cigarette consumption per adult*	
		Level change	Trend change	Level change	Trend change	Level change	Trend change
Alberta (CA)	18-34 years	-3.24 (-6.63, 0.15)	-1.51 (-3.10, 0.07)	-0.20 (-6.73, 0.15)	**1.06 (0.25, 1.87)**	**80.39 (18.12, 142.66)**	**-52.23 (-99.91, -4.54)**
British Columbia (CA)		3.29 (-3.98, 10.56)	1.38 (-0.81, 3.57)	-1.36 (-6.91, 4.19)	-0.90 (-2.35, 0.55	4.67 (-90.30, 99.63)	6.40 (-4.99, 17.80)
Ontario (CA)		-1.24 (-5.00, 2.52)	**-2.00 (-3.50, -0.50)**	**-2.21 (-4.36, -0.07)**	-1.06 (-2.17, 0.04)	-81.60 (-210.57, 47.38)	**-80.71 (-146.98, -14.44)**
Quebec (CA)		1.48 (-8.77, 5.80)	-2.12 (-4.80, 0.55)	-2.37 (-6.63, 1.88)	-1.36 (-2.81, 0.09)	-116.78 (-271,28, 37.71)	**-93.84 (-136.06, -51.63)**

* Measured as number of sticks sold per adult in Canada and Japan, cigarette retail value per adult (2018 USD) in the UK, and cigarette chain volume (2018 AUD) in Australia

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Summary of findings

Province/ country	Age group	Impact of vaping introduction on smoking					
		Male smoking prevalence		Female smoking prevalence		Cigarette consumption per adult	
		Level change	Trend change	Level change	Trend change	Level change	Trend change
UK	16-24 years	-1.65 (-6.01, 2.71)	**3.50 (0.37, 6.63)**	-1.46 (-5.74, 2.82)	-0.06 (-3.82, 3.69)	7.83 (-22.54, 38.21)	4.34 (-10.16, 18.84)
	25-34 years	**6.90 (3.91, 9.88)**	-1.24 (-3.23, 0.75)	**3.05 (0.73, 5.36)**	**-2.80 (-4.94, -0.65)**		
Japan	20-29 years	0.12 (-2.01, 2.26)	-0.58 (-2.56, 1.39)	0.05 (-1.00, 1.11)	-0.36 (-1.15, 0.42)	71.37 (-125.35, 268.09)	**-118.83 (-199.79, -37.87)**
	30-39 years	-0.91 (-2.62, 0.80)	0.00 (-1.59, 1.60)	**0.87 (0.06, 1.68)**	0.27 (-0.22, 0.77)		
Australia	18-24 years	AHS: 2.22 (-1.63, 6.07); NDSHS: -0.46 (-1.06, 0.14)	**AHS: 3.47 (1.08, 5.86); NDSHS: 1.28 (0.81, 1.76)**	AHS: -0.89 (-3.63, 1.84); NDSHS: -0.52 (-1.75, 0.70)	**AHS: -2.03 (-3.69, -0.38);** NDSHS: -0.38 (-1.42, 0.66)	**34.82 (2.78, 66.85)**	**94.59 (55.24, 133.94)**
	25-34 years	AHS: -0.21 (-2.41, 1.99); NDSHS: 1.41 (-1.42, 4.24)	AHS: -0.85 (-2.23, 0.52); NDSHS: -1.79 (-3.95, 0.37)	AHS: -0.65 (-6.21, 4.91); NSHS: 1.72 (-1.45, 4.91)	AHS: 1.54 (-1.87, 4.94); NDSHS: -0.58 (-3.00, 1.85)		

* Measured as number of sticks sold per adult in Canada and Japan, cigarette retail value per adult (2018 USD) in the UK, and cigarette chain volume (2018 AUD) in Australia

Limitations and Implications of the study

- Some of the limitations of our study include:
  - No fixed intervention point
  - Does not account for smoking intensity and frequency
  - Not controlled for vaping laws
- Some of the implications of the study include:
  - Whether vaping acts as a gateway to cigarette smoking among young adults may depend upon the nicotine content in vape products and vaping policies

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Questions