

Does grandparental smoking affect obesity in adolescence?

A three-generational study

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Presenter Disclosures

Marcelle M. Dougan

(1) The following personal financial relationships with commercial interests relevant to this presentation existed during the past 12 months:

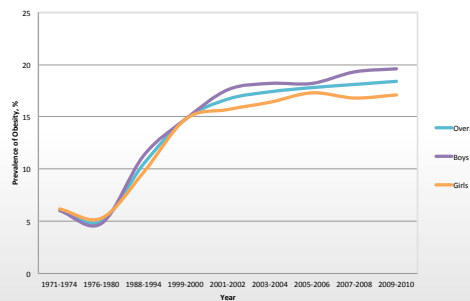
No relationships to disclose

Epidemiology

- Currently more than 1 in 3 adolescents is overweight or obese in the US
- Risk factors include physical inactivity and diet
- Positively associated with depression, adult obesity, and obesity-related conditions
- May develop *in utero*



Adolescent Obesity United States, 1971-2010

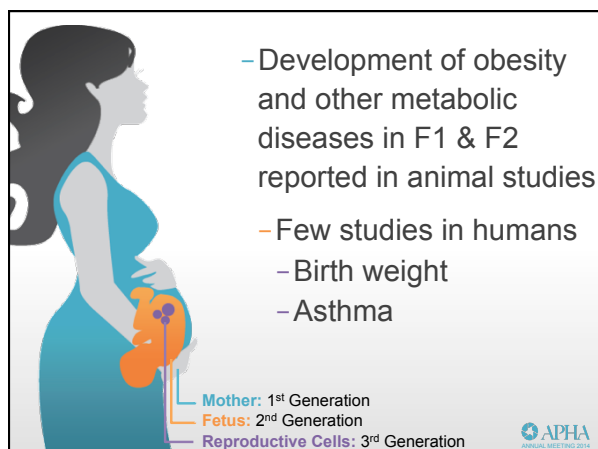
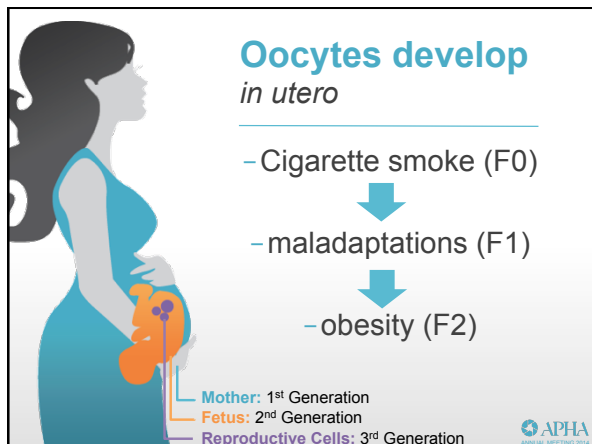


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Grandparental Smoking and Adolescent Obesity

- Consistent positive associations between maternal smoking and offspring obesity
 - 40-60% increased risk
- Does association persist in future generations?

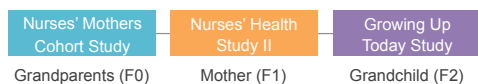


Objective and Hypotheses

- Grandparental smoking is positively associated with obesity in adolescence
- Association may differ in boys and girls



Methods: Study Population



Grandparents (F0) Mother (F1) Grandchild (F2)



Methods: Outcomes

	BOYS (kg/m ²)		GIRLS (kg/m ²)	
	Overweight	Obese	Overweight	Obese
Age 12	21.22	26.02	21.68	26.67
Age 17	24.46	29.41	24.70	29.69

- Self-reported height and weight at ages 12 and 17
- Categorized using sex- and age-specific cut-offs

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Methods: Exposures

	BOYS (kg/m ²)		GIRLS (kg/m ²)	
	Overweight	Obese	Overweight	Obese
Age 12	21.22	26.02	21.68	26.67
Age 17	24.46	29.41	24.70	29.69

- Exposures self-reported by grandmother
 - Grand-maternal
 - Grand-paternal
 - Grandparental

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Statistical Analysis

- Grand-parental smoking variables
 - Grand-maternal [none; quit during pregnancy; 1-14/day; 15+/day]
 - Grand-paternal [none; 1-14/day; 15+/day]
 - Grandparental [none; either; both]

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Statistical Analysis

- Separate analyses for boys and girls
 - Two populations: age 12 and age 17
- Randomly selected one child per family
- Logistic regression
- Secondary analyses: children of non-smoking mothers



Statistical Analysis

- **Model 1:** age-adjusted
- **Model 2:** Model 1 + G-M pre-pregnancy BMI, G-M age during pregnancy with nurse, G-M and G-F education
- **Model 3:** Model 2 + TV viewing, vigorous physical activity, Tanner stage

G-M: grandmother, G-F: grandfather



Age-standardized participant characteristics by grand-maternal smoking

	GIRLS		BOYS	
	Non-smoker	15+/day	Non-smoker	15+/day
Number of participants	1643		1458	
n	1232	126	1087	105
Age at baseline	11.0 (0.9)	10.9 (0.9)	10.9 (0.9)	11.0 (0.8)
Baseline BMI	18.3 (3.1)	18.2 (3.1)	18.4 (3.3)	18.7 (3.3)
Normal weight, %	80	79	80	76
Overweight, %	16	18	16	18
Obese, %	3	3	5	5
TV viewing (hr/wk)	14.3 (9.4)	14.8 (9.2)	16.5 (10.3)	17.1 (19.9)
Vigorous activity (hr/wk)	7.8 (5.9)	8.2 (6.0)	11.5 (7.3)	13.8 (9.5)
Ever tried cigarettes, %	3	2	4	4
GM education, some college, %	38	38	38	38
GP education, some college, %	45	55	46	40
Maternal smoking, %	27	30	27	41

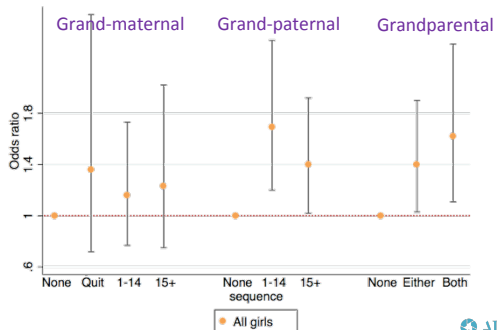


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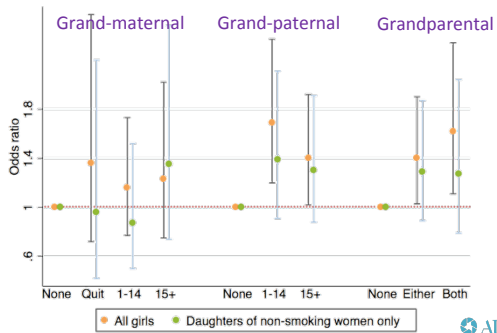
Results: Grandparental smoking and overweight/obesity in girls at age 12



Results: Girls at age 12 (All mothers)

- **Grand-maternal:** 1.00, 1.36 (0.72 – 2.57), 1.16 (0.77 – 1.73), 1.23 (0.75 – 2.02); $p_{trend} = 0.27$
- **Grand-paternal:** 1.00, 1.69 (1.20 – 2.37), 1.40 (1.02 – 1.92); $p_{trend} = 0.03$
- **Grand-parental:** 1.40 (1.03 – 1.90), 1.62 (1.11 – 2.34)

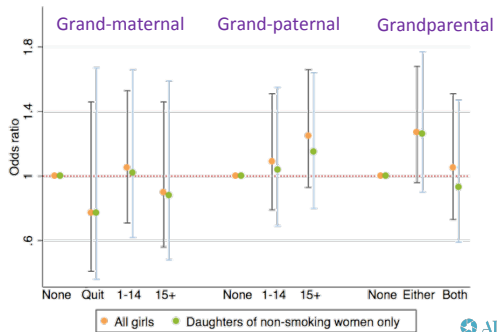
Results: Grandparental smoking and overweight/obesity in girls at age 12



Results: Girls at age 12 (N-S mothers)

- **Grand-maternal:** 1.00, 0.96 (0.42 – 2.20), 0.87 (0.50 – 1.52), 1.35 (0.74 – 2.48); $p_{trend} = 0.66$
- **Grand-paternal:** 1.00, 1.39 (0.91 – 2.11), 1.30 (0.88 – 1.91); $p_{trend} = 0.16$
- **Grand-parental:** 1.29 (0.89 – 1.87), 1.27 (0.79 – 2.04)

Results: Grandparental smoking and overweight/obesity in girls at age 17



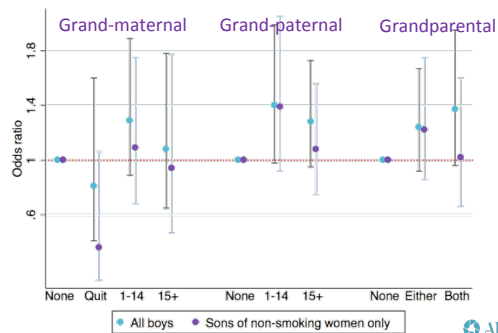
Results: Girls at age 17 (All mothers)

- **Grand-maternal:** 1.00, 0.77 (0.41 – 1.46), 1.05 (0.71 – 1.53), 0.90 (0.56 – 1.46); $p_{trend} = 0.27$
- **Grand-paternal:** 1.00, 1.09 (0.79 – 1.51), 1.25 (0.93 – 1.66); $p_{trend} = 0.14$
- **Grand-parental:** 1.27 (0.96 – 1.68), 1.05 (0.73 – 1.51)

Results: Girls at age 17 (N-S mothers)

- **Grand-maternal:** 1.00, 0.96 (0.42 – 2.20), 0.87 (0.50 – 1.52), 1.35 (0.74 – 2.48); $p_{trend} = 0.66$
- **Grand-paternal:** 1.00, 1.39 (0.91 – 2.11), 1.30 (0.88 – 1.91); $p_{trend} = 0.16$
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Results: Grandparental smoking and overweight/obesity in boys at age 12

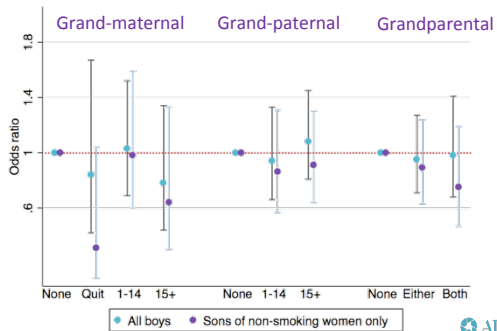


Results: Boys at age 12 (All mothers)

- **Grand-maternal:** 1.00, 0.81 (0.41–1.60), 1.29 (0.89 – 1.89), 1.08 (0.65 – 1.78); $p_{trend} = 0.35$
- **Grand-paternal:** 1.00, 1.40 (0.98 – 1.99), 1.28 (0.95 – 1.73); $p_{trend} = 0.09$
- **Grand-parental:** 1.24 (0.92 – 1.67), 1.37 (0.96 – 1.95)

**Results: Boys at age 12 (N-S mothers)**

- **Grand-maternal:** 1.00, 0.36 (0.12 – 1.06), 1.09 (0.68 – 1.75), 0.92 (0.47 – 1.77); $p_{trend} = 0.88$
- **Grand-paternal:** 1.00, 1.39 (0.92 – 2.05), 1.08 (0.75 – 1.56); $p_{trend} = 0.60$
- **Grand-parental:** 1.22 (0.86 – 1.75), 1.02 (0.66 – 1.60)

**Results: Grandparental smoking and overweight/obesity in boys at age 17****Results: Boys at age 17 (All mothers)**

- **Grand-maternal:** 1.00, 0.84 (0.42 – 1.67), 1.03 (0.69 – 1.52), 0.78 (0.45 – 1.34); $p_{trend} = 0.53$
- **Grand-paternal:** 1.00, 0.94 (0.66 – 1.33), 1.08 (0.81 – 1.45); $p_{trend} = 0.62$
- **Grand-parental:** 0.95 (0.71 – 1.27), 0.98 (0.68 – 1.41)



Results: Boys at age 17 (N-S mothers)

- **Grand-maternal:** 1.00, 0.31 (0.09 – 1.04), 0.98 (0.60 – 1.59), 0.64 (0.30 – 1.33); $p_{trend} = 0.25$
- **Grand-paternal:** 1.00, 0.86 (0.57 – 1.31), 0.91 (0.64 – 1.30); $p_{trend} = 0.56$
- **Grand-parental:** 0.89 (0.63 – 1.24), 0.75 (0.47 – 1.19)



Discussion: Grand-maternal

- Grand-maternal smoking was not associated with adolescent obesity in girls or boys



Discussion: Grand-paternal

- Grand-paternal smoking was associated with obesity at age 12 in girls
 - Correlation with maternal smoking stronger than for grand-maternal smoking
 - Associations attenuated and became non-significant among children of non-smoking mothers
 - Limited power in sub-group analyses



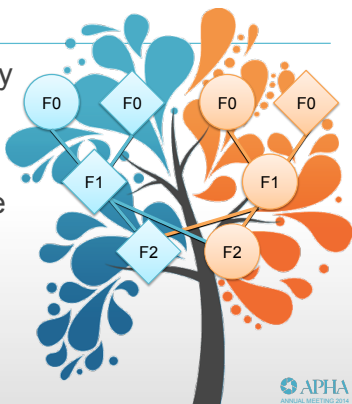
Discussion

- May affect only offspring of males
 - Dutch famine study



Discussion

- May affect only offspring of males
- Dutch famine study



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Limitations and Strengths

- Homogenous population → limited generalizability
- Limited power for secondary analyses
- Three generations of high quality data
- First study to examine grand-parental smoking and adolescent obesity

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Implications

- Effects of grand-maternal smoking may not be transferred to the grandchild



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Implications

- Association with grand-paternal smoking cannot be ruled out
- Future studies should also assess offspring of males



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Thank You

