The Health of the Amish and What we can learn

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Disclosures

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The Lancaster County Old Order Amish as a Genetic Isolate

~ 35,000 present data Lancaster County Amish

~ 400-500 ‘founding’ immigrants

1727-1757

Traditional/unique culture

Unique genetics

• Less genetic diversity
Some core characteristics of the Old Order Amish

- Adult baptism (anabaptist)
- Church, community, family
- Local governance through church districts
- ‘Humble’ lifestyle
- Education through 8\textsuperscript{th} grade
- Excellent genealogical records
- Technological conservatism
Amish lifestyle

- High levels of physical activity
- High social cohesiveness
- Low smoking and alcohol consumption
- Home grown and prepared foods
- Limited access to health care systems
The health of the Amish
Low prevalence of **diabetes and prediabetes** in the Amish

![Graph showing prevalence of diabetes and prediabetes in Amish and NHANES populations.]

OR for diabetes: 0.22 (0.18-0.27)

NHANES data (1988-2012) from Menke et al., 2015

Diabetes: FBG ≥ 126 or HbA1c ≥ 6.5 or medication use
Pre-diabetes: 100 ≤ FBG ≤ 125 or 5.7 ≤ HbA1c ≤ 6.4
Low prevalence of **hypertension** in the Amish

1 NHANES data from Yoon et al., 2015

Hypertension: SBP ≥ 140 mmHg or DBP ≥ 90 mmHg or medication use
Higher prevalence of total and LDL-cholesterol in the Amish, (age ≥ 20)

NHANES data from Benjamin et al., 2018
Higher prevalence of cholesterol in the Amish is partly due to an enrichment for LDL-raising mutations (e.g., APOB R3527Q).

NHANES data from Benjamin et al., 2018

High total cholesterol (≥ 240 mg/dl);
High LDL cholesterol (≥ 130 mg/dl)
Use of lipid-lowering medications in Amish vs NHANES, by age group and sex

NHANES data from Carroll et al., 2012
Low prevalence of **obesity** in Amish men (but not women)

NHANES data from Flegal et al., 2016, NHWs

Obesity: BMI ≥ 30 kg/m²
Cardiovascular Risk Factors in Amish and non-Amish Caucasians

Compared to non-Amish Caucasians, Amish have:

- Less diabetes and less hypertension
- Lower BMI (men only)
- Higher LDL-C; but ↓ TG
- Much less Rx medication use:
  - Less smoking: (20% of Amish men)
  - Higher physical activity

Lifespan in Amish vs than Framingham Heart Study: (cohorts born 1886 - 1922)
Does high physical activity blunt the effect of the FTO risk allele on BMI?

**Association of FTO rs1861868 with BMI in the Amish**

*Rampersaud et al., Arch Intern Med 168:1791, 2008*
High ‘usual’ levels of physical activity blunt the TG response following a high fat meal

- Nonfasting TGs associated with incident CHD (post-prandial inflammation and endothelial dysfunction?)
- Standardized oral fat tolerance test administered (n = 671 subjs)
- TG excursions measured over 6 hrs
- 7-day physical activity by accelerometer

P = 0.003, adj for age, sex, BMI, LDL

Submitted for publication
34% of Amish men reported ever smoking (esp. cigars)

Ever smoking associated with lower lung function, higher heart rate

Secondary smoking associated (in men) with higher BMI, higher fasting glucose, lower heart rate.
Summary and Conclusions

• Amish are one of the fastest growing population groups in the U.S.

• Across multiple indices, Amish adults have lower disease rates compared to other non-Hispanic whites in the U.S.
  - Less diabetes, obesity, and hypertension

• Exploration of lifestyle differences can provide insights into improving the nation’s health
  - Physical activity
  - Other lifestyle factors (social cohesiveness, family support, diet, etc.)
Amish Investigators at Maryland

- Alan Shuldiner
- Brackie Mitchell
- Toni Pollin
- Jeff O’Connell
- Liz Streeten
- Jim Perry
- Patrick McArdle
- May Montasser
- Christy Chang
- Norann Zaghloul

- Kathy Ryan
- Simeon Taylor
- Amber Beitelshees
- Josh Lewis
- Coleen Damcott
- Da-Wei Gong
- Mao Fu
- Hui Xu
- Brady Gaynor
- Melanie Daue

- Nanette Steinle
- Teo Postolache
- Elliot Hong

[Image of the Amish Research Clinic sign]
[Image of Amish children in a horse-drawn buggy]
Amish Research Clinic

• **Support staff**
  • RNs, Amish liaisons, lab tech, driver, admin

• **Recruiting visits**
  • Home visits: ~400-500/month
  • Wellness study: ~70-80/mon
  • Mobile van

• **Testing done**
  • Fat biopsies, OGTT, IVGTT,
  • metabolic studies (TrueOne 2400 cart), lipoprotein turnover studies
  • platelet functional studies
  • Anthropometry
  • Imaging/ultrasound:
The End