



Cost Effectiveness of Use of Coronary Artery Disease Family History to Direct Hyperlipidemia Screening

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Background

- **Public health burden of cardiovascular disease (CVD) (Thacker et al., 2006)**
 - **Mortality – leading cause of death in U.S.**
 - ◆ **35% of all deaths in U.S. in 2002 due to CVD**
 - **Costs – leading causes of hospital discharges and health care costs**
- **Hypercholesterolemia (HC) is a risk factor for CVD**
 - **Must evaluate lipid profiles, not just total level**
 - **Other risk factors such as obesity and insulin resistance are also important**
- **Atherosclerosis begins in childhood and adolescence**
 - **Primary prevention of atherosclerosis is key**



Professional Guidelines

- In 1998, American Academy of Pediatrics (AAP) recommended that children ages 2+ be screened for high cholesterol if they have a
 - Family history of premature CVD (≤ 55 years of age) or
 - Parent history of hypercholesterolemia (HC) (≥ 240 mg/dL)



Usefulness of Family History to Identify Youth with HC?

- O'Loughlin et al. (2004, *Pediatrics*)
 - Ages 9, 13, and 16 (n=3,665 in Quebec)
 - Questioned usefulness of AAP 1998 recommendation on parent history to identify youth with HC (high LDL-C)
 - ◆ Sensitivity: 41-51%
 - ◆ Specificity: 69-75%
 - Family history offered little improvement over random screening
 - ◆ % with HC 7.7% with positive family history
 - ◆ % with HC 4.8% overall



Usefulness of Family History to Identify Youth with HC?

- Inaccuracy of parent self-reports of CVD history (Newell et al. 1999)
- Inaccuracy of parent self-reports of unknown HC status (Ford et al. 2003)
 - NHANES (1999-2000) indicated among adults (20+ years old) with HC
 - ◆ 40% were aware of their condition
 - ◆ 15% were being treated
- Screening with family history information tends to miss children from vulnerable populations (Dennison et al. 1994)
 - ◆ Single-parent families
 - ◆ Less educated parents
 - ◆ Parents without insurance



Framing the Question

- **What is the goal:**
 - Maximize case detection, or
 - Minimize cost of case detection?
- **Epidemiology Studies**
 - Glass is half *empty*...
 - Some question the usefulness of family history tool, due to relatively low
 - ◆ sensitivity/specificity
 - ◆ total cases detected
- **Economics Studies**
 - Glass is half *full*...
 - Encouraged the use of family history
 - Screening with family history is more cost-effective than universal or opportunistic screening



Cost-Effectiveness Analysis Methods

- **Outcome measure**
 - Extension of life expectancy resulting from intervention
- **Costs**
 - Costs of screening, follow-up, diagnosis
 - Treatment costs – therapy, hospitalization
- **Incremental cost-effectiveness ratio (ICER)**
 - Net cost per life year saved
 - The lower value of ICER, the more cost-effective



Cost-Effectiveness Case Study

(Marks et al. 2002, *BMJ*)

- **Problem** – what is the most cost-effective strategy to identify undiagnosed individuals with familial hypercholesterolemia (FH)?
 - About 110,000 people in UK have FH (1 in 500)
 - 95% have HC
 - For males, 50% risk of CHD by age 50
- **Methods**
 - Define screening strategies
 - Simulation modeling based on UK data
 - Calculate numbers of cases identified and total screening costs



Cost-Effectiveness Case Study

(Marks et al. 2002, *BMJ*)

- Hypothetical family tracing or case finding strategy
 - Ask patients with clinically confirmed cases of FH to identify first-degree relatives
 - Ask patients to invite their first-degree relatives to provide a blood sample for a lipid test
 - Half of family members will be affected



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Cost-Effectiveness Case Study

(Marks et al. 2002, *BMJ*)

	Screening strategies
Family tracing	Systematic screening of 1st degree relatives of people with clinically confirmed familial HC
Universal (16)	Screening all young people aged 16 years
Universal	Universal population screening aged 16-54 years
Opportunistic	Opportunistic screening of patients consulting for unrelated reasons in primary care



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Cost-Effectiveness Case Study

(Marks et al. 2002, *BMJ*)

Screening option	# needed to screen to find one FH case	Cost per person screened	Cost per FH case detected
Family tracing	2.6	\$74	\$190
Universal (16)	1365	\$10	\$14,100
Universal	1146	\$12	\$13,950
Opportunistic	938	\$14	\$13,120

Effectiveness/cost discounted at 1%/6%



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Cost-Effectiveness Case Study

(Marks et al. 2002, *BMJ*)

Cost-Effectiveness Ratio: \$ per life year saved relative to doing nothing

Screening option	Average CER
Family tracing	\$8,800
Universal (16)	\$10,480
Universal	\$30,790
Opportunistic	\$26,870

Effectiveness and costs both discounted at 3%



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Summary of Cost-effectiveness Analysis Results (Marks et al. 2002, *BMJ*)

- Identifying relatives of patients with clinically confirmed FH is most cost-effective strategy to screen for FH
 - Family tracing minimizes number screened
 - Doesn't maximize case detection
- The earlier FH is diagnosed, the more cost-effective screening becomes



Limitations of CEA Case Study

- No information on numbers of cases identified by different strategies
 - No assumption about uptake of screening
- No incremental cost-effectiveness ratios
- Other benefits of lipid screening excluded
 - Detection of non-FH hyperlipidemia
 - FH cases account for 3% of HC cases
- Uncertain relevance to use of family history tools in primary practice



Next Steps for Cost-Effectiveness Analysis of Family History in HC

- **Evaluate AAP screening protocol**
- **Use US epidemiology and cost data**
- **Screen with family history at ages of 9, 13 and 16 years**
- **Compare effectiveness with other strategies**
 - **Population-based health promotion**
 - **Targeted promotion based on HC**



Comparison of FH FHx vs. General Population HC Screening

(Khoury et al., *Genet Med*, 2006)

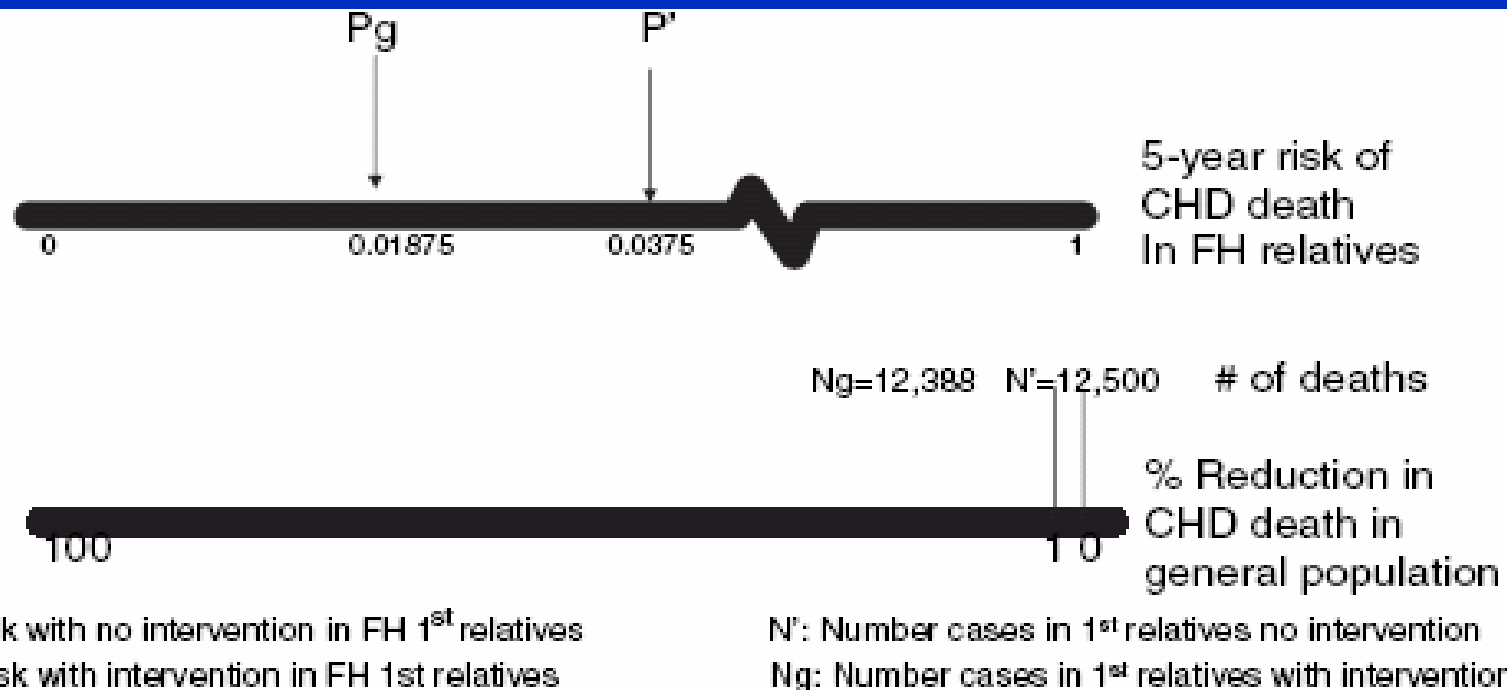
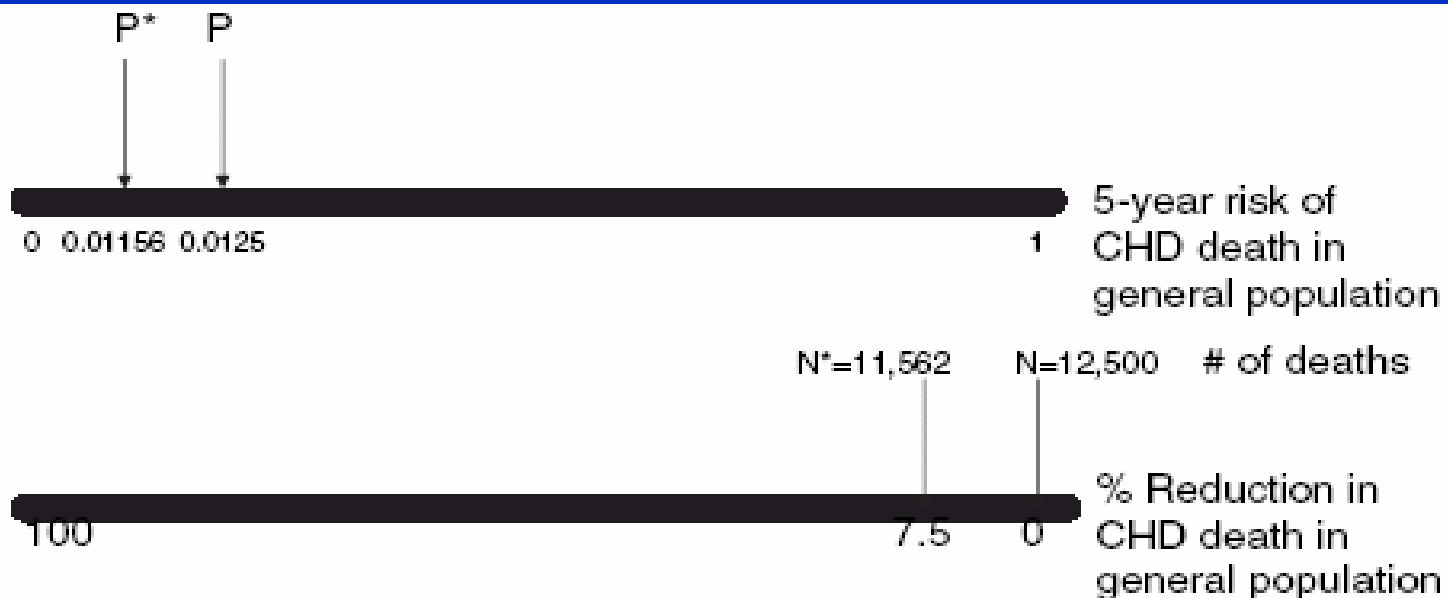


Fig. 3. Quantifying population health benefits of genetic-based intervention in terms of absolute and proportional risk reduction of an adverse health outcome: Testing first-degree relatives in familial hypercholesterolemia.

Comparison of FH FHx vs. General Population HC Screening

(Khoury et al., *Genet Med*, 2006)



P : Risk in population with no intervention

N : Number cases with no intervention

P^* : Population risk after intervention in >95th percentile

N^* : Number cases after intervention

Fig. 4. Quantifying population health benefits of genetic-based intervention in terms of absolute and proportional risk reduction of an adverse health outcome: Population screening for high serum cholesterol.

References

- American Academy of Pediatrics (1998). "American Academy of Pediatrics. Committee on Nutrition. Cholesterol in childhood." *Pediatrics* 101: 141-7.
- Dennison BA, Jenkins PL, et al. (1994). "Challenges to implementing the current pediatric cholesterol screening guidelines into practice." *Pediatrics* 94: 296-302.
- Ford ES, Mokdad AH, et al. (2003). "Serum total cholesterol concentrations and awareness, treatment, and control of hypercholesterolemia among US adults: findings from the National Health and Nutrition Examination Survey, 1999 to 2000." *Circulation* 107: 2185-9.
- Khoury MJ, Jones K, Grosse SD. Quantifying the health benefits of genetic tests: The importance of a population perspective. *Genet Med.* 2006: In press.
- Marks D, Wonderling D, et al. (2002). "Cost effectiveness analysis of different approaches of screening for familial hypercholesterolaemia." *BMJ* 324: 1303.
- Newell SA, Girgis A, et al. (1999). "The accuracy of self-reported health behaviors and risk factors relating to cancer and cardiovascular disease in the general population: a critical review." *Am J Prev Med* 17: 211-29.
- O'Loughlin J, Lauzon B, et al. (2004). "Usefulness of the American Academy of Pediatrics recommendations for identifying youths with hypercholesterolemia." *Pediatrics* 113: 1723-7.
- Thacker SB, Stroup DF, et al. (2006). "Measuring the public's health." *Public Health Rep* 121:14-22.

