What is the evidence for prevention in later life?

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Objectives

- Explain why specialists in Geriatric Medicine should be knowledgeable about prevention
- Review concepts of Preventive Health Care
- Examine the process of developing Preventive Health Care recommendations
- Explore challenges in implementation
To prevent: to stop from happening

- “An ounce of prevention is worth a pound of cure”
- “A stitch in time saves nine”
- “Una mela al giorno leva il medico di torno”
- “An apple a day keeps the doctor away”
A colleague asks you:

- What should my 78 year old mother do for preventive health maintenance?
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- What should my 78 year old mother do for preventive health maintenance?
- A less informed colleague might answer: “Well, how long has she got (to live)?”
How long has she got to live?

Providing she is in “good” health?
How long has she got to live?
A colleague asks you:

- What should my 78 year old mother do for preventive health maintenance?
- A less informed colleague might answer: “Well, how long has she got (to live)?”
- But your answer might be: “According to WHO estimates, she has 12.2 years. We must get to work…”
Roles of the Specialist Physician

- Initiator of preventive health manoeuvres
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- Initiator of preventive health manoeuvres
- Educator of other physicians, students, health care workers
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- Initiator of preventive health manoeuvres
- Educator of other physicians, students, health care workers
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- Resource for health care planners
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- Educator of other physicians, students, health care workers
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- Resource for health care planners
- Advocacy for better living conditions
Roles of the Specialist Physician

- Initiator of preventive health manoeuvres
- Educator of other physicians, students, health care workers
- Source of information for patients, relatives, senior citizens groups
- Resource for health care planners
- Advocacy for better living conditions
- Role model for healthy behaviours
Determinants of population health

- Biology (genetic and physiological)
Progeria: (Hutchinson-Guilford syndrome)
Determinants of population health

- Biology (genetic and physiological)
- Social environment (education, literacy, income, shelter)
Social environment: poverty
### The social environment (WHO 2002)

<table>
<thead>
<tr>
<th></th>
<th>Sierra Leone</th>
<th>Afghanistan</th>
<th>Italy</th>
<th>Canada</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adult literacy (m/f) %</strong></td>
<td>51/23</td>
<td>51/21</td>
<td>99/98</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>% Reaching grade 5</strong></td>
<td>n/a</td>
<td>49/0</td>
<td>96</td>
<td>99</td>
</tr>
<tr>
<td><strong>Telephones per 100</strong></td>
<td>2</td>
<td>0</td>
<td>142</td>
<td>101</td>
</tr>
<tr>
<td><strong>Average income ’03 $</strong></td>
<td>150</td>
<td>250</td>
<td>21,560</td>
<td>23,930</td>
</tr>
<tr>
<td><strong>Life expectancy</strong></td>
<td>30.4/35.7</td>
<td>41.9/43.8</td>
<td>76.0/82.0</td>
<td>76.4/81.8</td>
</tr>
</tbody>
</table>
Determinants of population health

- Biology (genetic and physiological)
- Social environment (education, literacy, income, shelter)
- Physical environment (toxins, hazards)
Road deaths per 100,000 population in 2003

Source: IRTAD 30/2005
Determinants of population health

- Biology (genetic and physiological)
- Social environment (education, literacy, income, shelter)
- Physical environment (toxins, hazards)
- Lifestyle (nutrition, substances, protective devices, sexual practices, risk tolerance)
Influence of lifestyle on mortality

![Bar chart showing the influence of different lifestyle factors on mortality. The factors include Tobacco, Diet/activity patterns, Alcohol, Microbial agents, Toxic agents, Firearms, Sexual behavior, Motor vehicles, and Illicit use of drugs. Tobacco causes the most deaths, followed by Diet/activity patterns and Alcohol.]
Determinants of population health

- Biology (genetic and physiological)
- Social environment (education, literacy, income, shelter)
- Physical environment (toxins, hazards)
- Lifestyle (nutrition, substances, protective devices, sexual practices, risk tolerance)
- Physical activity “fitness”
Physical fitness

- Very heavy exercise
Physical fitness

- Very heavy exercise
- *No helmet !!!!*
Determinants of population health

- Biology (genetic and physiological)
- Social environment (education, literacy, income, shelter)
- Physical environment (toxins, hazards)
- Lifestyle (nutrition, substances, protective devices, sexual practices, risk tolerance)
- Physical activity “fitness”
- AND .... Health (illness) care
<table>
<thead>
<tr>
<th>Country</th>
<th>GNI (2002 international $)</th>
<th>% GDP spent on health</th>
<th>Health care expenditure per person/year</th>
<th>Life expectancy (M)</th>
<th>Life expectancy (F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sierra Leone</td>
<td>150</td>
<td>2.9</td>
<td>30.4</td>
<td>30.4</td>
<td>35.7</td>
</tr>
<tr>
<td>Afghanistan</td>
<td>250</td>
<td>8.0</td>
<td>41.9</td>
<td>41.9</td>
<td>43.8</td>
</tr>
<tr>
<td>Italy</td>
<td>21,560</td>
<td>8.5</td>
<td>2166</td>
<td>76.0</td>
<td>82.0</td>
</tr>
<tr>
<td>Canada</td>
<td>23,930</td>
<td>9.6</td>
<td>2931</td>
<td>76.4</td>
<td>81.8</td>
</tr>
<tr>
<td>USA</td>
<td>36,056</td>
<td>14.6</td>
<td>5274</td>
<td>75.0</td>
<td>80.0</td>
</tr>
</tbody>
</table>
## Life expectancy in later life 2000

<table>
<thead>
<tr>
<th>Age</th>
<th>Italy</th>
<th>Russian Federation</th>
<th>Sierra Leone</th>
</tr>
</thead>
<tbody>
<tr>
<td>70-74 Males</td>
<td>12.6</td>
<td>9.0</td>
<td>7.8</td>
</tr>
<tr>
<td>Female</td>
<td>15.9</td>
<td>11.8</td>
<td>9.0</td>
</tr>
<tr>
<td>80-84 Males</td>
<td>7.1</td>
<td>5.7</td>
<td>4.5</td>
</tr>
<tr>
<td>Females</td>
<td>8.8</td>
<td>6.5</td>
<td>5.3</td>
</tr>
</tbody>
</table>
History of Preventive Health Care

- Antiquity: biblical kashrut laws (diet)
- Lime juice against scurvey (vitamin C)
- Vaccination prevents small pox (inoculation)
- Hand washing prevents puerperal fever
- Clean water prevents cholera
- Smoking and lung cancer
History of Preventive Health Care

- Why didn’t you come sooner?
- American insurance industry 20th century: the “annual physical”
- The Executive Physical (1960-75)
- The birth of Evidence Based preventive health care: Canadian Task Force on the Periodic Health Examination (1979) US Preventive Services Task Force, UK National Health Service etc
Concepts of Prevention

- Prevention or delay of premature death from preventable disease
- Improvement of quality of life by reducing disabling disease
- Improving self perceived health
- Reduction of hazardous lifestyles
Some definitions:

- Health Promotion: the process of enabling people to increase control over, and to improve, their health (WHO)
- Screening: a population approach which aims to reach all individuals at risk for a specific condition
- Case finding: identifies individuals at risk for or having asymptomatic disease during specific or opportunistic encounters
More definitions

- **Primary prevention**: prevents disease before it occurs by immunization or lifestyle counselling

- **Secondary prevention**:  
  (a) early detection of subclinical disease to prevent disability by screening or case finding  
  (b) prevention of recurrent disease (e.g., stroke, MI)

- **Tertiary prevention**: minimizes disability and handicap from established disease (equivalent to treatment or therapeutic care)
Canadian Task Force on Preventive Health Care

- To make recommendations (Clinical Practice Guidelines) to Primary Care Physicians on what to include and exclude from the periodic health examination
- Systematic evidence review
- Internal and external peer review
- Recommendations graded according to strength of evidence
PHC Manoeuvres to include in older people (over age 65 years)

**PRIMARY PREVENTION**
- Counselling
- Immunizations

**SECONDARY PREVENTION**
- Medications
- Screening
An example where counselling might have helped.
Traffic deaths in Canada
Road deaths per 100,000 population by age in 2002
- selected countries -
Counselling for safe driving
Smoking and lung cancer (men, women)
Primary prevention: Examples where evidence is good or fair

- Counselling about safe driving
- Counselling against tobacco use
- Counselling for prudent diet
- Counselling about alcohol
- Counselling about injury prevention
- Counselling about domestic water temperature
### The Public Health environment 2002 (WHO)

<table>
<thead>
<tr>
<th></th>
<th>Sierra Leone</th>
<th>Afghanistan</th>
<th>Italy</th>
<th>Canada</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adequate sanitation %</td>
<td>39</td>
<td>8</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Inoculation DPT 3 %</td>
<td>70</td>
<td>54</td>
<td>96</td>
<td>91</td>
</tr>
<tr>
<td>Inoculation Polio %</td>
<td>60</td>
<td>54</td>
<td>97</td>
<td>88</td>
</tr>
</tbody>
</table>
Effects of immunization: poliomyelitis
Effectiveness of poliomyelitis inoculation (WHO 2004)
Inoculations: good or fair evidence

- Influenza inoculation (annual strain specific)
- Pneumococcal inoculation (every 10 years)
- Tetanus inoculation (every 10 years or once after age 65)
Secondary Prevention: good evidence

E.g. After Myocardial infarction

- ASA
- Beta adrenergic blockers
- ACE inhibitors
- HMG CoA inhibitors (statins)
Secondary Prevention: good evidence

E.g. After Myocardial infarction

- ASA {50% adherence}
- Beta adrenergic blockers {30-50%}
- ACE inhibitors {25-50%}
- HMG CoA inhibitors (statins) {<50%}
Before we discuss screening, how do we arrive at recommendations?
Clinical Practice Guidelines

“Systematically developed statements designed to assist the decision making of practitioners and patients about appropriate health care for specific clinical circumstances”

Audet & Greenfield  Ann Intern Med 1990;113:709
Subject selection

Analytic Framework developed and key questions defined

Literature search initiated (systematic, multiple, medical librarian, reviews, bibliographies, experts)

Abstracts reviewed for RELEVANCE by 2 reviewers, full articles retrieved
CTFPHC & USPSTF Process-2

- Articles undergo QUALITY assessment by 2 reviewers
- For articles of sufficient quality, results abstracted
- Results summarized, meta analyzed if appropriate
- Draft technical report, internal review including US task force
CTFPHC & USPSTF Process -3

- Feedback received, incorporated and brought back to CTF (often several times)
- Recommendations established
- Final draft sent out for external expert review
- Submission for publication
- Recommendation statement, technical report, academic paper
- Amen
How do we rate the Evidence?

I: From at least one well designed RCT (or meta analysis) {Ia Ib in some systems}
II-1: well designed controlled trials without randomization
II-2: well designed cohort or case control
II-3: comparisons between times or places with or without intervention
III: Opinions
Levels of Recommendation

- A: Good evidence to include
- B: Fair evidence to include
- C: Contradictory or marginal evidence; may be recommended on other grounds
- D: Fair evidence to exclude
- E: Good evidence to exclude
- I: Insufficient evidence to make a recommendation
Should we screen?

- Good screening test?
- Adverse effects?
- Early treatment effective?
- Reduces burden of illness
- Preclinical phase?
- Burden of illness?
- Natural history known?
- Reduces burden of illness
Screening examples: A or B

- Problem drinking
- Functional status
- Blood pressure
- Vision
- Hearing
- Clinical breast examination
Deaths from malignancies: rate per 100,000 per year in men

- All CA
- Lung
- Prostate
- Colon

Italy
Spain
Canada
Screening examples: A or B

- Pap smear q 3 years up to age 69
- Fecal occult blood/colonoscopy
- Se cholesterol
- Mammography q 2 years to age 69
- Fasting blood sugar (if hypertensive or hyperlipidemic)
- Bone Mineral Density (at 65 if not earlier)
Controversial manoeuvres

- Prostate cancer
- Cognitive impairment
- Depression
- Elder abuse
Example: Should we screen for Abdominal Aortic Aneurysm (AAA)?
Analytic framework: Screening for AAA

- General population
- Asymptomatic AAA
- Symptomatic AAA
- Rupture and death
- Correct Risk factors
- Screen for AAA
- Surgical repair
- Side effects
- Side effects
Should we screen for AAA?

- Burden of illness?
- Prevalence?
- Mortality?
- High risk groups?
- Symptoms
Should we screen for AAA?

- Burden of illness?
- Prevalence: community 1-7%
- Mortality: 300? deaths per year in Canada
- High risk groups: middle aged and older men; HTN; family history; smokers
- Symptoms: unusual, if present implies impending rupture (severe backpain 100% mortality untreated; 50% if reach hospital)
Prevalence of AAA in men

Figure 1: Prevalence of AAA > 3.0 cm by Age and Smoking History

- NEVER-SMOKER
- EVER-SMOKER

Percent with AAA

Age (Years)

50-64  55-69  60-64  65-69  70-74  75+79
AAA

- Definition?
- Natural history known?
- Preclinical phase?
AAA

- Definition: 3cm or 150% of diameter at diaphragm
- Natural history known: Yes-slow growth, but exponential 0.17-0.48 cm/year
- Preclinical phase: Yes, long
Good detection manoeuvre?
Adverse effects of screening?
Costs?
AAA

- Good detection manoeuvre: Yes palpation detects large aneurysms in slim people. Ultrasound is almost 100% sensitive and specific.
- Adverse effects of screening: worry-must I wait for surgery? Will I survive operation?....?
- Costs: U/S is cheap (NB: NNS=20-100)
AAA

- Effective treatment?
- Treatment changes natural history?
- Mortality, morbidity of treatment?
AAA

- Effective treatment: Yes, graft replacement; more recently endovascular procedures.
- Treatment changes natural history: Yes, with survival, mortality returns to that of co-morbidities
- Mortality of treatment: <5%
- Morbidity of treatment: ARF, MI, delirium
AAA screening AAA related deaths
(USPSTF 2005)

![Figure 2: Forest Analysis of AAA-Related Deaths in Population Screening Trials](image)

### Table 1: Forest Analysis of AAA-Related Deaths in Population Screening Trials

<table>
<thead>
<tr>
<th>Study</th>
<th>Invited to screening n/N</th>
<th>Untreated Controls n/N</th>
<th>OR (random) 68% CI</th>
<th>OR (random) 68% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>MVR</td>
<td>6/4310</td>
<td>15/4310</td>
<td></td>
<td>0.81 (0.15, 0.73)</td>
</tr>
<tr>
<td>Olmsted Trial</td>
<td>30/1015</td>
<td>17/1015</td>
<td></td>
<td>0.84 (0.23, 1.25)</td>
</tr>
<tr>
<td>Wexford Australia</td>
<td>35/1925</td>
<td>35/1925</td>
<td></td>
<td>0.72 (0.38, 1.32)</td>
</tr>
<tr>
<td>MASS</td>
<td>(53.3)1015</td>
<td>(53.3)1015</td>
<td></td>
<td>0.93 (0.43, 1.98)</td>
</tr>
<tr>
<td>Total (68% CI)</td>
<td></td>
<td></td>
<td></td>
<td>0.97 (0.48, 1.97)</td>
</tr>
</tbody>
</table>

Total events: 69 (Invited to Screening), 174 (Untreated Controls)
Test for heterogeneity: Chi² = 2.92, df = 9, p = 0.96, I² = 0
Test for overall effect: L = 4.82 (p < 0.005)

CI = confidence interval; MASS = Multicentre Anomaly Screening Study; OR = odds ratio.

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**Figure 2:** Forest Analysis of AAA-Related Deaths in Population Screening Trials.
AAA screening: all cause mortality (USPSTF 2005)
AAA (Frame, Fryback, Patterson. Ann Intern Med 1993;119:411)

- Modeling screening 10,000 men ages 60-80
- A single U/S gains 57 life years at $US 41,555 per life year gained.
- Repeat U/S after 5 years gains one additional life year at $US 906,769.
- More recent estimates $14,000-20,000 per QALY.
So, should we screen for AAA?

- In whom?
- How?
- How often?
- What do we give up for this?
Screening for AAA (USPSTF, 2005)

- **B recommendation for:**
  - Single screen in male smokers, age 65-75
  - Ultrasound in accredited facility

- **C recommendation for other men**

- **D recommendation for women**

- What do we give up?
Who to target

- Healthy or not healthy
- Long life expectancy or short life expectancy
- Competing co-morbidities
- Personal values
- Economics
Clinical Practice Guidelines

- Better care, based on evidence
- Reduce variations in practice
- Set a standard by which to judge physician treatment (lawyers like them…)}
Clinical Practice Guidelines

- Better care, based on evidence
- Reduce variations in practice
- Set a standard by which to judge physician treatment (lawyers like them…)
  
  BUT

- Resource intensive
- Need updating
- Not followed consistently!
Why don’t physicians follow clinical practice guidelines?
Why don’t physicians follow clinical practice guidelines?

- Too many guidelines
- Conflicting recommendations
- Not enough time
- Concern about loss of autonomy
- Fear of decreased satisfaction with practice
- Suspicious when issued by governments or insurance agencies
Why don’t physicians follow clinical practice guidelines?

They are more likely to be followed if:

- they agree with them
- they are endorsed by respected colleagues (local opinion leaders)
- they are endorsed by major professional organizations
- they are user-friendly

(after Hayward R CMAJ 1997;156:1715)
Did we meet our objectives?

- Explain why specialists in Geriatric Medicine should be knowledgeable about prevention
- Review concepts of Preventive Health Care
- Examine the process of developing Preventive health Care recommendations
- Explore challenges in implementation
CONCLUSIONS

- Recommendations on Preventive Health Care must be based on best evidence
- Surprising abundance of evidence in older people
- Consider co-morbidities and life expectancy
- Consider individual’s values
Useful resources

- Canadian Task Force on Preventive Health Care: ctfphc.org (great links; all my references)
- Agency for Healthcare Research and Quality (USA): Ahrq.gov
Table 6. Mortality summary odds ratio and 95% confidence intervals by length of follow up

<table>
<thead>
<tr>
<th>Length of Follow Up (mo)</th>
<th>Number of Studies</th>
<th>Total Sample Size</th>
<th>Heterogeneity</th>
<th>Summary Odds Ratio (95% Confidence Limits)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>2</td>
<td>1123</td>
<td>.90</td>
<td>1.06 (0.57, 1.77)</td>
</tr>
<tr>
<td>12</td>
<td>11</td>
<td>5714</td>
<td>.80</td>
<td>0.80 (0.66, 0.96)</td>
</tr>
<tr>
<td>24</td>
<td>11</td>
<td>13 426</td>
<td>.87</td>
<td>0.78 (0.70, 0.87)</td>
</tr>
<tr>
<td>36</td>
<td>7</td>
<td>4680</td>
<td>.20</td>
<td>0.90 (0.75, 1.06)</td>
</tr>
<tr>
<td>48</td>
<td>2</td>
<td>5749</td>
<td>.15</td>
<td>0.90 (0.76, 1.04)</td>
</tr>
</tbody>
</table>
Primary Care Screening for Abdominal Aortic Aneurysm
### Table 4. Odds ratios for mortality

<table>
<thead>
<tr>
<th>AUTHOR</th>
<th>INTERVENTION n/N</th>
<th>CONTROL n/N</th>
<th>ODDS RATIO 95% CONFIDENCE INTERVAL</th>
<th>WEIGHT %</th>
<th>ODDS RATIO (95% CONFIDENCE LIMITS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tellis and Moore, 1979&lt;sup&gt;1&lt;/sup&gt;</td>
<td>24/170</td>
<td>42/169</td>
<td>3.3 0.76 (0.44, 1.26)</td>
<td>5.6</td>
<td>0.69 (0.47, 1.02)</td>
</tr>
<tr>
<td>Hendriksen et al., 1984&lt;sup&gt;2&lt;/sup&gt;</td>
<td>54/200</td>
<td>75/200</td>
<td>5.6 0.69 (0.47, 1.02)</td>
<td>8.2</td>
<td>0.72 (0.52, 0.98)</td>
</tr>
<tr>
<td>Vetter et al., 1984&lt;sup&gt;3&lt;/sup&gt;</td>
<td>80/577</td>
<td>105/571</td>
<td>8.2 0.72 (0.52, 0.98)</td>
<td>301/777</td>
<td>0.91 (0.74, 1.11)</td>
</tr>
<tr>
<td>Sorensen and Siverstuen, 1988&lt;sup&gt;4&lt;/sup&gt;</td>
<td>262/777</td>
<td>381/777</td>
<td>10.3 0.91 (0.74, 1.11)</td>
<td>66/272</td>
<td>1.26 (0.84, 1.90)</td>
</tr>
<tr>
<td>Cozzolino and Donnadio, 1990&lt;sup&gt;5&lt;/sup&gt;</td>
<td>16/151</td>
<td>22/145</td>
<td>1.9 0.63 (0.32, 1.25)</td>
<td>51.1</td>
<td>1.36 (0.84, 1.90)</td>
</tr>
<tr>
<td>Clarke et al., 1992&lt;sup&gt;6&lt;/sup&gt;</td>
<td>70/261</td>
<td>60/262</td>
<td>5.4 1.23 (0.83, 1.83)</td>
<td>14/81</td>
<td>0.63 (0.32, 1.25)</td>
</tr>
<tr>
<td>Hell et al., 1992&lt;sup&gt;7&lt;/sup&gt;</td>
<td>14/81</td>
<td>18/86</td>
<td>1.5 0.80 (0.57, 1.17)</td>
<td>67/269</td>
<td>0.70 (0.49, 1.00)</td>
</tr>
<tr>
<td>Potth et al., 1992&lt;sup&gt;8&lt;/sup&gt;</td>
<td>70/261</td>
<td>60/262</td>
<td>5.4 1.23 (0.83, 1.83)</td>
<td>10/249</td>
<td>0.55 (0.25, 1.21)</td>
</tr>
<tr>
<td>Watson et al., 1992&lt;sup&gt;9&lt;/sup&gt;</td>
<td>10/249</td>
<td>18/248</td>
<td>1.5 0.55 (0.25, 1.21)</td>
<td>42/292</td>
<td>0.80 (0.51, 1.25)</td>
</tr>
<tr>
<td>Van Bruggen et al., 1993&lt;sup&gt;10&lt;/sup&gt;</td>
<td>17/635</td>
<td>23/487</td>
<td>2.2 0.70 (0.38, 1.32)</td>
<td>48/520</td>
<td>0.77 (0.51, 1.18)</td>
</tr>
<tr>
<td>Wagner et al., 1994&lt;sup&gt;11&lt;/sup&gt;</td>
<td>206/2165</td>
<td>454/2090</td>
<td>27.9 0.84 (0.72, 0.97)</td>
<td>5/289</td>
<td>1.0 0.46 (0.18, 1.20)</td>
</tr>
<tr>
<td>Burton et al., 1997&lt;sup&gt;12&lt;/sup&gt;</td>
<td>1304/7452</td>
<td>1406/7459</td>
<td>1.0 0.46 (0.18, 1.20)</td>
<td>1/101</td>
<td>0.8 0.59 (0.60, 0.54)</td>
</tr>
<tr>
<td>Hey et al., 1998&lt;sup&gt;13&lt;/sup&gt;</td>
<td>7/72</td>
<td>3/69</td>
<td>0.8 2.14 (0.58, 7.97)</td>
<td>12/250</td>
<td>1.6 0.67 (0.22, 1.40)</td>
</tr>
<tr>
<td>Hult et al., 2000&lt;sup&gt;14&lt;/sup&gt;</td>
<td>10/250</td>
<td>18/253</td>
<td>1.6 0.67 (0.22, 1.40)</td>
<td>1/50</td>
<td>0.8 0.25 (0.04, 1.59)</td>
</tr>
<tr>
<td>Neubauer et al., 2001&lt;sup&gt;15&lt;/sup&gt;</td>
<td>48/520</td>
<td>47/411</td>
<td>4.8 0.77 (0.51, 1.18)</td>
<td></td>
<td>0.83 (0.75, 0.91)</td>
</tr>
</tbody>
</table>

*Pooled random effects estimate

Heterogeneity chi-square 19.03 (df=18) P=.29

\*n/N = number dying/number studied.
# Table 5. Odds ratios for living in the community

<table>
<thead>
<tr>
<th>AUTHOR</th>
<th>INTERVENTION n/N*</th>
<th>CONTROL n/N*</th>
<th>ODDS RATIO 95% CONFIDENCE INTERVAL</th>
<th>WEIGHT %</th>
<th>ODDS RATIO (95% CONFIDENCE LIMITS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hendriksen et al, 1984a</td>
<td>213/360</td>
<td>206/300</td>
<td>-</td>
<td>13.6</td>
<td>1.12 (0.79, 1.54)</td>
</tr>
<tr>
<td>Vetter et al, 1984a</td>
<td>471/577</td>
<td>441/571</td>
<td>-</td>
<td>17.8</td>
<td>1.28 (0.96, 1.71)</td>
</tr>
<tr>
<td>Sorensen and Siversten, 1988a</td>
<td>289/777</td>
<td>271/777</td>
<td>-</td>
<td>26.4</td>
<td>1.11 (0.90, 1.36)</td>
</tr>
<tr>
<td>Clarke et al, 1992a</td>
<td>190/260</td>
<td>189/262</td>
<td>-</td>
<td>11.8</td>
<td>1.03 (0.87, 1.25)</td>
</tr>
<tr>
<td>Hall et al, 1992a</td>
<td>61/81</td>
<td>51/86</td>
<td>-</td>
<td>4.7</td>
<td>2.07 (1.07, 3.99)</td>
</tr>
<tr>
<td>Fathy et al, 1992a</td>
<td>290/369</td>
<td>244/356</td>
<td>-</td>
<td>14.5</td>
<td>1.68 (1.20, 2.35)</td>
</tr>
<tr>
<td>Van Rossum et al, 1993a</td>
<td>231/292</td>
<td>223/288</td>
<td>-</td>
<td>11.3</td>
<td>1.10 (0.87, 1.44)</td>
</tr>
<tr>
<td>Pooled random effects estimate</td>
<td>1745/2657</td>
<td>1607/2640</td>
<td>-</td>
<td>1.23</td>
<td>(1.06, 1.43)</td>
</tr>
</tbody>
</table>

Heterogeneity chi-square 8.23 (df = 6) P = .22

* n/N = number living in the community/number studied.
## The social environment 2002 (WHO)

<table>
<thead>
<tr>
<th></th>
<th>Adult literacy (m/f) %</th>
<th>Children reaching grade 5</th>
<th>Telephones per 100</th>
<th>Annual income Int $</th>
<th>Life expectancy (m/f)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sierra Leone</td>
<td>51/23</td>
<td>n/a</td>
<td>2</td>
<td>150</td>
<td>30.4/35.7</td>
</tr>
<tr>
<td>Afghanistan</td>
<td>51/21</td>
<td>49/0</td>
<td>0</td>
<td>250</td>
<td>41.9/43.8</td>
</tr>
<tr>
<td>Italy</td>
<td>99/98</td>
<td>96</td>
<td>142</td>
<td>21,560</td>
<td>76.0/82.0</td>
</tr>
<tr>
<td>Canada</td>
<td>99</td>
<td>99</td>
<td>101</td>
<td>23,930</td>
<td>76.4/81.8</td>
</tr>
</tbody>
</table>
The social environment: clean water
Homicide rates per 100,000 in 2001

<table>
<thead>
<tr>
<th></th>
<th>Russian federation</th>
<th>USA</th>
<th>Canada</th>
<th>Italy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>50.2</td>
<td>9.2</td>
<td>2.2</td>
<td>1.5</td>
</tr>
<tr>
<td>Females</td>
<td>14.1</td>
<td>2.7</td>
<td>0.8</td>
<td>0.5</td>
</tr>
</tbody>
</table>
Deaths from malignancies: rate per 100,000 per year in women

[Bar chart showing the comparison of death rates from malignancies (All CA, Breast, Lung, Colon) between Italy, Spain, and Canada.]
Deaths from acute myocardial infarction, other ischemia & stroke rate per 100,000 per year in women

[Bar chart showing AMI, Other heart, and CVA rates for Italy, Spain, and Canada.]
Prevalence of AAA
## Life expectancy at birth 2000

<table>
<thead>
<tr>
<th></th>
<th>Canada</th>
<th>Italy</th>
<th>Cuba</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Males</strong></td>
<td>76.4</td>
<td>76.0</td>
<td>74.7</td>
<td>74.1</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td>81.8</td>
<td>82.0</td>
<td>79.0</td>
<td>79.4</td>
</tr>
</tbody>
</table>
## Life expectancy at birth 2000

<table>
<thead>
<tr>
<th></th>
<th>Italy</th>
<th>Russian Federation</th>
<th>Sierra Leone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>76.0</td>
<td>58.9</td>
<td>30.4</td>
</tr>
<tr>
<td>Females</td>
<td>82.0</td>
<td>72.2</td>
<td>35.7</td>
</tr>
</tbody>
</table>
## Life expectancy in later life 2000

<table>
<thead>
<tr>
<th>Age</th>
<th>Canada</th>
<th>Italy</th>
<th>Cuba</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>70-74</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>13.0</td>
<td>12.6</td>
<td>13.4</td>
<td>13.0</td>
</tr>
<tr>
<td>Females</td>
<td>16.3</td>
<td>15.9</td>
<td>15.4</td>
<td>15.4</td>
</tr>
<tr>
<td>80-84</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>7.4</td>
<td>7.1</td>
<td>8.1</td>
<td>7.6</td>
</tr>
<tr>
<td>Females</td>
<td>9.5</td>
<td>8.8</td>
<td>9.2</td>
<td>9.1</td>
</tr>
</tbody>
</table>
## Life expectancy and health expenditure (2002 Internationalized $)

<table>
<thead>
<tr>
<th></th>
<th>Sierra Leone</th>
<th>Afghanistan</th>
<th>Cuba</th>
<th>Italy</th>
<th>Canada</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life expectancy</td>
<td>30.4</td>
<td>35.7</td>
<td>41.9</td>
<td>43.8</td>
<td>74.7</td>
<td>76.0</td>
</tr>
<tr>
<td></td>
<td>35.7</td>
<td>43.8</td>
<td>74.7</td>
<td>82.0</td>
<td>76.4</td>
<td>75.0</td>
</tr>
<tr>
<td>% GDP</td>
<td>2.9</td>
<td>8.0</td>
<td>7.5</td>
<td>8.5</td>
<td>9.6</td>
<td>14.6</td>
</tr>
<tr>
<td>Dollar amount</td>
<td>27</td>
<td>34</td>
<td>236</td>
<td>2166</td>
<td>2931</td>
<td>5274</td>
</tr>
</tbody>
</table>
### Health Care Workers per 100,000 population by country

<table>
<thead>
<tr>
<th></th>
<th>United Kingdom</th>
<th>Canada</th>
<th>Spain</th>
<th>USA</th>
<th>Italy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physicians</td>
<td>166</td>
<td>209</td>
<td>319</td>
<td>548</td>
<td>606</td>
</tr>
<tr>
<td>Nurses</td>
<td>496</td>
<td>1009</td>
<td>361</td>
<td>772</td>
<td>446</td>
</tr>
<tr>
<td>Pharmacists</td>
<td>58</td>
<td>79</td>
<td>76</td>
<td>68</td>
<td>109</td>
</tr>
</tbody>
</table>
Diffusing best practices

Perceptions of the innovation:

- Perceived benefit
- Compatible: beliefs, values, needs
- Complexity
- Local adaptation
- “Trialability”
- “Observability”
- Account for 49-87% of the spread
Techniques that change physician performance

- *Didactic Continuing Medical Education (CME) does not change performance*
- Needs defined by learners
- Interaction (e.g. case discussions, role play, hands on, academic detailing, audit/feedback)
- Sequenced, multifaceted (e.g. work learn work, opinion leaders, follow up)

Mazmanian P, Davis D  JAMA; 288(9): 1057
Epidemiological triangle

Host

Agent

Environment