Members of the Primary Prevention Planning Group

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Framework for cancer health economics research

Economic Inputs
- Insurance Coverage
- Benefit Design
- Access to Care
- Price of Care
- Social Determinants of Health
- Employee Benefits

Cancer Control Continuum
- Prevention
- Screening
- Treatment
- Survivorship
- End-of-Life

Patient-Level Outcomes
- Survival
- QALYs
- Patient Costs
- Financial Hardship
- Variations by Patient/Provider Characteristics
- Employment Impacts,

Payer-, Provider-, System- and Societal-Level Outcomes
- Cost-Effectiveness
- Value of Care
- Cost of Care
- Health Equity
- Quality of Care

Structural Factors
- Cancer care workforce
- Health care organizations/system
- Availability of personnel, services, and technologies

Policy Factors
- Coverage and eligibility
- Payments/payment models
- Federal or state mandates
- Regulatory factors
- Innovation and technology diffusion

Background

• Purpose of primary cancer prevention
  • Primary prevention is an effective means to lower the **incidence of cancer**
  • The aim is to lower the incidence of cancer by avoiding the known causes and risk factors

• Exposures to Risk factors
  • "The food we eat, how active we are and how much we weigh are all things that influence our risk of cancer, and all of these factors are modifiable – there are things people can do to reduce their risk."

  Dr Kate Allen, Executive Director,
  World Cancer Research Fund International
NCI’s portfolio analysis on competitive awards in cancer prevention, fiscal year 2015-2020

Cancer Continuum

- Prevention: 30
- Screening: 5
- In treatment: 1

Study Type

- Interventional RCT: 30
- Simulation/model: 5
- Interventional non-RCT: 1
- Retrospective: 1

Clinical Outcome

- Behavior change (e.g. smoking cessation): 30
- Screening/diagnosis: 5
- [Other]: 1
- Incidence/prevalence: 1
- Patient knowledge: 1
- Quality of life/well being: 1
- Survival/mortality: 1

Economic Outcome

- Cost effectiveness: 25
- Other/unspecified costs: 20
- Policy impact: 1
- Cost benefit: 1
- Economic analysis: 1
- Medical care costs (= cost of cancer care): 1
- Patient costs (= out-of-pocket costs): 1
Example of strength of the evidence on causal relationship between exposure to cancer risk factors and cancer as the outcome (Source: World Cancer Research Fund/American Ins for Cancer Research, 2018)

<table>
<thead>
<tr>
<th>Cancer as outcome</th>
<th>Alcoholic drinks</th>
<th>Body fatness and weight gain</th>
<th>Physical activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung</td>
<td>Convincing decreases risk</td>
<td>Adult body fatness</td>
<td>Physical activity</td>
</tr>
<tr>
<td>Stomach</td>
<td>Probable decreases risk</td>
<td>AYA body fatness</td>
<td></td>
</tr>
<tr>
<td>Pancreas</td>
<td>Limited - suggestive decreases risk</td>
<td>Adult weight gain</td>
<td></td>
</tr>
<tr>
<td>Gallbladder</td>
<td>Probable decrease risk</td>
<td>Physical activity</td>
<td></td>
</tr>
<tr>
<td>Liver</td>
<td>Probable decreases risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colorectal</td>
<td>Probable decreases risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breast (pre-menopause)</td>
<td>Convincing decreases risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breast (post-menopause)</td>
<td>Probable decreases risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ovarian</td>
<td>Probable decreases risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cervical</td>
<td>Probable decreases risk</td>
<td></td>
<td></td>
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<tr>
<td>Endometrial</td>
<td>Probable decreases risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prostate</td>
<td>Limited - suggestive decreases risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kidney</td>
<td>Probable decreases risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bladder</td>
<td>Convincing decreases risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skin</td>
<td>Probable decreases risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Month, pharynx, and larynx</td>
<td>Probable decreases risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasopharynx</td>
<td>Probable decreases risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Esophageal (Adeno carcinoma)</td>
<td>Probable decreases risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Esophageal (Squamous cell carcinoma)</td>
<td>Probable decreases risk</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Impact of Tobacco

Effects on the Human Body
- cancer of the nose
- cancer of the mouth
- increased coughing and sneezing
- shortness of breath
- lung cancer
- leukaemia
- chronic bronchitis and emphysema
- cancer of the kidney
- cancer of the bladder
- affected fertility
- defective vision
- cancer of the larynx
- cancer of the throat
- cancer of the oesophagus
- aortic aneurysm
- coronary heart disease
- cancer of the stomach
- stroke

Effects on the Lungs
- Chronic Bronchitis
- Emphysema

Second Hand Smoke

Nicotine Addiction

Money Spent

Chewing Tobacco

Source: www.thinglink.com/scene/449926203772502016
Gaps in primary cancer prevention research in health economics literature

- A recent systematic review of 30 years of cancer health economic studies that used QALY as an outcome measure

<table>
<thead>
<tr>
<th>Prevention stage</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>7.1</td>
</tr>
<tr>
<td>Secondary</td>
<td>14.8</td>
</tr>
<tr>
<td>Tertiary</td>
<td>68.4</td>
</tr>
<tr>
<td>Multiple</td>
<td>9.7</td>
</tr>
</tbody>
</table>

- Strong epidemiologic evidence exist in the literature on causal relationship between exposure (risk factors) and cancer as (outcome)

- Limited health economic studies exist in the literature to quantify the causal relationship between risk factors and cancer outcomes

- Limits knowledge on how to effectively allocate scarce health care resources
# Challenges and barriers in conducting health economics research in primary cancer prevention

<table>
<thead>
<tr>
<th>Cancer risk factors</th>
<th>Improved training of health economists</th>
<th>Data quality and access</th>
<th>Improvements in methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diet and nutrition</td>
<td>✓✓</td>
<td>✓✓</td>
<td>✓</td>
</tr>
<tr>
<td>Alcoholic drinks</td>
<td>✓</td>
<td>✓✓</td>
<td>✓✓</td>
</tr>
<tr>
<td>Physical activity and obesity</td>
<td>✓✓</td>
<td>✓✓</td>
<td>✓</td>
</tr>
<tr>
<td>Tobacco use</td>
<td>✓</td>
<td>✓✓</td>
<td>✓</td>
</tr>
<tr>
<td>Occupational and environmental risk</td>
<td>✓✓✓</td>
<td>✓✓</td>
<td>✓</td>
</tr>
<tr>
<td>Sun protection/ultraviolet radiation</td>
<td>✓</td>
<td>✓✓</td>
<td>✓</td>
</tr>
<tr>
<td>HPV vaccine/vaccination</td>
<td>✓✓</td>
<td>✓</td>
<td>✓✓</td>
</tr>
<tr>
<td>Chemoprevention</td>
<td>✓✓</td>
<td>✓✓</td>
<td>✓</td>
</tr>
<tr>
<td>Hepatitis B vaccination</td>
<td>✓</td>
<td>✓</td>
<td>✓✓</td>
</tr>
<tr>
<td>Hepatitis C screening/treatment</td>
<td>✓</td>
<td>✓</td>
<td>✓✓</td>
</tr>
<tr>
<td><strong>Socioeconomic factors (Social determinants of health)</strong></td>
<td>✓✓✓</td>
<td>✓✓</td>
<td>✓✓</td>
</tr>
</tbody>
</table>

†Lack of adequate funding; Planning Group’s suggested ranking: ✓ = Important; ✓✓ = Very important; ✓✓✓ = Extremely important
Recommendations and next steps

Training

• Award grants to institutions of higher learning to recruit and train undergraduate students in health economics and/or health services research field

• Create a task force consisting of federal agencies and universities to develop rigorous training programs for cancer health economists or health services researchers
  • Trained in grant writing
  • Technical/manuscript writing
  • Other career development areas

• Encourage interdisciplinary trainings with other disciplines such as epidemiology, medicine, and other health-related professions

• Encourage trainings in health economics in economic departments, schools of public health and other allied health sciences

• Develop communication platforms for training seminars and networks to provide career development opportunities for health economists and health services researchers
Recommendations and next steps (Cont’d)

Data

• Meta-Data for Cancer prevention Research
  o BIG Data and Advances in Methods
    ▪ Use of unconventional dataset (e.g., Satellite data, Google searches, social media discussions)
    ▪ Data Mining / Machine Learning (MI)
    ▪ Natural Language Processing (NLP)

  o Cancer Data Repository
    ▪ e.g., BioLINCC – NHLBI
    ▪ Private and Public Data Collaboration
      ▪ e.g., SEER-MarketScan for young cancer population
      ▪ Mobile-based mobility data from Apple and Google (e.g., COVID community mobility report)
      ▪ Consumer spending data (e.g., credit cards; Amazon)

  ▪ Data to improve quality of cancer care
    • “Cancer surveillance data systems can also become powerful tools for assessing quality of care when linked to other data sources or when used to select individual cases for special studies” (IOM: National Cancer Policy Board, 2000)
Recommendations and next steps (Cont’d)

Methods

• Continue to engage with state-of-the-art methodologists in economic evaluation, biostatistics, and econometrics

• Big data methods
  • Machine-learning methods can deal with unconventional data that are too high dimensional for conventional methods
  • Variable selection methods: LASSO, regression trees, random forests
  • Many big data methods focus on prediction, but are being adapted to the causal inference questions of interest to cancer prevention health economics

• Small area estimation techniques to disentangle population sub-groups from a larger observational study
  • For decision analysis, how small of a population is reasonable?
  • How to convey uncertainty in decision analysis estimates to a small population versus a large population?

• Statistical power calculations for quasi-experimental research design