Health Behavior and Cancer

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Objectives

- Explain role of behaviors in etiology and treatment of cancer
- Explain theories of health behavior and behavior change
- Explain issues of measurement in health behavior
Relevance of Behavior

- Risk factors
- Protective/preventative factors
- Screening
- Compliance
- Information seeking
Role of Behaviors in Cancer

- Tobacco use accounts for about 1/3 of cancer deaths
- Physical inactivity and poor diet account for up to 30% of cancer deaths
- Compliance with screening recommendations, which can help prevent or mitigate cancer, is a behavioral issue
  - Mammography, colonoscopy, PSA/DRE
Behavioral Risk Factors

- Smoking
- Smokeless tobacco use
- Physical inactivity
- Alcohol use
- Sexual activity
- Low fruit and vegetable consumption
- Obesity
- Tanning/Excessive sun exposure

- Lung, oral, trachea, bladder, esophagus, kidney, pancreas, cervix, colon, leukemia, stomach
- Oral, pancreas
- Colon, breast
- Oral, esophagus, liver
- Cervix, Oral
- Breast, colorectal, oral, larynx, esophagus, stomach
- Breast, endometrium, kidney, esophagus, colon
- Melanoma
Purpose of a Theoretical Framework

- Focus attention on certain factors, allowing you to ignore others;
- Models force the investigator to make causal assumptions explicit.
- To make predictions (allows hypothesis testing)
- For practitioners models allow one to understand why interventions work or fail to work and help guide improvements in programs.
Social Ecological Model of Health Policy

- Public Policy: national, state, local laws and regulations
- Community: relationships between organizations
- Organizational: organizations, social institutions
- Interpersonal: families, friends, social networks
- Individual: knowledge, attitudes, skills
Health Behavior Models

- Cognitive theories (*tell me what I need to know*)
  - Health belief model (HBM)
  - Fishbein’s Behavioral Intention Model
  - Subjective Expected Utility Theory

- Stimulus response theory (*rewards & punishments*)

- Social Learning Theory (*social influences and expectations*)

- Diffusion of Innovations (*macro social influences*)
Theory of Reasoned Action

- Behavior is best predicted from a person’s intention to perform the behavior.
- Intention to perform the behavior is the result of two factors:
  - Attitude about the behavior
  - Social norms related to the behavior
Theory of Planned Behavior

- Extends TRA to include perceived behavioral control
  - Belief that one has, and can exercise, control over performing the behavior

- People may try harder to perform a behavior if they feel they have a lot of control over it
  - Behavioral skills
Attitude toward the behavior

- Attitude toward the behavior is a function of one’s beliefs about the following:
  - Belief that doing the behavior will lead to a particular outcome;
  - The individual’s evaluation of the outcome (rating of good or bad)
Social Norms

- **behavioral expectations** and cues within a society or group
- Customary rules of behavior that coordinate our interactions with others
- Deference to the social norms maintains one's acceptance and popularity within a particular group
- Ignoring the social norms risks one becoming unacceptable, unpopular or even an outcast from a group
Social Norms

- Norms are a special category of beliefs
  - perceived to be socially shared regarding prevalent or prescribed behaviors

- **behavioral** (descriptive) norms refer to the most common actions or behaviors actually exhibited in a social group.
  - what most individuals of a social group actually do.

- **attitudinal** (injunctive) norms refer to the most widely shared beliefs or expectations in a social group about how people in general or members of the group *ought* to behave in various circumstances.
Applications:
Consumer Perception

• Relevant to product regulation, as products are ultimately used by people

• Why do consumers purchase goods and services?
  • Market segmentation -- research on the wants, needs, and desires of different groups of consumers and potential consumers
  • Product differentiation -- design of products and advertising with an eye towards meeting wants, needs, and desires of target groups of consumers
Review of Consumer Perception Literature: Tobacco industry and mainstream methods

“Consumer response” not a unitary concept:
  i) Response to product use (behavioral, sensory & other subjective)
  ii) Reaction to messaging (KAB; risk perceptions)
  iii) Both domains are inter-related

A wide variety of research methods used

Two major purposes:
  • Pre-market evaluation (industry)
  • Post-market evaluation (industry & independent)

Hypothetical model of tobacco CR.

Rees V W et al. Cancer Epidemiol Biomarkers Prev
2009;18:3225-3240
A conceptual framework for consumer perception and product use

- **Product Perception**
  - Sensory
  - Affective
  - Cognitive

- **Product Responses**
  - Sensory
  - Affective
  - Cognitive

- **Behavioral Intention**

- **Adoption/Rejection**
  - Abuse Potential, Price, Availability, Environmental constraints

- **Initial Experience**

- **Initial cognitive beliefs**

- **Normative Beliefs**

- **Behavioral intention**

- **Initial affective associations**
Example: Screening Adherence
Understanding CRC

- Colorectal cancer (CRC) starts in the colon or rectum
- CRC is the 3rd most common form of cancer diagnosed in men and women in the US (148,000 new cases in 2010)
- CRC is the 2nd leading cause of cancer deaths in the US. (48,000 deaths in 2010)
- The number of people dying from CRC has declined over the past 20 years with better screening, diagnosis and treatments
- Screening for/removing polyps early is the best way to prevent and cure CRC
• Age 50, 25% risk of developing polyps
• Age 75, 50-75% risk of developing polyps
Screening = Prevention & Early Detection

Prevention
Polyp removal $\rightarrow$ Decreased Incidence

Early Detection $\rightarrow$ Decreased Mortality
Colorectal Cancer Screening

  - Acceptable modalities
    - Colonoscopy
    - Fecal blood test
      - Fecal immunochemical test, high-sensitivity hemoccult
    - Flexible sigmoidoscopy
  - Insufficient evidence for CT colonography, fecal DNA
Issues Related to CRC Screening

- **Practical barriers**
  - System
  - Cost
  - Environment/area
  - Lack of access to healthcare provider

- **Psychological barriers**
  - Lower knowledge or awareness
  - Lower perceived risk of CRC
  - Negative attitudes towards screening
  - Higher worry or fear of CRC
Outcome beliefs
Patient’s belief in the benefits of collecting a stool sample

Rewards of action
Reward they will receive by collecting the stool sample

Normative beliefs
Patient’s perception of what others think of stool collection

Motivation to comply
Willingness to collect a stool sample

Self-efficacy
Patient’s confidence in their ability to collect a stool sample

External factors
Barriers/facilitators to stool collection beyond the patient’s control

Personal attitude

Subjective norms

Intention to collect the stool sample

Perceived behavioural control

Behaviour
I will collect and return the stool sample to the GP
Colorectal Cancer Screening

- Fecal immunochemical test (FIT) more acceptable than colonoscopy

- Randomized screening trial in Spain of biennial FIT vs. one-time colonoscopy 53,302 subjects ages 50 to 69

- Primary outcome is CRC mortality after 10 years
Screening Outcomes

Quintero E. NEJM 2012;366:697
Colorectal Cancer Screening

- Recommending only colonoscopy resulted in lower adherence

- Randomized trial offering colonoscopy, FOBT, or choice of colonoscopy/FOBT

- 997 subjects ages 50 to 79

- 12-month follow up
Screening Completion

Inadomi JM. Arch Intern Med 2012;172:575
Implications for Practice

- Offer screening

- Testing modalities
  - Fecal immunochemical tests more acceptable and accurate than Hemoccult II
  - Flex sig no longer routinely performed
  - Colonoscopy RCT ongoing
  - CT colonography not reimbursed by Medicare
Implications for Practice

- Recognize importance of patient preferences
  - “The best test is the one that gets done”

- Positive fecal blood tests must be evaluated with diagnostic colonoscopy
Behavior Change
Transtheoretical Model

- Behavior change as process, not event
- 5(6) distinct stages (Stages of Change)
  - Precontemplation, contemplation, preparation, action, maintenance, (termination)
- Circular rather than linear (people can move between stages readily in any sequence)
Transtheoretical Model of Change
Prochaska & DiClemente
Transtheoretical Model

- Extended TTM includes decisional balance and self efficacy
- TTM originally developed out of smoking cessation, but is now widely applied to hard-to-change behaviors, particularly relapsing behaviors.

![Diagram of Transtheoretical Model]
Processes of Change

- Transitions between the stages of change are effected by *processes of change*.
- *Consciousness raising, counterconditioning, dramatic relief, environmental reevaluation, helping relationships, reinforcement management, self-liberation, self-reevaluation, social liberation, and stimulus control.*
Stages by Processes of Change

<table>
<thead>
<tr>
<th>Precontemplation</th>
<th>Contemplation</th>
<th>Preparation</th>
<th>Action</th>
<th>Maintenance</th>
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<td>Consciousness Raising</td>
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<td>Dramatic Relief</td>
<td>Social Liberation</td>
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<td>Self-Reevaluation</td>
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<td>Helping Relationships</td>
<td>Counter Conditioning</td>
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<td>Reinforcement</td>
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<td>Management</td>
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<td>Stimulus Control</td>
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<td>Pros of Changing Increasing</td>
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<tr>
<td>Cons of Changing Decreasing</td>
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<td>Self-Efficacy Increasing</td>
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Social Marketing

- Application of marketing principles for the promotion of ‘social good’

- Primary objective is to influence the behavior of target market members
  - Discourage negative behaviors
  - Encourage positive behaviors

- Influence behavior by offering package of benefits and reducing critical barriers

- Beneficiaries of the campaign are target market or society at large, rather than the group doing the marketing
Doing Social Marketing

- Challenge is to determine...
  - WHO we would like to do WHAT, and how we can BEST ENCOURAGE THEM TO DO IT

- Segmenting and targeting
- Setting objectives
- Formulating the offer
- Positioning
Segmentation

• Generally look to segment on:
  • Personal characteristics (demographic, psychographic, geographic)
  • Past behavior; proximity to desired behavior
  • Benefits sought/motivations

• Want to divide population into reasonably homogeneous subsegments, so that each can be approached with offers that best match their needs/desires and circumstances
Targeting

- Which segments become targets?
  - **Viable**: should be big enough to warrant attention; potential to make impact on problem being addressed
  - **Accessible**: usable channels of communication and service delivery exist
  - **Responsive**: marketer is capable of serving the group, and the group would be receptive to the offer
Problems and Pitfalls

- Failing to consider social context
- Failing to consider other stakeholders besides the target market
  - Influential community members
  - Local service providers
Setting objectives

- Should be MEASURABLE and ACHIEVABLE
  - Mix of theory and pragmatism
- Ideally, these will have been decided upon before the campaign goes forward
Formulating the offer

- Determine the marketing mix *vis a vis* the 4 P’s
  - Product - service, behavior, commodity
  - Price
  - Place
  - Promotion

- Diffusion concepts can help identify potential barriers to adoption
Social Marketing

Product Must Be

Solution to a problem:

- Benefits
- Unique
- Competitive

Real:

- Defined in terms of the user’s beliefs, practices, and values
Social Marketing

*Price*

The cost of adopting the product:

- Money
- Time
- Pleasure
- Loss of self-esteem
- Embarrassment
Social Marketing

*Place*

**Channels for information:**

- Where service is provided
- Where information is received
- Where tangible product is purchased
- Available
- Easy to find and use
- Appropriate
- Timely
Social Marketing

Promotion

Message design elements:

• Type of appeal
• Tone
• Spokesperson
Formulating the offer

- **Trialability**—can behavior be tried out before permanent or full adoption?
- **Ease**—how easy/difficult is it to adopt behavior?
- **Risks**—what are the risks of adopting the behavior?
Formulating the offer

- Image—is the behavior attractive or unattractive?
- Acceptability—is the behavior socially acceptable?
- Duration—is the behavior practiced once or repeatedly? Short-term or long-term?
- Cost—does the behavior have a financial cost?
Measurement
# Measurement of Behavior

## Measuring Behavior:

- **How do you measure behavior?**
- **Levels of measurement:**
  (nominal, ordinal, interval, ratio)

<table>
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<th>Interval</th>
<th>Ratio</th>
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<tr>
<td>People with the same scale value are the same on some attribute. The values of the scale have no 'numeric' meaning in the way that you usually think about numbers.</td>
<td>People with a higher scale value have more of some attribute. The intervals between adjacent scale values are indeterminate. Scale assignment is by the property of &quot;greater than,&quot; &quot;equal to,&quot; or &quot;less than.&quot;</td>
<td>Intervals between adjacent scale values are equal with respect to the attribute being measured.</td>
<td>There is a true zero point for the scale. Ratios are equivalent.</td>
</tr>
</tbody>
</table>
Measurement Error

The combined error that results from inevitable imperfections and variability in the process of measurement

- Random error
- Systematic Error (BIAS)

Reliability and Validity in measurement
Reliability

Concerns the extent to which measurement is repeatable and consistent (free from random errors)

If the random error in your measurements is so large that there is almost no stability in your measures, you can't explain anything!
Reliability

Reliable measures: measure a variable precisely and consistently.

Factors to consider when determining reliability of a measure:
- Precision
- Sensitivity
- Resolution
- Consistency

Reliability also serves as a limiting factor on the correlation one can see between two measures.
Validity

The extent to which a measurement actually measures what it is intended to measure

Factors to consider when determining validity of a measure:

- Accuracy
- Specificity
Types of Validity:

- Face validity
- Criterion validity (concurrent, predictive, discriminant)
- Construct validity

Internal validity

External validity (generalizability)

Biochemical validation
Threats to Internal Validity:
- Selection
- Attrition
- History
- Regression to the mean
- Instrumentation
- Maturation

Threats to External Validity:
- Learning
- Experimenter effects
- Reactance
- Diffusion
- Poor operationalization
Sources of Invalidity of Measures

- Reactive measurement effects
  - Awareness of being tested
  - Role selection
  - Measurement as change agent
  - Response sets

- Error from the Investigator
  - Interviewer effects
  - Change in research instrument
    - WORDING MATTERS!!!
VALIDITY IS ALSO AFFECTED BY BIAS!

Bias is the result of systematic error in the design or conduct of a study

- **Selection Bias**
- **Information Bias**

Bias has a preferred direction and won’t average out over participants

- Day effects
- Order effects
- Practice effects
We spend a lot of time designing studies to avoid bias

- There’s a difference between bias and imprecision
Study Validity Pyramid

Randomized Experiment
Quasi-experimental
Observational Cohort
Case-control / Cross-sectional
Ecological

Internal Validity

External Validity
Developing Measures

Development of measures or identification of suitable existing measures is crucial to any evaluation or study.

- Direct vs. Indirect
- Multiple measures
- Proximate measures

Careful attention needs to be paid to how the measure is taken.

- Wording makes a difference
- Questions should be age and culturally appropriate
- Context matters
Scales: Multiple measures

- Because most behavioral measures are fallible, we need more than one to measure a construct.

**GUTTMAN SCALE**

- The more items you endorse, the stronger the attitude.

**DOMAIN SAMPLING SCALE**

- Multiple items measure the same underlying construct in different ways; items correlated.

**RISK SCALE**

- The more events you identify, the greater your risk; items not necessarily correlated.
Behavioral Science at RPCI

- Andrew Hyland, PhD - Tobacco control policy; Survey Research resource director; Dept. chair
- Richard O’Connor, PhD - biobehavioral interactions; measurement
- Martin Mahoney, MD, PhD - smoking cessation; cancer screening; vaccination
- Maansi Bansal-Travers, PhD - health communication
- Mark Travers, PhD - exposure science
- Maciej Goniewicz, PhD, PharmD - e-cigarettes; smoking cessation; toxicology
- Deborah Erwin, PhD - health disparities; community outreach; cancer screening
- Elisa Rodriguez, PhD, MPH - health disparities; community engagement in research
- Rodney Haring, PhD, MSW - behavioral interventions