HIV and the Stages of Prevention Model

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The Stages of Prevention: A new paradigm (Hattis and Law, 2009)

- The development of diseases (esp. chronic) generally involves 5 stages, and each lends itself to preventive interventions:
    - 1. Exposure to agents/causes/risk factors of disease
    - 2. Acquisition of early disease due to exposure
    - 3. Progression of acquired disease from early to advanced
    - 4. Complications resulting from advanced disease
    - 5. Death or Disability, generally from complications

The Stages of Prevention: A new paradigm, contd.

- Each stage of disease development has a corresponding stage of prevention
- Stage 1: Avoidance of exposure to agents of disease
  - Sexual abstinence; anti-smoking efforts
- Stage 2: Reduction of acquisition of disease (as a result of exposure)
  - Post-exposure prophylaxis; hepatitis B vaccine for drug users
- Stage 3: Interruption of the progression of a disease (that has been acquired)
  - Screening tests (Pap, cholesterol, etc.) <u>followed by treatment</u>; INH for latent TB; some diseases can be cured or progression reversed
- Stage 4: Avoidance of complications (from progressed disease)
  - Prophylactic antimicrobials for AIDS patients; anticoagulants
- Stage 5: Delay of mortality, rehabilitation of disability, or palliative care for terminal disease
  - ICU care for stroke; physical therapy; hospice care

The Stages of Prevention applied to HIV/AIDS

- Stage 1: Avoiding exposure - abstinence; sex only with faithful partners with both seronegative; not sharing needles

- Stage 2: Mitigating exposure/harm reduction – condoms; needle exchange; post-exposure prophylaxis

- Stage 3: Interruption of transmission (and of secondary infection) – screening; early treatment

- Stage 4: Avoiding complications – antimicrobials, treating metabolic effects

- Stage 5: Keeping complications from getting worse – hospital care of infections; rehabilitation; palliative care

Applying Stages of Prevention model to individual counseling

- - Stage 1 prevention to avoid exposure to the disease (e.g., abstinence, not using drugs)
- - Stage 2 prevention to avoid infection despite exposure (e.g., condoms, needle exchange)
- - Stage 3 prevention to detect infection and treat it to avoid AIDS (e.g., get tested for HIV; take antiretroviral drugs if infected and CD4 count dropping, which also reduces exposure of partners)
- - Stage 4 prevention to prevent complications of AIDS (e.g., antimicrobial drugs added to antiretroviral drugs)
- - Stage 5 prevention after an episode of an opportunistic infection (e.g., treatment of the infection)

Applying Stages of Prevention model to public health planning

- Each consecutive stage is targeted at a smaller population (a potential cost saving), but *may* be more expensive or difficult to apply to each member of that population as become more ill
  - Example: Hospitalization for advanced diseases/complications
  - Examples of exceptions:
    - - Changing behavior or an entire population to reduce risky sex or drug use (Stage 1) may be difficult and expensive per capita
    - - Trimethoprim-sulfa to prevent complications of AIDS (Stage 4) is inexpensive for each person treated
- As each stage of prevention is applied, it can reduce the rate of its respective stage of disease development and of all subsequent stages, so early stage prevention pays off
  - Example: If fewer acquire disease, fewer complications occur

Using the Stages of Prevention for calculations of rates

- Ultimately, the death rate in a defined population "p" per year or other time period "t," due to complication-specific mortality, $D/(p*t)$, is equal to the product of five factors:
  - $E/(p*t)$, the exposures per defined population per year
  - A/E, the rate of disease acquisition per exposed persons
  - P/A, the progression rate of acquired disease per acquired cases
  - C/P, the rate of complications per cases of progressed disease
  - D/C, the complication-specific death rate

Using the Stages of Prevention for calculations of rates, contd.

- The rate of an earlier stage will be the product of the rates of the stages up to that point; examples (note the algebraic cancellations):
  - The incidence rate of the disease is
    - $A / (p*t) = E/(p*t) * A/E$
  - The rate of a specific complication within the defined population is
    - $C/(p*t) = E/(p*t) * A/E * P/A * C/P$
  - The mortality rate is
    - $D/(p*t) = E/(p*t) * A/E * P/A * C/P * D/C$
- Key: E = exposures, A = acquisitions, P = progressed cases, C = complications, D = deaths, p = popn., t = time

Limitations

- Limitations of this particular classification system:
  - - Exposure to risk cannot always be avoided
  - - Not all diseases/conditions have preventable progression or complications, and some lack progression at all
  - - Use of term "stages" for disease development (though not of prevention) may be confused with stage classifications of specific diseases (various cancers, CHF)
- Disadvantages of revising the classification of prevention:
  - - Will have difficulty competing with a paradigm over half a century old and in wide use
  - - New terms and 2 more divisions to remember

Limitations, contd.

- Limitations of <u>any</u> classification system:
  - Cannot make universally applicable distinctions
    - The real world is messy
    - Prevention is complicated
  - Can be ineffective if the disease entity to be prevented, and each stage for each disease, are not clearly defined
    - Some articles identify attempts to prevent a complication as primary prevention of the complication
    - Others considered similar interventions as secondary or tertiary prevention of the disease