Cumulative exposures: Cumulative effects

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An ecological or “systems” health framework considers the individual in the context of family, community, society, and ecosystem.
Cumulative exposures; effects

• Cumulative exposures
  ▪ Food, chemical/contaminant, built, social environments; multi-level

• Cumulative effects
  ▪ Health outcomes: increased risk of various adverse pregnancy outcomes; increased risk of chronic diseases; co-morbidities
n=226, 2 yr old MDI; prenatal ETS, material hardships
Columbia Center for Children’s Environmental Health

Rauh et al, Neurotox Teratol, 2004
Premature birth

- Consequences depend on actual gestational age and birth weight
- Increased infant illness and mortality
- Adverse effects on neurological development, immune system, other
- Large economic costs—individuals, families, society
Premature birth, traffic density, season, community economic status

- Season: more air pollution in winter
- Low SES: > 10% unemployment, > 20% of families in poverty, and > 15% receiving public assistance.
- High SES: < 10% unemployed, < 20% of families living in poverty, and < 15% receiving public assistance.

(Ponce, Am J Epid, 2005)
Air pollution, poverty, premature births

- Low SES community: higher traffic-related pollution exposure had 30% increased risk of preterm delivery compared with those who lived in less trafficked locations.
- Middle SES: traffic density was associated with 18–19% increased risk of preterm birth during both seasons.
- High SES: high traffic not associated with increase preterm delivery risk.
Air pollution, poverty, premature births

- Conclusion: Reducing preterm births warrants a concerted effort of social, economic, and environmental policies, focused not only on individual risk factors but also the reduction of localized air pollution, expansion of health-care coverage, and improvement of neighborhood resources.
Socioeconomic, Psychosocial Stressors

Lower socioeconomic status → risk of impaired neurodevelopment, cardiovascular disease, diabetes, obesity, Alzheimer’s disease, many kinds of cancer, asthma.

Due to: Combinations of increased exposures to hazards, increased susceptibility, decreased capacity to cope and recover.

Elevated levels of inflammatory markers, stress hormones, altered immune function
Complex Web of Variables Influences Pregnancy Outcomes
Why do this?

- to acknowledge, communicate complexity
  - confirms the multi-level, systemic nature of the issues
  - highlights the need for broad and diversified efforts to study and change the dynamics of the system.

- to make sense of complexity.
  - helps in understanding the system
  - Once the general architecture of a model is grasped, it becomes a filter for identifying relevant variables and an aid to thinking about the further study and interventions
Why do this?

- to support the development of strategies to study and intervene
  - Suggests ways and places to intervene most effectively in the system.
  - These are: leverage points, feedback loops, and causal cascades, among others