Healthy, Wealthy, and Wise?
The Causal Pathways between Health and Socioeconomic Status

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The links between health, wealth

- Higher socio-economic status (SES) is associated with better health and longer life
- The association is found in different eras, places, genders, and ages

- **The association holds for:**
  - **A variety of health variables (most illnesses, mortality, self-rated health status, psychological well-being, and biomarkers such as allostatic load)**
  - **Alternative measures of SES (wealth, education, occupation, income, level of social integration).**

Prevalence Relative Risk

Low vs High SES, AHEAD 1993

Condition	F	M	Condition	F	M
Cancer	0.52	1.03	Incontinent	1.15	1.29
Heart	2.15*	1.35*	Hip Fract.	1.68	2.31
Stroke	1.44	2.46*	Cog. Imp.	1.82*	6.97*
Lung	3.18*	2.38*	Psychiatric	0.86	1.78
Diabetes	5.25*	1.64	Depression	2.78*	5.33*
HBP	1.21*	1.58*	Smoker	4.67*	4.27*
Arthritis	1.31*	1.63*	P/F SRHS	3.09*	2.69*

The association must be rooted in fundamental heterogeneities of nature and nurture in human populations

It is not explained solely by:

- Poverty
- Social discrimination
- Availability of medical technology
- Specific systems for delivery and financing of health care

Sources:

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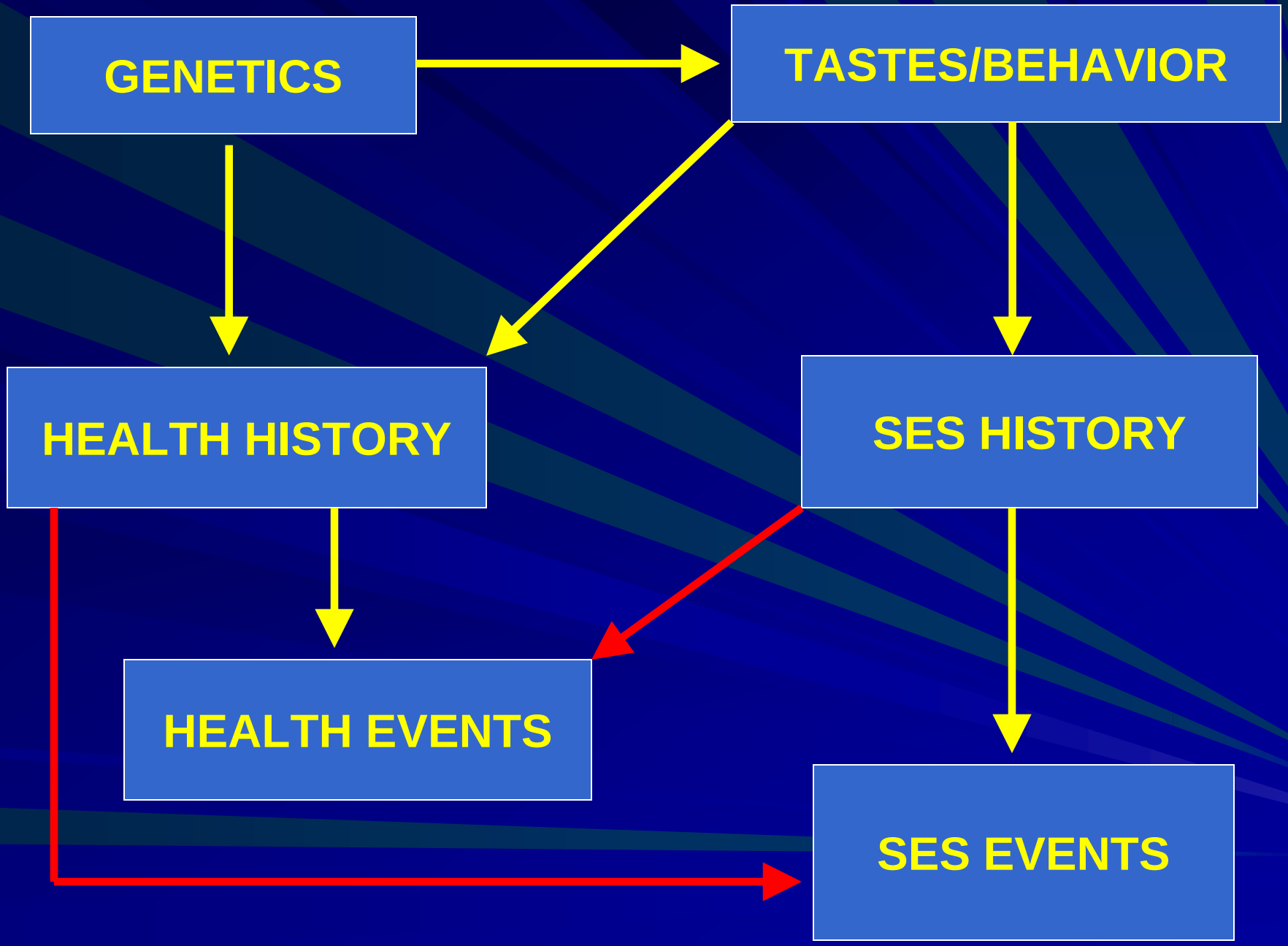
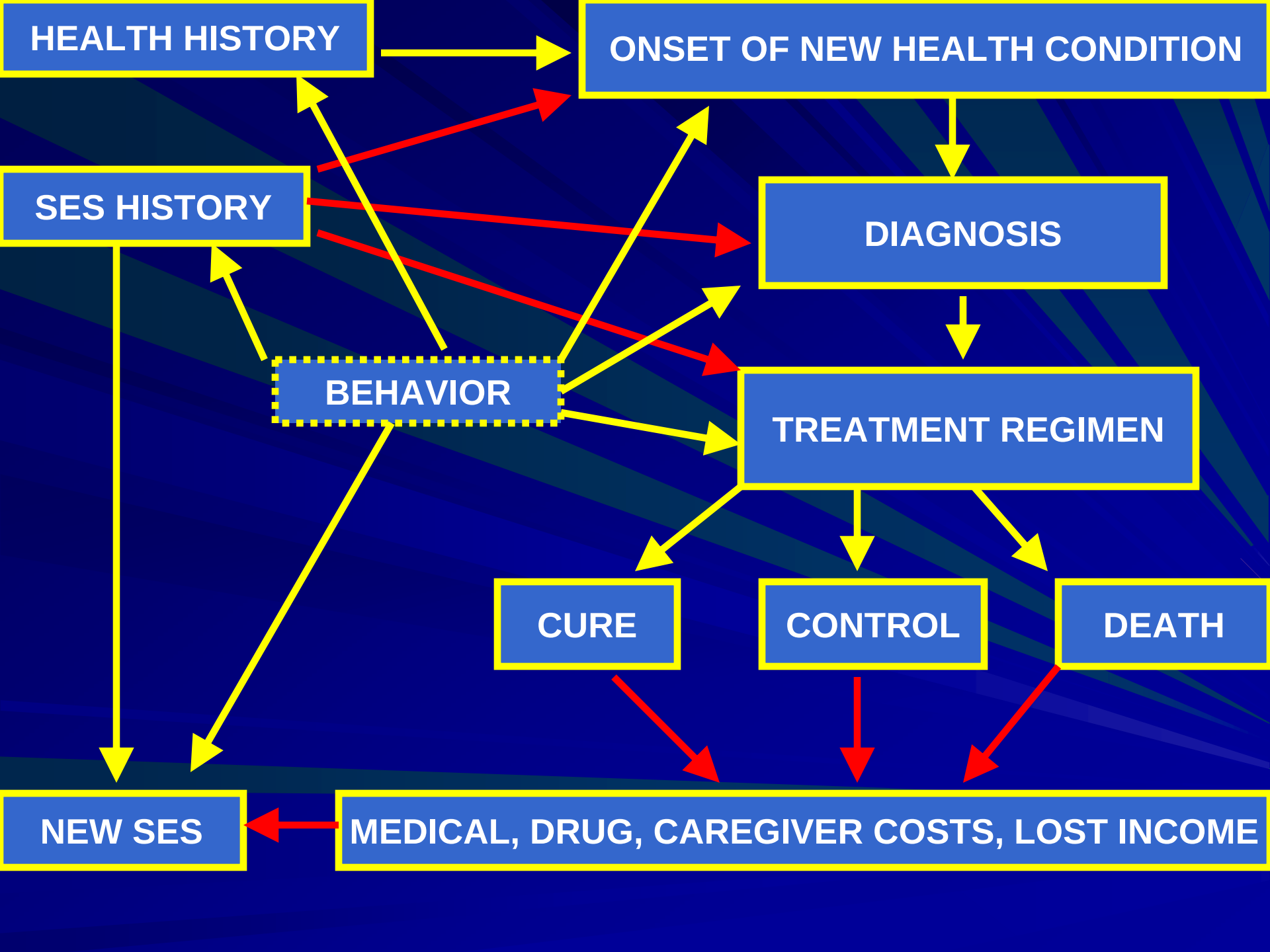
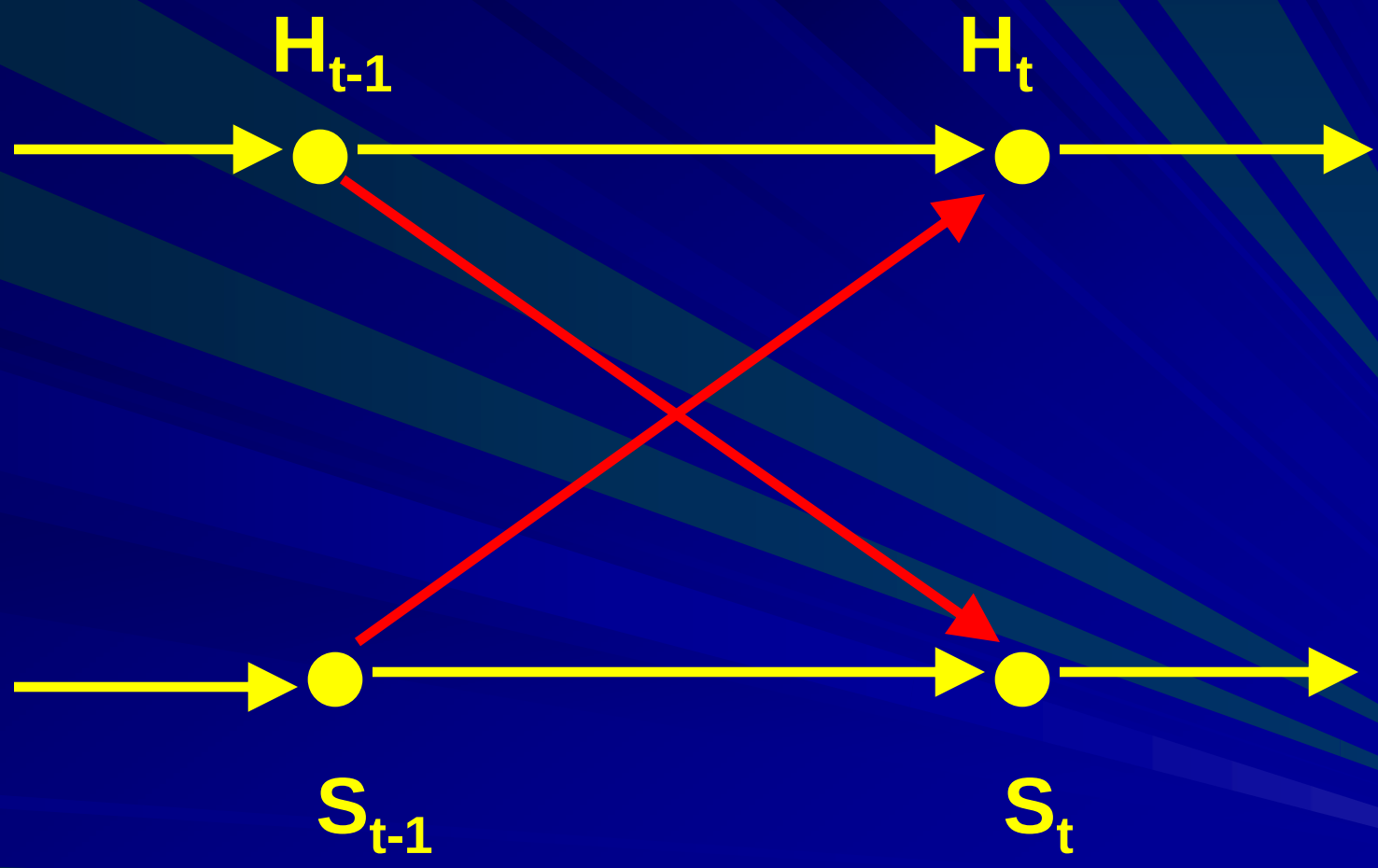
- ---------- (2003) “Addendum”, forthcoming in D.Wise (ed) *Research in the Economics of Aging*, NBER.
- J. Adda, T. Chandola, M. Marmot (2003) “Socio-economic Status and Health: Causality and Pathways,” *Journal of Econometrics, 112, 57-63.*
- A. Case, A. Deaton (2003) "Broken Down by Work and Sex: How Our Health Declines,“ Carefree Conference on the Economics of Aging, Princeton/NBER working paper.
- J. Smith (2003) “Consequences and Predictors of New Health Events,” Carefree Conference on the Economics of Aging, RAND/NBER working paper.


GENETICS
TASTES/BEHAVIOR
HEALTH HISTORY
SES HISTORY
HEALTH EVENTS
SES EVENTS


HEALTH HISTORY
ONSET OF NEW HEALTH CONDITION
SES HISTORY
DIAGNOSIS
BEHAVIOR
TREATMENT REGIMEN
CURE
CONTROL
DEATH
NEW SES
MEDICAL, DRUG, CAREGIVER COSTS, LOST INCOME

Policy Implications

- Research interest in the health-wealth nexus is fueled by the potential policy implications of alternative causal paths.
- If the poor are less healthy because of specific failures in the health care delivery system, targeted changes in that system could have a significant net social benefit.
- If the poor are less healthy because of behavior that increases risk, delays diagnosis, or reduces the effectiveness of treatment, then policies that increase information and encourage protective behavior, or increase preventative interventions, may be beneficial.
- If the less healthy are poor due to work disability and medical costs, then health and disability insurance need to be strengthened.


H_{t-1}
H_t
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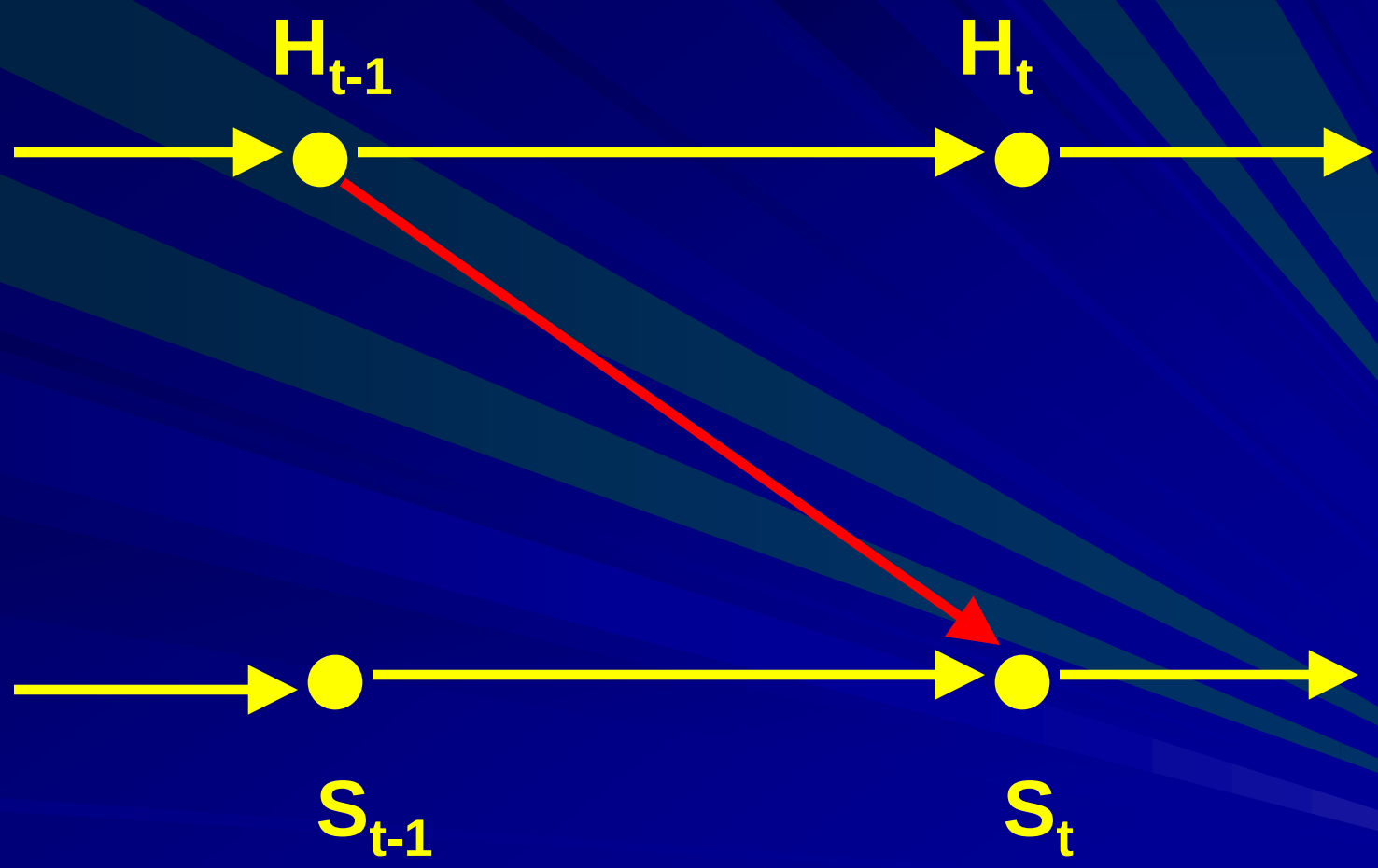
S_t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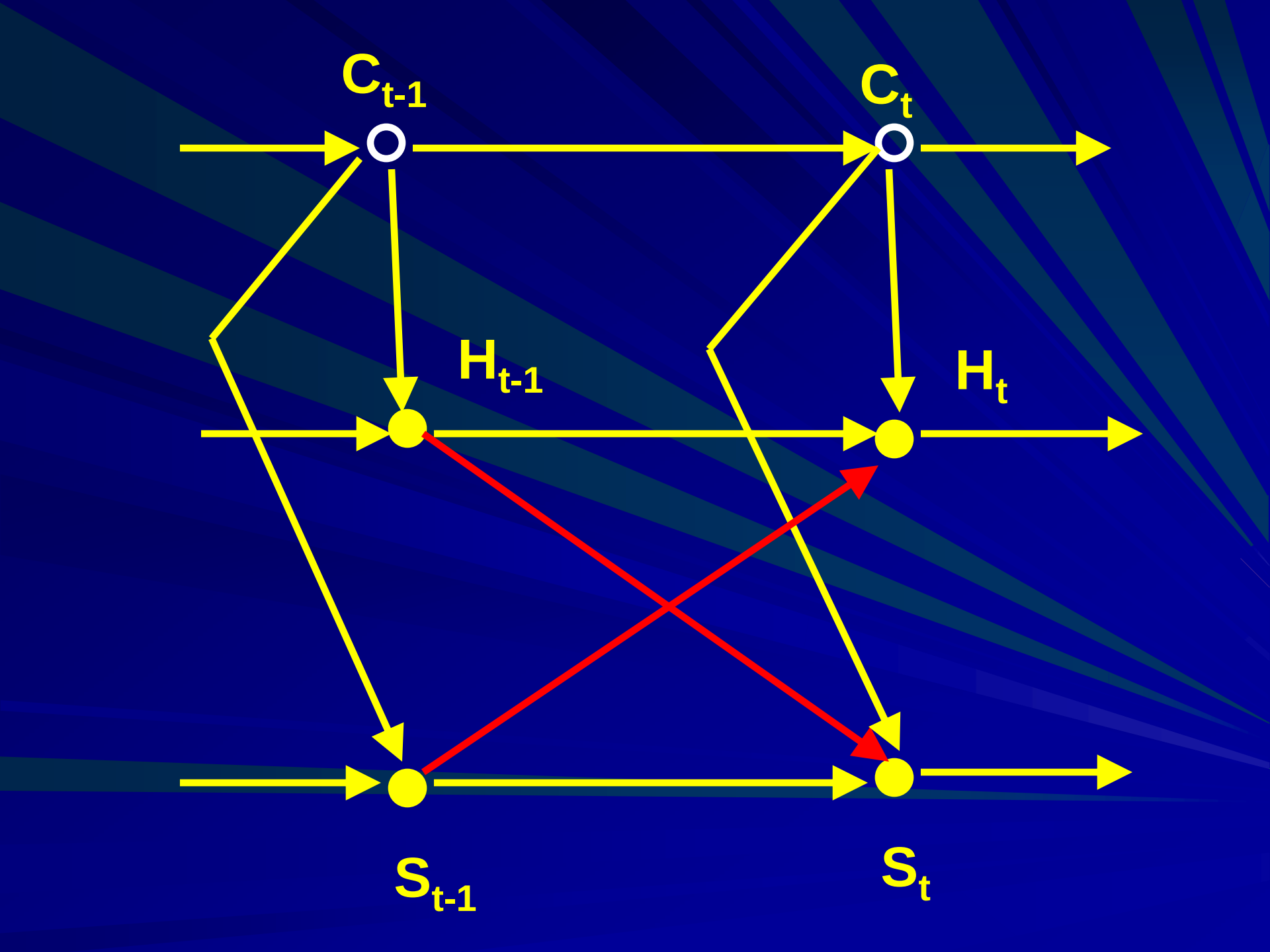
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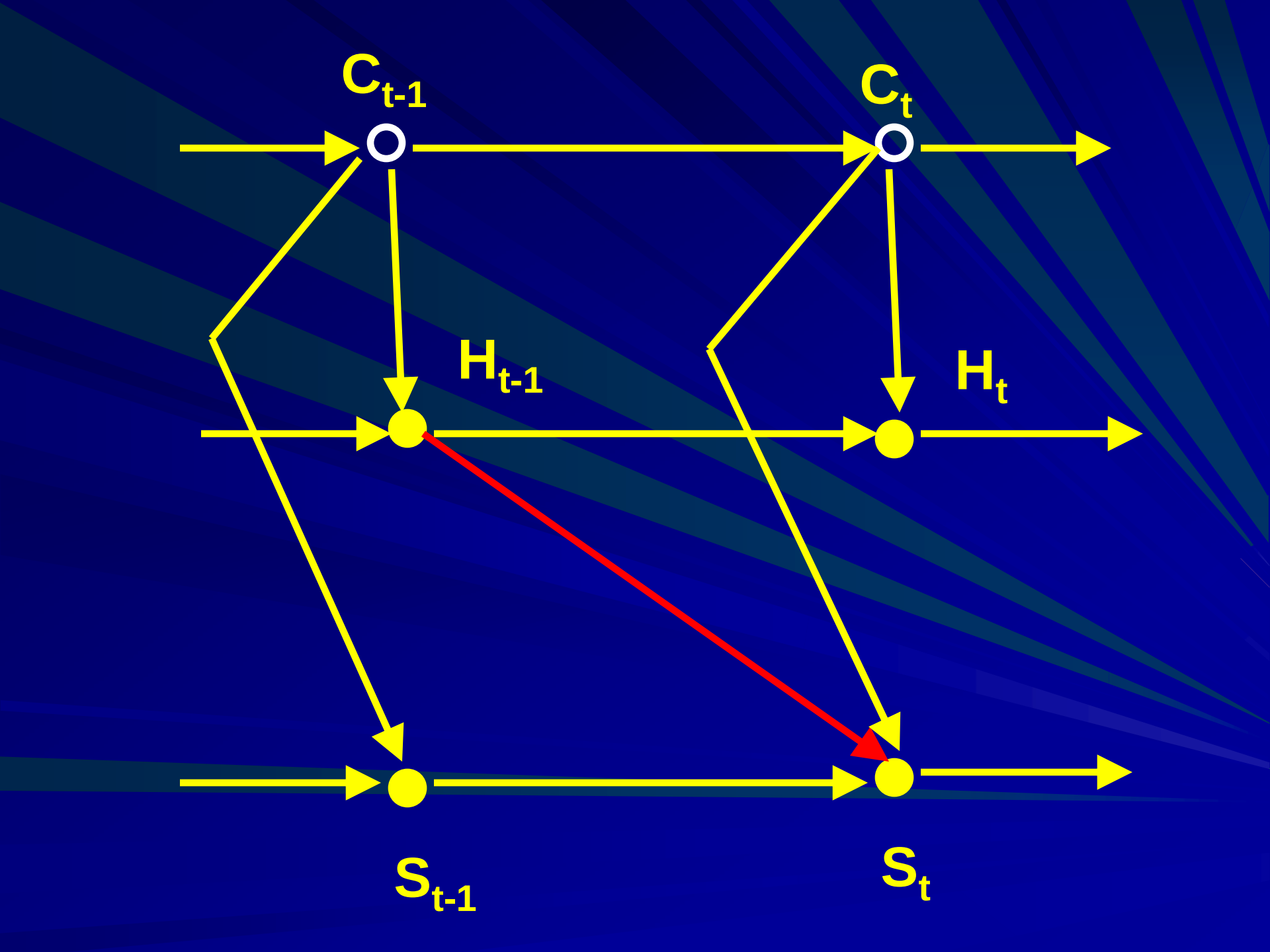
C_{t-1}
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A Markov model of Health/SES dynamics

- The evolution of socioeconomic states S_t and health states H_t is modeled as a first-order Markov process,

$$f(H_t,S_t \mid H_{t-1},S_{t-1}) = f_H(H_t \mid H_{t-1},S_{t-1}) f_S(S_t \mid H_t,H_{t-1},S_{t-1}),$$

  the conditional distribution of H_t,S_t given H_{t-1},S_{t-1}.

- The model $f(H_t,S_t \mid H_{t-1},S_{t-1})$ is ***valid*** for a history H_{t-1},S_{t-1} if it is the true conditional distribution of H_t,S_t given this history.

- ***f*** **is a *structural* or *causal* model for H_t,S_t *relative* to a family of histories if it has the *invariance* property that it is valid for each history in the family.**
- **Operationally, invariance means that *within specified history and treatment domains*, *f* has the *transferability* property that it is valid in different populations where the marginal distribution of H_{t-1},S_{t-1} changes, and the *predictability* or *invariance under treatments* property that it remains valid following policy interventions that alter the marginal distribution of H_{t-1},S_{t-1} .**

- Restricted history and treatment domains identify *families* of structural models.
- S is ***conditionally non-causal*** for H if $f(H_t|H_{t-1})$ is a valid model; i.e., given H_{t-1}, knowledge of S_{t-1} is ***not needed*** to achieve the invariance properties of a causal model. [Granger non-causality]
- Conversely, if $f(H_t|H_{t-1},S_{t-1}) \neq f(H_t|H_{t-1})$, then knowing S_{t-1} ***contributes to the predictability*** of H_t. A direct causal link is possible, but not proved unless common factors can be ruled out.

- We array H components in a Wold causal chain based on the etiology of health events. Either one or both conditional non-causality of S for H and conditional non-causality of H given S may hold. If either holds, then H and S can be arrayed in a (block) causal chain. If both hold, H and S are conditionally independent.
- However, if critical invariance tests for a valid model fail, then non-causality tests are inconclusive.

Data: The AHEAD Panel

- 7447 elderly Americans, aged 70+ in 1993, including spouses, followed through waves in 1995 and 1998. (A 2001 wave is now released.)
- This population is retired, so that health problems have little impact on earnings. Relatively homogeneous, comprehensive health care at limited out-of-pocket cost to the individual is provided by Medicare.

Tests for Invariance and Non-Causality

SES to health incidence, significance levels

Condition	Invariance Test		Non-Causality Test	
	F	M	F	M
Cancer (no prev.)	0.857	0.129	0.313	0.166
Heart	0.085	0.690	0.398	0.243
Stroke	0.384	0.204	0.657	0.059
Mortality	0.221	0.376	0.652	0.364
Lung	0.552	0.689	0.343	0.010
Diabetes	0.189	0.234	0.110	0.025
HBP	0.007	0.393	0.534	0.990

Tests for Invariance and Non-Causality

SES to health incidence, significance levels

Condition	Invariance Test		Non-Causality Test	
	F	M	F	M
Arthritis	0.046	0.071	0.085	0.395
Incontinent	0.781	0.351	0.163	0.463
Hip Fracture	0.491	0.126	0.159	0.430
Cognitive Imp.	**0.005**	0.288	**0.002**	0.026
Psychiatric	0.127	0.295	**0.004**	0.065
Depression	0.211	0.944	0.011	0.065
P/F SRHS	0.376	0.934	**0.001**	0.020

Incidence Relative Risk

Low vs High SES, AHEAD 1993-98

Condition	F	M	Condition	F	M
Cancer	0.76	1.37	Arthritis	0.97	1.84*
Heart	1.03	0.98	Incontinent	1.18	0.90
Stroke	1.37	1.07	Hip Fracture	3.06*	4.77*
Mortality	1.45	0.86	Cog. Imp.	1.28	1.69*
Lung	3.06*	1.98	Psychiatric	2.54*	6.29*
Diabetes	1.44	0.67	Depression	2.66*	3.50*
HBP	1.12	1.35	P/F SRHS	1.48*	1.55*

Test Results - 1

- Cross-wave invariance holds for most conditions
- Conditional independence in the assumed causal chain is supported, with important exceptions: mortality, ADL, IADL, cognitive impairment, accidents
- Non-causality is accepted for most acute conditions and mortality
- Either common behavioral factors or direct causality lead to rejection of non-causality for mental conditions and SRHS

Test Results - 2

- The absence of an SES gradient for incidence in the 70+ population gives no evidence on the issue in working-age populations.
- Case and Deaton find interactions through the working years in which increased exposure to manual work is associated with more rapidly declining health.

Links from Health to Wealth

- Tests for direct causal links from health to wealth innovations are inconclusive due to invariance failures arising from wealth measurement problems in wave 1.

- Granger non-causality tests fail for liquid wealth, and in some cases also for non-liquid wealth, for intact couples and singles.

AHEAD (US), Whitehall (GB), ULF (Sweden) SES Non-Causality Test

Source: J. Adda, T. Chandola, M. Marmot (2003)

No causality sig. level	Heart - no prev	Mort	Diabet	HBP	P/F SRHS
F - AHEAD	0.73	0.65	0.11	0.53	0.00
F - Whitehall	0.18	----	0.10	0.42	0.00
F - ULF	0.18	0.04	0.94	0.00	0.00
M - AHEAD	0.04	0.36	0.03	0.99	0.02
M - Whitehall	0.00	----	0.06	0.42	0.00
M - ULF	0.30	0.47	0.12	0.11	0.22

AHEAD (US), Whitehall (GB), ULF (Sweden) Relative Risk, Low vs High SES

Source: J. Adda, T. Chandola, M. Marmot (2003)

No causality sig. level	Heart - no prev	Mort	Diabet	HBP	P/F SRHS
F - AHEAD	1.22	1.45	1.44	1.12	1.48
F - Whitehall	1.67	----	4.05	1.18	4.13
F - ULF	5.8	7.5	4.7	3.8	5.1
M - AHEAD	0.77	0.86	0.67	1.35	1.55
M - Whitehall	1.90	----	4.24	1.13	2.73
M - ULF	3.5	4.1	3.5	3.5	5.0

Net Cumulative OOP Medical Costs
HRS, incidence in wave 2

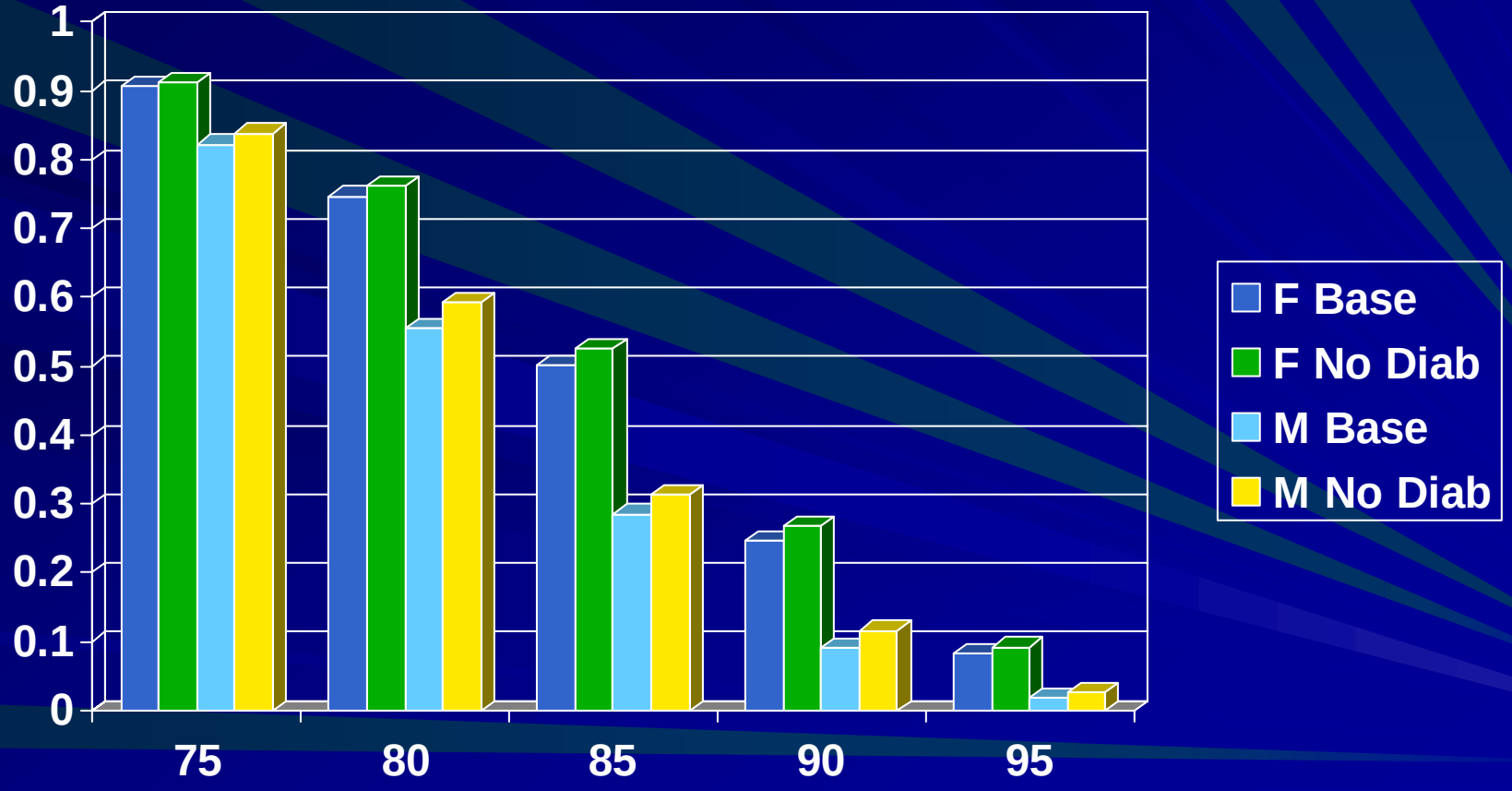
Source: J. Smith (2003)	Median	95th Percentile
Severe Condition		
All (age 51-61)	$3,496	$40,201
No insurance	$2,080	$91,195
Mild Condition		
All (age 51-61)	$23	$18,035
No insurance	$307	$18,492

Cumulative Effect of New Health Events

Source: J. Smith (2003)	Major Health Event, Wave 2	Minor Health Event, Wave 2
HRS Sample Income Loss + Medical Cost	$44,164	$10,792
AHEAD Sample Income Loss + Medical Cost	$10,376	$6,532

Survival Probabilities from Age 70

Female and Male, Baseline and No Diabetes



Conclusions - 1

- In the U.S. retired, Medicare-eligible population, the evidence is against strong direct causal links from SES to incidence of most new health conditions, or to mortality.
- Self-reported health status and mental conditions show an SES gradient, with the cross-country evidence favoring individual behavior as the source, rather than deficiencies in delivery of mental health services.

Conclusions - 2

- There is inconclusive evidence for direct causal links from health to wealth changes within the AHEAD panel, but occupational exposure, income loss and medical costs suggest strong links in working-age populations.
- Even though relative risks are mostly near one, SES gradients operating from age 70 to the end of life have an economically significant cumulative effect on incidence and mortality.