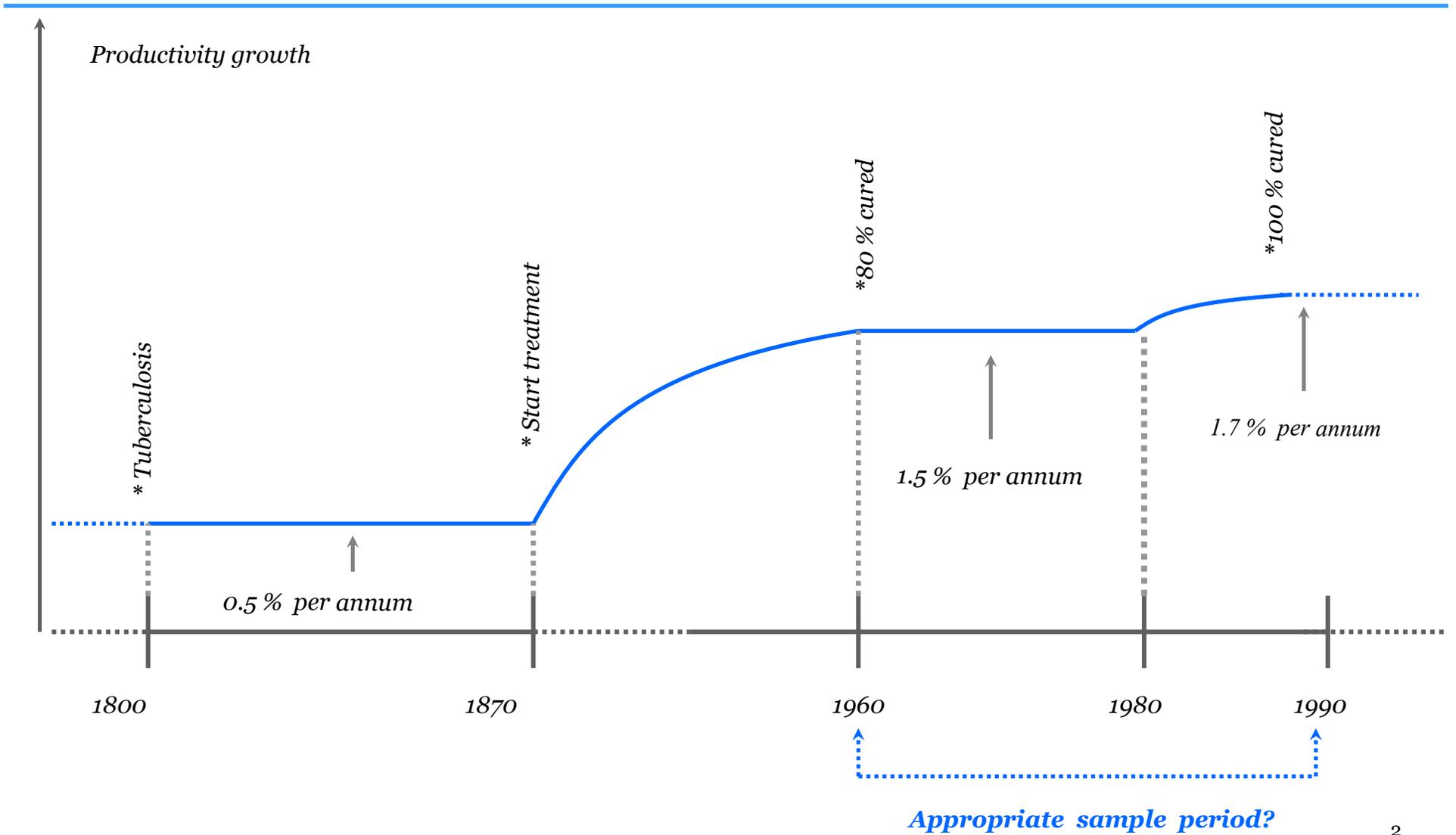
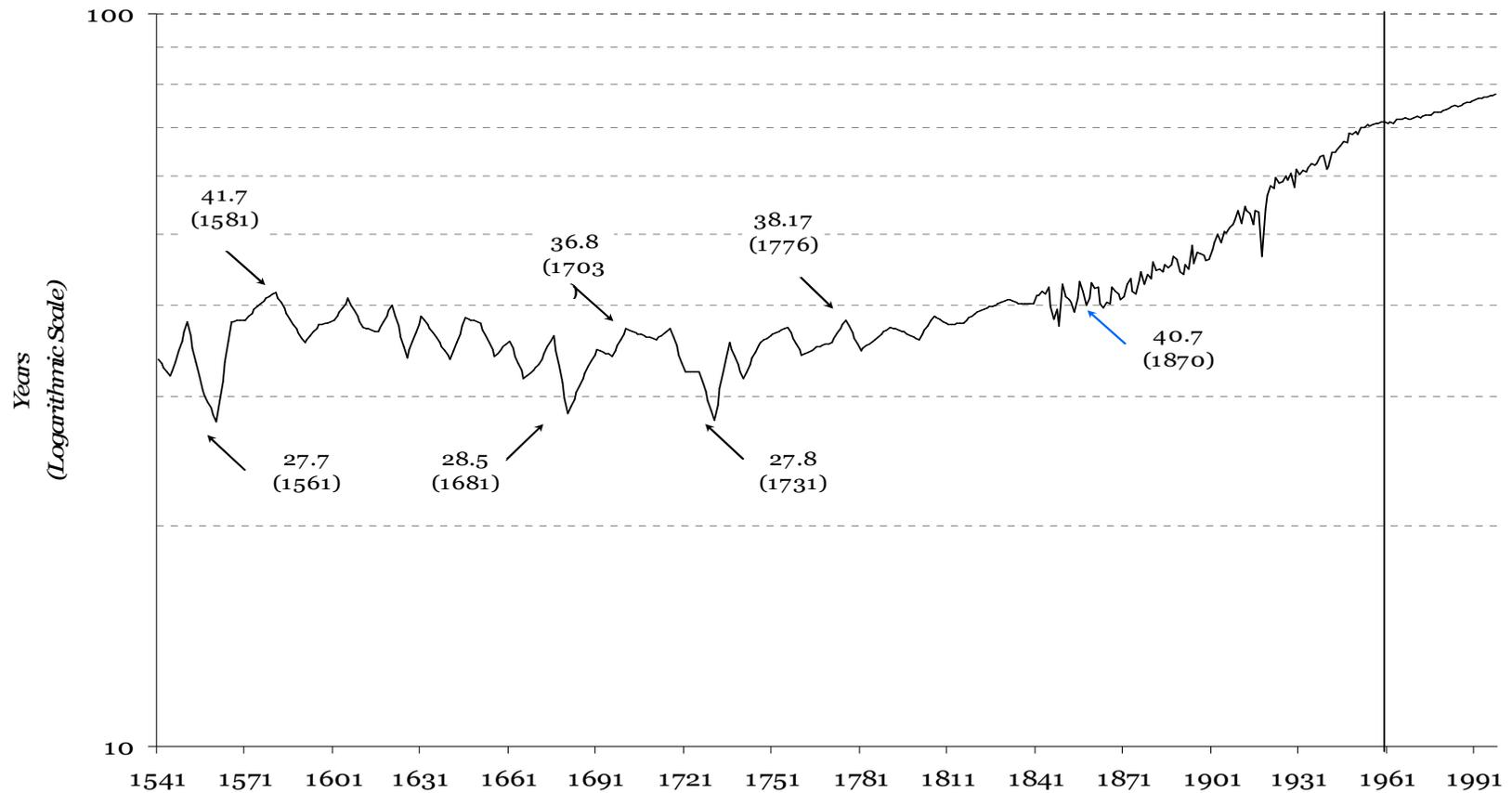

Aging during the epidemiologic transition: a historical view

Suchit Arora

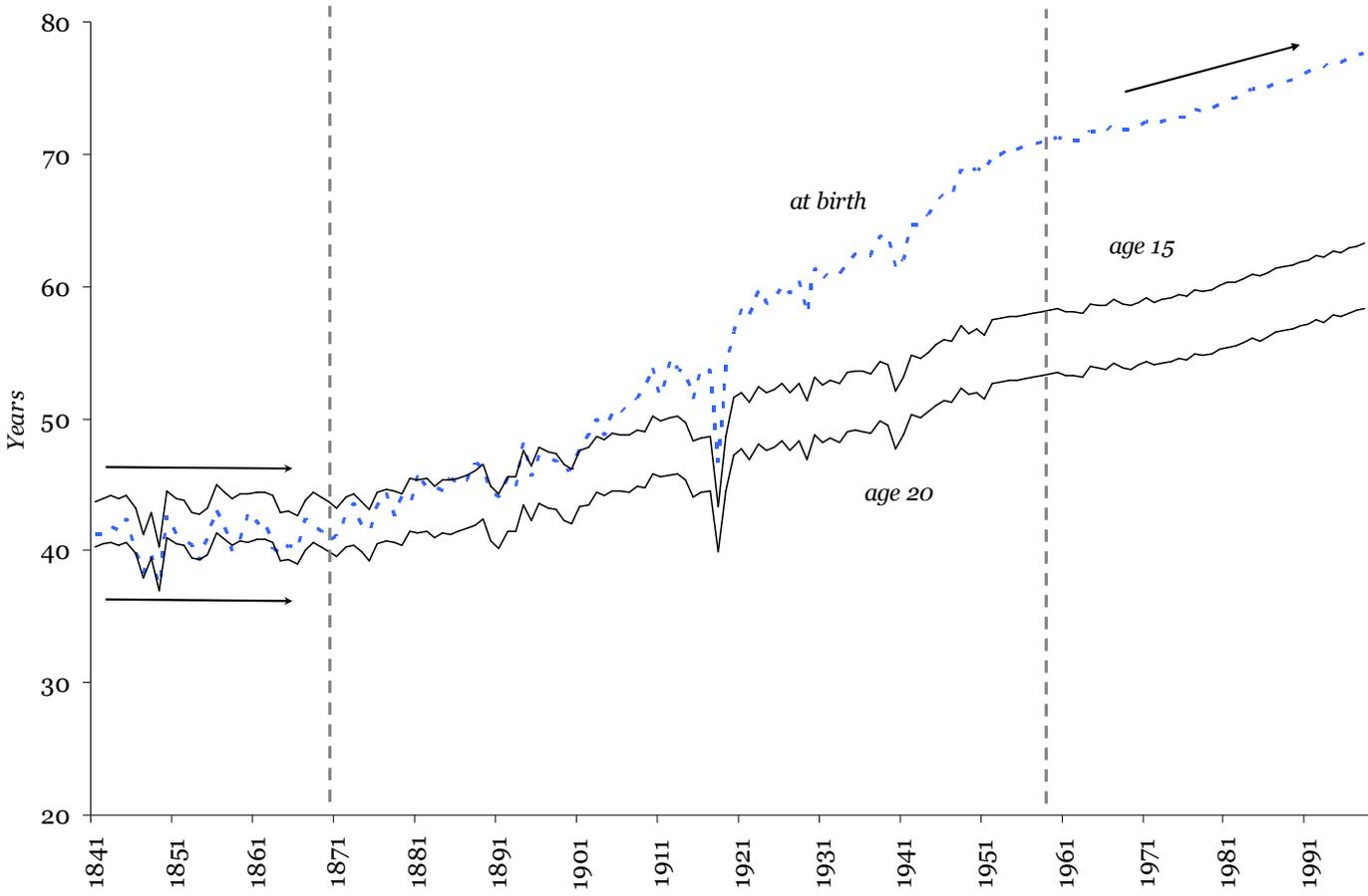
Why historical view?



Life expectancy at birth in England and Wales changed course permanently circa 1860/70, achieving about 85% of total progress by 1955/60 – most of the action is before 1960



..... and so did life expectancy at ages 15 and 20, and older.....

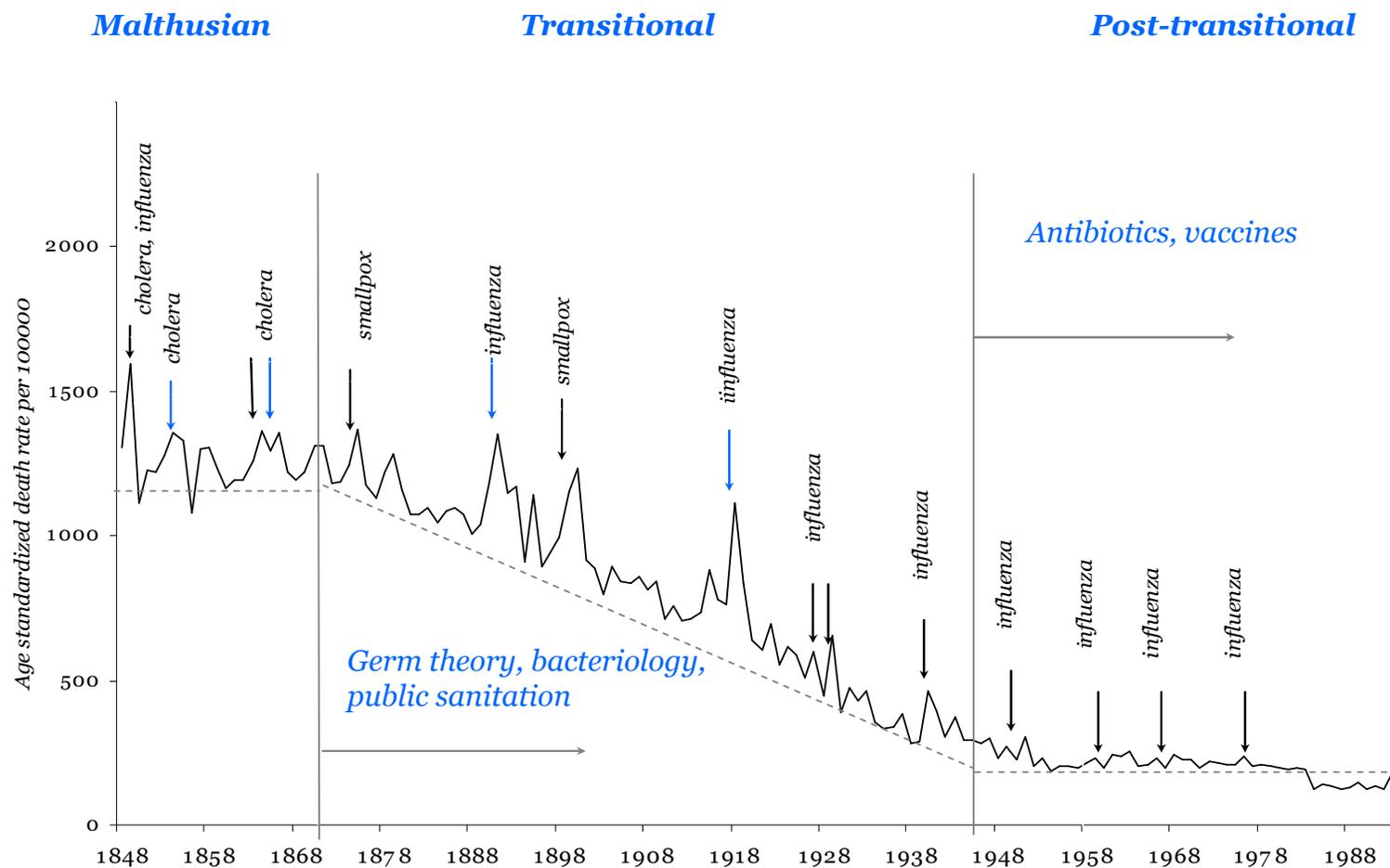


Epidemiologic change underpins the rise of life expectancy

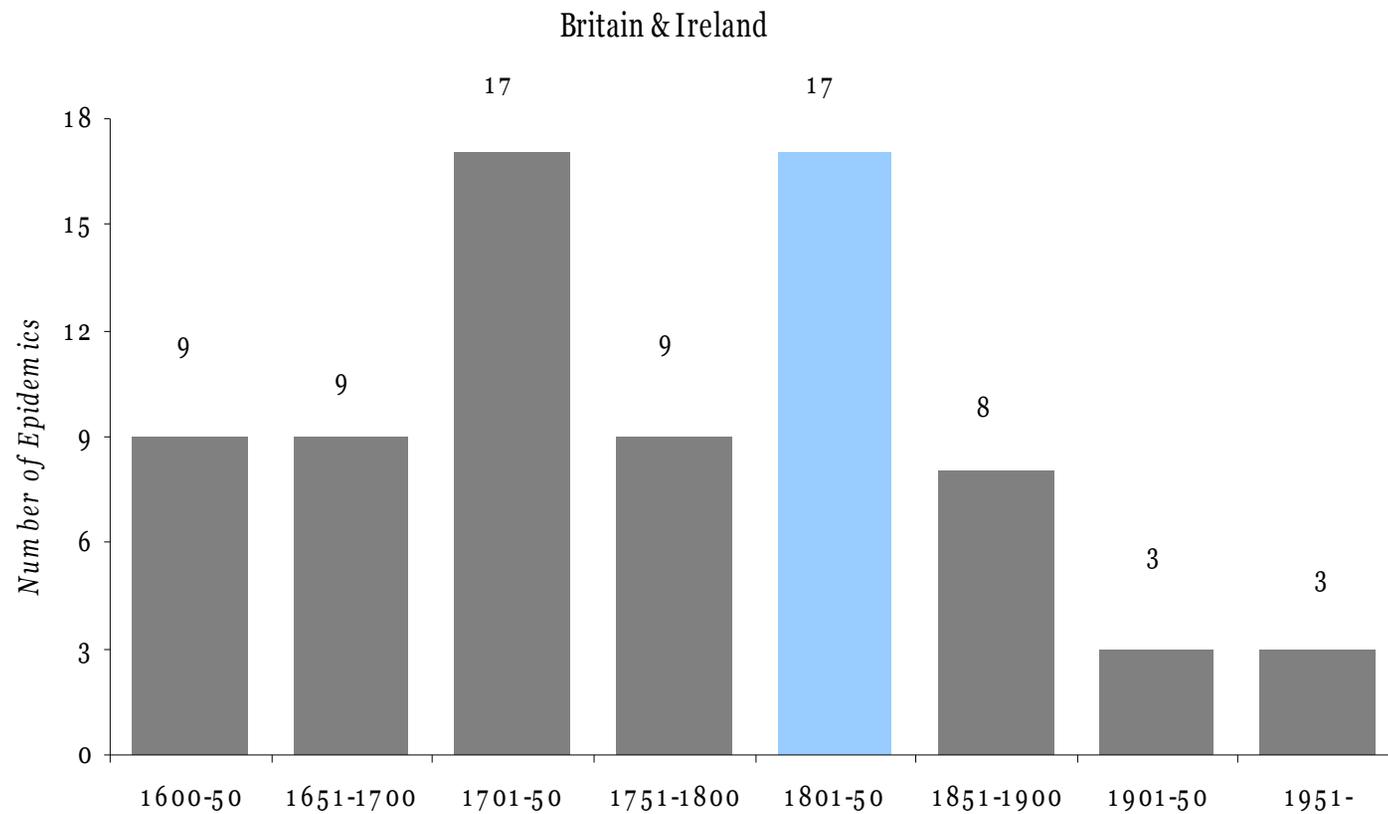
The received view of the Epidemiologic Transition has 3 distinct stages

<i>Stage</i>	<i>Features</i>
<i>Malthusian “age of pestilence & famine”</i>	<ul style="list-style-type: none">• <i>Dominated by infectious disease</i>• <i>Frequent epidemics</i>• <i>Low life expectancy, short life spans</i>
<i>Transitional “age of receding pandemics”</i>	<ul style="list-style-type: none">• <i>Infectious diseases recede</i>• <i>Life expectancy improves</i>• <i>Degenerative diseases rise</i>
<i>Post-transitional “age of man-made and degenerative diseases”</i>	<ul style="list-style-type: none">• <i>Degenerative diseases dominate</i>• <i>Longer life spans</i>

Infectious diseases retreating circa 1860/70, achieving about 95% of the reduction by 1955/60

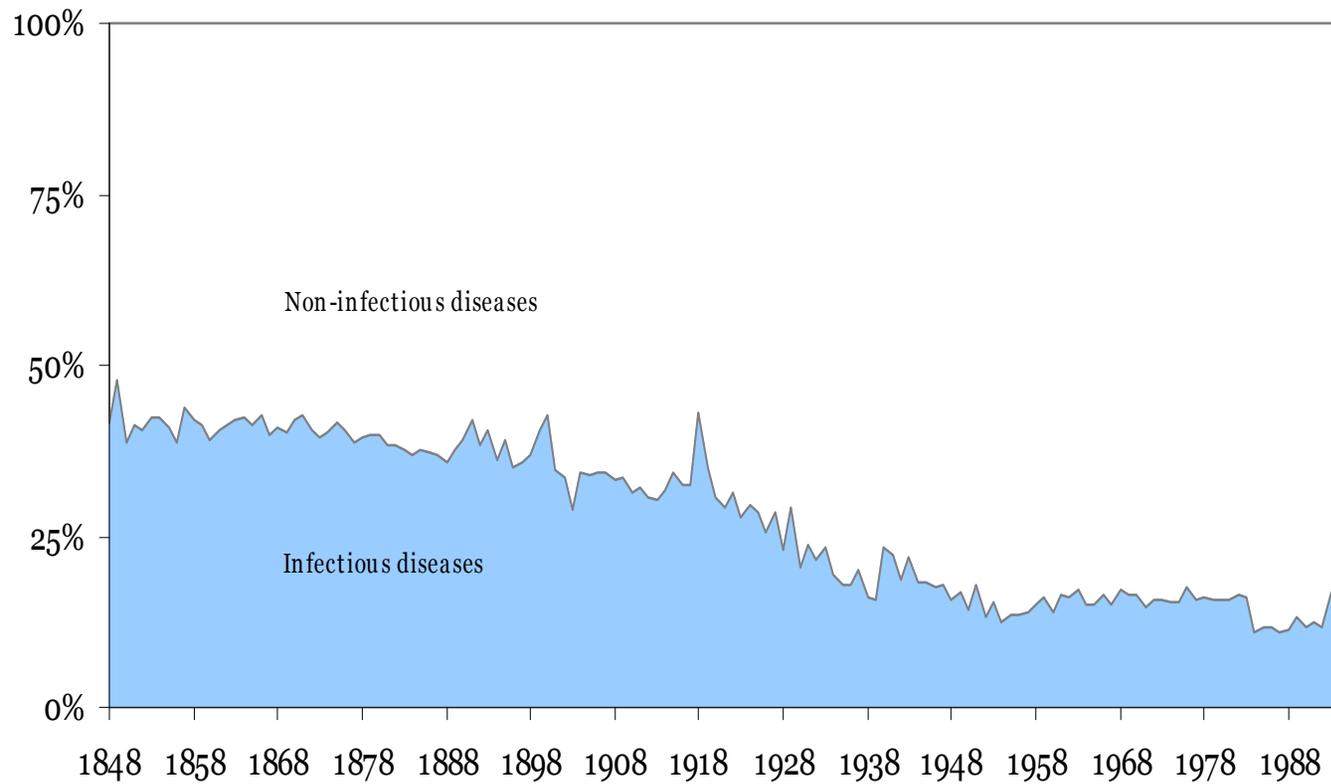


Frequency of major epidemics indicates even worse conditions during the first half of the 19th century



Infectious diseases were very significant during the Malthusian regime

→ *Non-infectious-degenerative maladies were substantial, too*



Revising the Malthusian “age of famine and pestilence”:

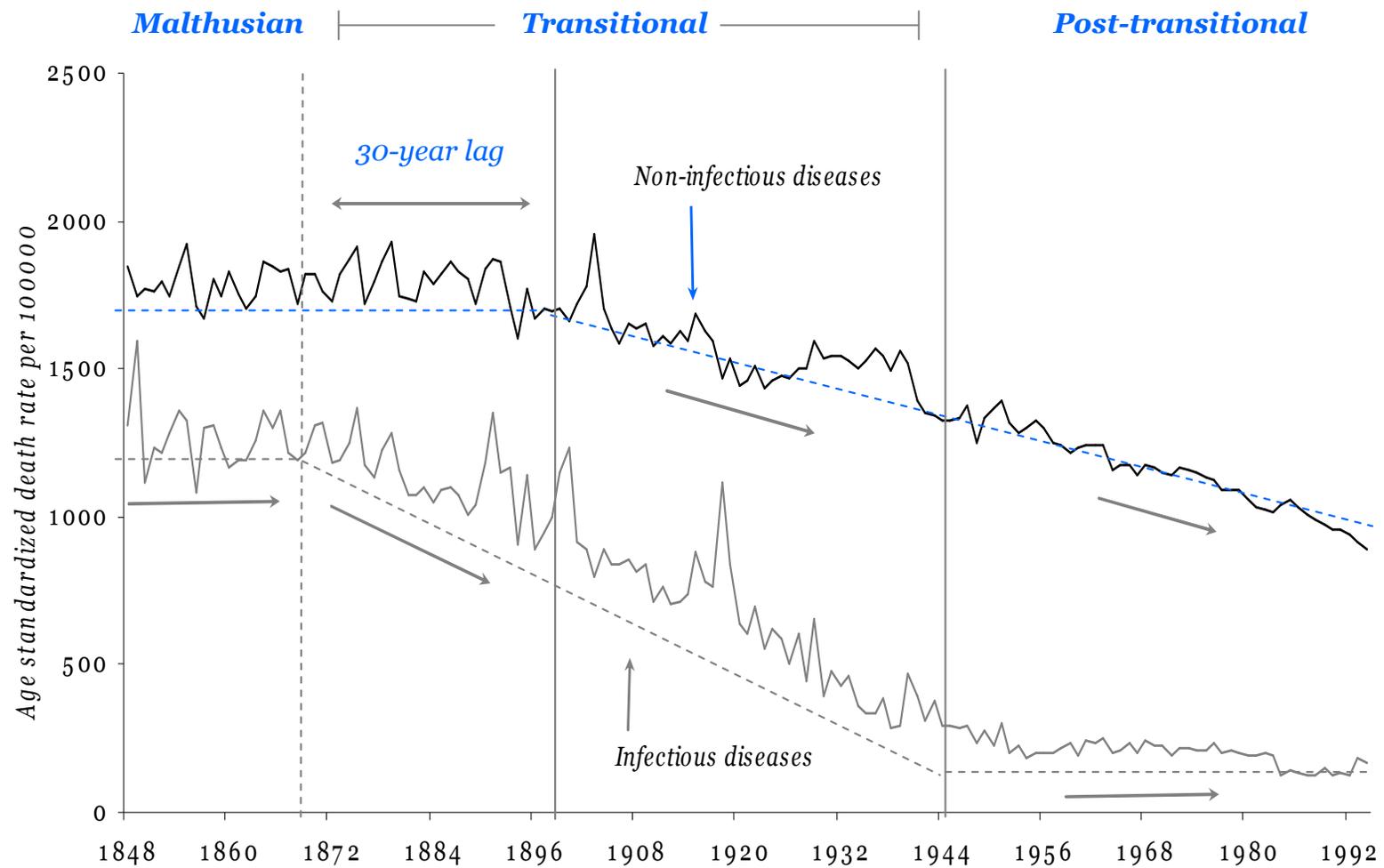
severe rates of infectious and non-infectious diseases coincide even as life spans were short

<i>Feature</i>	<i>Received view</i>	<i>Revision</i>
<i>Life spans, life expectancy</i>	<i>Short, low</i>	<i>Short, 30-40 years</i>
<i>Infectious diseases</i>	<i>Dominant</i>	<i>Substantial</i>
<i>Epidemics</i>	<i>Frequent</i>	<i>Frequent</i>
<i>Non-infectious diseases</i>	<i>Not very large</i>	<i>Substantial</i>

Shorter average life spans and severe rates of non-infectious diseases

→ ***degenerative, non-infectious maladies at relatively younger age***

*Non-infectious diseases, too, have been retreating for almost hundred years,
achieving about 65% of the total improvement by 1955/60*



Revising the transitional “age of receding pandemics”:

both infectious and non-infectious diseases diminished, as if there were a synergy between them

<i>Feature</i>	<i>Received view</i>	<i>Revision</i>
<i>Life spans, life expectancy</i>	<i>Lengthen, grows</i>	<i>Lengthen, grows</i>
<i>Infectious diseases</i>	<i>Recede</i>	<i>Recede</i>
<i>Epidemics</i>	<i>Less frequent</i>	<i>Less frequent</i>
<i>Non-infectious diseases</i>	<i>Ascend</i>	<i>Recede after brief lag</i>

Receding non-infectious diseases and lengthening life spans:

→ *degenerative, non-infectious maladies being deferred to chronologically older ages*

Tell-tale signs in the calendar-level view send us toward the cohort-level view of the Transition

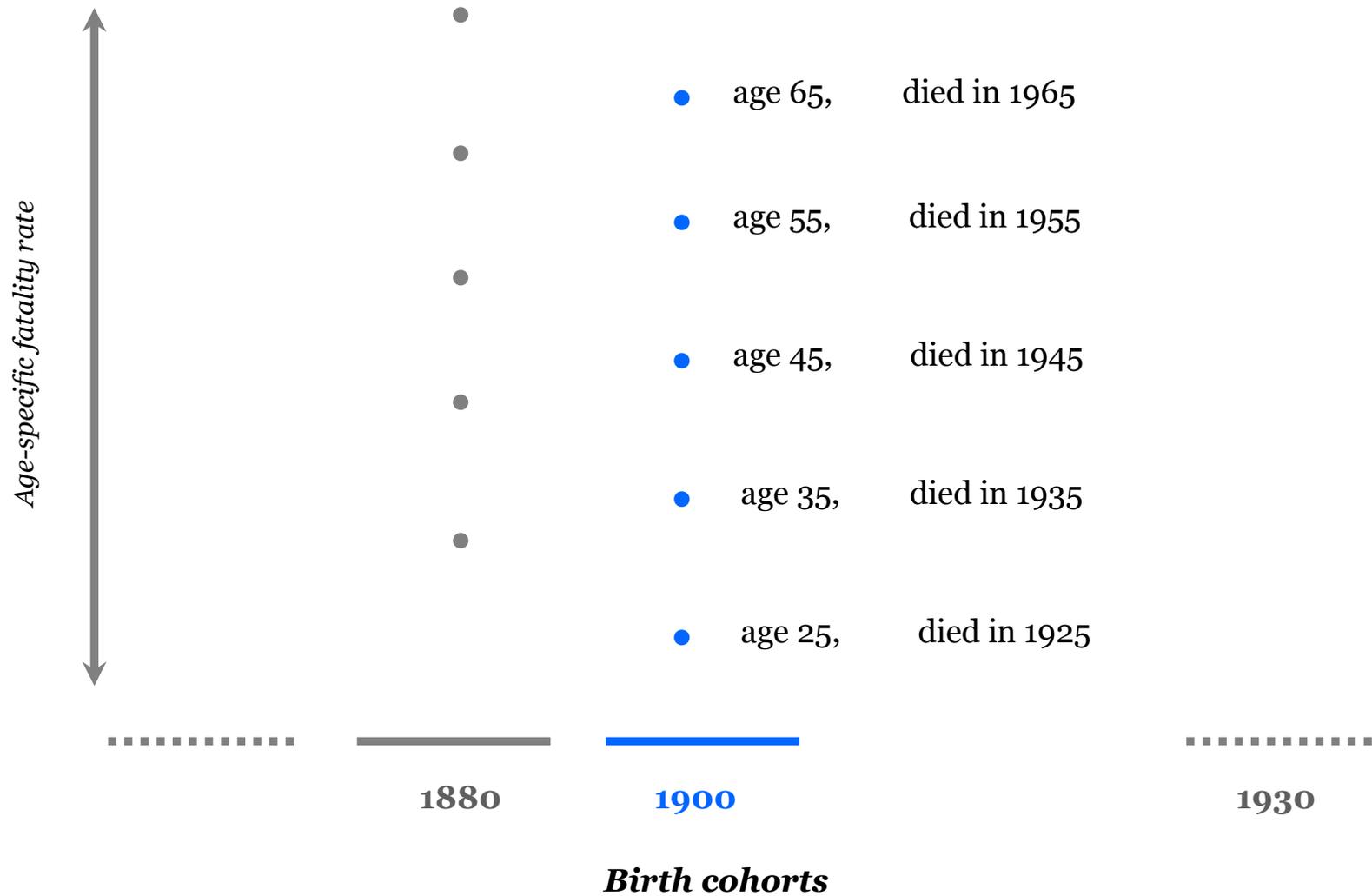
Non-infectious, degenerative diseases were being deferred to older chronological ages for a long time

Was the age-profile of non-infectious maladies shifting? And Why?

Underlying synergy

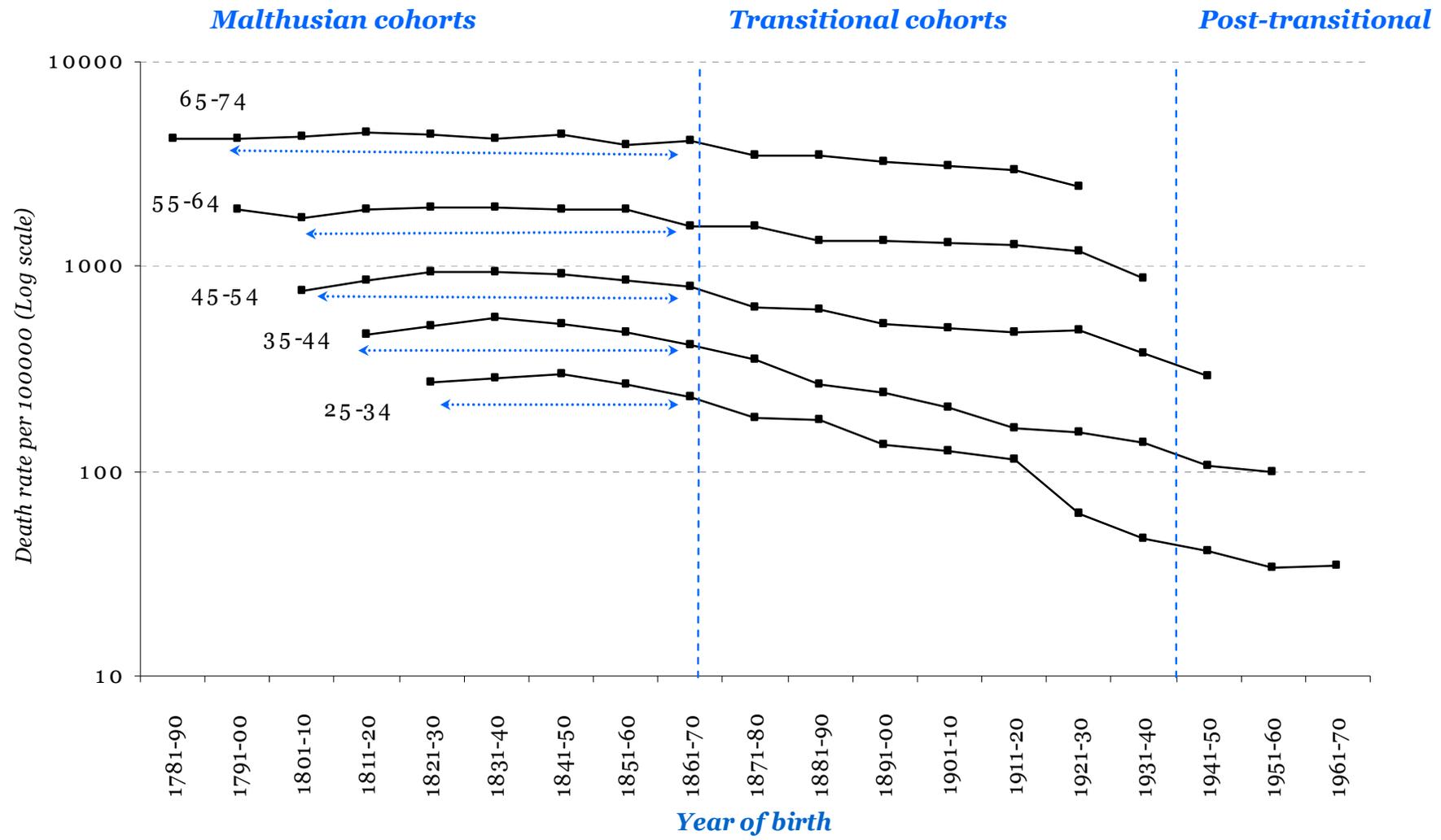
As infectious diseases retreated, non-infectious diseases followed after a brief lag. Why?

A primer on cohort-level trends



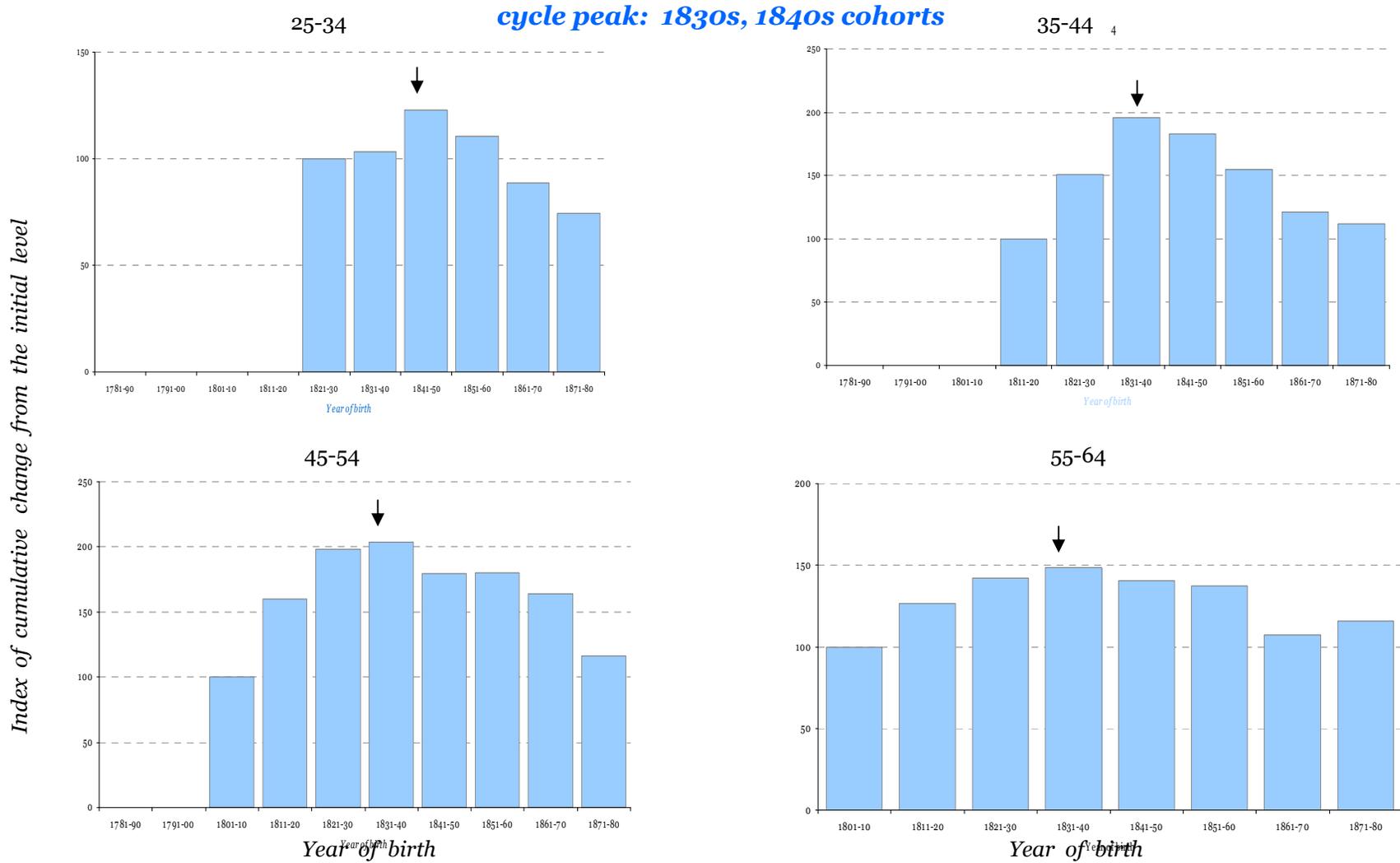
Cohort-level trends for all degenerative, non-infectious maladies:

- 1) Malthusian reversal 2) Progress since the 1870s



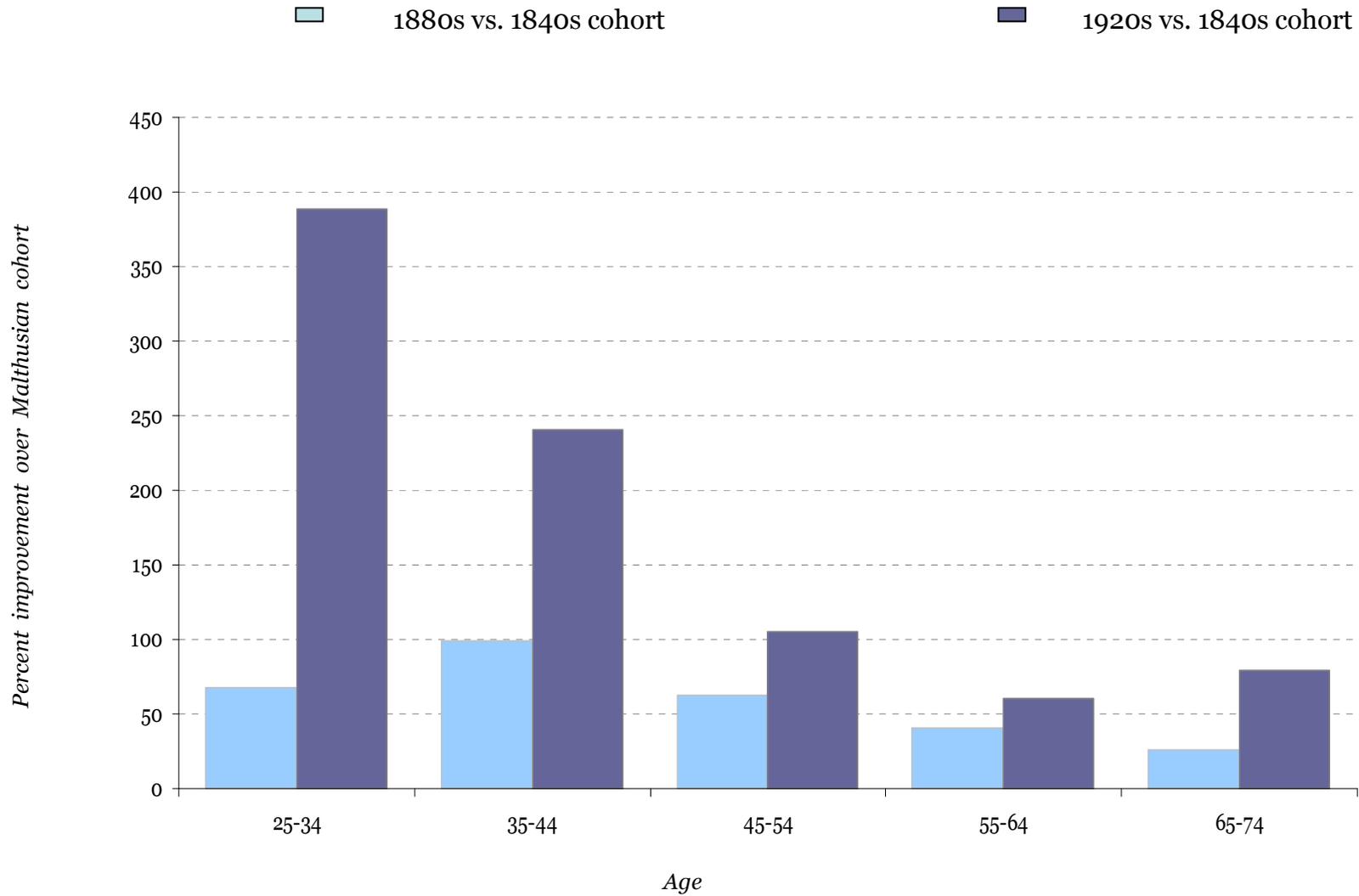
Upswing in non-infectious maladies for Malthusian cohorts damaged well being until decades later

Circulatory maladies, for example....



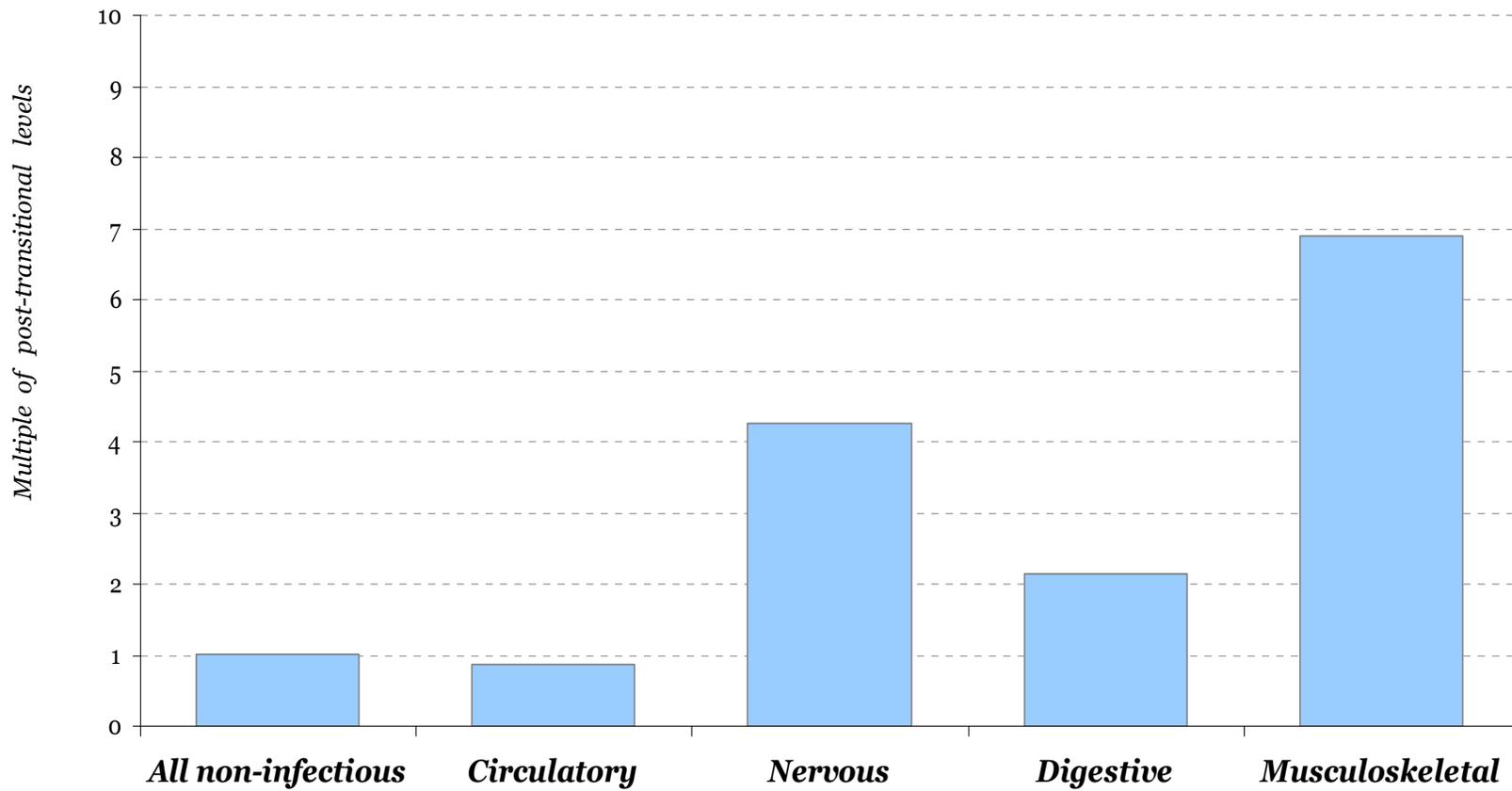
Early-transition (1880s) and mid-transition (1920s) cohorts fared better than the Malthusian cohort (1840s)

Age-profile of non-infectious diseases had shifted to chronologically older ages



Malthusian 25-34-year olds did worse than post-transitional 45-54-year olds

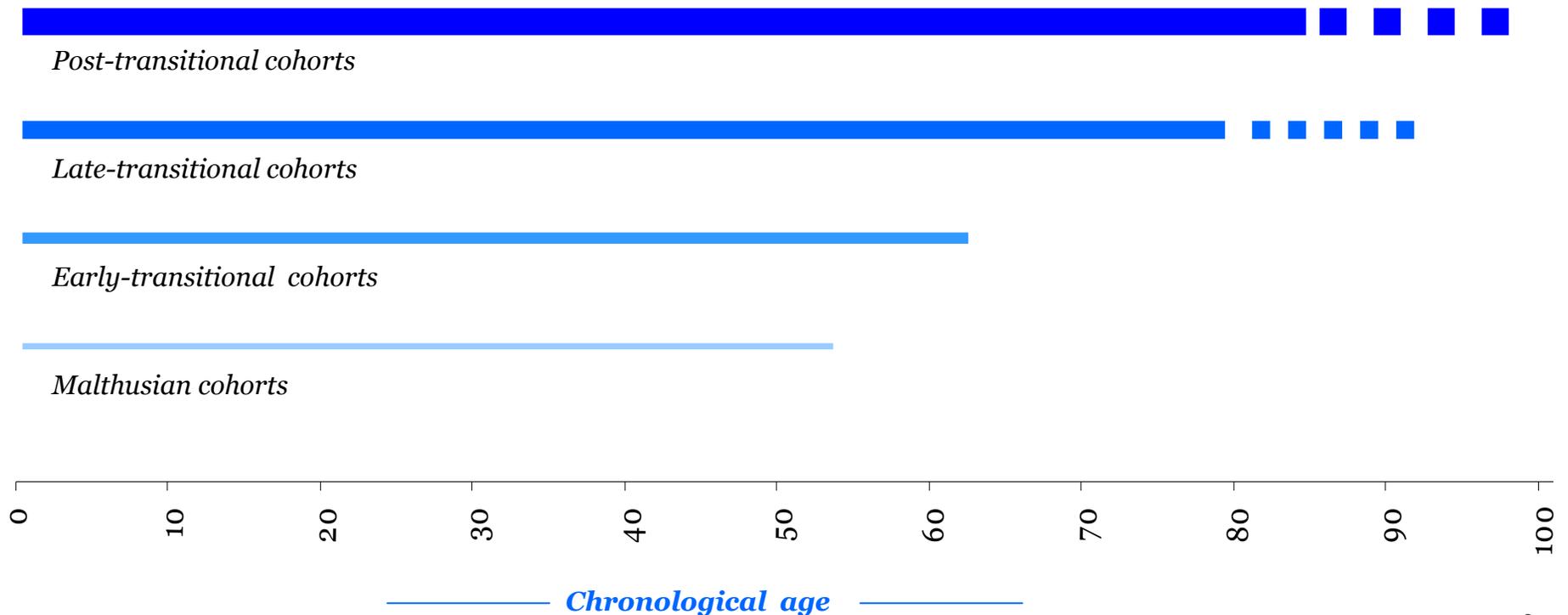
As if modern-day middle-aged are “younger” than Malthusian 25-34-year olds



Aging during the epidemiologic transition appears to be about becoming “younger” at each chronological age

- (1) *Better physiological status* (2) *Greater scale of survival* (3) *Longer life span*
-

Echoes from the past imply that period-life expectancy misgauges cohort-life expectancy



Synergy: infectious disease during childhood tells on non-infectious maladies later in life

Positive correlation, non-contemporaneous data

	<i>25-34</i>	<i>35-44</i>	<i>45-54</i>	<i>55-64</i>	<i>65-74</i>
	<i>Infectious diseases at age 0-4</i>				
<i>All non-infectious</i>	0.94	0.89	0.88	0.85	0.93
<i>Circulatory</i>	0.92	0.82	0.70	0.77	0.92
<i>Nervous</i>	0.91	0.84	0.82	0.65	0.41
<i>Digestive</i>	0.94	0.92	0.87	0.83	0.79
<i>Genitourinary</i>	0.95	0.93	0.89	0.81	0.82
<i>Musculoskeletal</i>	0.68	0.82	0.85	0.73	0.59
	<i>Infectious diseases at age 5-14</i>				
<i>All non-infectious</i>	0.96	0.93	0.91	0.88	0.93
<i>Circulatory</i>	0.95	0.84	0.78	0.75	0.88
<i>Nervous</i>	0.90	0.84	0.77	0.78	0.57
<i>Digestive</i>	0.95	0.93	0.92	0.89	0.86
<i>Genitourinary</i>	0.94	0.95	0.94	0.90	0.86
<i>Musculoskeletal</i>	0.78	0.79	0.93	0.82	0.70

Synergy: early-age cellular damage appears to tell on non-infectious maladies later in life

Negative correlation between adult stature and non-infectious maladies later in life

	25-34	35-44	45-54	55-64	65-74
<i>All non-infectious</i>	-0.82	-0.79	-0.74	-0.67	-0.69
<i>Circulatory</i>	-0.85	-0.78	-0.56	-0.25	-0.12
<i>Nervous</i>	-0.79	-0.63	-0.46	-0.34	-0.23
<i>Digestive</i>	-0.77	-0.75	-0.68	-0.53	-0.40
<i>Genitourinary</i>	-0.86	-0.86	-0.87	-0.80	-0.68
<i>Musculoskeletal</i>	-0.62	-0.49	-0.64	-0.72	-0.67
<i>All non-infectious</i>	-0.82	-0.79	-0.74	-0.67	-0.69

The epidemiologic transition not driven by genetic “evolution”

- *Evolutionary theory of senescence says selection not intense on genes causing degenerative maladies*
 - *Degenerative maladies to stay with us, prospect of immortality is grim*
- *So rapid improvement in degenerative maladies cannot be natural selection at work*
 - *Also, genetic evolution is not so rapid*

This epidemiologic change happened for reasons unique to the 19th century

Notes
