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Comment Daniel McFadden and Wei Xie

There is a plausible conjecture that morbidity should be expanding among seniors: risks from early, quick killers like heart attacks and strokes are falling, leaving the elderly more exposed to risk from slow, disabling "killers of last resort" like senile dementia. Improved treatments have increased survival times after onset of some potentially mortal conditions such as kidney disease, and people living with such diseases are prone to other complications. If health research dollars and medical advances are tilted toward acute conditions and their treatment, people may live longer, but do so with burdensome disabilities. The chapter "Evidence for Significant Compression of Morbidity in the Elderly US Population" by David Cutler, Kaushik Ghosh, and Mary Beth Landrum presents persuasive evidence that this conjecture is wrong. They make clever use of data from the Medicare Current Beneficiary Study (MCBS), linked to 2008 National Death Index data, and find that while disease prevalence is rising for key conditions, functional disabilities are falling, and overall, morbidity measured by disabilities that cause substantial functional limitations is falling as a portion of the total life span. In conclusion, medical science is not creating a population of zombies. We compliment the authors on this research, and in this comment will also complement it with tabulations from a 20 percent sample of Medicare claims records.

To understand the authors' results, it is useful to clarify what "morbidity" means. The correlated but distinct aspects in figure 1C.1 seem important.

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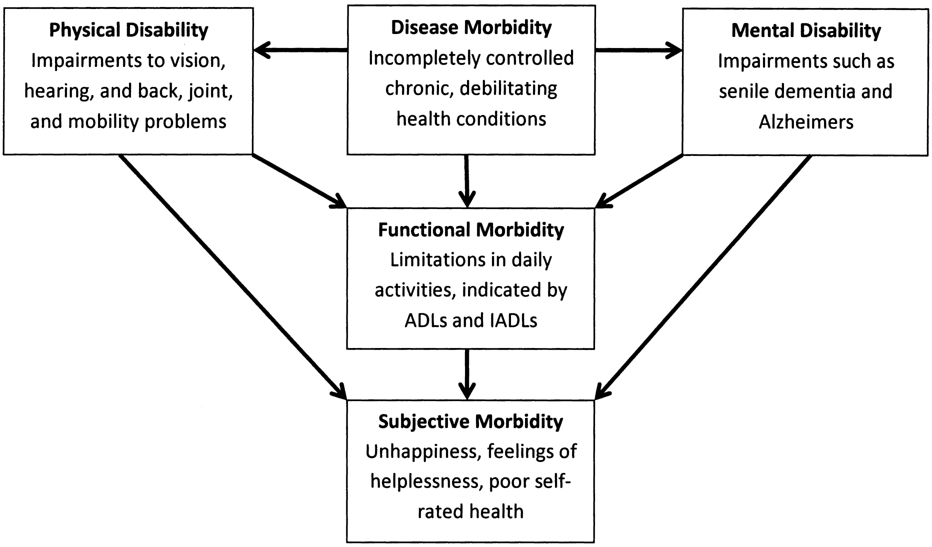


Fig. 1C.1 Physical disability, disease morbidity, and mental disability

Disease morbidity may contribute to physical and mental disabilities, and these impairments may contribute to functional and subjective morbidities. The authors conduct a factor analysis of nineteen questions on health limitations in the MCBS data, and identify three factors that among the aspects pictured roughly span functional morbidity and physical and mental disabilities. Their key finding is that their impairment factors, looking back one or more years before death, have been falling over time. This is despite an apparent increase in disease prevalence over time, particularly for controllable chronic diseases.

A leading interpretation is that with the assistance of medical science people are getting better at managing diseases and functioning without severe impairments. However, there are other possibilities. Figure 1C.2 shows health status over the life course, stylistically described in terms of "life force." The individual depicted has an onset of disease 1, from which she has a full recovery, and then has an onset of disease 2, which leads to a progressively disabling fall in life force and eventually to death. At some point disease 2 is diagnosed, and thereafter this person is observed as having disease 2 morbidity. When her life force falls below a threshold, she also has functional morbidity, indicated by ADL or IADL limitations. Now ask what factors could decrease functional morbidity or increase disease morbidity. Changes lowering functional morbidity include (a) lowering the threshold below which activities of daily living are limited; (b) changing the treatment of disease 2 in a way that slows the progress of the disease and the decline in life force more in its initial stages than in its late stages, pro-

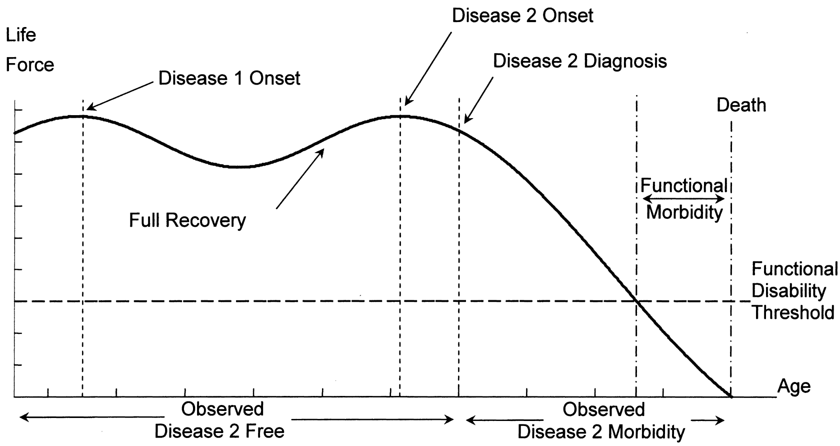


Fig. 1C.2 Disease and functional morbidities over the life course

longing the time during which life force is above the threshold level; and (c) lowering the incidence of disease 2 relative to quick killers that have short spells of morbidity. These changes are all real, so long as lowering the threshold reflects improvement in coping strategies (e.g., Internet grocery shopping for home delivery) rather than increasing reluctance to admit to functional disabilities. Changes that increase disease morbidity include (a) raising the relative risk of the disease (by lowing competing risks from quicker killers); (b) accelerating the diagnosis of the disease so that it is identified in an earlier stage; or (c) changing diagnostic coding so that the diagnosis includes people who have less virulent forms of the disease or are more resistant to it. Some of these changes may be apparent rather than real. A particular issue is that increased diagnostic testing, or upcoding that classifies less sick people as having a disease, could increase apparent disease morbidity without altering the real conditions that lead to functional morbidity; this is sometimes called a "Will Rogers effect" from his observation that migration between states can sometimes raise an average in both.

To complement the authors' analysis of disease prevalence using MCBS data, we have run tabulations from a 20 percent longitudinal sample of Medicare A and B claims from 1999 to 2010. We use Chronic Condition Warehouse (CCW) definitions of health conditions observed from ICD-9 diagnostic codes on claims.[1] To carry out the CCW coding of conditions, we restrict analysis to people age 67–95 with at least two years of full or nearly full enrollment in fee-for-service (ffS) Medicare coverage. This

1. For detailed information on the construction of the chronic conditions, see www.ccwdata.org/cs/groups/public/documents/document/ccw_conditioncategories2011.pdf .

selects out many dual-eligible, institutionalized, and Medicaid-qualified low-income people who are assigned to Medicare Advantage plans and do not have A/B claims for most conditions. For our analysis, we are left with 5,139,917 people in 2004, 4,831,246 in 2007, and 4,790,793 in 2010; the decline in the face of increasing overall Medicare enrollment by seniors reflects diversions from ffS to Medicaid and Medicare Advantage programs. The claims records contain no information on functional disabilities, biometric data, or self-rated health, so our analysis is limited to disease morbidity. Our tabulations do not account for drift in diagnostic practices, or drifts in the demographic mix of the Medicare ffS population other than age and sex, so they leave unanswered the question of whether observed drifts in prevalence are to some extent ecological or definitional.[2] We closely follow the authors in classifying diseases into *cancers* (prostate, breast, colorectal, lung), *chronic disabling conditions* (Alzheimer's, dementia, and related disorders, chronic obstructive pulmonary disease [COPD], chronic kidney disease, osteoporosis), *acute treatable diseases* (acute myocardial infarction [AMI], ischemic heart disease, stroke, and broken hip), and *nonfatal controllable conditions* (arthritis, diabetes, depression, glaucoma, hypertension, acquired hypothyroidism, anemia, asthma, hyperlipidemia).

Figures 1C.3, 1C.4, 1C.5, and 1C.6 present age-specific prevalence rates by gender for selected conditions for the years 2004, 2007, and 2010. Figure 1C.7 gives age-specific average counts of major (i.e., all except nonfatal controllable conditions) CCW conditions and of all CCW conditions. The cancers in figure 1C.3 show initially increasing prevalence with age, but eventually turn down as higher risk people are selected out of the population. There is relatively little drift, although breast and lung cancers for females show rising rates that may be attributable to rising smoking rates in the past in these age cohorts. Colorectal cancer shows a modest decline. In figure 1C.4 for chronic degenerative diseases, Alzheimer's and senile dementia and COPD show little drift, while osteoporosis and chronic kidney disease show significant increases over time. The acute treatable conditions in figure 1C.5 increase fairly sharply with age, and show very little drift over time except for falling prevalence of AMI and strokes. However, almost all the nonfatal, controllable conditions in figure 1C.6 show sharply increasing prevalence over time; the particularly strong drifts for diabetes, hypertension, and hyperlipidemia almost certainly are due in part to more aggressive diagnosis of these conditions conducted as part of implementing new, effective control therapies. Finally, figure 1C.7 shows that the numbers of major and total CCW conditions both rise with age, and drift up sharply over time for the

2. In general, Medicaid enrollees appear to be less healthy, and MA enrollees appear to be more healthy than the ffS population, so that drifts in enrollments are a factor in drifts in prevalence.

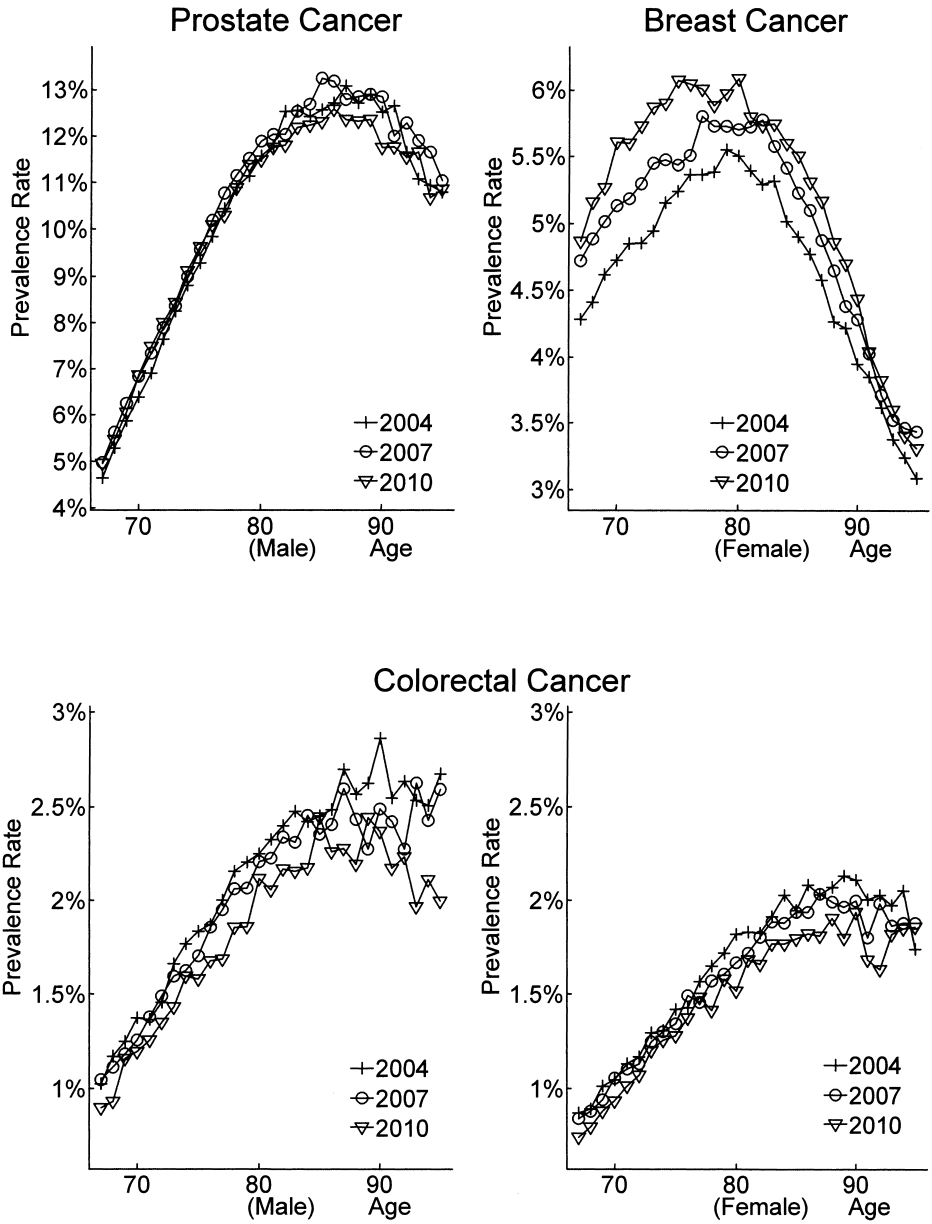


Fig. 1C.3 Cancer condition prevalence rates by year, age, and gender

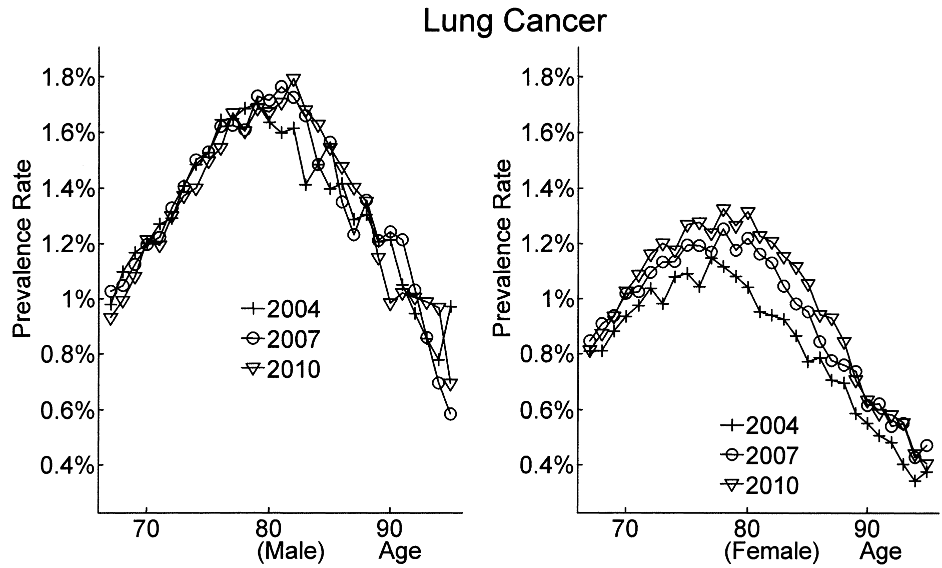


Fig. 1C.3 (Cont)

count of all conditions, and modestly over time for the count of major conditions. These figures agree with and reinforce the authors' conclusion that disease morbidity is rising, with AMI, stroke, and colorectal cancer the only significant exceptions, and age-specific prevalence is drifting up most sharply for nonfatal controllable conditions.

Next, we follow the authors and look at the prevalence of conditions in the years prior to death. The structure of the claims data allows us to take the cohort of individuals by gender who die in a given year and have a specific disease, and trace them back longitudinally to get disease prevalence in years up to the year of death.[3] Our findings are generally consistent with a story of improved therapies that increase survival times after onset of a disease, although they are also consistent with a story in which more aggressive diagnosis identifies people who are in earlier stages of the disease and are less sick. Our rates are age adjusted (to the 2010 age profile). Figure 1C.8 shows that cancer prevalence falls fairly sharply with years to death, reflecting the high mortality risk and hence short morbidity spells

3. Our death cohorts are not selected by cause of death, which may be attributed to multiple conditions, some of which may be opportunistic when the person has the disease that we are analyzing. These cohorts are also not adjusted for trends in comorbidities. There is some attrition in the sampled cohort as we look back, from people who were not enrolled in Medicare ffS plans throughout the look-back period; calculated look-back prevalence rates are for the subsample whose ffS data is sufficient for the CCW disease determination.

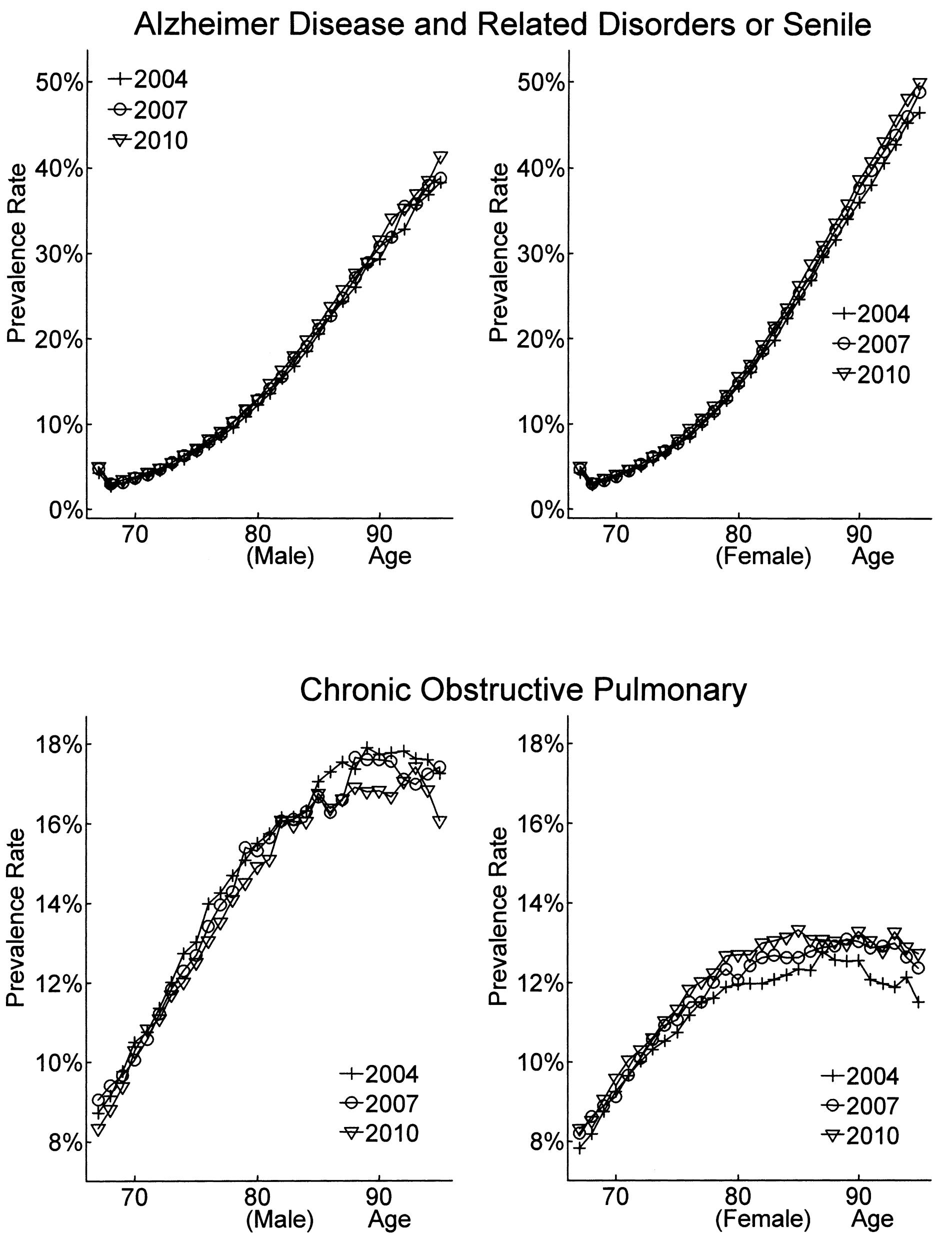


Fig. 1C.4 Chronic disabling condition prevalence rates by year, age, and gender

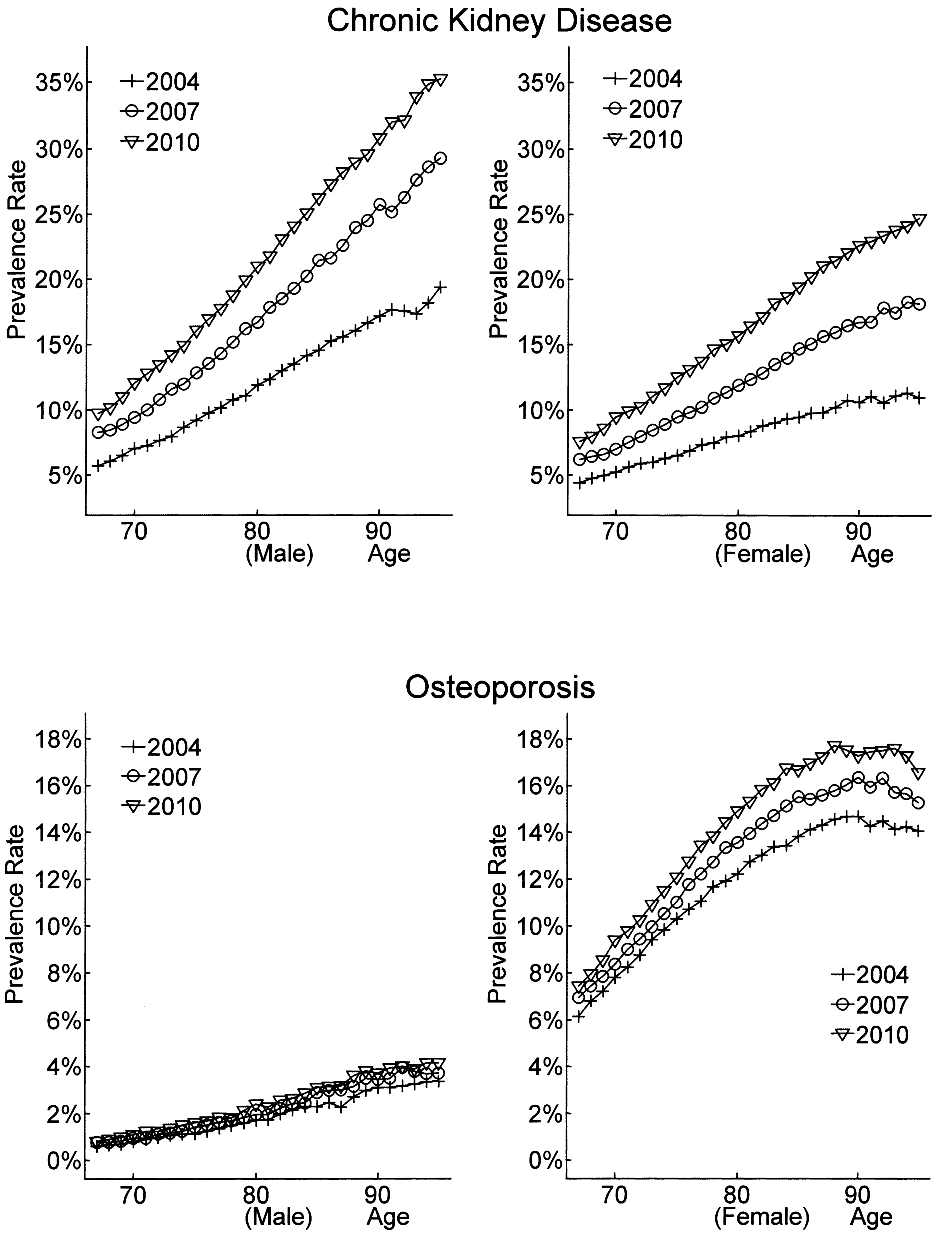

Chronic Kidney Disease
Prevalence Rate
35%
30%
25%
20%
15%
10%
5%
2004
2007
2010
70
80
90
(Male)
Age
(Female)
Osteoporosis
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%

Fig. 1C.4 (cont.)

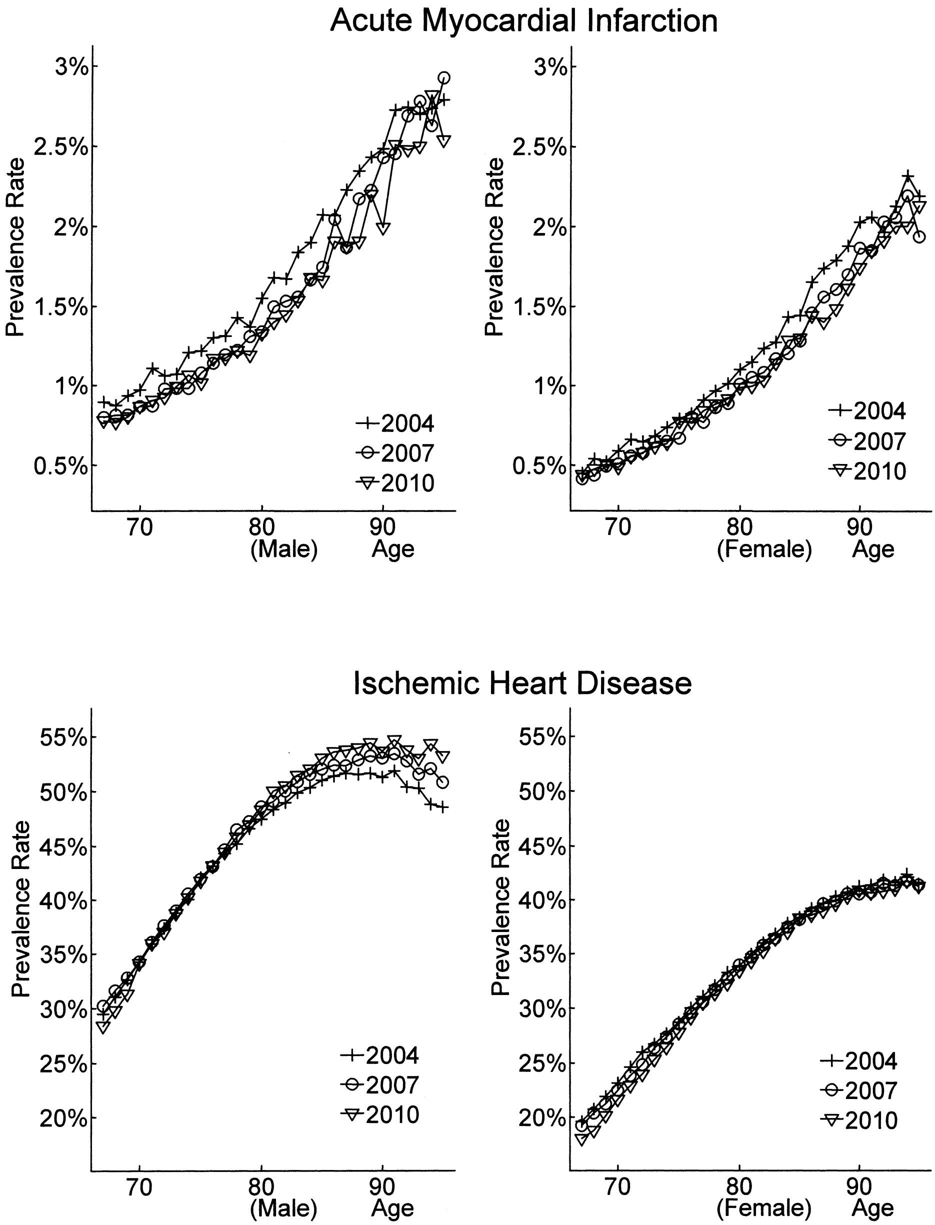
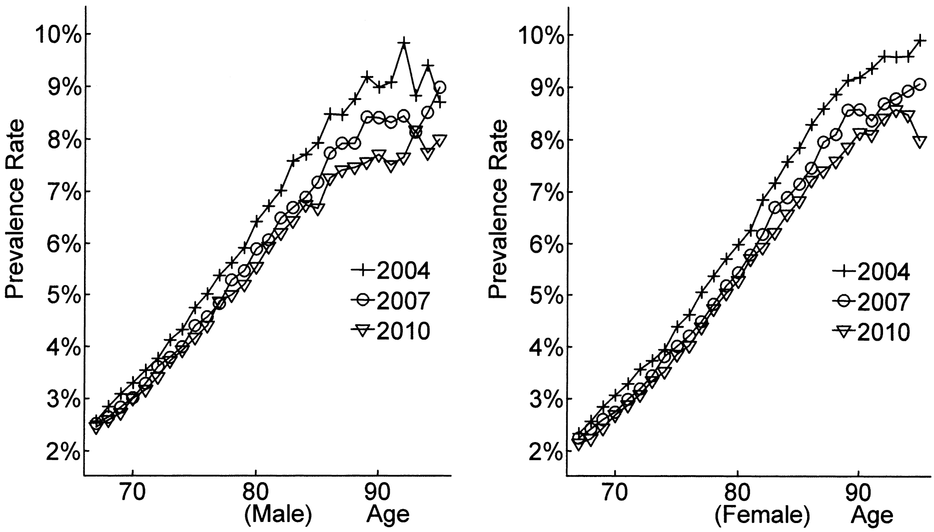


Fig. 1C.5 Recoverable acute condition prevalence rates by year, age, and gender

Stroke/Transient Ischemic Attack



Hip/Pelvic Fracture

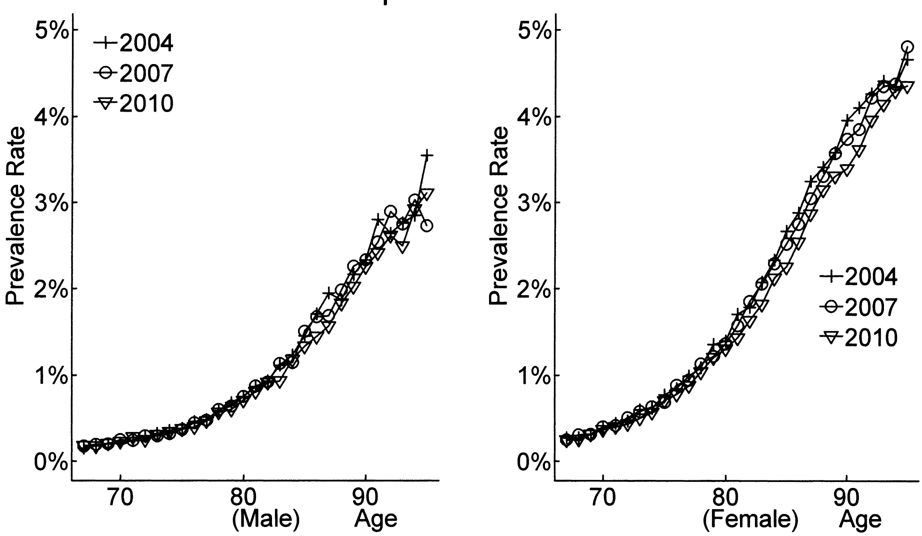


Fig. 1C.5 (cont.)

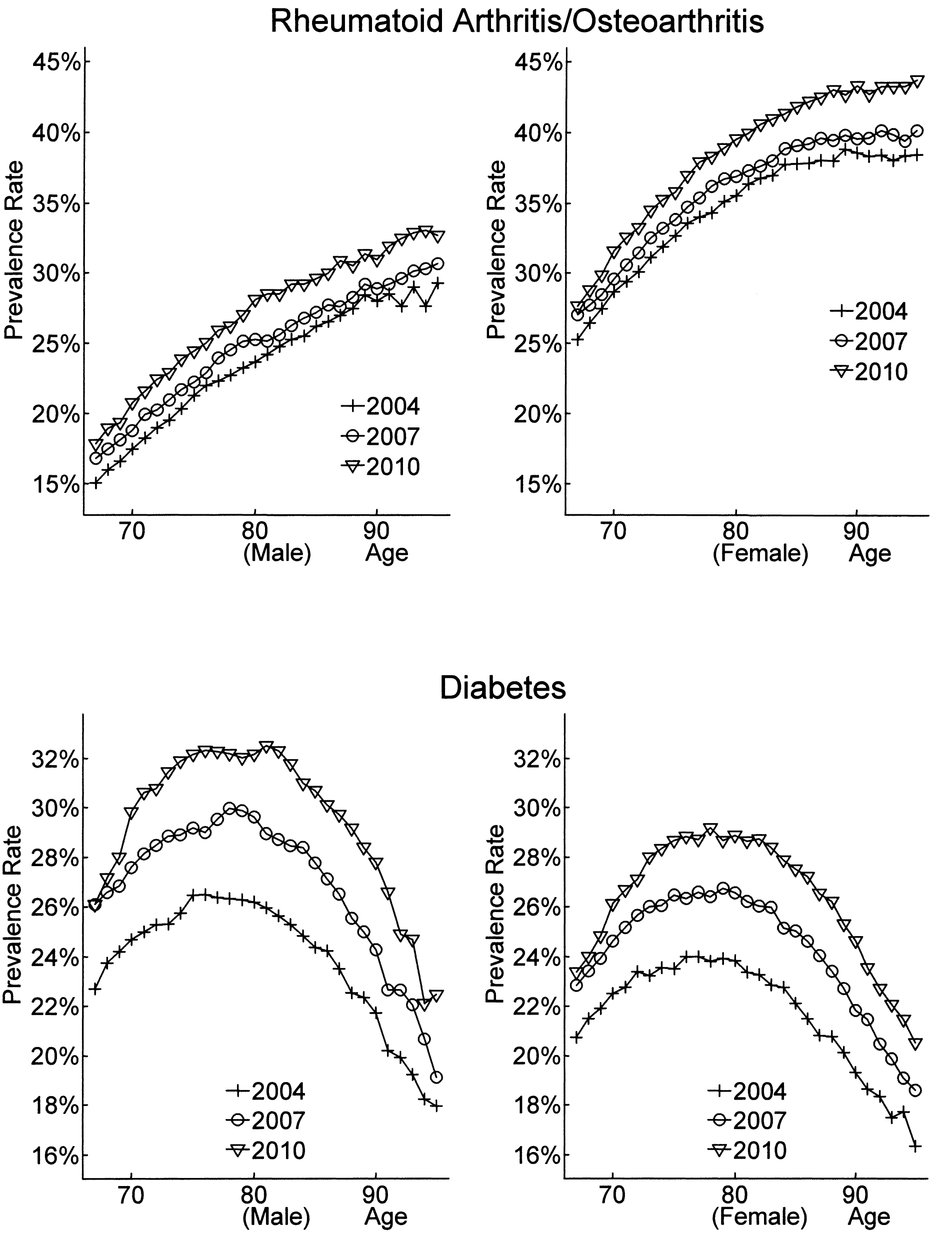
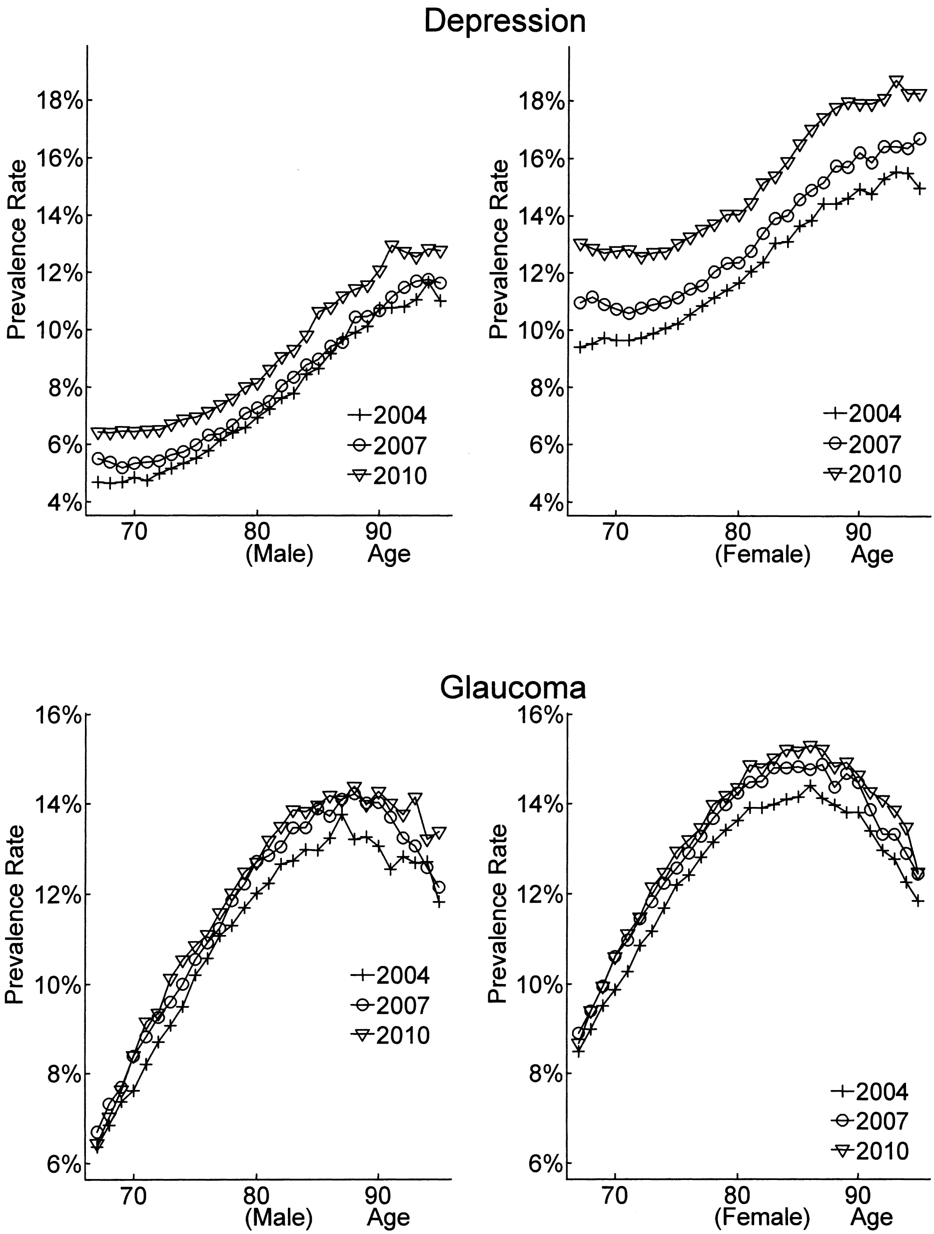
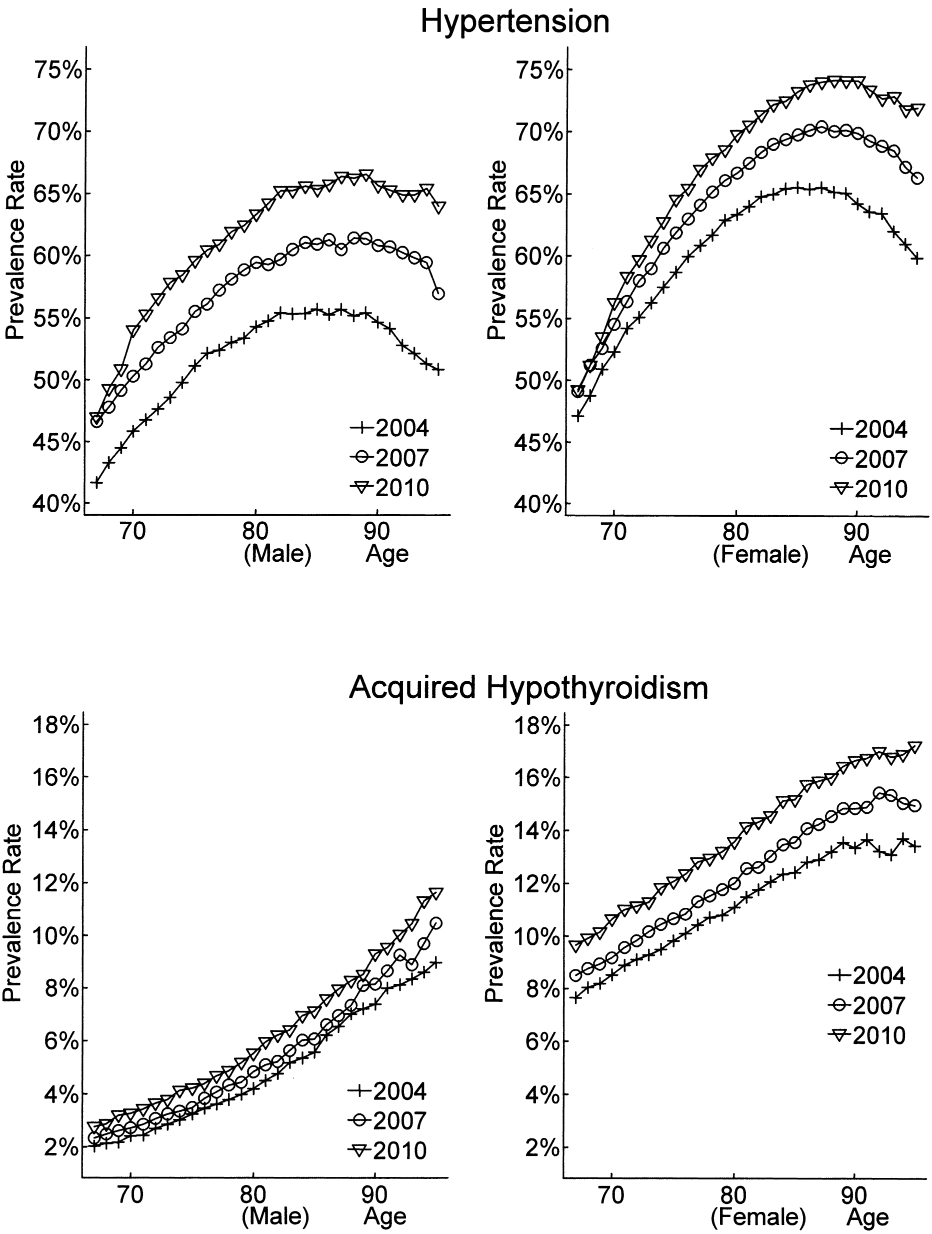


Fig. 1C.6 Nonfatal controllable condition prevalence rates by year, age, and gender



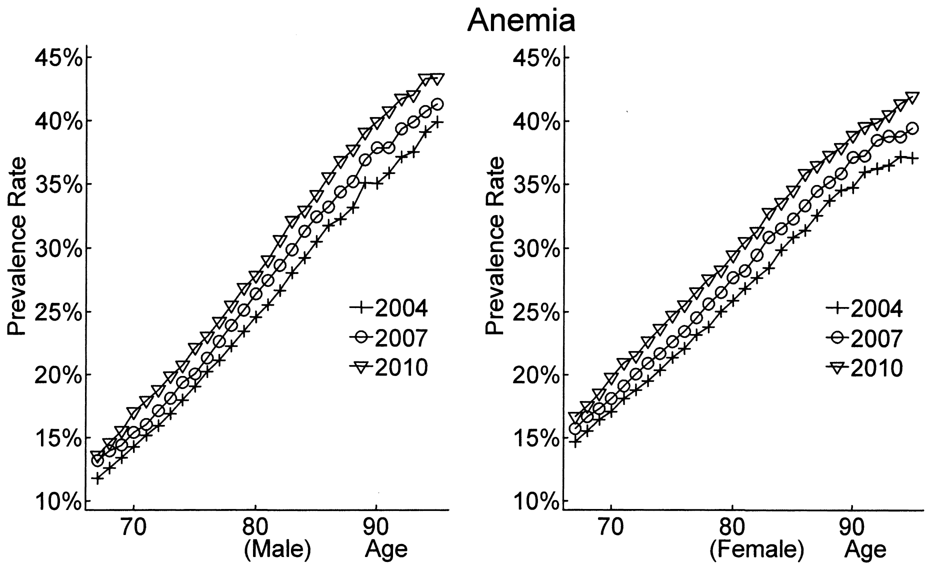
Depression
Prevalence Rate
18%
16%
14%
12%
10%
8%
6%
4%
70
80
90
(Male)
(Female)
Age
2004
2007
2010
Glaucoma
16%
14%
12%
10%
8%
6%

Fig. 1C.6 (cont.)



Hypertension
Prevalence Rate
75%
70%
65%
60%
55%
50%
45%
40%
70
80
90
(Male)
Age
+2004
2007
2010
(Female)
Acquired Hypothyroidism
18%
16%
14%
12%
10%
8%
6%
4%
2%

Fig. 1C.6 (cont.)


Anemia
45%
40%
35%
30%
25%
20%
15%
10%
Prevalence Rate
2004
2007
2010
70
80
90
(Male)
Age
(Female)
Age

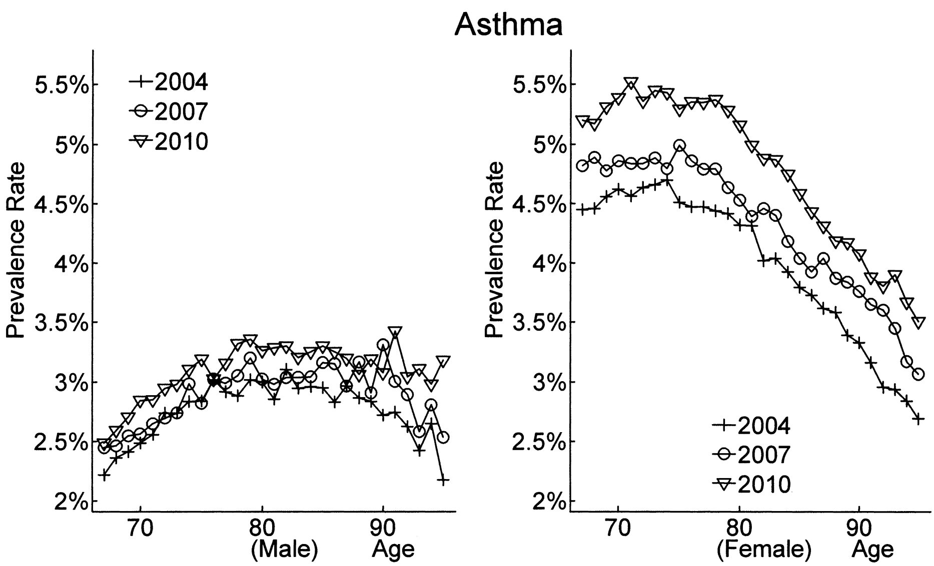

Asthma
5.5%
5%
4.5%
4%
3.5%
3%
2.5%
2%
Prevalence Rate
2004
2007
2010
70
80
90
(Male)
Age
(Female)
Age

Fig. 1C.6 (cont.)

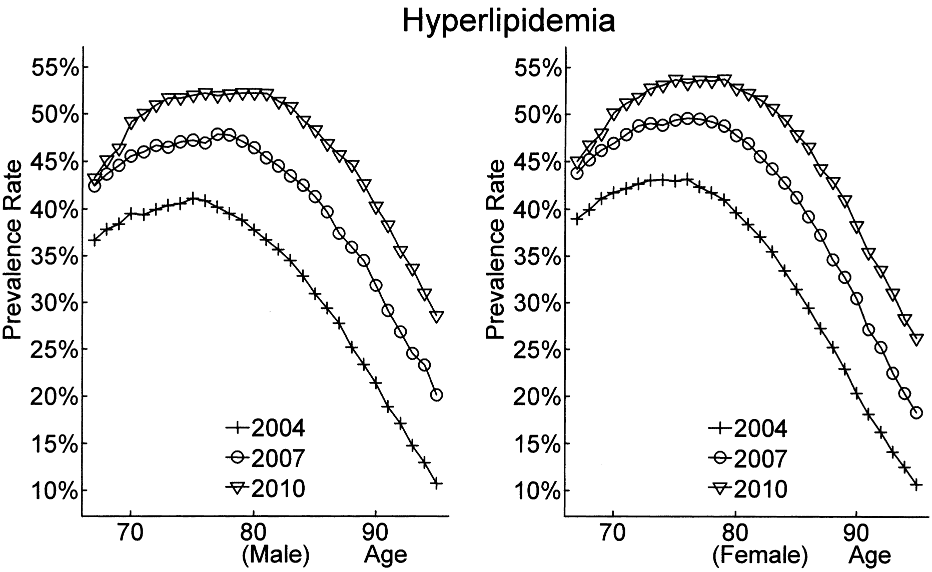


Fig. 1C.6 (cont.)

for these diseases. Both breast cancer and prostate cancer show modest upward drift over time in prevalence in each year before death, suggesting that therapies may be increasing survival times, but there is no evidence of this for colorectal and lung cancer. Figure 1C.9 shows upward drift in prevalence over time at each year prior to death for all the chronic degenerative diseases, again suggesting that therapies are prolonging survival. For the recoverable acute conditions shown in figure 1C.10, therapies appear to be prolonging survival with ischemic heart disease. Figure 1C.11 shows these curves for nonfatal, controllable conditions. For most of these conditions, we see a flattening of the prevalence gradients in the years before death, with sharp increases for diabetes, hypertension, and hyperlipidemia, conditions where new therapies have substantially improved disease control and the payoff to early diagnosis. Taken together, figures 1C.8, 1C.9, 1C.10, and 1C.11 show evidence of mild expansion of the duration of disease morbidity in the years before death. Combined with rising prevalence for many diseases, particularly in the nonfatal controllable category, these indicate a steady increase in the frequencies and durations of disease morbidities. Our disease-specific figures do not control for disease comorbidities. A more comprehensive analysis would have to look at the patterns of development of comorbidities, perhaps applying to the list of CCW conditions some dynamic version of the factor analysis that the authors have done for functional and other disabilities. Going further, it might be informative to estimate a dynamic multiple-indicator, multiple-cause model in which

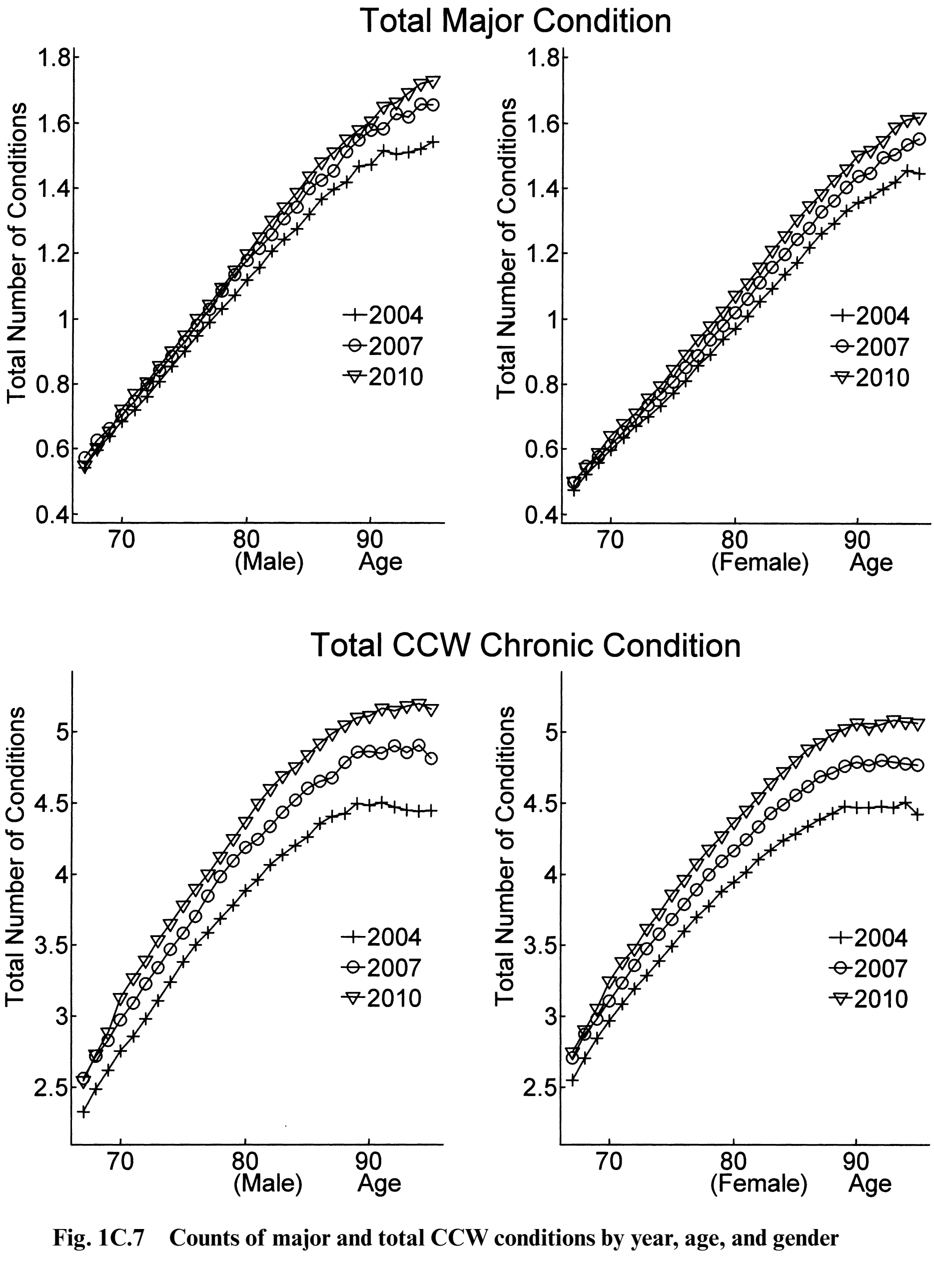


Fig. 1C.7 Counts of major and total CCW conditions by year, age, and gender

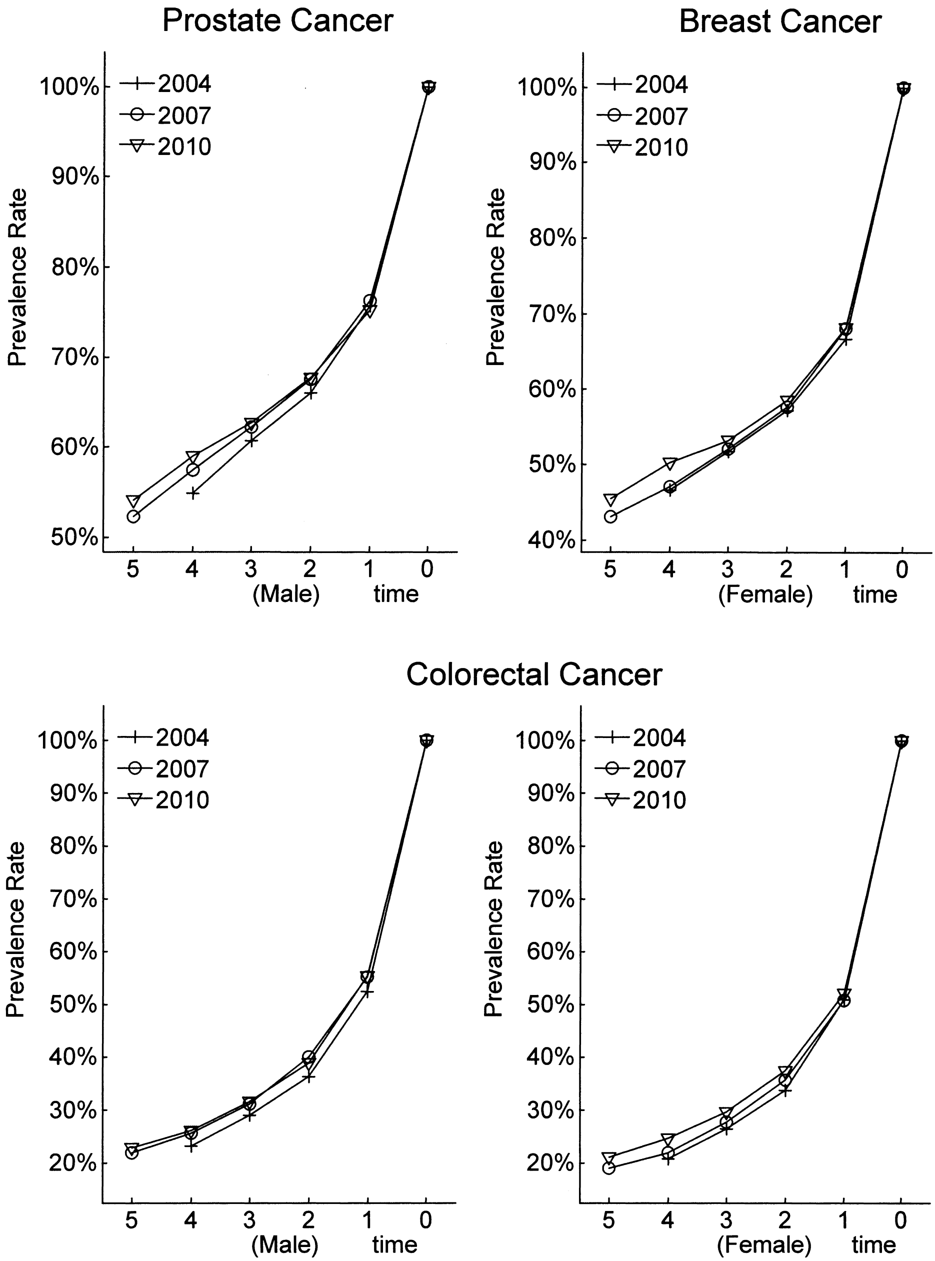


Fig. 1C.8 Cancer condition prevalence rates, years before death, by death year, and gender

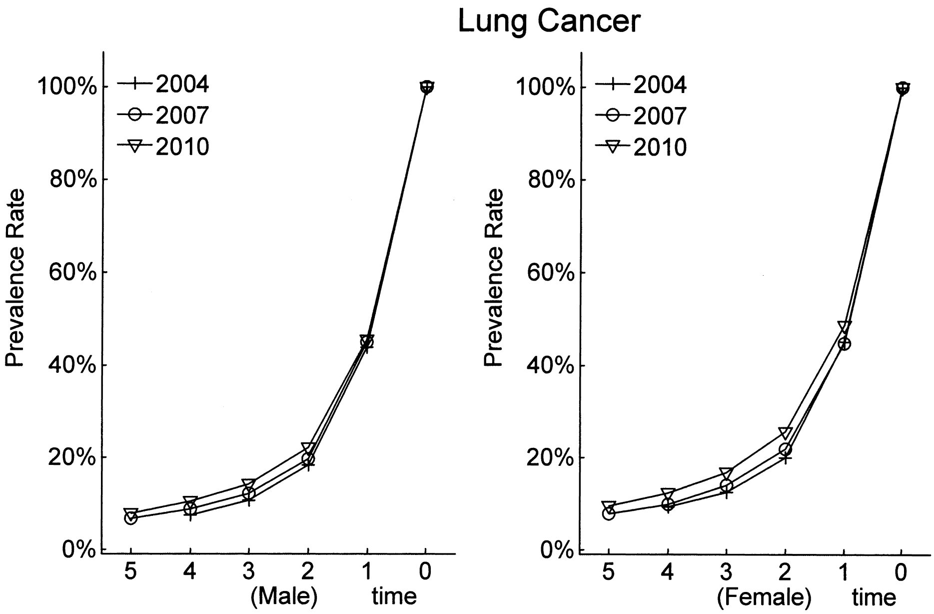


Fig. 1C.8 (cont.)

a list of CCW conditions and durations since onset map through a few life force factors to a list of functional limitations and physical and mental disabilities.

Finally, figure 1C.12 shows how numbers of total CCW conditions, and of major CCW conditions, vary with years before death; these give some evidence that disease comorbidity rates are rising. The curves show that people develop more conditions as death approaches, and these will frequently be causes of death. However, the curves are not very steep. We conclude that people can often live for quite a long time with multiple conditions, and still cope with the corresponding disabilities.

Given the lack of compression of disease morbidity, and the authors' finding of sharp compression in functional morbidity, there has to be a sharp fall in the proportion of people with disease morbidity who also have functional morbidity. Whether this is due to improved coping skills and functional aids, to improved and earlier diagnosis, or more aggressive coding that makes the pool of people with a disease less sick on average, is an open question. It would be useful to have further research on the following topics:

- Is coding of diseases drifting up over time, or is the apparent increase in disease prevalence really there? This might be tested by examining diseases with and without coding discretion, and by comparing CCW

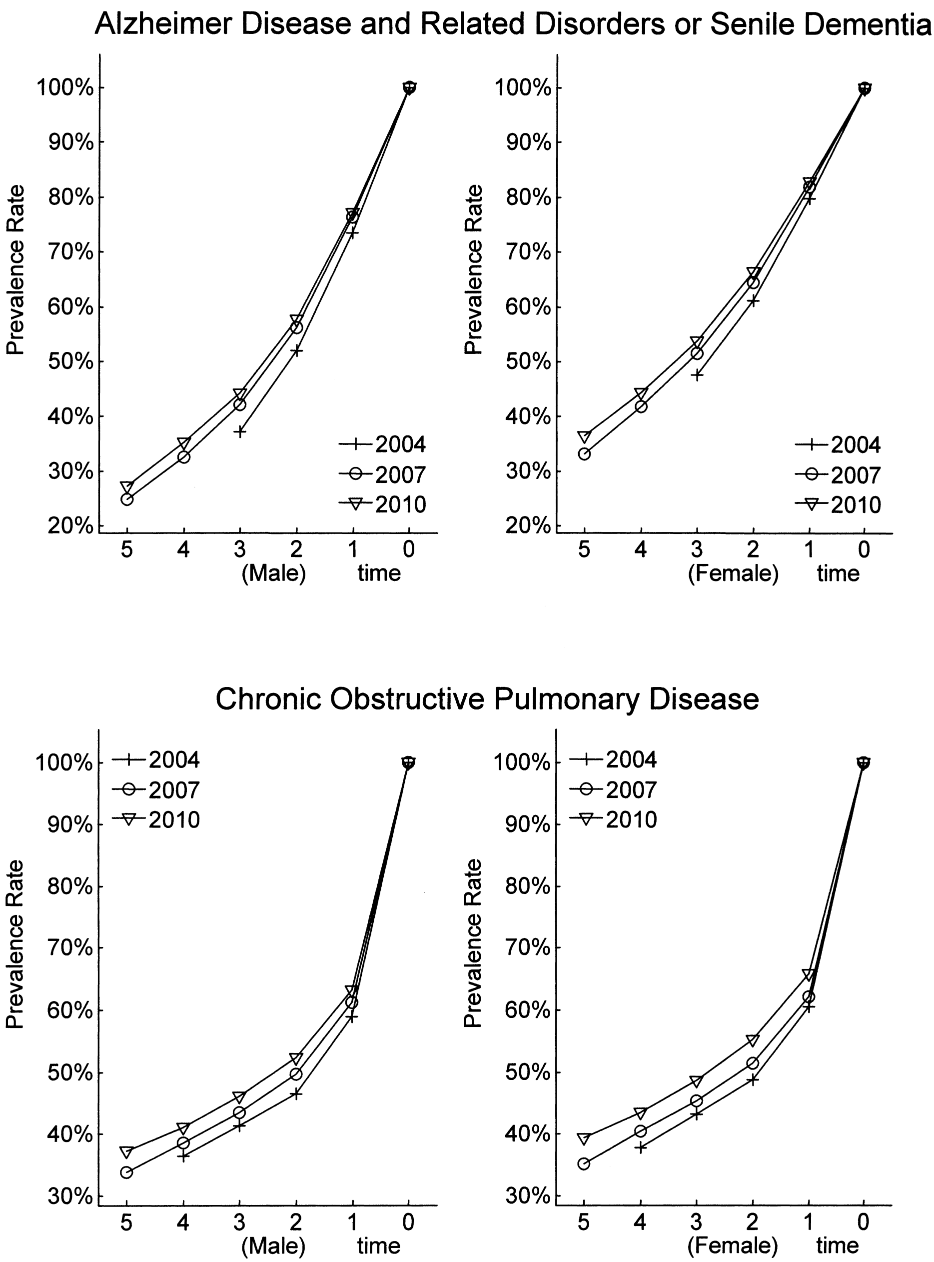
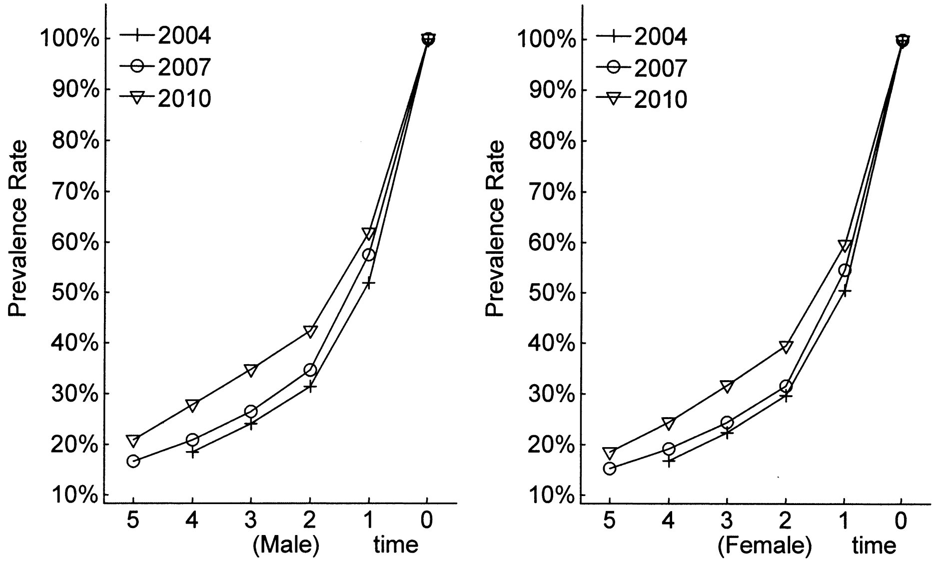


Fig. 1C.9 Chronic disabling condition prevalence rates, years before death, by death year, and gender

Chronic Kidney Disease



Osteoporosis

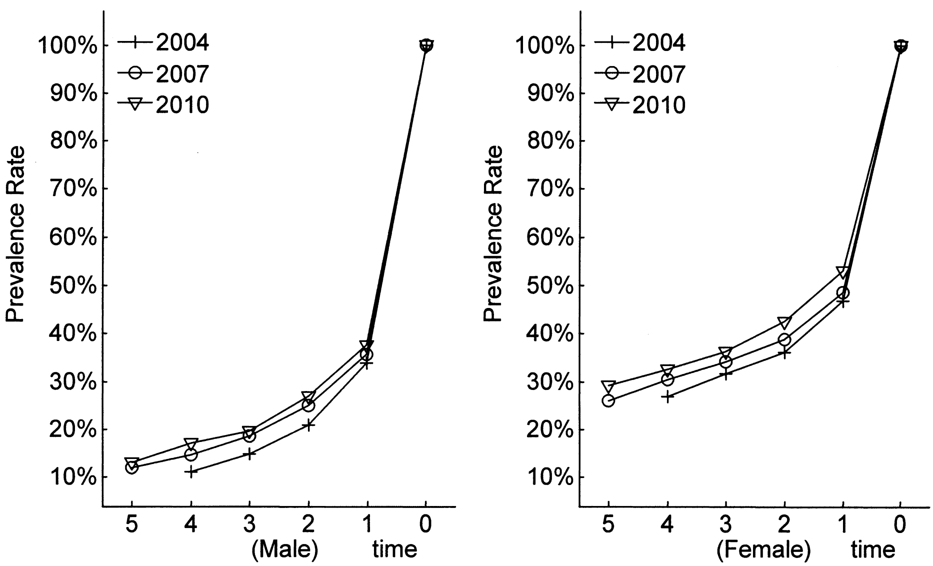


Fig. 1C.9 (cont.)

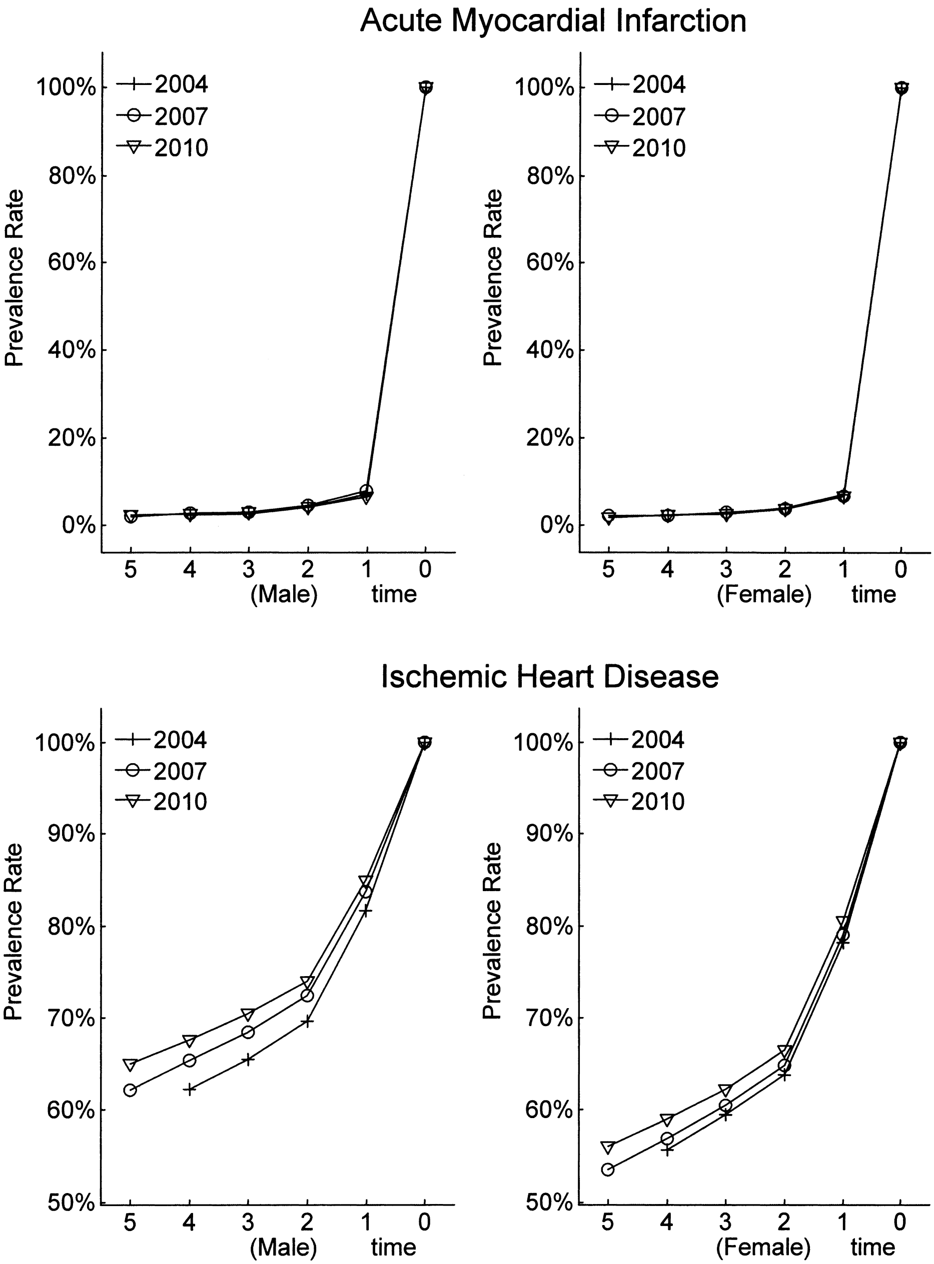
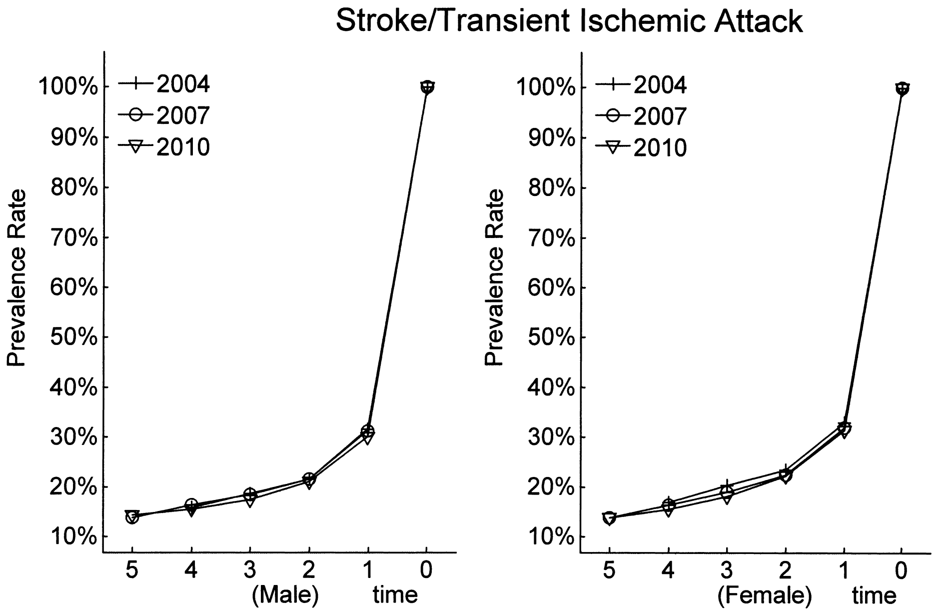


Fig. 1C.10 Recoverable acute condition prevalence rates, years before death, by death year, and gender



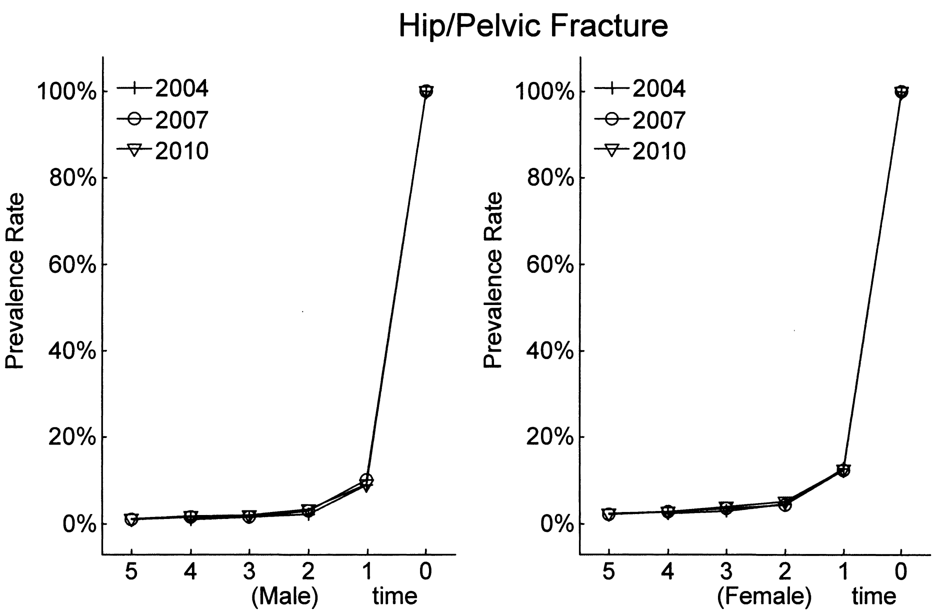


Fig. 1C.10 (cont)

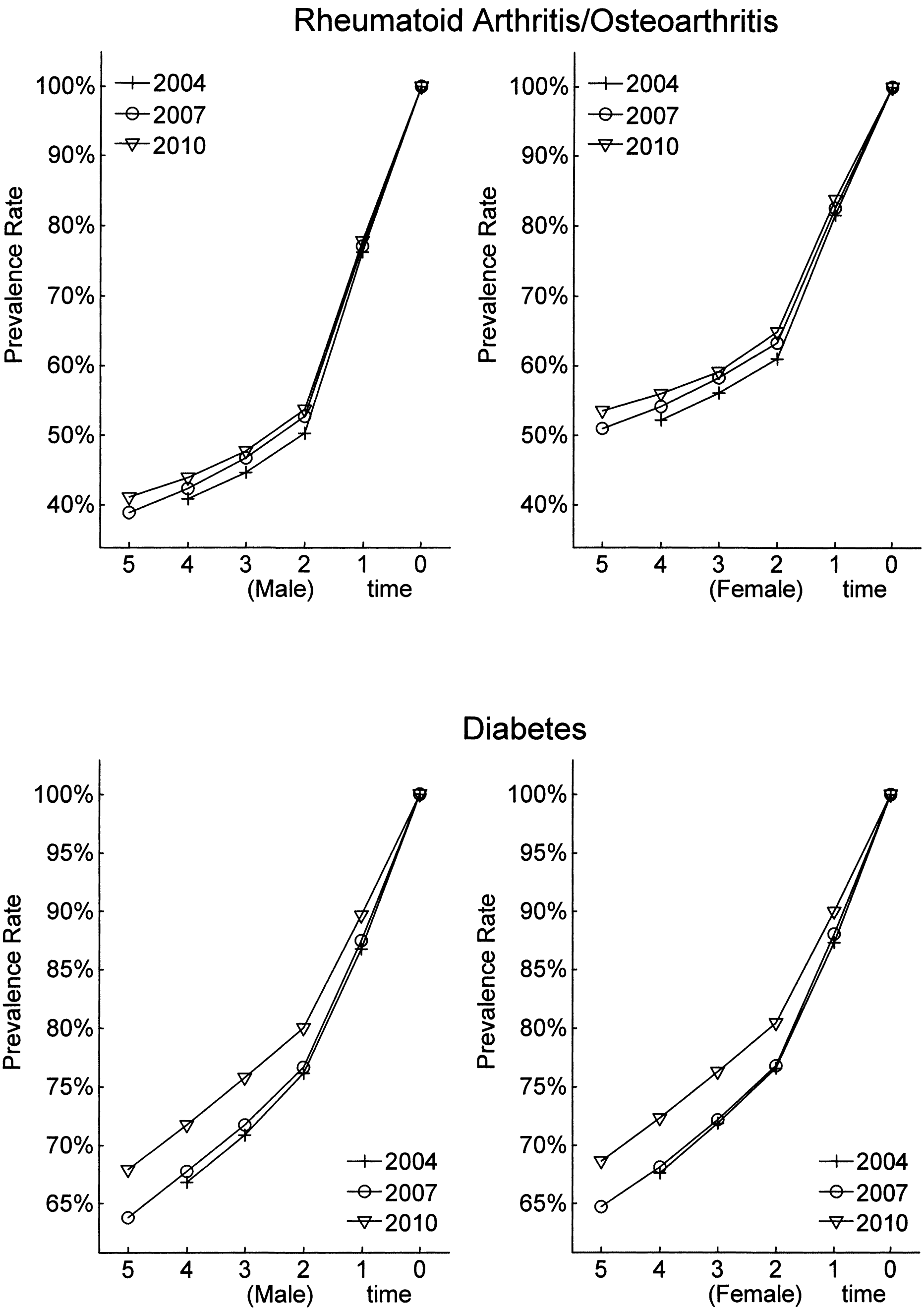
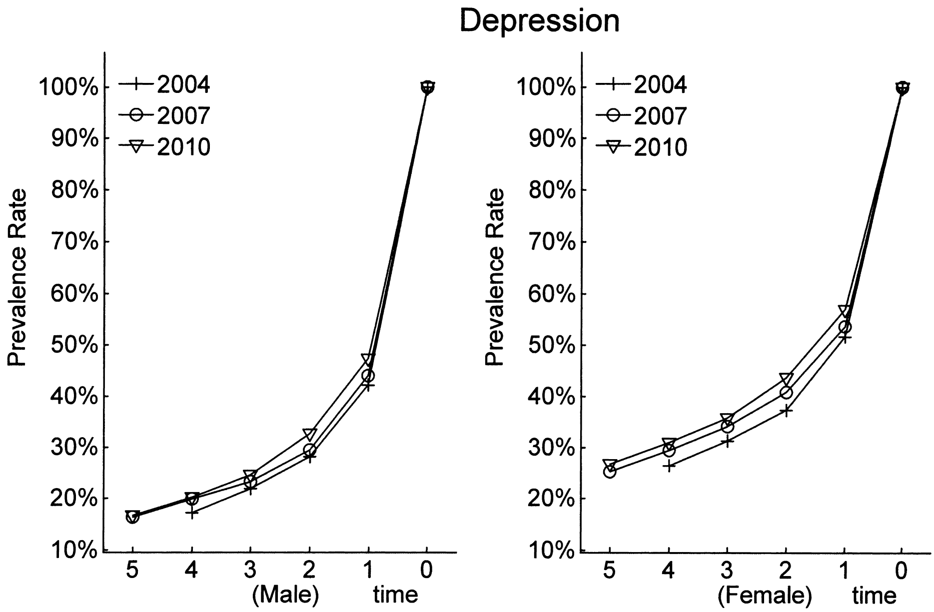


Fig. 1C.11 Nonfatal controllable condition prevalence rates, years before death, by death year, and gender



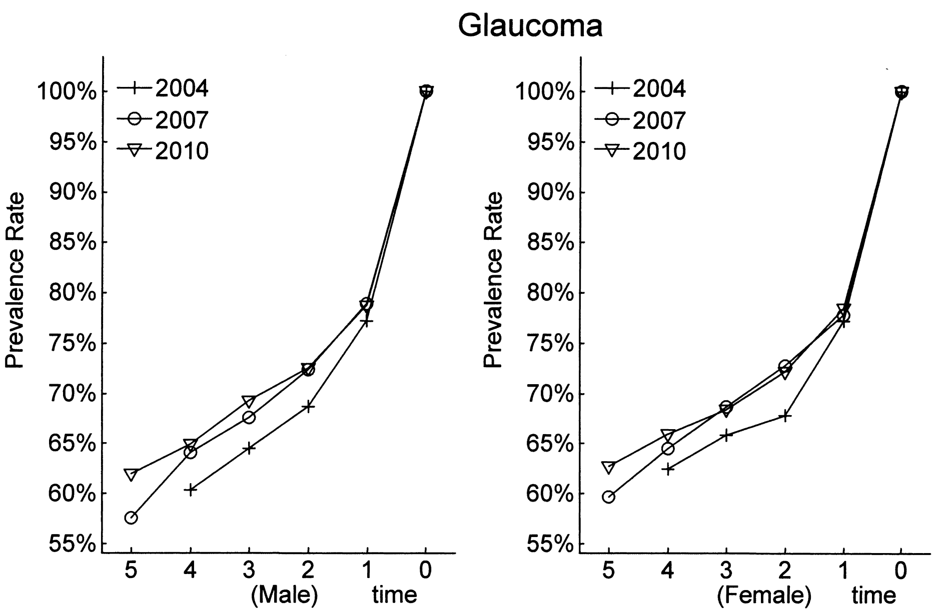


Fig. 1C.11 (cont.)

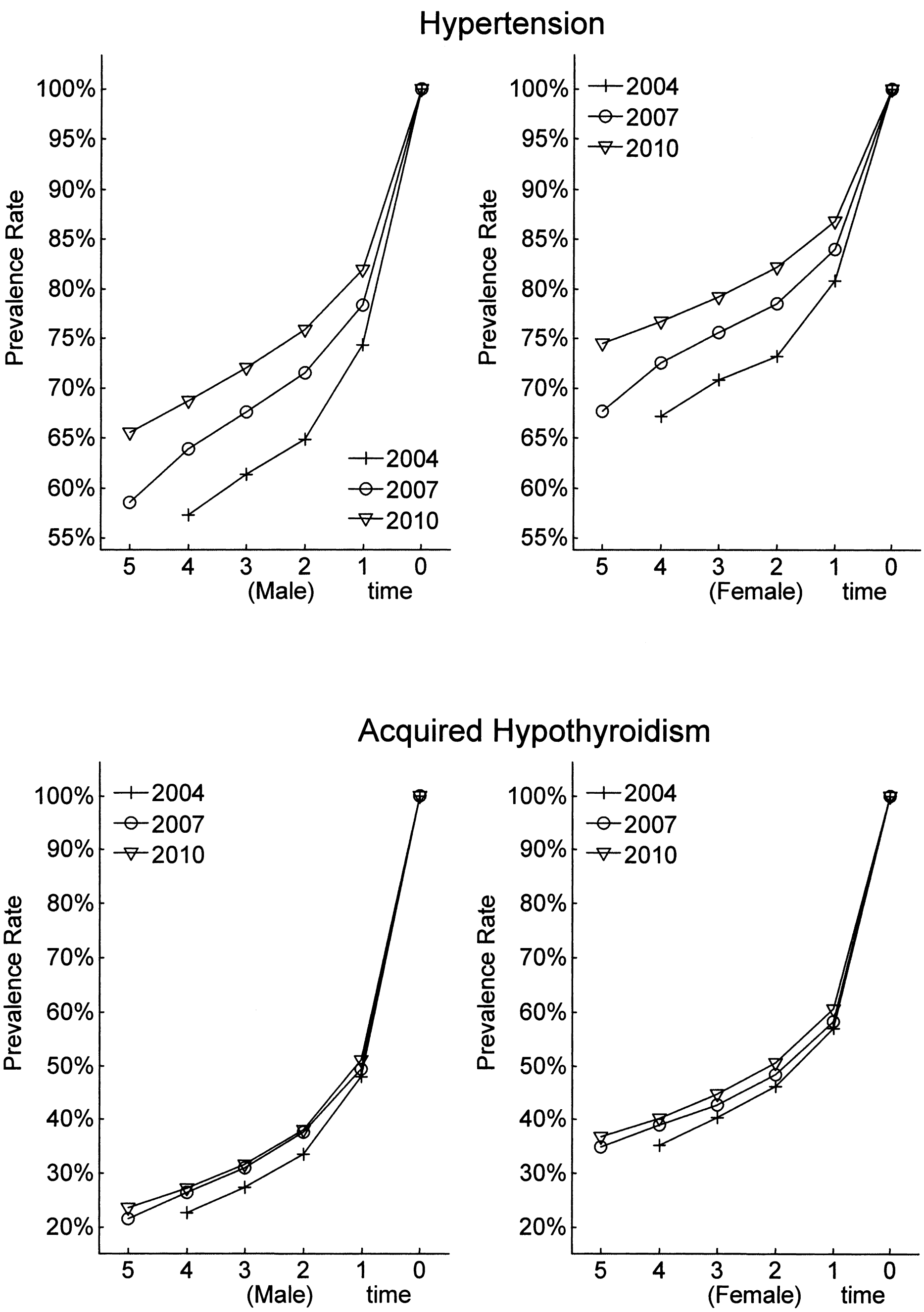
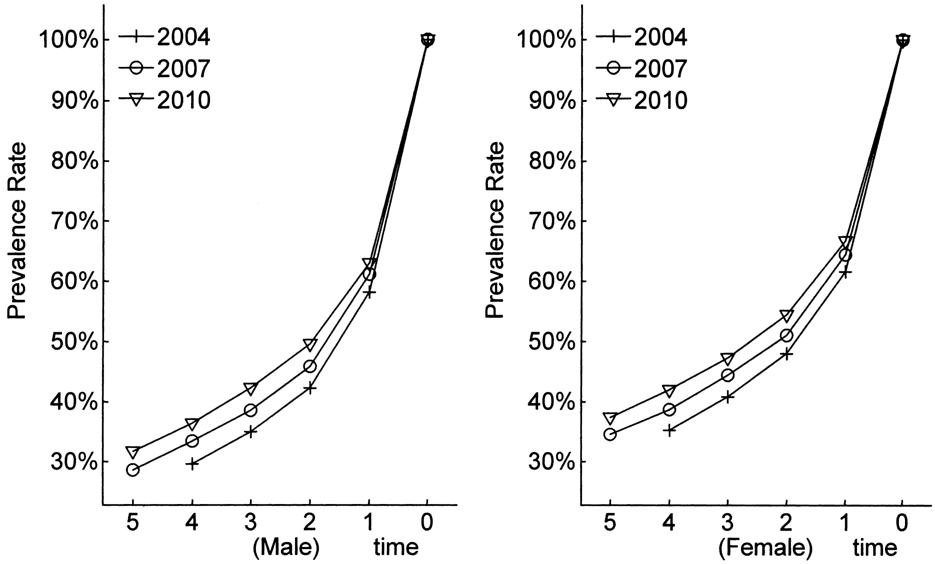


Fig. 1C.11 (cont.)

Anemia



Asthma

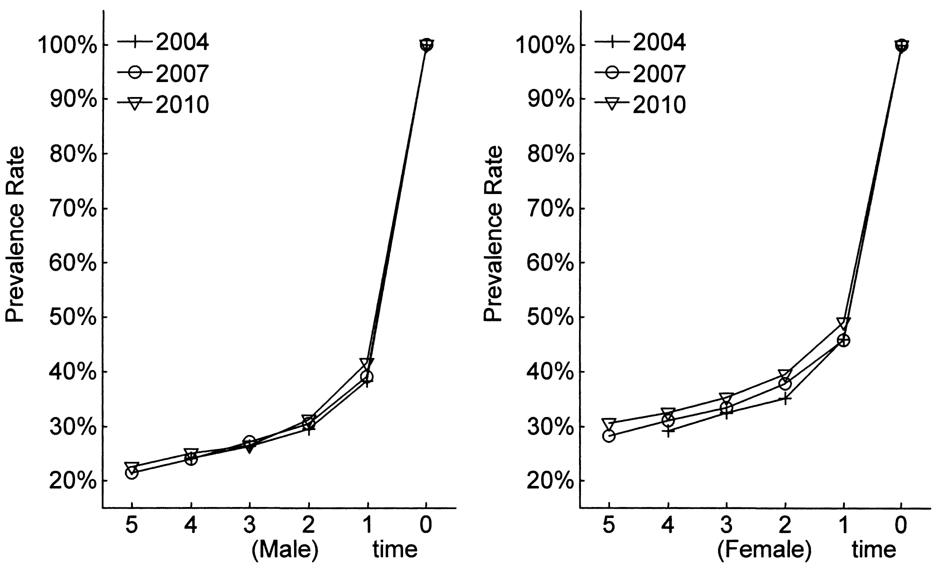


Fig. 1C.11 (cont.)

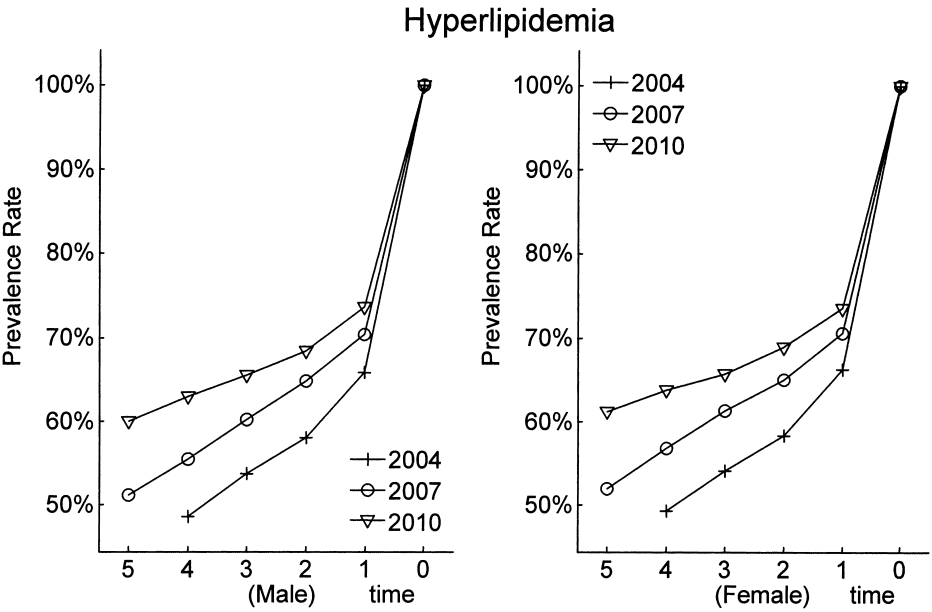


Fig. 1C.11 (cont.)

coding of conditions with clinical diagnoses in a sample of people with medical records, and by examining drifts in the scope and frequency of diagnostic tests.

- Are people really getting better in managing disabilities without reporting ADL and IADL limitations? This might be tested by studying the activities of people, and identifying coping strategies.
- Are subjective morbidity rates relatively stable, despite increased disease morbidity, as the "hedonic treadmill" would predict? This might be tested through use of some of the currently popular measures of happiness tabulated against levels of disease and functional morbidity.

Finally, we point out that while the authors' chapter does not dwell on policy implications, there are some important ones. First, if there is a tilt in NIH and commercial medical research toward innovation in acute care, it does not seem to be causing an explosion in disabled elderly. Specifically, apparently rising disease prevalence does not appear to be causing a lockstep increase in functional morbidity or prevalence of physical or mental disabilities. Second, both increasing disease morbidity and decreasing functional morbidity could be an artifact of progressively more aggressive diagnostic coding of conditions at earlier, more treatable stages. There is a

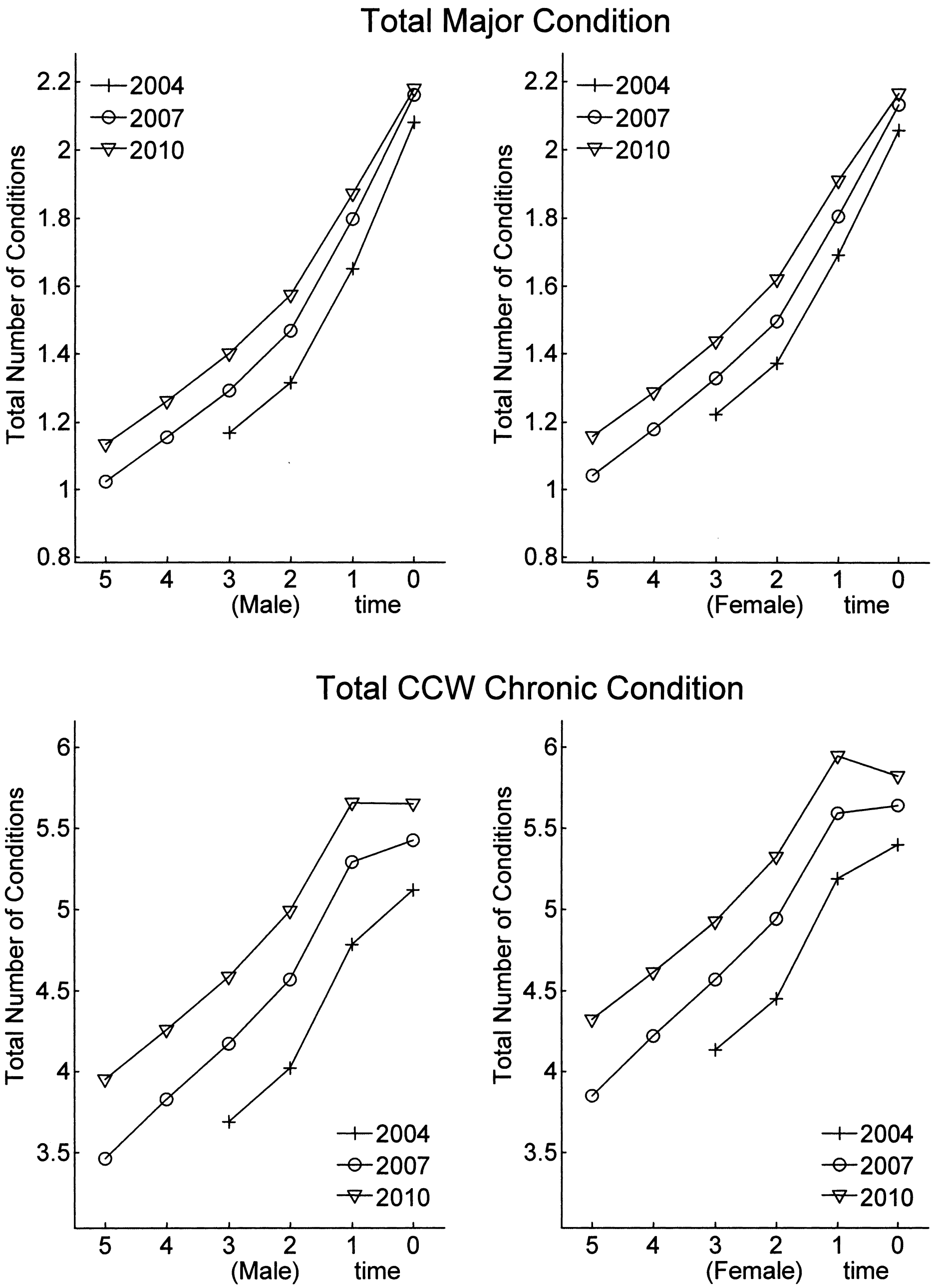


Fig. 1C.12 Counts of major and total CCW conditions, years before death, by death year, and gender

need for more time-consistent clinical data on disease onset and prevalence, and an analysis of the health consequences of early diagnosis, to determine how much of this drift is real, and what can be done to improve further the disability-free lives of people even if they are diagnosed and treated for a variety of diseases.