Comment on "Understanding the Improvement in Disability Free Life Expectancy in the U.S. Elderly Population", by Michael Chernew, David M. Cutler, Kaushik Ghosh, and Mary Beth Landrum.

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The paper by Chernew, Cutler, Ghosh, and Landrum is an ambitious one that covers considerable ground, ranging from updated measures of disability compression in the U.S. to the key question of how much the diffusion of health care technology have contributed to improving health outcomes. First, the authors have revisited the questions posed in Cutler et al. (2014) to test whether the decline in disability (and increase in disability-free days) has continued through 2008; the reassuring answer is yes. But they go beyond this question to dig in more as to the causes of this continued decline; which medical conditions have made the greatest contribution to the rise in disability-free survival, and more importantly, how much of the disease-specific declines in morbidity and mortality can be attributed to the diffusion of medical innovations such as statins or aspirin? These are great questions, and the authors have done an excellent job of addressing them using a variety of data from the demography and clinical literatures.

In my comments, I have no quarrel with the central conclusion of the paper, but instead focus on three separate issues raised at different points in the paper. The first is an intriguing pattern that the authors uncover regarding trends in disability prior to death. While the trend for ADL/IADL measures in the two to three years prior to death exhibited a steady decline, the

fraction of people with a disability has remained stubbornly fixed at roughly four-fifths between 1991 and 2009 for those in the last year of life (their Table 5). This might appear to be puzzling; generally we might expect disability rates to be declining across the life-cycle. But perhaps this isn't so puzzling after all: people still have to die of something, and it would be surprising to find a rise in (e.g.) the fraction of sudden cardiac arrest or accidental deaths – more common causes of death among the non-disabled. Still, the empirical patterns uncovered by Chernew et al. suggest a slightly more nuanced view of disability.

For example, suppose disability arises from two general causes. The first is associated with medical factors that are not immediately life-threatening, such as diabetes, depression, stable angina, or arthritis, where lifestyle changes and medical innovations might be most effective in reducing both prevalence of the disease, and ensuring that the disease is less likely to result in disability. It is these kinds of disability that we observe most often among those in the 2nd or 3rd year prior to death. The second type of disability arises from serious medical conditions associated with an elevated likelihood of mortality. For example, Class IV congestive heart failure (CHF) has as much as a 50 percent risk of one-year mortality (Ahmed et al., 2006), as well as a poor quality of life associated with it, and so we might be expected to find more of these CHF patients in the (unfortunate) group within one year of death. Thus moving from the second or third year prior to death into those just prior to death may represent a fundamental shift in the type of disability, with the second type far less likely to exhibit secular improvement.

Second, the authors show a substantial improvement in vision during this period, one that seems difficult to explain solely through the increase in cataract surgery. The authors have certainly done their best to solve this puzzle, with a careful read of the clinical literature and clever regression analysis. I don't have much to add to their inquiries, except to suggest that the

improvement in vision may be associated with other, non-cataract-related improvements in health. For example, high blood pressure is a risk factor for vision impairment, so improved cardiovascular health will reduce vision impairment as well (van Leeuwen et al., 2003). Even among diabetics, whose population is on the rise, there has been a growth in monitoring and control, with eye examinations for diabetic patients the standard of care during the past decade. Thus the remarkable decline in vision impairment may be a dividend arising from other sources of health improvement.

Third, the authors have provided further understanding of the fundamental causes for the increase in disability-free life-years. Rather than estimate treatment effects from their data, they correctly turned to the comprehensive IMPACT study (Earl et al., 2007) that uses evidence from randomized trials on drugs or cardiovascular treatments to impute how the diffusion of medical treatments (and pharmaceutical use) might have affected patient health. The authors perform this accounting exercise for cardiovascular disease, and find that roughly half of the improvement in disability-free years arises from medical treatments.

They are most likely right, but I would still argue that one must be careful in translating estimates of effectiveness from randomized trials to actual outcomes in the larger community. This was shown first in an earlier study by Wennberg et al. (1998) who compared the mortality rate for carotid endarterectomy reported in the randomized clinical trial (RCT) (e.g., 0.6 percent) with actual mortality in community-based hospitals, which was as much as 2.5 percent depending on the volume of surgical procedures. The differences in outcomes arise because the institutions in the RCT were so selective in choosing appropriate patients for the trials, and because the overall quality of the institutions that performed RCTs – typically academic medical centers – were higher than average community-based hospitals (Wennberg et al., 1998)

While Cutler et al. do not use estimates of carotid endarterectomies in their own analysis, they do use estimates of benefits arising from the increase in (e.g.) statin and estimated aspirin use, so similar issues could arise for their estimates. For example, one recent study from Finland showed substantially lower marginal health effects of statin use once one accounted for the poor adherence with the drug regimen observed in the community (Aarnio et al., 2015). Another study effects of aspirin use found evidence of its impact on lowering the incidence of cancer, but suggested that the "…use of aspirin in the general population does not have a major impact on cardiovascular mortality." (Cuzik et al., 2015). This doesn't detract from the view that advances in treatment had an impact on health outcomes, but it does suggest some caution in interpreting estimates from randomized trials as applying to treatments performed in the general population.

With this concern set aside, one can only hope that this team of researchers will return to the question of why disability rates continue to fall among those not receiving new medical or pharmaceutical treatments in an environment of stagnating health care spending. It's an important question, and surely one of the few reassuring trends that we see in U.S. health care.

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