

**Session 2A: Effects of Obesity and Other Controllable
Factors on Survival Q&A**

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Steve Austad: I have a question I guess for anyone in the panel; it has to do with BMI. Now, I'm a zoologist and BMI is a very strange concept to me because there's no rationale for squaring the height. It should be cubed probably. So it's going to work very differently depending on if you're a very small person or a very large person. My question has to do with the way that childhood obesity is defined. Do they use the same criteria as greater than 25 or greater than 30, if you're 6 years old?

Sam Gutterman: Childhood obesity is categorized based upon a percentage of the 2000 CDC growth charts by gender and by age. Its current definition is the 95th percentile of the applicable table for 'obesity' and 85th to 95th percentile for 'overweight'. Morbidly obese children and adolescents are considered to be at least 97 percent in the growth tables.

However, the use of BMI as the defining metric to determine obesity is a complicated and controversial topic -- BMI is not as good a metric as we would like, but it is practical and convenient. This controversy is due to several factors: (1) use of self-estimated height and weight, the basis of BMI, has known estimation errors that vary by age and gender, (2) particularly for older ages, metrics such as waist size may be a better metric due to the significance of location as well as amount of adiposity tissues and (3) weight is made up of a mix of bone, muscle and fat, the relative amounts of each may have different health implications. I addressed some of these issues in my paper.

In addition, since the effect of obesity, and as a result the BMI metric, can have a cumulative effect, studies relating current health status and mortality compared to current obesity level may be misleading.

Bob Pokorski: Hiram, could you turn to page 8 of the handout? This shows exercisers with no activity limitation, and non-exercisers with no activity limitation. The data don't reflect

the significant differences I would have expected. At first I thought these were the same two charts and an error had been made. I follow this literature very carefully. As one gets older, if you exercise, it makes a huge difference in mortality—maybe a 40 percent difference—and it's not reflected in these data. It could be because they're not looking at the extremes of exercise. For example, some papers conclude that if you can run at a rate of 10 METS (metabolic equivalents) on a treadmill compared to less than five METS, there's a large difference in mortality. But if you look at these data, there's almost no difference if you exercise or not.

Hiram Beltran-Sanchez: What happens is there is really not much difference among women, but there is a big difference among men as you see in the graphs. But remember this is by level of education; this is not only conditional on whether you exercise or not. It is conditional on exercises and conditional on having this particular level of education where the difference might be life expectancy. If we get rid of education, conditional education, then we might see a bigger difference because now you are not conditioning and the other factor, which is educational level. You will see only differences due to whether you exercise or not. The other thing is that this is a self-reported measure of whether you do these kinds of exercise activities, but there is no measure of how long you do it in the two weeks, how extensive or how moderate or very intense exercise. It's just a cruder measure of exercise.

Sam Gutterman: Fitness in addition to the current level of physical activity is another important factor that can difficult to quantify and study.

Carol Hasday: I also have a BMI question. Years ago when you looked at a weight chart it was divided by sex and then it was also divided by build: small, medium and large. So I was wondering if those factors should be taken into account. And also what about age? Because as you age you have less muscle mass, which weighs more, and fat weighs less, so you have more fat, but it weighs less than muscle. So your BMI would be lower than it would be if you had more muscle mass, and you would be penalized if you were in very athletic shape with very good muscle mass because it weighs more. So all this together, has there been any discussion to

update a BMI to take account of age, sex, body build, percentage of fat? Then I have another question.

Sam Gutterman: Most studies of mortality and health status adjust for age and gender. They don't all adjust for type of build or degree or location of fatness. There are some recent studies that have been able to compare the effect of multiple measures of obesity, including waist size, waist to abdomen ratios, and skinfold measures of fat, in addition to BMI. These have come to different conclusions, in part depending on the demographic population studied. I indicated several of these studies in my paper, but there are also others. There are also different types of adipose tissues, including brown. It remains an important and complicated issue that demands further study.

Carol Hasday: OK, and I have a question for Hiram. You have the educational level less than high school, high school or college and above. Like 50 years ago or whatever when these people who are now 65 or 80 were thinking of going to college, the opportunities weren't there for everybody to go to college; whereas now more and more people are going to college so that people who may have not have even graduated from high school 50 years ago would today be going to college. The education level is likely going to be more people going to college. So I guess my question is what characteristics were you looking for when you had these three categories to divide people into to determine their potential for longevity?

Hiram Beltran-Sanchez: What we had in mind is that I've seen several papers in which they try to get up socioeconomic differences, not only life expectancy, survivorship and other health measures that are differences, so the most reliable measure particularly for all ages in terms of socioeconomic status has been education. There have been other measures they've tried in terms of income, in terms of assets and in terms of other different measures that may give you an idea of socioeconomic status. I'm thinking in terms of socioeconomic status or education it is not what the education brings to a table per se; it's what all the life experience that you have that this educational level gets you access to different health patterns, health paths throughout your

life that may probably be different once you survive to old age.

Carol Hasday: So in the future, if you don't use education, what characteristics would you be looking for?

Hiram Beltran-Sanchez: We might still be using it, even though people are getting the same level of education, that doesn't mean that they will end up with the same health outcome. I think that even in the future we'll be still seeing socioeconomic differences in lots of health measures even though people by then might have completed another level of education. It's what Jay just mentioned. These gradients in education are not only seen in less than high school and high school, we're also seeing these gradients in people who are highly educated, 16 years and more. So by then all those individuals are really highly educated and we still see significant differences in lots of health measures, so I would expect to see something similar in the future.

Tom Levy: First of all, with regard to the last one, just a reminder that the RP2000 tables that the Society published some years ago showed a bigger difference at age 65 blue collar compared to white collar than male compared to female. So that's a current measure as opposed to a measure 30 years ago in terms of differentiation by a socioeconomic characteristic. As a practicing retirement actuary, the big thing we're wrestling with these days is: how do we forecast future mortality at retirement ages for pension plans? Obviously the same thing applies to Social Security, Medicare and the like, and what the higher rates of obesity and diabetes will do to the future rate of improvement in mortality. My gut reaction, having listened to this today, is at retirement ages not much. Is that a fair conclusion to draw from what we've heard today?

Hiram Beltran-Sanchez: Well, as I was saying before, if we think of populations as this dynamic entity, I think the way to get an understanding of future changes in mortality would be the approaches Jay suggested. While they're looking at factors that may be associated with survivorship from 65 to older, looking the other way and saying if I have a group of middle-aged individuals and I follow up with these individuals throughout life, what experiences in their lives

made them survive to this particular age and end up with this particular health status? That will give us an understanding of what we can expect into the future. Like I said, if we observe some health pattern now, this is the result of what happened in the past really. So if we want to understand the health pattern or the mortality in the future, we need to start understanding the pattern of the middle-aged individuals now because these are the ones who eventually will become old.

Eric Stallard: If you recall the time frame of the obesity epidemic, the most significant increases occurred over the past 30 years. During that same time period, there were very substantial improvements in longevity, with corresponding declines in mortality; and those changes in longevity/mortality occurred despite the increases in obesity. So you might consider the counterfactual condition—if the increases in obesity hadn't occurred, what would have happened? What would have happened is that you would have seen even larger declines in mortality than the declines that actually occurred. So in thinking how this would play out, one could consider all of the different factors that are changing simultaneously. Smoking declined; education increased; obesity increased. These and other factors have effects that are very difficult to quantify. If obesity increases at about the same rate going forward as it has over the past 30 years, then you would not be terribly far off doing an extrapolation of the mortality improvements that have occurred. On the other hand, the declines in cigarette smoking may have played themselves out, so you're not going to get a continuation going from around 51 percent (male; 34 percent female) of the adult population smoking in 1965 down to about 23 percent (male; 18 percent female) in 2009 because you can't go to negative numbers. Certain types of effects will play out, so I would encourage you to consider doing the more complex modeling needed to capture these effects. For the short term, as long as all of the trends that have been happening continue, you can have a relatively naïve extrapolation.

Sam Gutterman: I agree with Eric. I'd add that different segment populations will experience different rates of change in mortality. The results of several studies of mortality at older ages (e.g., age 65 or 75 and up) relative to various characteristics may even have a positive

effect in some cases, e.g., protective from the effects of falls and frailty.

Eric Stallard: Preston and Wang published a paper in the 2009 *Proceedings of the National Academy of Sciences* that you should look at which shows the potential impact of ignoring cohort differences in smoking patterns. The impact can be very, very large, and so in the interest of time I would just have you look at that paper. I think almost everybody here has seen that paper, but the impact is dramatic.

Jay Olshansky: Actually your question is a particularly important one for a number of reasons, especially those involved in generating forecasts for pension funds and the like. Here's where I'd urge great caution, because many of these forecasts (certainly some that we saw earlier this morning) are based on linear extrapolations from past trends in extinguishing cohorts, so these were people that were born prior to 1950. But the people who are going to grow old and die and retire in the next 50 years are still alive. I think, to be quite frank, we're looking in the wrong direction. I don't think we should be looking to the past in order to make these estimates of where things are headed in the future. As Hiram said a moment ago, a focus of our attention should not be on those who have already died; it should be on those who are currently alive. What is the health status of those individuals? What do we know about the relationship between their current health status and subsequent mortality risk, and how does that play itself out? This was the very point that Eric was making a moment ago about cohort phenomenon. Leonid made this point very clearly earlier today that we have to be acutely aware of differences by birth cohort because there are very, very significant. There's a very large degree of variation by birth cohort. There's evidence to suggest that some of the cohorts now approaching older ages in the United States have a potential for a significantly higher risk of cardiovascular disease than the generations that just preceded them into retirement. So the last place I would look would be to the past, quite frankly.

Tom Levy: That's fine. It leaves me with having to do actuarial cost pricing of retirement plans today. I can't look at the future quite yet, so I understand what you're saying

about differences in the past and also some of what we heard earlier and just now about the very significant improvements with respect to cardiovascular medicine.

Jay Olshansky: We have these wonderful health surveys that really clue us in. They're giving us very good clues on what the health status is of younger people today. We're all younger people in this room. So for those of us in the room, what is it that's going to happen to us based on our current health status? To me that is a far more useful piece of information. Now, it may be something that actuaries aren't used to working with, but people like Eric and others who work with health surveys on a regular basis are familiar with this. This is extremely important information, I think, for the actuarial world to be acutely aware of the health status of people alive rather than historical trends of those who have died.

Tom Levy: Absolutely right. That's why we're here.