

THE ECONOMIC CONSEQUENCES OF MILLENNIAL HEALTH

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This report was written and prepared by:

MOODY'S
ANALYTICS

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Executive Summary

In the course of the last several years, millennials have shown that they are very different from previous generations in a number of ways. Defined as the generation born from 1981 to 1996, they are the largest, most educated, and most connected generation the world has ever seen¹. However, recent data also show the beginnings of troubling generational health patterns that could hamper the future prosperity of millennials, and in turn the prosperity of the U.S. If the current pace of decline in millennial health continues unabated, the long-term consequences to the U.S. economy could be severe.

Millennials now make up the largest share of the U.S. population and labor force, placing them at the heart of U.S. economic growth as consumers, workers, and business owners. How their health plays out in the years ahead will determine not only the overall health of the country, but also its potential economic trajectory. By using Blue Cross Blue Shield Health Index data to analyze these questions, we are able to take a much broader and forward-looking view of these impacts relative to previous studies. In our examination of millennial health patterns we have found several interesting and concerning findings, particularly regarding future impacts on healthcare costs and economic activity.

1. Millennials are seeing their health decline faster than the previous generation as they age. This extends to both physical health conditions, such as hypertension and high cholesterol, and behavioral health conditions, such as major depression and hyperactivity. Without intervention, millennials could feasibly see mortality rates climb up by more than 40% compared to Gen-Xers at the same age.
2. These accelerated declines will result in greater demand for treatment and higher healthcare costs in the years ahead. Under the most adverse scenario, millennial treatment costs are projected to be as much as 33% higher than Gen-Xers experienced at a comparable age.
3. Poorer health among millennials will keep them from contributing as much to the economy as they otherwise would, manifesting itself through higher unemployment and slower income growth. Under the most adverse set of projections, lower levels of health alone could cost millennials more than \$4,500 per year in real per-capita income compared to similarly aged Gen-Xers. Such impacts would be most likely concentrated in areas already struggling economically, potentially exacerbating instances of income inequality and contributing to a vicious cycle of even greater prevalence of behavioral and physical health conditions.

These findings should serve as a call to action among policymakers and the healthcare community at large to address declining health among younger Americans before the more severe consequences in this analysis become reality. If nothing is done, the impacts could be game-changing for the U.S. and its economy.

Projecting millennial health outcomes

To better quantify the potential consequences of continued health declines, Moody's Analytics constructed ten-year forecasts for millennial health using data from the Blue Cross Blue Shield Health Index.² The forecasts are

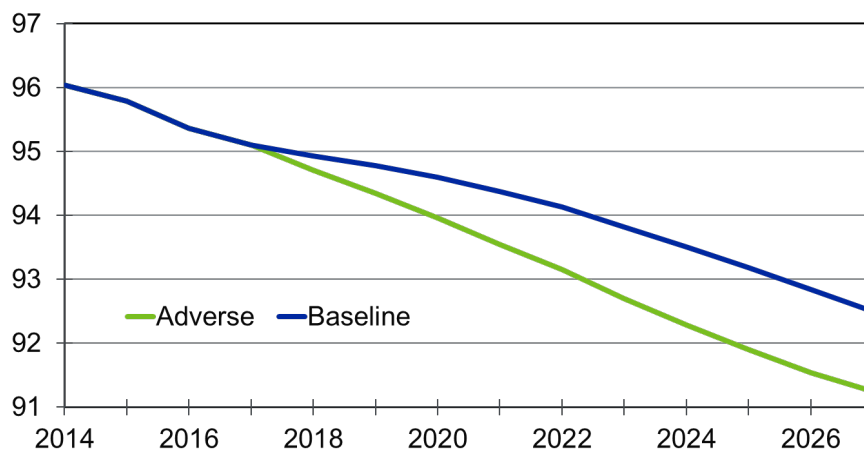
¹ Dimock, Michael; *Defining generations: Where Millennials end and Generation Z begins*; Pew Research Center, January 17, 2019

² The BCBS Health Index is a unique measure of the health of Americans using the claims data of more than 41 million BCBS commercially insured members. The Health Index quantifies the overall health of U.S. population using a score between 0 and 100. A score of '100' represents optimal health -- a population's potential lifespan, absent any conditions that lead to disability and increased risk of death. Any score less than 100 represents a reduction in health due to presence of conditions that lead to disability and increased risk of death.

composed of two different scenarios, baseline and adverse. The baseline represents how health shocks have historically played out, and the adverse represents a continuation of current trends throughout the next decade.

Chart X1: Health Decline Under Baseline and Adverse Scenarios

Predicted health index Millennial cohort



Sources: BCBS, Moody's Analytics

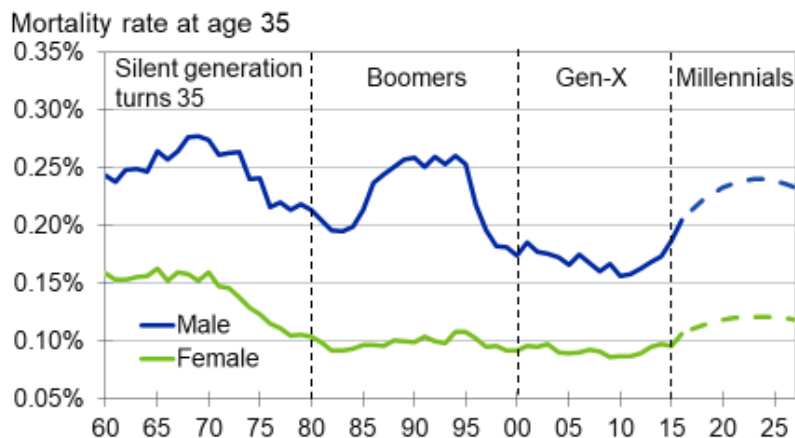
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The two scenarios provide us a plausible range of outcomes as to the potential severity of the millennial health shock. At its core the adverse is a continuation of the patterns seen over the past several years. Therefore, to the extent that those patterns are expected to continue out into the future, the adverse is the most plausible scenario, while to the extent a reversion to historical health patterns is expected, the baseline is the most plausible scenario.

Which projection ultimately proves the most accurate may boil down to the speed and degree of intervention by key stakeholders in response to the current pace of decline.

Health shocks, in terms of mortality, have been captured by government data since 1960. They were experienced by both the Silent Generation and baby boomers as they came into their mid-30s. These health shocks can be traced back to specific circumstances such as the Vietnam War, increases in recreational drug use, and the outbreak of HIV/AIDS. The current uptick in millennial mortality is representative across a wide range of causes and is still in its early onset. The limited nature of the mortality data makes it difficult to pinpoint a specific cause of the most recent uptick, given that the overall mortality rate is up across the board, from overdoses to cancers.

Chart X2: Health Shocks Since 1960



Sources: Human Mortality Database, Moody's Analytics

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One key to the millennial health shock may be behavioral health, given how much the recent decline has been attributable to rapid upticks in conditions like depression, substance abuse, and hyperactivity. Between 2014 and 2017 alone, prevalence of major depression and hyperactivity among millennials was up roughly 30%. What's more, according to the CDC, accidental deaths, which include overdoses, and suicides were the cause of 60% of the deaths among 25-29 years old in 2017. A generation before, in 2002, those two causes accounted for less than half of all deaths in the same age cohort.

Table X1: Top 5 conditions affecting Millennials by prevalence rate, rate per 100

| | 2014 Prevalence | 2017 Prevalence | % Increase |
|----------------------|-----------------|-----------------|------------|
| Hypertension | 7.0 | 8.1 | 16% |
| High cholesterol | 5.5 | 6.2 | 12% |
| Tobacco use disorder | 5.2 | 5.6 | 7% |
| Hyperactivity | 5.2 | 6.8 | 29% |
| Major Depression | 3.8 | 5.0 | 31% |

Sources: BCBS, Moody's Analytics

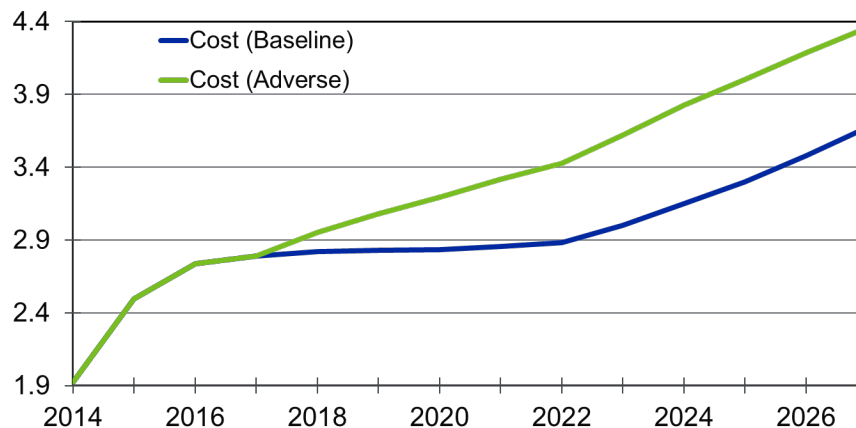
Counting the cost

The logical first consequence of these overall health declines is an increase in the amount of treatment that will need to be accessed. This, of course, is not without cost. A rapid increase in the need for treatment for the most populous generation in the U.S. has the potential to tax our already burdened healthcare infrastructure. The U.S. already spends more than 18% of its GDP on healthcare expenditures, the highest in the developed world. These additional cost pressures would be borne not only by consumers and businesses, but by states and the federal government as well, adding to already mounting mandatory spending burdens.

By combining the average cost per treatment from the Blue Cross Blue Shield Health Index data and a projection of the number of patients seeking treatment consistent with our baseline and adverse health scenarios, we can see real overall costs of care soar over the next decade.

Chart X3: Higher Costs of Treatment

Treatment cost for top 10 conditions (in billions of dollars), Millennial cohort



Sources: BCBS, Moody's Analytics

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These projections are again driven in large part by much higher millennial prevalence rates for behavioral health conditions, which prove to be some of the more costly treatments for individuals in the millennial cohort.

Table X2: Average health expenditure per patient per year ages 31-46, 2014-2017

| Crohn's Disease | Alcohol Use | Substance Abuse | Diabetes II | Hyperactivity |
|------------------|--------------------|-----------------|------------------|---------------|
| \$11,209.77 | \$1,372.55 | \$1,316.25 | \$1,158.73 | \$846.59 |
| Major Depression | Psychotic Disorder | Hypertension | High Cholesterol | Tobacco Use |
| \$706.79 | \$338.09 | \$230.83 | \$138.30 | \$55.99 |

Sources: BCBS, Moody's Analytics

The uptick in physical health prevalence among millennials is less of an immediate concern given how relatively inexpensive treatment for most of these conditions is earlier in life, but storm clouds are forming just beyond the horizon. Millennials show particularly elevated prevalence for high cholesterol and hypertension, both of which have a tendency to grow more expensive over time as their cumulative effects begin to manifest into other more serious conditions like heart or cerebrovascular diseases.

The youngest millennials won't turn 40, around the time when most of these conditions historically begin to reach critical mass, for another 17 years. Thus, the projected increases in millennial healthcare costs over the next ten years may only be the tip of the iceberg, with more serious implications to come.

Less health, less wealth

The second important consequence of a less healthy millennial population is slower economic growth. Our previous research has shown strong correlations between health and economic conditions, particularly that healthier workers also tend to be more productive workers.

As millennials become less healthy, they are more likely to miss work or stop working altogether. Furthermore, even when they are working, health concerns may prevent them from being as productive as they would have been had they had the same health profile as previous generations.

These potential consequences take on added importance when we take into account the outsize role that millennials will play in the economy over the coming decade. Millennials are now the largest contributors to the U.S. labor market, comprising more than 35% of all workers and rising.

Comparing projections for the oldest millennials to observed data on the youngest Gen-Xers, incomes are likely to see the biggest adverse effects as productivity declines. Under the most extreme scenario the oldest Millennials could see real incomes of more than \$4,500 less per person ten years from now than the youngest Gen-Xers enjoy today.

Table X3: Economic differences between Millennials and Gen-Xers based on health outcomes, 2017 vs. 2027

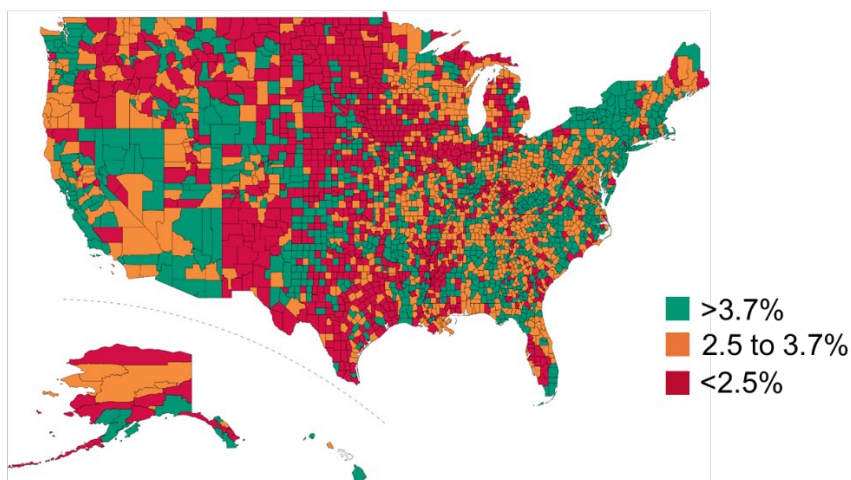
| | Actual | | Baseline | | Adverse | |
|--------------------------|------------------|---------------------|------------|---------------------|-------------|--|
| | Gen-Xers in 2017 | Millennials in 2027 | Difference | Millennials in 2027 | Difference | |
| Income per-capita | \$39,617.83 | \$39,287.38 | -\$330.45 | \$35,098.96 | -\$4,518.87 | |
| Unemployment | 3.47% | 3.51% | 0.04% | 4.1% | 0.63% | |

Sources: Census, BCBS, Moody's Analytics

In addition to a slower overall pace of growth, millennial health patterns may also exacerbate some underlying economic issues as well, most notably income inequality. Having previously established the fact that there is a strong correlation between overall health and several important economic measures, regression analysis on the relationship between millennial health specifically confirms this relationship, particularly with measures such as growth in house prices and per-capita incomes. Based on these statistical relationships we can conjecture that some of the areas that may see the largest economic drag from lower millennial health are areas with already below average economic outcomes.

Chart X4: Incomes Strongly Tied to Health

Per-capita income growth by county, percent change 2016 to 2017



Sources: BEA, Moody's Analytics

As with the U.S. population as a whole, millennials who live in areas with better economic outcomes generally have higher levels of overall health relative to other millennials. In turn, declines in millennial health are generally

most acute in areas of the country that are already falling behind economically. A continuation of these declines, without intervention, risks exacerbating this disconnect even further.

Lastly, these long-term economic impacts also have the potential to reinforce long-term declines in health. Several survey-based studies have found that one of the potential causes of increased depression, alcohol use, and substance abuse among millennials are worries about finances³.

If we hold such a hypothesis to be true in the context of this study, then millennial health patterns can cause declining millennial economic outcomes that in turn can cause further declines in millennial health. This represents a potentially vicious cycle resulting in even higher prevalence of depression and other behavioral health conditions over time.

Delving deeper into the relationship between millennial finances and behavioral health would provide a better understanding of what the future looks like in terms of overall health outcomes. Seeking out answers with regard to these correlations could help better explain some of the root causes of changing millennial health patterns, and provide stakeholders with guidance on the best ways to limit the potential economic fallout in the years to come.

³ *Stress in America, Paying With Our Health*; American Psychological Association, February 4, 2015

The Economic Consequences of Millennial Health

1. Key Findings

In the course of the last several years, millennials have shown that they are very different from previous generations in a number of ways. Defined as the generation born from 1981 to 1996, they are the largest, most educated, and most connected generation the world has ever seen⁴. However, recent data also show the beginnings of troubling generational health patterns that could hamper the future prosperity of millennials, and in turn the prosperity of the U.S. If the current pace of decline in millennial health continues unabated, the long-term consequences to the U.S. economy could be severe.

Millennials now make up the largest share of the U.S. population and labor force, placing them at the heart of U.S. economic growth as consumers, workers, and business owners. How their health plays out in the years ahead will determine not only the overall health of the country, but also its potential economic trajectory. By using Blue Cross Blue Shield Health Index data to analyze these questions, we are able to take a much broader and forward-looking view of these impacts relative to previous studies. In our examination of millennial health patterns we have found several interesting and concerning findings, particularly regarding future impacts on healthcare costs and economic activity.

1. Millennials are seeing their health decline faster than the previous generation as they age. This extends to both physical health conditions, such as hypertension and high cholesterol, and behavioral health conditions, such as major depression and hyperactivity. Without intervention, millennials could feasibly see mortality rates climb more than 40% compared to Gen-Xers at the same age.
2. These accelerated declines will result in greater demand for treatment and higher healthcare costs in the years ahead. Under the most adverse scenario, millennial treatment costs are projected to be as much as 33% higher than Gen-Xers experienced at a comparable age.
3. Poorer health among millennials will keep them from contributing as much to the economy as they otherwise would, manifesting itself through higher unemployment and slower income growth. Under the most adverse set of projections, lower levels of health alone could cost millennials more than \$4,500 per year in real per-capita incomes compared to similarly aged Gen-Xers. Such impacts would be most likely concentrated in areas already struggling economically, potentially exacerbating instances of income inequality and contributing to a vicious cycle of even greater prevalence of behavioral health conditions.

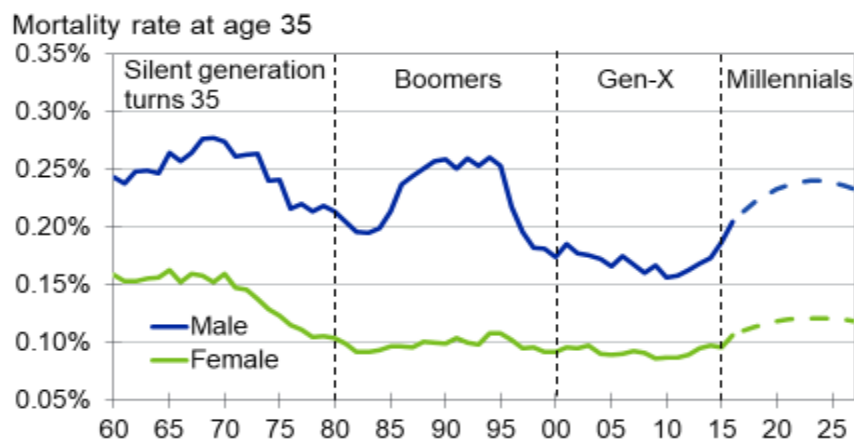
These findings should serve as a call to action among policymakers and the healthcare community at large to address declining health among younger Americans before the more severe consequences in this analysis become reality. If nothing is done, the impacts could be game changing for the U.S. and its economy.

⁴ Dimock, Michael; *Defining generations: Where Millennials end and Generation Z begins*; Pew Research Center, January 17, 2019

2. An Alarming Trend

The first and most troubling finding of this study is the confirmation that millennials are undoubtedly less healthy than the previous generation as they come into their most formative years. The oldest millennials are now entering their late 30s, a time when overall health traditionally begins its lifelong decline in earnest. This pattern is borne out first and foremost in the most recent mortality data from the Human Mortality Database (see Chart 1)⁵.

Chart 1: Health Shocks Since 1960



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Previous upticks in mortality, the most recent taking place in the late 1960s and late 1980s, can be traced back to specific circumstances such as the Vietnam War, increases in recreational drug use, and the outbreak of HIV/AIDS. The current uptick in millennial mortality is representative across a wide range of causes and is still in its early onset. The limited nature of the mortality data makes it difficult to pinpoint a specific cause of the most recent uptick, given that the overall mortality rate is up across the board, from overdoses to cancers.

However, looking at the mix of causes of death over time is instructive as to some of the different health challenges millennials are facing compared with Gen-Xers. For example, looking at data from the Centers for Disease Control we can see that accidental deaths make up a much larger share of overall mortality among millennials than the previous generation (see Table 1).

Accidental deaths include accidental overdoses, to which much of the increase can be attributed. The most high-profile correlation, according to the CDC, is with the rapid rise in opioid deaths that have occurred in the last decade⁶. Between 2010 and 2017, accidental deaths attributable to overdose from heroin and other synthetic opioids have increased by roughly 1,400% across all age cohorts⁷.

⁵ The projected Millennial mortality rate beyond 2016 represents a simple extrapolation assuming that the average annual mortality increase from 2013-2016 will eventually level off at the same pace as previous health shocks.

⁶ Scholl, Kariisa, Wilson, and Baldwin; *Drug and Opioid-Involved Overdose Deaths – United States, 2013-2017*; Centers for Disease Control https://www.cdc.gov/mmwr/volumes/67/wr/mm675152e1.htm?s_cid=mm675152e1_w

⁷ The Three Waves of Opioid Overdose Deaths; Centers for Disease Control, National Vital Statistics System Mortality file; <https://www.cdc.gov/drugoverdose/epidemic/index.html#three-waves>

Another noticeable difference between millennials and Gen-Xers in terms of mortality is the degree to which deaths appear to be more concentrated among the top four or five causes. Additionally, the uptick in mortality is much more prevalent among millennial men than millennial women. However, before jumping to any hasty conclusions it is important to first add some context to the HMD and CDC data by taking a more comprehensive overall view of health.

Table 1: Top 5 causes of death by year and age cohort, percent of total deaths

| Millennials - 2017 | | | | | |
|---------------------|------|---------------------|------|---------------------|------|
| 25-29 yo | | 30-34 yo | | 35-39 yo | |
| Accidents | 45.0 | Accidents | 40.5 | Accidents | 33.5 |
| Suicides | 14.4 | Suicides | 12.1 | Malignant neoplasms | 11.1 |
| Homicide | 10.9 | Diseases of heart | 7.6 | Diseases of heart | 10.6 |
| Malignant neoplasms | 4.6 | Homicide | 7.5 | Suicides | 10.1 |
| Diseases of heart | 4.5 | Malignant neoplasms | 7.2 | Homicide | 5.4 |
| Sum | 79.4 | Sum | 74.9 | Sum | 70.7 |
| Gen-Xers - 2002 | | | | | |
| 25-29 yo | | 30-34 yo | | 35-39 yo | |
| Accidents | 34.1 | Accidents | 27.6 | Accidents | 21.6 |
| Homicide | 14.0 | Suicides | 11.2 | Malignant neoplasms | 14.6 |
| Suicides | 13.5 | Malignant neoplasms | 11.2 | Diseases of heart | 12.6 |
| Malignant neoplasms | 7.0 | Diseases of heart | 8.9 | Suicides | 8.9 |
| Diseases of heart | 6.0 | Homicide | 8.4 | HIV | 7.4 |
| Sum | 74.6 | | 67.3 | | 65.1 |

Sources: CDC, Moody's Analytics

The mortality data alone tell a compelling, however incomplete story of millennial health. One major reason for this is that mortality alone does not reflect overall health. There are lots of things that can make you unhealthy, but not all of them will kill you, at least not right away. Therefore, focusing solely on mortality obscures a large part of the overall picture, presenting a distorted view of the root causes and concerns surrounding millennial health patterns.

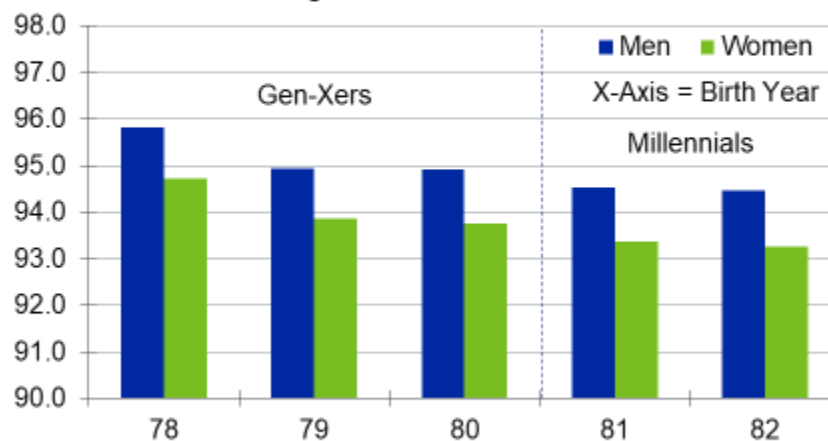
For this reason, it is imperative that a more comprehensive measure of overall health be examined in the context of generational health. It is only by incorporating data from the Blue Cross Blue Shield Health Index that we see a broader and more concerning view of the issue and its potential impacts on the future of the U.S. The Health Index is designed as a holistic measure of individual health based on a treasure trove of data compiled by the Blue Cross Blue Shield Association. Though as of yet we have only five years of historical observations from the Health Index, we are able to draw some intergenerational comparisons between the youngest Gen-Xers and the oldest millennials by focusing on actual health observations of individuals in their mid-30s.

Individuals born in 1978 through 1982 turned 35 years old in 2013 through 2017, the five years for which Health Index data are currently available. Fortunately, these years also correspond to the beginnings of the mortality shock we can observe in the Human Mortality Database. The Health Index data not only corroborate the shock observed in the mortality data, but actually expand upon it by showing that the shock extends much further than just mortality.

A first glance at the Health Index data in the context of the uptick in mortality reveals two aspects of millennial health that will be particularly important as the generation ages and takes on an even greater role in the U.S. economy. First, the mortality shock observed among millennial men is actually the leading edge of a much broader health shock among both millennial men and women (see Chart 2).

Chart 2: Larger Shock Beyond Mortality

BCBS Health Index at age 35



Sources: BCBS, Moody's Analytics

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The second, and possibly more concerning, aspect revealed in the Health Index's condition specific prevalence data is that health declines are not only visible in terms of physical health, but in terms of behavioral health as well (see Table 2)⁸. This correlates with the uptick in millennial deaths from accidental overdose and suicide, and has a potentially major impact on near-term healthcare costs and economic outcomes for millennials.

Table 2: Top 5 conditions affecting Millennials by prevalence rate, rate per 100

| | 2014 Prevalence | 2017 Prevalence | % Increase |
|----------------------|-----------------|-----------------|------------|
| Hypertension | 7.0 | 8.1 | 16% |
| High cholesterol | 5.5 | 6.2 | 12% |
| Tobacco use disorder | 5.2 | 5.6 | 7% |
| Hyperactivity | 5.2 | 6.8 | 29% |
| Major Depression | 3.8 | 5.0 | 31% |

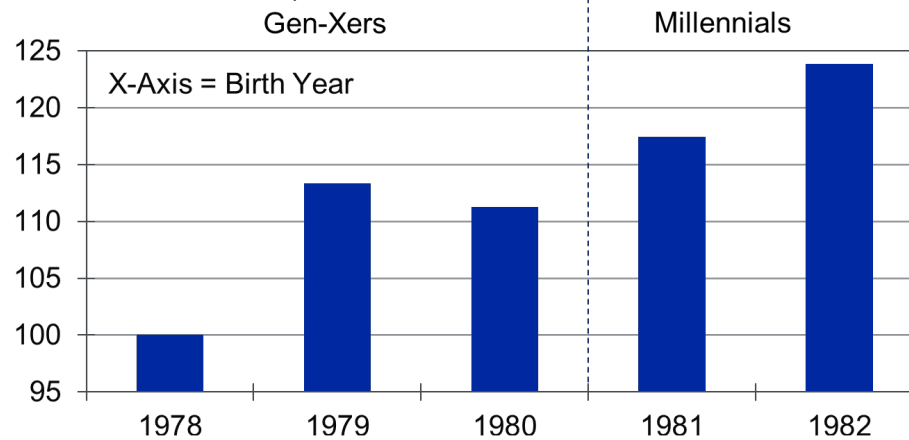
Sources: BCBS, Moody's Analytics

Just as troubling, though, are the increases in physical health conditions that can be relatively benign in the near-term, but potentially portend major health issues down the road. Higher prevalence for hypertension and high cholesterol in particular suggest that even more difficult health issues await millennials as these conditions run their course during the normal aging process (see Charts 3 and 4).

⁸ *The Health of Millennials*; The Blue Cross Blue Shield Association, Health of America Report, April 24, 2019

Chart 3: Less Healthy Physically...

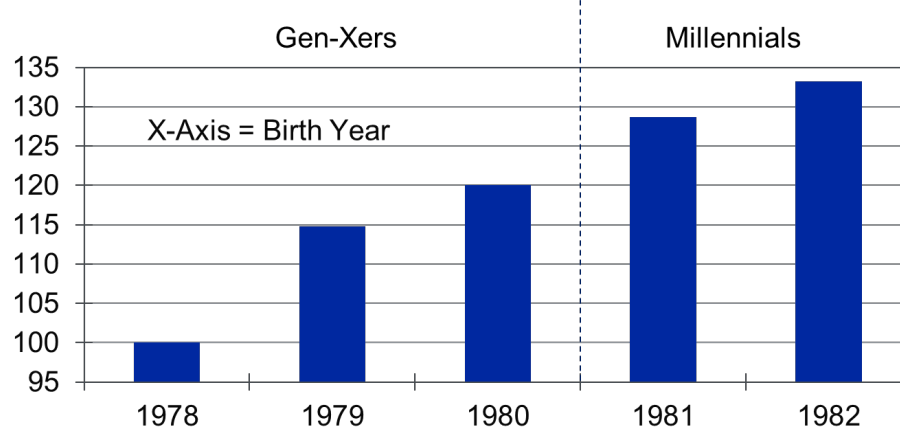
Prevalence of physical health conditions at age 35, (1978 standardized to 100)



Sources: BCBS, Moody's Analytics

Chart 4: ...and Mentally

Prevalence of behavioral health conditions at age 35, 1978 standardized to 100



Sources: BCBS, Moody's Analytics

By focusing on this more holistic view of overall health, we see millennial health declining more broadly and more quickly than the mortality data alone would suggest. The pace of this decline will have significant long-term consequences on not only mortality, but also on employers, healthcare providers, and the economy as a whole.

3. Projecting Millennial Health Outcomes

To better quantify the potential consequences of continued declines in millennial health, Moody's Analytics has constructed 10 year projections of millennial health using the Blue Cross Blue Shield Health Index. Because of the limited historical time-series available, these projections are extrapolations based on assumptions around how previous health shocks have evolved over time. Specifically, the projections are composed of two different scenarios, baseline and adverse.

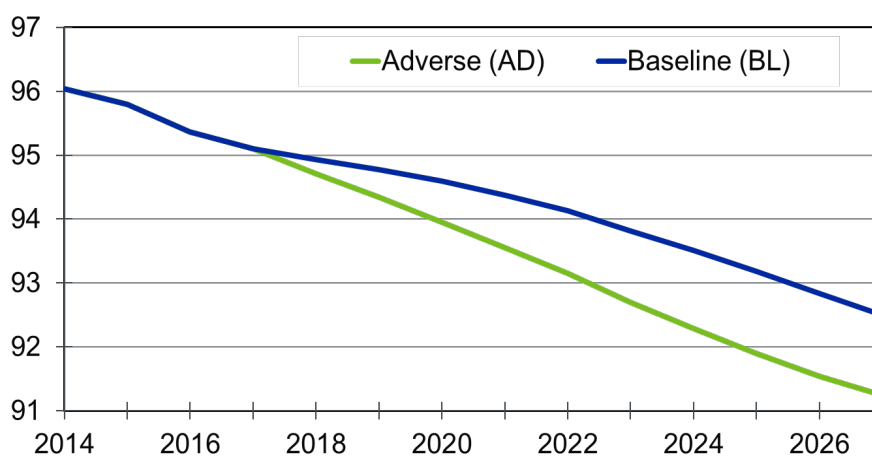
The first of these two scenarios, the baseline, is conditioned on how historical health shocks have actually played out in previous generations. Chart 1 showed that health shocks, especially in terms of mortality, are nothing new in the U.S. Both the Silent Generation and baby boomers experienced similar shocks as they came into their mid-30s. In each of these instances the shocks proved to be temporary as the roots of each underlying health shock eventually ran their course or were addressed by a public health response. The effects of these declines have historically leveled out over the course of 10 years following an initial shock as a result of such responses.

In the same way, the baseline health forecast assumes that the current shock in millennial health will eventually run its course, and that the pace of decline will level out within the next decade. This is a likely scenario should the recent shock to millennial health eventually be traced back to one or two root causes, such as the opioid crisis for example. However, should the recent changes in millennial health be less of a shock and more of a new normal owing to structural factors, be they social media, student loans, the environment, or any number of other theories, then the pace of decline in millennial health could persist much longer than in previous periods.

The second scenario, the adverse, provides us with a lower-bound estimate of health in line with such a persistent pace of decline by assuming that the current health shock among millennials continues relatively unabated throughout the 10 year forecast. This obviously provides a much darker, though not implausible, look at how current millennial health patterns could play out as the generation ages into its late 40s. Continuing the current pace of decline in millennial health results in significantly worse health outcomes a decade from now versus the baseline (see Chart 5).

Chart 5: Alternative Health Scenarios

Projected health index score of millennial age cohort, 2014 to 2027



Sources: BCBS, Moody's Analytics

Table 3: Projected condition prevalence (in percent) among individuals age 37 to 46, rate per 100 individuals

| Condition ranked by prevalence | Men | | | Condition ranked by prevalence | Women | | |
|--------------------------------|---------------|-------------------------|-------------------------|--------------------------------|---------------|-------------------------|-------------------------|
| | Gen-X in 2017 | Millennial in 2027 (BL) | Millennial in 2027 (AD) | | Gen-X in 2017 | Millennial in 2027 (BL) | Millennial in 2027 (AD) |
| High cholesterol | 25.54 | 25.79 | 31.38 | Hypertension | 19.89 | 20.50 | 24.05 |
| Hypertension | 25.05 | 25.74 | 29.74 | High cholesterol | 17.36 | 17.53 | 21.45 |
| Tobacco use | 8.17 | 7.76 | 9.24 | Major depression | 8.50 | 8.87 | 9.74 |
| Diabetes II | 6.35 | 6.36 | 7.64 | Tobacco use | 8.06 | 7.71 | 8.82 |
| Major depression | 3.89 | 4.13 | 4.56 | Diabetes II | 7.15 | 7.24 | 9.02 |
| Hyperactivity | 3.60 | 3.51 | 5.33 | Hyperactivity | 4.51 | 4.54 | 6.43 |
| Alcohol abuse | 2.07 | 2.06 | 1.81 | Substance abuse | 1.55 | 1.54 | 1.60 |
| Substance abuse | 1.93 | 1.85 | 2.13 | Alcohol abuse | 1.14 | 1.18 | 1.04 |
| Crohn's/colitis | 0.41 | 0.40 | 0.49 | Crohn's/colitis | 0.52 | 0.50 | 0.58 |
| Psychotic conditions | 0.31 | 0.35 | 0.23 | Psychotic conditions | 0.32 | 0.34 | 0.24 |

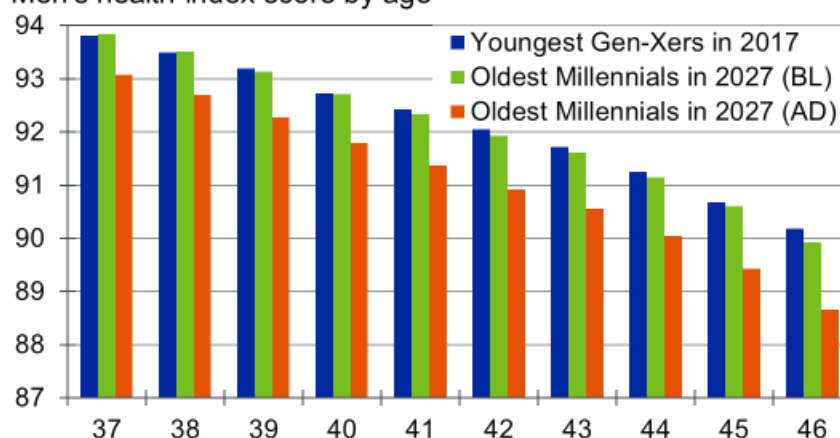
Sources: BCBS, Moody's Analytics

While the overall forecast makes intuitive sense, there are nuances in the breakdowns by gender and condition. Table 3 shows the difference in prevalence for selected conditions between the oldest millennials in our forecasts and the youngest Gen-Xers for which we have sufficient historical data, individuals age 37 to 46 in 2017 and 2027, respectively. Both millennial men and women are impacted similarly by the various physical conditions accounted for in the forecast. Hypertension and high cholesterol, in particular, have significant consequences across both genders and scenarios.

From a behavioral health perspective, however, the forecasts for millennial men and women do see some significant differences that manifest themselves in their overall Health Index forecasts. In general, millennial men see a much steadier pace of decline in their overall health scores with less of a difference over a decade between the baseline and the adverse scenarios compared with women (see Chart 6).

Chart 6: Men See More Consistent Decay

Men's health index score by age



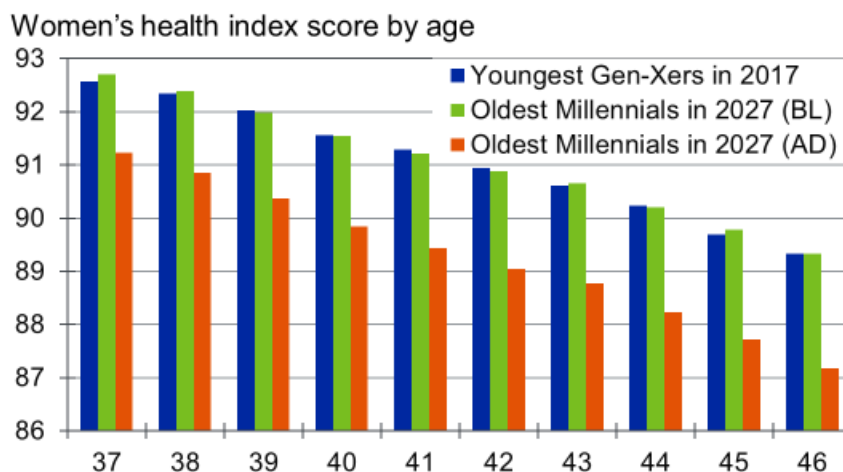
Sources: BCBS, Moody's Analytics

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This owes in large part to millennial men's mix of behavioral health conditions. Generally, millennial men have a lower prevalence for behavioral health conditions than millennial women. This causes more of the men's overall

score to be driven by physical health conditions, which ultimately decline at a much more consistent pace across both scenarios. The behavioral health conditions millennial men do have higher prevalence for, namely alcohol and substance abuse, are slower growing and less volatile relative to hyperactivity and major depression, which drive a large portion of the overall health decline in millennial women's health index scores (see Chart 7).

Chart 7: Women See Greater Variability



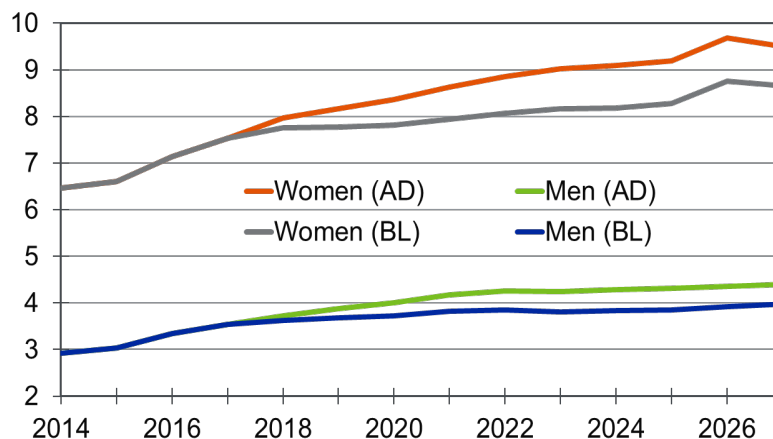
Sources: BCBS, Moody's Analytics

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Millennial women have a substantially higher prevalence for both hyperactivity and major depression than men, which causes their health score projections to be more impacted by these faster growing and more volatile conditions (see Chart 8). This subsequently results in greater differentiation between the two health scenarios for women based on the way those scenarios were constructed. The baseline assumes that growth in these two conditions will eventually level out in line with previous health shocks. However, the adverse scenario assumes that the recent rapid pace of acceleration in these conditions will continue through at least the next decade.

Chart 8: Prevalence of Major Depression

Predicted prevalence rate (in percent) at age 35, by year & gender



Sources: BCBS, Moody's Analytics

Thus the two scenarios provide us a range of potential outcomes as to the severity of the millennial health shock. At its core the adverse scenario is a continuation of the patterns seen over the past several years. Therefore, to the extent that those patterns are expected to continue out into the future, the adverse is the most plausible scenario, while to the extent a reversion to historical health patterns is expected, the baseline is the most plausible scenario.

Which projection ultimately proves the most accurate may boil down to the speed and degree of intervention by stakeholders in response to the current pace of decline.

The key for the millennial shock may be behavioral health, which drives much of the difference between the two scenarios owing to how much of the recent decline in millennial health has been attributable to rapid upticks in those conditions. Between 2014 and 2017 alone, prevalence of major depression and hyperactivity among millennials was up roughly 30%. What's more, according to the CDC, accidental deaths, which include overdoses, and suicides were the cause of 60% of all 25-29 year old deaths in 2017. A generation before, in 2002, those two causes accounted for less than half of all deaths in the same age cohort.

Behavioral health conditions are much more variable given that so much of the historical uptick in prevalence has been seen very recently. It is unclear in the context of this analysis whether or not this is an artifact of the data, a case of increased diagnoses, or whether it is reflective of a true increase in prevalence of these conditions.

Because we have not yet experienced this level of acceleration in behavioral health conditions before, it is difficult to adequately handicap whether the prevalence of these conditions will continue to accelerate at the same pace as in recent years, or whether they will begin to revert back to a slower pace of growth. This variability in assumptions is the main reason why we have provided more than one forecast scenario, and we think that the two options provide a reasonable range of potential health outcomes to use as part of this analysis.

Having established that millennials are experiencing worse health outcomes than Gen-Xers, and that this decline in overall health is likely to continue into the future, we must next grapple with the consequences.

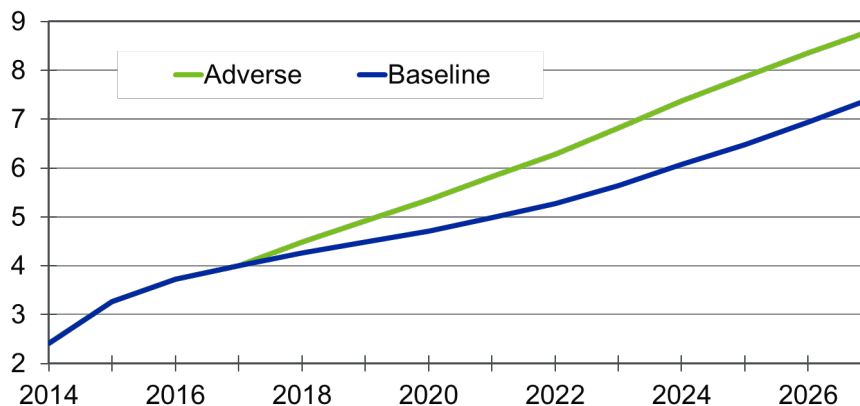
4. Counting the Costs

The logical first consequence of a less healthy population is an increase in the amount of treatment that will need to be accessed. This, of course, is not without cost. Therefore, the first step in examining the consequences of millennial health patterns over time is to try to quantify the increased healthcare costs associated with faster declines in overall health. To do this we rely on our 10 year projections of millennial health across ages, genders, and conditions. The cost of care can vary greatly based on all three of these criteria.

Given the projected increase in prevalence among the top 10 conditions examined as part of this study, we expect a sizable increase in the number of millennial patients seeking treatment over the next decade under both the baseline and adverse scenarios. Chart 9 shows the projections for patient numbers within the BCBS insured population over the next decade. In addition to the state of millennial health, these projections assume that the BCBS insured population grows and ages at the same rate as the overall U.S. population.

Chart 9: Patient Numbers Grow Quickly

Projected patient count for any condition (in millions) by year, millennial cohort



Sources: Census, BCBS, Moody's Analytics

It should be mentioned that while this increase may appear dramatic, as it suggests that twice as many millennials could be under treatment 10 years from now, these figures do include some double-counting. A patient who is under treatment for more than one condition is counted separately for each condition. This is because the patient will generally incur a separate cost of treatment for each condition.

To estimate total costs we once again rely on data from the Blue Cross Blue Shield Health Index database which contains a large amount of individual observations on treatment costs for specific conditions across specific ages and genders (see Table 4). These average costs from 2014 to 2017, the period for which the most complete cost data exist, can then be combined with the number of patients seeking treatment to develop an estimate for overall treatment costs over time.

Table 4: Average health expenditure per patient per year ages 31-46, 2014-2017

| Crohn's Disease | Alcohol Use | Substance Abuse | Diabetes II | Hyperactivity |
|------------------|--------------------|-----------------|------------------|---------------|
| \$11,209.77 | \$1,372.55 | \$1,316.25 | \$1,158.73 | \$846.59 |
| Major Depression | Psychotic Disorder | Hypertension | High Cholesterol | Tobacco Use |
| \$706.79 | \$338.09 | \$230.83 | \$138.30 | \$55.99 |

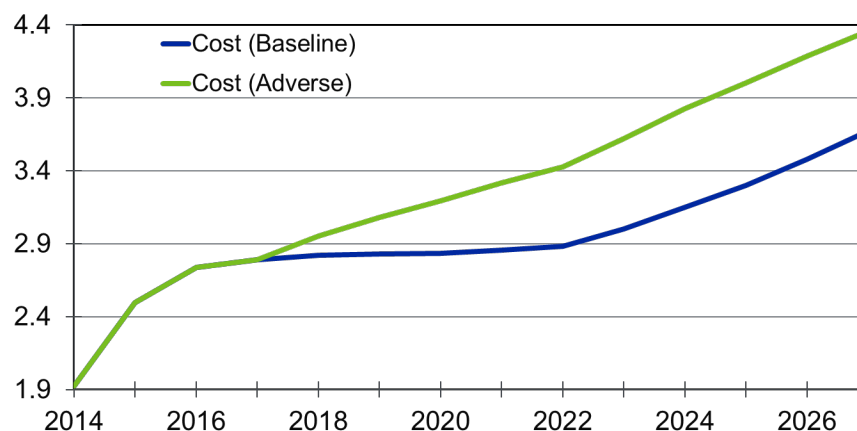
Sources: BCBS, Moody's Analytics

Average treatment cost data show that the most common conditions, such as hypertension or high cholesterol, are among the least expensive conditions to treat in the age range of most current millennials. Meanwhile, behavioral health conditions such as alcohol use, substance abuse, hyperactivity, and major depression generally come with much higher price tags at this phase of an individual's lifecycle. This corresponds with a sizable uptick in millennial cost of treatment over the next 10 years as prevalence rates for these conditions are projected to remain elevated if not increase under both the baseline and adverse scenarios.

Combining average costs per treatment and the number of patients seeking treatment, we are able to develop estimates of how overall treatment costs for millennials will evolve over the next decade and compare with previous generations. Even when holding the cost of care for individual conditions constant at 2017 dollar levels, we see a material increase in the costs of treatment for millennials in the BCBS insured population (see Chart 10).

Chart 10: Higher Costs of Treatment

Treatment cost for top 10 conditions (in billions of dollars),
Millennial cohort



Sources: BCBS, Moody's Analytics

The largest drivers of healthcare costs among millennials over the next decade are thus expected to be behavioral health conditions. For men this is projected to be more concentrated in treatments for alcohol use and substance abuse, while for women this is forecast to be more concentrated in treatments for major depression and hyperactivity. A continuing uptick in these conditions under the adverse scenario potentially contributes not only to a sharp increase in mortality, but also portends significantly higher healthcare costs over the next decade.

Higher costs from physical health conditions among millennials are less of a concern over the next 10 years, but major storm clouds are brewing just beyond the horizon. Millennials currently show elevated prevalence rates for hypertension and high cholesterol, conditions with relatively low costs of care for individuals below the age of 40. However, these conditions have a tendency to grow more expensive over time as their cumulative effects begin to manifest themselves in other more serious conditions like heart or cerebrovascular diseases. As they age over the proceeding few decades, the cost of treating these patients will accelerate dramatically.

Because a majority of millennials are still in their late 20s and early 30s it is unlikely that we will experience the full brunt of these costs within the next decade. The youngest millennials won't turn 40, around the time when most of these conditions historically begin to reach critical mass, for another 17 years. This means that the projected increases in millennial costs of care over the next decade may be just the tip of the iceberg, with more serious implications beyond the current forecast horizon.

Healthcare costs for millennials will see a sizable increase over the next 10 years, but that can be said about almost every generation. What makes the healthcare cost increases for millennials really stand out is their comparison with the previous generation in real terms.

Table 5: Total cost of treatment, individuals aged 37 to 46, 2017 (in billions)

| | Gen-Xers in 2017 | Millennials in 2027 | |
|-------|------------------|---------------------|------------|
| | Actual | Baseline | Adverse |
| Men | \$1,181.36 | \$1,326.30 | \$1,572.84 |
| Women | \$1,082.65 | \$1,226.60 | \$1,456.05 |

Sources: BCBS, Moody's Analytics

Table 5 shows the difference between the oldest millennials in our forecasts and the youngest Gen-Xers for which we have sufficient historical data, again using individuals aged 37 to 46 in 2017 and 2027, respectively. Comparing real dollars at comparable age ranges, costs for this subset of millennials are projected to be more than 33% higher than for Gen-Xers under the adverse scenario.

Even under baseline forecast assumptions, the cost of millennial healthcare is projected to increase steadily relative to the previous generation at a comparable age. This is a function not only of lower levels of overall health, but also from increased prevalence in those behavioral health conditions with relatively high costs of treatment, including alcohol and substance abuse, hyperactivity, and major depression.

As millennials continue to age beyond the next decade, higher prevalence rates for physical conditions such as hypertension and high cholesterol mean these costs will rise even higher compared with previous generations over the long run.

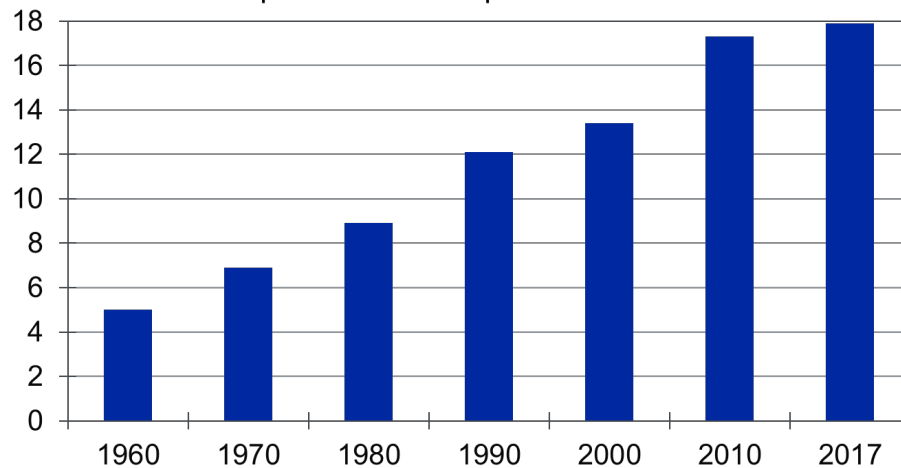
The increase in the cost of treatment for millennials will contribute to the already growing impact of healthcare costs on the U.S. economy (see Chart 11). The Centers for Medicare and Medicaid Services estimates that national health expenditures already make up more than 17% of the U.S. economy, growing to nearly 20% within a decade⁹. This carries significant implications for the nature of U.S. economic growth, particularly with regard to consumer and government spending.

Expanding out-of-pocket costs for consumers will limit their ability to spend on other goods and create additional stress within already strapped household budgets. Additionally, with the creation of federal healthcare exchanges nationwide and the expansion of Medicaid programs in 37 states as part of the Affordable Care Act, more millennials qualify for healthcare plans provided by or subsidized by government than in previous generations.

⁹ National Health Expenditure Accounts, Centers for Medicaid and Medicare Services, 2017

Chart 11: Growing Share of Economy

National health expenditures as a percent of GDP



Sources: CMS, Moody's Analytics

Thus, any increases in the cost of care for millennials will not only be borne by consumers and private companies, but also by states and the federal government. This would add to already mounting mandatory spending burdens within the public sector, and create additional fiscal stress in the long-term outlook.

5. Less Healthy, Less Wealthy

The second important consequence of a less healthy working-age population is slower economic growth. An economy is traditionally measured by how much it is able to produce, via its gross domestic product. At its core, GDP is made up of two primary components, the number of individuals producing, and the amount that each individual is able to produce. Both of these components are threatened by lower levels of health in the workforce. As part of our previous research with the BCBS Health Index we established that workers who are less healthy also tend to be much less productive, generating lower per-capita incomes and being employed less often. As millennials become less healthy, they are more likely to miss work or stop working altogether. Furthermore, even when they are working, health concerns may prevent them from being as productive as they would have been had they had the same health profile as previous generations.

As part of our analysis we have developed ballpark estimates for the potential changes in several key economic measures that could result from declining millennial health patterns. The relationship between changes in the Health Index and underlying economic conditions has been explored in detail in previous research¹⁰. This research found that even relatively minor variations in health outcomes were strongly correlated with different economic outcomes (see Table 6).

Table 6: Impact of a two-standard deviation improvement in the health index

| | |
|-------------------|---------|
| Per capita income | \$3,593 |
| Unemployment rate | -0.50% |

Sources: BCBS, Moody's Analytics

Using the study's recommended findings, which controlled for demographic factors and state-by-state variations in healthcare delivery, we can estimate the potential impact of both the baseline and adverse health scenarios to millennial per-capita incomes and unemployment. We do this by calculating the difference between millennials and Gen-Xers at the same age by again relying on individuals in the 37 to 46 year old age cohort. This gives us as close to an apples-to-apples comparison as possible of projected health and economic outcomes for the oldest millennials and observed health and economic outcomes for the youngest Gen-Xers.

The results show a broad range of potential economic outcomes across the two health scenarios. The economic consequences under baseline health assumptions are relatively small, but still material. If the current health shock being experienced by millennials were to revert back to normal levels of growth relatively quickly, per-capita incomes could be almost 1% lower in 2027 compared with Gen-Xers in 2017 (see Table 7)¹¹.

Table 7: Economic differences between Millennials and Gen-Xers based on health outcomes

| | | | |
|-------------------|------------------|---------------------|---------------------|
| | Actual | Baseline | Adverse |
| | Gen-Xers in 2017 | Millennials in 2027 | Millennials in 2027 |
| Income per-capita | \$39,617.83 | -\$39,287.38 | -\$35,098.96 |
| Unemployment | 3.47% | 3.51% | 4.1% |
| Difference | | | -\$4,518.87 |

Sources: Census, BCBS, Moody's Analytics

¹⁰ Healthy People, Healthy Economies: The Blue Cross Blue Shield Association and Moody's Analytics, 2016
¹¹ Income and unemployment data for 35 to 44 year olds are used as a proxy for 37 to 46 year olds in this comparison owing to data availability.

Under the adverse scenario, however, the economic costs are much more substantial. If the current pace of health declines were to continue through the next decade, millennials could see per-capita incomes more than 11% below their Gen-X peers and see their unemployment rate rise by more than half a percentage point.

This difference in the economic consequences between the two scenarios is largely a function of the pace of overall health decline in the baseline scenario reverting back to trend over the next 10 years. This highlights the significance of a potential response from stakeholders to ensure that the current pace of accelerated declines does indeed revert back to trend. The alternative, a continuation of the current pace of declines, would have much more severe consequences from both a health and economic standpoint.

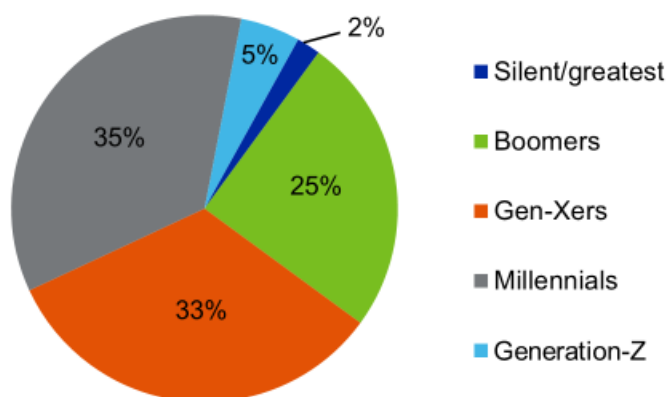
The difference is also indicative of the way in which prevalence rates for specific conditions evolve over time in each of the two scenarios. Behavioral health conditions in particular see much more dramatic increases in the adverse scenario than under the baseline, helping pull the overall health score lower, faster and resulting in more economic disruption.

While these estimates give us some helpful context as to the potential magnitude of economic changes resulting from millennial health patterns, they are only a rough estimate based on work dealing with two very different populations. The impacts estimated as part of the previous study on the Health Index's relationship to underlying economic factors were calculated based on county level data across all age cohorts. The health projections for millennials were based on individual member level data for a select age cohort. Potential differences between these two sets of data undoubtedly introduce some uncertainty into these estimates.

The projected consequences of these estimates take on added importance when we take into account the outside role that millennials will play in the economy over the coming decade. In addition to making up a larger portion of the overall population, millennials are now the largest contributors to the U.S. labor force (see Chart 12).

Chart 12: The Millennial Labor Force

Share of the U.S. labor force, 2017



Sources: CPS IPUMS, Pew Research Center, Moody's Analytics

MOODY'S ANALYTICS

That share will only grow in the years ahead as more Boomers retire and the number of millennials in the work force continues to grow thanks to net in-migration. For context, Boomers maxed out their share of the labor force

in the late 1990s when they made up more than half of all workers¹². Thus it is expected that the millennial share of the workforce will continue to accelerate in the years ahead.

Therefore, if health declines more quickly in the largest segment of the U.S. labor force, causing higher levels of unemployment and lower incomes, the pace of overall economic growth will certainly take a hit. Unfortunately, data limitations prevent us from deriving more precise GDP estimates in terms of this effect. However, incomes are a useful proxy for productivity.

If a majority of American workers are generating less income than they otherwise would, we can reasonably assume that overall productivity and thus GDP will also grow at a slower rate than if millennials had exhibited similar health outcomes to previous generations.

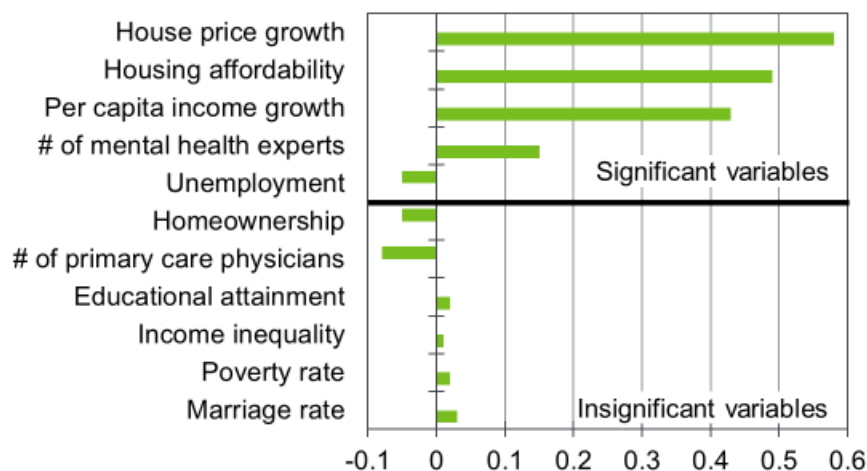
In addition to a potentially slower rate of headline economic growth, millennial health patterns have the potential to exacerbate some underlying economic issues as well. Income inequality, for example, has grown in recent decades for a variety of reasons. Having previously established the fact that there is a strong correlation between overall health and several important economic measures, we can conjecture that some of the areas that may see the largest economic drag from lower millennial health are areas with already below average economic outcomes.

To help pinpoint populations that may be more at risk of declining millennial health than others, we ran several regression equations using county-level Health Index data for millennials and a variety of socioeconomic factors. The results of these regressions confirmed findings from previous work with the Health Index that show a distinct correlation between changes in overall millennial health and economic conditions.

Within the millennial cohort we see differentiation across health outcomes driven predominantly by economics as opposed to demographics or other social factors. Chart 13 shows the importance of eleven specific factors in explaining variations in changes to millennial Health Index scores at the county level.

Chart 13: Economics Make the Difference

Standardized coefficient estimates from panel regressions



Sources: BEA, Census, ACS, BLS, Moody's Analytics
MOODY'S ANALYTICS

¹² Fry, Richard; *Millennials are the largest generation in the U.S. labor force*; Pew Research Center, April 11, 2018

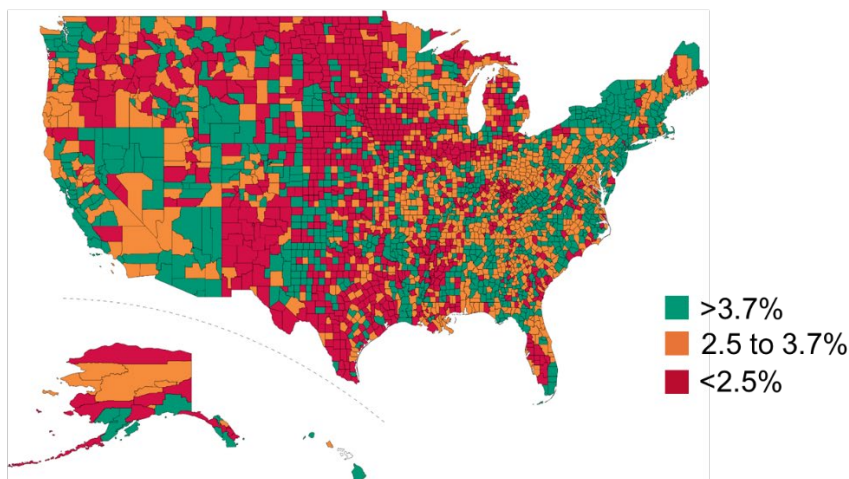
The way to interpret these results is that a positive coefficient means the underlying factor has a positive correlation with overall health dynamics. Similarly, a negative coefficient has a negative correlation. For example, if unemployment in a county were to increase, the average millennial Health index in that county would likely decrease at a faster rate.

Generally, the larger the absolute value of the coefficient, the more important that factor is in explaining millennial health dynamics. All variables are standardized, so that a coefficient of 1.0 would indicate that the average annual change in millennial Health would increase by one standard deviation if the determinant increased by one standard deviation.

A county's economic characteristics, particularly growth in home prices, changes in housing affordability, and growth in per-capita incomes showed the most statistically significant correlations to changes in the health of millennials living in that county. These variables are tied together in that the Moody's Analytics' Housing Affordability Index is a function of both median house prices and median incomes. In simple terms, average millennial health is likely to decline less relative to the national average in counties with above average growth in house prices and incomes (see Chart 14).

Chart X4: Incomes Strongly Tied to Health

Per-capita income growth by county, percent change 2016 to 2017



Sources: BEA, Moody's Analytics

These factors have a strong impact on household finances, and as such can be a significant source of financial stress, which is especially notable given the outsize role that behavioral health has played in declining millennial health outcomes. Similarly, the number of mental health professionals within a county was also significantly correlated with slower millennial health declines.

As with the U.S. population as a whole, millennials who live in areas with better economic outcomes generally have higher levels of overall health relative to other millennials. Furthermore, declines in millennial health are generally most acute in areas of the country that are already struggling to grow economically. Thus, if these patterns were to persist unabated, as assumed in the adverse health forecast, they would likely contribute to a greater divergence between more economically well-off areas and those that are struggling.

These long-term economic impacts also have the potential to reinforce long-term declines in health. Several survey-based studies have found that one of the potential causes of increased depression, alcohol use, and substance abuse among millennials are worries about finances¹³.

If we hold this to be true in the context of this study, then millennial health patterns can cause declining millennial economic outcomes that in turn can cause further declines in millennial health. This represents a potentially vicious cycle resulting in even higher prevalence of depression and other behavioral health outcomes over time.

Given that an increase in behavioral health conditions represents much of the difference between millennials and previous generations in terms of overall health, such a hypothesis does seem plausible. millennial finances are proving very different from previous generations. Their balance sheets are generally home to more liabilities and fewer assets than Gen-Xers at a comparable age (see Table 8)¹⁴.

| Generation | Total assets | Total debt | Net worth |
|---------------------|---------------------|-------------------|------------------|
| Millennials in 2016 | \$162,000 | \$72,000 | \$90,000 |
| Gen-Xers in 2001 | \$198,000 | \$67,000 | \$131,000 |

Sources: Federal Reserve Bank of St. Louis, Moody's Analytics

This too corresponds to our regression findings that household finances, particularly with regards to income and housing, play a potentially major role in millennial health patterns. As a next step, delving deeper into the relationship between millennial finances and behavioral health would provide a better understanding of what the future looks like in terms of overall health outcomes.

Seeking out answers with regard to these correlations could help better explain some of the root causes of changing millennial health patterns, and provide stakeholders with guidance on the best ways to limit the potential economic fallout in the decades to come. These findings should serve as a call to action among policymakers and the healthcare community at large to address declining health among younger Americans before the more severe consequences in this analysis become reality. If nothing is done, the impacts could be game changing for the U.S. and its economy.

¹³ *Stress in America, Paying With Our Health*; American Psychological Association, February 4, 2015

¹⁴ Chien and Morris; *Accounting for Age: The Financial Health of Millennials*; Federal Reserve Bank of St. Louis, Regional Economist, May 16, 2018

Appendix A – Historical and Projected Health Index by Age and Gender

| Calendar Year | | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | |
|---------------|---------|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1981 | Female | Age | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 |
| | | Baseline | 95.49 | 94.55 | 94.14 | 93.40 | 92.93 | 92.60 | 92.37 | 92.01 | 91.62 | 91.26 | 90.89 | 90.61 | 90.22 | 89.74 | 89.34 |
| | Adverse | 95.49 | 94.55 | 94.14 | 93.40 | 92.93 | 92.21 | 91.61 | 90.88 | 90.15 | 89.50 | 88.89 | 88.46 | 87.98 | 87.48 | 87.18 | |
| | Male | Baseline | 96.47 | 95.63 | 95.21 | 94.54 | 94.06 | 93.69 | 93.46 | 93.10 | 92.67 | 92.28 | 91.83 | 91.48 | 90.97 | 90.41 | 89.92 |
| Adverse | | 96.47 | 95.63 | 95.21 | 94.54 | 94.06 | 93.48 | 93.05 | 92.49 | 91.87 | 91.31 | 90.72 | 90.28 | 89.69 | 89.11 | 88.66 | |
| 1982 | Female | Age | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 |
| | | Baseline | 95.71 | 94.76 | 94.46 | 93.77 | 93.27 | 92.94 | 92.63 | 92.39 | 92.03 | 91.65 | 91.28 | 90.92 | 90.64 | 90.25 | 89.78 |
| | Adverse | 95.71 | 94.76 | 94.46 | 93.77 | 93.27 | 92.57 | 91.89 | 91.32 | 90.64 | 89.96 | 89.36 | 88.84 | 88.50 | 88.11 | 87.71 | |
| | Male | Baseline | 96.65 | 95.76 | 95.51 | 94.91 | 94.47 | 94.14 | 93.84 | 93.61 | 93.23 | 92.83 | 92.43 | 92.00 | 91.65 | 91.14 | 90.61 |
| Adverse | | 96.65 | 95.76 | 95.51 | 94.91 | 94.47 | 93.95 | 93.45 | 93.04 | 92.49 | 91.93 | 91.40 | 90.86 | 90.47 | 89.94 | 89.43 | |
| 1983 | Female | Age | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 |
| | | Baseline | 95.96 | 95.03 | 94.66 | 94.07 | 93.59 | 93.22 | 92.90 | 92.58 | 92.35 | 92.00 | 91.59 | 91.23 | 90.87 | 90.59 | 90.21 |
| | Adverse | 95.96 | 95.03 | 94.66 | 94.07 | 93.59 | 92.86 | 92.19 | 91.53 | 91.00 | 90.38 | 89.74 | 89.22 | 88.78 | 88.52 | 88.23 | |
| | Male | Baseline | 96.83 | 96.01 | 95.69 | 95.22 | 94.80 | 94.45 | 94.14 | 93.85 | 93.60 | 93.24 | 92.83 | 92.43 | 92.00 | 91.65 | 91.15 |
| Adverse | | 96.83 | 96.01 | 95.69 | 95.22 | 94.80 | 94.26 | 93.77 | 93.30 | 92.90 | 92.39 | 91.86 | 91.36 | 90.87 | 90.52 | 90.04 | |
| 1984 | Female | Age | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 |
| | | Baseline | 96.20 | 95.28 | 94.94 | 94.34 | 93.98 | 93.62 | 93.27 | 92.95 | 92.63 | 92.40 | 92.04 | 91.65 | 91.29 | 90.93 | 90.65 |
| | Adverse | 96.20 | 95.28 | 94.94 | 94.34 | 93.98 | 93.28 | 92.59 | 91.95 | 91.34 | 90.87 | 90.29 | 89.74 | 89.30 | 88.94 | 88.77 | |
| | Male | Baseline | 97.04 | 96.28 | 95.95 | 95.43 | 95.11 | 94.74 | 94.42 | 94.12 | 93.81 | 93.57 | 93.21 | 92.80 | 92.39 | 91.95 | 91.61 |
| Adverse | | 97.04 | 96.28 | 95.95 | 95.43 | 95.11 | 94.56 | 94.07 | 93.60 | 93.13 | 92.77 | 92.28 | 91.78 | 91.32 | 90.86 | 90.56 | |
| 1985 | Female | Age | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 |
| | | Baseline | 96.39 | 95.62 | 95.21 | 94.61 | 94.19 | 93.93 | 93.58 | 93.22 | 92.90 | 92.59 | 92.34 | 91.99 | 91.59 | 91.23 | 90.88 |
| | Adverse | 96.39 | 95.62 | 95.21 | 94.61 | 94.19 | 93.61 | 92.93 | 92.26 | 91.65 | 91.09 | 90.66 | 90.15 | 89.67 | 89.30 | 89.04 | |
| | Male | Baseline | 97.16 | 96.48 | 96.13 | 95.63 | 95.30 | 95.06 | 94.73 | 94.42 | 94.10 | 93.80 | 93.56 | 93.19 | 92.78 | 92.37 | 91.93 |
| Adverse | | 97.16 | 96.48 | 96.13 | 95.63 | 95.30 | 94.90 | 94.40 | 93.92 | 93.45 | 93.02 | 92.68 | 92.22 | 91.76 | 91.33 | 90.92 | |
| 1986 | Female | Age | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 |
| | | Baseline | 96.55 | 95.83 | 95.48 | 94.89 | 94.45 | 94.15 | 93.91 | 93.55 | 93.19 | 92.88 | 92.55 | 92.32 | 91.96 | 91.56 | 91.21 |
| | Adverse | 96.55 | 95.83 | 95.48 | 94.89 | 94.45 | 93.84 | 93.30 | 92.64 | 92.00 | 91.45 | 90.91 | 90.56 | 90.12 | 89.71 | 89.44 | |
| | Male | Baseline | 97.26 | 96.67 | 96.37 | 95.91 | 95.52 | 95.24 | 95.05 | 94.72 | 94.38 | 94.08 | 93.77 | 93.53 | 93.16 | 92.74 | 92.34 |
| Adverse | | 97.26 | 96.67 | 96.37 | 95.91 | 95.52 | 95.08 | 94.74 | 94.25 | 93.77 | 93.34 | 92.92 | 92.61 | 92.19 | 91.75 | 91.38 | |
| 1987 | Female | Age | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| | | Baseline | 96.80 | 96.04 | 95.74 | 95.19 | 94.73 | 94.42 | 94.13 | 93.89 | 93.53 | 93.18 | 92.85 | 92.53 | 92.30 | 91.93 | 91.55 |
| | Adverse | 96.80 | 96.04 | 95.74 | 95.19 | 94.73 | 94.12 | 93.55 | 93.02 | 92.40 | 91.81 | 91.28 | 90.82 | 90.54 | 90.16 | 89.85 | |
| | Male | Baseline | 97.38 | 96.79 | 96.50 | 96.11 | 95.76 | 95.46 | 95.22 | 95.03 | 94.68 | 94.36 | 94.05 | 93.74 | 93.50 | 93.11 | 92.70 |
| Adverse | | 97.38 | 96.79 | 96.50 | 96.11 | 95.76 | 95.30 | 94.92 | 94.59 | 94.10 | 93.65 | 93.24 | 92.85 | 92.58 | 92.18 | 91.79 | |
| 1988 | Female | Age | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 |
| | | Baseline | 96.70 | 96.49 | 95.97 | 95.49 | 95.08 | 94.75 | 94.45 | 94.16 | 93.92 | 93.57 | 93.21 | 92.89 | 92.57 | 92.34 | 91.99 |
| | Adverse | 96.70 | 96.49 | 95.97 | 95.49 | 95.08 | 94.47 | 93.90 | 93.34 | 92.85 | 92.27 | 91.71 | 91.26 | 90.87 | 90.65 | 90.37 | |
| | Male | Baseline | 97.02 | 96.95 | 96.64 | 96.30 | 96.01 | 95.74 | 95.48 | 95.25 | 95.04 | 94.70 | 94.38 | 94.06 | 93.75 | 93.50 | 93.14 |
| Adverse | | 97.02 | 96.95 | 96.64 | 96.30 | 96.01 | 95.59 | 95.20 | 94.82 | 94.49 | 94.04 | 93.61 | 93.22 | 92.87 | 92.62 | 92.28 | |
| 1989 | Female | Age | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 |
| | | Baseline | 96.77 | 96.18 | 96.38 | 95.80 | 95.38 | 95.10 | 94.78 | 94.48 | 94.19 | 93.96 | 93.60 | 93.25 | 92.93 | 92.61 | 92.39 |
| | Adverse | 96.77 | 96.18 | 96.38 | 95.80 | 95.38 | 94.84 | 94.25 | 93.70 | 93.18 | 92.74 | 92.19 | 91.70 | 91.31 | 90.99 | 90.85 | |
| | Male | Baseline | 96.98 | 96.50 | 96.84 | 96.49 | 96.19 | 95.98 | 95.75 | 95.49 | 95.24 | 95.05 | 94.71 | 94.38 | 94.07 | 93.75 | 93.51 |
| Adverse | | 96.98 | 96.50 | 96.84 | 96.49 | 96.19 | 95.85 | 95.48 | 95.09 | 94.72 | 94.43 | 93.99 | 93.59 | 93.23 | 92.91 | 92.70 | |
| 1990 | Female | Age | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 |
| | | Baseline | 96.72 | 96.10 | 95.89 | 96.10 | 95.69 | 95.42 | 95.15 | 94.83 | 94.54 | 94.26 | 94.01 | 93.67 | 93.32 | 93.00 | 92.70 |
| | Adverse | 96.72 | 96.10 | 95.89 | 96.10 | 95.69 | 95.17 | 94.67 | 94.10 | 93.58 | 93.11 | 92.70 | 92.22 | 91.79 | 91.47 | 91.23 | |
| | Male | Baseline | 96.92 | 96.38 | 96.24 | 96.64 | 96.41 | 96.22 | 96.05 | 95.81 | 95.55 | 95.32 | 95.12 | 94.78 | 94.46 | 94.15 | 93.85 |
| Adverse | | 96.92 | 96.38 | 96.24 | 96.64 | 96.41 | 96.09 | 95.80 | 95.44 | 95.07 | 94.73 | 94.45 | 94.05 | 93.68 | 93.35 | 93.08 | |
| 1991 | Female | Age | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
| | | Baseline | 96.65 | 96.00 | 95.76 | 95.39 | 95.86 | 95.47 | 95.20 | 94.92 | 94.58 | 94.30 | 93.98 | 93.73 | 93.37 | 93.01 | 92.70 |
| | Adverse | 96.65 | 96.00 | 95.76 | 95.39 | 95.86 | 95.23 | 94.72 | 94.20 | 93.63 | 93.14 | 92.65 | 92.30 | 91.86 | 91.47 | 91.23 | |
| | Male | Baseline | 96.74 | 96.26 | 96.12 | 95.86 | 96.41 | 96.20 | 96.04 | 95.88 | 95.61 | 95.36 | 95.11 | 94.90 | 94.55 | 94.21 | 93.89 |
| Adverse | | 96.74 | 96.26 | 96.12 | 95.86 | 96.41 | 96.07 | 95.79 | 95.51 | 95.13 | 94.78 | 94.45 | 94.18 | 93.79 | 93.42 | 93.13 | |
| 1992 | Female | Age | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 |
| | | Baseline | 96.64 | 95.92 | 95.69 | 95.26 | 95.04 | 95.32 | 94.70 | 94.16 | 93.64 | 93.09 | 92.56 | 92.13 | 91.81 | 91.39 | 91.09 |
| | Adverse | 96.64 | 95.92 | 95.69 | 95.26 | 95.04 | 94.52 | 94.07 | 93.54 | 93.02 | 92.49 | 91.96 | 91.43 | 90.90 | 90.43 | 90.10 | |
| | Male | Baseline | 96.82 | 96.16 | 96.07 | 95.78 | 95.66 | 96.28 | 96.14 | 95.98 | 95.78 | 95.54 | 95.27 | 95.01 | 94.80 | 94.43 | 94.10 |
| Adverse | | 96.82 | 96.16 | 96.07 | 95.78 | 95.66 | 96.16 | 95.90 | 95.62 | 95.32 | 94.98 | 94.62 | 94.31 | 94.06 | 93.68 | 93.36 | |
| 1993 | Female | Age | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 |
| | | Baseline | 96.77 | 95.95 | 95.64 | 95.29 | 95.06 | 95.09 | 95.64 | 95.26 | 94.97 | 94.69 | 94.33 | 94.01 | 93.70 | 93.44 | 93.08 |
| | Adverse | 96.77 | 95.95 | 95.64 | 95.29 | 95.06 | 94.83 | 95.21 | 94.59 | 94.09 | 93.62 | 93.08 | 92.64 | 92.26 | 92.00 | 91.68 | |
| | Male | Baseline | 96.87 | 96.19 | 96.01 | 95.78 | 95.66 | 95.71 | 96.38 | 96.24 | 96.06 | 95.88 | 95.63 | 95.37 | 95.11 | 94.90 | 94.55 |
| Adverse | | 96.87 | 96.19 | 96.01 | 95.78 | 95.66 | 95.57 | 96.15 | 95.90 | 95.63 | 95.36 | 95.04 | 94.71 | 94.42 | 94.21 | 93.87 | |
| 1994 | Female | Age | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 |
| | | Baseline | 96.88 | 96.05 | 95.71 | 95.26 | 95.09 | 95.11 | 95.17 | 95.70 | 95.33 | 95.06 | 94.75 | 94.41 | 94.10 | 93.80 | 93.56 |
| | Adverse | 96.88 | 96.05 | 95.71 | 95.26 | 95.09 | 94.85 | 94.68 | 95.10 | 94.51 | 94.06 | | | | | | |

Appendix B – Men's Prevalence Rates at Comparable Ages, Rate per 100

| | Age | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | Average |
|----------------------|-------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| Crohn's/colitis | Gen-X in 2017 | 0.41 | 0.42 | 0.40 | 0.42 | 0.41 | 0.41 | 0.40 | 0.39 | 0.42 | 0.42 | 0.41 |
| | Millennial in 2027 (BL) | 0.38 | 0.39 | 0.39 | 0.42 | 0.41 | 0.42 | 0.40 | 0.39 | 0.41 | 0.42 | 0.40 |
| | Millennial in 2027 (AD) | 0.46 | 0.47 | 0.48 | 0.51 | 0.50 | 0.51 | 0.49 | 0.48 | 0.50 | 0.51 | 0.49 |
| Alcohol abuse | Gen-X in 2017 | 1.99 | 2.05 | 2.05 | 2.08 | 2.04 | 2.03 | 2.09 | 2.08 | 2.12 | 2.22 | 2.07 |
| | Millennial in 2027 (BL) | 1.90 | 1.97 | 1.99 | 2.03 | 2.06 | 2.06 | 2.08 | 2.09 | 2.13 | 2.27 | 2.06 |
| | Millennial in 2027 (AD) | 1.67 | 1.74 | 1.75 | 1.79 | 1.82 | 1.81 | 1.83 | 1.84 | 1.87 | 2.00 | 1.81 |
| Substance abuse | Gen-X in 2017 | 2.21 | 2.16 | 2.09 | 2.02 | 1.96 | 1.86 | 1.80 | 1.76 | 1.74 | 1.73 | 1.93 |
| | Millennial in 2027 (BL) | 2.10 | 2.05 | 2.01 | 1.89 | 1.83 | 1.74 | 1.73 | 1.68 | 1.72 | 1.76 | 1.85 |
| | Millennial in 2027 (AD) | 2.42 | 2.36 | 2.31 | 2.18 | 2.11 | 2.01 | 1.99 | 1.93 | 1.98 | 2.03 | 2.13 |
| Tobacco Use | Gen-X in 2017 | 7.68 | 8.00 | 8.09 | 8.23 | 8.08 | 8.20 | 8.21 | 8.36 | 8.39 | 8.45 | 8.17 |
| | Millennial in 2027 (BL) | 7.63 | 7.65 | 7.70 | 7.54 | 7.66 | 7.72 | 7.72 | 7.79 | 8.01 | 8.15 | 7.76 |
| | Millennial in 2027 (AD) | 9.09 | 9.11 | 9.17 | 8.98 | 9.13 | 9.20 | 9.19 | 9.28 | 9.54 | 9.71 | 9.24 |
| Hypertension | Gen-X in 2017 | 17.79 | 19.30 | 20.69 | 22.35 | 24.04 | 25.75 | 27.34 | 29.35 | 31.05 | 32.87 | 25.05 |
| | Millennial in 2027 (BL) | 18.41 | 19.83 | 21.46 | 23.11 | 25.00 | 26.87 | 28.03 | 29.95 | 31.33 | 33.45 | 25.74 |
| | Millennial in 2027 (AD) | 21.26 | 22.91 | 24.79 | 26.70 | 28.88 | 31.04 | 32.38 | 34.60 | 36.19 | 38.65 | 29.74 |
| Major depression | Gen-X in 2017 | 3.74 | 3.85 | 3.80 | 3.97 | 3.87 | 3.85 | 3.98 | 3.91 | 3.94 | 4.00 | 3.89 |
| | Millennial in 2027 (BL) | 4.07 | 4.11 | 4.13 | 4.21 | 4.19 | 4.14 | 4.13 | 4.06 | 4.07 | 4.15 | 4.13 |
| | Millennial in 2027 (AD) | 4.50 | 4.54 | 4.56 | 4.65 | 4.63 | 4.57 | 4.57 | 4.48 | 4.49 | 4.59 | 4.56 |
| Hyperactivity | Gen-X in 2017 | 4.37 | 4.23 | 3.96 | 3.87 | 3.65 | 3.43 | 3.30 | 3.22 | 3.05 | 2.91 | 3.60 |
| | Millennial in 2027 (BL) | 4.04 | 3.94 | 3.85 | 3.75 | 3.52 | 3.33 | 3.33 | 3.23 | 3.14 | 3.01 | 3.51 |
| | Millennial in 2027 (AD) | 6.13 | 5.98 | 5.85 | 5.70 | 5.34 | 5.05 | 5.05 | 4.90 | 4.76 | 4.57 | 5.33 |
| Diabetes II | Gen-X in 2017 | 3.63 | 4.10 | 4.66 | 5.19 | 5.90 | 6.60 | 7.21 | 8.01 | 8.77 | 9.46 | 6.35 |
| | Millennial in 2027 (BL) | 3.76 | 4.40 | 4.77 | 5.36 | 5.90 | 6.51 | 7.10 | 7.89 | 8.53 | 9.40 | 6.36 |
| | Millennial in 2027 (AD) | 4.51 | 5.29 | 5.73 | 6.44 | 7.09 | 7.82 | 8.53 | 9.48 | 10.24 | 11.29 | 7.64 |
| High cholesterol | Gen-X in 2017 | 16.95 | 18.73 | 20.58 | 22.33 | 24.50 | 26.67 | 28.47 | 30.39 | 32.40 | 34.41 | 25.54 |
| | Millennial in 2027 (BL) | 17.22 | 18.94 | 20.55 | 22.70 | 24.98 | 26.53 | 28.78 | 30.95 | 32.80 | 34.49 | 25.79 |
| | Millennial in 2027 (AD) | 20.95 | 23.04 | 25.00 | 27.62 | 30.39 | 32.27 | 35.01 | 37.65 | 39.90 | 41.96 | 31.38 |
| Psychotic conditions | Gen-X in 2017 | 0.32 | 0.33 | 0.31 | 0.31 | 0.32 | 0.31 | 0.30 | 0.32 | 0.30 | 0.29 | 0.31 |
| | Millennial in 2027 (BL) | 0.38 | 0.37 | 0.37 | 0.35 | 0.35 | 0.35 | 0.34 | 0.32 | 0.31 | 0.35 | 0.35 |
| | Millennial in 2027 (AD) | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.23 | 0.22 | 0.21 | 0.20 | 0.23 | 0.23 |

Sources: BCBS, Moody's Analytics

Appendix C – Women's Prevalence Rates at Comparable Ages, Rate per 100

| | Age | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | Average |
|----------------------|-------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|
| Crohn's/colitis | Gen-X in 2017 | 0.50 | 0.50 | 0.52 | 0.54 | 0.51 | 0.53 | 0.53 | 0.51 | 0.52 | 0.55 | 0.52 |
| | Millennial in 2027 (BL) | 0.46 | 0.49 | 0.49 | 0.52 | 0.48 | 0.48 | 0.51 | 0.49 | 0.52 | 0.54 | 0.50 |
| | Millennial in 2027 (AD) | 0.54 | 0.57 | 0.58 | 0.61 | 0.56 | 0.56 | 0.59 | 0.57 | 0.60 | 0.63 | 0.58 |
| Alcohol abuse | Gen-X in 2017 | 1.08 | 1.10 | 1.09 | 1.13 | 1.13 | 1.16 | 1.16 | 1.21 | 1.19 | 1.19 | 1.14 |
| | Millennial in 2027 (BL) | 1.12 | 1.15 | 1.13 | 1.16 | 1.17 | 1.16 | 1.18 | 1.22 | 1.25 | 1.29 | 1.18 |
| | Millennial in 2027 (AD) | 0.99 | 1.02 | 1.00 | 1.02 | 1.03 | 1.02 | 1.04 | 1.08 | 1.10 | 1.13 | 1.04 |
| Substance abuse | Gen-X in 2017 | 1.55 | 1.54 | 1.54 | 1.61 | 1.54 | 1.52 | 1.52 | 1.56 | 1.57 | 1.55 | 1.55 |
| | Millennial in 2027 (BL) | 1.56 | 1.57 | 1.55 | 1.54 | 1.56 | 1.52 | 1.50 | 1.50 | 1.55 | 1.58 | 1.54 |
| | Millennial in 2027 (AD) | 1.61 | 1.63 | 1.61 | 1.59 | 1.61 | 1.58 | 1.56 | 1.56 | 1.60 | 1.64 | 1.60 |
| Tobacco Use | Gen-X in 2017 | 7.87 | 7.92 | 8.09 | 8.08 | 7.97 | 7.95 | 7.94 | 8.08 | 8.28 | 8.44 | 8.06 |
| | Millennial in 2027 (BL) | 7.47 | 7.45 | 7.48 | 7.39 | 7.44 | 7.64 | 7.68 | 7.95 | 8.12 | 8.44 | 7.71 |
| | Millennial in 2027 (AD) | 8.55 | 8.53 | 8.56 | 8.46 | 8.51 | 8.74 | 8.79 | 9.10 | 9.29 | 9.66 | 8.82 |
| Hypertension | Gen-X in 2017 | 14.23 | 15.29 | 16.45 | 17.74 | 19.02 | 20.35 | 21.72 | 23.22 | 24.78 | 26.12 | 19.89 |
| | Millennial in 2027 (BL) | 14.85 | 15.99 | 17.05 | 18.56 | 19.79 | 21.27 | 22.27 | 23.79 | 25.04 | 26.37 | 20.50 |
| | Millennial in 2027 (AD) | 17.42 | 18.77 | 20.01 | 21.78 | 23.22 | 24.96 | 26.14 | 27.91 | 29.38 | 30.94 | 24.05 |
| Major depression | Gen-X in 2017 | 8.12 | 8.12 | 8.24 | 8.39 | 8.45 | 8.49 | 8.77 | 8.81 | 8.77 | 8.83 | 8.50 |
| | Millennial in 2027 (BL) | 8.64 | 8.72 | 8.91 | 8.99 | 8.91 | 8.89 | 9.00 | 8.94 | 8.80 | 8.93 | 8.87 |
| | Millennial in 2027 (AD) | 9.49 | 9.57 | 9.78 | 9.87 | 9.78 | 9.76 | 9.88 | 9.81 | 9.67 | 9.81 | 9.74 |
| Hyperactivity | Gen-X in 2017 | 4.89 | 4.75 | 4.66 | 4.61 | 4.46 | 4.46 | 4.48 | 4.35 | 4.27 | 4.20 | 4.51 |
| | Millennial in 2027 (BL) | 4.54 | 4.63 | 4.62 | 4.62 | 4.65 | 4.67 | 4.59 | 4.47 | 4.35 | 4.24 | 4.54 |
| | Millennial in 2027 (AD) | 6.43 | 6.55 | 6.55 | 6.54 | 6.59 | 6.61 | 6.49 | 6.34 | 6.16 | 6.00 | 6.43 |
| Diabetes II | Gen-X in 2017 | 5.80 | 6.07 | 6.36 | 6.59 | 6.89 | 7.32 | 7.59 | 7.93 | 8.37 | 8.62 | 7.15 |
| | Millennial in 2027 (BL) | 5.73 | 6.00 | 6.46 | 6.77 | 7.00 | 7.38 | 7.64 | 8.16 | 8.42 | 8.83 | 7.24 |
| | Millennial in 2027 (AD) | 7.13 | 7.48 | 8.05 | 8.43 | 8.73 | 9.20 | 9.52 | 10.17 | 10.49 | 11.00 | 9.02 |
| High cholesterol | Gen-X in 2017 | 11.26 | 12.48 | 13.63 | 15.08 | 16.42 | 17.88 | 19.44 | 20.87 | 22.50 | 24.09 | 17.36 |
| | Millennial in 2027 (BL) | 11.33 | 12.52 | 13.88 | 15.32 | 16.87 | 18.32 | 19.48 | 21.13 | 22.41 | 24.08 | 17.53 |
| | Millennial in 2027 (AD) | 13.86 | 15.32 | 16.98 | 18.74 | 20.64 | 22.41 | 23.83 | 25.85 | 27.42 | 29.46 | 21.45 |
| Psychotic conditions | Gen-X in 2017 | 0.30 | 0.32 | 0.32 | 0.34 | 0.31 | 0.31 | 0.31 | 0.33 | 0.33 | 0.34 | 0.32 |
| | Millennial in 2027 (BL) | 0.33 | 0.35 | 0.35 | 0.34 | 0.33 | 0.33 | 0.33 | 0.34 | 0.36 | 0.36 | 0.34 |
| | Millennial in 2027 (AD) | 0.23 | 0.24 | 0.25 | 0.24 | 0.23 | 0.23 | 0.23 | 0.24 | 0.25 | 0.25 | 0.24 |

Sources: BCBS, Moody's Analytics

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