



Million Hearts®: 2012–2016 Final Report Addendum

Significant Impact; Significant Opportunity

Authors: Matthew D. Ritchey, Hilary K. Wall, Judy Hannan, Laurence S. Sperling

This addendum serves as an update to the final report, **“Million Hearts®: Meaningful Progress 2012–2016.”** It provides final estimates for the number of heart attacks, strokes, and related acute cardiovascular events prevented during the initial 5-year period (2012–2016) of the Million Hearts® initiative.

A methodology was developed at the beginning of the initiative to monitor trends in both non-fatal and fatal cardiovascular events that are potentially preventable by the community and clinical interventions recommended by Million Hearts®.¹ This methodology combined findings from three datasets to track progress toward meeting the goal of preventing 1 million acute cardiovascular events in 5 years. The Nationwide Emergency Department Sample (NEDS), supported by the

Agency for Healthcare Research and Quality’s (AHRQ) Healthcare Cost and Utilization Project (HCUP), collects data on emergency department encounters related to cardiovascular disease (CVD). HCUP’s National Inpatient Sample (NIS) collects data on CVD hospitalizations. CDC’s National Vital Statistics System (NVSS) collects data on CVD deaths. At the time of publication of the final report, complete data from all three systems were available only through 2013, so a methodology to calculate projected event rates and estimates of events prevented through 2016 was used (for details about the methodology used, please see Appendix A in the original report). At that time, using the available data, we estimated that up to 500,000 events may have been prevented from 2012 through 2016.

Complete data from all three sources became available in 2019. **Figure 1** describes the trends in overall Million Hearts® event rates (i.e., a combination of mutually exclusive treat-and-release emergency department encounters, non-elective hospitalizations, and deaths) by sex and age group prior to the

initiative (2006–2011) and during the initiative (2012–2016). Comparing these event rates to those observed during 2011 (serves as a baseline) indicates that approximately 135,000 events (95% confidence interval: 32,000 excess events to 302,000 events prevented; non-significant

Figure 1. Million Hearts® cardiovascular disease† event rates, by age group‡ and sex—United States, 2006–2016¶



Data Sources: AHRQ's Healthcare Cost and Utilization Project's Nationwide Emergency Department Sample, Nationwide Inpatient Sample, and National Inpatient Sample; Centers for Disease Control and Prevention's National Vital Statistics System Mortality Multiple Cause of Death Files.

† Includes mutually exclusive non-fatal and fatal events related to acute myocardial infarction, stroke, symptomatic precursor conditions (e.g., stable angina pectoris), and other cardiovascular disease conditions (e.g., heart failure).¹

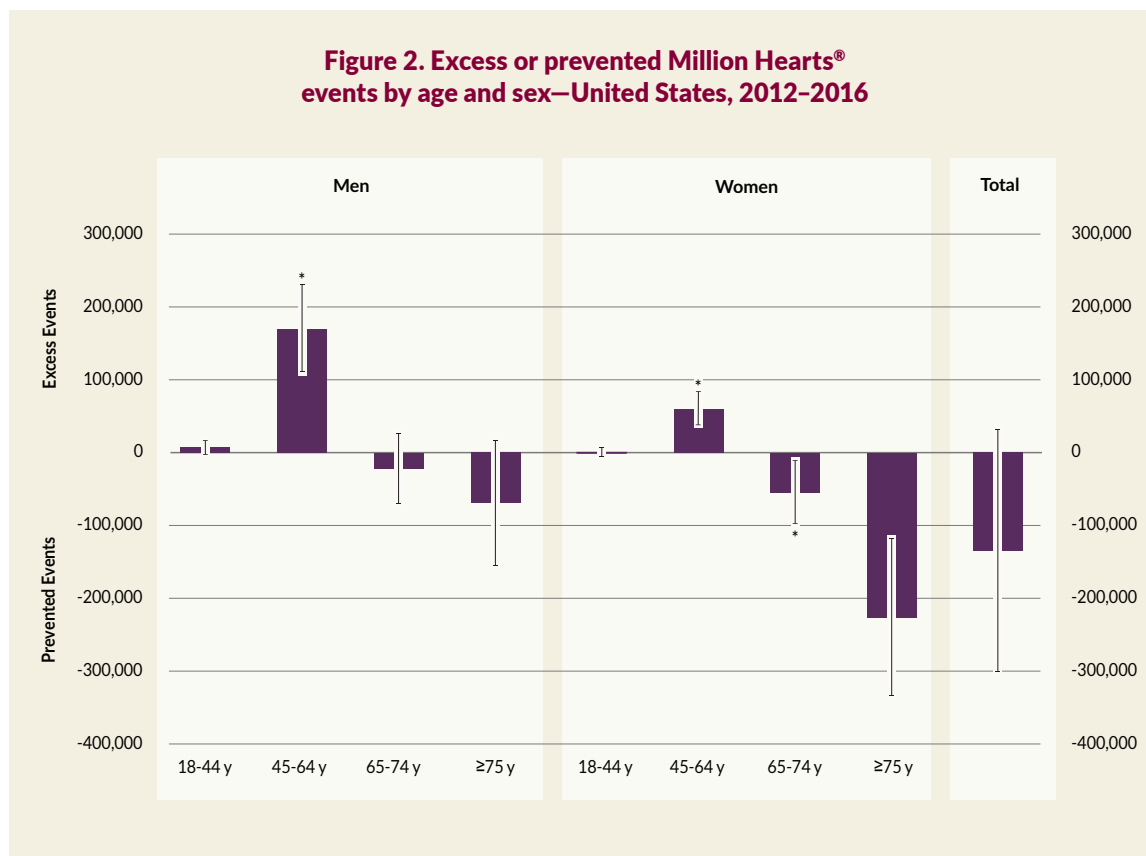
‡ Overall rates are standardized by age to the 2010 US Standard Population.

¶ Rates during 2006–2011 occurred prior to the initiative; rates during 2012–2016 occurred during the initiative.

with $P \geq .05$) were prevented during the initial 5-year phase of Million Hearts® (Figure 2). The final calculated events prevented are lower than the aspirational goal of 1 million and the interim projection of up to 500,000 events prevented. A considerable number of events were prevented among adults aged 75 years or older, especially

among women (reduction of 226,000 events [95% confidence interval: 118,000 to 335,000 events prevented]). However, these gains were offset by excess events observed among many of the younger age groups, especially among men aged 45–64 years (excess of 170,000 events [95% confidence interval: 110,000 to 230,000 excess events]).

Figure 2. Excess or prevented Million Hearts® events by age and sex—United States, 2012–2016



Data Sources: AHRQ's Healthcare Cost and Utilization Project's Nationwide Emergency Department Sample, Nationwide Inpatient Sample, and National Inpatient Sample; Centers for Disease Control and Prevention's National Vital Statistics System Mortality Multiple Cause of Death Files.

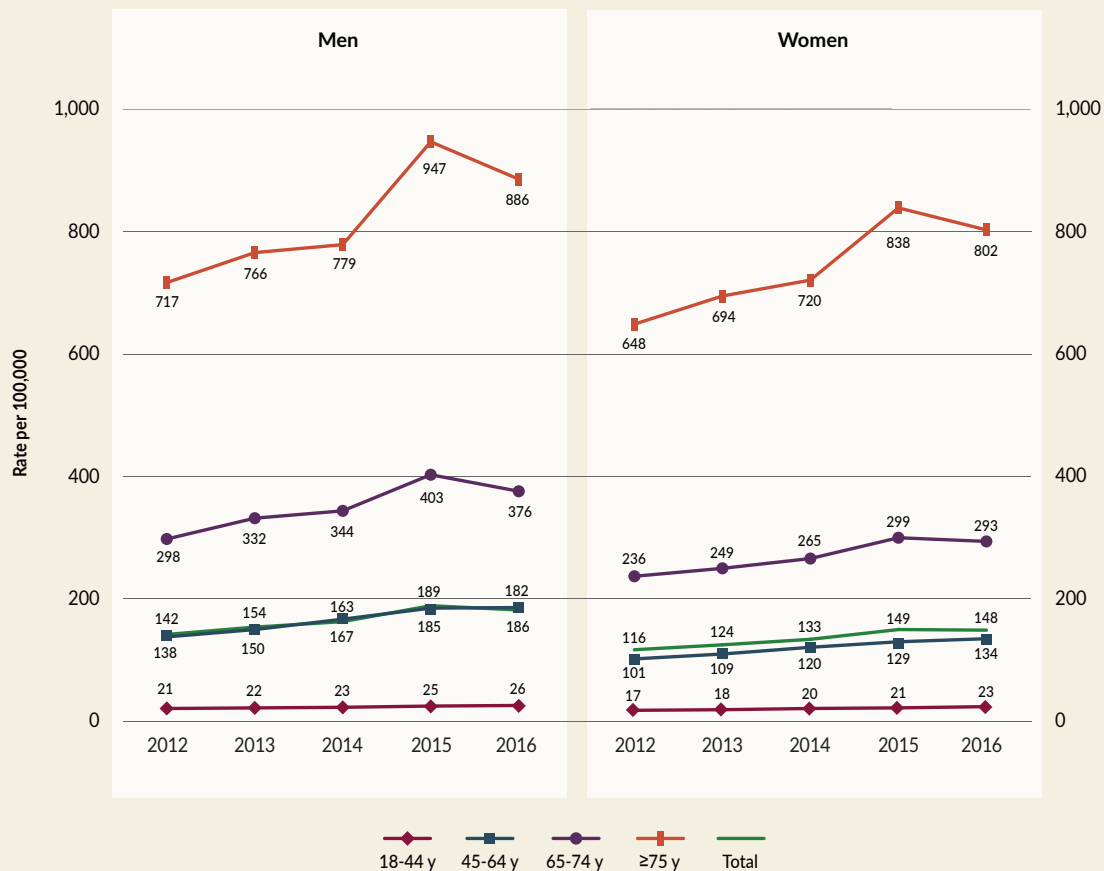
Determined by combining the observed event totals from 2012–2016 and subtracting the expected number of events calculated by multiplying the 2011 modeled sex- and age-specific rates and multiplying those rates by the US Census mid-year population estimates for 2012–2016, respectively.

* Statistically significantly different than 0 (z-score $\geq |1.96|$).

During the 5-year period, the age-standardized, treat-and-release emergency department visit rates increased by 28% among both men and women; the hospitalization rate decreased by 5% among women

and remained stable among men; and the overall mortality rate remained relatively stable among both sexes (**Figures 3, 4, and 5**).

Figure 3. Million Hearts® emergency department[§] event rates,[‡] by age group and sex—United States, 2012–2016

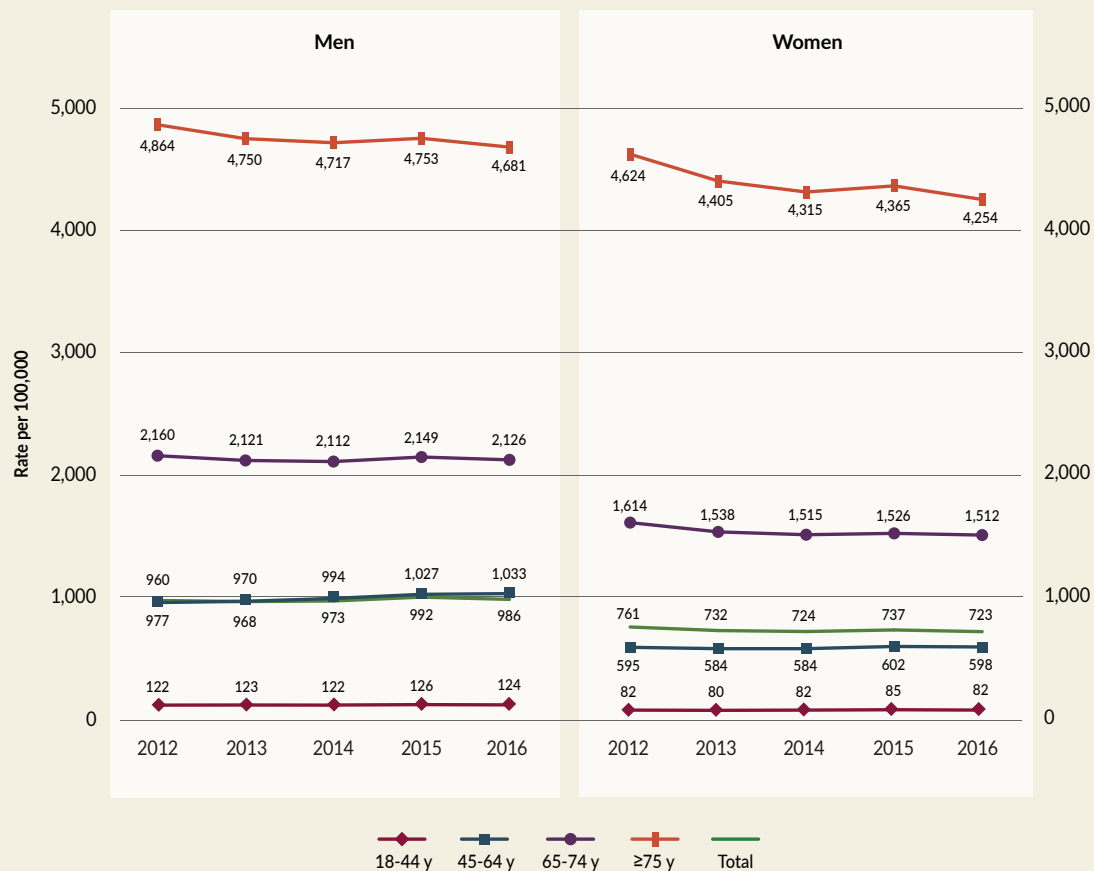


Data Sources: AHRQ's Healthcare Cost and Utilization Project's Nationwide Emergency Department Sample, Nationwide Inpatient Sample, and National Inpatient Sample; Centers for Disease Control and Prevention's National Vital Statistics System Mortality Multiple Cause of Death Files.

[§] Reflective of treat-and-release emergency department visits; events where the patients died in the emergency department, were transferred to another hospital, or were admitted to the same hospital were excluded.

[‡] Overall rates are standardized by age to the 2010 US Standard Population.

Figure 4. Hospitalization^{†||} event rates,[‡] by age group and sex—United States, 2012–2016



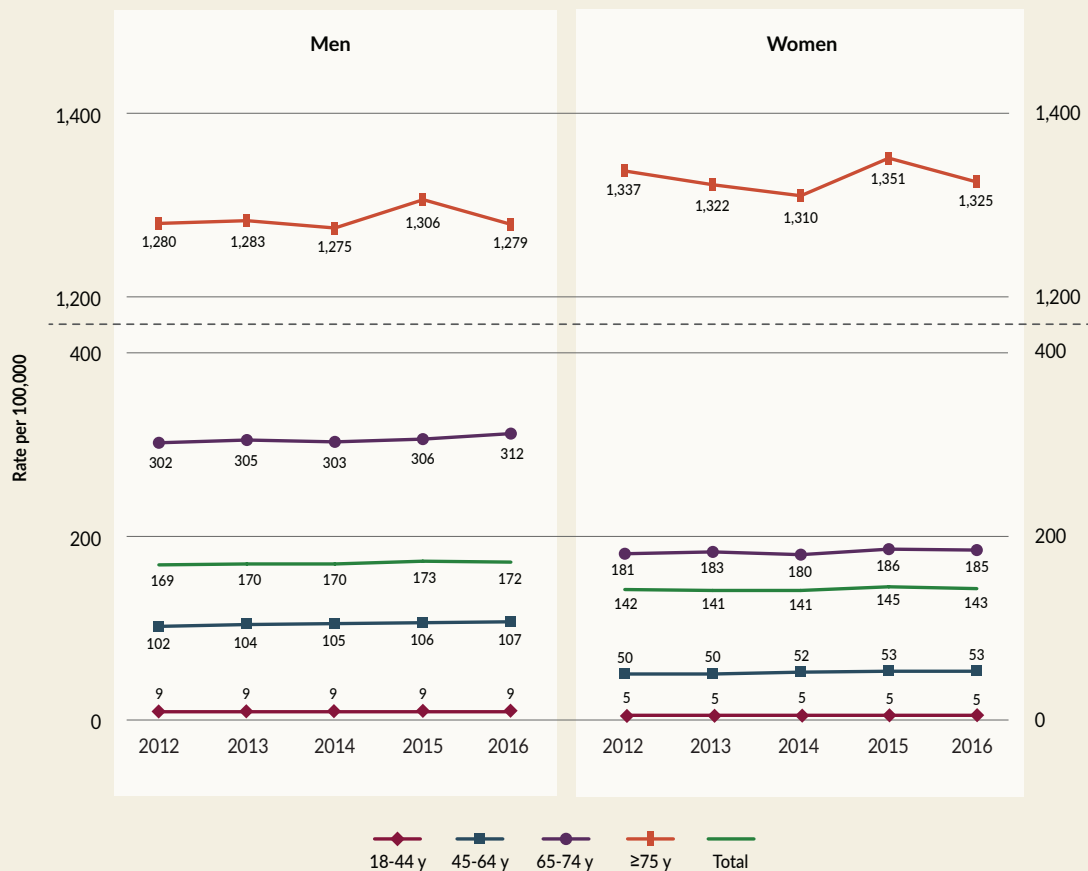
Data Sources: AHRQ's Healthcare Cost and Utilization Project's Nationwide Emergency Department Sample, Nationwide Inpatient Sample, and National Inpatient Sample; Centers for Disease Control and Prevention's National Vital Statistics System Mortality Multiple Cause of Death Files.

[†] Includes mutually exclusive non-fatal and fatal events related to acute myocardial infarction, stroke, symptomatic precursor conditions (e.g., stable angina pectoris), and other cardiovascular disease conditions (e.g., heart failure).¹

^{||} Excludes hospitalization events which were reported as elective or where the patient died in the hospital or was transferred to another hospital.

[‡] Overall rates are standardized by age to the 2010 US Standard Population.

Figure 5. Death# event rates,[‡] by age group and sex—United States, 2012–2016



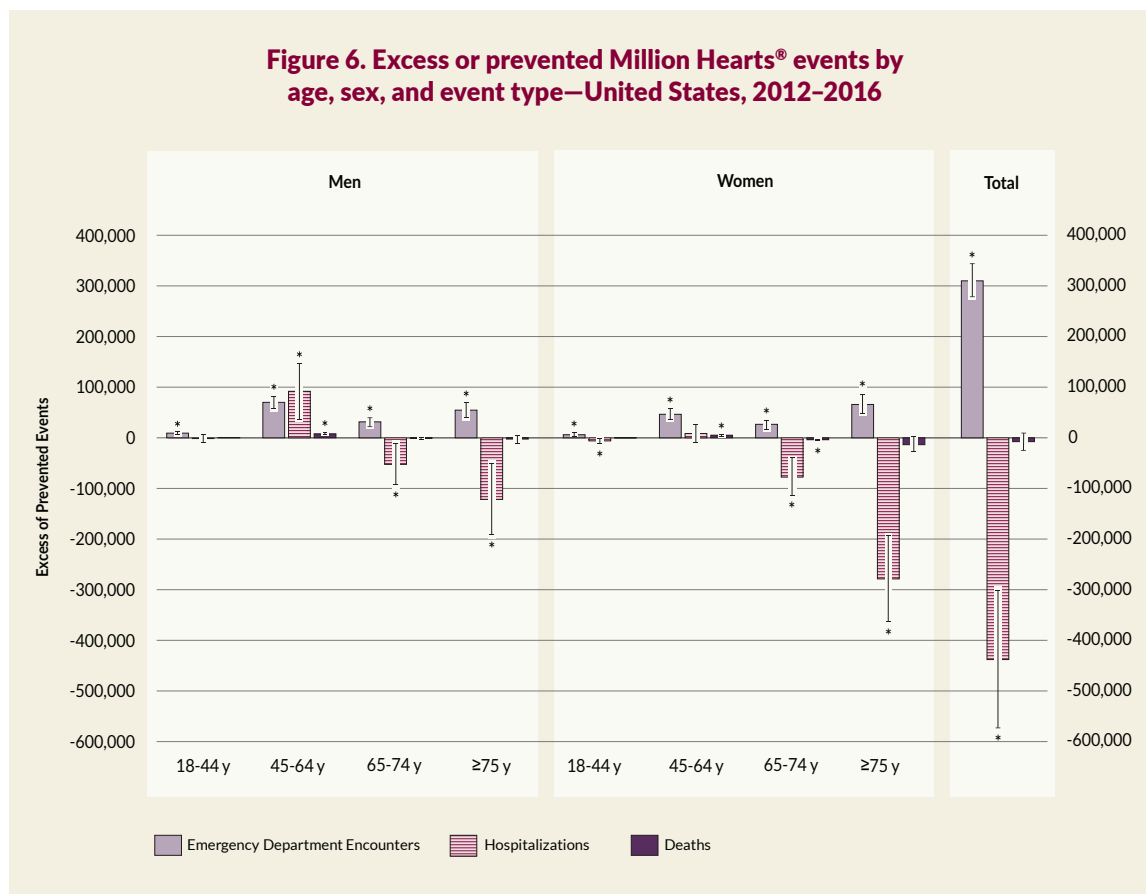
Data Sources: AHRQ's Healthcare Cost and Utilization Project's Nationwide Emergency Department Sample, Nationwide Inpatient Sample, and National Inpatient Sample; Centers for Disease Control and Prevention's National Vital Statistics System Mortality Multiple Cause of Death Files.

[#] Includes all deaths classified as potentially preventable via strategies recommended by Million Hearts®.

[‡] Overall rates are standardized by age to the 2010 US Standard Population.

Thus, most of the events prevented were non-fatal hospitalization events, with an estimated 438,000 CVD hospitalizations (95% confidence interval: 301,000 to 575,000; $P < .05$) prevented from 2012–2016 among all age groups and both sexes combined (**Figure 6**). However, an estimated

310,000 excess emergency department encounters (95% confidence interval: 277,000 to 343,000; $P < .05$) occurred among all groups combined. There was a non-significant change in death totals (8,000 deaths prevented [95% confidence interval: 25,000 deaths prevented to 10,000 excess deaths]; $P \geq .05$).^{**}



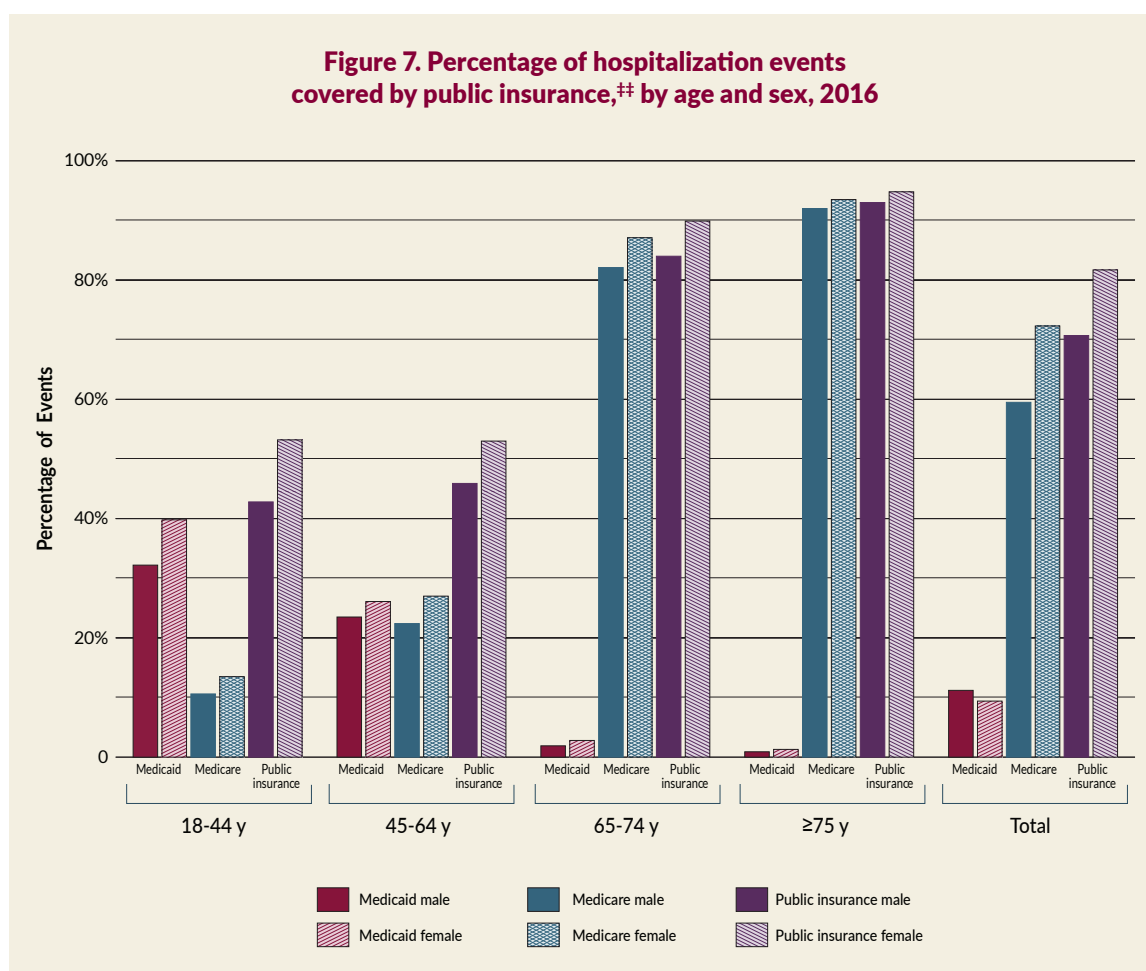
Data Sources: AHRQ's Healthcare Cost and Utilization Project's Nationwide Emergency Department Sample, Nationwide Inpatient Sample, and National Inpatient Sample; Centers for Disease Control and Prevention's National Vital Statistics System Mortality Multiple Cause of Death Files.

* Statistically significantly different than 0 (z-score $\geq |1.96|$).

** Sum of emergency department encounters, hospitalizations, and deaths does not exactly equal total because of rounding.

In 2016, the mean cost of a Million Hearts® hospitalization event was \$14,600 (includes only hospital costs; excludes professional [physician] fees) and the estimated mean cost of a Million Hearts® emergency department event was \$2,500.† Applying these averages to the estimated total number of hospitalizations prevented and excess emergency department encounters results in an estimated savings in direct medical costs of \$5.6 billion (\$US 2016) over the 5-year period.

The overall percentage of hospitalization events that occurred among adults with public insurance was substantial during 2012–2016, with a peak in 2016 (71% of total hospitalizations among men and 82% among women [data not shown]). In 2016, Medicaid was the primary payer for around one-third of Million Hearts® hospitalizations among adults aged 18–44 years, and Medicare (either via fee-for-service or through Medicare Advantage) was the primary payer for most of the hospitalization events among adults aged 65 years or older (Figure 7).



Data Sources: AHRQ's Nationwide Inpatient Sample and National Inpatient Sample.

†† Public insurance is the sum of the male and female Medicaid and Medicare values in each age range.

††† Charge information was available for emergency department and hospitalization events; however, charge amounts represent only what was billed for services and do not reflect how much the services actually cost the hospital to provide or the amount received in payment. Use of HCUP Cost-to-Charge Ratio (CCR) Files (HCUP, December 2019, Agency for Healthcare Research and Quality, Rockville, MD. <https://hcup-us.ahrq.gov/db/state/costtocharge.jsp>) allowed for the conversion from charges to costs, but CCRs are available only for hospitalization charges and not for emergency department charges via HCUP. Therefore, to estimate emergency department costs, the national average CCR observed among Medicare beneficiaries in 2013² (average markup of 340% or 4.4 times the Medicare allowed amount) was applied to the average charges per emergency department encounter observed in HCUP.



The initial 5-year phase of Million Hearts® highlights the initiative's favorable impact on the significant reduction in acute cardiovascular events observed among women aged 75 years or older, the reduction in almost half a million hospitalizations that occurred predominately among older individuals, and an estimated \$5.6 billion in averted direct medical costs. The excess events that occurred among those aged 45–64 years, which affected men more than women, reflects a concerning trend of increasing cardiovascular events within this demographic group that is due, in part, to continued high rates of uncontrolled hypertension and increasing prevalence of obesity and diabetes.³ The increase in emergency department encounters occurred among both sexes and in all age groups and played an important role in limiting the total number of events prevented. Additional data are needed to better understand the factors driving this pattern. It will likely take years to realize the compounded benefits of targeted interventions focused on reducing the burden of chronic disease events in a large population from real-world multi-dimensional prevention initiatives like Million Hearts®. Developing and setting ambitious national goals and targets for how to get there has provided an important platform for focused CVD

prevention efforts. Importantly, high-quality and timely data may better inform and redirect such initiatives. This addendum further emphasizes the challenges and opportunities presented in addressing the ongoing CVD epidemic in the United States.

References

1. Ritchey MD, Loustalot F, Wall HK, Steiner CA, Gillespie C, George MG, Wright JS. Million Hearts: Description of the national surveillance and modeling methodology used to monitor the number of cardiovascular events prevented during 2012–2016. *J Am Heart Assoc.* 2017;6(5):pii: e006021.
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3. Ritchey MD, Wall HK, George MG, Wright JS. US trends in premature heart disease mortality over the past 50 years: Where do we go from here? *Trends Cardiovasc Med.* 2019;pii: S1050-1738(19)30134-3.