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Supplementary Appendix 1. Estimation and decomposition of trends.

Estimation of Trends

For each outcome, we estimated trends in terms of the annual average absolute amount of change and the relative (percentage) change during 2001-2014. For estimating the change in amounts, we used ordinary least squares regression. For estimating the annual average percentage change (AAPC), we used a joinpoint regression model as shown in this equation.

$$AAPC = \left\{exp\left(\frac{\sum w_i b_i}{\sum w_i}\right) - 1\right\} * 100 \quad (1)$$

Which is the average of the slope coefficient joinpoint regression line weighted by the length of each segment, where w_i=length or year period of each segment over the interval, and b_i=beta coefficient or slope of a segment.

We used joinpoint regression because the plots of raw data (figure 2 a-g) clearly show that for most outcomes, the patterns are not linear. The assumption of average constant growth over the entire series would not be appropriate, as it does not take into account the variation in the trends in the series (1).

Decomposition of Trends in Total Costs

After we estimated the AAPC in diabetes-related preventable hospitalization costs and its contributing factors, we estimated the contribution of each factor in terms of its proportional contribution and its share in the percent trends.

For decomposition of trends in total cost, we borrowed the methods from Dunn et al. (2). For example, at the first level, given that total cost (tc_t) at time t is the product of the total number of preventable hospitalizations ($hosp_t$) and mean cost per admission (mc_t), then the medical cost growth can be decomposed into that attributable to two factors as follows:

$$TC_t = HOSP_t + MC_t + \frac{(hosp_t - hosp_0)(mc_t - mc_0)}{(tc_0)} - 1 \quad (2)$$

Where TC_t is total cost growth index, a ratio of total cost at time t (tc_t) to that at time 0 (i.e. $TC_t = \frac{tc_t}{tc_0}$). Similarly, growth indices for the total number of preventable hospitalizations and mean cost per admission are ($HOSP_t = \frac{hosp_t}{hosp_0}$) and ($MC_t = \frac{mc_t}{mc_0}$), respectively. Alternatively, the decomposition using natural logarithms is;

$$ln(TC_t) = ln(HOSP_t) + ln(MC_t) \quad (3)$$

This shows that the total cost between two time periods will change if there is any change in the growth in the total number of preventable hospitalization or mean cost per admission.

As described above, most patterns of data series are not linear. We used AAPC estimates from joinpoint regression to calculate the proportional contribution of factors contributing to the changes in total costs. For this, we converted the coefficient to the natural logarithm of growth and then applied the approach as shown in equation 3.

We also decomposed the trends in total costs between 2001 and 2014 assuming a linear growth. For this, we estimated the annual average percentage change using equation 4 below (3) and applied equation 3 to calculate contribution of factors to the trends in costs.

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$$AAPC = \left(\left(\frac{Value\ in\ final\ year}{Value\ in\ base\ year}\right)^{\frac{1}{period}} - 1\right) * 100 \quad (4)$$

Where period=2014 – 2001=13. The decomposition results based on the linear growth assumption is presented in Supplementary Table 2.

References

1. Clegg LX, Hankey BF, Tiwari R, Feuer EJ, Edwards BK: Estimating average annual per cent change in trend analysis. Stat Med 2009;28:3670-3682

2. Dunn A LE, Shapiro AH.: Decomposing Medical-Care Expenditure Growth, NBER Working Paper No. 23117. JEL No. I10,I11. Accessed (11/06/2017), Available at: http://www.nber.org/papers/w23117.pdf. 2017;

3. Pfuntner A, Wier LM, Steiner C: Costs for Hospital Stays in the United States, 2010: Statistical Brief #146. In *Healthcare Cost and Utilization Project (HCUP) Statistical Briefs* Rockville (MD), 2006

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Supplementary Table 1. Estimates of annual average percentage trends in diabetes-related preventable hospitalization costs, total and by contributing factors; overall and by condition, 2001-2014, using joinpoint regressions

Cost/Contributors	Any condition	Short-term complication	Long-term complication	Uncontrolled Diabetes	Lower Extremity Amputation
Trends in total costs	1.55%	4.17%	1.50%	-2.60%	1.88%
Proportional share of the trends in costs:					
No. of preventable hospitalizations	0.75	1.11	0.4	1.2	0.73
No. of people with diabetes	3.21	0.96	9.32	-1.07	3.26
Rate of preventable hospitalizations	-2.21	0.04	-8.32	2.07	-2.26
Mean cost per admission	0.75	1.11	0.4	1.2	0.73
Mean length of stay	3.21	0.96	9.32	-1.07	3.26
Mean cost per day	-2.21	0.04	-8.32	2.07	-2.26
No. of people with diabetes	2.42	1.06	3.72	-1.28	2.4
Rate of preventable hospitalizations	-1.66	0.04	-3.32	2.48	-1.66
Mean length of stay	-0.81	-0.42	-0.65	0.21	-0.83
Mean cost per day	1.06	0.32	1.25	-0.41	1.1
Share of the trends in costs:					
No of preventable hospitalizations	1.17%	4.61%	0.60%	-3.12%	1.38%
No. of people with diabetes	3.75%	4.43%	5.58%	3.33%	4.51%
Rate of preventable hospitalizations	-2.58%	0.18%	-4.98%	-6.45%	-3.13%
Mean cost per admission	0.38%	-0.44%	0.90%	0.52%	0.50%
Mean length of stay	-1.26%	-1.76%	-0.98%	-0.56%	-1.56%
Mean cost per day	1.64%	1.32%	1.88%	1.08%	2.06%

Notes: The estimated trends were based on joinpoint regressions. Costs were evaluated at 2014 US$ using the gross domestic product deflator.

SUPPLEMENTARY DATA

Supplementary Table 2. Estimates of annual percentage trends in diabetes-related preventable hospitalization costs, total and by contributing factors; overall and by condition, between 2001 and 2014, assuming linear growth.

Cost/Contributors	Any condition	Short-term complication	Long-term complication	Uncontrolled Diabetes	Lower Extremity Amputation
Trends in total costs	2.05%	4.24%	1.71%	-2.87%	2.10%
Proportional share of the trends in costs:					
No. of preventable hospitalizations	0.62	1.04	0.37	1.49	0.72
No. of people with diabetes	3.17	0.93	6.37	-0.92	2.67
Rate of preventable hospitalizations	-2.17	0.07	-5.37	1.92	-1.67
Mean cost per admission	0.38	-0.04	0.63	-0.49	0.28
Mean length of stay	-1.58	9.26	-0.84	-0.68	-2.84
Mean cost per day	2.58	-8.26	1.84	1.68	3.84
No. of people with diabetes	1.97	0.96	2.36	-1.37	1.92
Rate of preventable hospitalizations	-1.35	0.08	-1.99	2.86	-1.2
Mean length of stay	-0.6	-0.37	-0.53	0.33	-0.79
Mean cost per day	0.98	0.33	1.16	-0.82	1.08
Share of the trends in costs:					
No of preventable hospitalizations	1.27%	4.41%	0.63%	-4.28%	1.51%
No. of people with diabetes	4.04%	4.08%	4.03%	3.94%	4.04%
Rate of preventable hospitalizations	-2.77%	0.33%	-3.40%	-8.22%	-2.53%
Mean cost per admission	0.77%	-0.17%	1.08%	1.41%	0.59%
Mean length of stay	-1.22%	-1.56%	-0.90%	-0.95%	-1.67%
Mean cost per day	2.00%	1.39%	1.98%	2.36%	2.26%

Notes: The estimated trends were based on linear growth assumption. Costs were evaluated at 2014 US$ using the gross domestic product deflator.