Institute for Healthcare Improvement

“Trillion Dollar Checkbook”

Reduce Waste and Cost in the US Health Care System

IHI Leadership Alliance

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Executive Summary

The IHI Leadership Alliance is a dynamic collaboration of US health care executives who share a goal to deliver on the full promise of the IHI Triple Aim: better care for individuals, better health for populations, and lower per capita health care costs. Alliance members believe that eliminating "waste" in health care — defined as resources expended in money, time, and/or personnel that do not add value for the patient, family, or community — is essential to providing care at an affordable cost. In some cases, this non-value-added waste can even harm patients, adding further cost.

This "Trillion Dollar Checkbook" compendium, developed by the Alliance, offers an in-depth analysis of significant and in many cases complex opportunities to reduce waste and cost in the United States health care system. The premise of the Checkbook is that successful waste reduction in the US health care system would, in effect, enable writing a "check" back to the American people or repurposing those savings to support essential patient-care services or meet community needs.

In the Checkbook, each of the specific improvement ideas for reducing waste includes:

- A summary of the literature scan;
- National estimates of total waste and potential savings across the US;
- Suggested resources to help organizations begin work in each area; and
- Calculations that describe how the estimated cost savings are derived, inflated to 2018 impact.

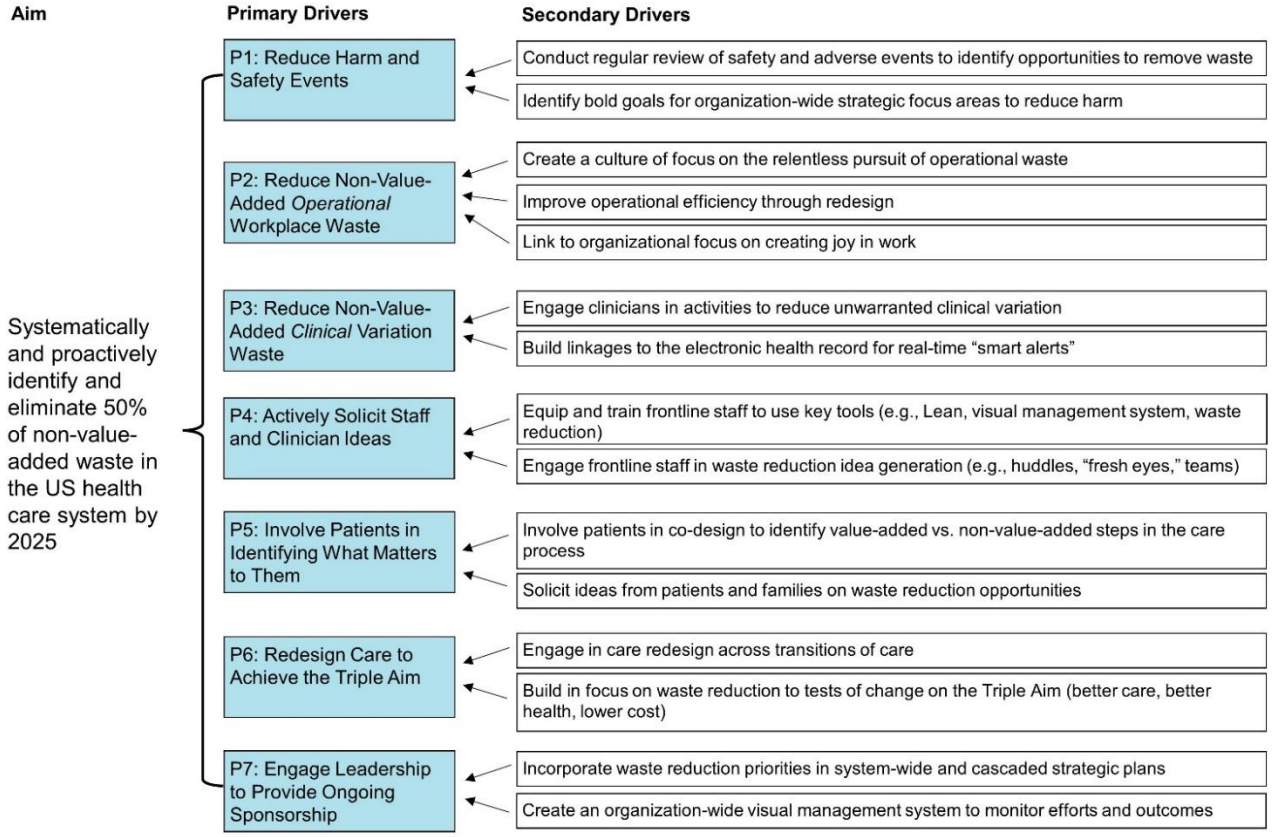
This Checkbook compendium provides additional detail to the accompanying IHI Leadership Alliance *Call to Action*.[1]

[1] Macfie H, Leo J. IHI Leadership Alliance. *Call to Action: Reduce Waste in the US Health Care System and Return the Cost Savings to Patients and the Economy*. Boston: Institute for Healthcare Improvement; 2019. http://www.ihi.org/Engage/collaboratives/LeadershipAlliance/Documents/IHILeadershipAlliance_CallToAction_ReduceWasteUSHealthCareSystem.pdf

A Framework for Reducing Waste

The IHI Leadership Alliance Waste Workgroup began its analysis of opportunities for waste reduction in health care, described in this "Trillion Dollar Checkbook," by first developing a driver diagram. The diagram articulates an audacious aim — **"Systematically and proactively identify and eliminate 50 percent of non-value-added waste in the US health care system by 2025"** — along with seven primary drivers (noted as P1 through P7) that will lead to attaining this aim, and secondary drivers or tactics for each primary driver (see Figure 1).[2] Together, the driver diagram and the Checkbook create a broad strategic framework for removing non-value-added waste in health care.

Figure 1. Driver Diagram for Reducing Waste and Cost in the US Health Care System



[2] IHI Leadership Alliance Waste Workgroup. "A Driver Diagram to Systematically and Proactively Identify and Eliminate Non-Value-Added Waste in the US Health Care System by 2025." Boston: Institute for Healthcare Improvement; 2019. http://www.ihi.org/Engage/collaboratives/LeadershipAlliance/Documents/IHILeadershipAllianceWasteWorkgroup_DriverDiagram.pdf

The primary and secondary drivers, as well as the specific improvement ideas described in this compendium, were sourced by Alliance members — derived from their own experience within their health systems — at several in-person meetings and during virtual roundtable sessions. Based on these definitions, members of the Leadership Alliance and the IHI Innovation team conducted targeted literature scans using Google Scholar on each specific improvement idea for waste reduction. Primary driver "P7: Engage Leadership to Provide Ongoing Sponsorship" is an essential component of the other six drivers; leadership commitment is needed to provide the resources and strategic prioritization to the overall waste reduction work.

The Checkbook organizes the specific improvement ideas to reduce waste by the six primary drivers (P1 through P6). Where possible, national estimates of total waste and potential savings are included.* Otherwise, results from studies of one or several health systems were extrapolated nationally using hospital beds, number of cases, population, etc. The definition of "savings" for each improvement idea may vary, although most estimates are based on analyses of claims data, cost-accounting data, or adjusted claims data using cost-to-charge ratios. Costs were then adjusted to 2018 using an online inflation calculator.[3]

In the Checkbook, each specific improvement idea for the six primary drivers includes:

- A summary of the literature scan;
- Key Literature Sources to Support Checkbook Estimates: National estimates of total waste and potential savings across the US;
- Getting Started: Suggested resources to help organizations begin work in each area; and
- Checkbook Calculations: Describe how the estimated cost savings are derived.

The Checkbook is a "living document" that needs to be refined over time as learning occurs, and as additional opportunities to reduce waste are identified and further quantified. In its current iteration, the Checkbook is focused on waste in the US health care system. However, members of the IHI Health Improvement Alliance Europe note that much of the same non-value-added waste also exists in other countries' health systems, presenting an opportunity to collaborate and share solutions more globally.

**Note: The IHI Leadership Alliance Waste Workgroup understands that the potential cost savings cited herein constitute gross estimates and we strived to be conservative. These estimates are intended to be directionally informative in helping institutions prioritize their efforts based on the magnitude of potential savings and the varying complexity surrounding each of the forms of waste. In addition, we realize that there are other forms of waste that certainly could be added to the Checkbook, and we welcome further conversation on items for consideration.*

[3] The Inflation Calculator. Morgan Friedman. https://westegg.com/inflation/#

P1: Reduce Harm and Safety Events

P1: Infections

A 2013 meta-analysis on the cost and financial impact of hospital-acquired infections (HAIs) identified five major HAIs — surgical site infection (SSI), central line-associated bloodstream infection (CLABSI), catheter-associated urinary tract infection (CAUTI), ventilator-associated pneumonia (VAP), and *Clostridium difficile* infection (CDI) — as the most common, costly, preventable, and well-tracked infections among hospitalized patients.[4]

Key Literature Sources to Support Checkbook Estimates

- A literature review on the most frequent HAIs found that between 50 and 70 percent[5,6,7] of these infections were preventable with current evidence-based practices.
- **Reducing these HAIs by the percentages described in the Checkbook Calculations table below would save approximately $6.2 billion in direct acute care medical costs to US hospitals in 2018 dollars over a one-year period.[8]**

Getting Started

- *Preventing Ventilator-Associated Events Change Package*. Health Research Educational Trust (HRET). www.hret-hiin.org/Resources/vae/17/preventing-ventilator-associated-events-change-package.pdf
- *Central Line-Associated Bloodstream Infection (CLASBI) Change Package*. HRET. www.hret-hiin.org/Resources/clabsi/17/central-line-associated-bloodstream-infection-clabsi-change-package.pdf
- *Catheter-Associated Urinary Tract Infection (CAUTI) Change Package*. HRET. www.hret-hiin.org/Resources/cauti/17/catheter-associated-urinary-tract-infection-cauti-change-package.pdf
- *Surgical Site Infections Change Package*. HRET. www.hret-hiin.org/Resources/ssi/17/surgical-site-infections-change-package.pdf
- Actionable Patient Safety Solutions (APSS). Patient Safety Movement. https://patientsafetymovement.org/actionable-solutions/actionable-patient-safety-solutions-apss/

[4] Zimlichman E, Henderson D, Tamir O, et al. Health care-associated infections: A meta-analysis of costs and financial impact on the US health care system. *JAMA Intern Med*. 2013;173(22):2039-2046.
[5] Umscheid CA, Mitchell MD, Doshi JA, Agarwal R, Williams K, Brennan PJ. Estimating the proportion of healthcare-associated infections that are reasonably preventable and the related mortality and costs. *Infect Control Hosp Epidemiol*. 2011;32(2):101-114.
[6] Gerding DN, Muto CA, Owens RC. Measures to control and prevent Clostridium difficile infection. *Clin Infect Dis*. 2008;46(Suppl 1):S43-S49.
[7] Prescott HC, Dickson RP, Rogers MA, Langa KM, Iwashyna TJ. Hospitalization type and subsequent severe sepsis. *Am J Respir Crit Care Med*. 2015 Sep 1;192(5):581-588.
[8] Most studies included in the literature review reported attributable cost per case. For those that reported charges, cost-to-charge ratio of 0.5 was used. A total of 26 articles were in the review. Authors averaged the point estimates of each study (weighted by sample size) to arrive at per case cost of each HAI.

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Infection	Incidence	Cost per Case	Lower Cost Burden[1]	Upper Cost Burden	Percentage Preventable	Potential Cost Savings Using Midpoint (2012)	Potential Cost Savings Using Midpoint (2018 Inflation Adjustment)
SSI	158,639	$20,786	$3b	$3.6b	55%	$1.8b	$2b
CLABSI	40,411	$45,814	$1.2b	$2.6b	65%	$1.2b	$1.4b
CAUTI	77,079	$896	$18.8m	$37m	70%	$19.5m	$21.9m
VAP	31,130	$40,144	$2.8b	$3.4b	55%	$1.7b	$1.9b
CDI	133,657	$11,285	$1.2b	$1.8b	50%	$754m	$850m
Total						**$5.5b**	**$6.2b**

P1: Sepsis

In the US, sepsis occurs in more than 750,000 patients every year and is responsible for more than 210,000 deaths.[9]

Key Literature Sources to Support Checkbook Estimates

- The AHRQ funded Healthcare Cost and Utilization Project (HCUP) reported sepsis to be the most expensive condition treated in US hospitals across all payers, totaling $23.6 billion in aggregate hospital costs across 1.3 million hospital stays in 2013.[10]
- One 2010 study analyzed the Nationwide Inpatient Sample database to investigate healthcare-associated sepsis and found the attributable hospital cost per case to be $32,900 for surgical and $5,800 for non-surgical patients.[11,12] Assuming 30 percent[13] of cases are surgical, we can estimate a blended cost per case of $13,930.
- **Applying this rate and a 20 to 25 percent reduction[14] in cost per case to the 2013 hospital stay count yields estimated savings to acute care facilities of $4.6 billion to $5.7 billion in 2018 US dollars over a one-year period.**

Getting Started

- Hour-1 Bundle. Surviving Sepsis Campaign. http://www.survivingsepsis.org/Bundles/Pages/default.aspx
- Early Detection and Treatment of Sepsis. Patient Safety Movement. https://patientsafetymovement.org/actionable-solutions/challenge-solutions/early-detection-and-treatment-of-sepsis/

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Total Number of Sepsis Hospitalizations	Cost per Case (2006)	Total Cost Burden	Estimated Cost Savings Assuming 20% Reduced Cost per Case (2018 Inflation Adjustment)	Estimated Cost Savings Assuming 25% Reduced Cost per Case (2018 Inflation Adjustment)
1,297,000	$13,930	$18.1b	$4.6b	$5.7b

[9] Skrupky LP, Kerby PW, Hotchkiss RS. Advances in the management of sepsis and the understanding of key immunologic defects. *Survey of Anesthesiology*. 2012;56(6):273-275.
[10] *National Inpatient Hospital Costs: The Most Expensive Conditions by Payer, 2013*. Healthcare Cost and Utilization Project (HCUP). https://www.hcup-us.ahrq.gov/reports/statbriefs/sb204-Most-Expensive-Hospital-Conditions.jsp
[11] Eber MR, Laxminarayan R, Perencevich EN, Malani A. Clinical and economic outcomes attributable to health care–associated sepsis and pneumonia. *Arch Intern Med*. 2010;170(4):347-353.
[12] Used National Inpatient Sample database to identify hospital-acquired sepsis cases among 59 million discharges from US hospitals in 40 states between 2001 and 2006. Sepsis identified in 494k cases. Hospital-specific cost-to-charge ratios used. Attributable hospital costs estimated using multivariate matching and regression analysis. Analyzed surgical and non-surgical patients separately.
[13] Vogel TR, Dombrovskiy VY, Lowry SF. Trends in postoperative sepsis: Are we improving outcomes? *Surg Infect (Larchmt)*. 2009;10(1):71-78.
[14] Based on experience at MemorialCare Health System in reducing sepsis cost per case.

P1: Medication Safety

Medication reconciliation is the process of creating and validating an accurate list of medications to ensure the provision of correct medication use across the continuum of care. A systematic review of the literature on medication reconciliation during transitions of care found that the median proportion of patients with at least one clinically significant medication discrepancy to be 45 percent.[15]

Key Literature Sources to Support Checkbook Estimates

- One academic medical center evaluated the results of a pharmacy-facilitated discharge counseling and medication reconciliation program and realized a 27 percent reduction in all-cause readmissions rate following implementation.[16]
- **Applying these results to the national readmission rate of 13.9 percent and an average cost of readmission between $10,100 and $14,200 per HCUP,[17,18] we can estimate savings between $14.7 billion and $20.7 billion in 2018 US dollars to inpatient providers over a one-year period.**

Getting Started

- *How-to Guide: Prevent Adverse Drug Events (Medication Reconciliation)*. Institute for Healthcare Improvement (IHI). http://www.ihi.org/resources/Pages/Tools/HowtoGuidePreventAdverseDrugEvents.aspx
- *Medication Reconciliation Review*. IHI. http://www.ihi.org/resources/Pages/Tools/MedicationReconciliationReview.aspx
- *Medication Reconciliation Tracking Tool*. IHI. http://www.ihi.org/resources/Pages/Tools/ReconciliationTrackingTool.aspx
- Medication Safety. Patient Safety Movement. https://patientsafetymovement.org/actionable-solutions/challenge-solutions/medication-safety/

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

2013 Readmission Rate	Total Number of Readmissions	Total Number of Readmissions Avoided Assuming 27% Reduction	Lower Bound Cost per Readmission (2013)	Upper Bound Cost per Readmission (2013)	Lower Bound Total Cost Savings (2018 Inflation Adjustment)	Upper Bound Total Cost Savings (2018 Inflation Adjustment)
0.139	4,887,092	1,319,515	$10,100	$14,200	$14.7b	$20.7b

[15] Kwan JL, Lo L, Sampson M, Shojania KG. Medication reconciliation during transitions of care as a patient safety strategy: A systematic review. *Ann Intern Med*. 2013;158:397-403.
[16] Zemaitis CT, Morris G, Cabie M, Abdelghany O, Lee L. Reducing readmission at an academic medical center: Results of a pharmacy-facilitated discharge counseling and medication reconciliation program. *Hosp Pharm*. 2016;51(6):468-473.
[17] Barrett ML, Wier LM, Jiang HJ, Steiner CA. *All-Cause Readmissions by Payer and Age, 2009–2013*. HCUP Statistical Brief #199. Rockville, MD: Agency for Healthcare Research and Quality; December 2015. http://www.hcupus.ahrq.gov/reports/statbriefs/sb199-Readmissions-Payer-Age.pdf
[18] Total hospital charges were converted to costs using HCUP Cost-to-Charge Ratios based on hospital accounting reports from the Centers for Medicare & Medicaid Services (CMS). Costs reflect the actual expenses incurred in the production of hospital services, such as wages, supplies, and utility costs; charges represent the amount a hospital billed for the case.

P1: Opioid Use

One study estimated the total burden of opioid abuse on the US health care system — accounting for costs related to research, prevention, and absenteeism — at $25 billion in 2007.[19]

Key Literature Sources to Support Checkbook Estimates

- Estimated direct medical costs of opioid drug overdoses are based on applying the average cost per overdose of $4,006[20] to the estimated 1.3 million opioid poisoning events (inpatient admissions and ED visits) per HCUP.[21] Between 2006 and 2013 the Oregon Health Authority (OHA) saw a 22 percent decrease in morphine milligram equivalents (MME) per person after the implementation of a prescription monitoring program. During this same period OHA also experienced a 38 percent reduction in opioid poisoning events.[22] **Assuming a 38 percent reduction to the 1.3 million annual poisoning events and applying the $4,006 cost per case, potential savings are estimated at $2.3 billion in direct medical, ambulatory, and naloxone costs in 2018 dollars over a one-year period.**
- In addition to opioid poisoning events, chronic opioid therapy also contributes to excess costs to the health care system. One study analyzed all-cause medical costs in chronic opioid users between one year prior to initial opioid prescription and one year following initial prescription, finding increased costs of $15,935 per patient.[23] Current prevalence studies estimate roughly 8 million Americans take opioids for chronic pain management.[24] Another study evaluating adult opioid prescribing in Massachusetts found that between 6 percent and 11 percent of adults prescribed opioids received at least one potentially inappropriate prescription. **Assuming between 6 percent and 11 percent of the 8 million chronic opioid users could have been avoided or received an alternative treatment, estimated savings are between $8.8 billion and $16.1 billion in 2018 US dollars over a one-year period.**

Getting Started

- *Stem the Tide: Addressing the Opioid Epidemic*. American Hospital Association. https://www.aha.org/system/files/content/17/opioid-toolkit.pdf
- *Accelerating Opioid Safety Ambulatory Care Toolkit*. California Health Care Foundation. http://www.calquality.org/storage/documents/Toolkits/AcceleratingOpioidSafety_Ambulatory_Care_Toolkit.pdf
- Opioid Safe Hospital Designation. Cal Hospital Compare. http://calhospitalcompare.org/about/opioid-safe-hospital-designation-program/
- *Actionable Patient Safety Solution (APSS) #4: Failure to Rescue: Monitoring for Opioid-Induced Respiratory Depression*. Patient Safety Movement. https://patientsafetymovement.org/wp-content/uploads/2016/02/APSS-4_-Failure-to-Rescue_-Monitoring-for-Opioid-induced-Respiratory-Depression-081518-1.pdf

[19] Birnbaum HG, White AG, Schiller M, Waldman T, Cleveland JM, Roland CL. Societal costs of prescription opioid abuse, dependence, and misuse in the United States. *Pain Medicine*. 2011;12(4):657-667.
[20] Inocencio TJ, Carroll NV, Read EJ, Holdford DA. The economic burden of opioid-related poisoning in the United States. *Pain Medicine*. 2013 Oct;14(10):1534-1547.
[21] Weiss AJ, Elixhauser A, Barrett ML, Steiner CA, Bailey MK, O'Malley L. *Opioid-Related Inpatient Stays and Emergency Department Visits by State, 2009–2014*. HCUP Statistical Brief #219. Rockville, MD: Agency for Healthcare Research and Quality; December 2016. http://www.hcupus.ahrq.gov/reports/statbriefs/sb219-Opioid-Hospital-Stays-ED-Visits-by-State.pdf
[22] *Oregon Prescription Drug Overdose, Misuse, and Dependency Prevention Plan*. Oregon Health Authority; November 2015. https://www.oregon.gov/oha/PH/PREVENTIONWELLNESS/SUBSTANCEUSE/OPIOIDS/Documents/prescription-drug-overdose-state-plan.pdf
[23] Kern DM, Zhou S, Chavoshi S, Tunceli O, Sostek M, Singer J, LoCasale RJ. Treatment patterns, healthcare utilization, and costs of chronic opioid treatment for non-cancer pain in the United States. *Am J Manag Care*. 2015;21(3):e222-e234.
[24] Baldini A, Von Korff M, Lin EH. A review of potential adverse effects of long-term opioid therapy: A practitioner's guide. *Prim Care Companion CNS Disord*. 2012;14(3):PCC.11m01326.

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Total Number of Opioid Poisoning Events	Cost per Poisoning Event (2011)	Total Number of Opioid Poisoning Events Avoided Assuming 38% Reduction	Total Cost Savings (2011)	Total Cost Savings (2018 Inflation Adjustment)
1,299,831	$4,006	493,900	$2b	$2.3b

Total Number of Chronic Opioid Users	Lower Bound Number of Chronic Opioid Users Receiving Inappropriate Prescriptions	Upper Bound Number of Chronic Opioid Users Receiving Inappropriate Prescriptions	Added All-Cause Medical Cost per Chronic Opioid User (2011)	Lower Bound Potential Cost Savings (2018 Inflation Adjustment)	Upper Bound Potential Cost Savings (2018 Inflation Adjustment)
8,000,000	480,000	880,000	$15,935	$8.8b	$16.1b

P1: Overdiagnosis

In addition to wasting resources, overdiagnosis can cause a wide range of physical and psychological patient harm, from minor to fatal.

Key Literature Sources to Support Checkbook Estimates

- *C. difficile* infection, breast cancer screening, hypertension, pre-diabetes, and asthma were all highlighted by *The BMJ* as conditions or tests that are commonly overused or overdiagnosed.[25] **Reducing the rates of diagnosis/usage of all six conditions/tests by 25 percent would yield total estimated savings of $33.7 billion over a one-year period.**

Getting Started

- *Improving Value: Putting a Strategic Focus on Overdiagnosis*. Memorial Care. http://app.ihi.org/FacultyDocuments/Events/Event-3135/Presentation-17764/Document-14234/Presentation_C21_Improving_Value.pdf
- Welch HG, Schwartz L, Woloshin S. *Overdiagnosed: Making People Sick in the Pursuit of Health*. New York: Random House, Inc.; 2012.
- Therapy (NNT) Reviews. The NNT Group. http://www.thennt.com/home-nnt/
  [Number needed to treat (NNT) for benefit and harm of many common conditions]

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Condition/Test	Cost per Case (2018)	Total Number of Cases	Assumed Percentage Reduction	Estimated Cost Savings (2018)
Breast Cancer Screenings	$345[26]	22,600,000[27]	25%	$2b
Hypertension	$410[28]	77,900,000[29]	25%	$8b
Pre-Diabetes	$511[30]	86,000,000[30]	25%	$11b
Asthma	$4,166[31]	12,000,000[32]	25%	$12.5b
C. difficile Infection	$2,376[33,34]	453,000[35]	25%	$269m
Total				**$33.7b**

[25] Too much medicine. *The BMJ*. https://www.bmj.com/too-much-medicine
[26] Odonoghue C, Eklund M, Ozanne EM, Esserman LJ. Aggregate cost of mammography screening in the United States: Comparison of current practice and advocated guidelines. *Annals of Internal Medicine*. 2014;160(3):145.
[27] FastStats: Mammography. Centers for Disease Control and Prevention. https://www.cdc.gov/nchs/fastats/mammography.htm
[28] Martin SA, Boucher M, Wright JM, Saini V. Mild hypertension in people at low risk. *BMJ*. 2014;349:g5432.
[29] Go AS, Mozaffarian D, Roger VL, et al.; on behalf of the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2013 update: A report from the American Heart Association. *Circulation*. 2013; 127:e6-e245.
[30] Economic Burden of Prediabetes Up 74 Percent Over Five Years. American Diabetes Association. November 20, 2014.
[31] Cost of Asthma on Society. Asthma and Allergy Foundation of America. https://www.aafa.org/cost-of-asthma-on-society/
[32] Vital Signs: Asthma in the US. Centers for Disease Control and Prevention. https://www.cdc.gov/vitalsigns/asthma/index.html
[33] Cost of drug treatment for C. diff can range from $1,392 (10-day supply of oral vancomycin 125 mg four times daily) to $3,360 (10-day course of fidaxomicin 200 mg twice daily).
[34] Cruz MP. Fidaxomicin (Dificid), a novel oral macrocyclic antibacterial agent for the treatment of Clostridium difficile-associated diarrhea in adults. *P T*. 2012;37(5):278-281.
[35] Roos R. CDC puts C. difficile burden at 453,000 cases, 29,000 deaths. *University of Minnesota Center for Infectious Disease Research and Policy News*. February 25, 2015. http://www.cidrap.umn.edu/news-perspective/2015/02/cdc-puts-c-difficile-burden-453000-cases-29000-deaths

P1: Staff Injuries

On average, US hospitals report 6.8 workplace injuries/illnesses per 100 full-time employees, nearly double the national average.[36] Interventions like the use of patient lifts have demonstrated reduction in musculoskeletal injuries among nursing staff, with some hospitals reporting injury rate reductions of as much as 40 percent.[37,38,39]

Key Literature Sources to Support Checkbook Estimates

- A report by UL Environmental Health & Safety (EHS) estimates that health care workplace injuries cost hospitals $6.2 billion and estimates hospital costs (in lost work time) of $73,000 per employee with an injury.[40]
- Per the Occupational Safety and Health Administration (OSHA), nearly 59,000 health care workers had an injury causing at least 2 days of lost work in 2011.[41]
- **Assuming 30 percent reduction in workplace injuries and using the EHS and OSHA estimates, hospitals could save approximately $1.4 billion in 2018 US dollars over a one-year period.**

Getting Started

- *Optimizing a Business Case for Safe Health Care: An Integrated Approach to Safety and Finance*. Institute for Healthcare Improvement. http://www.ihi.org/resources/Pages/Tools/Business-Case-for-Safe-Health-Care.aspx
- *Leading a Culture of Safety: A Blueprint for Success*. Institute for Healthcare Improvement. http://www.ihi.org/resources/Pages/Publications/Leading-a-Culture-of-Safety-A-Blueprint-for-Success.aspx

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Cost per Employee with Lost Work Days (2013)	Total Number of Employees with 2 Lost Work Days	Number of Avoidable Injuries Assuming 30% Reduction	Estimated Cost Savings (2013)	Estimated Cost Savings (2018 Inflation Adjustment)
$73,000	58,860	17,658	$1.3b	$1.4b

[36] *Worker Safety in Your Hospital: Know the Facts*. Occupational Safety and Health Administration. https://www.osha.gov/dsg/hospitals/documents/1.1_Data_highlights_508.pdf
[37] A review of patient lifting interventions to reduce health care worker injuries. *Workplace Health & Safety*. 2015;63(6):267-275.
[38] Li J, Wolf L, Evanoff B. Use of mechanical patient lifts decreased musculoskeletal symptoms and injuries among health care workers. *Injury Prevention*. 2004;10:212-216.
[39] Schoenfisch AL, Lipscomb HJ, Pompeii LA, Myers DJ, Dement JM. Musculoskeletal injuries among hospital patient care staff before and after implementation of patient lift and transfer equipment. *Scandinavian Journal of Work, Environment & Health*. 2012;39(1):27-36.
[40] Workplace injuries cost healthcare $13B: What hospitals can do. *Becker's Hospital Review*. November 21, 2013. https://www.beckershospitalreview.com/human-capital-and-risk/workplace-injuries-cost-healthcare-13b-what-hospitals-can-do.html
[41] *Facts about Hospital Worker Safety*. Occupational Safety and Health Administration; September 2013. https://www.osha.gov/dsg/hospitals/documents/1.2_Factbook_508.pdf

P1: Hospital-Acquired Conditions

Falls, pressure ulcers, and venous thromboembolism (VTE) are among the most prevalent hospital-acquired conditions (HACs) in the US.

Key Literature Sources to Support Checkbook Estimates

- A meta-analysis of the additional costs attributable to these three HACs found an estimated cost per case of $14,506 to $18,537 for pressure ulcers, $6,694 to $7,888 for falls, and $8,723 to $17,367 for VTE. Additional costs are defined as the incremental costs to the hospital for the inpatient stay attributable with the HAC.
- A "Stop the Pressure" campaign implemented by NHS Midland and East in the United Kingdom saw a 50 percent reduction in the rate of pressure ulcers during the campaign's first year.[42] A seven-hospital collaborative sponsored by The Joint Commission Center for Transforming Healthcare demonstrated aggregate reductions of 62 percent in the falls with injury rate and 35 percent in total falls rate.[43] Evidence-based strategies and risk assessments for VTE prevention by various collaboratives has demonstrated nearly 40 percent reduction in VTE rates.[44]
- Estimates of HAC annual prevalence suggest that there are 670,767 patient admissions with at least one pressure ulcer, 547,596 adult VTE hospitalizations, and approximately 850,000 hospital falls per year. **Using these cost and prevalence estimates and assuming a 30 percent[45] reduction across all three conditions, estimated savings are between $6.4 billion and $9.1 billion in 2018 US dollars over one-year period.**

Getting Started

- Boushon B, Nielsen G, Quigley P, et al. *Transforming Care at the Bedside How-to Guide: Reducing Patient Injuries from Falls*. Institute for Healthcare Improvement. http://www.ihi.org/resources/Pages/Tools/TCABHowToGuideReducingPatientInjuriesfromFalls.aspx
- *Actionable Patient Safety Solution (APSS) #14: Falls and Fall Prevention*. Patient Safety Movement. https://patientsafetymovement.org/wp-content/uploads/2017/10/APSS-14_-Falls-and-Fall-Prevention-081518-1.pdf
- *How-to Guide: Prevent Pressure Ulcers*. Institute for Healthcare Improvement. http://www.ihi.org/resources/Pages/Tools/HowtoGuidePreventPressureUlcers.aspx

[42] Stop the Pressure: NHS Improvement. http://www.nhs.stopthepressure.co.uk/
[43] *Preventing Patient Falls: A Systematic Approach from The Joint Commission Center for Transforming Healthcare Project*. Chicago: Health Research & Educational Trust; October 2016.
[44] Maynard G. *Preventing Hospital-Associated Venous Thromboembolism: A Guide for Effective Quality Improvement* (2nd ed). Rockville, MD: Agency for Healthcare Research and Quality; August 2016. AHRQ Publication No. 16-0001-EF.
[45] Haines TP, Bennell KL, Osborne RH, Hill KD. Effectiveness of targeted falls prevention programme in subacute hospital setting: Randomised controlled trial. *BMJ*. 2004;328(7441):676.

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Condition	Lower Bound Cost (2015)	Upper Bound Cost (2015)	Total Number of Cases	Percentage Preventable Share	Total Number of Avoidable Cases	Lower Bound Potential Cost Savings (2018 Inflation Adjustment)	Upper Bound Potential Cost Savings (2018 Inflation Adjustment)
Pressure Ulcers	$14,506	$18,537	670,767	30%	201,230	$3.1b	$4b
VTE	$8,723	$17,367	547,596	30%	164,278	$1.5	$3b
Falls	$6,694	$7,888	850,000	30%	255,000	$1.8b	$2.1b
Total						**$6.4b**	**$9.1b**

P1: Maternal and Child Health

An obstetric adverse event (OBAE) is an adverse maternal or fetal outcome that occurs during labor and/or birth. OBAEs can include eclampsia, infection not present on admission, injury to other body part, and fetal or maternal death, among others.

As more than one third of births in the US are delivered through C-section, appropriate use of C-sections is an increasingly important patient safety and cost consideration. Nulliparous, term singleton, vertex (NTSV) C-sections are those performed on women with first-time, low-risk pregnancies and have been targeted by California as a source of variation in California hospitals.[46]

Key Literature Sources to Support Checkbook Estimates

- A meta-analysis of the additional costs attributable to OBAEs found an estimated cost per case of $602.[47] Additional costs are defined as the incremental costs to the hospital for the inpatient stay attributable to the OBAE. **The same report estimated a total of 27,372 OBAEs occurred in 2015. Assuming a 30 percent reduction in the incidence of OBAEs, we can estimate potential savings of $5.2 million in 2018 US dollars over a one-year period.**
- A 2016 University of Minnesota study evaluated the association between improved safety practices and perinatal medical malpractice costs.[48] The 13 included hospitals were taking part in a quality improvement Collaborative focusing on reducing perinatal harm between 2006 and 2009. One year following the safety interventions, OB claims paid per 10,000 deliveries decreased from 1.9 to 1.2, and average losses paid per OB claim decreased from $1.2 million to $175,000. **Extrapolating these reductions nationally to the nearly 4 million[49] deliveries yields estimated cost savings of approximately $1.1 billion in 2018 US dollars over a one-year period.**
- A C-section adds between $2,861 and $7,000 in cost to a birth and carries higher risk of negative outcomes to both the mother and child.[50] Nationally the percent of all deliveries by C-section is 31.9 percent.[51] As of 2017 California's rate is at 24.5 percent, and HealthyPeople 2020 set a target to reduce their C-section rate to 23.9 percent from their 2012 baseline of 27 percent. An initiative at Virginia Hospital Center successfully reduced their C-section rate from 33 percent to 20 percent using a combination of monthly C-section case reviews, daily safety huddles, and increased transparency efforts.[52] **Assuming a national rate of 25 percent, reducing NTSV C-section rates to 23.9 percent across all 1.3 million C-sections performed annually is estimated to save payers between $87.1 million and $222.2 million in 2018 US dollars over a one-year period.**

[46] Healthy Beginnings: Reducing Cesarean Births. Let's Get Healthy California. https://letsgethealthy.ca.gov/goals/healthy-beginnings/reducing-first-birth-cesarean-birth-rate-ntsv/
[47] *Estimating the Additional Hospital Inpatient Cost and Mortality Associated with Selected Hospital-Acquired Conditions*. AHRQ Publication No. 18-0011-EF. Agency for Healthcare Research and Quality; November 2017. https://www.ahrq.gov/sites/default/files/publications2/files/hac-cost-report2017.pdf
[48] Riley W, Meredith LW, Price R, et al. Decreasing malpractice claims by reducing preventable perinatal harm. *Health Serv Res*. 2016;51 Suppl 3:2453-2471.
[49] FastStats: Births — Method of Delivery. Centers for Disease Control and Prevention. https://www.cdc.gov/nchs/fastats/delivery.htm
[50] *Report: Variation in NTSV C-section Rates Among California Hospitals*. Pacific Business Group on Health; October 2015. http://www.pbgh.org/storage/documents/PBGH_C-Section_NTSV_Variation_Report_Oct_2015.pdf
[51] FastStats: Births — Method of Delivery. Centers for Disease Control and Prevention. https://www.cdc.gov/nchs/fastats/delivery.htm
[52] "An Interview with Virginia Hospital Center." The Leapfrog Group. August 30, 2017. https://www.leapfroggroup.org/news-events/interview-virginia-hospital-center

Getting Started

- Maternal Quality Improvement Toolkits. California Maternal Quality Care Collaborative. https://www.cmqcc.org/resources-tool-kits/toolkits
- Neonatal Safety. Patient Safety Movement. https://patientsafetymovement.org/actionable-solutions/challenge-solutions/neonatal-safety/
- Optimizing Obstetric Safety. Patient Safety Movement. https://patientsafetymovement.org/actionable-solutions/challenge-solutions/optimizing-obstetric-safety/

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Cost per OBAE (2015)	Total Number of OBAEs	Total Cost Impact	Assumed Percentage Reduction	Estimated Cost Savings (2018 Inflation Adjustment)
$602	27,372	$16.5m	30%	$5.2m

Annual Deliveries in US (2017)	Baseline Obstetric Claims per 1,000 Deliveries	Baseline Cost per Obstetric Claim	Obstetric Claims per 1,000 Deliveries After Assumed Reduction	Cost per Obstetric Claim After Assumed Reduction	Difference in Total Cost Burden of Obstetric Claims (2006)	Estimated Cost Savings (2018 Inflation Adjustment)
3,943,384	1.9	$1.2m	1.2	$175k	$834.3m	$1.1b

Total Number of C-Sections	Total Number of Avoidable C-Sections Assuming 2% Absolute Reduction (from 26% to 24%)	Lower Bound Added C-Section Cost (2009)	Upper Bound Added C-Section Cost (2009)	Lower Bound Estimated Cost Savings (2018 Inflation Adjustment)	Upper Bound Estimated Cost Savings (2018 Inflation Adjustment)
1,272,000	25,430	$2,860	$7,300	$87.1m	$222.2m

P1: Delirium

Delirium, a sudden onset of stress and confusion complicates hospital stays for 20 percent of the 11.8 million annual hospital stays among patients 65 years of age and older. A delirium episode in an elderly patient increases mortality, increases likelihood of discharging to nursing home care, and can linger for weeks or months.[53]

Key Literature Sources to Support Checkbook Estimates

- One 2005 study estimated the total attributable cost for a patient that experienced delirium up to one-year post-discharge and found added costs between $16,000 and $64,000 per patient.[54]
- Evidence from randomized control trials testing multi-component approaches have demonstrated delirium can be prevented in up to one third of high-risk patients.[55]
- **Assuming a 30 percent reduction in delirium stays, we can estimate savings between $14.8 billion and $59.1 billion in 2018 US dollars over a one-year period.**

Getting Started

- Delirium (PDQ®): Supportive Care — Health Professional Information [National Cancer Institute]. Kaiser Permanente. https://healthy.kaiserpermanente.org/health-wellness/health-encyclopedia/he.delirium-pdq®-supportive-care-health-professional-information-nci.ncicdr0000062772#ncicdr0000062772-06
- *The Business Case for Becoming an Age-Friendly Health System*. Institute for Healthcare Improvement. http://www.ihi.org/Engage/Initiatives/Age-Friendly-Health-Systems/Documents/IHI_Business_Case_for_Becoming_Age_Friendly_Health_System.pdf
- *Age-Friendly Health Systems Inpatient ROI Calculator Instructions*. Institute for Healthcare Improvement. http://www.ihi.org/Engage/Initiatives/Age-Friendly-Health-Systems/Documents/IHI_Age_Friendly_Health_Systems_Inpatient_ROI_Calculator_Instructions.pdf
- Post-operative Delirium in Older Adults. Patient Safety Movement. https://patientsafetymovement.org/actionable-solutions/challenge-solutions/post-operative-delirium-in-older-adults/

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Lower Bound Cost per Patient (2005)	Upper Bound Cost per Patient (2005)	Total Number of Delirium Stays	Percentage of Avoidable Delirium Cases	Lower Bound Potential Cost Savings (2018 Inflation Adjustment)	Upper Bound Potential Cost Savings (2018 Inflation Adjustment)
$16,000	$64,000	2,360,000	30%	$14.8b	$59.1b

[53] McKinney M. Best practices: Hospital reduces delirium in elderly patients. *Modern Healthcare*. February 28, 2015. https://www.modernhealthcare.com/article/20150228/MAGAZINE/302289996/best-practices-hospital-reduces-delirium-in-elderly-patients
[54] Leslie DL, Inouye SK. The importance of delirium: Economic and societal costs. *J Am Geriatr Soc*. 2011;59(Suppl 2):S241–S243.
[55] Hosker C, Ward D. Hypoactive delirium. *BMJ*. 2017 May 25;357:j2047

P2: Reduce Non-Value-Added Operational Workplace Waste

P2: Drug Expiration Dating

There are two major sources that contribute to drug expiration dating waste: 1) discarding expensive new supplies in hospitals and 2) discarding medications after patients are discharged or pass away in nursing homes.

Key Literature Sources to Support Checkbook Estimates

- A case study of Newton-Wellesley Hospital in Massachusetts shows how this type of waste can manifest in hospital settings, finding that the 240-bed hospital destroyed $200,000 worth of expired drugs in one year.[56] Similar findings were observed at Tufts University Medical Center.[57] **Extrapolating these estimates to hospitals nationwide yields annual waste estimated at $790.1 million in 2018 US dollars over a one-year period.**

Getting Started

Another case study explores drug expiration dating waste is in the US Military Health System. The Department of Defense has roughly $13.6 billion in stockpiled expired drugs. In 2016 the Shelf Life Extension Program (SLEP) was implemented, yielding an estimated $2.1 billion in savings from drugs that would have been replaced. The following policy suggestions may allow other health care sectors to achieve similar savings:

- Require pharmaceutical manufacturers to do long-term stability testing.
- Conduct independent testing using an outside agency that follows the protocols used by the SLEP.
- Use the data gleaned from the drugs tested by SLEP and apply them to hospital drugs, pharmacies, home medications, etc.

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Cost of Drug Expiration Waste per Hospital Bed (2015)	Total Number of US Hospital Beds	Estimated Cost Savings (2018 Inflation Adjustment)
$833	894,574	$790.1m

[56] Allen M. The myth of drug expiration dates. *ProPublica*. July 18, 2017. https://www.propublica.org/article/the-myth-of-drug-expiration-dates
[57] Diven DG, Bartenstein DW, Carroll DR. Extending shelf life just makes sense. *Mayo Clinic Proceedings*. 2015 Nov;90(11):1471-1474.

P2: Billing Systems

The average hospital in the United States spends roughly one quarter of their budget on billing.[58]

Key Literature Sources to Support Checkbook Estimates

- A synthesis of billing and insurance related (BIR) micro-costing studies across health care sectors found $471 billion in total BIR costs to the US health care system in 2012. The same study estimated that 52 percent of BIR work is considered "added" (excess) by comparing these costs to those seen in US and Canadian Medicare.[59]
- Another study examined BIR work in the California health care system specifically, and measured BIR as a percentage of total revenue among different health care sectors.[60] The researchers found that BIR work in hospitals and commercial insurers accounts for between 7 percent and 11 percent of revenue. Annual revenue for US community hospitals is approximately $826 billion.[61]
- Applying the rates from the California-focused study, we can assume BIR-related costs between $58 billion and $91 billion. **Assuming between 52 percent of this cost is "added" (or waste), we can estimate potential savings between $30.6 billion and $48.1 billion in 2018 US dollars over a one-year period.**

Getting Started

- Consensus Statement on Improving the Prior Authorization Process. American Medical Association. https://www.ama-assn.org/sites/ama-assn.org/files/corp/media-browser/public/arc-public/prior-authorization-consensus-statement.pdf

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Total Annual Hospital Revenue (2017)	Lower Bound Revenue Attributed to Billing/ Insurance Work (7%)	Upper Bound Revenue Attributed to Billing/ Insurance Work (11%)	Percentage of Billing/Insurance Work Considered Non-Value-Added	Lower Bound Cost Savings (2018 Inflation Adjustment)	Upper Bound Cost Savings (2018 Inflation Adjustment)
$826b	$57.8b	$90.9b	52%	$30.6b	$48.1b

[58] Woolhandler S, Campbell T, Himmelstein DU. Costs of healthcare administration in the United States and Canada. *N Engl J Med*. 2003;349(8):768-775.
[59] Jiwani A, Himmelstein D, Woolhandler S, Kahn JG. Billing and insurance-related administrative costs in United States' health care: Synthesis of micro-costing evidence. *BMC Health Serv Res*. 2014 Nov 13;14:556.
Published online 2014 Nov 13. doi: 10.1186/s12913-014-0556-7
[60] Kahn JG, Kronick R, Kreger M, Gans DN. The cost of health insurance administration in California: Estimates for insurers, physicians, and hospitals. *Health Affairs*. 2005;24(6):1629-1639.
[61] Elflein J. US Hospitals: Statistics & Facts. Statista. November 6, 2018. https://www.statista.com/topics/1074/hospitals/

P2: Team-Based Care

An optimized care team provides the expertise and resources to deliver care and jointly plan and support individuals and families to better manage their own health. In designing primary care services to address prevention, health promotion, and chronic disease management, there is significant opportunity to improve outcomes and reduce costs.[62]

Key Literature Sources to Support Checkbook Estimates

- One study assessed the impact of team-based care in five primary care practices. While outcomes improved, the implementation of team-based care was not revenue neutral, leading to a 2.5 percent loss in overall primary care revenue.[63]
- The average primary care physician (PCP) generates approximately $1.4 million in primary care revenue per year.[64] Extrapolating to the total number of primary care physicians nationally (233,403), we can estimate total PCP revenue of roughly $327 billion.[65]
- **Assuming a 2.5 percent reduction in annual PCP revenue, we can estimate approximately $8.5 billion in annual savings to payers from large-scale implementation of team-based care in primary care settings in 2018 US dollars over a one-year period.**

Getting Started

- Optimize the Care Team. Institute for Healthcare Improvement. http://www.ihi.org/resources/Pages/Changes/OptimizetheCareTeam.aspx
- The Primary Care Team Guide. Improving Primary Care. http://www.improvingprimarycare.org/

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Revenue per Primary Care Physician (2016)	Total Number of US Primary Care Physicians	Total Primary Care Physician Revenue	Estimated Cost Savings Assuming 2.5% Reduction (2018 Inflation Adjustment)
$1.4m	233,403	$327.3b	$8.5b

[62] Optimize the Care Team. Institute for Healthcare Improvement. http://www.ihi.org/resources/Pages/Changes/OptimizetheCareTeam.aspx
[63] Kottke TE, Maciosek MV, Huebsch JA, et al. The financial impact of team-based care on primary care. *American Journal of Managed Care*. 2016;22(8):e283-e286.
[64] The Business of Health Care November 2016. McKesson. November 23, 2016. https://www.mckesson.com/blog/the-business-of-health-care-november-2016/
[65] The Number of Practicing Primary Care Physicians in the United States. Rockville, MD: Agency for Healthcare Research and Quality; July 2018. https://www.ahrq.gov/research/findings/factsheets/primary/pcwork1/index.html

P2: Price Variation

Reducing price variation for similar or identical health care services represents a significant opportunity to reduce waste.

Key Literature Sources to Support Checkbook Estimates

- In 2011 out-of-pocket health spending among the commercially insured population totaled $80.8 billion in the US. Of that total, $37.7 billion was spent on "shoppable services," or non-emergency services that could be scheduled in advance (e.g., hip and knee replacements, colonoscopies, flu shots, blood tests).[66] An analysis by the American Academy of Actuaries estimates that implementing reference pricing[67] broadly could result in between a 3 percent and 28 percent reduction in spending on shoppable services.[68] **Applying this percentage reduction range to 2011 out-of-pocket health spending translates to an estimated reduction of between $1.3 billion and $12.1 billion in out-of-pocket payments for shoppable services in 2018 US dollars over a one-year period**.

Getting Started

- California Regional Health Care Cost & Quality Atlas. Integrated Healthcare Association and California Health Care Foundation. https://atlas.iha.org/

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Total Cost of Out-of-Pocket Payments for Shoppable Services (2011)	Estimated Cost Savings Assuming 3% Reduction (2018 Inflation Adjustment)	Estimated Cost Savings Assuming 28% Reduction (2018 Inflation Adjustment)
$37.7b	$1.3b	$12.1

[66] Frost A, Newman D. *Spending on Shoppable Services in Health Care*. Issue Brief #11. Health Care Cost Institute; March 2016. https://www.healthcostinstitute.org/images/easyblog_articles/110/Shoppable-Services-IB-3.2.16_0.pdf

[67] Shafrin J. What is reference pricing? *Healthcare Economist*. July 28, 2014. https://www.healthcare-economist.com/2014/07/28/what-is-reference-pricing/ ["Reference pricing sets patient coinsurance rates as the difference between the drug's retail or list price and the price of the "reference" product… a generic version of a product or the most cost-effective molecule available in a class."]

[68] *Estimating the Potential Health Care Savings of Reference Pricing*. American Academy of Actuaries; November 2018. https://www.actuary.org/sites/default/files/files/publications/ReferencePricing_11.2018.pdf

P2: Burden of Measurement

There is a key opportunity to reduce waste by ensuring that the quality and efficiency measures used in various payment and public reporting programs are meaningful to improving patient care while also minimizing undue administrative burden.

Key Literature Sources to Support Checkbook Estimates

- On average, 1 percent of hospital net revenue is dedicated to measurement. The average net revenue per US community hospital is $170 million.[69] Extrapolating these estimates to hospitals nationwide yields a total hospital net revenue of roughly $826 billion, and total measurement burden of $8 billion. **Don Berwick, IHI President Emeritus, has called for a 50 percent reduction in all measures being used.[70] Doing so would generate estimated savings of $4.2 billion in 2018 US dollars over a one-year period.**

Getting Started

- Schuster MA, Onorato SE, Meltzer DO. Measuring the cost of quality measurement. *JAMA*. 2017 Oct 3;318(13):1219-1220. https://jamanetwork.com/journals/jama/article-abstract/2653111

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Total Hospital Net Revenue (2017)	Percentage of Revenue Dedicated to Measurement	Total Revenue Dedicated to Measurement	Estimated Cost Savings Assuming 50% Reduction (2018 Inflation Adjustment)
$826.5b	1%	$8.3b	$4.2b

[69] 13 statistics on hospital profit and revenue in 2011. *Becker's Hospital Review*. February 4, 2013. https://www.beckershospitalreview.com/finance/13-statistics-on-hospital-profit-and-revenue-in-2011.html ["In 2011, the nearly 5,000 nonfederal, short-term, general community hospitals in the United States posted a cumulative profit of $53.2 billion, a 0.5 percent increase from 2010."]
[70] "Measures That Matter — But to Whom?" *Health Affairs* Blog. March 10, 2016. https://www.healthaffairs.org/do/10.1377/hblog20160310.053833/full/

P2: Electronic Health Record Redesign

As electronic health record (EHR) systems have become more pervasive, physicians must increasingly split their time between EHR documentation and patient care, potentially driving physician burnout.[71]

Key Literature Sources to Support Checkbook Estimates

- After the Veterans Administration rolled out an initiative to remove "low-value" EHR notifications, physicians across the health system saw a reduction of 1.5 hours per week in EHR-related work.[72] **Extrapolating these results nationally, assuming primary care physician costs of $100[73] per hour and approximately 209,000 practicing primary care physicians nationwide, we estimate approximately 14.1 million hours saved per year, and estimated annual savings of $1.5 billion in 2018 US dollars over a one-year period.**

Getting Started

- *Ways to Improve Electronic Health Record Safety*. The Pew Charitable Trusts; August 2018. https://www.pewtrusts.org/en/research-and-analysis/reports/2018/08/28/ways-to-improve-electronic-health-record-safety
- Jarrett M, Schreiber M. Why can't our EHRs be more like smartphones? *Modern Healthcare*. November 7, 2016. https://www.modernhealthcare.com/article/20161107/NEWS/161109938/commentary-why-can-t-our-ehrs-be-more-like-smartphones

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Primary Care Physician Cost per Hour (2018)	Total Number of Avoidable EHR Work in Hours per Week	Total Number of US Practicing Primary Care Physicians (2010)	Total Physician Hours Available per Year	Estimated Cost Savings (2018)
$100	1.5	209,000	14,107,500	$1.5b

[71] Bates DW, Longhurst CA. Physician burnout in the electronic health record era: Are we ignoring the real cause? *Ann Intern Med*. 2018;169(1):50-51. https://annals.org/aim/article-abstract/2680726/physician-burnout-electronic-health-record-era-we-ignoring-real-cause
[72] Shah T, Patel-Teague S, Kroupa L, et al. Impact of a national QI programme on reducing electronic health record notifications to clinicians. *BMJ Qual Saf*. 2019 Jan;28(1):10-14.
[73] Occupational Employment and Wages, May 2018. 29-1062 Family and General Practitioners. United States Department of Labor, Bureau of Labor Statistics. https://www.bls.gov/oes/current/oes291062.htm

P2: Supply Chain Standardization

Reducing pricing variation and unnecessary use of drugs and products represent an opportunity for hospitals to safely reduce supply costs.

Key Literature Sources to Support Checkbook Estimates

- **An analysis of 2,300 US hospitals by Navigant found that if all analyzed hospitals could match the performance of the top quartile of hospitals for supply chain budget efficiency decency, $25.3 billion could be saved annually on supply chain products and related operations, processes, and procedures.**[74] Total supply costs include medical and implantable device costs, medical/surgical and pharmaceutical supplies charged to patient care departments, and supplies related to buildings/fixtures, maintenance, and plant operations.

Getting Started

- Ault N. How Mercy Health consolidated its supply chain. *Supply Chain Dive*. July 24, 2018. https://www.supplychaindive.com/news/Mercy-Health-care-supply-chain-consolidation/526518/

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Total Number of US Hospitals in the Target Population	Estimated Cost Savings per Hospital (2018)	Total Estimated Cost Savings (2018)
2,300	$11m	$25.3b

[74] *Hospitals' Supply Chain Savings Opportunity Increases to $25.4 Billion a Year*. Navigant Consulting; October 2018. https://www.navigant.com/-/media/www/site/insights/healthcare/2018/supplychainanalysisinfographic.pdf

P3: Reduce Non-Value-Added Clinical Workplace Waste

P3: Antimicrobial Stewardship

Between 20 percent and 50 percent of prescribed antimicrobials in the US are unnecessary or inappropriate, contributing to antibiotic-resistant bacteria that infects 2 million people and causes more than 20,000 deaths per year.[75]

Key Literature Sources to Support Checkbook Estimates

- One study estimated the cost to the health system is $13 per antibiotic prescription, including costs of hospitalization, inpatient/outpatient antibiotic use, and running hospital antimicrobial stewardship programs.[76] **Assuming annual ambulatory antibiotic prescriptions of between 213 million and 263 million,[77] we can estimate a total cost burden of between $2.8 billion and $3.5 billion in 2018 US dollars over a one-year period.**
- One study of 2010–2011 ambulatory antibiotic prescriptions estimates that as many as 30 percent were inappropriate.[78] **Assuming a 30 percent reduction nationally, we can estimate savings to the health system between approximately $917 million and $1.1 billion in 2018 US dollars over a one-year period.**
- These cost savings estimates do not include added savings and reduced harm from improved inpatient antimicrobial de-escalation practices and evidence-based earlier antibiotic therapy cessation.

Getting Started

- Core Elements of Hospital Antibiotic Stewardship Programs. Centers for Disease Control and Prevention. https://www.cdc.gov/antibiotic-use/healthcare/implementation/core-elements.html

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Cost per Antibiotic Prescription (2013)	Lower Bound Total Number of Annual Antibiotic Prescriptions	Upper Bound Total Number of Annual Antibiotic Prescriptions	Lower Bound Estimated Cost Savings Assuming 30% Reduction (2018 Inflation Adjustment)	Upper Bound Estimated Cost Savings Assuming 30% Reduction (2018 Inflation Adjustment)
$13	213,000,000	263,000,000	$917.7m	$1.1b

[75] Lohr G and Freedman S. *Are You Seeing Cost Savings from Antibiotic Stewardship?* Advisory Board. May 13, 2016. https://www.advisory.com/research/physician-executive-council/prescription-for-change/2016/05/pef-antibiotic-stewardship
[76] Michaelidis CI, Fine MJ, Lin CJ, et al. The hidden societal cost of antibiotic resistance per antibiotic prescribed in the United States: An exploratory analysis. *BMC Infect Dis*. 2016;16(1):655.
[77] Hicks LA, Bartoces MG, Roberts RM, et al. US outpatient antibiotic prescribing variation according to geography, patient population, and provider specialty in 2011. *Clin Infect Dis*. 2015;60:1308-1316.
[78] Fleming-Dutra KE, Hersh AL, Shapiro DJ, et al. Prevalence of inappropriate antibiotic prescriptions among US ambulatory care visits, 2010-2011. *JAMA*. 2016;315(17):1864-1873.

P3: Blood Use

The major sources of waste related to blood use are adverse events such as allergic reactions, fever, immune suppression, and iron overload. Infection rates declined by 20 percent[79] when hospitals performed fewer red blood cell transfusions. A 2015 analysis[80] found that the overuse of blood transfusions was one of the most common medical errors in the US. More than 14 million units of blood were used in the US in 2013, or for 1 in 10 hospitalizations.[81]

Key Literature Sources to Support Checkbook Estimates

- Blood transfusions cost about $1,000 per unit when direct and indirect costs are accounted for. In 2013, hospital respondents to an American Association of Blood Banks (AABB) survey reported an average cost of $218.87 per unit of red blood cells.[82] In addition, providers also absorb indirect expenses like transport and overhead that can raise the cost of blood from $726 to $1,183 per unit — up to 4.8 times higher than the actual cost of the physical unit of blood.[83]
- One study estimated that approximately 60 percent of blood transfusions are unnecessary.[84] Vanderbilt University Medical Center saved $2 million over three years with a 30 percent reduction (reducing utilization from 675 units per 1,000 discharges in 2011 to 432 units per 1,000 discharges in 2016).[85,86,87]
- **Applying the 30 percent reduction rate to the 14 million units of blood used annually yields estimated savings between $3.6 billion and $5.9 billion in 2018 US dollars over a one-year period.**

[79] Zieger A. JAMA: Fewer transfusions, fewer infections. *Healthcare Dive*. April 3, 2014. https://www.healthcaredive.com/news/jama-fewer-transfusions-fewer-infections/246966/
[80] Miller AM. 5 common preventable medical errors. *U.S. News & World Report*. March 30, 2015. https://health.usnews.com/health-news/patient-advice/slideshows/5-common-preventable-medical-errors?slide=3
[81] *SPOTLIGHT: Margin of Excellence – Blood Utilization*. Premier Inc.; July 2017. http://offers.premierinc.com/rs/381-NBB-525/images/SPOTLIGHT-MarginofExcellence%E2%80%93BloodUtilization.pdf
[82] Whitaker B, Rajbhandary S, Kleinman S, Harris A, Kamani N. Trends in United States blood collection and transfusion: Rresults from the 2013 AABB Blood Collection, Utilization, and Patient Blood Management Survey. *Transfusion*. 2016 Sep;56(9):2173-2183.
[83] Shander A, Hofmann A, Ozawa S, Theusinger OM, Gombotz H, Spahn DR. Activity-based costs of blood transfusions in surgical patients at four hospitals. *Transfusion*. 2010 Apr;50(4):753-765.
[84] "Better Blood Management Leads to Increased Safety and Reduced Cost." Institute for Healthcare Improvement Blog. June 27, 2014. http://www.ihi.org/communities/blogs/_layouts/15/ihi/community/blog/itemview.aspx?List=0f316db6-7f8a-430f-a63a-ed7602d1366a&ID=33
[85] Whitman E. Best practices: How to stop wasting so much blood. *Modern Healthcare*. July 30, 2016. https://www.modernhealthcare.com/article/20160730/MAGAZINE/307309997/best-practices-how-to-stop-wasting-so-much-blood
[86] Improved blood management system reduces waste, costs. *VUMC Reporter*. September 28, 2106. http://news.vumc.org/2016/09/08/improved-blood-management-system-reduces-waste-costs/
[87] Caspi H. Better blood management can save millions, study finds. *Healthcare Dive*. July 21, 2016. https://www.healthcaredive.com/news/better-blood-management-can-save-millions-study-finds/422980/

Getting Started

- Sadana D, Pratzer A, Scher LJ, et al. Promoting high-value practice by reducing unnecessary transfusions with a patient blood management program. *JAMA Intern Med*. 2018 Jan 1;178(1):116-122.
- Louden K. Conserving blood: How hospitals are reducing blood transfusion rates. *ACP Hospitalist*. October 2018. https://acphospitalist.org/archives/2008/10/transfusion.htm
- "Johns Hopkins Health System Reduces Unnecessary Transfusions with New Blood Management Program." Johns Hopkins Medicine. September 7, 2017. https://www.hopkinsmedicine.org/news/media/releases/johns_hopkins_health_system_reduces_unnecessary_transfusions_with_new_blood_management_program
- Actionable Patient Safety Solutions (APSS). Patient Safety Movement. https://patientsafetymovement.org/actionable-solutions/actionable-patient-safety-solutions-apss/

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Total Number of Blood Units Annually	Lower Bound Cost per Blood Unit (2008)	Upper Bound Cost per Blood Unit (2008)	Total Number of Blood Units Assuming 30% Reduction	Lower Bound Estimated Cost Savings (2018 Inflation Adjustment)	Upper Bound Estimated Cost Savings (2018 Inflation Adjustment)
14,000,000	$726	$1,183	4,200,000	$3.6b	$5.9b

P3: Diagnostic Error

According to the Society to Improve Diagnosis in Medicine, more than 12 million Americans per year are affected by diagnostic errors.[88]

Key Literature Sources to Support Checkbook Estimates

- While definitive cost statistics are not available, with over 12 million Americans affected each year by diagnostic error, the Society to Improve Diagnosis in Medicine estimates that **improving the accuracy and timeliness of diagnosis will potentially save in excess of $100 billion each year in annual costs from inappropriate testing, wrong treatments, and malpractice lawsuits.[89]**

Getting Started

- *Improving Diagnosis in Medicine: Diagnostic Error Change Package*. Chicago, IL: Health Research & Educational Trust; September 2018. http://www.hret-hiin.org/topics/diagnostic_error.shtml
- JB Reilly, JS Myers, D Salvador, RL Trowbridge. Use of a novel, modified fishbone diagram to analyze diagnostic errors. *Diagnosis*. 2014 Jun 1;1(2):167-171. https://www.degruyter.com/view/j/dx.2014.1.issue-2/dx-2013-0040/dx-2013-0040.xml
- Graber ML. The incidence of diagnostic error in medicine. *BMJ Qual Saf*. 2013;22(Suppl 2):ii21-ii27. https://qualitysafety.bmj.com/content/22/Suppl_2/ii21

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Total Estimated Cost Savings from Reduced Diagnostic Error
$100b

[88] Consensus Statement. Society to Improve Diagnosis in Medicine. May 16, 2019. https://www.improvediagnosis.org/consensusstatement/
[89] Newman-Toker DE. Diagnostic value: The economics of high-quality diagnosis and a value-based perspective on diagnostic innovation. *Modern Healthcare* Annual Patient Safety & Quality Virtual Conference. June 17, 2015.

P3: Overuse of Medical Tests, Treatments, and Procedures

Choosing Wisely is a national campaign initiated by the ABIM Foundation to encourage physicians to engage with patients to avoid unnecessary medical tests, treatments, and procedures.[90]

Key Literature Sources to Support Checkbook Estimates

- The Virginia Center for Health Innovation (VCHI) used the state's All-Payer Claims Database and the MedInsight Health Waste Calculator to estimate the cost of wasteful health care utilization among 5.6 million public and privately insured residents.[91] Using Choosing Wisely and other recommendations from government and industry, VCHI estimated that approximately 35 percent of services were considered wasteful. This potential waste translates to approximately 2.6 percent of total health care spending, or roughly $11.94 per member per month (or $143.28 per member annually).
- **Applying the per member per month estimate to the insured US population of 294.9 million[92] yields potential estimated cost savings of $45.9 billion across all payers in 2018 US dollars over a one-year period.**

Getting Started

- Implementing the Choosing Wisely Program — Practices Share Their Lessons Learned. Patient-Centered Primary Care Collaborative. https://www.pcpcc.org/webinar/implementing-choosing-wisely-program-–-practices-share-their-lessons-learned-0
- Getting Started. Choosing Wisely. https://www.choosingwisely.org/getting-started/

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Annual Cost (per Member per Year) of Unnecessary Medical Tests, Treatments, and Procedures (2014)	Total US Insured Population	Estimated Cost Savings (2018 Inflation Adjustment)
$143.28	294,900,000	$45.9b

[90] *Choosing Wisely: A Special Report on the First Five Years*. Choosing Wisely, ABIM Foundation; 2010. http://www.choosingwisely.org/wp-content/uploads/2017/10/Choosing-Wisely-at-Five.pdf
[91] Mafi JN, Russell K, Bortz BA, Dachary M, Hazel WA, Fendrick AM. Low-cost, high-volume health services contribute the most to unnecessary health spending. *Health Affairs*. 2017;36(10):1701-1704.
[92] FastStats: Health Insurance Coverage. Centers for Disease Control and Prevention. https://www.cdc.gov/nchs/fastats/health-insurance.htm

P3: Generic Drug Substitution

On average, the retail price of a generic drug is 75 percent lower than the retail price of a brand-name drug. Cases where brand-name drugs are prescribed in the place of appropriate generics represent a significant opportunity to reduce waste.[93]

Key Literature Sources to Support Checkbook Estimates

- One 2005 study estimated the economic impact in the US of substituting the generic version for 39 percent of the multisource drugs dispensed as brand name.[94] The authors found generic drug substitutions reduced annual drug expenditures by $45.89 per person (under age 65) and by $78.05 per person (ages 65 or older). The same study found that the total savings comprised 11 percent of national drug expenditures in 2005. In 2016 national drug expenditures totaled $328.6 billion.[95]
- **Assuming this same rate, substituting generic brands for all multisource drugs would save an estimated $37.6 billion per year in 2018 US dollars over a one-year period.**

Getting Started

- Haas JS, Phillips KA, Gerstenberger EP, Seger AC. Potential savings from substituting generic drugs for brand-name drugs: Medical expenditure panel survey, 1997–2000. *Ann Int Med*. 2005;142(11):891-897. https://annals.org/aim/fullarticle/718428
- Choudhry NK, Denberg TD, Qaseem A. Improving adherence to therapy and clinical outcomes while containing costs: Opportunities from the greater use of generic medications: Best practice advice from the Clinical Guidelines Committee of the American College of Physicians. *Ann Intern Med*. 2016;164(1):41-49. https://annals.org/aim/fullarticle/2471597
- Wouters OJ, Kanavos PG, McKee M. Comparing generic drug markets in Europe and the United States: Prices, volumes, and spending. *Milbank Q*. 2017 Sep;95(3):554-601. https://onlinelibrary.wiley.com/doi/full/10.1111/1468-0009.12279

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Estimated Annual Cost Savings per Person Under Age 65	Estimated Annual Cost Savings per Person Age 65 or Older	Estimated Total Cost Savings as a Percentage of National Drug Expenditures	Total Cost of National Drug Expenditures (2016)	Estimated Cost Savings (2018 Inflation Adjustment)
$45.89	$78.05	11%	$328.6b	$37.6b

[93] Sullivan T. GAO Report drug pricing: Research on savings from generic drug use. *Policy and Medicine*. May 6, 2018. https://www.policymed.com/2012/03/gao-report-drug-pricing-research-on-savings-from-generic-drug-use.html
[94] Haas JS, Phillips KA, Gerstenberger EP, Seger AC. Potential savings from substituting generic drugs for brand-name drugs: Medical expenditure panel survey, 1997–2000. *Ann Intern Med*. 2005 Jun 7;142(11):891-897.
[95] NHE Fact Sheet. Centers for Medicare & Medicaid Services. https://www.cms.gov/research-statistics-data-and-systems/statistics-trends-and-reports/nationalhealthexpenddata/nhe-fact-sheet.html

P3: Direct-to-Consumer Drug Advertising

The literature has shown that direct-to-consumer drug advertising has significant effects on patient demand and prescriptions. One study estimates the effect of patient requests for specific medications, finding as much as a 20 percent increase in prescription rates when brand names were mentioned.[96] A survey by the Kaiser Family Foundation found that 28 percent of consumers report asking doctors about drugs they saw in television ads.[97]

Key Literature Sources to Support Checkbook Estimates

- Another study attempted to estimate the effect of advertising on demand using aggregated sales and prescription data. The authors found that between 13 percent and 22 percent of growth in annual prescription drug spending was attributable to direct-to-consumer drug advertising.[98]
- In 2016 pharmaceutical spending in the US reached $450 billion, with an estimated compounded annual growth rate of 7 percent through 2020.[99] **Assuming annual growth in spending of roughly $31.5 billion, applying a reduction rate of between 13 percent and 22 percent we can estimate national savings between $4.3 billion and $7.2 billion in 2018 US dollars over a one-year period.**

Getting Started

- Becker SJ, Midoun MM. Effects of direct-to-consumer advertising on patient prescription requests and physician prescribing: A systematic review of psychiatry-relevant studies. *J Clin Psychiatry*. 2016 Oct;77(10):e1293-e1300. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5293137/
- Daubresse M, Hutfless S, Kim Y, et al. Effect of direct-to-consumer advertising on asthma medication sales and healthcare use. *Am J Resp Crit Care Med*. 2015 Jul 1;192(1):40-46. https://www.atsjournals.org/doi/full/10.1164/rccm.201409-1585OC
- Alpert A, Lakdawalla D, Sood N. *Prescription Drug Advertising and Drug Utilization: The Role of Medicare Part D*. NBER Working Paper No. 21714. Cambridge, MA: National Bureau of Economic Research; November 2015. https://www.nber.org/papers/w21714
- Layton JB, Kim Y, Alexander GC, Emery SL. Association between direct-to-consumer advertising and testosterone testing and initiation in the United States, 2009–2013. *JAMA*. 2017;317(11):1159-1166. https://jamanetwork.com/journals/jama/article-abstract/2612615

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Total Cost of US Pharmaceutical Spending (2016)	Compounded Annual Percentage Growth Rate	Total Cost of US Pharmacy Spending Growth per Year Assuming 7% Growth Rate	Lower Bound Percentage Annual Spending Attributable to Direct-to-Consumer Advertising	Upper Bound Percentage Annual Spending Attributable to Direct-to-Consumer Advertising	Lower Bound Estimated Cost Savings (2018 Inflation Adjustment)	Upper Bound Estimated Cost Savings (2018 Inflation Adjustment)
$450b	7%	$31.5b	13%	22%	$4.3b	$7.2b

[96] McKinlay JB, Trachtenberg F, Marceau LD, Katz JN, Fischer MA. Effects of patient medication requests on physician prescribing behavior. *Medical Care*. 2014;52(4):294-299.
[97] *Understanding the Effects of Direct-to-Consumer Prescription Drug Advertising*. Kaiser Family Foundation; November 2001. https://www.kff.org/wp-content/uploads/2013/01/understanding-the-effects-of-direct-to-consumer-prescription-drug-advertising-report.pdf
[98] Rosenthal MB, Berndt ER, Donohue JM, Epstein AM, Frank RG. Demand effects of recent changes in prescription drug promotion. *Forum for Health Economics & Policy*. 2003;6(1).
[99] US prescription drug spending as high as $610 billion by 2021: Report. *CNBC*. May 4, 2017. https://www.cnbc.com/2017/05/04/us-prescription-drug-spending-as-high-as-610-billion-by-2021-report.html

P4: Actively Solicit Staff and Clinician Ideas

P4: Operational Waste

Everything health care providers do can be divided into two categories: the first adds value for the customer that they would be willing to pay for, and the second does not add value. The pursuit of reducing operational waste focuses on this second category.

Key Literature Sources to Support Checkbook Estimates

- A study by Intermountain Healthcare and AHRQ developed an observational tool to categorize waste based on Toyota Production System activities. An observer shadowed 61 staff for 72 hours in a 46-bed medical unit. Staff observed included 8 physicians, 26 nurses, and 10 other staff. The average cost of waste per hour per worker across all staffing groups was between $7.40 and $18.98.
- Using the most conservative estimate and focusing specifically on caregiving activities, the study authors estimated the hospital's annual cost of waste to be $843,000. **Extrapolating this waste estimate to the nearly 900,000[100] US acute care hospital beds yields estimated total costs of waste of $20.9 billion in 2018 US dollars over a one-year period.**

Getting Started

- Macfie H, Browne L. "MemorialCare: Leveraging Lean to Put Joy Back in Work." Presentation at the IHI National Forum, December 2017. http://app.ihi.org/FacultyDocuments/Events/Event-2930/Presentation-16143/Document-12595/Presentation_D10E10_Leveraging_Lean_Macfie.pdf
- Lean Health Care Improvement. Virginia Mason Institute. https://www.virginiamasoninstitute.org/
- Transforming Healthcare: Healthcare Leadership Coaching: Transformation Journey Assessment and Education. Catalysis. https://createvalue.org/
- *Going Lean in Health Care*. IHI Innovation Series White Paper. Cambridge, MA: Institute for Healthcare Improvement; 2005. http://www.ihi.org/resources/Pages/IHIWhitePapers/GoingLeaninHealthCare.aspx

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Cost of Estimated Annual Operational Waste for 46-Bed Unit (2006)	Cost of Annual Waste per Hospital Bed (2006)	Total Number of US Acute Care Hospital Beds	Estimated Cost Savings (2018 Inflation Adjustment)
$843,000	$18,326[101]	894,574	$20.9b

[100] *Fast Facts for US Hospitals 2018*. American Hospital Association; February 2018. https://www.aha.org/system/files/2018-02/2018-aha-hospital-fast-facts.pdf
[101] The Intermountain Healthcare study was conducted in a 46-bed unit; estimated cost of annual waste per hospital bed calculated as: $843,000 / 46 beds = $18,326 per bed.

P4: Workforce Burnout and Turnover

Burnout is extremely common among health care workers. Characteristics of the health care environment (e.g., time pressure, lack of control over work processes, role conflict, emotional intensity of clinical work) put clinicians at a particularly high risk of burnout. Clinicians with burnout are more likely to subjectively rate patient safety lower within their organizations and to admit to having made mistakes or delivered substandard care.[102]

Key Literature Sources to Support Checkbook Estimates

- The annual turnover rate for nurses is estimated at 30 percent, with a cost per turnover between $23,000 and $31,000.[103] The annual turnover rate for physicians is estimated at 7 percent, with a cost per turnover in excess of $1 million when accounting for recruiting and lost revenue.[104,105]
- Case studies of hospitals that have been successful with improving in this area have demonstrated more than a 30 percent reduction in staff turnover rates.[106]
- **Extrapolating these costs nationally and assuming a 30 percent reduction in turnover yields potential estimated savings between $7.4 billion and $9.9 billion for nurses, and $22.5 billion for physicians in 2018 US dollars over a one-year period.**

Getting Started

- Perlo J, Balik B, Swensen S, Kabcenell A, Landsman J, Feeley D. *IHI Framework for Improving Joy in Work*. IHI White Paper. Cambridge, MA: Institute for Healthcare Improvement; 2017. http://www.ihi.org/resources/Pages/IHIWhitePapers/Framework-Improving-Joy-in-Work.aspx
- "WIHI: How to Beat Burnout and Create Joy in Work." Institute for Healthcare Improvement. September 28, 2017. http://www.ihi.org/resources/Pages/AudioandVideo/WIHI_How_to_beat_burnout_and_create_joy_in_work.aspx

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Staff Type	Lower Bound Cost per Turnover	Upper Bound Cost per Turnover	Total Number of Annual Turnovers	Total Number of Avoidable Turnovers Assuming 30% Reduction Rate	Lower Bound Estimated Cost Savings (2018 Inflation Adjustment)	Upper Bound Estimated Cost Savings (2018 Inflation Adjustment)
Nurse	$23,487 (2004)	$31,486 (2004)	779,033	233,710	$7.4b	$9.9b
Physician	$1m (2012)	$1m (2012)	66,759	20,028	$22.5b	$22.5b
Total					**$29.9b**	**$32.4b**

[102] Lyndon A. Burnout among health professionals and its effect on patient safety. *AHRQ Perspectives on Safety*. February 2016. https://psnet.ahrq.gov/perspectives/perspective/190/burnout-among-health-professionals-and-its-effect-on-patient-safety
[103] Waldman JD, Kelly F, Arora S, Smith HL. The shocking cost of turnover in health care. *Health Care Management Review*. 2010;35(3):206-211.
[104] Understanding the Real Costs of Recruiting. NEJM Career Center. https://www.nejmcareercenter.org/minisites/rpt/understanding-the-real-costs-of-recruiting/
[105] Vuong K. Turnover rate for hospitalist groups trending downward. *The Hospitalist*. September 14, 2018. https://www.the-hospitalist.org/hospitalist/article/130462/turnover-rate-hospitalist-groups-trending-downward
[106] *Case Study: Parkview Health — Data Empowers Hospital Leaders to Reduce Turnover, Boost Quality*. Work Institute; November 2017. https://workinstitute.com/resources/case-studies/articleid/2237/case-study-parkview-health

P5: Involve Patients in Identifying What Matters Most to Them

For this primary driver, "what matters most" means the value-added steps in the care processes from the patients' perspective. Health care organizations are encouraged to solicit ideas from patients and families on waste reduction opportunities (i.e., identifying the non-value-added steps in care processes) and engage them in co-design.

P5: Palliative Care

In 2015, 4.8 percent of all US hospital admissions received palliative care. Palliative care programs typically consist of 3 to 8 full-time equivalent (FTE) staff, often varying based on number of hospital beds.[107] Approximately 22 percent of palliative care patients die in the hospital. In hospitals with more than 500 beds, palliative care programs provided an average of 1,242 initial inpatient consults and 2.2 billable subsequent visits per consult. In hospitals with fewer than 150 beds, they provided an average of 353 consults and 1.3 billable subsequent visits per consult.[108]

Key Literature Sources to Support Checkbook Estimates

- Palliative care consultation was associated with a reduction in direct hospital costs of almost $1,700 per admission ($174 per day) for patients who were discharged and of almost $5,000 per admission ($374 per day) for patients who died in the hospital. For an average 400-bed hospital containing an interdisciplinary palliative care team that sees 500 patients per year (300 discharges and 200 hospital deaths), these figures translate into a net savings of $1.3 million per year after adding physician revenues ($240,000) and subtracting personnel costs ($418,000).[109] These savings account for ICU days saved, and pharmacy and lab reductions. However, savings are a conservative estimate and do not incorporate savings from length of stay (LOS) reduction, readmissions, mortality, and improving patient and family satisfaction. In 2016 there were nearly 6 million hospital admissions with a LOS between 7 and 30 days for the population screened in the palliative care program noted above.[110,111] **Applying the $1.3 million annual cost savings to the national population yields estimated cost savings of $5.5 billion to $7.3 billion in direct medical costs to acute care facilities in 2018 US dollars over a one-year period.**
- Another study evaluated the effectiveness of palliative care referrals among patients with advanced cancer, COPD, and congestive heart failure in outpatient settings, finding $7,552 in savings in total cost of care per terminally ill patient.[112] Most savings resulted from a decreased likelihood of ED visits and hospitalizations compared to patients receiving usual care. A 2016 cost-effective analysis of palliative care programs by the Institute for Clinical and Economic Review estimated a target national population of terminal cancer and mixed diagnoses patients of 787,000.[113] **Using these estimates we can approximate national cost savings of $7.4 billion in 2018 US dollars over a one-year period.**

[107] Early palliative care is key driver in reducing costs. *Medscape*. October 30, 2017. https://www.medscape.com/viewarticle/887756#vp_2
[108] Morrison RS. "Cost Savings from Palliative Care." National Palliative Care Research Center. http://www.npcrc.org/files/news/NPCRC_breakout_cost_savings_morrison.pdf
[109] Morrison RS, Penrod JD, Cassel JB, et al. Cost savings associated with US hospital palliative care consultation programs. *Arch Intern Med*. 2008;168(16):1783-1790.
[110] *Understanding Length of Stay Benchmarks*. Truven Health Analytics; 2012. https://truvenhealth.com/Portals/0/assets/HP_11514_0812_LOSBenchmarks_SS_WEB.pdf
[111] Weiss AJ, Elixhauser A. *Overview of Hospital Stays in the United States, 2012*. HCUP Statistical Brief #180. Rockville, MD: Agency for Healthcare Research and Quality; October 2014. https://www.hcup-us.ahrq.gov/reports/statbriefs/sb180-Hospitalizations-United-States-2012.jsp
[112] Brumley R, Enguidanos S, Jamison P, et al. Increased satisfaction with care and lower costs: Results of a randomized trial of in-home palliative care. *Journal of the American Geriatrics Society*. 2007;55(7):993-1000.
[113] *Palliative Care in the Outpatient Setting*. Institute for Clinical and Economic Review. March 9, 2016. https://icer-review.org/wp-content/uploads/2016/03/Palliative-Care-Revised-Draft-Report-030916.pdf

Getting Started

- Sokol-Hessner L, Zambeaux A, Little K, Macy L, Lally K, McCutcheon Adams K. *"Conversation Ready": A Framework for Improving End-of-Life Care (Second Edition)*. IHI White Paper. Boston: Institute for Healthcare Improvement; 2019. http://www.ihi.org/resources/Pages/IHIWhitePapers/ConversationReadyEndofLifeCare.aspx
- Palliative Care Best Practices Guidelines. American College of Surgeons Trauma Quality Improvement Program; October 2017. https://www.facs.org/-/media/files/quality-programs/trauma/tqip/palliative_guidelines.ashx?la=en
- National Seminar: Tools and Training for Clinicians: Palliative Care Programs. Center to Advance Palliative Care. https://www.capc.org/

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Direct Medical Costs, In-Hospital Palliative Care Program:

Total Number of Hospital Admissions with LOS 7 to 30 Days	Lower Bound Percentage Outcomes of Hospital LOS 7 to 30 Days	Upper Bound Percentage Outcomes of Hospital LOS 7 to 30 Days	Percentage of Hospital Live Discharges Eligible for Palliative Care	Percentage of Hospital Deaths Eligible for Palliative Care	Estimated Cost Savings per Live Discharge (2004)	Estimated Cost Savings per Hospital Death (2004)	Lower Bound Total Estimated Cost Savings (2018 Inflation Adjustment)	Upper Bound Total Estimated Cost Savings (2018 Inflation Adjustment)
5,987,500	80% patients discharged alive 20% patients died in hospital	70% patients discharged alive 30% patients died in hospital	12.5%	52%	$1,700	$4,908	$5.5b	$7.3b

Ambulatory Service Costs, Utilization of Palliative Care Services:

Palliative Care per Patient Cost Savings (2007)	Total Number of Patients in the Target Population: COPD, CHF, Cancer (2013)	Estimated Cost Savings (2007)	Estimated Cost Savings (2018 Inflation Adjustment)
$7,552	787,000	$5.9b	$7.4b

P5: Telehealth

A 2014 case study estimates that the Veterans Health Administration (VHA) averaged annual savings of $6,500 in 2012 for each patient that participated in their telehealth program, or nearly $1 billion in estimated total annual savings.[114] In Vermont, savings of $63,804 per patient were created through the use of home-based telehealth and telemonitoring that eliminated expenses related to time and travel expenses during 2013.[115] Another study indicated that hospitalizations among nursing home patients decreased by 4.4 percentage points when telehealth was utilized.[116] Applying this savings rate to an average size nursing home (106 beds in 2013) indicates that regular use of telehealth in nursing homes could save the Medicare program about $151,000 annually per nursing home due to reduced inpatient admissions. However, a barrier to increased adoption is that the nursing home must invest in the technology required to offer telehealth services — estimated at $30,000 per facility — while almost all savings would accrue to Medicare.

Key Literature Sources to Support Checkbook Estimates

- A review of the telehealth vendor market found that there is an average cost savings of $126 per telehealth appointment among the commercially insured population compared to an office visit.[117] An Advisory Board report estimates approximately 20 percent of current outpatient visits could be appropriate for telehealth appointments.[118]
- **Applying this 20 percent rate to the nearly 64 million annual outpatient visits among the commercially insured population, use of telehealth for outpatient visits could yield estimated cost savings of $1.8 billion in 2018 US dollars over a one-year period.**

Getting Started

- *Telemedicine Expansion Toolkit*. University of Arkansas for Medical Sciences; November 2016. http://sites.uams.edu/arkansaselink/wp-content/uploads/sites/21/2018/03/Telemedicine-Expansion-Toolkit.pdf

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Total Number of Outpatient Visits among Commercially Insured	Average Cost Savings per Visit Using Telehealth	Total Number of Appropriate Telehealth Visits Assuming a 20% Rate	Estimated Cost Savings (2013)	Estimated Cost Savings (2018 Inflation Adjustment)
63,623,000	$126	12,724,600	$1.6b	$1.8b

[114] For veterans, telehealth offers access, convenience. *AAMCNews*. June 19, 2017. https://news.aamc.org/patient-care/article/veterans-telehealth-offers-access-convenience/
[115] Telehealth saves Vermont VA $63,000 a patient in annual travel expenses, study finds. *Healthcare IT News*. March 17, 2016. https://www.healthcareitnews.com/news/telehealth-saves-vermont-va-63000-patient-annual-travel-expenses-study-finds
[116] Grabowski DC, O'Malley AJ. Use of telemedicine can reduce hospitalizations of nursing home residents and generate savings for Medicare. *Health Aff (Millwood)*. 2014 Feb;33(2):244-250. https://www.healthaffairs.org/doi/full/10.1377/hlthaff.2013.0922
[117] Yamamoto DH. *Assessment of the Feasibility and Cost of Replacing In-Person Care with Acute Care Telehealth Services*. Red Quill Consulting, Inc.; December 2014. http://www.connectwithcare.org/wp-content/uploads/2014/12/Medicare-Acute-Care-Telehealth-Feasibility.pdf
[118] Telehealth Industry Trends for 2019. Advisory Board. April 1, 2019. https://www.advisory.com/research/market-innovation-center/resources/2018/telehealth-industry-trends

P5: Emergency Department Visits

Emergency department (ED) visits resulting from patients seeking non-urgent care or ED care that could have been treated in alternate settings represent a significant opportunity for waste reduction in the US health care system.

Key Literature Sources to Support Checkbook Estimates

- In 2012 the Healthcare Cost and Utilization Project (HCUP) estimated the rate of preventable treat-and-release emergency department (ED) visits to be 2,618 per 100,000 population.[119] A national study investigating non-emergent ED visits between 2006 and 2010 found a similar estimate, categorizing roughly 10 percent of US ED visits as non-urgent.[120]
- Retail clinics and urgent care centers are two lower levels of care that can treat many non-urgent needs. Prior studies have estimated that retail clinic and urgent care center per case costs are between $279 and $228 less than ED costs, respectively.[121]
- **Applying these per case savings to the rate of preventable ED visits estimated by HCUP, we estimate cost savings between $2.5 billion and $3 billion. These savings are in line with one study examining potential cost savings from treatment in lower levels of care, with estimated health system savings of $2.5 billion to $3 billion in 2018 US dollars over a one-year period.[122]**

Getting Started

- Mate K. "Reducing the Impact of Low-Acuity ED Visits." Institute for Healthcare Improvement. Presentation November 1, 2016. http://app.ihi.org/FacultyDocuments/Events/Event-2842/Presentation-14744/Document-10990/Presentation_2_6_Reducing_Low_Acuity_ED_Visits.pdf

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Total Number of Annual Preventable ED Visits	Estimated Cost Savings per Diversion to Urgent Care (2006)	Estimated Cost Savings per Diversion to Retail Clinic (2006)	Estimated Cost Savings Assuming All Diverted to Urgent Care (2018 Inflation Adjustment)	Estimated Cost Savings Assuming All Diverted to Retail Clinic (2018 Inflation Adjustment)
8,526,826	$228	$279	$2.5b	$3b

[119] Fingar KR, Barrett ML, Elixhauser A, Stocks C, Steiner CA. *Trends in Potentially Preventable Inpatient Hospital Admissions and Emergency Department Visits*. HCUP Statistical Brief #195. Rockville, MD: Agency for Healthcare Research and Quality; November 2015. https://www.hcup-us.ahrq.gov/reports/statbriefs/sb195-Potentially-Preventable-Hospitalizations.jsp
[120] Honigman LS, Wiler JL, Rooks S, Ginde AA. National study of non-urgent emergency department visits and associated resource utilization. *West J Emerg Med*. 2013 Nov;14(6):609-616.
[121] Thygeson M, Van Vorst KA, Maciosek MV, Solberg L. Use and costs of care in retail clinics versus traditional care sites. *Health Aff (Millwood)*. 2008;27(5):1283-1292.
[122] Weinick RM, Burns RM, Mehrotra A. Many emergency department visits could be managed at urgent care centers and retail clinics. *Health Aff (Millwood)*. 2010;29(9):1630-1636.

P6: Redesign Care to Achieve the Triple Aim

The IHI Triple Aim is a framework that describes an approach to optimizing health system performance by simultaneously pursuing three dimensions, which IHI calls the "Triple Aim": improving the patient experience of care (including quality and satisfaction); improving the health of populations; and reducing the per capita cost of health care.[123]

P6: Skilled Nursing Facility Utilization

The Healthcare Cost and Utilization Project (HCUP) presents data on hospital discharges to post-acute care (PAC) settings in 2013 from an all-payer view, finding that nearly 8 million hospital stays were discharged with PAC services, accounting for 22.3 percent of all hospital discharges in 2013. Over 11 percent of inpatient stays were discharged home with home health agency services, and 9 percent of inpatient stays were discharged to skilled nursing facilities (SNFs). Only 1.6 percent of all hospital discharges went to inpatient rehabilitation facilities. Long-term care hospitals were the least used PAC setting and represented only 0.5 percent of all discharges. Of the 8 million discharges to PAC, more than 40 percent (or 3.2 million) were discharged to SNFs.[124]

According to Medicare beneficiary data[125] in 2014, 1.7 million fee-for-service (FFS) Medicare beneficiaries were cared for in 15,000 SNFs, costing Medicare $28.6 billion, with an average stay of 28 days. This represents 2.4 million SNF stays: 20 percent of all hospitalized FFS Medicare beneficiaries are discharged to a SNF. The majority of these facilities are the same institutions as those providing residential long-term care; 95 percent of SNFs provide both kinds of care. The average payment to SNF was between $12,400 and $15,000 per discharge. The site of discharge has a profound effect on hospital costs. According to the HCUP report, stays discharged to PAC were much longer and costlier than those with routine discharges (7.0 days vs. 3.6 days; $16,900 vs. $8,300 on average).[126]

[123] Berwick DM, Nolan TW, Whittington J. The Triple Aim: Care, health, and cost. *Health Aff (Millwood)*. 2008 May-Jun;27(3):759-769.
[124] Tian W. *An All-Payer View of Hospital Discharge to Post Acute Care, 2013*. HCUP Statistical Brief #205. Rockville, MD: Agency for Healthcare Research and Quality; May 2016. https://www.hcup-us.ahrq.gov/reports/statbriefs/sb205-Hospital-Discharge-Postacute-Care.jsp
[125] UpToDate. https://www.uptodate.com/contents/search?search=medical-care-in-skilled-nursing-facilities-snfs-in-the-united-states%20&sp=0&searchType=PLAIN_TEXT&source=USER_INPUT&searchControl=TOP_PULLDOWN&searchOffset=1&autoComplete=false&language=&max=0&index=&autoCompleteTerm=
[126] Tian W. *An All-Payer View of Hospital Discharge to Post Acute Care, 2013*. HCUP Statistical Brief #205. Rockville, MD: Agency for Healthcare Research and Quality; May 2016. https://www.hcup-us.ahrq.gov/reports/statbriefs/sb205-Hospital-Discharge-Postacute-Care.jsp

Key Literature Sources to Support Checkbook Estimates

- A literature review on patient outcomes after the implementation of Home-Based Primary Care Programs found that long-term care admissions decreased between 10 percent and 25 percent.[127]
- A randomized controlled trial examining the effect of Guided Care, a team-based care model for chronically ill adults, realized 24 percent fewer hospital days, 37 percent fewer nursing facility days, and 15 percent fewer emergency department visits.[128] Accounting for 2009 Medicare payment rates and these differences in utilization, annual net savings were achieved of $1,364 per patient per year. **Applying these savings to the 14 percent to 32 percent of Medicare beneficiaries with between 2 and 6 chronic conditions, annual cost savings to the Guided Care program are estimated at between approximately $12.6 billion and $28.9 billion in 2018 US dollars over a one-year period.**

Getting Started

- *Viewing Post-Acute Care in a New Light: Strategies to Drive Value*. Deloitte; 2017. https://www2.deloitte.com/content/dam/Deloitte/us/Documents/life-sciences-health-care/us-lshc-post-acute-care-innovation-report.pdf

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Estimated Cost Savings per Patient with 6+ Chronic Conditions (2009)	Total Number of Medicare Beneficiaries	Lower Bound Percentage of Beneficiaries with 6+ Chronic Conditions	Upper Bound Percentage of Beneficiaries with 6+ Chronic Conditions	Lower Bound Estimated Cost Savings (2018 Inflation Adjustment)	Upper Bound Estimated Cost Savings (2018 Inflation Adjustment)
$1,364	55,300,000	14%	32%	$12.6b	$28.9b

[127] Stall N, Nowaczynski M, Sinha SK. Systematic review of outcomes from home-based primary care programs for homebound older adults. *J Am Geriatr Soc*. 2014 Dec;62(12):2243-2251.
[128] Leff B, Reider L, Frick KD, et al. Guided care and the cost of complex healthcare: A preliminary report. *Am J Manag Care*. 2009;15(8):555-559.

P6: Skilled Nursing Facility 3-Day Rule

For nearly 50 years, Medicare has required patients to have at least a three-day hospital stay before they are eligible for coverage of care in a skilled nursing facility (SNF) following hospital discharge.[129] A more recent study, however, finds that the main consequence of waiving the three-day rule, as Medicare Advantage plans commonly do, has meant less days in the hospital.[130]

Key Literature Sources to Support Checkbook Estimates

- One Pioneer accountable care organization (ACO) participating in the SNF 3-Day Rule program reported $308,000 in savings, but the exact period over which these savings were realized or how they were calculated was not specified. To assess the implications of eliminating the three-day qualifying stay requirement, another study compared hospital and post-acute skilled nursing facility utilization among Medicare Advantage enrollees in matched plans that did or did not eliminate that requirement between 2006 and 2010.[131] Among hospitalized enrollees with a SNF admission, the mean hospital length of stay declined from 6.9 days to 6.7 days for those no longer subject to the qualifying three-day stay, but increased from 6.1 days to 6.6 days among those still subject to the rule, for a net decline of 0.7 day when the three-day stay requirement was eliminated. The elimination was not associated with more hospital or skilled nursing facility admissions or with longer lengths of stay in a SNF.
- Assuming one day of inpatient care costs between $700[132] and $2,271,[133] a 0.7-day reduction would translate into an estimated cost savings between $490 and $1,500 for every inpatient admission that concluded with a discharge to a skilled nursing facility. **Applying this rate to the share of 9.5 million Medicare acute discharges yields estimated cost savings between $1 billion and $3.4 billion in 2018 US dollars over a one-year period.**

Getting Started

- Phelan MP, Meldon S, Breener R, et al. 120 Skilled Nursing Facility 3-Day Waiver pilot: Direct admission to skilled nursing facilities from the emergency department avoids hospital admissions and decreases costs. *Ann Emerg Med*. 2018 Oct;72(4 Suppl):S51. https://www.annemergmed.com/article/S0196-0644(18)30861-8/abstract
- Hernandez VH, Ong A, Post Z, Orozco F. Does the Medicare 3-Day Rule increase length of stay? *J Arthroplasty*. 2015 Sep;30(9 Suppl):34-35. https://www.sciencedirect.com/science/article/pii/S0883540315005185

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Lower Bound Estimated Cost Savings per Acute Medicare Admission Discharged to SNF (2018)	Upper Bound Estimated Cost Savings per Admission (2018)	Total Number of Medicare Admissions Discharged to SNF	Lower Bound Estimated Cost Savings (2018)	Upper Bound Estimated Cost Savings (2018)
$490	$1,590	2,124,700	$1b	$3.4b

[129] *Congressional Research Services Report on Three-Day Stay Requirement*. Centers for Medicare & Medicaid Services; June 2, 2016.
[130] *Pioneer ACO Model: 3-Day Skilled Nursing Facility (SNF) Waiver Final Evaluation Report*. Centers for Medicare & Medicaid Services; May 7, 2019.
[131] Grebla RC, Keohane L, Lee Y, Lipsitz LA, Rahman M, Trivedi AN. Waiving the three-day rule: Admissions and length-of-stay at hospitals and skilled nursing facilities did not increase. *Health Aff (Milwood)*. 2015 Aug;34(8):1324-1330.
[132] Estimate of cost of last day of inpatient care provided by MemorialCare Health System.
[133] Hospital Adjusted Expenses per Inpatient Day. Kaiser Family Foundation; 2017. https://www.kff.org/health-costs/state-indicator/expenses-per-inpatient-day/

P6: Behavioral Health

Between 2011 and 2015, total US spending on behavioral health reached $213.6 billion, a 13.4 percent increase.[134] One potential opportunity for cost savings lies in the rise of integrative care models, care delivery systems designed to integrate physical and behavioral health to improve outcomes and reduce costs.

Key Literature Sources to Support Checkbook Estimates

- One report by Milliman analyzed 2016 Medicare, Medicaid, and commercial claims data to find the additional health care costs incurred by patients with medical and behavioral comorbidities.[135] The Milliman Research Report authors also conducted a literature review of integrated care models and found that between 9 percent and 17 percent of costs among these patients could be saved through effective integration of care.
- Assuming a savings rate of 12 percent, the report gives per member per month (PMPM) savings of $133, $234, and $205 among commercial, senior, and Medicaid populations, respectively. **Incorporating a $73 PMPM cost of operating an integrated behavioral health program[136] and extrapolating nationally, we can estimate net cost savings of approximately $38.1 billion in 2018 US dollars over a one-year period.**

Getting Started

- Unutzer J, Harbin H, Schoenbaum M, Druss B. *The Collaborative Care Model: An Approach for Integrating Physical and Mental Health Care in Medicaid Health Homes*. Centers for Medicare & Medicaid Services; May 2013. https://www.chcs.org/media/HH_IRC_Collaborative_Care_Model__052113_2.pdf
- Laderman M, Dasgupta A, Henderson R, Waghray A, Bolender T, Schall M. *Integrating Behavioral Health in the Emergency Department and Upstream*. IHI Innovation Report. Boston: Institute for Healthcare Improvement; 2018. http://www.ihi.org/resources/Pages/Publications/Integrating-Behavioral-Health-Emergency-Department-and-Upstream.aspx
- Case Study: Inland Empire Health Plan. Sidebench. https://sidebench.com/case-study-iehp/

[134] *Behavioral Health Spending and Use Accounts, 1986-2014*. Substance Abuse and Mental Health Services Administration; 2016. https://store.samhsa.gov/product/Behavioral-Health-Spending-and-Use-Accounts-1986-2014/SMA16-4975

[135] Melek SP, Norris DT, Paulus J, Matthews K, Weaver A, Davenport S. *Potential Economic Impact of Integrated Medical-Behavioral Healthcare: Updated Projections for 2017*. Milliman Research Report; January 2018. http://www.milliman.com/uploadedFiles/insight/2018/Potential-Economic-Impact-Integrated-Healthcare.pdf

[136] Average cost to operate integrated program, at full-functioning operation; includes staffing from LCSW, psychiatrist consultant, PCP. Assumes implementation of telehealth to scale the program. Assumes 8 locations servicing 1,600 patients per year with behavioral health diagnosis. Model imbedded within clinic. Assumes 200 patients per location on average supported by 5 LCSWs, 1 psychiatry resource. Based on costs at MemorialCare Health System in Southern California.

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Payer Type	PMPM Behavioral Health Program Operating Cost (2017)	Commercial PMPM Net Cost Savings (2018)	Total Number of Commercial, Senior, and Medicaid Member Months (2017)	Estimated Cost Savings (2017)	Estimated Cost Savings (2018 Inflation Adjustment)
Commercial	$73	$60	246,000,000	$14.7b	$15b
Senior	$73	$161	23,000,000	$3.7b	$3.8b
Medicaid	$73	$132	144,000,000	$19b	$19.3b
Total				**$37.4b**	**$38.1b**

P6: Alternative Payment Models

A study found that community hospitals saw increased revenue under ACO programs.[137] Evidence from RAND indicates that bundled payments can result in savings to both payers and providers.[138] Payers benefit from discounts negotiated with providers, and providers benefit from practice changes such as decreased use of intensive care nursing. At the same time, most hospital executives expect that value-based contracts will result in a decrease in operating profits, more now than in the earlier years of the Affordable Care Act.[139]

Key Literature Sources to Support Checkbook Estimates

- Another article estimates the potential savings if episode-based and patient-based bundled payments were applied across the Medicare Fee-for-Service (FFS) population. The authors observed significant variation after averaging the costs for 245 episode types in over 300 hospital referral regions. **They found that in each region if the average costs above the 25th percentile were brought down to that level, Medicare would realize $29 billion in annual savings. Using a more conservative 50th percentile standard, $15 billion could be saved nationally.**[140]
- At MemorialCare Health System in California, participating ACOs reported realizing a 6 percent to 10 percent reduction in monthly premium costs among commercially insured populations. **Assuming a national commercially insured population of 175 million and average monthly premium costs between $393 and $1021,**[141] **extrapolating these results nationally results in estimated cost savings between $49.7 billion and $82.9 billion in premium payments in 2018 US dollars over a one-year period.**

Getting Started

- *First Annual Report: Next Generation Accountable Care Organization (NGACO) Model Evaluation*. NORC at the University of Chicago; August 2018. https://innovation.cms.gov/files/reports/nextgenaco-firstannrpt.pdf
- McClellan MB, Smith MD, Buckingham T. "A Roadmap for Driving High Performance in Alternative Payment Models." *Health Affairs* Blog. April 3, 2019. https://www.healthaffairs.org/do/10.1377/hblog20190328.638435/full/

[137] "Caravan Health ACOs Achieved More Than $26M in Savings in 2016, Higher Than Average Quality Scores." Caravan Health. October 16, 2017. https://caravanhealth.com/thought-leadership/news/caravan-health-acos-achieved-$26m-savings/
[138] Analysis of Bundled Payment. RAND Corporation. https://www.rand.org/pubs/technical_reports/TR562z20/analysis-of-bundled-payment.html
[139] Under construction: Risk-based contracting. *Modern Healthcare*. June 18, 2016. http://www.modernhealthcare.com/article/20160618/MAGAZINE/306189982
[140] Cutler DM, Ghosh K. The potential for cost savings through bundled episode payments. *NEJM*. 2012;366(12):1075-1077.
[141] *Health Insurance Price Index Report: 2016 Open Enrollment Period*. eHealth; October 2016. https://news.ehealthinsurance.com/_ir/68/20169/eHealth%20Health%20Insurance%20Price%20Index%20Report%20for%20the%202016%20Open%20Enrollment%20Period%20-%20October%202016.pdf

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Cost Reduction Assuming Spending Cap at 50th Percentile (2018)	Cost Reduction Assuming Spending Cap at 25th Percentile (2018)
$15b	$29b

Policy Type	Average Annual Premium Costs	Total Number of Beneficiaries	Percentage of Assumed Cost Savings	Estimated Cost Savings (2018)
Individual	$4,716	85,588,200	6% to 10%	$24.2b to $40.4b
Family	$12,252	34,666,200	6% to 10%	$25.5b to $42.5b
Total				**$49.7b to $82.9b**

P6: Health Equity

Addressing the adverse impact of social determinants of health and racial disparities comprise a significant opportunity to reduce waste in the health care system.

Key Literature Sources to Support Checkbook Estimates

- Evaluations of the Housing First model targeting homeless adults with behavioral health conditions achieved net savings between $9,000 and $30,000 per person per year.[142] The Oregon Bud Clark Commons pilot, a housing complex integrating health and social services, achieved more than a $13,000 reduction in annual Medicaid spending per person among previous homeless residents one year after move in.[143] **Applying the savings seen in the Bud Clark Commons program to the estimated national homeless population of between 193,000 and 554,000 individuals yields estimated national annual savings to Medicaid between $3 billion and $8.7 billion in 2018 US dollars over a one-year period.**
- Food accessibility and nutrition programs were also identified as potential sources of savings. One study found that increased spending on home-delivered meals of $25 per older adult was associated with a 1 percent decline in nursing home admissions.[144] Another study analyzed the impact of Supplemental Nutrition Assistance Program (SNAP) benefits on older adults in Maryland. The authors found that enrollees were 14 percent less likely to be hospitalized and 23 percent less likely to enter a nursing home compared to non-enrollees. Overall, they estimated Medicare savings of $2,120 for every low-income senior enrolled in SNAP.[145] **Nationally there are 5.5 million eligible seniors who are not enrolled in SNAP, yielding potential annual cost savings of $13.1 billion in direct health care spending to Medicare in 2018 US dollars over a one-year period.[146]**
- The costs of racial disparities in care and outcomes to the health care system are well documented in the literature. For example, one study in Virginia estimated the costs of racial disparities in stroke, heart disease, cancer, injury, and low birth weight babies among adult nonelderly inpatients to be $160.3 million.[147] **Using data from the Medical Expenditure Panel survey, another national study estimated that eliminating racial disparities could save $66.2 billion in out-of-pocket and third-party payments to providers.**[148] After dividing their sample into age/gender cohorts and developing a model of estimated health expenditures by health status, the authors re-estimated the model assuming all had the health status of the healthiest cohort.

[142] Taylor LA, Coyle CE, Ndumele C, Rogan E, Canavan M, Curry L, Bradley EH. *Leveraging the Social Determinants of Health: What Works?* Blue Cross Blue Shield of Massachusetts Foundation; June 2015. https://bluecrossmafoundation.org/sites/default/files/download/publication/Social_Equity_Report_Final.pdf
[143] *Integrating Housing & Health: A Health-Focused Evaluation the Apartments at Bud Clark Commons*. The Center for Outcomes Research & Education; October 2013. http://www.mentalhealthportland.org/wp-content/uploads/2014/04/Integrated-Housing-Health-a-Health-Focused-Evaluation-of-The-Apartments-at-Bud-Clark-Commons.pdf
[144] Thomas KS, Mor V. Providing more home-delivered meals is one way to keep older adults with low care needs out of nursing homes. *Health Aff (Millwood)*. 2013;32(10):1796-1802.
[145] Samuel LJ, Szanton SL, Cahill R, et al. Does the Supplemental Nutrition Assistance Program affect hospital utilization among older adults? The case of Maryland. *Population Health Management*. 2018;21(2):88-95.
[146] Zielinskie G, Samuel LJ, Szanton S. "To Improve Health and Reduce Costs for Low-Income Seniors, Invest Upstream." *Health Affairs* Blog. October 27, 2017.
[147] *Virginia Health Equity Report 2012*. Virginia Department of Health; 2012. https://sph.umd.edu/sites/default/files/files/HealthEquityReport2012.pdf
[148] Laveist TA, Gaskin D, Richard P. Estimating the economic burden of racial health inequalities in the United States. *International Journal of Health Services*. 2011;41(2):231-238.

Getting Started

- Taylor LA, Coyle CE, Ndumele C, Rogan E, Canavan M, Curry L, Bradley EH. *Leveraging the Social Determinants of Health: What Works?* Blue Cross Blue Shield of Massachusetts Foundation; June 2015. https://bluecrossmafoundation.org/sites/default/files/download/publication/Social_Equity_Report_Final.pdf
- Wyatt R, Laderman M, Botwinick L, Mate K, Whittington J. *Achieving Health Equity: A Guide for Health Care Organizations*. IHI White Paper. Cambridge, MA: Institute for Healthcare Improvement; 2016. http://www.ihi.org/resources/Pages/IHIWhitePapers/Achieving-Health-Equity.aspx
- Pathways to Population Health. http://www.pathways2pophealth.org/

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Estimated Cost Savings per Resident Using Bud Clark Commons Estimates (2010)	Upper Bound Total Number of Homeless Persons	Lower Bound Total Number of Homeless Persons (Unsheltered Only)	Lower Bound Estimated Cost Savings (2018 Inflation Adjustment)	Upper Bound Estimated Cost Savings (2018 Inflation Adjustment)
$13,300	554,000	193,000	$3b	$8.7b

Cost Savings per Low-Income Senior in SNAP	Total Number of SNAP Eligible Seniors Not Enrolled	Estimated Cost Savings (2018 Inflation Adjustment)
$2,120	5,500,000	$13.1b

Annualized Estimated Reduced Indirect Costs to Economy from Reducing Racial Disparities (2003 to 2006)	Annualized Estimated Reduced Direct Medical Care Expenditures from Reducing Racial Disparities	Annualized Estimated Reduced Direct Medical Care Expenditures from Reducing Racial Disparities (2018 Inflation Adjustment)
$252b	$57.3b	$66.2b

P6: Use of Dialysis Days

There is a growing emphasis on advancing kidney health in the US with improved management of end-stage renal disease (ESRD) and chronic kidney disease. While there is more to be studied here, the Presidential Executive Order published in 2019 puts forth three broad goals: 1) reduce the number of Americans developing ESRD by 25 percent by 2030; 2) 80 percent of new ESRD patients in 2025 will either start dialysis at home or start with a transplant; and 3) double the number of organs available for transplant by 2030.[149]

Key Literature Sources to Support Checkbook Estimates

- A coordinated care program run by Optum realized $15,133 in savings per year per patient among end-stage renal disease patients.[150] **Extrapolating these savings to 20 percent of the national population of 500,164[151] Medicare ESRD beneficiaries would yield estimated cost savings to providers of $1.5 billion in 2018 US dollars over a one-year period.**
- Other estimates are needed for key populations to add to this number, noting global estimates of starting dialysis at home can be as high as 60 percent to 70 percent in Hong Kong, 30 percent in Europe, and 52 percent in Colombia.

Getting Started

- *Care Coordination Toolkit*. Center for Medicare & Medicaid Services; March 2019. https://innovation.cms.gov/Files/x/aco-carecoordination-toolkit.pdf
- "Webinar: Comprehensive ESRD Care Initiative — Making the ACO Business Case." Centers for Medicare & Medicaid Services. https://innovation.cms.gov/resources/ComprehensiveESRD-ESCO-ACO.html

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Estimated Cost Savings per Chronic Kidney Disease Patient (2018)	Total Number of Medicare ESRD Beneficiaries	Percentage of Target Population	Estimated Cost Savings (2018)
$15,133	500,164	20%	$1.5b *(Medicare only)*

[149] Executive Order on Advancing American Kidney Health. Washington, DC: The White House. July 10, 2019. https://www.whitehouse.gov/presidential-actions/executive-order-advancing-american-kidney-health/
[150] *How Specialized Kidney Care Programs Yield Cost Savings and Better Outcomes*. Optum; 2018. https://cdn-aem.optum.com/content/dam/optum3/optum/en/resources/white-papers/optum-specialized-kidney-care-programs-whitepaper.pdf
[151] State Health Facts: Medicare Beneficiaries with End-Stage Renal Disease (ESRD). Kaiser Family Foundation; 2016. https://www.kff.org/medicare/state-indicator/enrollees-with-esrd/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D

P6: Optimizing Inpatient Psychiatric Days

Hospitals often face challenges in finding appropriate community-based resources for patients who are ready to be discharged from inpatient psychiatric units. These delays inhibit the optimal provision of care, may cause stress for patients and families, and often lead to patients staying in more expensive hospital settings longer than necessary.[152]

Key Literature Sources to Support Checkbook Estimates

- Per the Healthcare Cost and Utilization Project (HCUP), the cost of an inpatient psychiatric stay is roughly $5,200, with an average length of stay (ALOS) between 4.8 days and 8 days.[153]
- According to the National Association of State Mental Health Program Directors, in 2014 there was approximately 254,000 inpatient psychiatric days at general hospitals with separate psychiatric units.[154]
- In 2016 the Minnesota Hospital Association ran a study of delays in discharge among behavioral health patients in 20 hospitals with an inpatient psychiatric unit. They found that nearly 20 percent of inpatient psychiatric days were potentially avoidable and cited the top three reasons for delay as unavailability of state psychiatric hospitals beds, chemical dependency treatment beds, and intensive resident treatment services.[155]
- **Extrapolating a 20 percent reduction in bed days nationally using the cost and ALOS data estimated by HCUP yields an estimated cost savings between $42.4 million and $70.7 million in 2018 US dollars over a one-year period.**

Getting Started

- Psychiatric Bed Shortages. Treatment Advocacy Center. https://www.treatmentadvocacycenter.org/key-issues/bed-shortages
- Actionable Patient Safety Solutions (APSS): Mental Health. Patient Safety Movement. https://patientsafetymovement.org/actionable-solutions/challenge-solutions/mental-health/

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Total Number of Inpatient Psych Days	Total Number of Avoidable Psych Days	Lower Bound Estimated Cost per Inpatient Psych Day (2005)	Upper Bound Estimated Cost per Inpatient Psych Day (2005)	Lower Bound Estimated Cost Savings (2018 Inflation Adjustment)	Upper Bound Estimated Cost Savings (2018 Inflation Adjustment)
252,743	50,548	$575	$1,083	$42.4m	$70.7m

[152] Dillon K, Thomsen D. *Reasons for Delays in Hospital Discharges of Behavioral Health Patients*. Wilder Research; July 2016. https://www.mnhospitals.org/Portals/0/Documents/policy-advocacy/mental-health/MHA%20Mental%20Health%20Avoidable%20Days%20Study%20Report%20July%202016.pdf
[153] Stranges E, Levit K, Stocks C, Santora P. *State Variation in Inpatient Hospitalizations for Mental Health and Substance Abuse Conditions, 2002-2008*. HCUP Statistical Brief #117. Rockville, MD: Agency for Healthcare Research and Quality; June 2011. https://www.hcup-us.ahrq.gov/reports/statbriefs/sb117.jsp
[154] Lutterman T, Manderscheid R. "Trends in Total Psychiatric Inpatient and Other 24-Hour Mental Health Residential Treatment Capacity, 1970 to 2014." Presentation at NASMHPD Commissioners Meeting July 2017. https://www.nri-inc.org/media/1302/t-lutterman-and-r-manderscheid-distribution-of-psychiatric-inpatient-capacity-united-states.pdf
[155] Dillon K, Thomsen D. *Reasons for Delays in Hospital Discharges of Behavioral Health Patients*. Wilder Research; July 2016. https://www.mnhospitals.org/Portals/0/Documents/policy-advocacy/mental-health/MHA%20Mental%20Health%20Avoidable%20Days%20Study%20Report%20July%202016.pdf

P6: Ambulatory Care-Sensitive Hospital Admissions

Ambulatory care-sensitive admissions are hospital admissions that could have been avoided with optimal primary care.[156] Dehydration, adult asthma, hypertension, and urinary tract infections are some examples of ambulatory care-sensitive conditions.

Key Literature Sources to Support Checkbook Estimates

- A 2006 study by the University of South Carolina estimated total hospital costs for preventable conditions at $30.8 billion.[157,158]
- A report by Milliman estimates that 14 percent of total Medicare inpatient admissions are ambulatory care sensitive.[159] As inpatient claims account for nearly half of total Medicare spending, reducing potentially preventable admissions presents a significant cost savings opportunity. A variety of interventions — including expansion of managed care, increased availability of primary care physicians, and improved chronic disease management — have realized reductions in ambulatory care-sensitive hospital admissions by 7 percent to 43 percent.
- **Applying these rates to the total national expenditures yields an estimated cost savings between $1.6 billion and $4.9 billion in 2018 US dollars over a one-year period.**

Getting Started

- *Decreasing Hospital Admissions for Ambulatory Care Sensitive Conditions: A $31 Billion Opportunity*. Network for Excellence in Health Innovation. https://www.nehi.net/bendthecurve/sup/documents/ACSC_Brief.pdf

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Total Cost Burden from Ambulatory Care-Sensitive Admissions (2006)	Total Number of US Hospital Admissions	Total Number of Medicare FFS Admissions	Lower Bound Estimated Cost Savings Assuming 7% Reduction (2018 Inflation Adjustment)	Upper Bound Estimated Cost Savings Assuming 43% Reduction (2018 Inflation Adjustment)
$30.8b	34,305,620	10,000,000	$1.6b	$4.9b

[156] Freund T, Campbell SM, Geissler S, et al. Strategies for reducing potentially avoidable hospitalizations for ambulatory care-sensitive conditions. *Ann Fam Med*. 2013;11(4):363-370.
[157] *Decreasing Hospital Admissions for Ambulatory Care Sensitive Conditions: A $31 Billion Opportunity*. Network for Excellence in Health Innovation. https://www.nehi.net/bendthecurve/sup/documents/ACSC_Brief.pdf
[158] Laditka JN, Laditka SB. Insurance status and access to primary health care: Disparate outcomes for potentially preventable hospitalization. *J Health Soc Policy*. 2004;19(2):81-100.
[159] Fitch K, Iwasaki K. *Ambulatory-Care-Sensitive Admission Rates: A Key Metric in Evaluating Health Plan Medical-Management Effectiveness*. Milliman Research Report; January 2009. http://us.milliman.com/insight/research/health/pdfs/Ambulatory-care-sensitive-admission-rates-A-key-metric-in-evaluating-health-plan-medical-management/

P6: Site-Neutral Payment

Historically in the US, a procedure performed at a hospital-owned outpatient department is reimbursed at a higher rate than the same procedure performed at an ambulatory surgical center (ASC) or physician office.[160] In 2015, MedPac recommended closing the gap between these disparate rates, known as site-neutral payment.[161] That same year Congress passed a budget bill that began to enact site-neutral payment for certain Medicare services.[162] These policies have also gained popularity among commercial payers. Health insurance plan provider Anthem announced that, by March 2018, it would no longer pay for outpatient MRIs and CT scans performed in hospital settings in 13 of the 14 states in which the company operates.[163]

Key Literature Sources to Support Checkbook Estimates

- According to a Healthcare Bluebook report, only half of procedures that can be performed in ASCs are actually performed in these settings.[164] **The report estimates that if the remaining half of procedures were actually performed in ASCs, assuming 3 percent of cases are ineligible (i.e., patients with complex needs), estimated annual savings between $38.2 billion and $55.6 billion could be achieved among commercial payers.**
- Another study by UC Berkeley estimated the potential savings to Medicare from surgeries being performed in ASCs as opposed to hospital outpatient departments (HOPDs).[165] **Assuming the number of procedures per 1,000 Medicare beneficiaries stays constant as the lower bound, and assuming a 3 percent annual increase as the upper bound, the authors estimated annual cost savings to Medicare between $3.3 billion and $5.8 billion in 2018 US dollars over a one-year period.**

Getting Started

- Alliance for Site-Neutral Payment Reform. http://www.siteneutral.org/

Checkbook Calculations (in 2018 US dollars: m = million; b = billion)

Payer Type	Lower Bound Estimated Cost Savings (2018)	Upper Bound Estimated Cost Savings (2018)
Commercial	$38.2b	$55.6b
Medicare	$3.3b	$5.8b
Total	**$41.5b**	**$61.4b**

[160] Morsey S. Site-neutral payments called an assault on the financial stability of hospitals. *Healthcare Finance*. November 2017.
[161] *Report to the Congress Medicare Payment Policy*. Medicare Payment Advisory Commission. March 13 2015. http://www.medpac.gov/docs/default-source/reports/mar2015_entirereport_revised.pdf?sfvrsn=0
[162] H.R.1314 — Bipartisan Budget Act of 2015. United States Library of Congress. https://www.congress.gov/bill/114th-congress/house-bill/1314
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