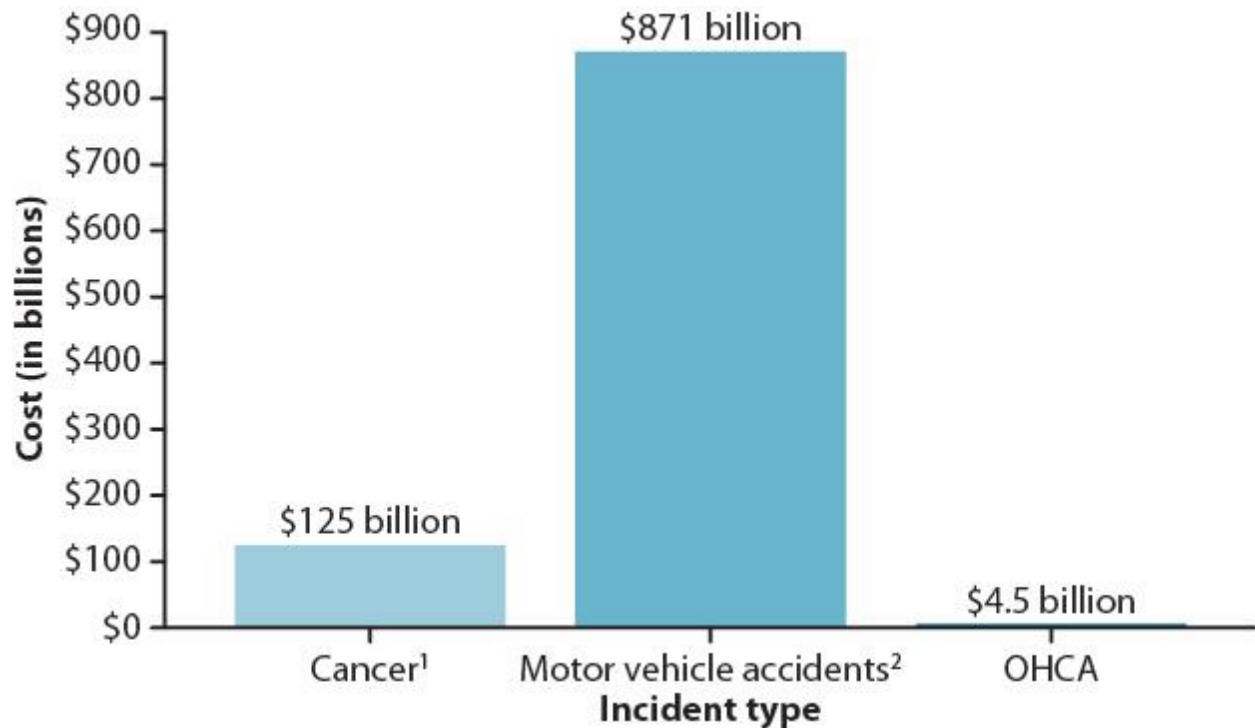


The Cost of Prehospital Cardiac Arrest Care

By

[Keith G. Lurie, MD](#), [Michael Levy, MD, FACEP, FAAEM, FACP](#), [Robert Swor, DO, FACEP, FAEMS](#), [johannamooremdms](#)

12.20.2017



It was just another busy morning for 26-year-old Bailey as she prepared breakfast for her five-month-old and five-year-old children in her rural Minnesota house. Suddenly, she collapsed onto the kitchen floor.

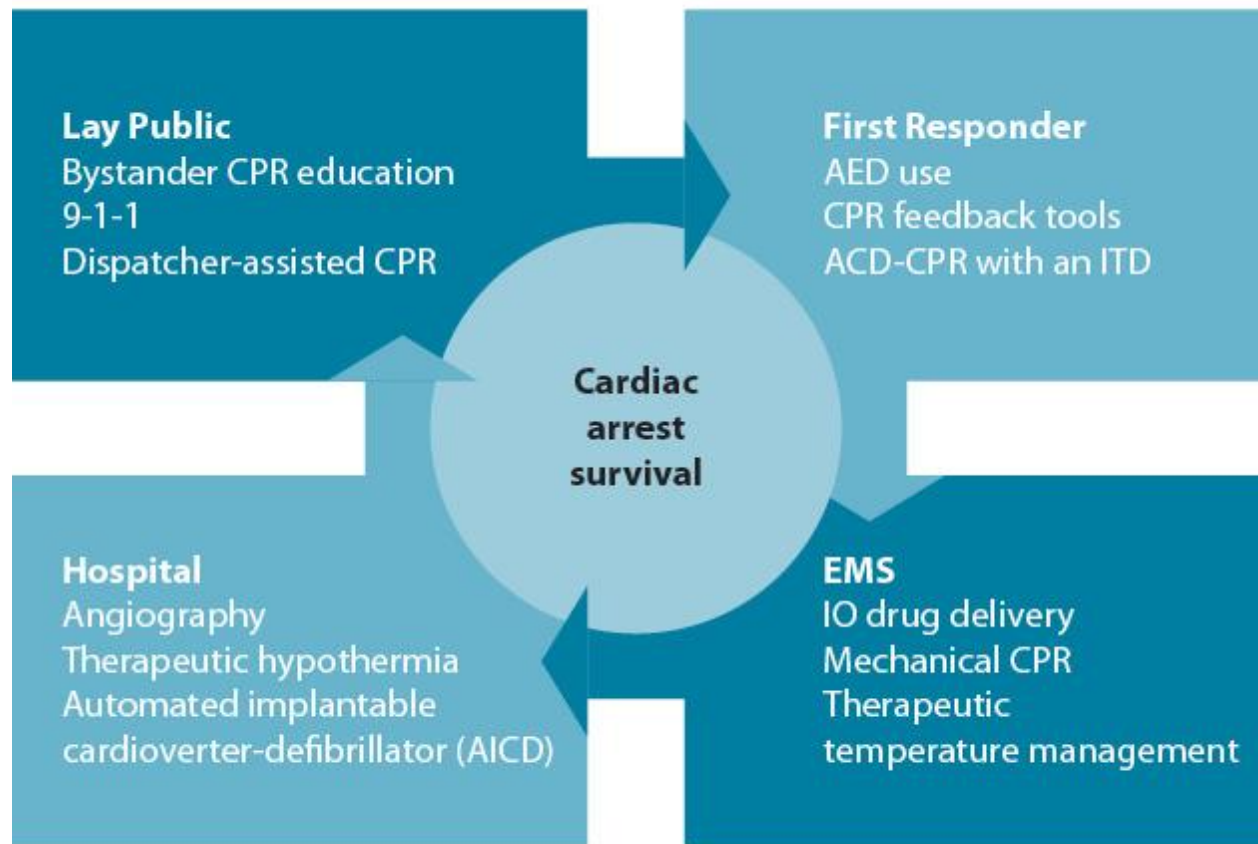
Bailey's boyfriend, who happened to be home that morning, immediately called 9-1-1 and started CPR. Although he knew CPR from a course he had taken at his construction job, the dispatcher on the phone guided him through chest compression-only CPR. He later reported that Bailey was gasping from time to time—a favorable prognostic sign.

It took about 12 minutes for EMS to arrive.

Defibrillation didn't initially convert the young patient, so Bailey was treated with automated CPR and an airway circulatory enhancement adjunct. After 15 minutes with those therapeutic measures, return of spontaneous circulation (ROSC) was achieved and she was transferred to St. Cloud Hospital

for advanced care, which included therapeutic hypothermia. Several days later, Bailey woke up—in time to get home for Christmas with her family.

Bailey received the Take Heart America (THA) “Bundle of Care,”¹ and that saved her life. (See Figure 1.) All the elements of the THA Bundle of Care are recommended by the American Heart Association (AHA) and International Liaison Committee on Resuscitation (ILCOR) when THA was first described 12 years ago.



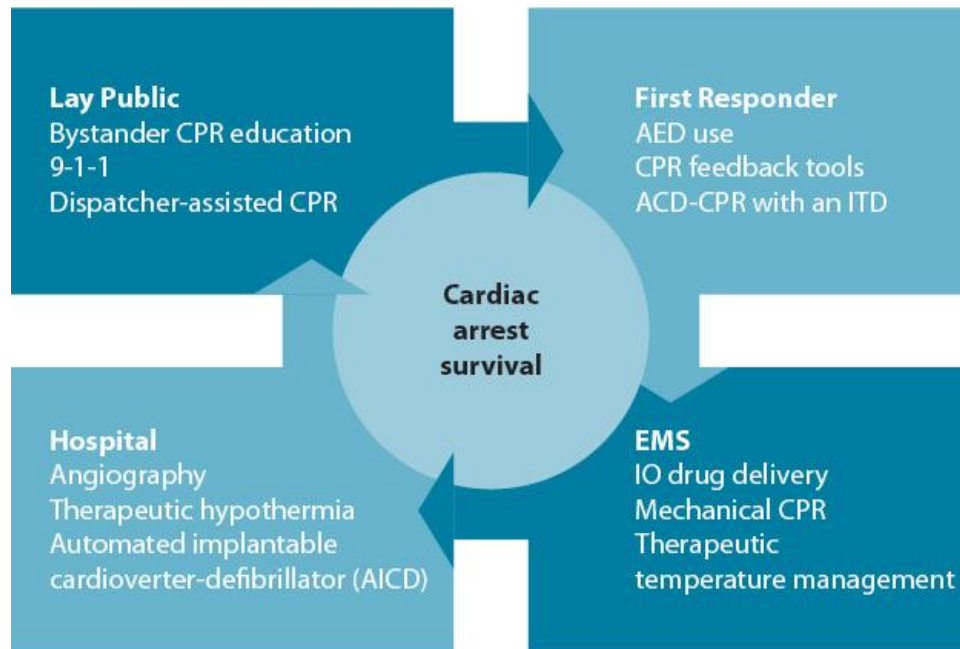


Figure 1. The Take Heart America Bundle of Care

As clinicians and EMS providers, we treat patients like Bailey on a daily basis. Unfortunately, the kind of care she received—the best care—is often denied due to limited resources. In fact, little is known about the real economic impact of out-of-hospital cardiac arrest (OHCA) and true cost of optimal care.

In this article, we look at the economic impact of OHCA in two terms: 1) cost to society for lives lost; and 2) cost to society to save more lives. We provide recommendations for reducing the economic burden and improving survival outcomes—all based upon the experience of the THA Cardiac Arrest Initiative.

We often use the cost associated with the best care as an excuse not to provide care. The cost to provide the best OHCA care is relatively low compared to the other ways we use our public resources and health care dollars. We hope you can use this analysis to obtain the resources you need and to optimize care for your patients.

Understanding Cost

To examine the costs of OHCA, we took a similar approach to the way the U.S. Department of Transportation (DOT) examined the economic burden associated with automobile deaths.

The DOT estimated the economic impact of loss of life from each car accident based on direct costs (e.g., EMS, medical care and rehab) and indirect costs (e.g., lost wages, loss of productivity, employer earnings and taxes).

In 2010, there were 32,000 motor vehicle deaths in the U.S. The combined direct and indirect economic burden from automobile accidents is approximately \$870 billion.²

To calculate the economic impact of the more than 300,000 OHCA that occur in the U.S. each year, we categorized direct costs as expenses for EMS and in-hospital care. The indirect costs, following the examples of motor vehicle deaths, included lost income, employers' losses, quality of life and costs associated with a poorer quality of life.

Direct Costs

We used the costs associated with what's currently considered state-of-the-art care for patients with OHCA. Using the THA Bundle of Care model, we estimated the cost associated with prehospital care and in-hospital care based on the costs associated with each of the key medical interventions.

This kind of care is currently provided in multiple EMS systems throughout the U.S., from Anchorage, Alaska; Whatcom County, Wash.; Salt Lake City; to Palm Beach County, Fla. When fully implemented, this approach can result in a nearly 20% overall survival rate with good neurologic function.

Current literature tells us that the direct costs of care for patients who survive to hospital discharge is \$37,000. For patients who die prior to hospital discharge, the cost of care is estimated at \$9,000 per patient.¹

There's also a direct margin (i.e., profit) of \$21,000 associated with each OHCA patient who survives to hospital discharge with good brain function, and \$3,300 for each patient who doesn't survive to hospital discharge.

With these data, we can now estimate the direct cost of prehospital care for the roughly 350,000 annual OHCA patients in the U.S. In some smaller cities and rural areas, the costs may be higher, and vice versa for larger urban areas.

Nonetheless, these calculations provide a reasonable estimate of the true costs. We can use these data to get the resources we need to take care of our patients.

We estimated the direct costs associated with the care of patients with OHCA based upon the experience in Minneapolis, where all elements of the THA Bundle have been fully implemented. With a population of 400,000, Minneapolis residents experience approximately 400 cardiac arrests each year.

We assume that all first responder firefighters and ALS ambulances in Minneapolis carry advanced defibrillators, automated CPR devices, manual active compression decompression (ACD) CPR devices, impedance threshold devices (ITD), intraosseous (IO) drug delivery systems, and CPR feedback tools. (See Table 1 for the estimated cost of this equipment, which we assume has a minimum of a three-year shelf life before it needs to be replaced.)

Table 1. Annual cost of prehospital equipment per vehicle used to treat OHCA (over three years)

Equipment	Cost
Defibrillator	\$13,000
Automated CPR device	\$13,000
ACD+ITD devices	\$1,000
Intra-osseous (IO) device	\$400
Annual equipment cost (ammortized over 3 years)	\$9,133
Consumables (annual cost)	\$1,500
Total annual cost per vehicle	\$10,633

Based on the annual cost of this equipment ammortized over a three-year period, and the total budget for the CPR technologies needed to serve a population of 400,000 people with 40 BLS and ALS rigs, we calculated a cost of approximately \$1,063 for each patient treated outside the hospital, regardless of outcome. With 400 OHCA patients, the direct cost for equipment in this scenario is estimated at \$425,200—or \$10,630 per rig, per year.

The direct cost for OHCA prehospital care is \$1,063 per patient, per year. In Minneapolis, about 40% of all OHCA patients are resuscitated and admitted to the hospital, and the overall rate of patients who survive to hospital discharge with good neurological function is approximately 15%.

Based on the calculations in Tables 2 and 3, we can determine that the direct costs for prehospital and in-hospital care for an OHCA is \$12,945, regardless of outcome. The cost for a survivor with good brain function is \$38,063 (i.e., the sum of the prehospital and in-hospital care costs).

Table 2. Direct costs of care for an OHCA patient who survives to discharge

Type of care	# of patients	Direct cost per patient	Direct cost per taxpayer ¹
Prehospital	52,500	\$1,063	\$17
In-hospital		\$37,000	

¹ CALCULATED BY MULTIPLYING COST PER PATIENT (\$38,063) BY THE NUMBER OF OHCA SURVIVORS (52,500), DIVIDED BY THE NUMBER OF TAX PAYERS (120,000,000)

Table 3. Direct costs of care for an OHCA patient who dies before discharge

Type of care	# of patients	Direct cost per patient	Direct cost per taxpayer ¹
Prehospital	297,500	\$1,063	\$24
In-hospital		\$8,700	

¹ CALCULATED BY MULTIPLYING COST PER PATIENT (\$9,763) BY THE NUMBER OF OHCA PATIENTS WHO DIE (297,500), DIVIDED BY THE NUMBER OF TAX PAYERS (120,000,000)

If we spread out the direct cost for each OHCA patient treated (\$12,945) across the approximately 120 million taxpayer families in the U.S., the direct costs for each survivor, regardless of the outcome, is \$38 per year. (See Table 4.)

Table 4. Direct costs of care for an OHCA patient, regardless of outcome

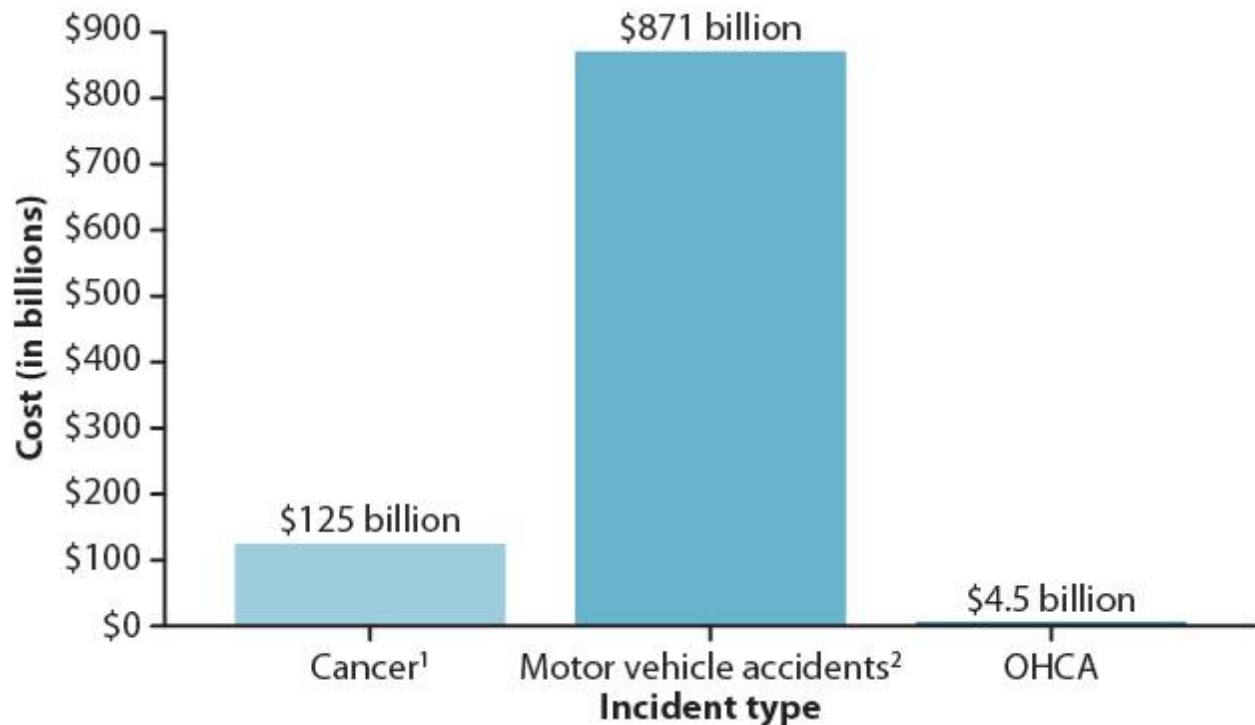
# of Patients	Direct Cost per patient	Direct cost per taxpayer ¹
350,000	\$12,945	\$38

¹ CALCULATED BY MULTIPLYING COST PER PATIENT (\$12,945) BY THE NUMBER OF OHCA EACH YEAR (350,000), DIVIDED BY THE NUMBER OF TAX PAYERS (120,000,000)

If we do the same with the costs of \$38,063 for each OHCA patient discharged with good brain function, the direct costs to individual taxpayers is \$17 per year for each OHCA survivor. (See Table 3.)

These costs include all of the latest state-of-the-art prehospital and in-hospital care, including all the interventions shown in Figure 1. Relative to the costs of other disease states, these direct costs are very manageable. (See Table 5.)

Table 5. Incident costs per year in the U.S.



Indirect Costs

What about indirect costs, such as lost wages or reduced quality of life? This value varies widely by industry and government. The EPA currently values a statistical life at \$7.9 million. When someone dies in a car accident, the DOT uses \$9.2 million as the indirect cost to society for each life lost.

This number can get very high very quickly if you factor in all cardiac arrest patients. With an OHCA death rate of 85% multiplied by \$6.2 million in indirect costs per person, we end up with \$1.8 trillion in losses to society. If we use a 75% discount, so that we only include cardiac arrest patients who are younger than 50, the number is still enormous: \$450 billion in annual indirect costs.

Consider, for example, a 53-year-old pharmacist who makes \$88,000 in Minneapolis, pays \$15,139 in federal taxes and \$5,072 in state taxes.

Suppose that, instead of dying at age 53 from an OHCA, that pharmacist survived and lived until 80 years of age. With those additional 27 years of life, the federal government would collect a total of \$408,726, and the state would collect \$136,944. (These calculations exclude Social Security and Medicare taxes.)

The lost tax revenue—more than \$500,000 for one pharmacist—is part of the enormous indirect economic burden associated with OHCA.

The Economic Burden on Society

These calculated costs are important, especially if we consider what the benefits would be for every 1% increase in the OHCA survival rate.

The annual U.S. government budget is approximately \$ 3.8 trillion. For OHCA patients, the annual U.S. direct cost (\$4.5 billion) and indirect cost (\$450 billion) total \$495 billion. The societal burden for cardiac arrest patients equates to an economic loss of about \$3,750 per U.S. taxpayer family. Every 1% increase in the OHCA survival rate represents \$4.5 billion in savings to our economy.

So how can we use these data to improve outcomes from cardiac arrest? We start with the direct costs.

We convinced multiple EMS systems in Minn. to purchase the tools needed to provide state-of-the art care for OHCA. We believe this change contributed to Minnesota's 14-16% OHCA survival rate, the highest of any survival rate in the U.S. The return on investment for the receiving hospitals and the community is substantial.

At the time of this writing, we haven't used these calculations to lobby at the state or national level, but we do plan to do this in the future. For all those reading this article who would like to help, please let us know.

Conclusion

The economic burden to our society from treatment of every OHCA is enormous: approximately \$4.5 billion in direct costs and a conservative estimate of \$450 billion in indirect costs.

Although OHCA accounts for only 1% of all EMS calls, it accounts for a large cost to society. The economic loss for from each OHCA is approximately \$3,750. These numbers alone are compelling enough to justify an investment in lowering the mortality rates from cardiac arrest and reducing the financial and non-financial costs.

Finally, let's not forget why we got into this business to begin with: It's for the Baileys of the world.

It goes without saying that, for families like Bailey's, the cost of OHCA is truly incalculable.

References

1. Lick CJ, Aufderheide TP, Niskanen RA, et al. Take Heart America: A comprehensive, community-wide, systems-based approach to the treatment of cardiac arrest. *Crit Care Med.* 2011;39(1):26–33.
2. U.S. Department of Transportation. National Highway Transportation Safety Association. (May 2015.) Economic and societal impact of motor vehicle crashes,

2010 (Revised). Retrieved Nov. 3, 2017, from
<https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812013>.