

METHODS TO CALCULATE THE DIRECT COSTS OF MEDICAL CARE FOR PEDESTRIAN AND BICYCLIST INJURIES DUE TO TRAFFIC COLLISIONS IN THE COUNTY OF LOS ANGELES, 2014

PURPOSE OF THIS ANALYSIS

Motor vehicle traffic crashes (MVTCs) result in devastating health outcomes. However, the economic impacts are also vast. In 2010, the economic costs of motor vehicle crashes totaled \$242 billion for the United States, with \$23.4 billion related to medical costs.¹ Addressing the root causes of crashes requires extensive investment and reallocation of government resources in infrastructure, communication, education, and systems changes that involve multi-stakeholder collaboration. Local governments often lack information about the extent of MVTCs and their associated costs, which makes decision making on important resource investment tradeoffs challenging. To address this need in planning and practice, the Los Angeles County Department of Public Health (DPH) calculated the minimum direct costs of medical care for pedestrian and bicyclist motor vehicle traffic collision victims in Los Angeles County. A high-level summary of the approach to the analysis follows. A more detailed version of this analysis can be found in the technical appendix on page 4.

This document is an accompaniment to the brief: Porter K et al. Los Angeles County Department of Public Health, Division of Chronic Disease and Injury Prevention, PLACE Program. Direct Costs of Medical Care for Pedestrians and Bicyclists Hit by a Vehicle in Los Angeles County. Issue Brief. October 2018.

TYPES OF COLLISION COSTS

The overall costs of collisions come in many forms and accrue to both the individual and society at large. The National Highway Traffic Safety Administration summarizes economic costs into the categories of: property damage; medical costs; emergency services; travel delay; administrative costs; legal costs; lost earnings; lost household production; vocational rehabilitation; workplace costs; and pain and lost quality of life.² These costs can be further categorized into direct and indirect costs. Direct costs are those that an individual incurs due to a collision, whereas indirect costs do not directly relate to the collision itself but are an eventual result of the collision, such as lost wages due to taking sick leave.³ Figure 1 (next page) visualizes the potential range of costs and highlights direct cost components included in our calculation of medical costs.

FIGURE 1. Summary of Collision Costs

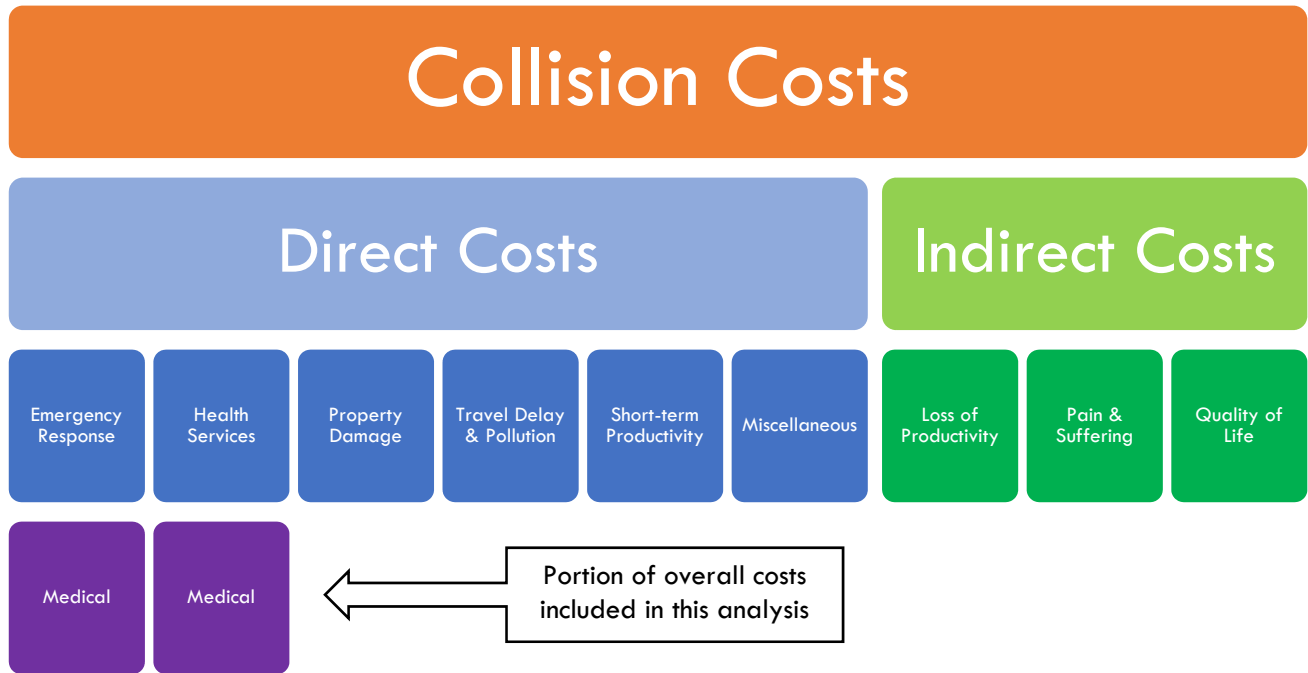


Diagram modified from: Capital Region Intersection Safety Partnership (CRISP). Cost collision study: Report summary. February 2010.

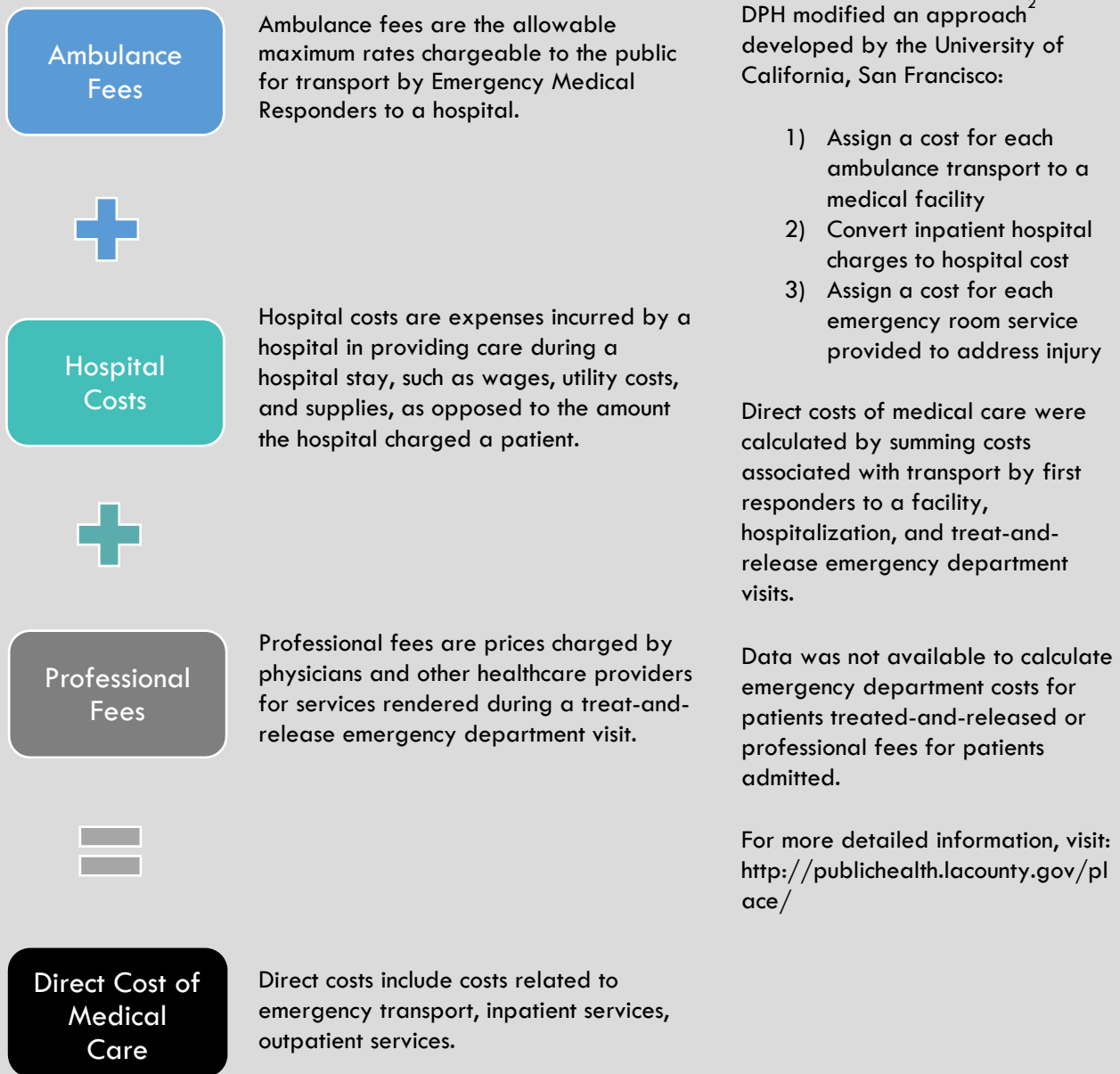
Although other agencies have produced estimates of the economic costs of crashes, their conceptual nature can make it difficult for these values to be interpreted by the public. Although medical costs are just one of many economic impacts of crashes, they are one of the most tangible costs that could be averted with prevention.

APPROACH

A high-level overview of the methodology used for this analysis is described below. The detailed methodology can be found in the Technical Appendix on page 4. The calculations employed numerous assumptions that are intended to approximate the minimum direct costs of medical care. They are projections only.

Each cost component calculation (ambulance fees, hospital costs, and professional fees) is derived from a different 2014 population of pedestrian and bicyclists who were motor vehicle traffic collision victims. Data about all victims may not be available due to the complexity the response to a collision and how a collision is reported or documented.

FIGURE 2: Basic Formula for Calculating Direct Costs of Medical Care



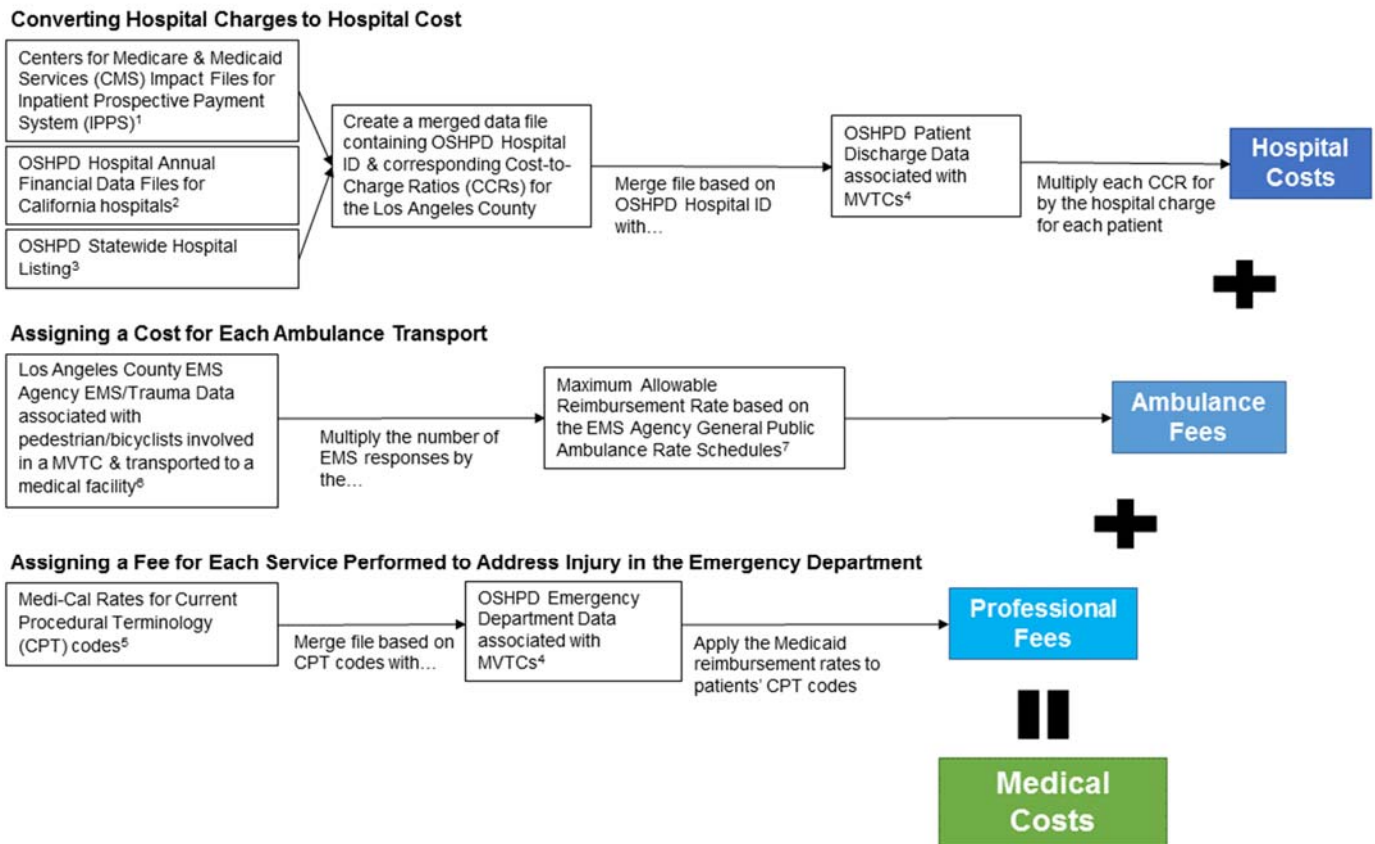
Technical Appendix

In this appendix, we provide a more complete set of the details on the data and methods we used to produce the estimates presented above. As mentioned, we made several assumptions to arrive at our estimated minimum direct costs. However, other sets of assumptions and approaches could be used that generate different findings. These calculations are intended to be suggestive and only describe our approach. All analyses were performed using SAS version 9.4 and ArcMap version 10.3.

CALCULATING DIRECT COSTS OF MEDICAL CARE

The figure below is a visual representation of the overall process to calculate direct medical costs using a modified University of California San Francisco Approach.⁴

FIGURE 3. Process for Calculating Direct Medical Costs of Collisions Using a Modified University of California San Francisco Approach



DATA SOURCES

We used:

- Federal-level Cost-to-Charge Ratios (CCRs) from the Centers for Medicare and Medicaid Services (CMS), where CCRs equals the total amount of money required to operate a hospital, divided by the sum of the revenues from patient care and other operating revenues⁵;
- State-level hospital data (financial⁶, hospital listing⁷, discharge and emergency department⁸) and Medicaid reimbursement⁹ and;
- County-level Emergency Medical Services (EMS) and Trauma data¹⁰, and ambulance rate schedules.¹¹

METHODS

Each cost component is derived from a different 2014 population of motor vehicle traffic crash (MVTC) victims. These are described further below.

HOSPITALIZED AND EMERGENCY DEPARTMENT VICTIMS

DEFINING COLLISION VICTIMS

We used California's Office of Statewide Health Planning and Development (OSHPD) datasets for California licensed local health departments to identify pedestrian and bicyclist collision victims treated in a County medical facility. OSHPD patient discharge data was used to identify collision victims who were admitted in the hospital. OSHPD Emergency Department (ED) data were used to identify victims who were treated-and-released from the ED. A MVTC was defined as a hospital visit with a primary external cause of injury code (E-code) of E810-E819 from the International Classification of Diseases, ninth revision. Specific sub-categories of E-codes were selected to identify the injured party; for pedestrians (X.7) and bicyclists (X.6).

IDENTIFYING INCIDENT LOCATION

Assumptions were made to identify where MVTC injuries occurred in the county versus the city of Los Angeles. The OSHPD data for local public health departments cannot identify incident location because it only contains geographic information on patient residence location and hospital location. As a proxy, we used hospital location to assign incident location. The Los Angeles County hospital Geographic Information Systems (GIS) shapefile¹² was used to map hospital locations and the county and city boundary shapefiles were overlaid to assign boundary locations. We assumed that if the hospital was in the city of Los Angeles, then the MVT injury occurred within the city. Likewise, we assumed that if the hospital was in the county then the MVT injury occurred in the county.

AMBULANCE TRANSPORT VICTIMS

DEFINING COLLISION VICTIMS

A subset of the EMS/Trauma data from the Los Angeles County Department of Health Services EMS Agency was used to identify victims who were transported to a medical facility from the incident (collision) site. Our EMS dataset contains select indicators from the assessment of patient encounters with EMS responders at the scene of an incident that is likely related to a MVTC and transported to a Los Angeles County non-trauma center. Our Trauma dataset contains select information on patients involved in a MVTC and transported to a Los Angeles County trauma center. Depending on the data source, collision victims were identified in two ways:

- 1) For victims transported to a Los Angeles County trauma center (Trauma data), we selected (E-codes) (E810 -E819) and subcategories occupants (X.0, X.1), motorcyclist (X.2, X.3), pedestrians (X.7) and bicyclists (X.6) and other/unspecified (X.4, X.5, X.8, X.9) to identify those injured in a MVTC.
- 2) For victims transported to a non-trauma center in Los Angeles County (EMS data), the identification of MVTC-related incidents had to be estimated, because EMS data lacks E-codes.

We used the Trauma database to obtain the number and percent of collision victims for each mode of travel (ex: occupant, motorcyclist, pedestrian, bicyclist, other/unspecified) that were transported to a trauma center.

To estimate the number of pedestrian and collisions victims that were transported to a non-trauma center, we used both the Trauma and EMS databases. Both the EMS and Trauma databases contain a variable called the “Mechanism of Injury (MOI),” which describes the mechanism of the patients’ injury. This variable has multiple field values, two which are associated with pedestrians/bicyclists/motorcyclists. They are: PB (NOT thrown or run over at <20 MPH) and RT (Thrown or run over at >=20 MPH). Using the EMS and trauma databases, we created two data subsets each containing only PB or RT field values.

To obtain the estimated number of pedestrian or bicyclist collision victims that were transported to a non-trauma center and had a PB or RT field value, we applied the proportion of pedestrian or bicyclist collision victims that had a PB or RT field value in the Trauma database to the number of patients with a PB or RT field value that were transported to a non-trauma center.

To obtain the estimated number of pedestrian or bicyclist collision victims that were transported to a non-trauma center without a PB or RT field value, we then applied that non-trauma value to the proportion of the proportion of trauma center patients that were without a PB or RT field value.

Finally, to obtain a combined estimate of pedestrian and bicyclist collision victims that were transported to trauma and non-trauma centers, we added the number of pedestrian and bicyclist collision victims in the trauma database to the estimated number of pedestrian and bicyclist collision victims in the EMS database.

IDENTIFYING INCIDENT LOCATION

The EMS/Trauma datasets contain geographic data fields (ex: Global Positioning System (GPS) coordinates, city, zip code) which, when data are available, provide information on incident location. For collision victims with GPS data, we determined incident location based on county and city boundary GIS shapefiles. In the absence of GPS coordinates, we assigned incident location based on city and zip code combination, city alone, or zip code alone. Because political boundaries do not align with zip code boundaries, we relied on the City of Los Angeles Housing Department’s map listing of zip codes¹³ to assign those incidents to the city of Los Angeles. Data without any geographic information were omitted, since geography could not be determined.

CAVEATS

Data limitations necessitated the development of assumptions and approaches that may impact the estimates, and our estimates are likely to be conservative. Challenges included:

- **Underestimation of hospital costs:** Our hospital costs are based on hospital discharge data only, and thus do not include hospital costs related to patients treated and released in the emergency department.
- **Calculating ambulance fees:** We used the most likely base ambulance fee for caring for a pedestrian or bicyclist and applied this average fee to all incidents. However, special charges such as an oxygen mask, bandages, cervical collar, mileage, etc., would be considered additional fees and would be added to the ambulance fee. These special charges were not available by incident.
- **Underestimation of professional fees:** Our professional fee estimates are based on pricing rates for Medicaid reimbursement for services rendered to outpatients in the emergency department, and do not account for instances where the patient was hospitalized, has Medicare, or private insurance. Reimbursement amounts vary widely across payers and both Medicaid and Medicare set a much lower rate than private insurers for the same procedure¹⁴; in one example (treating a broken leg), we found a difference of up to \$584.00.¹⁵ Procedures not eligible for Medicaid reimbursement were assigned a reimbursement of \$0 by Medi-Cal, California's Medicaid program.
- **Estimation of MVTC victims transported by an ambulance to a non-trauma center:** Information on patients transported to non-trauma centers is in the EMS database. While the EMS data contains geographic information related to an incident, it lacks identifying information on whether the victim was involved in a MVTC versus some other incident. Our approach to estimating the probable number of MVTC victims in the EMS data was to take the proportion of pedestrian and bicyclist MVTC victims in the Trauma Data and apply this to the EMS data; this may have biased the ambulance fee estimates.
- **Possible misclassification of victims injured in the county vs. city:** We assumed that victims were injured in the same general area as the medical facility they were transported to because neither the hospital nor emergency department data (OSHPD) contained information on incident location. Using the location of the treating facility as a proxy for the location of the incident may have skewed the identification of victims injured in the county versus the city, and subsequently the distribution of hospital costs and professional fees between the two regions.
- **Missing values:** We imputed observations/values in the databases using corresponding county and city costs averages when these missing values prevented the calculation of hospital costs and professional fees.

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