# CODES Cost Estimates:
# Background and Methodology

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# Executive Summary

CODES research and analysis has utilized hospital and ED charges for the last 12 years. However, hospital/EDcharges are an inadequate measure insofar as they do not capture all medically related costs, nor do they provide information about the other types of costs which are not directly related to medical care.

Utilizing research published in 2004 (*Crash costs by body part injured, fracture involvement and threat-to-life severity, United States, 2000*" (Zaloshnja et al., 2003 ), we developed diagnostic/injury code based cost estimate groupings for motor vehicle crash victims. The generation of these cost estimates requires:

1. Categorization of injuries into specific body parts/groups
2. Determination of whether a fracture occurred
3. Generation and use of an MAIS score

The development of all three components is driven by ICD9 injury diagnostic codes in the 80000 to 95999 range. For each of the 137 groups, we generate three types of cost estimates:

| | |
|---|---|
| ⇨ Medical Costs: | Ambulance, ER, physician/specialists, inpatient hospital, rehabilitation, prescription, medical equipment and related special treatment costs. |
| ⇨ Other Costs: | Police/Fire services, household work, wage work/human capital losses, insurance administration, legal/court costs and property damage. |
| ⇨ Quality of Life (QOL): | Costs related to suffering caused by injury and death both to the victim and to their families. |

These estimated costs are then deflated/inflated from 2000 base estimates using nationally published estimates of medical inflation and the Consumer Price Index. Additionally, state specific cost of living adjustments are applied.

For property damage only cases, and cases for which no crash to hospital/ED match was made, we utilize cost estimates provided by NHTSA's Motor Vehicle System (MVS) crash cost estimation software. These estimates are then similarly adjusted for inflation and state specific cost of living differentials.

The value of using costs vs hospital charges is shown by much greater average medical costs compared to hospital charges, as well as by the magnitude of other costs – which are several times larger than even estimated medical costs.

For the last 18 months, Wisconsin has been providing cost estimate information to CODES programs across the country. To date, 13 CODES states have taken advantage of this and have been provided this information for at least one year of their linked data. This document attempts to provide more detailed information on the background, methods and development of the estimated costs provided to CODES states.

## Introduction

Codes linked data provides a rich pool of information concerning the types of injuries individuals suffer when involved in a motor vehicle crash. Linked data also provide a source of information regarding the admission and discharge status of motor vehicle crash (MVC) victims, the types of procedures they receive and who is paying for their injuries.

However, one of the areas in which most health data (and thus CODES linked data) suffers is in the estimate of costs surrounding injuries sustained in a motor vehicle crash. Wisconsin CODES data contains hospital inpatient and Emergency Department charges with respect to motor vehicle injuries. Charges are difficult to evaluate for several reasons:

- They don't represent what the actual cost for the inpatient stay is, nor do they tell us what an insurer will pay for the inpatient stay.
- Hospital charges usually do not include professional fees associated with services rendered to the patient (most notably surgically related services).
- Hospital/ED charges are also deficient insofar as "cost shifting" may occur between certain kinds of patients.
- They don't link together the cost of multiple, non-contiguous, hospital admissions needed by MVC victims – particularly those with multiple fractures and internal injuries.
- Hospital/ED charges are also deficient with respect to the panoply of services provided over the course of an episode of injury (which may last for the rest of an MVC victim's life) surrounding a motor vehicle crash. Such services include EMS, rehabilitation, professional services, recuperative aid, diagnostic services and pharmacy costs.
- Net of "medically" related costs, there are other monetary costs victims and society incur in the event of a motor vehicle crash. Costs which can't be captured as a component of hospital/ED costs. These include police/EMS costs, insurance administration, legal costs and, most important, loss of work and household related costs.

## Cost Estimate Methodology

In an attempt to better estimate the costs associated with motor vehicle related crashes, we utilize diagnostic code based cost estimates outlined in a paper published in 2004: "*Crash costs by body part injured, fracture involvement and threat-to-life severity, United States, 2000*" (Zaloshnja et al., 2003 ). This paper is an elaboration of analyses the authors performed while working on a major NHTSA study: *"The Economic Impact of Motor Vehicle Crashes, 2000"*, which was published in 2002 (Blincoe et al., 2002) . This study used the methods employed in the US Consumer Product Safety Commission's injury cost model (available online at http://www.cpsc.gov/library/foia/foia02/os/costmodept1.PDF ) , and utilized nationally representative samples of hospitalized patients to derive detailed cost estimates for medical and other costs based on specific types of injuries.

The study identifies three broad types of cost:

**Medical Costs**: Ambulance, ER, physician/specialists, inpatient hospital, rehabilitation, prescription, medical equipment and related special treatment costs.

**Other Costs**: Police/Fire services, household work, wage work/human capital losses, insurance administration, legal/court costs and property damage.

**Quality of Life (QOL)**: Costs related to suffering caused by injury and death both to the victim and to their families. These costs are estimated utilizing quality adjusted life years (QALYs) where perfect health is assigned a value of 1 while death is 0. Estimates of age/sex and diagnostic specific QALY loss values were developed by Miller et al. (1995) and the average value of a year of life came from a meta-analytic review by Miller (1990) and discounted over time at 3%. The discount factor is important insofar as QOL costs often occur over the remainder of a lifetime in the event of disability. For their 2000 study, the monetary value of a QALY was $91,752.

In developing their cost estimates, the authors utilized nationally representative data samples of MVC victims to develop their cost estimates. These included:

- National Hospital Discharge Survey (1996-1997)
- National Health Interview Survey (1990-1996)
- Maryland/New York hospital cost/charge information (1994-1995)
- CHAMPUS data on physician costs (1992-1994)
- National Medical Expenditure Survey (1987)
- National Council on Compensation Insurance (1979-1987)
- Crashworthiness Data System (1997-1999)

And a variety of other smaller and more specialized data sets.

The authors of the study utilized diagnostic codes to develop their cost estimates. Their method involves three steps:

1. They determined the specific body part which had been injured using ICD-9 numeric injury codes in the range of 8000 to 95999.
2. They determined if a fracture was involved. To do this, they used ICD9 numeric diagnostic codes in the ranges of 800-829 (fractures) and 925-929 (crushing injuries) to identify fractures.
3. The authors utilized the Abbreviated Injury Score (AIS) to group together specific cases for cost estimation. Specifically, the authors used the Maximum Abbreviated Injury Score (MAIS) to group cases. The MAIS is highest AIS score found for an injury to one of nine AIS body regions. The AIS itself is a six step scale with the following values:
    1. Minor
    2. Moderate
    3. Serious
    4. Severe
    5. Critical
    6. Maximum (usually indicating a patient's death)

    The AIS scoring system was initially developed jointly by the American Medical Association, the Association for the Advancement of Automotive Medicine and the Society of Automotive Engineers and was introduced in 1971 (AMA, 1971). Major revisions to the AIS occurred in 1980, 1985 and 1990. The authors used ICDMAP90 software (MacKenzie and Sacco, 1997), developed by John Hopkins University, to generate the MAIS scores.

Thus, to group cases into their appropriate cost estimate groups we need to group body regions appropriately, determine if a fracture occurred and determine the MVC victim's AIS score. To do these three things we utilize all available ICD9 diagnostic code information available in the medical record. States have from 5 to 15 ICD9 codes which can be utilized to determine MAIS scores and costs. A list of all diagnostic code based cost groups is provided in Appendix 1.

An example of the use of these three criteria is shown below for knee injuries.

## Figure 1.
## Determination of Cost Estimate Group for Knee Injuries

Step 1. ICD9 codes = 878xx, 9224x, 9260x, 942x5

⇩ **Knee Injury**

Step 2. ICD9 codes = of 800-829 or 925-929 ⇨ Knee Injury w/ Fracture (FX): **Group A**

⇩ **Knee Injury, No FX**

Step 3. MAIS = 1 ⇨ **Group B**

MAIS = 2 ⇨ **Group C**

MAIS = 3 ⇨ **Group D**

## Development of CODES Cost Estimates

Several additional steps and changes were included in developing the current CODES cost estimates provided to State programs:

- We initially utilized diagnostic code groupings developed for the 2004 article. Utilizing Wisconsin CODES data for 2001 and 2002., we evaluated which specific injury diagnostic codes were not being grouped into one of the body part/regions. We then developed appropriate groupings for those diagnostic codes where possible.

- For Wisconsin hospital stays in 2002, 20 cases had an MAIS but didn't have a diagnostic code which we could group into the categories developed by the authors of the study. For ED visits, 24 cases had an MAIS, but couldn't be grouped into the study categories. An examination of some of these cases showed that the ICD9 codes were missing 5$^{th}$ digits required to determine body group, but nonetheless had adequate detail to be grouped into an AIS category. Cases like these remain ungrouped.

- In the course of grouping the cases, we discovered that there were many instances were the MAIS scores for Wisconsin data were higher than those in the groupings developed by the authors. For example, while only MAIS=2/3/4 were developed by the authors for skull fractures, we found several instances where MAIS equaled 5 or 6 for Wisconsin data. Similarly, for ankle/feet/toes the authors only developed groupings for MAIS=1/2/3. We found many cases for which MAIS =4 and some where MAIS=5. To be conservative in developing cost estimates we group all cases with a higher MAIS into the highest MAIS available in the detailed cost groupings provided by the authors. For instance, even though one would assume that a skull fracture with an MAIS = 5 would be more costly than a case with an MAIS = 4, we nonetheless grouped the MAIS=5 with the MAIS=4 because this is the highest MAIS score reported by the authors.

- In order to correctly group cases, an MAIS has to be available. We evaluated 2002 Wisconsin CODES data to see the extent to which MAIS scores were missing. Out of 4,497 linked crash/hospital cases in 2002, only 220 (5%) didn't have an MAIS score. For Emergency Department data, out of 28, 826 linked crash/ED cases, 3,209 (11.1%) didn't have an MAIS score. This has been a consistent pattern in the 2003-2004 Wisconsin CODES data, and for other states providing ED data – missing AIS scores are much more frequent for ED visits compared to inpatient stays because the effort put into coding on the inpatient side is greater and is more relevant for reimbursement purposes.

- In a large percentage of cases, multiple diagnostic groupings were found for the same patient. In all cases, we select the detailed diagnostic group which had the highest medical cost as the correct group.

- In the event that a crash victim dies, they are placed into a single category regardless of the underlying injury group they are placed into (if appearing at an ED or being admitted). This is in keeping with the methodology used by the authors. This significantly reduces the medical costs for fatalities appearing in an ED or inpatient setting, but dramatically increases the other monetary costs and QOL costs

## Inflation and Cost of Living Differentials

Utilizing Bureau of Labor Statistics data, we deflate/inflate medical costs between 2000 (the base year in both the 2000 study and the 2004 article) and the year of data for which the cost estimates are being generated. We deflate/inflate other monetary costs and QOL costs by using Consumer Price Index changes in the same manner. CPI and medical cost inflation can be obtained from the Bureau of Labor Statistics. Information on the methodology underlying CPI estimates can be found in the *BLS Handbook of Methods* (chapter 17, The Consumer Price Index). That document can be found at: www.bls.gov/opub/hom/pdf/homch17.pdf.

- Appendix 1. contains the inflation/deflation factors for 1995-2006 for both medical and other costs.

- There are different cost of living levels for individual CODES state. Appendix 1 also provides the state specific cost of living adjustment used to provided appropriately adjusted estimates of costs to each CODES state already provided with cost data. These cost of living indices were obtained from NHTSA's Motor Vehicle Safety (MVS) modeling software.

The final estimate of one of the three cost components for a specific case is:

***Adjusted Cost = Cost(i) * Deflation/Inflation(j) * Cost of Living Index(k) , where***

***i = Diagnostic/MAIS Group***
***j = Year***
***k = State***

## Generating Cost Estimates for Unlinked CODES Cases

The methodology discussed above relates to cases for which diagnostic code information is available. For some ED/Inpatient cases adequate ICD9 information is not available to either generate an MAIS score or a diagnostic based cost grouping. More importantly, for cases which are not linked to an inpatient hospitalization or an ED visit, cost estimates are not available using this methodology.

NHTSA's MVS cost modeling software allows us to estimate costs for cases which aren't linked, but which have a KABCU/0 code. It does so by converting KABCU/0 cases into MAIS 1-6 and Property Damage Only cases and then attaching "medical" and "other cost" amounts to them. The methodology underlying the MVS modeling software is also derived from the 2002 NHTSA study "*The Economic Impact of Motor Vehicle Crashes, 2000*".

A simple Excel spreadsheet providing cost estimates for unlinked cases, and linked cases for which costs could not be generated, is available upon request. To use it, all that is required is to type in the year and state appropriate to your data. The spreadsheet is shown in Appendix 1. This appendix also shows the inflation factors for medical costs and CPI, as well as the state cost of living differentials mentioned above. Additionally, a SAS program which can be run against a specific CODES state's data to generate costs for these cases is available. The program is shown in Appendix 3.

## Charge vs Estimated Cost Comparisons

Table1 provides results for selected groups for all vehicle occupants except motorcyclists, and for motorcyclists only, for Wisconsin motor vehicle crashes in 2003 and 2004. . For all groups medical costs are much larger than charges alone. And other costs are much larger than medical costs. Such clear differences highlight the need to utilize cost estimates rather than simply use hospital charges.

### TABLE 1.
### Comparison of Hospital/ED Charges vs Estimated Medical and Other Costs for Selected Outcomes, Wisconsin, 2003-2004

| ALL VEHICLE OCCUPANTS EXCEPT MOTORCYCLES | | | | |
|---|---|---|---|---|
| | Number | Charges | Medical Costs | Other Costs |
| **Impaired Drivers** | **18,510** | **$2,140** | **$6,680** | **$41,512** |
| **Other Drivers and All Occupants** | **643,647** | **$360** | **$1,202** | **$7,382** |
| | | | | |
| **Persons Not Wearing Restraints** | **58,814** | **$1,822** | **$5,171** | **$29,563** |
| **Persons Wearing Restraints** | **584,823** | **$269** | **$976** | **$6,231** |
| **MOTORCYCLE RIDERS ONLY** | | | | |
| Rider Not Wearing Helmet | 2,958 | $7,765 | $18,081 | $77,157 |
| Rider Wearing Helmet | 3,403 | $7,964 | $19,827 | $82,340 |
| | | | | |
| No TBI | 5,654 | $4,952 | $8,862 | $56,857 |
| Potential TBI | 117 | $4,576 | $5,908 | $59,491 |
| Mild TBI | 21 | $20,546 | $138,694 | $191,950 |
| Moderate TBI | 264 | $12,231 | $64,601 | $117,265 |
| Severe TBI | 305 | $58,625 | $164,609 | $475,500 |

## Considerations

The use of "Quality of Life" costs should be carefully considered in the context of the audience to which you are presenting the information. Most DOT staff do not have a background in health economics, epidemiology or population health and are unlikely to find QOL costs useful. Indeed, the use of QOL costs may bias them against your analysis regardless of the value of the other cost information provided (which I've found to be understood and accepted by DOT staff). However, if you primarily have a group of health professions or people working in health related industries and occupations then QOL costs are likely to be understood and appreciated. Additionally, the real "financial" component of QOL costs is unclear. While persons with significant vehicle insurance are likely to obtain the QOL costs in question, those with no or little insurance may not be able to receive compensation for losses to their quality of life. While QOL costs are a real and important part of injury analysis, the true fiscal impact related to declines in quality of life is unclear.

The selection of health data records for linkage to your crash data is of critical importance in generating the cost estimates. If you select all hospital records the percentage of linked cases for which costs can be generated will plummet. One state did that for one year and 60% of their linked cases didn't have costs estimated. If you select hospital records and include all cases with any E Code indicated in the data, the percent of cases for which cost estimates can't be generated seems to fall between 15 and 20%. If you more narrowly select cases for selected E Codes, the percent of cases for which cost estimates can't be generated hovers between 5 and 12%. The population you select for linkage critically impacts your ability to have costs generated for your data.


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## APPENDIX 1:
## Specific Diagnostic Code Based Cost Groups

**1** = Skull Fracture - MAIS 2
**2** = Skull Fracture - MAIS 3
**3** = Skull Fracture - MAIS 4
**4** = Brain/Intracranial NonFx MAIS 1
**5** = Brain/Intracranial NonFx MAIS 2
**6** = Brain/Intracranial NonFx MAIS 3
**7** = Brain/Intracranial NonFx MAIS 4
**8** = Brain/Intracranial NonFx MAIS 5
**9** = Ear NonFX MAIS 1
**10** = Eye&Adnexa NonFX Mais 1
**11** = Eye&Adnexa NonFX Mais 2
**12** = Nose/Mouth/Face/Scalp/Neck NonFX MAIS 1
**13** = Nose/Mouth/Face/Scalp/Neck NonFX MAIS 2
**14** = Nose/Mouth/Face/Scalp/Neck NonFX MAIS 3
**15** = Nose/Mouth/Face/Scalp/Neck FX MAIS 1
**16** = Nose/Mouth/Face/Scalp/Neck FX MAIS 2
**17** = Nose/Mouth/Face/Scalp/Neck FX MAIS 3
**18** = Nose/Mouth/Face/Scalp/Neck FX MAIS 4
**19** = Neck-Internal Blood Vessels NonFX MAIS 1
**20** = Neck-Internal Blood Vessels NonFX MAIS 2
**21** = Neck-Internal Blood Vessels NonFX MAIS 3
**22** = Neck-Internal Blood Vessels NonFX MAIS 5
**23** = Neck-Spinal Cord NonFX MAIS 3
**24** = Neck-Spinal Cord NonFX MAIS 4
**25** = Neck-Spinal Cord NonFX MAIS 5
**26** = Shoulder/Clavicule/Scapula/Upper Arm NonFX MAIS 1
**27** = Shoulder/Clavicule/Scapula/Upper Arm NonFX MAIS 2
**28** = Shoulder/Clavicule/Scapula/Upper Arm NonFX MAIS 3
**29** = Shoulder/Clavicule/Scapula/Upper Arm FX MAIS 2
**30** = Shoulder/Clavicule/Scapula/Upper Arm FX MAIS 3
**31** = Elbow NonFX MAIS 1
**32** = Elbow NonFX MAIS 2
**33** = Elbow FX MAIS 1
**34** = Upper Extremities-Superficial NonFX MAIS 1
**35** = Upper Extremities-Superficial NonFX MAIS 2
**36** = Upper Extremities-Superficial NonFX MAIS 3
**37** = Forearm FX MAIS 2
**38** = Forearm FX MAIS 3
**39** = Wrist/hand/finger/thumb NonFX MAIS 1
**40** = Wrist/hand/finger/thumb NonFX MAIS 2
**41** = Wrist/hand/finger/thumb NonFX MAIS 3
**42** = Wrist/hand/finger/thumb FX MAIS 1
**43** = Wrist/hand/finger/thumb FX MAIS 2
**44** = Upper Extremities/multi-unspecified NonFX Mais 1
**45** = Upper Extremities/multi-unspecified NonFX Mais 2
**46** = Upper Extremities/multi-unspecified NonFX Mais 3
**47** = Upper Extremities/multi-unspecified FX Mais 2
**48** = Chest/Breast/Abdomen NonFX MAIS 1
**49** = Chest/Breast/Abdomen NonFX MAIS 2
**50** = Chest/Breast/Abdomen NonFX MAIS 3
**51** = Ribs/Sternum NonFX MAIS 1

**52** = Ribs/Sternum FX  MAIS 1
**53** = Ribs/Sternum FX  MAIS 2
**54** = Ribs/Sternum FX  MAIS 3
**55** = Ribs/Sternum FX  MAIS 4
**56** = Ribs/Sternum FX  MAIS 5
**57** = Back (incl Vertebrae) NonFX  MAIS 1
**58** = Back (incl Vertebrae) NonFX  MAIS 2
**59** = Back (incl Vertebrae) NonFX  MAIS 3
**60** = Back (incl Vertebrae) FX  MAIS 2
**61** = Back (incl Vertebrae) FX  MAIS 3
**62** = Trunk/Spinal Cord  NonFX  MAIS 2
**63** = Trunk/Spinal Cord  NonFX  MAIS 3
**64** = Trunk/Spinal Cord  NonFX  MAIS 4
**65** = Trunk/Spinal Cord  NonFX  MAIS 5
**66** = Trunk-Superficial NonFX  MAIS 1
**67** = Trunk-Superficial NonFX  MAIS 2
**68** = Trunk-Superficial NonFX  MAIS 3
**69** = Trunk Multi/unspecified NonFX  MAIS 1
**70** = Trunk Multi/unspecified NonFX  MAIS 3
**71** = Trunk Multi/unspecified NonFX  MAIS 4
**72** = Trunk Multi/unspecified NonFX  MAIS 5
**73** = Thoracic Organs/Blood Vessels NonFX  MAIS 1
**74** = Thoracic Organs/Blood Vessels NonFX  MAIS 2
**75** = Thoracic Organs/Blood Vessels NonFX  MAIS 3
**76** = Thoracic Organs/Blood Vessels NonFX  MAIS 4
**77** = Thoracic Organs/Blood Vessels NonFX  MAIS 5
**78** = Liver NonFX  MAIS 2
**79** = Liver NonFX  MAIS 3
**80** = Liver NonFX  MAIS 4
**81** = Liver NonFX  MAIS 5
**82** = Spleen NonFX  MAIS 2
**83** = Spleen NonFX  MAIS 3
**84** = Spleen NonFX  MAIS 4
**85** = Spleen NonFX  MAIS 5
**86** = Kidney NonFX  MAIS 2
**87** = Kidney NonFX  MAIS 3
**88** = Kidney NonFX  MAIS 4
**89** = Kidney NonFX  MAIS 5
**90** = Gastrointestinal NonFX  MAIS 2
**91** = Gastrointestinal NonFX  MAIS 3
**92** = Gastrointestinal NonFX  MAIS 4
**93** = Gastrointestinal NonFX  MAIS 5
**94** = Genitourinary NonFX  MAIS 1
**95** = Genitourinary NonFX  MAIS 2
**96** = Genitourinary NonFX  MAIS 3
**97** = Genitourinary NonFX  MAIS 4
**98** = Genitourinary NonFX  MAIS 5
**99** = Trunk, other organs/blood vessels NonFX  MAIS 1
**100** = Trunk, other organs/blood vessels NonFX  MAIS 2
**101** = Trunk, other organs/blood vessels NonFX  MAIS 3
**102** = Trunk, other organs/blood vessels NonFX  MAIS 4
**103** = Trunk, other organs/blood vessels NonFX  MAIS 5
**104** = Pelvis Bone and external  FX  MAIS 2
**105** = Pelvis Bone and external  FX  MAIS 3
**106** = Lower Extremities, superficial NonFX  MAIS 1

**107** = Lower Extremities, superficial NonFX MAIS 2
**108** = Hip/Thigh NonFX MAIS 1
**109** = Hip/Thigh NonFX MAIS 2
**110** = Hip/Thigh NonFX MAIS 3
**111** = Hip/Thigh NonFX MAIS 4
**112** = Hip/Thigh NonFX MAIS 5
**113** = Hip/Thigh FX MAIS 2
**114** = Hip/Thigh FX MAIS 3
**115** = Knee NonFX MAIS 1
**116** = Knee NonFX MAIS 2
**117** = Knee NonFX MAIS 3
**118** = Knee FX MAIS 2
**119** = Lower Leg NonFX MAIS 1
**120** = Lower Leg FX MAIS 2
**121** = Lower Leg FX MAIS 3
**122** = Ankle/Foot/Toes NonFX MAIS 1
**123** = Ankle/Foot/Toes NonFX MAIS 2
**124** = Ankle/Foot/Toes FX MAIS 1
**125** = Ankle/Foot/Toes FX MAIS 2
**126** = Ankle/Foot/Toes FX MAIS 3
**127** = Lower Extremities, multi/unspec NonFX MAIS 1
**128** = Lower Extremities, multi/unspec NonFX MAIS 2
**129** = Lower Extremities, multi/unspec NonFX MAIS 3
**130** = Lower Extremities, multi/unspec NonFX MAIS 4
**131** = Lower Extremities, multi/unspec FX MAIS 3
**132** = Burns, unspecified Body Part NonFX MAIS 1
**133** = Burns, unspecified Body Part NonFX MAIS 2
**134** = Burns, unspecified Body Part NonFX MAIS 3
**135** = Burns, unspecified Body Part NonFX MAIS 5
**136** = Whole Body minor external NonFX MAIS 1
**137** = Died
**999**= Missing AIS Score ;

# APPENDIX 2.
# GENERATING COST ESTIMATES FOR UNLINKED CODES CASES

NHTSA's MVS software allows us to estimate costs for cases which aren't linked, but which have a KABCU/0 code. It does so by converting KABCU/0 cases into AIS 1-6 and PDO cases and then attaching "full medical" and "other costs" amounts to them. The methodology is derived from the 2002 NHTSA study "*The Economic Impact of Motor Vehicle Crashes, 2000*". The cost estimates for the linked Codes cases also emanated out of the research done for this study.

Attached is an Excel spreadsheet which allows states to estimate their own KABCU/0 medical and other costs. For your state, simply type in the state adjustment factor, CPI year adjustment and the medical inflation year adjustment into the top of the page and the medical and other costs will automatically be adjusted.

Also attached is a copy of some SAS code which will calculate the KABCU/0 medical and other costs if you run it (text version is at bottom). If you have already added the linked case cost estimates, it will ignore those cases. If you haven't added the linked case cost estimates it will apply KABCU medical and other cost estimates to all KABCU/0 cases. Only states which have previously requested cost estimates have state cost adjustment factors built into the SAS code. By default, other states have the adjustment factor set to 1.0000 – the national average. Contact me for your state adjustment factor. As new states come on board I'll add them to the SAS code and ship it out a couple of times a year.

Note that the MVS cost estimates for U and 0 cases are identical.

For states that have already received the SAS code, note that the inflation factors for 2006 are included. Also note that the program now attaches quality of life costs to all cases for persons who have died based on either the presence of a "K" or a discharge status of died from the hospital data. Change the element which is moved to "DISCHARGE" to fit your own definition.

CPI estimates are obtained from the Bureau of Labor Statistics. Information on the methodology underlying CPI estimates can be found in the *BLS Handbook of Methods* (chapter 17, The Consumer Price Index). That document can be found at:

www.bls.gov/opub/hom/pdf/homch17.pdf

In general, note that quality of life costs are only available for:

- Linked cases with appropriate AIS and DX codes (Wisconsin misses 5% of the time)
- All "K" or discharged dead cases

Thus, the use of the QOLCOST data element needs to be carefully considered and perhaps constrained to hospitalized cases and fatal crash cases only. Using QOLCOST for all cases in PROC MI (in SAS) has caused problems for more than one state.

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## Cost Estimation Spreadsheet for Unlinked Cases and Cases for Which Costs Could Not Be Generated

### WISCONSIN 2004

| | | |
|---|---|---|
| State Adjustment Factor: | 0.9520 | <===(Fill in YOUR from information located below) |
| Consumer Price Index Inflation/Deflation: | 1.0970 | <===(Fill in YOUR from information located below) |
| National Medical Price Index Inflation/Deflation: | 1.1890 | <===(Fill in YOUR from information located below) |

| | Medical | Other Costs | Total Costs |
|---|---|---|---|
| Per 1 extra A case | 22,076 | 52,493 | 72,860 |
| Per 1 extra B case | 7,803 | 20,161 | 27,360 |
| Per 1 extra C case | 3,794 | 10,982 | 14,482 |
| Per 1 extra U case | 7,267 | 18,313 | 25,018 |
| Per 1 extra fatality | 23,414 | 1,286,853 | 1,308,455 |
| Per 1 extra Property Damage Only case | 35 | 2,666 | 2,699 |

| | Medical | Other Costs | Total Costs |
|---|---|---|---|
| Per 1 extra A case | 19,503 | 50,264 | 69,767 |
| Per 1 extra B case | 6,893 | 19,305 | 26,198 |
| Per 1 extra C case | 3,351 | 10,516 | 13,867 |
| Per 1 extra U or 0 case | 6,420 | 17,535 | 23,956 |
| Per 1 extra fatality | 20,685 | 1,232,212 | 1,252,897 |
| Per 1 extra Property Damage Only case | 31 | 2,553 | 2,584 |

| State | State Adjustment | Year | CPI Adjustment | Medical Inflation Adjustment |
|---|---|---|---|---|
| Arizona | 0.918 | 1995 | 0.8850 | 0.8455 |
| Delaware | 1.052 | 1996 | 0.9110 | 0.8750 |
| Iowa | 0.899 | 1997 | 0.9321 | 0.8995 |
| Kentucky | 0.859 | 1998 | 0.9466 | 0.9283 |
| Maryland | 1.156 | 1999 | 0.9675 | 0.9609 |
| New York | 1.246 | 2000 | 1.0000 | 1.0000 |
| Minnesota | 1.051 | 2001 | 1.0285 | 1.0460 |
| Oklahoma | 0.812 | 2002 | 1.0401 | 1.0951 |
| Tennessee | 0.869 | 2003 | 1.0685 | 1.1392 |
| Utah | 0.844 | 2004 | 1.0970 | 1.1890 |
| Virginia | 1.024 | 2005 | 1.1341 | 1.2393 |
| Wisconsin | 0.952 | 2006 | 1.1777 | 1.3075 |