

## THE SOCIAL COSTS OF DANGEROUS PRODUCTS: AN EMPIRICAL INVESTIGATION

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The tort system offers a valuable service to society when it deters the sale of consumer products that are defective under the relevant common law product liability standards.<sup>1</sup> For ease of convenience, we will refer to such products as “dangerous products.” From an economic perspective, dangerous products that remain on the market impose costs on consumers and third parties when they cause fatalities and injuries. This study seeks to put the role of the civil justice system in perspective by offering a new methodology to estimate these costs.

Available data either overestimate or underestimate the costs of injuries and fatalities associated with the use of dangerous products. Our study attempts to improve on the existing information by directly estimating the cost of injuries and fatalities attributable to three dangerous products: Ford SUV’s with Firestone tires, the pharmaceutical drug Baycol, and All Terrain Vehicles (ATVs) with three wheels. In each case study, we identify the adverse consequences caused by the product defect and then estimate the costs associated with each consequence using published data. These estimates employ the cost-of-injury (COI) approach commonly used in the economic literature, but we also broaden our cost estimates to include costs that are not traditionally included in the COI methodology. This extension is necessary to present a more complete estimate of the costs to society of dangerous products. Because of limitations in the availability of data, we employ a synthetic cohort technique to generate demographic information on the victim’s age and the distribution of injuries by gender for COI measurements. For the same reason, we use hypothetical scenarios to estimate costs not traditionally considered in COI measurements, which we describe as “extended costs.”

Our methodology offers a different and more complete picture of the value of the tort system than do existing studies. Moreover, this perspective is a better way to evaluate the significance of preventing torts as a matter of public policy because it looks at society-wide implications of avoidable death and injury. Our results indicate that the

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<sup>1</sup> While this is not the only social benefit of the tort system, it is the one that is the focus of this study. See Marc Galanter, *Real World Torts: An Antidote to Anecdote*, 55 MD. L. REV. 1093, 1142 (1996) (benefits include the deterrence of undesirable behavior, the inducement of investments in safety, and the vindication of legal rights); Gary T. Schwartz, *Mixed Theories of Tort Law: Affirming Both Deterrence and Corrective Justice*, 75 TEX. L. REV. 1801 (1997) (recognizing the humane or progressive benefit of preventing unnecessary deaths and injuries).

three products we studied created nearly \$4.7 billion dollars in external costs not taking into account extended costs, that extended costs can be greater than costs measured by a COI methodology, and that families and taxpayers may end up paying for significant extended costs. Our results also suggest that the compensation awarded in the tort system is less than the actual costs created by dangerous products, although our evidence for is weaker than for the prior conclusions.

This article proceeds in four steps. We first discuss the significance in economic theory for measuring the costs of injuries and fatalities caused by dangerous products and why available information does not provide a good estimate of these costs. We then explain the methodology used in this study. We next present our three case studies. And finally, we end with a discussion of the implication of our results for public policy.

## I. SOCIAL COSTS

Economic theory identifies the cost of injuries and fatalities caused by dangerous products as an economic inefficiency. The tort system therefore improves the efficiency of markets by forcing the sellers of dangerous products to pay for these costs. Available information, however, is inadequate to measure these costs.

### A. *Economic Theory*

Economics recognizes two types of costs associated with the sale and use of a consumer product. An “internal” cost is a cost associated with the production and sale of a product that is paid for by its seller.<sup>2</sup> A manufacturer, for example, will have to pay for the labor and raw materials that are necessary to manufacture its product. These costs are “internal” to the transaction of making and selling the product in the sense that the seller must pay for these expenses in order to be in business. An “external” cost is a cost associated with the making and use of a product that is paid for by persons other than the seller.<sup>3</sup> For example, the medical expense paid by a consumer as the result of an injury by a dangerous product is an external cost.

For a market to be efficient, the seller of a dangerous product would pay for its external costs and include these expenses in the price for which the product is sold.<sup>4</sup> If the product is sold for a price less than its internal and external costs, there will be more demand for the product than if it were sold at a higher price that reflected both of these

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<sup>2</sup> See SIDNEY A. SHAPIRO & JOSEPH P. TOMAIN, *REGULATORY LAW AND POLICY: CASES AND MATERIALS* 379 (3<sup>RD</sup> ed. 2003) (defining “internal cost”).

<sup>3</sup> See FRED BOSSELMAN, JIM ROSSI & JACQUELINE LANG WEAVER, *ENERGY, ECONOMICS, AND THE ENVIRONMENT* 41 (2000) (defining “externality”). This cost is also described as a “spillover” cost because it is a cost that spills over onto someone other than the seller of the product. SIDNEY A. SHAPIRO & JOSEPH P. TOMAIN, *supra* n. 2, at 378.

<sup>4</sup> See Giuseppe Dari Mattacci & Francesco Parisi, *The Economics of Tort Law*, in *THE ELGAR COMPANION OF LAW & ECONOMICS* 88 (Jürgen G. Backhaus ed., 2<sup>nd</sup> ed. 2005) (explaining that “[t]ort rules should ... be designed to induce parties to internalize the external costs of the activities....”).

costs, which is economically inefficient.<sup>5</sup> This over-production also reduces aggregate social wealth by creating costs that would not exist if the product were properly priced.

As we will develop, some of the costs of accidents created by dangerous products are borne by the person who is injured. Additional costs are paid for by third parties, including government programs such as Medicaid and Food Stamps, which means that the public at large ends up paying for some of the costs created by the sale of dangerous products.<sup>6</sup>

### ***B. Total Injury Costs***

There are a number of studies that attempt to estimate the total cost of injuries in the United States or the total cost of specific types of injuries, but this data overestimates the external costs of dangerous products. Finkelstein and his colleagues, for example, have estimated that the total cost of injuries from all sources in the United States in 2000 was \$406 billion (\$80 billion for medical costs and \$326 for lost productivity costs).<sup>7</sup> Lawrence and his colleagues estimated the annual costs of non-fatal consumer product injuries to be “approximately \$500 billion in 1996, accounting for nearly one-third of all injury costs.”<sup>8</sup> These studies presumably include the cost of injuries and fatalities due to dangerous products, but there is no separate estimate of these costs. Since we lack reliable data for knowing how many accidents are caused by legally culpable behavior, we have no means of knowing what percentage of Finkelstein’s \$406 billion estimate constitute social costs from the sale of dangerous products and other types of tortuous behavior.

### ***C. Total Insurance Payments***

Insurance payments offer another potential measurement of the external cost of dangerous products. Towers, Perrin, an actuarial consulting firm, estimated that insurance companies and firms which self-insure paid or anticipated paying \$247 billion in 2006 for expenses associated with tort litigation.<sup>9</sup> Although this point has been

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<sup>5</sup> WILLIAM J. BAUMOL & ALAN S. BLINDER, *ECONOMICS: PRINCIPLES & POLICY* 315 (6<sup>TH</sup> ed. 1994)

<sup>6</sup> See *infra* §ID3.

<sup>7</sup> See, e.g. ERIC A. FINKELSTEIN, PHAEDRA S. CORSO AND TED R. MILLER, *INCIDENCE AND ECONOMIC BURDEN OF INJURIES IN THE UNITED STATES* (2006); DORTHY P. RICE & ELLEN J. MACKENZIE, *COST OF INJURY IN THE UNITED STATES: A REPORT TO CONGRESS* (1989). For addition estimates of the total cost of injuries, see Phaedra Corso, Eric Finkelstein, Ted Miller, Ian Fiebelkorn, Eduard Zaloshnja, *Incidence and Lifetime Costs of Injuries in the United States*, 12 *INJURY PREVENTION* 212 (2006); Jeffrey W. Runge, *The Cost of Injury*, 11 *Emergency Medicine Clinics of North America* 241 (1993).

<sup>8</sup> Bruce A. Lawrence, Ted R. Miller, Alan F. Jensen, Deborah A. Fisher, and William W. Zamula, *Estimating the Costs of Von-Fatal Consumer Product Injuries in the United States*. 7 *INJURY CONTROL & SAFETY PROMOTION* 97, 97 (2000). The methodology of the Finkelstein and Lawrence studies differ; Lawrence includes more categories of costs, e.g. insurance administration as well as, importantly, pain and suffering. For another estimate of the total costs of a specific type of injury, see Ted. R. Miller, *Societal Costs of Transportation Crashes*, in *THE FULL SOCIAL COSTS AND BENEFITS OF TRANSPORTATION* 281 (David Greene, Donald Jones, & Mark Delucchi eds. 1997).

<sup>9</sup> Tillinghast-Towers Perrin, *U.S. Tort Costs: 2007 Update on U.S. Tort Cost Trends*, at 5, available at [http://www.towersperrin.com/tp/getwebcachedoc?webc=TILL/USA/2007/200712/tort\\_2007\\_1242007.pdf](http://www.towersperrin.com/tp/getwebcachedoc?webc=TILL/USA/2007/200712/tort_2007_1242007.pdf).

misconstrued by tort critics,<sup>10</sup> the amount of compensation paid by insurance companies or self-insurers through the tort system, as determined in adjudications or settlements, is an approximation of the external costs caused by the sale of dangerous products and other types of tortuous behavior. Studies of workers compensation, for example, rely on similar insurance payment data to estimate the external costs attributable to workplace injuries and diseases.<sup>11</sup> Unfortunately, because the Towers, Perrin estimate includes more than payments made through the tort system, it is over-inclusive.<sup>12</sup> It is possible to

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<sup>10</sup> Commentators describe cost estimates by Towers, Perrin as a “tax” on the American consumers. See, e.g., Bruce Cartlett, *The Tort Tax: Greedy Trail Lawyers Are Slowing Economic Growth and Investment*, NATIONAL REVIEW, March 3, 2003, available at [http://www.nationalreview.com/nrof\\_bartlett/bartlett\\_030303.asp](http://www.nationalreview.com/nrof_bartlett/bartlett_030303.asp) (citing a 2001 Towers, Perrin estimate and making the claim that this cost is “like a tax of 2% on everything in the American economy that takes \$721 per year out of the pockets of every citizen”); see also, Lawrence J. McQuillan & Hovannes Abramyan, *The Tort Tax*, WALL STREET JOURNAL, March 27, 2007 (op-ed), available at <http://online.wsj.com/article/SB117496524456750056.html>. The tort tax claim is based on the assumption that the total cost of torts (as estimated by the Towers, Perrin studies) will be passed on to consumers in the form of higher prices by manufacturers and other sellers and that this is an undesirable outcome. To the extent, however, that tort judgments reflect legitimate costs to society resulting from preventable accidents, it would be a good thing for society, not a bad thing, if manufacturers and others increased the cost of their products because of tort settlements and verdicts. As discussed earlier, see *supra* §IA, the tort system performs a service for society when it causes the internalization of external costs by manufacturers that make dangerous products. For the same reason, it is economically desirable if the tort system causes entities or persons engaged in other types of behavior which violates common law common law product liability standards to pay for the costs of that behavior. Clearly, tort critics seek to obscure this conclusion by using the word “tax” and by capitalizing on public disapproval of taxes. This rhetorical move, however, stands economic theory on its head.

It would be socially undesirable if consumers paid higher prices that are not the result of manufacturers and others paying for external costs. Tort critics seek to make this claim by associating the Towers, Perrin estimates with stories of apparently outrageous results in the tort system. The implication is that some significant amount of the total cost of torts (as estimated by the Towers, Perrin studies) reflects erroneous tort settlements and verdicts. This claim is problematic for two reasons. First, by claiming that the entire amount of an estimate by Towers, Perrin estimate is a tort “tax,” critics raise the implication that the entire amount reflects erroneous tort settlements and verdicts, a totally improbable conclusion. Second, the implication that some significant amount of Towers, Perrin estimate reflects erroneous tort settlements and verdicts is unproven.

The public may understand the tort tax claim to mean that the Towers, Perrin estimate is the amount of money it costs to administer the tort system, but an estimate by Towers, Perrin does not include the governmental costs of administering the tort system. It presumably does, however, include the amount of money that tort victims have or will pay to their lawyers in the form of contingent fees. There is no way of knowing, based on published data, what portion of the Towers, Perrin estimate is composed of such fees. Moreover, although the Towers, Perrin estimate includes administrative fees, there is also no way of knowing what portion of these expenses are legitimately considered as transaction costs as opposed to the costs of running an insurance company in general.

<sup>11</sup> See, e.g. J. PAUL LEIGH, STEVEN MARKOWITZ, MARIANNE FAHS, & PHILIP LANDRIGAN, COSTS OF OCCUPATIONAL INJURIES AND ILLNESSES (2000).

<sup>12</sup> The Towers, Perrin estimate is composed of three cost components: the benefits paid or expected to be paid to third parties, defense costs, and administrative expenses. Towers, Perrin, *supra* n. 9, at 7. For insurance companies, the first component, paid benefits, is an estimation of the money that has been or will be paid to tort victims. Towers, Perrin refers to these amounts as “paid benefits” and “incurred benefits,” respectively. The latter amount is derived from the amount of money that insurance companies reserve for payments to potential tort victims. *Id.* For firms that self-insure, the estimate of payments to third parties (i.e., tort victims) is based on actual payments by various forms of self-insurance and on the cost of insurance purchased directly from non-insurance companies. *Id.* at 9. This portion of the Towers, Perrin estimate – actual or anticipated payments to tort victims – is an approximation of the total external costs

infer from the Tower-Perrin data that the insurance industry and companies which self-insure paid about \$190 billion for compensation and for the costs of defending lawsuits.<sup>13</sup> Although the \$190 billion estimate overstates external costs by some unknown amount, it is a reasonable assumption that defense costs are only a small portion of that total, and that compensation will total close to \$190 billion. If this assumption is correct, the Towers, Perrin estimate suggests that various types of torts impose a very large amount of external costs each year and result in a substantial decrease in social wealth. Moreover, as we will discuss below,<sup>14</sup> significant external costs fall on third parties, and this amount is not included in the Towers, Perrin estimate because the tort system does not compensate many of these third parties for their costs.

#### *D. Jury Verdicts and Settlements*

Jury verdicts and settlements are the final source of information about the external cost of torts, but this information suffers from two defects. These data are both incomplete and do not for the most part include the external costs of dangerous products paid by persons or entities other than plaintiffs, such as costs paid by family members, businesses who employ tort victims and their families, and by the public sector.

##### 1. Jury Verdict and Settlement Information

The debate over far reaching changes in the common law of torts has produced an “abundance of studies – indeed an entire industry of studies – that have focused on the operation of the tort litigation system.”<sup>15</sup> Analysts have sought to estimate mean and median jury verdicts in the federal and state courts. Table 1 offers a representative sampling of studies of federal court product liability verdicts. Table 2 does the same for studies of state and county product liability awards.

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paid by insurance companies or firms that self-insure to persons who have been harmed by tortious behavior, as determined in adjudications or settlements. The second and third components of the Towers, Perrin estimate are for costs related to the administration and handling of claims. The second component – defense costs – reflects costs “directly incurred in the defense and investigation of a claim, as well as generally handling costs.” *Id.* at 7. The third component – administrative expenses – reflects “expenses, other than defense costs, incurred by either the insurance industry or self-insured entity in the administration of tort claims.” *Id.* Towers, Perrin does not indicate what portion of its total cost estimate is comprised of the first category – benefits to be paid or expected to be paid.

<sup>13</sup> Towers, Perrin indicates that administrative expenses constituted an average of 23.0 percent of the total tort costs from 2000 to 2006, but it does not indicate how much of the total cost is made up of defense costs. If one assumes that administrative expenses constitute 23 percent of the 2006 total insurance company costs, then the insurance industry and self-insured will pay (or have paid) external costs and defense costs totaling \$190.19 billion.

<sup>14</sup> See *infra* §III D3.

<sup>15</sup> Gary T. Schwartz *Empiricism and Tort Law*, 2002 U. ILL. L. REV. 1067, 1067 (2002).

**Table 1: Federal Product Liability Trial Awards**

Year(s)	Trial Award (dollars)		Sample Size
	Mean	Median	
1978-89 <sup>16</sup>	\$1,143,000	\$205,000	4,217
1980-84 <sup>17</sup>	\$858,000	\$197,000	2,284
1979-93 <sup>18</sup>	\$1,547,000	\$318,000	261
1991-92 <sup>19</sup>	\$2,332,000	\$668,000	-
1994-95 <sup>20</sup>	-	\$284,000	527
2000 <sup>21</sup>	-	\$368,000	385

**Table 2: State and County Product Liability Trial Awards**

Year(s)	Source	Trial Award (dollars)		Sample Size
		Mean	Median	
1983-85 <sup>22</sup>	Five states	\$633,000	\$150,000	136
1991-92 <sup>23</sup>	75 largest counties in US	-	\$260,000	-
1985-96 <sup>24</sup>	Franklin County, Ohio	-	\$207,560	44
2001 <sup>25</sup>	75 largest counties in US	-	\$450,000	158

## 2. Limitations of Existing Data

A significant problem with the federal databases is that most tort cases are litigated in the state courts. Researchers estimate that federal litigation constitutes only two percent of

<sup>16</sup> Theodore Eisenberg & James A. Henderson, Jr., *Inside the Quiet Revolution in Products Liability*, 39 UCLA LAW REV. 731, 762-63, 797(1992).

<sup>17</sup> *Id.* at 767, 797.

<sup>18</sup> Theodore Eisenberg, John Goerd, Brian Ostrom, & David Rottman, *Litigation Outcomes in State and Federal Courts*, 19 SEATTLE U. L. REV. 433, 439, 443 (1996).

<sup>19</sup> *Id.* at 439.

<sup>20</sup> ANDREW H. PRESS & CAROL J. DEFRANCES, FEDERAL TORT TRIALS AND VERDICTS, 1994-95, BUREAU OF JUSTICE STATISTICS, SPECIAL REPORT (December 1997), at 4 tbl. 5, available at <http://www.ojp.usdoj.gov/bjs/pub/pdf/fttv95.pdf>.

<sup>21</sup> Theodore Eisenberg & Margo Schlanger, *The Reliability of the Administrative Office of the United States Database: An Initial Theoretical Analysis*, 78 NOTRE DAME L. REV. 1455, 1494 (2003). The actual data indicates a median award for product liability of \$486,000 based on 385 verdicts, but the authors doubt the reliability of this figure because of a problem with the federal data entry system. After making a correction for this problem, the authors hypothesize that the median is closer to \$368,000. *Id.* at 1494. The problem is that the federal data entry system does not permit the entry of verdicts larger than \$999,999.00, which suggests that federal data understates awards of \$1 million dollars or more. *Id.* at 1466.

<sup>22</sup> GENERAL ACCOUNTING OFFICE, PRODUCT LIABILITY: VERDICTS AND CASE RESOLUTION IN FIVE STATES, GAO/HRD-89-99 102 tbl. V.2 (1989). The study is based on data from five states: Arizona, Massachusetts, Missouri, North Dakota and South Dakota. *Id.* at 19.

<sup>23</sup> CAROL J. DEFRANCES, ET. AL., BUREAU OF JUSTICE STATISTICS, U.S. DEPARTMENT OF JUSTICE, CIVIL JUSTICE SURVEY OF STATES COURTS 1992: CIVIL JURY CASES AND VERDICTS IN LARGE COUNTIES 5 (1995).

<sup>24</sup> Deborah Jones Merritt & Kathryn Ann Barry, *Is The Tort System in Crisis? New Empirical Evidence*, 60 OHIO ST. L. REV. 315, 334 (1999).

<sup>25</sup> Thomas H. Cohen & Steven K. Smith, *Civil Trial Cases and Verdicts in Large Counties, 2001*, BUREAU OF JUSTICE STATISTICS BULLETIN (April, 2004), at 2, tbl. 1, 5 tbl. 6, available at <http://www.ojp.gov/bjs/pub/pdf/ctcvlc01.pdf>.

all of the tort cases that are filed.<sup>26</sup> The percentage of product liability cases litigated in the federal courts is higher; one estimate is that federal trials constitute 25 percent of all product liability trials excluding asbestos cases.<sup>27</sup>

State data also have limitations. The National Center for State Courts collects information about lawsuits filed in state courts, but there is no broad and systematic data gathered by the states on awards.<sup>28</sup> Researchers have been able to employ public records in some states or counties to gain information about product liability case awards. The studies included in Table 2 are of this type. There are also reports by private firms such as Jury Verdict Research, but these data are regarded as unreliable by researchers because they are not produced by systematic and representative sampling.<sup>29</sup>

Furthermore, estimates based on trial awards do not take into account the fact that most tort cases that result in compensation for plaintiffs are not tried. Researchers estimate that fewer than 10 percent of lawsuits require a trial for their resolution,<sup>30</sup> and we lack information on how many of the remaining law suits result in cash payment settlements.<sup>31</sup> More generally, there is little systematic information available on the total dollar value of tort settlements or the transaction costs of a settlement for plaintiffs or defendants.<sup>32</sup> As well, there are few available studies of settlements.<sup>33</sup>

Another consideration is how accurately pre-trial and trial awards compensate plaintiffs for the damages that they have suffered. Some empirical work has found that the most seriously injured plaintiffs collect a relatively smaller portion of their economic losses than do those with less serious injury.<sup>34</sup> A number of aspects of the tort system are thought to be responsible for this result including that defendants and their insurers have a greater incentive to invest in contesting large claims and the full costs of major injuries may be more difficult to assess.<sup>35</sup>

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<sup>26</sup> Michael J. Saks, *Do We Really Know Anything About the Behavior of the Tort Litigation System—And Why Not?*, 140 U. PA. L. REV. 1147, 1155 (1992).

<sup>27</sup> Eisenberg, et. al., *supra* n. 18, 441 (estimating that federal trials account for 25 percent of product liability actions that do not involve asbestos).

<sup>28</sup> Saks, *supra* n. 26, at 1206; Thomas A. Eaton & Susette M. Talarico, *A Profile of Tort Litigation in Georgia and Reflections on Tort Reform*, 30 GEORGIA L. REV. 627, 635, 635 n. 21 (1996).

<sup>29</sup> Saks, *supra* n. 26, at 1245-46.

<sup>30</sup> Herbert M. Kritzer, *Adjudication to Settlement: Shading in the Gray*, 70 JUDICATURE 161, 161-62 (1986); William L. Felstiner et. al., *The Emergence and Transformation of Disputes: Naming, Blaming, and Claiming*, 15 LAW & SOC. REV. 631, 649-52 (1981) (estimating one to twelve percent of tort trials filed go to the jury).

<sup>31</sup> Saks, *supra* n. 26, at 1213.

<sup>32</sup> *Tort Cases in Large Counties*, BUREAU OF JUSTICE STATISTICS BULLETIN (NCJ-153177), available at <http://www.ojp.gov/bjs/pub/ascii/tcilc.txt>.

<sup>33</sup> *Summary: Civil Justice Roundtable*, BUREAU OF JUSTICE STATISTICS (April 22, 2004), available at <http://www.ojp.gov/bjs/pub/pdf/cjrd.pdf>.

<sup>34</sup> See D. DEWEES ET. AL., *EXPLORING THE DOMAIN OF ACCIDENT LAW* 422-23 (1996) (jurors tend to under compensate the most severe injuries); Galanter, *supra* n. 1, at 1116-1120 (reviewing the empirical evidence on under-compensation).

<sup>35</sup> Galanter, *supra* n. 1, 1120.

A related problem is that not all persons who are eligible to sue do so. In a massive national survey of the filing of lawsuits, the Institute for Civil Justice found that claims for compensation were made for only about ten percent of accidental injuries.<sup>36</sup> Another study found that five percent of persons who believe that their injury might have been caused by another person actually sue.<sup>37</sup> Based on these studies, scholars suggest there are a significant number of potential plaintiffs with valid claims who never sue.<sup>38</sup> We do not know whether these estimates are accurate, but to the extent that this behavior occurs, estimates of external costs based on pre-trial and trial awards will be too low.

### 3. Third Party Payments

A final problem with the existing data on pre-trial and trial awards is that persons or entities other than plaintiffs pay for external costs associated with dangerous products. We could not find data indicating the full extent of such third party payments. The Department of Transportation (DOT), however, has published data (see Table 3) indicating the extent to which third parties pay for the costs associated with motor vehicle accidents.<sup>39</sup> The DOT data presumably include the cost of injuries (or fatalities) due to defective automobiles and trucks, but there is no separate estimate of these externalities.

**Table 3: Injury Costs in 2000, Estimated Source of Payment by Cost Category**

	(Percent of Total Cost)						
	Federal	State	Total	Insurer	Other	Self	Total
Medical	14.4%	9.8%	24.2%	54.9%	6.4%	14.6%	100%
Emergency Services	3.9	75.8	79.6	14.7	1.7	3.9	100
Market Productivity	16.2	3.1	19.3	41.1	1.6	38.1	100
Household Productivity	-	-	0.0	41.1	1.6	57.4	100
Insurance Administration	0.9	0.5	1.4	98.6	--	-	100
Legal/Court	-	-	-	100.0	--	-	100
Travel Delay	-	-	-	-	100.0	-	100
Property Damage	-	-	-	-	65.0	35.0	100

There are four sources of third party payments of the external costs of dangerous products: (1) private insurance, (2) government programs, (3) the business community, and (4) the families of tort victims. The extent to which the first two sources – private insurance and government programs – pay for external costs is impacted by the common

<sup>36</sup> DEBORAH HENSLER, ET AL., COMPENSATION FOR ACCIDENTAL INJURIES IN THE UNITED STATES 110 (1991) (study for the Rand Institute for Civil Justice). Claims were made for 44 percent of motor vehicle claims, 7 percent of work injuries, and 3 percent of other injuries. *Id.* at 121.

<sup>37</sup> Richard E. Miller & Austin Sarat, *Grievances, Claims & Disputes: Assessing the Adversary Culture*, 15 LAW & SOC'Y REV. 525, 544 (1980-81). This study found that of every one thousand events for which an injury was noticed, 718 became claims in which the victim brought the problem to the alleged harm doer, 103 were brought to the attention of a lawyer, and 50 became filed cases. *Id.*

<sup>38</sup> See, e.g., Merritt & Barry, *supra* n. 24, at 315 (“Researchers have shown the majority of individuals injured by negligent conduct – whether medical malpractice, flawed manufacturing processes or other actions – never file a legal complaint.”); Saks, *supra* n. 26, at 1185; Galanter, *supra* n. 1, at 1102-1103.

<sup>39</sup> U.S. Department of Transportation, National Highway Traffic Safety Administration, *The Economic Impact of Motor Vehicle Crashes, 2000*, available at <http://lhsc.lsu.edu/OutsideLinks/EconomicImpact-1.pdf>, retrieved October 2007.

law collateral source rule and subrogation rights. While payments by private insurance, government programs, and the business community are commonly recognized, the final category – payments by family members – is commonly overlooked. The DOT data, for example, do not include this category, as Table 3 indicates.

a. *Private Insurance.* A person injured by a dangerous product who has private insurance may receive reimbursement of his or her costs from health insurance and disability insurance. Nearly 40 million Americans, however, have no health insurance.<sup>40</sup> In addition, general purpose life insurance covers death resulting from accidents.

b. *Government Programs.* Persons injured by dangerous products may also be eligible for cash or in-kind assistance from government programs, including unemployment compensation, food stamps, Medicaid, Medicare, State Children's Health Insurance Program (SCHIP), Temporary Assistance for Needy Families (TANF), Social Security Disability, and Old Age, Survivors and Disability Insurance. There may also be costs to Veterans Affairs for use of military hospitals and clinics.

Affected families may need more community services – emergency calls, ambulance services, tutoring programs, job training programs, and rehabilitation services. These families may also require community resources such as special programs for children, special programs for persons with disabilities, counseling services, and local social services and mental health services. Local school systems may have an increase in their special education population.

c. *Collateral Source Rule.* As noted earlier, it is a relatively common occurrence that people injured by dangerous products do not file a law suit.<sup>41</sup> One likely reason is that the persons who are injured receive reimbursement of expenses from private insurance. Similarly, people may not sue because they receive assistance from government safety net programs. When they do file a lawsuit, the collateral source rule and subrogation rights impact whether private insurance companies and some government programs ultimately pay for some or even all of the external costs of dangerous products.

The common law collateral source rule permits a plaintiff to recover from a defendant sums already paid to the plaintiff by an insurance company or government program.<sup>42</sup> In this circumstance, however, the third party payer can recover the cost of its payments if there is a contractual or statutory right of subrogation.<sup>43</sup> Because of subrogation rights,

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<sup>40</sup> National Center for Health Statistics, Table 1.1. Number and percent of persons without health insurance coverage, by age group: United States, 1997 - quarter one 2002, available at [http://www.cdc.gov/nchs/about/major/nhis/released200209/table01\\_1.htm](http://www.cdc.gov/nchs/about/major/nhis/released200209/table01_1.htm) (indicating that 39.7 million persons lacked health insurance as of the first quarter of 2002, the latest data available).

<sup>41</sup> See *supra* notes 36-38& accompanying text (noting that many persons injured as a result of a tort do not file a law suit).

<sup>42</sup> Kenneth S. Abraham & Lance Liebman, *Private Insurance, Social Insurance, and Tort Reform: Toward A New Vision of Compensation for Illness and Injury*, 93 COLUM. L. REV. 75, 95 (1993).

<sup>43</sup> Private insurers contract for a right of subrogation except for life insurance companies. Abraham & Liebman, *supra* n. 43, at 96. Congress has likewise established a right of subrogation for Medicaid and

some plaintiffs may not keep any compensation from a tort award or cash payment settlement because the amount collected from the defendant is less than the amount the person received from his or her insurance company. Subrogation rights may also discourage a plaintiff from filing a law suit in the first place.<sup>44</sup> In the twenty-five states which have abolished or changed the common law collateral source rule,<sup>45</sup> the manufacturer of a dangerous product is relieved of paying for some of all of the social costs that have been or will be paid by private insurance or government programs.<sup>46</sup>

d. *Business Community.* The business community also bears some of the external costs of dangerous products. First, there are more costs to the manufacturer of a dangerous product than the payment of compensation through the tort system. Companies, for example, lose money from recalls, poor public relations and bad press, and from the need to redesign a product to avoid earlier hazards. Many corporate annual reports, in their financial notes, comment on such impact. Second, there are costs to other firms. For example, the company that employs the person injured or killed by a dangerous product loses his or her services for a time or permanently. The firms employing the family members of a victim can also lose their services for a time or permanently, resulting in costs to the firm to locate and train replacements, or the family members may be less productive on the job because of dislocations at home.

e. *Family Members.* Families and family members may incur a number of types of costs when there is an injury, illness, or death from the use of a dangerous product. A family member (or another individual), for example, may become an unpaid caretaker to a seriously injured individual, thus foregoing earned income. Or, because of the financial strain on a family, children may have to cut their education short, resulting in a loss of life-time earnings.

## II. METHODOLOGY

The external costs of dangerous products can be estimated from current data sources, but each has limitations and defects. In light of these problems, we have developed a new methodology to estimate these costs. This section identifies and explains the basic building blocks of our methodology: case studies, synthetic cohorts, cost of injury measurements, and hypothetical scenarios. Each of the case studies has additional information about the methodology. Readers who wish to see the details of our calculations can consult our on-line data base.<sup>47</sup>

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Medicare by statute. 42 U.S.C. §1395(b)(2)(A)(ii) (1988 Supp. IV). The extent to which local and state programs have similar provisions is unknown.

<sup>44</sup> See *supra* notes 36-38& accompanying text (noting that many persons injured as a the result of a tort do not file a law suit).

<sup>45</sup> CONG. BUDGET OFFICE, U.S. CONG., THE EFFECTS OF TORT REFORM: EVIDENCE FROM THE STATES 3 (2004), available at <http://www.cbo.gov/ftpdocs/55xx/doc5549/Report.pdf>.

<sup>46</sup> Abraham & Liebman, *supra* n. 36-38, at 96. In states that have modified the rule, the result will be the same to the extent that third parties ultimately pay for external costs.

<sup>47</sup> See [http://www.\\_\\_\\_\\_\\_](http://www._____) (pending).

### ***A. Case Studies***

We estimate the external costs attributable to three dangerous products: Ford SUV's with Firestone tires, the pharmaceutical drug Baycol, and All Terrain Vehicles (ATVs) with three wheels. Our choice of these three dangerous products was based on the availability of injury and fatality data. The results of the study may have been affected by the decision to study these products rather than other products, but we believe that these products are representative of the types of injuries and fatalities that dangerous products can cause in a mass consumer society.

### ***B. Synthetic Cohorts***

An estimate of the external costs of dangerous products requires demographic information about the tort victims, such as their age and gender, as well as injury information about which part of the body was injured, the medical classification of that injury, and what treatment, therapy and drugs were required. To obtain the necessary information, we searched legal opinions, publically available databases, published articles in the scholarly and popular legal, economic, and medical literature, and newspaper articles, and attorneys familiar with the productive defects. These efforts did not produce the detailed demographic information required for our cost studies.

Because of this gap, we created synthetic cohorts of victims. The synthetic cohort technique is an established method for estimating effects and outcomes in medicine and economics when demographic and other necessary data are not available.<sup>48</sup> In fact, it is the method of choice for investigating the cost-effectiveness of pharmaceuticals.<sup>49</sup> Our cohorts were generated after thorough review of the existing literature and discussions with lawyers involved in litigation concerning the products we study. These synthetic cohorts represent our best judgments regarding the demographics, injury, and medical characteristics.

### ***C. Cost of Injury Measurements***

The use of a synthetic cohort method in medicine and economics is typically paired with a cost-of-illness or cost-of-injury (COI) approach, which we also adopt. This methodology divides costs into two categories: direct and indirect costs. In the simplest version, direct costs include only medical expenses and indirect costs include only lost earnings. Medical costs include hospital bills, doctor visits, medical tests, rehabilitation and drug costs. Lost earnings measure the dollar value of the lost work-time that results from injury or illness. This measurement of lost earnings is sometimes referred to as the

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<sup>48</sup> See, e.g., Anna Peeters; Abdullah Al Mamun; Frans Willekens, Luc Bonneux, *A Cardiovascular Life History – A Life Course Analysis of the Original Framingham Heart Study Cohort*, 23 EUROPEAN HEALTH J. 458 (2002); Pierre-Olivier Gourinchas, Jonathan A. Parker; *Consumption over the Life Cycle*, 70 ECONOMETRICA 47 (2002).

<sup>49</sup> See, e.g., MARTHE R. GOLD, JOANNA E. SIEGEL, LOUISE B. RUSSEL, & MILTON C. WEINSTEIN, COST-EFFECTIVENESS IN HEALTH AND MEDICINE (1996); Brain F. Gage, Andira B. Cardinalli, Gregory W. Albers, Douglas K. Owens, *Cost-effectiveness of Warfarin and Aspirin for Prophylaxis of Stroke in Patients with Nonvalvular Atrial Fibrillation*, 274 J. AM. MED. ASSOC. 1839 (1995).

“human capital” technique. More elaborate versions of COI include such additional direct costs as the cost of administering medical insurance and such indirect costs as the dollar value of lost production in the household and lost fringe benefits.

As direct costs, we measured the medical costs of persons injured or killed as the result of using one of the three products we studied. As indirect costs, we measured the cost of lost wages, lost fringe benefits, and the lost value of home production. All traditional costs are expressed in 2007 dollars.

Unlike trial awards, which may or may not fully compensate a tort victim,<sup>50</sup> our calculations include 100 percent of medical costs and lost wages. As noted, we also estimated the lost economic value of home production which appears to be sometimes included and sometimes excluded from tort awards.<sup>51</sup> Finally, in contrast to the tort system, the COI method does not estimate pain and suffering, and we adhere to this approach.

We also used the COI methodology to develop estimates of costs not normally measured using a COI methodology, which we describe as “extended costs.” In our approach, “extended” costs include any external cost that results from an injury or fatality caused by a dangerous product other than the direct and indirect costs considered in traditional COI measurements (i.e., the medical costs of persons injured by a dangerous product and that person’s lost wages, lost fringe benefits, and the lost value of home production). For example, we estimated the cost of care-giving provided by a spouse for her husband, a permanent quadriplegic who was injured as the result of a SUV rollover.<sup>52</sup> All extended costs are expressed in 2007 dollars, discounted at three percent, with no adjustment for future inflation.

#### *D. Hypothetical Scenarios*

Although we have sought to measure extended costs, there is little available information about the distribution of extended costs for the three dangerous products that we studied. For example, as mentioned, the cost of care-giving provided by a spouse for her husband, a permanent quadriplegic who was injured as the result of a SUV rollover, is an extended cost. We do not know, however, how many persons injured as a result of a SUV rollover were injured in this manner and whether the care of such persons involved care-giving by a spouse, although it seems likely that this situation exists.

To address this limitation, we created three hypothetical scenarios of potential extended costs for each cost study, and we estimated the extended costs identified in each scenario using published data. Although we are forced to use hypothetical examples, we still believe our methodology is an improvement over existing efforts to measure external costs. This extension is necessary to develop a more complete picture of external costs

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<sup>50</sup> See *supra* n. 34 & accompanying text.

<sup>51</sup> See Ann Laquer Estin, *Love and Obligation, Family Law and the Romance of Economics*, 36 WM. & MARY L. REV. 989, 1023 (1995) (discussing the exclusion of home production in tort awards).

<sup>52</sup> See *infra* note 76 & accompanying text.

because, as we will develop, there can be significant extended costs borne by public agencies, the business community, and by family members. In fact, these costs can be greater than the costs measured by the traditional COI methodology, as we will demonstrate.<sup>53</sup>

### III. FORD/FIRESTONE ROLLOVERS

The first case study is of the social costs associated with the rollover of the Ford Explorer model SUV equipped with Firestone tires. This section first describes the product defect that made these automobiles a dangerous product. We then describe how we derived our estimates of traditional COI external costs, which total almost \$555 million, and our estimates of extended costs, which total between \$733,000 and \$2.55 million dollars per family. We end with a discussion of our results.

#### A. Product Defect

The Ford Explorer model SUV, which was first produced in 1991, had suspension problems due to its high center of gravity,<sup>54</sup> which created “significant handling and stability defects” and the “substantial risk of rollovers.”<sup>55</sup> To alleviate these design flaws, Ford recommended that tires on Explorers be kept at 26 psi in order to lower the weight of the car closer to the ground.<sup>56</sup> Since the tires had been designed for 30 psi,<sup>57</sup> Ford was recommending that owner’s substantially under-inflate their tires.

The National Highway Traffic Safety Administration (NHTSA) had classified the Firestone ATX tire, which came on the Ford Explorer as standard equipment, as having the lowest heat/temperature rating allowed to be sold under the agency’s Uniform Tire Quality Grading System.<sup>58</sup> Tires with this rating are unable to resist heat-buildup as well as higher quality tires. In addition, because NHTSA grades tires under controlled laboratory conditions, it assumes, among other conditions, that tires are properly inflated.<sup>59</sup> Ford’s recommendation to keep the ATX tires at reduced pressures, therefore, resulted in significantly higher percentage of tire failure than the government’s tests would have predicted.<sup>60</sup>

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<sup>53</sup> See *infra* §VI, at Table 17 (comparing traditional and extended costs).

<sup>54</sup> In re Ford Motor Co. Securities Litigation, 184 F.Supp.2d 626, 269 (E.D. Mich. 2001).

<sup>55</sup> In re Bridgestone/Firestone, Inc. Tires Products, 155 F.Supp.2d 1069, 1077 (S.D. Ind. 2001).

<sup>56</sup> In re Ford, 184 F.Supp.2d at 629.

<sup>57</sup> Jamie Butters, *Tire Pressure Alert is Promised for Fall Also On the Horizon: Side Airbags, New Brakes*, DETROIT FREE PRESS, Jan. 10, 2001, at 1E.

<sup>58</sup> In re Ford, 184 F.Supp.2d at 269; see Terril Yue Jones and Ricardo Alonso-Zaldivar, *Low Heat Rating Found in Tires on Ford SUVs; Safety: Virtually All Similar Vehicles from Rival Auto Makers Use Models that Have Higher Ratings, A Survey Shows*, L.A. TIMES, Sept. 23, 2000, Saturday Home Edition, Part A, Part 1, at 1.

<sup>59</sup> 49 C.F.R. § 575.104 (Figure 2—[Part I]—Dot Quality Grades).

<sup>60</sup> In re Ford, 184 F.Supp.2d at 269. ATX tires had a failure rate of 60 to 200 per million tires, while the average failure rate of tires from other manufacturers was five per million tires. Keith Bradsher, *Ford Intends to Replace 13 Million Firestone Wilderness Tires*, N.Y. TIMES, May 23, 2001, at C1.

Consumers in the United States began filing claims involving problems with Firestone tires on Ford Explorers as early as 1993.<sup>61</sup> In 1995, Firestone redesigned the “ATX” tire, and released its “ATX II” model tire, and, in 1996, another redesign was implemented and was called the “Wilderness AT” tire.<sup>62</sup> In 1996, Firestone received an increasing number of complaints regarding all three models of tires. Most of these complaints alleged problems with tread separation,<sup>63</sup> a problem that creates the potential for a driver to lose complete control of an Explorer, particularly during significant braking or steering.<sup>64</sup> In response, Ford recommended drivers increase the tire pressure for their vehicles, which forced consumers to choose between the risk of tread separation or a rollover.<sup>65</sup> As noted earlier, Ford had originally recommended that drivers under-inflate their tires to counter the tendency of the SUV to rollover.

After a Houston television station aired a special report regarding fatalities and Firestone tires in February 2000, NHTSA launched an investigation.<sup>66</sup> Firestone responded by announcing a voluntary recall of all ATX and ATX II tires that had been manufactured since 1991.<sup>67</sup>

### ***B. Traditional COI Costs***

According to news reports, between 271 and 476 people died as a result of the Ford SUV rollovers in the United States, and there were over 800 serious injuries.<sup>68</sup> News reports also indicate Ford settled approximately 1,500 Explorer related cases, and Firestone settled more than 1,300 lawsuits.<sup>69</sup> Based on this information, we estimated traditional COI costs.

Since we could not verify new reports of the number of fatalities, we chose 271 deaths, the low end of the estimate, in order to adopt the most conservative approach. By comparison, we assumed that the reports of 800 non-fatal injuries captured only some of these injuries for two reasons. First, it is not cost-effective for tort lawyers to take cases

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<sup>61</sup> Erica McCallum, *Rearranging Deck Chairs on the Titanic: Will the Early Warning Reporting Required by the Tread Act Uncover Deadly Defects Soon Enough?*, 44 ARIZ. L. REV. 939, 944 (2002).

<sup>62</sup> Kevin M. McDonald, *Don't TREAD on Me: Faster Than a Tire Blowout, Congress Passes Wide-Sweeping Legislation That Treads on the Thirty-Five Year Old Motor Vehicle Safety Act*, 49 BUFF. L. REV. 1163, 1172 (2001). [hereinafter, *McDonald I*].

<sup>63</sup> *Id.* Tread separation occurs when the outer steel belt and tread of the tire separate from the tire and become totally detached. *Henry v. Bridgestone/Firestone Inc.*, 63 Fed.App'x 953, 956 (7<sup>th</sup> Cir. 2003).

<sup>64</sup> *In re Ford*, 184 F.Supp.2d at 269; *Henry v. Bridgestone/Firestone Inc.*, 63 Fed.App'x 953, 956 (7<sup>th</sup> Cir. 2003).

<sup>65</sup> *In re Bridgestone*, 155 F.Supp.2d 1080.

<sup>66</sup> *McDonald I*, *supra* n. 62, at 1172-73. Firestone did not comply with NHTSA recommendation to expand the recall to the “Wilderness AT” model tire, but agreed to replace those tires on a case by case basis. Ford, however, agreed to a recall to replace all “Wilderness AT” tires on Explorers with a different brand of tire. *Id.*

<sup>67</sup> *Id.*

<sup>68</sup> Kevin M. McDonald, *Separations, Blow-Outs, and Fallout: A TREADise on the Regulatory Aftermath of the Ford-Firestone Tire Recall*, 37 J. MARSHALL L. REV. 1073, 1079 (2004) [hereinafter *McDonald II*]; Jon S. Vernick, Julia Samia Mair, Stephen P. Teret, Jason W. Sapsin, *Role of Litigation in Preventing Product-Related Injuries*, 25 EPIDEMIOLOGIC REVIEWS 90 (2003).

<sup>69</sup> *McDonald II*, *supra* n. 68, at 1078.

involving limited damages. Second, the work by Finkelstein and his collaborators indicates that there are far more injuries from accidents that involve no hospital visit than injuries that require hospitalization.<sup>70</sup> To estimate the number of non-fatal injuries involving hospitalization, we calculated ratios of hospitalized-to-fatal injuries based data in Finkelstein that indicated by age group and sex the number of motor-vehicle accidents that resulted in hospitalizations as compared to the number of fatalities for the same age groups and sex.<sup>71</sup> We used a similar methodology to estimate the number of injuries not requiring hospitalization. We calculated ratios of non-hospitalized-injuries to fatal injuries based on data in Finkelstein that indicated by age group and sex the number of motor-vehicle accidents that did not result in hospitalizations and the number of fatalities for the same age groups and sex.<sup>72</sup>

Gender and age compositions were assumed to be the same as those for all motor vehicle crash deaths in the Fatal Accident Reporting System from NHTSA.<sup>73</sup> Table 4 indicates the results in terms of gender, age, and the nature of injuries suffered in each age and gender category. The first row of the second column contains the number 0.2077, which indicates that men who are 20 years old or younger comprised 20.77 percent of all injuries to men and women in our synthetic cohort. The sum of the percentages in the second column and the sixth column equals 100 percent. The number 56 in the first row of the third column represents the estimated number of men who are 20 years old or younger who died as the result of a Ford-Firestone rollover. The numbers 307 and 5,375 represent the number of men who are 20 years old or younger who were hospitalized and who were not hospitalized as a result of their injuries respectively.

**Table 4: Ford-Firestone Cohort Numbers**

Age	Men				Women			
	Percent of all injuries	Number of			Percent of all injuries	Number of		
		Fatal injuries	Hospitalized	Non-Hospitalized		Fatal injuries	Hospitalized	Non-Hospitalized
20	0.2077	56	307	5375	0.1023	28	151	2647
40	0.2211	60	327	5722	0.1089	30	161	2818
60	0.2412	65	357	6239	0.1188	32	176	3074

The next step was to match medical costs and lost production to this distribution of fatalities, hospitalized and non-hospitalized injuries. The data for direct and indirect COI costs were drawn from Finkelstein and his colleagues, who, as mentioned earlier, compiled this information in order to estimate the total cost of injuries in the United States.<sup>74</sup> The number of injuries identified in Table 4 was then multiplied by these per

<sup>70</sup> See FINKELSTEIN, ET. AL., *supra* n. 7, at 48 appendix 1.4 (indicating number of motor-vehicle accidents resulting in fatalities, hospitalization, and no-hospitalization by age group and sex).

<sup>71</sup> See *id.* (indicating number of motor-vehicle accidents resulting in fatalities and hospitalization by age group and sex).

<sup>72</sup> See *id.* (indicating number of motor-vehicle accidents resulting in fatalities and no hospitalization by age group and sex).

<sup>73</sup> Fatality Analysis Report System Encyclopedia (FARS), available at <http://www-fars.nhtsa.dot.gov/Main/index.aspx>.

<sup>74</sup> FINKELSTEIN, ET. AL., *supra* n. 7, at 56, 97.

person costs to generate total costs. The costs were adjusted to reflect the value of the dollar in the year 2007. These results are presented in Table 5:

**Table 5: Ford-Firestone COI Across Age and Gender**

Age	Medical	Lost Production	Total
<b>Men</b>			
20	\$17,748,443	\$130,544,249	\$148,292,692
40	\$17,155,266	\$136,055,456	\$153,210,722
60	\$19,645,879	\$ 96,133,696	\$115,779,574
<b>Sub-total, Men</b>	\$54,549,588.08	\$362,733,401	\$417,282,989
<b>Women</b>			
20	\$7,463,776	\$40,523,454	\$47,987,230
40	\$7,272,527	\$42,991,472	\$50,263,999
60	\$8,317,103	\$30,994,466	\$39,311,569
<b>Sub-total, Women</b>	\$23,053,407	\$114,509,392	\$137,562,798
<b>Total</b>			<b>\$554,845,787</b>

### *C. Extended Costs*

In this section, we describe three scenarios involving extended external costs caused by a SUV rollover and explain our methodology for estimating the costs that we have identified. These scenarios produce extended costs of \$288,000 to \$2.4 million per family.

#### 1. Permanent Quadriplegia

The first scenario assumes that a man, age 46, with two children who are 16 and 18 years old, suffers permanent quadriplegia as a result of a Ford-Firestone rollover. His wife, age 46, falls back to part-time employment to care for her husband, and the older child drops out of college to take on dual work and care-taking roles. After two years, the family loses one car and its home, prompting them to file for bankruptcy, a relatively common occurrence in this situation.<sup>75</sup> The younger child graduates from high school, but goes directly into the work force and foregoes a college education. In addition, the employers of family members bear the costs of lost productivity due to care-taking burdens. Table 6 summarizes the extended costs associated with these circumstances, which total \$733,254, discounted at three percent and without taking into account any future inflation.

<sup>75</sup> The assumption of bankruptcy is based on data indicating that 50 percent of bankruptcies in families relate to medical events. David U. Himmelstein, Elizabeth Warren, Deborah Thorne, and Steffie Woolhandler, *Illness and Injury as Contributors to Bankruptcy*, *Health Affairs*, 2005, available at <http://content.healthaffairs.org/cgi/reprint/hlthaff.w5.63v1>.

**Table 6: Ford-Firestone Extend Costs—Scenario One**

Costs	\$
Care-giving	\$115,165
Two children: No college	401,124
Lost equity in home	100,800
Lost vacation	23,080
Lost Social Security	27,216
Lost productivity to employers of family members	65,869
<b>TOTAL</b>	<b>\$733,254</b>

We estimated the value of the costs of the spouse's care-giving based on published data indicating the value of informal care-giving per hour<sup>76</sup> and of the average out-of-pocket cash outlays by such caregivers.<sup>77</sup> The cost to the children of not having a college education is based on data from the Department of Labor comparing median earnings of college and high school graduates.<sup>78</sup> The lost equity calculation assumes the victim lived in a \$200,000 home and had the average amount of equity that people in the U.S. have in terms of their ownership interest.<sup>79</sup> Two weeks of lost vacation for 20 years is valued on the basis of the \$30,000 compensation of the husband prior to the accident. Lost Social Security payments of the husband were calculated using worksheets provided by the Social Security Administration.<sup>80</sup> No benefits were assumed for the wife or children. The amount of lost productivity to the employers of family members was based on data indicating the average cost of decreased productivity of workers caring for disabled family members.<sup>81</sup>

## 2. Multiple Family Injuries Including Child in Persistent Vegetative State

For our second scenario, we assume that a rollover that resulted in the death of a grandmother, injuries to a mother and father, and injuries to their two children. The older child, age 10, has several broken bones and the younger child, age 8, is left in a persistent vegetative state. Because the grandfather is unable to live alone, he is forced to move into an assisted living facility. An aunt takes care of the older child in her home for

<sup>76</sup> See Mary Jo Gibson & Ari N. Houser, *Valuing the Invaluable: A New Look at the Economic Value of Family Caregiving*, Issue Brief, AARP Public Policy Institute, June 2007 (indicating the value of informal care-giving as \$10,400 per year), available at [http://www.aarp.org/research/housing-mobility/caregiving/ib82\\_caregiving.html](http://www.aarp.org/research/housing-mobility/caregiving/ib82_caregiving.html).

<sup>77</sup> See *id.* (indicating family and friends who are caregivers spend an estimated \$2,400 per year for groceries, medicine, and other out-of-pocket cash outlays).

<sup>78</sup> See U.S. Department of Labor, Bureau of Labor Statistics, *Occupational Outlook Quarterly*, October 23, 1998 (indicating persons with a high school degree earn 36 percent less than persons with a Bachelor's degree), available at <http://www.bls.gov/opub/ooq/ooqhome.htm>. This estimate does not take into account how much money the children saved by not attending college.

<sup>79</sup> Alan Greespan and James Kennedy, Federal Reserve Board, Finance and Economics Discussion Series, Divisions of Research & Statistics and Monetary Affairs, *Sources and Uses of Equity Extracted from Homes, March 2007*, available at <http://www.federalreserve.gov/pubs/feds/2007/200720/200720pap.pdf>.

<sup>80</sup> Social Security Administration, *Your Retirement Benefit: How It Is Figured*, SSA Publication No. 05-10070, January 2008, available at <http://www.ssa.gov/pubs/10070.pdf>.

<sup>81</sup> See Walter F. Steward, Judith A. Ricci, Elsbeth Chee, Steven R. Hahn, David Morganstein, *Cost of Lost Productive Work Time Among US Workers with Depression*, 289 J. AM. MEDICAL ASSOC. 3135 (2003) (indicating an average cost of \$3,600 per year).

two months, and she then moves in with the family for six months to provide support while the parents get back on their feet. Because of her injuries (an arm amputation and facial scarring), the mother, age 38, loses her job and cannot find a new one for two years, eventually settling on a position paying less than one-half as much as her prior position. She becomes clinically depressed and requires psychotherapy for eight years. The family attempts to care for the disabled child at home, but after two years, the father, unable to cope with the constant stress, abandons the family, forcing the mother and older son to move to subsidized housing for six years and to rely on TANF, food stamps, and Medicaid. With the parent's agreement, the comatose son becomes a ward of the state for the remaining 28 years of his life. This move was necessitated because the parents lacked the financial resources to care for the child. Table 7 summarizes the extended costs associated with this scenario, which total \$1,476,136 in 2007 dollars, discounted at three percent and without taking into account future inflation.

**Table 7: Ford-Firestone Extend Costs—Scenario Two**

		Family \$	Public Sector \$
<b>Funeral Expenses - Grandmother</b>	Airfare	\$ 4,920	-
	Hotel and per diem	10,890	-
	Funeral costs	7,323	-
<b>Grandfather</b>	Assisted living	256,106	-
<b>Aunt</b>	Hosting old son	927	-
	Related household costs.	1,200	-
	Leave without pay	25,000	-
<b>Mother and Older Son</b>	Subsidized housing	-	\$ 36,199
	TANF	-	26,296
	Food Stamps	-	5,809-
	Medicaid	-	22,893
	Medicaid prescription	-	9,817
<b>Mother</b>	Unemployment insurance	-	4,195
	Lost wages	65,600	-
	Lower income	310,444	-
	Psychotherapy	38,229	-
<b>Disabled Son</b>	Attendant service	209,181	-
	Medicaid	-	28,261
	Medicaid prescription	-	1,954
	Physical therapy	50,999	-
	Nursing home (Medicaid)	-	359,893
<b>SUBTOTAL</b>		<b>\$980,819</b>	<b>\$495,317</b>
<b>TOTAL</b>		<b>\$1,476,136</b>	

We assumed that 15 family members traveled to the grandmother's funeral incurring average travel expenses.<sup>82</sup> Funeral costs likewise reflect average costs.<sup>83</sup> The cost of

<sup>82</sup> See U.S. Department of Transportation, Research and Innovation Technology Administration, Bureau of Transportation Statistics (data for 3<sup>rd</sup> quarter 2007), available at [http://www.bts.gov/press\\_releases/2008/bts005\\_08/pdf/bts005\\_08.pdf](http://www.bts.gov/press_releases/2008/bts005_08/pdf/bts005_08.pdf).

<sup>83</sup> See National Funeral Directors Association, *NFDA Releases Results of General Price List Survey*, June 2, 2008 (indicating the median national cost of funerals in 2006 was \$7,323), available at <http://www.nfda.org/pressRelease.php?eID=293>.

assisted living for the grandfather is based on insurance company data.<sup>84</sup> The aunt's cost of hosting the oldest son uses Census data on the weekly cost of raising a child,<sup>85</sup> and her costs of taking care of the family are based on average household costs.<sup>86</sup> We assume that she took a leave without pay from her job at a cost of \$25,000 in lost income. The costs to the public sector of providing subsidized housing,<sup>87</sup> TANF,<sup>88</sup> Food Stamps,<sup>89</sup> and Medicaid<sup>90</sup> reflect government data and our assumptions about the duration of these benefits as indicated in the footnotes. The cost of unemployment insurance for the mother is based on the national 2006 average.<sup>91</sup> For her lost income, we assumed that she earned \$24,000 after the accident as compared to \$50,000 prior to the accident.<sup>92</sup> The cost of her psychotherapy is based on a national average cost.<sup>93</sup> Likewise, the disabled son's costs for attendant services (two shifts per day for two years),<sup>94</sup> physical therapy (one hour daily for two years),<sup>95</sup> Medicaid,<sup>96</sup> and a nursing home<sup>97</sup> are based on data

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<sup>84</sup> See *Private and Semi-Private Nursing Home Room Rates Increase 3% in 2007 Assisted Living Rates Remain Steady*, According to MetLife Market Survey, MATURE MARKET NEWS, October 2007 (data from the Metlife Mature Market Institute indicating a monthly cost for assisted living of \$2,969/month), available at <http://www.metlife.com/FileAssets/MMI/MMIPRNursingHomeAsstLiving2007L.pdf>.

<sup>85</sup> See U.S. Census, Table C2 Weekly Child Care Costs Paid by Families with Employed Mothers: 1985-2005 (indicating cost per week of \$107), available at <http://www.census.gov/population/www/socdemo/child/weeklychldcare.xls>.

<sup>86</sup> See *supra* n. 77 (AARP study indicating that family and friends who are caregivers spend an estimated \$2,400 per year for groceries, medicine, and other out-of-pocket cash outlays).

<sup>87</sup> See U.S. Department of Housing and Urban Development (HUD), 1998 (indicating the average operating cost of single room occupancy for Section 8 housing is \$298 per month), available at <http://www.huduser.org/publications/pdf/economic.pdf>.

<sup>88</sup> See Social Security Administration, Annual Statistical Supplement, 2005, Public Assistance, Temporary Assistance for Needy Families/AFDC and Emergency Assistance (9.G), available at <http://www.ssa.gov/policy/docs/statcomps/supplement/2005/9g.pdf> (indicating cost of TANF benefits). We assume the mother and son were eligible for TANF for one year.

<sup>89</sup> See U.S. Department of Agriculture, Food Stamp Program (indicating food stamps cost the government a maximum rate of \$298 for a family of two for FY2008 and a maximum of \$162 for one person), available at [http://www.fns.usda.gov/fsp/applicant\\_recipients/BEN.HTM](http://www.fns.usda.gov/fsp/applicant_recipients/BEN.HTM). Our calculation uses the minimum amount of food stamp benefits available from the government. The maximum amount of food stamps is three times as much. Our estimate assumes that two members of the family received food stamps for six years and one member of the family received food stamps for 25 years.

<sup>90</sup> See Medicaid (indicating that Medicaid per person is \$2,215 per year, on average), available at <http://www.socialsecurity.gov/policy/docs/statcomps/supplement/2006/medicaid.pdf>. We assumed Medicaid for two people for six years and one for 25 years.

<sup>91</sup> Social Security Administration, Office of Policy Data, Annual Statistical Supplement, 2006, June 2007 (indicating a \$266.60 average weekly benefit, for 15.3 weeks), available at <http://www.socialsecurity.gov/policy/docs/statcomps/supplement/2006>.

<sup>92</sup> Our calculation does not take into account any loss of benefits and subtracts the unemployment compensation that she received.

<sup>93</sup> See Erwin Brown, Jr. and Karen Beauregard, *Regional Differences in Total and Out-of-Pocket Expenditures for Selected Types of Office-Based Visits, 2004*, Agency for Health Care Research and Quality, Statistical Brief #157, January 2007 (indicating average hourly cost of \$106.08), available at [http://www.meps.ahrq.gov/mepsweb/data\\_files/publications/st157/stat157.pdf](http://www.meps.ahrq.gov/mepsweb/data_files/publications/st157/stat157.pdf).

<sup>94</sup> See Metlife Mature Market Institute and LifePlans, Inc., *The MetLife Market Survey of Adult Day Services & Home Care Costs*, September 2007 (indicating national average hourly cost of \$19), available at <http://www.metlife.com/WPSAssets/18746211091190810760V1F2007ADSHCCStudy.pdf>.

<sup>95</sup> See Texas Health and Human Services Commission, Historical CBA/CWP Costs/Recommended Rate and Funded Rate in 2008 in 2008 dollars (Cost/Recommended rate for SFY0405), (indicating rate of

indicating the average or reimbursable cost of these services and on our assumptions about their duration.

### 3. Woman Suffering Serious Mental Illness

In the final scenario, we assume that a woman becomes seriously mentally ill after her husband and two children die in a rollover crash. She is 40 years old and must be institutionalized for the remaining 40 years of her life. For 40 years, the economic cost from this single rollover event is \$2,554,783 in 2007 dollars, discounted three percent over 40 years.<sup>98</sup> This estimate does not account for any inflation in the cost of her institutionalized care.

#### *D. Discussion*

Our estimate of the number of fatalities is based on news reports indicating between 271 and 476 persons died as the result of Ford SUV rollovers.<sup>99</sup> Since we chose the low end of this estimate (271), our calculation of traditional COI costs may be understated. Our calculation of the COI costs concerning injuries requiring hospitalization and not requiring hospitalization may be likewise understated because these estimates are extrapolated from our estimate of the number of fatalities.<sup>100</sup>

We assumed that the gender and age compositions were the same as for all motor vehicle crash deaths as indicated by NHTSA data.<sup>101</sup> Because the accidents we studied involved SUVs, there may be more women and children involved than in the average crash. We were unable, but we were unable to locate data that would permit us to fine-tune our gender and age compositions.

The per-injury medical cost for fatalities for all ages ranged from \$5,910 to \$8,755 for males and from \$6,800 to \$10,072 for females.<sup>102</sup> If anything, these results appear to underestimate the costs associated with a fatality. Zaloshnja and Miller indicate that a

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\$77.65 per hour), available at [http://www.hhsc.state.tx.us/news/presentations/0308\\_HHSC\\_Presentation.pdf](http://www.hhsc.state.tx.us/news/presentations/0308_HHSC_Presentation.pdf).

<sup>96</sup> See Social Security Administration, Office of Policy Data, Annual Statistical Supplement, 2006, June 2007 (indicating average cost of \$23,882/year, 2003), available at <http://www.socialsecurity.gov/policy/docs/statcomps/supplement/2006/medicaid.pdf>.

<sup>97</sup> See University of Alabama at Birmingham, The National SCI Statistical Center, Spinal Cord Injury: Facts and Figures at a Glance, June 2006 (finding an individual “ventilator dependent at any level,” who survived at least a year, and was injured at age 20, had a life expectancy of 23.3 years), available at <http://images.main.uab.edu/spinalcord/pdf/Files/Facts06.pdf>.

<sup>98</sup> See Washington State Department of Community, Trade and Economic Development, Housing Division, Olympia (360-725-2930), Ten-Year Homeless Plan, July 2006, (indicating that the cost per day for institutionalized care in a mental hospital in the state of Washington is \$555, or \$202,575 per year), available at [http://cted.wa.gov/CTED/documents/ID\\_3356\\_Publications.doc](http://cted.wa.gov/CTED/documents/ID_3356_Publications.doc).

<sup>99</sup> See *supra* note 68 & accompanying text.

<sup>100</sup> See *supra* note 70-72 & accompanying text.

<sup>101</sup> See *supra* note 73 & accompanying text.

<sup>102</sup> Methodology Appendix, *supra* n. 47, at 8.

fatal vehicle crash involves medical costs of \$20,655, and this estimate assumes instant death, and not critical injuries causing death weeks later.<sup>103</sup>

Our per-injury estimate of medical costs and indirect costs for fatalities ranges from \$448,581 to \$1,409,627.<sup>104</sup> Department of Transportation data suggests the general accuracy of these estimates if one assumes that Firestone/Ford Rollover accidents were at least as severe as motor vehicle accidents generally. According to DOT, each motor vehicle fatality represents an average discounted lifetime cost of \$977,000 and each critically injured survivor cost an average of \$1.1 million.<sup>105</sup>

Our estimate of traditional costs includes minor injuries, which we defined as injuries not involving hospitalization. Presumably persons with relatively minor injuries did not sue Ford or Firestone, particularly if the cost of their injuries was covered by medical insurance. On the other hand, we do not include the cost of the property damage to the vehicles that were in the rollovers, costs which are presumably paid for by a person's automobile insurance. Once again, this omission suggests that our estimates of COI are understated.

Our estimate that the SUV accidents involved almost \$555 million in direct costs, excluding pain and suffering, gains some credence from published reports indicating that Ford was defending over \$590 million (probably in 2000 dollars) in personal injury and class action lawsuits and that Firestone had set aside \$800 million (probably in 2000 dollars) for lawsuits relating to the "ATX" and "ATX II" tires.<sup>106</sup> We cannot vouch for the reliability of these newspaper reports, but assuming that they are accurate, they suggest that our estimates of COI are understated. We suspect that this discrepancy may be explained at least in part by the fact that we may have underestimated the number of fatalities and injuries. As discussed at the start of this section, news reports indicated somewhere between 271 and 476 persons died in SUV accidents, and we used the 271 number as the starting point for our calculations. Our estimate may also be too low because we excluded pain and suffering from our estimates, assuming that the Ford and Firestone payments included compensation for pain and suffering.

Our estimate that extended costs range from \$733,000 to \$2.55 million depends on the assumptions that we made about the nature of the injuries that were suffered and the duration of various costs. We believe that we have made realistic assumptions, but the amount of extended costs is affected by the assumptions that we have made.

Because the estimates of extended costs involving medical expenses do not take into account future inflation, they are understated. Consider, for example, scenario three, an

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<sup>103</sup> Eduard Zaloshnja, Ted Miller, & Forrest Council, and Bhagwant Persaud, *Crash Costs in the United States by Crash Geometry*, 38 ACCIDENT ANALYSIS & PREVENTION 644 (2006).

<sup>104</sup> To derive these figures, we added the per-injury medical costs and per-injury indirect costs for males, age 20, 40, and 60, and for females, age 20, 40, and 60. See Methodology Appendix, *supra* n. 47, at 8, 11. The lowest combined cost is for females, age 60 and the highest combined cost is for males, age 20.

<sup>105</sup> U.S. Department of Transportation, National Highway Traffic Safety Administration, *The Economic Impact of Motor Vehicle Crashes, 2000*, <http://www-nrd.nhtsa.dot.gov/Pubs/809446.PDF>.

<sup>106</sup> McDonald II, *supra* n. 68, at 1078.

estimate of the cost of institutionalized care for 40 years. As discussed, the discounted cost of the care is about \$2.55 million using a three percent discount rate.<sup>107</sup> The rate of inflation for medical services, however, has been 109 percent for the decade 1998-2007, as compared to an increase in the general Consumer Price Index of 44 percent.<sup>108</sup> If we assume that medical services, such as the women's institutionalized care increased ten percent per year (even though 2006-2007 medical services prices rose nearly 15 percent), the cost of care is nearly \$28.5 million in 2007 dollars, again using a discount rate of three percent.

Some of our estimates of extended costs may be overstated in the sense that they do not produce a net reduction in social wealth as large as the cost itself. For example, we counted as a cost in scenario one the equity that the family lost in the value of their home (\$100,800) when they filed for bankruptcy.<sup>109</sup> The purchase price of the house, however, may have been discounted to some extent because it was sold as part of a bankruptcy proceeding, which means an economic gain for some other family would have offset the loss of wealth to the family we studied to some extent. Since this information is unknown, we calculated the entire loss of equity as resulting in a loss of social wealth.

A similar objection might be raised concerning the loss of wages in scenario two. Analysts who follow a "friction cost" approach believe that the only decrease in social wealth occurs during the time it takes a firm to find a healthy replacement worker. While this may be a correct description of the cost to the individual employer, it is not an appropriate measurement of the loss from society's point of view. Consider, for example, the hiring of a replacement worker after the original worker is killed in an SUV accident. From society's point of view (and as a measurement of externalities), both the worker who was killed, had he or she lived, and the replacement worker would have added value to aggregate social wealth over their lifetimes. The problem with the "friction cost" approach is that it assumes the potential healthy replacement worker would be unemployed for a lifetime, which is, of course, unrealistic.

Moreover, even in the short-run, the "friction cost" approach is problematic because it assumes that replacement workers are available to fill in for all of the persons who are unable to work because of injuries from dangerous products. This is unrealistic. Based on data from Finkelstein and his colleagues<sup>110</sup> and from Lawrence and his coauthors,<sup>111</sup> we can estimate dangerous products are responsible for over 22,000 deaths and over 25 million injuries in 2000. If we assume "full employment" corresponds to a four percent unemployment rate, the number of potential replacement workers available for those jobs left vacant by the deaths and injuries would be zero in 2000 and roughly one million in 2001.<sup>112</sup>

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<sup>107</sup> See *supra* note 98 & accompanying text.

<sup>108</sup> U.S. Department of Labor, Bureau of Labor Statistics, available at <http://www.bls.gov/cpi/home.htm#tables>.

<sup>109</sup> See *supra* note 79 & accompanying text.

<sup>110</sup> FINKELSTEIN, ET. AL., *supra* n. 7.

<sup>111</sup> Lawrence, *supra* n. 8,

<sup>112</sup> There are no workers available in 2000 because the unemployment rate is 4.0 percent. There are one million workers available in 2001 because the unemployment rate is 4.7 percent. The different between 4.0

Finally, it is easy enough to imagine that our scenarios understate the external costs of an SUV rollover because they do not include other likely expenses. In scenario one, for example, we did not include any probable public sector costs. These costs could run into the hundreds of thousands of dollars if the family qualifies for Social Security Disability payments, and perhaps food stamps and housing and utility subsidies.

#### IV. BAYCOL

The second case study is of the social costs associated with serious side-effects caused by the pharmaceutical drug Baycol. This section first describes the product defect that made this drug a dangerous product. We then discuss how we derived our estimate of a total of \$248 million in traditional COI costs and \$159,000 to \$2.2 million in extended costs per family, both in 2007 dollars. We again end with a discussion of our results.

##### A. Product Defect

The generic name for Baycol is cerivastatin, and, as this name indicates, it is a member of a class of drugs known as statins.<sup>113</sup> The main purpose of statins is to reduce cholesterol levels in the body, which decreases the probability of heart attacks and strokes.<sup>114</sup> Generally, statins are a safe medication, but muscles can be sensitive to elevated levels of statins, thereby causing a muscular disease known as myopathy.<sup>115</sup> Statins can also cause a severe form of myopathy known as rhabdomyolysis,<sup>116</sup> which can lead to permanent damage, significant disability, or even death.<sup>117</sup>

While all statins carry a risk of myopathy and rhabdomyolysis, persons taking Baycol experienced higher incidence of these side-effects. Part of the problem may have been that Baycol was designed to be 60 to 200 times more potent than other statins on the market.<sup>118</sup> To counter this concentration, FDA approved the use of the drug in small doses,<sup>119</sup> but in an attempt to make the drug more effective, Bayer ask FDA to approve higher dosages, which it eventually did.<sup>120</sup>

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percent unemployment and 4.7 percent unemployment is one million workers. See US Statistical Abstract, 2008, Table 569: Civilian Population—Employment Status: 1970 to 2006 (indicating unemployment data for 2000 and 2001), available at <http://www.census.gov/compendia/statab/tables/08s0569.pdf>.

<sup>113</sup> *In re Baycol Products Litigation*, 218 F.R.D. 197, 201 (D.Minn. 2003).

<sup>114</sup> Jane E. Brody, *Statins: Miracles for Some, Menace for a Few*, N.Y. Times, Dec. 10, 2002, at F7.

<sup>115</sup> Scott M. Grundy, *The Issue of Statin Safety: Where Do We Stand?*, 111 CIRCULATION 3016, 3016 (2005).

<sup>116</sup> Amy Haavisto Kind, et al, *Rhabdomyolysis from the Combination of a Statin and Gemfibrozil: An Uncommon But Serious Adverse Reaction*, 101 WISCONSIN MEDICAL J. 53, 54 (2002).

<sup>117</sup> Jeanne Bruno-Joyce, et al, *Cerivastatin and Gemfibrozil—Associated Rhabdomyolysis*, 35 THE ANNALS OF PHARMACOTHERAPY, 1016, 1018 (2001).

<sup>118</sup> *Id.* at 1016.

<sup>119</sup> Bruce M. Psaty, et al, *Potential for Conflict of Interest in the Evaluation of Suspected Adverse Drug Reactions: Use of Cerivastatin and Risk of Rhabdomyolysis*, 292 J. AM. MED. ASS'N 2622, 2622 (2004). Bayer has responded to this article and many of its claims. Joseph D. Piorkowski, *Bayer's Response to "Potential for Conflict of Interest in the Evaluation of Suspected Adverse Drug Reactions: Use of Cerivastatin and Risk of Rhabdomyolysis"*, 292 J. AMERICAN MEDICAL ASS'N 2655 (2004).

<sup>120</sup> Psaty, *supra* n. 119, at 2624; *In re Baycol Products Litigation*, 218 F.R.D. at 200.

When people started ingesting Baycol in these higher doses, problems began to occur,<sup>121</sup> particularly in elderly women with smaller bodies.<sup>122</sup> Physician reports of side-effects sent to FDA from 1990 to 2002 indicated that the probability of Baycol-induced rhabdomyolysis was 65 times higher than the probability of this side-effect in all other statins combined.<sup>123</sup> A subsequent FDA supervised analysis found that rhabdomyolysis-related mortality rates for Baycol users was 16 to 86 times higher than for users of other statins.<sup>124</sup>

Bayer recalled Baycol from the market on August 8, 2001.<sup>125</sup> Documents, emails, memos, and sworn depositions uncovered during class action litigation against Bayer suggest that company executives were aware of the serious health risks associated with the drug prior to the recall.<sup>126</sup> Bayer, however, continued to market the drug in a manner that caused the FDA to warn the company that its marketing materials were “false, lacking in fair balance or otherwise misleading” and that “the most important risk information” had been downplayed.<sup>127</sup>

Baycol was linked to at least 100 deaths by early 2002<sup>128</sup> and to 1,000 to 1,600 severe non-fatal injuries.<sup>129</sup> Parties in a multi-district class action concerning Baycol reported to the court in January 2007 that defendants had settled 3,023 cases with a total value of \$1,143,748,591.<sup>130</sup> They also reported that the number of active cases was approximately 1,200.<sup>131</sup>

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<sup>121</sup> Gina Kolata and Edmund L. Andrews, *Anticholesterol Drug Pulled After Link With 31 Deaths*, N.Y. TIMES, Aug. 9, 2001, at A12.

<sup>122</sup> Psaty, *supra* n. 119, at 2628.

<sup>123</sup> *Id.* at 2625.

<sup>124</sup> *Id.* at 2625. FDA also found that mortality rates for Baycol users was 10 to 50 times higher than for the use of other statins when individuals used both Baycol and Gemfibrozil, another drug often prescribed with Baycol. *Id.* at 2626. The two drugs were prescribed together because, when combined, they greatly increased the reduction in cholesterol, but, when used together, even individuals using a relatively low-risk statin experienced some muscle destruction. Kind, *supra* note 116, at 55.

<sup>125</sup> Phillip J. Hilts, *Drug's Problems Raise Questions on Warnings*, N.Y. TIMES, Aug. 21, 2001, at F1.

<sup>126</sup> Psaty, *supra* n. 119, at 2623-2626; Melody Petersen and Alex Berenson, *Papers Indicate That Bayer Knew of Dangers of Its Cholesterol Drug*, N.Y. TIMES, Feb. 22, 2003, at A1.

<sup>127</sup> Petersen and Berenson, *supra* n. 126. Responding to mounting pressure, Bayer issued a “Dear Healthcare Professional” letter in May 2001, three months before the recall, warning physicians of the potential side effects of the drug, and highlighting the fact that Gemfibrozil created a particular hazard. *In re Baycol Products Litigation*, 218 F.R.D. at 202.

<sup>128</sup> Hilts, *supra* n. 125.

<sup>129</sup> *In re Baycol Products Litigation*, 218 F.R.D. at 201-02; Petersen and Berenson, *supra* n. 126; Ameet Sachdev, *Attorney Fired On Perjury Charge; Kenneth Moll Loses Key Post*, Chicago Tribune, Apr. 16, 2004, at C1. See also Expert Witness Report of R. Samuel Mayer, MD, at 4, *In re Baycol Products Litigation*, No. MDL 1431, 2005 WL 2464940 (D.Minn. 2005), available at 2005 WL 1341252 (referring to 1,579 reports of severe muscle damage from toxic rhabdomyolysis).

<sup>130</sup> Baycol Product Liability Litigation, Current Developments, U.S. District Court, District of Minnesota, available at [http://www.mnd.uscourts.gov/Baycol\\_Mdl/index.htm](http://www.mnd.uscourts.gov/Baycol_Mdl/index.htm).

<sup>131</sup> *Id.*

## B. Traditional COI Costs

We assumed that there were 3,023 total injuries caused by Baycol based on the report that Bayer had settled 3,023 cases in the multi-district class action litigation.<sup>132</sup> Based on an analysis of FDA data,<sup>133</sup> we made assumptions about the number of fatalities and long-term disabilities. We assumed that 3.6 percent or 109 of these 3,023 injuries resulted in deaths.<sup>134</sup> We further assumed there were 157 injuries that resulted in long-term disability (5.2 percent of the 3,023 total injuries).<sup>135</sup> For the remaining 2,757 injuries,<sup>136</sup> we assumed each injury resulted in acute disease and a single hospitalization. Finally, based on the same FDA data, we assume that the injuries occurred in two age categories (50-64 and 65+), 30 percent of the cases were in the first category and 70 percent were in the second, and 52.35 percent of those injured were male.<sup>137</sup>

Costs were matched to the fatal and non-fatal categories as well as to the age and gender categories identified above. Hospital charges and costs were drawn from government health care data.<sup>138</sup> We estimated all medical costs with the traditional total-to-hospital costs method.<sup>139</sup> We again used Finkelstein for our estimate of lost production due to

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<sup>132</sup> See *supra* note 130 & accompanying text.

<sup>133</sup> See Omar and Wilson, *FDA Adverse Event Reports on Statin-Associated Rhabdomyolysis*, 16 ANNALS OF PHARMACOTHERAPY 288 (2002).

<sup>134</sup> *Id.* at 291.

<sup>135</sup> *Id.* The article is not clear about the definition of disability, but the authors present separate categories for persons who suffered disabilities and persons who were only hospitalized, which is the same distinction that we make.

<sup>136</sup> The number of remaining injuries was calculated by deducting the previous two numbers from the total number of injuries; i.e., 3,023 total injuries – 109 (deaths) – 157 (long-term disability) = 2,757.

<sup>137</sup> Omar & Wilson, *supra* n. 133, at 291.

<sup>138</sup> See U.S. Dept. of Human Services, Agency for Health Care Research and Quality, Welcome to H-Cupnet, available at <http://hcupnet.ahrq.gov/>. From this source, we obtained data for the cost of treating rhabdomyolysis using cost estimates for all disorders of muscle, ligament and fascia (ICD9 = 728.8 and number 728). These data, however, need to be deflated because they are expressed as charges, not true hospital costs. The actual hospital charges reflect the interaction of insurance companies and the hospitals because insurance companies routinely challenge initial charges. Since the H-CUPnet estimated that the ratio between hospital charges and actual costs is 0.3554, we multiplied by the charges for the treatment of rhabdomyolysis by 0.3554 to produce our treatment cost estimates.

<sup>139</sup> In this method, a multiplication factor is calculated based upon the ratio of the percent all medical costs for all diseases and injuries (100%) divided by hospital only costs for all diseases and injuries (in our case 100% / 30.7%). HCUP Facts and Figures, Statistics on Hospital Based Case in the United States, 2005, available at [http://www.hcup-us.ahrq.gov/reports/factsandfigures/HAR\\_2005.pdf](http://www.hcup-us.ahrq.gov/reports/factsandfigures/HAR_2005.pdf). We assumed average medical costs would apply to our “hospitalizations” category, but that our categories of death and disability involve higher medical costs. For fatalities, we assumed that medical costs would be two times the average medical costs for hospitalizations. See H-Cupnet, *supra*, (indicating a mean medical cost for treating disorders of muscle, ligament and fascia of \$17,762 and a median cost of \$11,857). Because the mean cost is so much higher than the median cost, and because this suggests that medical costs have long right tail, it is reasonable to assume fatal costs at least twice the average. For disabilities, we assumed that medical costs for persons in the age 50-64 category would be four times the average medical costs of hospitalizations, and for persons in the 65 and older category, we assumed these costs to be two times this average. The medical cost estimates from H-CUPnet reflect only one year. Permanent disability will likely generate medical costs for every year until the person dies. For persons who were permanently disabled, we assumed those in the 50-64 age category will live longer and require 4 times more medical care than the

fatalities and to injuries.<sup>140</sup> We then assumed that the lost production costs for permanent injuries were the same as for fatalities. All of these estimates were adjusted upward for inflation from the years 2000 and 2003 to the year 2007. Table 8 summarizes the results of the previous calculations.

**Table 8: Baycol Per-person Medical and Lost-Production Costs**

	Medical Costs	Lost Production	Total
<b>Male fatalities by age</b>			
60 years	\$736,679	\$16,996,840	\$17,733,520
70 years	\$2,416,046	\$9,964,835	\$12,380,893
<b>Female fatalities by age</b>			
60 years	\$644,594	\$9,428,822	\$10,073,420
70 years	\$2,239,262	\$ 8,210,271	\$10,449,544
<b>Disabled men by age</b>			
60 years	\$4,604,241	\$26,557,563	\$31,161,800
70 years	\$6,835,642	\$14,096,597	\$20,932,258
<b>Disabled women by age</b>			
60 years	\$4,051,732	\$14,816,721	\$18,868,454
70 years	\$6,128,507	\$ 11,235,108	\$17,363,632
<b>Hospitalized men by age</b>			
60 years	\$759,681	\$1,747,070	\$2,506,746
70 years	\$29,758,046	\$16,279,342	\$46,037,820
<b>Hospitalized women by age</b>			
60 years	\$9,070,134	\$12,030,183	\$21,100,276
70 years	\$27,106,339	\$12,494,789	\$39,601,400
<b>TOTAL</b>	<b>\$94,350,903</b>	<b>\$153,858,141</b>	<b>\$248,209,044</b>

### C. Extended Costs

We also estimated that Baycol caused extended costs of between \$159,000 and \$2.2 million per family based on three hypothetical scenarios. This section summarizes our methodology and results.

#### 1. Individual with Severe Leg Pain

A sixty year old divorced woman, following an episode of rhabdomyolysis after taking Baycol, requires twice weekly physical therapy for 2 years for leg pain. During this period, she can barely walk, cannot drive her car, and takes early retirement from a \$30,000 a year job. Instead of private health insurance, she must rely on Medicaid. Her daughter postpones college for two years to care for her mother full-time and thereby

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average cost. We assumed those persons in the 65 and older category would only require two times as much care as the average cost since these persons would not live as long as those in age 50-64 category.

<sup>140</sup> FINKELSTEIN, ET. AL., *supra* n. 7, at 119, 121.

enters the work force two years later. As summarized in Table 9, there are nearly \$160,000 in extended costs paid for by the family and by the public sector. This estimate is in 2007 dollars, discounted at three percent and does not take inflation into account.

**Table 9: Baycol Extended Costs—Scenario One**

	Family \$	Public Sector \$
Physical therapy	\$ 14,572	-
Reduced retirement account	14,139	-
Medicaid	-	\$62,479
Daughter delay into workforce	68,159	-
<b>TOTAL</b>	<b>\$96,870</b>	<b>\$62,479</b>
<b>GRANT TOTAL</b>	<b>\$159,349</b>	

We estimated physical therapy costs based on therapy twice a week for two years and used the reimbursement rates of the Texas state health commission.<sup>141</sup> The cost of early retirement assumes contributions to the woman’s 401(k) totaled 10 percent of her total compensation and earned a 5 percent return. The Medicaid estimate assumes 5 years of support and is based on cost data published by the federal government.<sup>142</sup> The cost to the daughter of delaying entry into college is based on the loss of two years of income at the median annual earnings of college graduates.<sup>143</sup>

## 2. Individual Unable to Walk

The second scenario assumes that a 68-year old man never walks again because of Baycol-induced rhabdomyolysis, also resulting in clinical depression. Because his 68-year old spouse cannot care for her husband, both move to a nursing home for seven years. A daughter, aged 50, moves back to the city where her parents live to provide support for them, taking a 20 percent pay cut. Her productivity in her new job is adversely affected by her care-taker role for her parents. After the wife dies, the husband moves to a less expensive, Medicaid-funded, nursing home for the remaining five years of his life. As summarized in Table 10, these extended costs total slightly over \$1.0 million in 2007 dollars, discounted at three percent and without any adjustment for inflation.

<sup>141</sup> See Historical CBA/CWP Costs/Recommended Rate, *supra* n. 95 (indicating rate of \$77.65 per hour).

<sup>142</sup> See Social Security Administration, Office of Policy Data, Annual Statistical Supplement, 2006, June 2007 (indicating disabled individuals on Medicaid had a cost in 2003 of approximately \$12,855 per year), available at <http://www.socialsecurity.gov/policy/docs/statcomps/supplement/2006>.

<sup>143</sup> See Occupational Outlook Quarterly, *supra* n. 78 (indicating persons with a college degree have a median income per year of \$36,155). Our estimate assumes she becomes a college graduate, and that there is no significant loss in pension or Social Security benefits.

**Table 10: Baycol Extended Costs—Scenario Two**

		<b>Family \$</b>	<b>Public Sector \$</b>
<b>Husband</b>	Nursing home	\$392,638	-
	Less Expensive nursing home	-	\$116,073
<b>Wife</b>	Nursing home	392,638	-
<b>Daughter</b>	Moving costs	10,700	-
	Lost income (12 years)	84,166	-
	Increased health premium	20,200	-
	Lost pension income	11,222	-
<b>Daughter's Employer</b>	Lost productivity	30,300	-
<b>TOTAL</b>		<b>\$941,864</b>	<b>\$116,073</b>
<b>GRAND TOTAL</b>		<b>\$1,057,937</b>	

The estimate of the nursing home costs for the couple assumes that they were in the home for seven years. It relies on published insurance company data indicating the cost of a semi-private room in a nursing home.<sup>144</sup> The cost of the less expensive nursing home is based on Medicaid data and assumes five years of occupancy.<sup>145</sup> The moving costs reflect data on the average cost of interstate moves.<sup>146</sup> The daughter's lost income is based on an assumption that she went from a job at \$50,000 to a job at \$40,000 for 12 years. In addition we hypothesize that she has \$200 per month higher health care premiums with no increase in the cost of insurance from year to year until she becomes eligible for Medicare. We calculated that the change in jobs reduces the contribution to her 401(k) by \$1,000 per year, which would have earned a five percent return. The estimate of lost productivity of the employer is based on a study of the cost of lost productive work time among workers with depression and assumes 12 years of employment.<sup>147</sup>

### 3. Individual on dialysis

The final scenario assumes a 45 year old man who is on dialysis for the remaining 25 years of his life as a result of Baycol-induced rhabdomyolysis. He is forced to give up his job as partner in a major law firm. His wife takes on major caretaking responsibilities. A physical therapist visits his home once a week to ease his leg pain. As summarized in Table 11, the estimated extended costs are \$2,206,630, discounted at three percent and not taking into account the impact of inflation.

<sup>144</sup> See MATURE MARKET NEWS, *supra* n. 84 (indicating average cost of a semi-private room is \$68,985 a year based on 2007 data).

<sup>145</sup> See *Annual Statistical Supplement to the Social Security Bulletin, 2006*, June 2007 (indicating average cost of Medicaid nursing facility services in 2003 of \$23,882), available at <http://www.socialsecurity.gov/policy/docs/statcomps/supplement/2006/supplement06.pdf>.

<sup>146</sup> See State, Moving Expense Regulation and Guide, (indicating average interstate move weighing 9,000 pounds cost \$10,700), available at <http://www.acadweb.wvu.edu/BFA/BusinessServices/a33form.pdf>.

<sup>147</sup> See Steward, et. al., *supra* n. 81 (indicating an average cost of \$3,600 per year).

**Table 11: Baycol Extended Costs—Scenario Three**

		<b>Family \$</b>
<b>Lawyer</b>	Lost earnings	\$1,791,020
	Lost vacation time	101,033
	Reduced 401(k) assets at retirement	191,042
	Physical therapist	46,149
<b>Spouse</b>	Caretaker costs 10 years	77,386
<b>TOTAL</b>		<b>\$2,206,630</b>

We included lost earnings as an extended cost because it is likely that the lawyer’s annual earnings exceeded the lost earnings reflected in our calculation of traditional COI costs, which was based on the average lost earnings of accident victims. We assumed the lawyer earned \$200,000 more than the average victim, would have worked for an additional 25 years but for his illness, and received \$50,000 a year in disability payments. The estimate of lost vacation time is based on the value of the lawyer’s compensation for five weeks per year. The reduced money in the victim’s 401(k) assumes that contributions to his retirement fund constituted 20 percent of the \$400,000 (with no interest accruing). The value of the wife’s care-taking is calculated on the basis of an AARP study on the economic value of family care-giving,<sup>148</sup> and assumes the spouse provides the care for 10 years. The cost of a physical therapist’s services is based on insurance data indicating the average cost of such services<sup>149</sup> and assumes that the services were provided once a week for 25 years.

#### ***D. Discussion***

Our calculations of traditional COI costs assumed a total of 3,023 injuries based on the number of settlements reported in a multi-district class action litigation concerning the drug.<sup>150</sup> This appears to understate the number of injuries because the parties in the litigation also reported that there were 1,200 cases that remained unresolved,<sup>151</sup> and because it is likely that at least some Baycol victims never sued. We further assumed that 3.6 percent or 109 of these 3,023 resulted in deaths based on a study by Omar and Wilson.<sup>152</sup> This assumption is consistent with reports that Baycol was linked to 100 deaths by early 2002.<sup>153</sup>

Our estimate of \$248 million in traditional COI costs is considerably less than the \$1.143 billion in settlements that Bayer is reported to have paid.<sup>154</sup> Since this number is based on a report to the court by the litigants, we assume that it is valid. Our methodology may have understated COI costs for a number of reasons.

<sup>148</sup> See Mary Jo Gibson and Ari N. Houser, *supra* n. 76 (indicating individual provides approximately \$10,400 a year in unpaid care).

<sup>149</sup> See Historical CBA/CWP Costs/Recommended Rate, *supra* n. 149 (indicating \$77.65 per hour rate).

<sup>150</sup> See *supra* note 130 & accompanying text.

<sup>151</sup> See *supra* note 131 & accompanying text.

<sup>152</sup> See *supra* note 133 & accompanying text.

<sup>153</sup> See *supra* note 128 & accompanying text.

<sup>154</sup> See *supra* note 130 & accompanying text.

First, our medical costs were drawn from hospital data on the costs of treating disorders of muscle, ligament and fascia.<sup>155</sup> Our estimate does not include the cost of dialysis because we do not know how many persons taking Baycol were forced to use this medical treatment, but it is likely that it is a significant number.

Second, our estimates of medical costs involved certain assumptions about the relationship of long-term medical costs to the average cost of hospitalizations.<sup>156</sup> For example, we assumed that medical costs for persons in the age 50-64 age category would be four times the average costs of hospitalization. While we believe that these assumptions are reasonable ones, they are assumptions and may not reflect the true cost of medical costs in the categories to which we applied the assumptions. Indeed, given the magnitude of the apparent understatement of COI costs, we may have significantly underestimated the relationship of long-term medical costs to the average cost of hospitalizations.

Finally, our estimate of traditional COI costs does not include pain and suffering. We are uncertain the extent to which the money paid by Bayer in Baycol settlements reflects this injury, but our exclusion of the cost of pain and suffering may explain some of the discrepancy between our estimate the total amount of the Baycol settlement.

Our calculations of extended costs between \$159,000 and \$2.2 million per family are subject to the same qualification mentioned in the discussion of our SUV rollover estimates. First, our estimate of extended costs depends on the assumptions that we made about the nature of the injuries that were suffered and the duration of various costs. Second, because the estimates of extended costs of medical expenses do not take into account future inflation, they are understated by some unknown amount. Third, we treated the loss of employment as a reduction in social wealth based on the existence of frictional employment. Finally, our estimates of extended costs may have been understated because we did not include additional costs that could occur in the type of situation we have hypothesized. Consider the daughter in scenario two who is forced to take a lower paid job in order to be with her parents. It is easy to imagine that she might have become isolated and depressed, resulting in additional medical expenses if she sought treatment.

## V. ALL TERRAIN VEHICLES (ATVs)

Our final case study is of the external costs of three-wheeled ATVs. We follow the same format as previously. We describe the product defect that made these ATVs a dangerous product. We then discuss how we derived our estimate of a total of \$3.9 billion in traditional COI social costs and \$289,000 to \$2.36 million of extended costs per family. Again, we end with a discussion of the results.

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<sup>155</sup> See *supra* note 139.

<sup>156</sup> See *supra* n. 139

### *A. Product Defect*

All-terrain vehicles were first introduced into the American market in 1970.<sup>157</sup> An ATV is a three- or four-wheeled motorized vehicle with large, low-pressurized tires, a seat designed to be straddled, and handlebars for steering, intended to be used on non-paved terrain. During the 1980s, there was both a substantial increase in ATV sales and in the number of persons injured and killed in ATV accidents. As Table 12 indicates, sales increased by more than 50 percent between 1984 and 1985 and peaked at 600,000 units, and this was accompanied by an 80 percent increase in injuries and fatalities between 1984 and 1985.

**Table 12: ATV Sales, Fatalities, Injuries<sup>158</sup>**

Year	Sales (1,000s)	Reported Deaths	Reported Injuries
1972-1977	139	n.a.	n.a.
1978-1979	154	n.a.	n.a.
1980	126	n.a.	n.a.
1981	100	n.a.	n.a.
1982	290	29	10,100
1983	457	85	32,100
1984	625	156	77,900
1985	602	251	105,700
1986	481	347	106,000
1987	399	283	93,600
1988	217	286	74,600
1989	145	258	70,300
1990	129	250	59,500
1991	138	256	58,100
1992	152	251	58,200
1993	173	136	49,800

The Consumer Product Safety Commission (CPSC), which became alarmed about the increasing number of death and injury reports, began to issue a series of safety alerts in late 1984.<sup>159</sup> In 1985, CPSC published an advanced notice of proposed rulemaking concerning ATVs, the first step required under its statutory mandate to establish a product safety standard.<sup>160</sup> CPSC then requested that manufacturers stop the production

<sup>157</sup> Michael J. Moore and Wesley A. Magat, *The Injury Risk Consequences of the All-Terrain Vehicle Consent Decrees*, 17 INT'L REV. L. & ECON. 379, 380 (1997).

<sup>158</sup> See U.S. Consumer Product Safety Commission, 2003 Annual Report of All-Terrain Vehicle (ATV)-Related Deaths and Injuries, Jan. 26, 2005, at 4 tbl. 1, 9 tbl. 5 (reporting on number of fatalities and injuries); Ford & Mazis, *supra* n. 159, at 92 tbl. 1 (indicating number of ATVs sold use during each given year).

<sup>159</sup> Gary T. Ford and Michael B. Mazis, *Informing Buyers of Risks: Analysis of the Marketing and Regulation of All Terrain Vehicles*, 30 J. CONSUMER AFF. 90, 94 (1996); see also Moore & Magat, *supra* note 157, at 383.

<sup>160</sup> Ford & Mazis, *supra* note 159, at 95. Before CPSC can publish a notice of proposed rulemaking for a new safety standard, it must publish an advanced notice of proposed rulemaking that solicits proposals for the standard. 15 U.S.C. § 2058(a) (2007); see also Teresa Schwartz, *The Consumer Product Safety Commission: A Flawed Product of the Consumer Decade*, 51 Geo Wash. L. Rev. 32, 71 (1982) (describing the CPSC rulemaking process).

of ATVs designed to be used by children under 12-years-old.<sup>161</sup> In 1985, after the ATV manufacturers rejected that request, the Department of Justice, at CPSC's request, filed a legal action seeking to have ATVs designed for use by children declared an imminently hazardous consumer product.<sup>162</sup> In 1988, the five major ATV manufacturers settled this lawsuit and agreed to stop sales of all three-wheel vehicles, among other actions.<sup>163</sup>

Four aspects of ATVs made them dangerous for consumers. First, the rider was challenged by two aspects of the machine's design. The low inflation tires were designed to absorb the impact with rugged terrain when traveling at higher speeds, but intuitively, riders slowed down when encountering significant bumps, which increased the likelihood of an accident.<sup>164</sup> Moreover, because the ATV's design, even a small amount of oversteering could tip it over.<sup>165</sup> According to CPSC analysis, 70 percent of ATV accidents involved a tip-over.<sup>166</sup> Second, the triangular configuration of the three wheel ATVs made these machines less stable and more prone to turn over than the four wheel model.<sup>167</sup> Third, a sizable number of the injuries and fatalities were among inexperienced users and children because ATVs were difficult to use.<sup>168</sup> Finally, the high percentage of accidents and fatalities among inexperienced drivers and young drivers appears to be linked to inadequate warnings and a lack of consumer education.<sup>169</sup>

An estimated 1,500 tort cases were filed against ATV manufacturers prior to 1992.<sup>170</sup> As of that time, 1000 cases had been resolved with about 95 percent of the cases resulting in

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<sup>161</sup> Ford & Masiz, *supra* n. 159, at 95.

<sup>162</sup> *Id.*

<sup>163</sup> Moore & Magat, *supra* n. 157, at 384. The manufacturers also agreed to engage in educational efforts to warn new and past purchases about age appropriate use of ATVs and other risks and to adopt a voluntary industry-wide design standard to make ATVs safer to use. The CPSC approved the voluntary standard adopted by the industry later in 1988, and it was adopted by the American National Standards Institute in 1990. *Id.* at 385.

<sup>164</sup> Ford & Mazis, *supra* n. 159, at 97. Slowing down compromised the tire's ability to compensate for impacts, creating a rebound effect that could unbalance the ATV and throw the rider. At the same time, because the balloon tires tended to create a large amount of friction because of their low inflation, the gripping effect had the potential to pull the ATV into a roll when the machine was operated on pavement as opposed to off-road surfaces. *Id.*

<sup>165</sup> *Id.* at 96. This propensity resulted from the fact that ATVs had a high center of gravity, a solid rear axle, and a relatively narrow wheel base. Moreover, when turning the vehicle, riders are suppose to shift their weight outwards while turning the handlebars inward, which is not intuitive, particularly for motorcyclists or bikers who are used to leaning into a turn, thus increasing the possibility of a rollover. *Id.*

<sup>166</sup> *Id.* (indicating that 70 percent of all ATV accidents involved the ATV rolling or tipping over).

<sup>167</sup> Daniel L. Rubinfeld & Gregory B. Rodgers, *Evaluating the Injury Risk Associated with All-Terrain Vehicles: An Application of Bayes' Rule*, 5 J. RISK & UNCERTAINTY 145, 149, 156 n.10 (1992).

<sup>168</sup> In the first half of the 1980s, 13 percent of all accidents involved a first-time rider, and riders with less than one month's experience had a risk of being in a serious accident that was 13 times greater than the average risk of having such an accident. Moore & Magat, *supra* n. 157, at 386. Furthermore, approximately 38 percent of all ATV fatalities and 40 percent of all serious injuries between 1985 and 1993 involved children under 16 years of age. Ford & Mazis, *supra* n. 159, at 94.

<sup>169</sup> Prior to the consent settlement, neither manufacturers nor dealers trained a substantial percentage of novice drivers nor supplied much information about ATV safety hazards. Ford & Mazis, *supra* n. 159, at 113. In addition, there is little evidence that ATV advertising stressed safety or the potential additional risks of three wheel vehicles. Rubinfeld & Rodgers, *supra* n. 167, at 153.

<sup>170</sup> Rubinfeld & Rodgers, *supra* n. 167, at 157 n. 24. The authors base this estimate on a conversation with an expert who testified in ATV tort litigation.

a settlement. Of the settlements, 40 percent were in the \$50,000 - \$250,000 range, 40 percent were in the \$250,000 - \$1,000,000 range, and 20 percent were over \$1 million.<sup>171</sup> Insurance data from Honda reveals that the average value of claims settled by the company for accidents between 1978 and 1988 was \$859,003.<sup>172</sup> Another source indicates that Honda had paid \$84 million dollars in settlements through 1990.<sup>173</sup> Based on this source and Honda's 75 percent market share, and by assuming that other manufacturers had a similar experience, Ford and Mazis estimate that the industry paid \$113 million in settlements through 1990.<sup>174</sup> Although there are no data on the overall results of cases that went to trial, it is noteworthy that in 1994 the United States Supreme Court affirmed a decision of the Oregon courts granting \$5 million in punitive damages in addition to \$735,000 in actual damages for a 1985 Honda ATV accident.<sup>175</sup>

### ***B. Tradition COI Estimates***

We based our estimate of traditional COI costs on the number of fatalities and injuries avoided by the decision of ATV manufacturers to stop making three-wheeled models. Put another way, we estimated the cost of fatalities and injuries that would have occurred if three wheel ATVs had not been removed from the market for the period 1990 through 2002. As noted earlier, the three wheel models were particularly prone to tipping over,<sup>176</sup> and the five major manufacturers of ATVs had stopped making three-wheelers by the time of the CPSC settlement.<sup>177</sup> This section summarizes the methodology we used to make this estimate.

We choose the years 1985 through 1989 as base-line for measuring percent of deaths due to three- and four-wheelers because three-wheeled vehicles cease to be a significant cause of ATV fatalities after 2002.<sup>178</sup> Prior to 1982, CPSC lacks data on the number of fatalities. The percent of all deaths due to four-wheelers from 1985 through 1989 was

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<sup>171</sup> *Id.*

<sup>172</sup> John C. Cabaniss, Honda ATV Litigation in Retrospect, available at <http://library.findlaw.com/1992/Nov/1/130577.html>. Cabaniss indicates that his source for this figure is an insurance claim printout from Honda in his possession.

<sup>173</sup> Ford & Mazis, *supra* n. 159, at 113, citing Ralph B. Wegis, *Honda ATV Litigation in Retrospect*, TRIAL, November, 1992, at 37.

<sup>174</sup> *Id.* at 114. The authors estimate that the industry had paid \$336 million dollars in settlements and legal fees. Since this estimate assumed that legal fees were twice as much as payments to plaintiffs, *id.* at 113, the settlement amount is \$113 million.

<sup>175</sup> Honda Motor Co., Ltd. v. Oberg, 512, U.S. 415, 114 S.Ct. 2331 (1994).

<sup>176</sup> See *supra* note 164 & accompanying text.

<sup>177</sup> Moore & Magat, *supra* n. 157, at 385.

<sup>178</sup> According to a CPSC report, the following percentage of fatalities was associated with 4-wheelers between 1985 and 2002: 19%(1985), 27%(1986), 45%(1987), 53%(1988), 59%(1989), 60%(1990) 91%(1999) and 93%(2002). Robin L. Ingle, Annual Report of ATV Deaths and Injuries (2005) (Directorate of Epidemiology, Division of Hazard Analysis, US Consumer Product Safety Commission), at 9 tbl. 4, available at <http://www.cpsc.gov/library/atv2005.pdf>. We calculated these percentages by dividing the estimated number of deaths involving four wheeled ATVs (column 3) by the estimated number of total fatalities (column 2).

39.6 percent,<sup>179</sup> which means that 60.4 percent (100% - 39.6%) of all deaths involved three-wheelers. Using the same approach, we estimated that three-wheeled ATVs injured 67.0 percent more persons from 1985 through 1989 than four-wheeled ATVs based on the CPSC data.<sup>180</sup>

Based on the percentage of fatalities and injuries caused by three-wheeled vehicles in the base period, we estimated the numbers of deaths and other injuries that would have occurred from 1990 and on if manufacturers had continued to produce three-wheeled vehicles. For example, the CPSC data indicate that there were 151 deaths in 1990 involving four-wheelers.<sup>181</sup> Based on this number, we estimate that had three-wheeled vehicles remained on the market, there would have been 61 additional fatalities in 1990.<sup>182</sup> Using this methodology, we estimated that, had three-wheeled vehicles remained on the market between 1990 and 1993, there would have been 1,543 excess fatalities during that period of time.

Using published data on ATV-related hospitalizations,<sup>183</sup> we assumed 80 percent of all injuries were among men and 20 percent among women. The same source estimates that 30 percent of all injuries were among persons who were 17 years old or younger and that 70 percent of all injuries were among persons who were older than 17.<sup>184</sup> In the interest of clarity in the construction of the synthetic cohort, we constructed it to consist of only two ages: exactly 17 years old and exactly 35 years old. We assumed the 17 year olds accounted for 30 percent of all injuries and deaths and that 35 year olds accounted for the other 70 percent. These assumptions are summarized in Table 13.

**Table 13: ATV Percentages of Men, Women, age 17 and age 35**

	Men, 80%	Women, 20%
Age=17, 30%	24%	6%
Age=35, 70%	56%	14%

<sup>179</sup> The percentage was calculated by dividing the total number of fatalities involving 4-wheeled vehicles (55+95+126+152+153) by the total number of estimated fatalities (258+286+282+347+295), where the first set of numbers are deaths due to 4-wheelers 1985-1989 and second set are all deaths. See Ingle, *id.*

<sup>180</sup> Moore and Magat, *supra* n. 157, at 391, interpret earlier published data as establishing “3-wheel ATVs are likely to experience between 57 and 86% more injuries than 4-wheel ATVs.” The average between these percentages is 67%.

<sup>181</sup> Ingle, *supra* n. 178, at 9 tbl. 4.

<sup>182</sup> We get this estimate by multiplying 151 by 0.604 and then multiplying the result by 0.67. The first calculation is based on our assumption, noted earlier, that 3-wheeled vehicles caused 60.4 percent of all fatalities during the base period. But, based on our base-line assumption, the 3-wheeled vehicles would have injured 67 percent more persons than 4-wheeled vehicles. We therefore multiplied the number of 3-wheeled fatalities by 0.67 to obtain the number of excess fatalities attributable to 3-wheeled vehicles had there been no cessation in their manufacture.

<sup>183</sup> James C. Helmkamp, Paul M. Furbee, Jeffrey H. Coben, Allison Tadros, *All-Terrain Vehicle-Related Hospitalizations in the U.S., 2000-2004*, 34 AMERICAN JOURNAL OF PREVENTIVE MEDICINE 239, 239 (2008).

<sup>184</sup> *Id.*

Finkelstein and his colleagues identify the number of persons who have been killed and hospitalized as a result of motorcycle injuries.<sup>185</sup> We took the ratio of these two numbers and applied it to ATV accidents to estimate the number of persons requiring hospitalization.<sup>186</sup> Based on this ratio, we estimate that had manufacturers not stopped making three-wheeled vehicles, there would have been 12,377 additional hospitalizations. The same publication has data on the number of persons injured in motorcycle accidents who did not require hospitalization.<sup>187</sup> We used the ratio of this number and the number of persons who died in motorcycle accidents to determine the number of persons whose injuries did not require hospitalization. Based on the second ratio, we estimate that had manufacturers not stopped making three-wheeled vehicles, there would have been 124,369 additional injuries not requiring hospitalization. Table 14 distributes the excess fatalities, injuries involving hospitalization, and injuries not involving hospitalization among the cohort identified in Table 13.

**Table 14: ATV Total Fatalities, Injuries With and Without Hospitalizations**

	Deaths	Injuries with hospitalizations	Injuries without hospitalizations
<b>Men</b>	1234	24,674	99,495
Age 17	370	2,970	29,849
Age 35	864	6,931	69,646
<b>Women</b>	309	2,475	24,874
Age 17	93	742	7,462
Age 35	216	1,733	17,412
<b>Total</b>	<b>1,543</b>	<b>12,377</b>	<b>124,369</b>

Using data from Finkelstein and his colleagues, we estimated three categories of medical costs: fatalities, injuries requiring hospitalization, and injuries not requiring hospitalization.<sup>188</sup> We also estimate the indirect costs associated with these three types of injuries using data from the same source.<sup>189</sup> Table 15 summarizes the results. As it

<sup>185</sup> FINKELSTEIN, ET. AL., *supra* n. 7, at 46, Appendix 1.3. The ratio of persons hospitalized as compared to the number who died was 8.0213 (22,957/2,862).

<sup>186</sup> Finkelstein and his coauthors do not have data limited exclusively to ATVs. Further, we reasoned that his category of “motorcycle” injuries and fatalities was more analogous to ATVs than his category of “motor vehicle occupant.”

<sup>187</sup> FINKELSTEIN, ET. AL., *supra* n. 7, at 46, Appendix 1.3. The ratio of the number of persons whose injuries did not require hospitalization to the number of fatalities was 80.602 (230,983/2862).

<sup>188</sup> FINKELSTEIN, ET. AL., *supra* n. 7, at 91-92, Appendices 2.1-2.2. To estimate costs for 17 year olds, we used the source’s data for age bracket 15-24 years old. To estimate costs for 35 year olds, we used the source’s data for age bracket 25 to 44 years old. Whereas Finkelstein has data for fatal injuries and injuries involving hospitalization, the source does not have data for injuries that do not involve hospitalization. We therefore used, instead, their category for “outpatient” which appeared to be near the middle of the difference between their “ER treated” and “Doctor’s office” categories.

<sup>189</sup> *Id.* at 191, Appendix 3.1; 121 appendix 3.3. We again used the 15-24 age bracket for 17 year olds and the 25 to 44 bracket for 35 year olds. We used Finkelstein’s data for the categories of fatal injuries, injuries involving hospitalization, and injuries not requiring hospitalization., but we used data for “productivity losses” rather for lost “wages and fringe benefits,” reasoning that lost home production should be counted in lost indirect costs from society’s perspective. This inclusion, in fact, is standard in the literature. *See id.* at 97.

reveals, if manufacturers had not stopped making 3-wheel ATV's, there would have been an additional \$3,892,537,700 in COI costs because of the injuries that the vehicles would have caused during the years 1990 to 2002.

**Table 15: ATV Total COI Costs, 2007**

	Deaths	Injuries with hospitalizations	Injuries without hospitalizations	Total
<b>Men</b>				
Age 17	\$533,571,500	\$346,344,620	\$108,141,620	\$988,057,740
Age 35	\$1,259,968,900	\$763,129,770	\$334,448,434	\$2,357,547,000
<b>Women</b>				
Age 17	\$82,099,229	\$62,345,400	\$22,822,595	\$167,267,210
Age 35	\$172,971,910	\$136,260,840	\$70,433,121	\$379,665,870
<b>TOTAL</b>	<b>\$2,048,611,500</b>	<b>\$1,308,080,500</b>	<b>\$535,845,760</b>	<b>\$3,892,537,700</b>

### *C. Extended Costs*

This section presents three scenarios involving extended social costs resulting from ATV rollovers. The scenarios involve extended costs that range from \$288,000 to almost \$2.4 million per family. After presenting each scenario, we summarize our methods and results.

#### 1. Young Amputee

The first scenario assumes that an 18 year old, riding his ATV, is thrown off balance and the ATV flips on him, resulting in a leg injury that requires amputation. He is unable to take advantage of a football scholarship that he was won to attend a Class I university, causing him to fall into a clinical depression for two years, during which time he does not work. He needs weekly physical therapy for a year and psychotherapy for ten years. He never goes to college, resulting in a loss of income. As Table 16 indicates, the extended costs in this scenario are \$289,000, discounted at three percent and without taking into account the impact of inflation.

**Table 16: ATV Extended Costs—Scenario One**

	Family \$
Lost income	\$ 39,212
Lost lifetime income for not going to college	200,561
Psychotherapy	45,054
Physical therapy	3,865
<b>TOTAL</b>	<b>\$288,692</b>

We estimated the young man's lost income for the two years that he was unable to work by assuming he would have earned \$10 per hour during that time period and that he had no lost benefits. The estimate of income he lost because he did not attend college is based on data published by the Bureau of Labor Statistics indicating the difference in

median annual earnings between college and non-college graduates.<sup>190</sup> The cost of psychotherapy<sup>191</sup> and physical therapy<sup>192</sup> is based national average hourly costs and our assumptions about the frequency of these services indicated above.

## 2. Child with Moderate Brain Injury

In this scenario, we assume that a 12 year old boy suffers a moderate traumatic brain injury in an ATV accident. His recovery at home includes a year of mental health counseling. At school, he receives special education for three years, and his eventual graduation from high school is delayed for one year. Because of his injury, he is unable to go to college as originally planned. His mother, age 41, quits her job to take care of her son for six months after he is injured. She finds another job, but at reduced pay and with reduced vacation, retirement, and health benefits. Because of the hours she works, she must pay for both additional child care and the services of someone to transport her children to and from after-school activities. Because of reduced health care benefits, she must pay for orthodontics for her two daughters, ages eight and ten years at the time of the accident, glasses for her son, and for dental services and drugs for all four family members. As Table 17 summarizes, this scenario produces nearly \$600,000 in extended costs in 2007 dollars, discounted at three percent and without taking into account the impact of inflation.

**Table 17: ATV Extended Costs—Scenario Two**

		Family \$	Public \$
<b>Injured Child</b>	Mental health therapy	\$ 6,055	-
	Lost wages	23,317	-
	Lost life time earnings	200,561	-
<b>Mother</b>	Mother's lost income	30,000	-
	Reduced Income	186,023	-
	Lost two-weeks vacation	27,554	-
	Lost paid holidays	8,275	-
<b>Family</b>	Orthodontics	10,285	-
	Dental check-ups	8,909	-
	Eye exams	2,765	-
	Eye wear	603	-
	Pharmacy	31,182	-
	Child care and support services	9,643	-
<b>School System</b>	Special education	-	\$32,232
<b>TOTAL</b>		<b>\$545,172</b>	<b>\$32,232</b>
<b>GRAND TOTAL</b>		<b>\$577,404</b>	

<sup>190</sup> See Occupational Outlook Quarterly, *supra* n. 78 (indicating in 1,966 persons with a high school degree had a median income of \$23,317 per year as compared to \$36,155 per year for high school graduates).

<sup>191</sup> See Brown, Jr. and Beauregard, *supra* n. 93 (indicating average hourly cost of \$106.08).

<sup>192</sup> See Historical CBA/CWP Costs/Recommended Rate, *supra* n. 95 (indicating cost of \$77.65 per hour).

Our estimate of the cost of the boy's mental health therapy is based on national average hourly costs and assumes weekly sessions for one year.<sup>193</sup> The estimate of his loss wages for his delayed entry into the work force uses government data indicating the average earnings of a high school graduate.<sup>194</sup> The income lost by the boy because he did not attend college is on the same data source which also compares median annual earnings of college and non-college graduates.<sup>195</sup> The mother's lost income while she took care of her child is based on her being out of the workforce for six months and assumes that she was paid \$5,000 per month. The estimate of her reduced income is based on our assumption that her new job paid \$10,000 less than her old one and that she was employed for 25 years in this position. We calculated the value of her lost vacation days by assuming that she had two more weeks of vacation at her prior job and we based the value of the lost vacation days on her prior compensation. We further assumed that she lost three paid holidays per year and valued this loss on the same basis. The cost of orthodontics,<sup>196</sup> dentist expenses,<sup>197</sup> eye examinations,<sup>198</sup> drugs,<sup>199</sup> and child care<sup>200</sup> is based on data indicating the average amount of these expenses. We based our estimate of the cost of special education on data from the National Education Association.<sup>201</sup>

### 3. Child with Brain Injury and Brother with Severe Emotional Problems

Our last scenario involves an ATV rollover that left a younger child comatose and an older child with serious emotional issues of guilt, survivorship and anger. Their mother, age 40, quits her job to become a full time caretaker, but she is unable to cope with the

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<sup>193</sup> See Brown, Jr. and Beauregard, *supra* n. 93 (indicating average hourly cost of \$106.08).

<sup>194</sup> See Occupational Outlook Quarterly, *supra* n. 78 (indicating in 1,966 persons with a high school degree had a median income of \$23,317 per year).

<sup>195</sup> *Id.* (indicating in 1,966 persons with a high school degree had a median income of \$23,317 per year as compared to \$36,155 per year for high school graduates).

<sup>196</sup> See Galewitz, Phil, *Brace Yourself: New Types Feel Better*, USA TODAY, October 15, 2006 (indicating orthodontics costs between \$5,000-\$6,000), available at [http://www.usatoday.com/news/health/2006-10-15-braces\\_x.htm](http://www.usatoday.com/news/health/2006-10-15-braces_x.htm).

<sup>197</sup> See Texas Health and Service Commission, Cost and Benefit Analysis for Senate Bill 34, December 2002) (indicating Texas Medicaid Reimbursement rate of \$50 for an examination, \$90 for cleaning, and \$150 for X-rays), available at [http://www.hhsc.state.tx.us/medicaid/reports/122002\\_sb34DentalCare.html#Costs](http://www.hhsc.state.tx.us/medicaid/reports/122002_sb34DentalCare.html#Costs).

<sup>198</sup> See Connecticut, The Average Cost of Care (indicating Connecticut Medicaid reimbursement rate of \$90 for eye examination), available at <http://www.connecticare.com/member/costofcare/costofcare.pdf>; ConsumerReports.org, Eye Glasses, November 2006 (indicating inexpensive plastic glasses cost \$120 per year), available at [http://www.consumerreports.org/cro/money/shopping/where-to-buy/eyeglasses-11-06/overview/1106\\_eye\\_ov.htm](http://www.consumerreports.org/cro/money/shopping/where-to-buy/eyeglasses-11-06/overview/1106_eye_ov.htm). We assumed that the family purchased six pairs of eye glasses.

<sup>199</sup> See State of Texas, *Healthcare Costs in Health and Human Services Programs*, Presentation to Senate Finance Committee, October 24, 2001 (indicating that the average cost of drugs is \$866.85), available at [http://www.hhsc.state.tx.us/news/presentations/HealthcareCosts\\_102401.pdf](http://www.hhsc.state.tx.us/news/presentations/HealthcareCosts_102401.pdf).

<sup>200</sup> See MetLife Mature Market Institute and LifePlans, Inc., September 2007 (indicating that average cost of child care was \$18 per hour), available at <http://www.metlife.com/WPSAssets/18746211091190810760V1F2007ADSHCCStudy.pdf>. We further assumed that she used these services for three hours a day and five days a week during a 36 week school year for four years, and that the costs were shared with two other families.

<sup>201</sup> See National Education Association (NEA), *Special Education and the Individuals with Disabilities Education Act*, (indicating that special education cost \$9,369 more than an average student cost of \$7,552), available at <http://www.nea.org/specialed/index.html>.

situation and spends one year in a psychiatric hospital. After rejoining the family, she continues in therapy and is not able to work again. A grandmother quits her job and moves into the house to help. Eventually the father decides the family is unable to care for the younger child and the child is moved into institutionalized care. The older child requires tutoring and psychological counseling, and after graduating from high school, is unable to go to college. As summarized in Table 18, this scenario involves over \$2.36 million in extended costs in 2007 dollars, based on a three percent discount rate and without taking into account the impact of inflation.

**Table 18: ATV Extended Costs—Scenario Three**

		<b>Family \$</b>	<b>Public Sector \$</b>
<b>Mother</b>	Mental health facility	\$ 208,345	
	Psychotherapy (twice per week for 9 years)	83,530	
	Lost income	344,449	
<b>Grandmother</b>	Moving expenses	4,500	
	Lost income	160,948	
	Lost health benefits	16,555	
	Lost vacation days	12,381	
	Lost 401(k) contributions	16,095	
	Incidental Expenses	16,555	
<b>Older Child</b>	Home tutoring costs	31,236	
	Mental health care	41,765	
	Loss of lifetime income	200,562	
<b>Younger Child</b>	Nursing home care		\$928,286
	Loss of life-time income	300,437	
<b>TOTAL</b>		<b>\$1,437,358</b>	<b>\$928,286</b>
<b>GRAND TOTAL</b>		<b>\$2,365,644</b>	

We estimated the cost of the mother’s one year of institutionalized care based on data from the State of Washington.<sup>202</sup> We assumed that the mother required additional psychotherapy twice a week for nine years, and we used published data indicating the average cost of such therapy.<sup>203</sup> Her lost income was based on the assumption that she stayed out of the work force for twenty-two years and, while working, earned \$30,000 per year. The grandmother’s moving expenses were based on average interstate moving expenses.<sup>204</sup> For her lost income, we assumed that she did not work a period of six years,

<sup>202</sup> Washington State Department of Community, Trade and Economic Development, Housing Division, Olympia (360-725-2930), Ten-Year Homeless Plan, July 2006 (indicating cost per day for institutionalized care in a mental hospital is \$555, or \$202,575 per year), available at [http://cted.wa.gov/CTED/documents/ID\\_3356\\_Publications.doc](http://cted.wa.gov/CTED/documents/ID_3356_Publications.doc).

<sup>203</sup> See Brown, Jr. and Beauregard, *supra* n. 93 (indicating average hourly cost of \$106.08).

<sup>204</sup> See State of Washington, Moving Expense Regulation and Guide (indicating average intrastate moving expenses for \$8,400 pounds), available at <http://www.acadweb.wvu.edu/BFA/BusinessServices/a33form.pdf>.

previously earned \$35,000 per year and \$300 per month in health benefits. We further assumed that she lost two weeks of paid vacation per year and ten days of paid holidays per year, which are valued on the basis of her \$35,000 rate of pay. Another assumption is that contributions to the grandmother's pension fund constituted ten percent of that income and would have earned a return of five percent. Finally, we assumed she spends approximately \$2,400 a year of her own money for incidental family expenses over the nine years she stayed with the family.

We further assumed that the older child requires tutoring three times a week during the four years of high school and for mental health counseling once a week for nine years. These costs reflect published data on average costs for tutoring<sup>205</sup> and mental health care.<sup>206</sup> The older child's loss of income is based on the difference in median earning capacity of high school and college graduates.<sup>207</sup> The cost of nursing home care for the younger child is based on average rates and assumes 25 years of care.<sup>208</sup> His lost of lifetime income assumes he would have worked for 40 years and would have graduated from college.<sup>209</sup>

#### ***D. Discussion***

Our estimate of the number of fatalities and injuries that would have occurred had manufacturers not stopped making three wheel vehicles is based on CPSC data concerning the numbers of persons killed by three-wheeled ATVs prior to their removal from the market. While this gives our estimate credibility, it does assume that the three wheeled vehicles would have caused the same number of fatalities had they remained on the market as they caused previously. Since our estimates of the numbers of persons whose injuries required and did not require hospitalization is extrapolated from our estimate of the number of fatalities, the accuracy of these estimates also depend on the reliability of our estimate of the number of fatalities.

Our estimate of \$3.893 billion dollars in traditional COI costs is considerably higher than a published estimate that the ATV industry paid \$113 million in settlements through 1990.<sup>210</sup> This is despite the fact that our estimate does not include pain and suffering costs. We are unsure of the reliability of the \$113 million number, and other published information suggests that the \$113 million total is too low to represent the amount paid by the industry. As mentioned earlier, insurance data indicate that Honda's average settlement per claim was \$859,000,<sup>211</sup> and another source says that 40 percent of

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<sup>205</sup> See Sam Dillon, *For Children Being Left Behind, Private Tutors Face Rocky Start*, *The New York Times*, April 16, 2004 (indicating that private high school tutoring costs \$40 to \$60 an hour), available at <http://query.nytimes.com/gst/fullpage.html?res=9F01E6D6153BF935A25757C0A9629C8B63>.

<sup>206</sup> See Brown, Jr. and Beauregard, *supra* n. 93 (indicating average hourly cost of \$106.08).

<sup>207</sup> See Occupational Outlook Quarterly, *supra* n. 78 (indicating persons with a college degree have a medium of \$36,155 a year compared to a medium income of \$23,317 for high school graduates).

<sup>208</sup> See MATURE MARKET NEWS, *supra* n. 84 (indicating the average cost of a nursing home is \$213/day, or \$77,745 a year, for a private room).

<sup>209</sup> See Occupational Outlook Quarterly, *supra* n. 78 (indicating the median compensation of college graduates is \$36,155 per year).

<sup>210</sup> See *supra* note 174 & accompanying text.

<sup>211</sup> See *supra* note 172 & accompanying text.

settlements were between \$250,000 and \$1 million and another 20 percent were more than \$1 million.<sup>212</sup>

Our calculations of extended costs between \$2889000 and \$2.4 million per family are subject to the same qualifications that we discussed regarding the Ford-Firestone SUV and Baycol scenarios. Once again these estimates depend on the assumptions that we made about the nature of the injuries that were suffered and the duration of various costs. While a different construction of the scenarios would produce a different estimate, we believe the scenarios are realistic. Nevertheless, we admit that the scenarios could be constructed to produce lower costs, but at the same time they could have been constructed as well to produce higher costs. They underestimate extended costs because inflation is not taken into account. We treat the loss of employment as a reduction in social wealth based on the existence of frictional employment.

## VI. CONCLUSIONS

No one has previously attempted a direct measurement of the external costs of dangerous products. Our efforts have the following implications for public policy.

First, the tort system provides a valuable service for society to the extent it successfully deters the sale of dangerous products. The three case studies reveal that dangerous products have the potential to create significant external costs. According to a COI measurement, the three products we studied alone created nearly \$4.7 billion in external costs,<sup>213</sup> and this estimate does not include the cost of pain and suffering or any extended costs. Of course, the tort system does not necessarily cause the manufacturers of dangerous products to internalize all external costs. But this does not change the conclusion that the tort system serves societal interests when it deters the sale of dangerous products, and that the value of this service, in economic terms, is very substantial.

Second, it appears compensation awarded in the tort system is less than the actual costs created by dangerous products, but our evidence for this conclusion is subject to two caveats. First, we had difficulty comparing our results with payouts by manufacturers because of the lack of reliable information about such payouts. Second, our results are mixed, with ATV COI costs being substantially higher than payouts (\$3.893 billion versus \$113 million),<sup>214</sup> Baycol COI costs being about the same as payouts (\$1.142 billion versus \$1.143 billion),<sup>215</sup> and Ford-Firestone SUVs COI costs being less than payouts (\$555 million versus \$590 million (Ford) and \$800 million (Firestone)).<sup>216</sup> There is reason to believe, however, that we may have significantly underestimated the number of fatalities and injuries from the SUV crashes.<sup>217</sup> Moreover, as a general matter, we

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<sup>212</sup> See *supra* note 171 & accompanying text.

<sup>213</sup> This total was derived by adding the sum of the COI costs for each of the three products: \$554, 845,787 + 248,209, 044 + 3,892,537,700 = \$4,695,592,531.

<sup>214</sup> See *supra* note 210 & accompanying text.

<sup>215</sup> See *supra* note 156 & accompanying text.

<sup>216</sup> See *supra* note 106 & accompanying text.

<sup>217</sup> *Id.*

have sought to adopt conservative assumptions, which had the impact of decreasing our estimates. Finally, the COI estimates are too low because they do not take into account extended costs, although we have no way of estimating the impact of this omission.

**Table 17: Traditional and Extended Costs Compared Across Dangerous Product Extent of Injury, and Family Situation**

Dangerous Product	Traditional Costs	Extended Costs	Ratio of Extended Costs to Traditional Costs
<b>Firestone Tire/Ford Explorer</b>			
Low Range	\$4,194	\$733,254	249-1
Medium Range	\$74,325	\$1,476,136	24-1
High Cost Range	\$1697,279	\$2,554,783	1.5-1
<b>Baycol</b>			
Low Range	\$45,582	\$159,349	4-1
Medium Range	\$333,916	\$1,057,037	3.6-1
High Cost Range	\$1,246,472	\$2,206,630	2-1
<b>All Terrain Vehicles</b>			
Low Range	\$4,045	\$288,692	8.6-1
Medium Range	\$84,023	\$577,404	8.3-1
High Cost Range	\$1,422,085	\$2,385,644	2-1

Third, product defects produce significant costs in addition to the medical costs and lost productivity we measured by the COI methodology. Indeed, our results suggest that extended costs can be greater than traditional costs, as Table 17 reveals. For purposes of Table 17, we created a low, medium, and high range scenario of traditional COI costs<sup>218</sup> and compared these costs to the extended cost scenarios used in each of our case studies.<sup>219</sup> As Table 17 reveals, traditional costs ranged from \$3,483 to \$1,442,085 per case and extended costs ranged from \$733,254 to \$2,554,783. All numbers are in 2007 dollars. In each case study, whether for a low, medium, or high level of expenditures, extended costs were greater than traditional costs by at a ratio of at least 1.5-1.

<sup>218</sup> For Firestone/Ford Explorer, the low range COI cost is based on a male, age 60, who had injuries not requiring hospitalization. The medium range estimate assumes a female, age 40, who had injuries requiring hospitalization. The high cost estimate contemplates a male, age 20, who died from his injuries. See Methodology Appendix, Ford/Firestone Table 8 figures divided by Table 3 figures and inflated by 1.204065.

For Baycol, we based the low range cost on a male, 70 years old, who was hospitalized. The medium estimate assumes a female, older than 70 years old, with a permanent severe disability. The high cost estimate is based on a male, age 60, who has a permanent severe disability. See *id.* Baycol, Table 23

Finally, the low cost ATV estimate reflects the COI costs of a female, age 35, who is not hospitalized. The medium estimate is calculated on the basis of a female, age 17, who is hospitalized. We measured the high cost estimate on the basis of a male, 17 years old, who died from his injuries. See *id.* ATV, Table 15 numbers divided by Table 2 numbers.

<sup>219</sup> The lowest estimate of extended costs for each set of scenarios is treated at the “low range” estimate. The middle estimate is treated as the “medium range” estimate. The highest estimate is considered to be the “high cost” range estimate.

Each cost category is difficult to compare, one with another, since each medical case is unique and the way that each family is able to respond to tragedy is also unique. The specific injuries described in the traditional costs column do not correlate with the specific injuries described in the extended cost scenarios. But as a general overview, the table suggests there are substantial costs that fall onto a family or other third parties that are not measured by traditional COI measurements. This is significant because, as our scenarios suggest, families can suffer unfortunate and life-altering changes when one or more family members are seriously injured by dangerous products. In addition, because our estimates of extended costs do not take into account future inflation, they understate the economic impact on families.

The ultimate impact on families depends on the extent to which they can recover compensation for traditional as well as extended social costs. We have no way of knowing the extent to which this occurs. We suspect, however, because of the imperfections of the tort system, the amount of compensation may be less than the costs paid by families when one or more family members are injured or killed by dangerous products.

When a family is unable to pay for some of the costs of dangerous products, some the costs will be shifted to taxpayers. If, for example, a family does not recover any compensation to pay for a health aide or housekeeper to help a disabled person, taxpayers will pay for these services if the disabled person qualifies for a safety net program. This means that taxpayers are likely on the hook for some of the external costs of dangerous products, although the extent of this obligation cannot be determined for this study.

Finally, it is simply not possible to account for the permanent life-changing aspects of the tragedies associated with the three products we have studied. Psychological trauma and physical suffering are not measured, nor are other burdens that cannot be monetized. This limitation does not make these “costs” any less real to those who suffer them. An incalculable value of the tort system is to protect many families against the pain, grief, and suffering caused by dangerous products.