Description of document:	Consumer Product Safety Commission (CPSC) Report on Valuation Methods for Nonfatal Injuries 2015-2017
Requested date:	2019
Release date:	29-August-2023
Posted date:	25-March-2024
Source of document:	U.S. Consumer Product Safety Commission 4330 East West Highway Bethesda, MD 20814 Fax: 301-504-0127 Email: CPSCFOIARequests@cpsc.gov CPSC e-FOIA Public Access Link Website

United States
Consumer Product Safety Commission

August 29, 2023

Via WatchDox

RE: Freedom of Information Act Request #19-F-00136: Request a copy of 1) The successful proposal (technical section only); 2) the statement of work (SOW); 3) the contract data requirements list; 4) the flna[l] report and final presentation, if delivered yet; and 5) the most recent three interim reports for each contract

Thank you for your Freedom of Information Act (FOIA) request seeking information the U.S. Consumer Product Safety Commission (CPSC). We must withhold from disclosure some information contained in the records pertaining to this contract pursuant to FOIA Exemptions 4, 5 U.S.C. §§ 552(b)(4), (b)(6).

Exemption 4. Section 6(a)(2) prohibits the CPSC from disclosing information that is exempt from disclosure under FOIA Exemption 4. That exemption protects trade secrets and confidential commercial information directly related to a vendor's business that the vendor has not made public, the disclosure of which could give a substantial commercial advantage to a competitor. We are withholding the following documents in full under FOIA Exemption 4, which contain confidential commercial information submitted by the contractor, including a methodology report, a draft alternative report, the contractor's proposal, and the contractor's final draft alternative report.

Exemption 6. FOIA Exemption 6 permits withholding personnel and medical files and similar files, the disclosure of which would constitute a clearly unwarranted invasion of personal privacy. Absent authorizations to disclose the records or personally identifying information from the persons identified in the records or their representatives, such information falls within the protection of this FOIA exemption to disclosure and is being withheld accordingly. The vendor's signature was redacted pursuant to Exemption 6.

FOIA Administrative Procedures

Right to appeal. If you are not satisfied with the response to this request, you may administratively appeal in writing, addressed to FOIA APPEAL, Office of the General Counsel, ATTN: Division of

Information Access, U.S. Consumer Product Safety Commission, 4330 East West Highway, Room 820 Bethesda, MD 20814-4408. Your appeal must be postmarked or electronically transmitted (cpscfoiarequests@cpsc.gov) within 90 days of the date of the response to your request. You may also fax your appeal to: 301-504-0127. You may contact us Monday – Friday from 8:00AM – 4:30PM EST, by telephone at: 1-800-638-2772, or by fax to: 301-504-0127.

Before filing a formal appeal with the CPSC, you may contact me or one of the Commission's FOIA Public Liaisons, Korinne Super (ksuper@cpsc.gov) or Bob Dalton (rdalton@cpsc.gov), via email or at 1-800-638-2772, for any further assistance or to discuss any aspect of your request. Assistance may include guidance on possible reformulation of your request or an alternative time frame for processing the request.

Right to Mediation. Additionally, you may contact the Office of Government Information Services (OGIS) at the National Archives and Records Administration to inquire about the FOIA mediation services they offer. The contact information for OGIS is as follows: Office of Government Information Services, National Archives and Records Administration, 8601 Adelphi Road-OGIS, College Park, MD 20740-6001; email at: ogis@nara.gov; telephone at: 202-741-5770; toll free at: 1-877-684-6448; or facsimile to: 202-741-5769.

Fees. No fees were charged.

Sincerely,

ABIOYE OYEWOLE Digitally signed by ABIOYE OYEWOLE
Date: 2023.08.29 16:50:39 -04'00'

Abioye Oyewole
Assistant General Counsel
Office of the General Counsel
Division of Information Access
301-504-7454
aoyewole@cpsc.gov

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1 CONTRACT ID CODE	PAGE OF PAGES
	1 | 2

2 AMENDMENT/MODIFICATION NO	3 EFFECTIVE DATE	4 REQUISITION/PURCHASE REQ NO.	5 PROJECT NO. (If applicable)
0001	03/20/2017		

6 ISSUED BY CODE EMPS

CONSUMER PRODUCT SAFETY COMMISSION
DIV OF PROCUREMENT SERVICES
4330 EAST WEST HWY
ROOM 523
BETHESDA MD 20814

7 ADMINISTERED BY (If other than Item 6) CODE

8 NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)

INDUSTRIAL ECONOMICS INCORPORATED
2067 MASS AVE STE 4
CAMBRIDGE MA 02140

CODE 007977887 FACILITY CODE

(x) 9A. AMENDMENT OF SOLICITATION NO.

9B. DATED (SEE ITEM 11)

X 10A. MODIFICATION OF CONTRACT/ORDER NO. CPSC-D-15-0004 0010

10B. DATED (SEE ITEM 13) 07/21/2016

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended. ☐ is not extended.
Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods: (a) By completing Items 8 and 15, and returning _____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12 ACCOUNTING AND APPROPRIATION DATA (If required)
0100A16DSE-2016-1412500000-EXHR004100-252H0

13. THIS ITEM ONLY APPLIES TO MODIFICATION OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 11.

CHECK ONE	
	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation data, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
X	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF: FAR 52.212-4(c) Contract Terms and Conditions - Commercial Items
	D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor ☐ is not ☒ is required to sign this document and return 1 copies to the issuing office.

14 DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

DUNS Number: 007977887
COR: Bill Zamula
301-504-7709
wzamula@cpsc.gov

Modification 0001 to Task Order 0010 from contract CPSC-D-15-0004 is hereby issued to extend the end date of the period of performance from March 20, 2017 to July 27, 2017 at no additional cost to the Government.

All other terms and conditions remain unchanged.

Continued ...

Except as provided herein, all terms and conditions of the document referenced in Item 9 A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)	16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)
Jennifer R. Baxter, Principal	Eddie Ahmad

15B. CONTRACTOR/OFFEROR	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA	16C. DATE SIGNED
(b)(6)		(Signature of Contracting Officer)	3/30/17

NSN 7540-01-152-8070
Previous edition unusable

STANDARD FORM 30 (REV. 10-83)
Prescribed by GSA
FAR (48 CFR) 53.243

CONTINUATION SHEET	REFERENCE NO. OF DOCUMENT BEING CONTINUED	PAGE	OF
	CPSC-D-15-0004/0010/0001	2	2

NAME OF OFFEROR OR CONTRACTOR
INDUSTRIAL ECONOMICS INCORPORATED

ITEM NO. (A)	SUPPLIES/SERVICES (B)	QUANTITY (C)	UNIT (D)	UNIT PRICE (E)	AMOUNT (F)
	Delivery: 07/28/2017 Discount Terms: Net 30 Delivery Location Code: EC CONSUMER PRODUCT SAFETY COMMISSION DIRECTORATE FOR ECONOMIC ANALYSIS 4330 EASTWEST HIGHWAY ROOM 723-02 BETHESDA MD 20814 USA Payment: CPSC Accounts Payable Branch AMZ 160 P. O. Box 25710 Oklahoma City OK 73125 FOB: Destination Change Item 0001 to read as follows(amount shown is the obligated amount):				
0001	CPSC-D-15-0004, Task Order 10 Develop Research Options to Conduct Willingness-to-Pay Valuations to Avoid Non-fatal Acute Injuries	1	EA	149,358.50	0.00

SOLICITATION/CONTRACT/ORDER FOR COMMERCIAL ITEMS
OFFEROR TO COMPLETE BLOCKS 12, 17, 23, 24, & 30

1. REQUISITION NUMBER	PAGE	OF
REQ-4100-16-0007	1	2

2. CONTRACT NO.	3. AWARD/ EFFECTIVE DATE	4. ORDER NUMBER	5. SOLICITATION NUMBER	6. SOLICITATION ISSUE DATE
CPSC-D-15-0004		0010		

7. FOR SOLICITATION INFORMATION CALL:	a. NAME	b. TELEPHONE NUMBER (No collect calls)	8. OFFER DUE DATE/LOCAL TIME
	Cassandra Sterba	301-504-7837	ET

9. ISSUED BY — CODE FMPS

CONSUMER PRODUCT SAFETY COMMISSION
DIV OF PROCUREMENT SERVICES
4330 EAST WEST HWY
ROOM 523
BETHESDA MD 20814

10. THIS ACQUISITION IS ☒ UNRESTRICTED OR ☐ SET ASIDE % FOR:
☐ SMALL BUSINESS
☐ HUBZONE SMALL BUSINESS
☐ SERVICE-DISABLED VETERAN-OWNED SMALL BUSINESS
☐ WOMEN-OWNED SMALL BUSINESS (WOSB) ELIGIBLE UNDER THE WOMEN-OWNED SMALL BUSINESS PROGRAM
☐ EDWOSB
☐ 8(A)
NAICS:
SIZE STANDARD:

11. DELIVERY FOR FOB DESTINATION UNLESS BLOCK IS MARKED ☐ SEE SCHEDULE	12. DISCOUNT TERMS	☐ 13a. THIS CONTRACT IS A RATED ORDER UNDER DPAS (15 CFR 700)	13b. RATING / 14. METHOD OF SOLICITATION
	Net 30		☒ RFQ ☐ IFB ☐ RFP

15. DELIVER TO — CODE EC

CONSUMER PRODUCT SAFETY COMMISSION
DIRECTORATE FOR ECONOMIC ANALYSIS
4330 EASTWEST HIGHWAY
ROOM 723-02
BETHESDA MD 20814

16. ADMINISTERED BY — CODE FMPS

CONSUMER PRODUCT SAFETY COMMISSION
DIV OF PROCUREMENT SERVICES
4330 EAST WEST HWY
ROOM 523
BETHESDA MD 20814

17a. CONTRACTOR/ OFFEROR — CODE 007977887 — FACILITY CODE

INDUSTRIAL ECONOMICS INCORPORATED
2067 MASS AVE STE 4
CAMBRIDGE MA 02140

TELEPHONE NO.

☐ 17b. CHECK IF REMITTANCE IS DIFFERENT AND PUT SUCH ADDRESS IN OFFER

18a. PAYMENT WILL BE MADE BY — CODE FMFS

CPSC Accounts Payable Branch
AMZ 160
P. O. Box 25710
Oklahoma City OK 73125

☐ 18b. SUBMIT INVOICES TO ADDRESS SHOWN IN BLOCK 18a UNLESS BLOCK BELOW IS CHECKED ☐ SEE ADDENDUM

19. ITEM NO.	20. SCHEDULE OF SUPPLIES/SERVICES	21. QUANTITY	22. UNIT	23. UNIT PRICE	24. AMOUNT
	DUNS Number: 007977887 COR: Bill Zamula 301-504-7709 wzamula@cpsc.gov Task Order 0010 to contract CPSC-D-15-0004 is hereby issued for the development of research options to conduct willingness-to-pay valuations to avoid non-fatal acute injuries, in accordance with the attached Statement of Work and the contractor proposal (dated July 13, 2016) for the *(Use Reverse and/or Attach Additional Sheets as Necessary)*				

25. ACCOUNTING AND APPROPRIATION DATA
0100A16DSE-2016-1412500000-EXHR004100-252H0

26. TOTAL AWARD AMOUNT *(For Govt. Use Only)*
$149,358.50

☐ 27a. SOLICITATION INCORPORATES BY REFERENCE FAR 52 212-1, 52 212-4 FAR 52 212-3 AND 52 212-5 ARE ATTACHED. ADDENDA ☐ ARE ☐ ARE NOT ATTACHED.
☐ 27b. CONTRACT/PURCHASE ORDER INCORPORATES BY REFERENCE FAR 52 212-4. FAR 52 212-5 IS ATTACHED. ADDENDA ☐ ARE ☐ ARE NOT ATTACHED.

☐ 28. CONTRACTOR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN _____ COPIES TO ISSUING OFFICE. CONTRACTOR AGREES TO FURNISH AND DELIVER ALL ITEMS SET FORTH OR OTHERWISE IDENTIFIED ABOVE AND ON ANY ADDITIONAL SHEETS SUBJECT TO THE TERMS AND CONDITIONS SPECIFIED.

☐ 29. AWARD OF CONTRACT _____ OFFER DATED _____ YOUR OFFER ON SOLICITATION (BLOCK 5), INCLUDING ANY ADDITIONS OR CHANGES WHICH ARE SET FORTH HEREIN, IS ACCEPTED AS TO ITEMS:

30a. SIGNATURE OF OFFEROR/CONTRACTOR

31a. UNITED STATES OF AMERICA *(SIGNATURE OF CONTRACTING OFFICER)*

30b. NAME AND TITLE OF SIGNER *(Type or print)*	30c. DATE SIGNED	31b. NAME OF CONTRACTING OFFICER *(Type or print)*	31c. DATE SIGNED
		Eddie Ahmad	7/21/16

AUTHORIZED FOR LOCAL REPRODUCTION
PREVIOUS EDITION IS NOT USABLE

STANDARD FORM 1449 (REV. 2/2012)
Prescribed by GSA - FAR (48 CFR) 53.212

19. ITEM NO	20. SCHEDULE OF SUPPLIES/SERVICES	21. QUANTITY	22. UNIT	23. UNIT PRICE	24. AMOUNT
	period of performance of July 21, 2016 through March 20, 2017. Delivery: 03/20/2017				
0001	CPSC-D-15-0004, Task Order 10 Develop Research Options to Conduct Willingness-to-Pay Valuations to Avoid Non-fatal Acute Injuries	1	EA	149,358.50	149,358.50
	The total amount of award: $149,358.50. The obligation for this award is shown in box 26.				

32a. QUANTITY IN COLUMN 21 HAS BEEN

☐ RECEIVED ☐ INSPECTED ☐ ACCEPTED, AND CONFORMS TO THE CONTRACT, EXCEPT AS NOTED: _____

32b. SIGNATURE OF AUTHORIZED GOVERNMENT REPRESENTATIVE	32c. DATE	32d. PRINTED NAME AND TITLE OF AUTHORIZED GOVERNMENT REPRESENTATIVE

32e. MAILING ADDRESS OF AUTHORIZED GOVERNMENT REPRESENTATIVE	32f. TELEPHONE NUMBER OF AUTHORIZED GOVERNMENT REPRESENTATIVE
	32g. E-MAIL OF AUTHORIZED GOVERNMENT REPRESENTATIVE

33. SHIP NUMBER	34. VOUCHER NUMBER	35. AMOUNT VERIFIED CORRECT FOR	36. PAYMENT	37. CHECK NUMBER
☐ PARTIAL ☐ FINAL			☐ COMPLETE ☐ PARTIAL ☐ FINAL	

38. S/R ACCOUNT NUMBER	39. S/R VOUCHER NUMBER	40. PAID BY

41a. I CERTIFY THIS ACCOUNT IS CORRECT AND PROPER FOR PAYMENT	42a. RECEIVED BY (Print)
41b. SIGNATURE AND TITLE OF CERTIFYING OFFICER / 41c. DATE	42b. RECEIVED AT (Location)
	42c. DATE REC'D (YY/MM/DD) / 42d. TOTAL CONTAINERS

CPSC-D-15-0004, Task Order 10

Develop Research Options to Conduct Willingness-to-Pay Valuations to Avoid Non-fatal Acute Injuries

Background

The Commission's major tool for estimating the benefits from the prevention of consumer product related injuries is the Injury Cost Model (ICM). The Commission originally funded the ICM because it recognized the need to measure, on a common basis, the magnitude of a wide range of injuries associated with consumer products. Used in conjunction with injury and fatality data, the ICM permits the CPSC to compare alternative policies designed to reduce the incidence of injuries.

The principal source of data available to CPSC concerning consumer product-related injuries is the National Electronic Injury Surveillance System (NEISS). NEISS is a statistically-valid national sample of product-related injuries collected from hospital emergency rooms throughout the country. The NEISS permits estimation of injury frequencies on the basis of type of injury and body part injured, the age and sex of the victim, and the consumer product associated with the injury. The underlying objective of the ICM is the development of disaggregated estimates of injury costs which can be integrated with the NEISS database to produce estimates of injury costs according to the various dimensions of the NEISS sample.

The ICM has been criticized over the years, because its major cost component, pain and suffering, is based on jury verdicts. Jury verdicts are an *ex post* measure of the welfare losses associated with acute injuries, rather than an *ex ante* measure. There are other criticisms of jury verdicts, such as the potential for biased selection of large awards, but this is the principal criticism of the ICM in terms of economic theory. Other agencies, such as the Department of Transportation, use monetized quality-adjusted life years, but this methodology has also been criticized on theoretical grounds.

The gold standard for estimating the benefits of fatal injuries is revealed preference wage risk studies, a willingness to pay methodology. Some estimates for non-fatal injuries were evaluated

by Viscusi and Aldy (2003), but estimates are for injuries that result in lost work days, and are not suitable for CPSC's needs.

Since there are numerous types of consumer product related injuries (e.g., fractures, burns), body areas affected, treatment settings, and variations in injury victim characteristics (age, sex, pre-existing conditions), it is important to focus the scope of the study to those non-fatal injuries that are being addressed by current or future projects. It is also important for valuation purposes that questions administered to consumers provide the probabilities a hazard scenario will result in a particular type or types of injury. One option may be to group injuries according to hazard patterns or according to severity level. For example, table saw injuries tend to be finger lacerations or amputations of various severities. It may make sense to group them into one scenario. Another possibility is grouping minor lacerations to various body extremities (e.g, fingers, toes, hands, and feet) together for survey purposes. Finally, grouping injuries with particular sequelae, such as chronic pain, disfigurement, or permanent disability may be appropriate.

Description of Work

The contractor shall conduct a conference call with CPSC staff within one week after task assignment.

Subtask 1: Recruit Outside Experts

The contractor shall recruit experts with expertise in conducting willingness to pay studies, such as stated preference surveys and revealed preference studies. The expert or experts shall be available for participation, if required, in all phases of this task, including preparation and review of reports, participation in workshops and conference calls, and the evaluation of alternative approaches to estimate the prospective benefits of CPSC regulatory actions.

Subtask 2: Review Valuation Methods for Non-Fatal Injury

The contractor shall review the methodologies used by academic researchers and other federal government agencies, including stated preference studies, revealed preference studies, and monetized quality adjusted life years, (and other approaches if available) and provide a discussion of the merits and criticisms of each methodology, and their potential applicability to the valuation of consumer product related injuries as reported to and collected by the CPSC.

Subtask 3: Conduct Workshop and Conference Calls with Outside Experts and CPSC Staff

The contractor shall conduct a one day workshop of outside experts and CPSC staff from Epidemiology and other CPSC divisions to develop research options and evaluate the feasibility of options developed. The contractor shall prepare a log of the workshop within one week and will follow up with two conference calls with CPSC staff to refine the results of the workshop at intervals of a month.

Subtask 3: Develop a Research Plan for Conducting Willingness to Pay Studies

Based on the results of the valuation review, the workshop, and the conference calls, the contractor and outside experts shall develop a research plan with options for conducting willingness to pay studies, such as stated preference projects, or other studies as appropriate. These options should discuss methodological issues; including constructing hypothetical questions that frame the risks of injuries properly. These options shall include schedules, resource requirements, likelihood of producing usable results, and the pros and cons of conducting the research.

Methods of research may include, but are not limited to, focus groups, and probability or convenience surveys. All projects must conform to Paperwork Reduction Act, Institutional Review Board, and Privacy Act requirements.

Government Furnished Materials

Readily available risk information from Epidemiology reports and the National Electronic Injury Surveillance System and other CPSC injury data sources. Product population estimates derived by CPSC Economics staff from sales data and the Product Population Model.

Delivery or Performance

The period of performance is eight months after the date of the award of the task. The contractor shall conduct a conference call with CPSC staff within one week after task assignment.

The contractor shall appoint a lead program manager with overall responsibility for performance under the contract. The lead program manager shall be the single point of interface with the government for all matters concerning technical progress.

All supporting data used in the preparation of the reports shall be provided in Excel spreadsheets, Word documents, or SAS datasets. Reports shall be emailed to William Zamula (wzamula@cpsc.gov), preferably in a recent version of Microsoft Word. CPSC staff shall provide comments on all draft and final reports within two weeks.

The following items shall be performed or delivered in accordance with the following schedule:

ITEM	QUANTITY	DELIVERY OR PERFORMANCE
(1) Conference call	1	Within one week after task assignment
(2) Recruit Experts	1	Within 1 month after task assignment
(3) Prepare Draft Report on Valuation Methods for Non-Fatal Injuries	2	Within 2 months after task assignment

(4) Conduct Workshop, prepare log	1	Within 2 months after task assignment
(5) Prepare Final Report on Valuation Methods	2	Within 3 months after task assignment
(6) First follow up conference call	1	Within 3 months after task assignment
(7) Second follow up conference call	1	Within 4 months after task assignment
(8) Prepare Draft Research Plan	2	Within 6 months after task assignment
(9) Final Research Plan	2	Within 7 months after task assignment

IEc

Review of Valuation Methods for Nonfatal Injuries

Final Report | January 26, 2017

Prepared by:

Saritha Ramakrishna, Jennifer Baxter, and Michael Welsh
Industrial Economics, Incorporated
2067 Massachusetts Avenue
Cambridge, MA 02140
www.indecon.com

With assistance from:

Lisa A. Robinson
Harvard University
Center for Risk Analysis and Center for Health Decision Science
[redacted]@comcast.net

Prepared for:

U.S. Consumer Product Safety Commission
Directorate for Economic Analysis
4330 East-West Highway
Room 723-02
Bethesda, MD 20814

Contracting Officer's Representative (COR):

William Zamula
wzamula@cpsc.gov

ACKNOWLEDGEMENTS

This final report was prepared by Industrial Economics, Incorporated (IEc) for the U.S. Consumer Product Safety Commission (CPSC), Directorate for Economic Analysis, under Contract No. CPSC-D-15-0004, Order No. 0010. CPSC staff, including the Contracting Officer's Representative (COR) William Zamula, as well as Gregory Rodgers and Robert Franklin, provided guidance and helpful comments.

The IEc project manager is Jennifer R. Baxter, who was assisted by Michael Welsh and Saritha Ramakrishna of IEc. Lisa A. Robinson of Harvard University (Center for Risk Analysis and Center for Health Decision Science) helped write Chapter 3, which describes methods currently used to value nonfatal injury risk reductions and draws on text originally drafted by Ms. Robinson under separate contracts with the U.S. Coast Guard and the U.S. Department of Health and Human Services. Ms. Robinson also provided helpful advice on other sections of the draft report. Finally, we are grateful for comments provided by two additional expert reviewers, Richard T. Carson of the University of California, San Diego (Department of Economics) and James K. Hammitt of Harvard University (Center for Risk Analysis and Center for Health Decision Science).

TABLE OF CONTENTS

CHAPTER 1 | INTRODUCTION

The U.S. Consumer Product Safety Commission (CPSC) estimates the benefits and costs of its regulatory and other initiatives to support related decision-making. To prepare these analyses, it requires information on the monetary value of the associated risk reductions. While these values have been well-studied for fatality risks (the value per statistical life, VSL), relatively few studies address the value of nonfatal injury risks. As a result, CPSC and other regulatory agencies rely on proxy measures.

The goal of this project is to assist CPSC in improving the data available on these values. It includes three components: (1) reviewing current methods for valuing nonfatal injury risk reductions; (2) convening a workshop involving CPSC staff and academic experts to identify options for new primary research; and (3) developing a research plan outlining the steps needed to implement the resulting options and discussing their advantages and limitations. CPSC may then decide to pursue one or more of the options under a separate task order.

This report represents the completion of the first component. In benefit-cost analysis, ideally values would reflect individual willingness to pay (WTP) for the risk reductions likely to accrue as a result of the regulation or other policy. However, the empirical literature provides few WTP estimates for nonfatal injury risk reductions, and the estimates that are available generally do not reflect the variation in the severity and duration of the injuries associated with different types of interventions. Thus CPSC and other agencies often sum estimates of averted costs and the associated impacts on the quality of life, including pain and suffering, as proxy measures of these values. The latter are typically estimated based on monetized quality-adjusted life year (QALY) losses, or at times based on jury awards. The extent to which the result differs from what individuals would be willing to pay is unknown.

In the near term, the proxy methods CPSC uses to estimate these values could be updated to reflect recent data and evolving best practice recommendations. However, such an update would not address uncertainties related to the differences between these measures and individual WTP. Understanding these differences requires new primary research that considers the range of nonfatal injuries associated with CPSC regulations and policies.

In this introductory chapter, we provide background information on CPSC and an overview of the remainder of the report. The subsequent chapters provide more information on the types of injuries to be addressed and the methods available for valuing them.

1.1 BACKGROUND

CPSC is an independent Federal agency that protects the public against unreasonable risk of injury from consumer products through education, safety standards and related activities, regulation, and enforcement (CPSC undated). It has jurisdiction over thousands of consumer products pursuant to a number of laws, including the Consumer Product Safety Act (CPSA), as amended by the Consumer Product Safety Improvement Act of 2008 (CPSIA) and Public Law No. 112-28; the Federal Hazardous Substances Act; the Flammable Fabrics Act; the Poison Prevention Packaging Act; the Refrigerator Safety Act; the Virginia Graeme Baker Pool and Spa Safety Act; and the Children's Gasoline Burn Prevention Act. Examples of regulated products include toys, cribs, power tools, cigarette lighters, and household chemicals.

As an independent agency, CPSC's regulations and supporting benefit-cost analyses are not subject to review by the U.S. Office of Management and Budget (OMB). However, its major rules (i.e., those likely to have an effect on the economy of $100 million or more) are subject to Congressional review pursuant to the Congressional Review Act. Thus CPSC generally prepares its analyses in accordance with the requirements applicable to other agencies, including Executive Orders 12866 and 13563 and the implementing guidance in OMB's *Circular A-4* (OMB 2003).

The primary benefits of CPSC's regulations are reductions in the risk of injury or death associated with the use of consumer products. To value fatal risk reductions, CPSC and other Federal agencies rely on VSL estimates, which are derived from research on individual WTP, consistent with the conceptual framework for benefit-cost analysis. The valuation of nonfatal risk reductions is more difficult due to the lack of research that provides applicable WTP estimates.

To value nonfatal injury risk reductions, CPSC currently relies on its Injury Cost Model (ICM, Miller *et al.* 2000), which uses proxy measures for valuation. The ICM sums estimates of medical costs, lost productivity, and some components of jury awards to value different types of injuries.[1] Jury awards are included to value "intangible" costs related to the effects of the injuries on quality of life, including pain and suffering, which may not be adequately reflected in the other cost elements. As introduced above and discussed in more detail later in this report, the application of such proxy measures introduces substantial uncertainty into the benefits estimates.

CPSC has received a number of public comments that criticize the ICM approach. For example, in response to CPSC's recent table saw proposed rulemaking, one group of commenters (Viscusi *et al.* 2012) raise several issues related to the transparency of, and justification for, the approach. They note that the ICM focuses on costs incurred rather than on individual WTP for the risk reduction; such *ex post* costs may differ significantly

[1] Jury awards include medical costs, lost productivity, and pain and suffering. CPSC estimates the portion attributable to pain and suffering using regression analysis, where pain and suffering is a residual. In the remainder of this report, when we refer to "jury awards," we are referring specifically to the pain and suffering component.

from *ex ante* values. Furthermore, they question the use of jury awards to value avoided pain and suffering.

CPSC's general approach for valuing nonfatal risk reductions is similar in many respects to current practices at other Federal regulatory agencies, as all agencies are constrained by the lack of sufficient, high-quality, directly relevant WTP estimates for policy making purposes. The specific cost categories included by each agency vary, however, and CPSC uses jury award data to value intangible losses. Other agencies often rely instead on monetized QALY estimates to value these impacts. With the effort envisioned for this project, CSPC seeks to meaningfully improve its approach for estimating the value of nonfatal injury risk reductions.

1.2 PURPOSE AND SCOPE OF THIS REPORT

This project includes three phases. First, this report represents the results of the initial phase, in which we review the National Electronic Injury Surveillance System (NEISS) database and CPSC's regulatory agenda to identify the types of injuries of interest to CPSC rulemakings. We also provide information on valuation methods and related research, and describe CPSC's current methodology as well as alternatives implemented by other Federal agencies.

This report provides background information for the second phase of the project. In that phase, we will conduct a workshop and conference calls with academic experts and CPSC staff. The experts include Lisa A. Robinson and Dr. James K. Hammitt, both of Harvard University (Center for Risk Analysis and Center for Health Decision Science) and Dr. Richard T. Carson of the University of California, San Diego (Department of Economics). The group will brainstorm to develop ideas for work that could be implemented to enhance CPSC's approach for valuing nonfatal injury risk reductions, including research that would improve its proxy estimates and new studies to more directly estimate WTP, discussing critical issues that must be addressed in the design of such studies.

In the final phase, we will draft a research plan outlining options for new work to improve the valuation of nonfatal injury risk reductions. For each option, we will describe the overall approach and its key implementation issues. For those options involving the use of survey methods, these will include the steps in questionnaire development, the likely mode of implementation, and the methods to be used to analyze the resulting data. We will also discuss the significant advantages and limitations of each option.

The remainder of this report consists of the following.

- In Chapter 2, we review data on the frequency and characteristics of consumer product-related injuries obtained from NEISS. We supplement this discussion with a review of CPSC's regulatory agenda to identify the types of injuries most likely to be relevant for future rulemaking efforts.

- In Chapter 3, we review the conceptual framework for valuation and examples of previous studies. Then, we summarize the approaches currently used to value nonfatal risk reductions in regulatory benefit-cost analyses by Federal agencies, including CPSC.

We conclude that CPSC could improve its approach in the near-term by updating and refining the approach used in the ICM, and in the longer term by conducting new primary research.

CHAPTER 2 | INJURY CHARACTERISTICS

This chapter explores the types of nonfatal injuries likely to be prevented by future CPSC regulations, to provide context for the discussion of valuation approaches in the following chapter. We first investigate the types of injuries most frequently associated with consumer products, the characteristics of the individuals injured, and the associated product(s). For historical data, we rely on data from NEISS, a system created and maintained by CPSC. We then turn our attention to the subset of these injuries associated with products likely to be addressed by forthcoming CPSC regulations. We review the information provided in the CPSC regulatory agenda as well as other information provided by CPSC staff.

Our goal is two-fold. First, because the value of reducing the risks of these injuries will depend on their characteristics and on the characteristics of those affected, we require related information to support development of appropriate valuation approaches. Second, given the time and expense associated with new valuation research, CPSC may wish to focus its efforts on those nonfatal injuries likely to dominate its benefits estimates in the foreseeable future. These total benefits will depend on both the number of injuries averted and on the monetary value per injury, which in turn will depend on injury severity. These data will aid us in identifying which injuries are likely to be most important in this context.

2.1 NEISS DATA

NEISS is a weighted national probability sample of injury visits to emergency departments related to consumer products. CPSC and its predecessor agencies developed the first version of the injury reporting system in the early 1970s. It has since undergone a series of changes; the most recent was completed in 2000. Approximately 100 U.S. hospitals with at least six beds that provide 24-hour emergency department service provide data to CPSC, where it is aggregated into the database. Each injury is then assigned a weight based on the sampled hospital that can be used to extrapolate to national estimates. This weighting process is described in Schroeder and Ault (2001).

NEISS includes a variety of injuries related to different consumer products. These range from minor lacerations and abrasions to more serious traumatic injuries. Each entry represents a single injury and includes information describing the product involved in the injury; the sex, race and age of the victim; the general injury diagnosis (e.g., laceration, abrasion, nerve damage); the injury disposition (i.e., whether the patient was treated and released or admitted to the hospital); the body part involved; and a brief narrative of the

incident.[2,3] NEISS does not include a severity scale; i.e., a qualitative or quantitative means of categorizing injuries by the relative harm. Nor does it provide data on their duration.

CPSC publishes a manual providing instructions for reporting injuries. Specifically, it requests that hospitals report all "consumer product-related emergency visits…including emergency department cases, hospital admissions, trauma center and burn center cases, and cases transferred to other hospitals" (CPSC 2016). Importantly, hospitals are not asked to determine whether a consumer product was "at fault" for the injury. Rather, it defines "product-related" as all poisoning and chemical burns to children under five years of age; all injuries where a consumer product, sport, or recreational activity is associated with the reason for the visit; and illnesses only if a consumer product or activity is associated with the onset of the illness. The manual lists product definitions and corresponding codes, as well as instructions for coding injury diagnoses, body parts, and demographic information of the victim.

The data are used in a variety of ways. CPSC publishes raw sample data and corresponding sample weights, as well as estimates of nonfatal injuries by consumer product annually. In addition, CPSC allows users to query NEISS via its website by product code, treatment date, victim demographic information, disposition, injury diagnosis, body part, and location. The query system allows users to view sample counts and estimated national frequencies applying a series of criteria.[4]

Researchers have used these data for broad reviews of consumer product-related injuries. For example, Lawrence, Spicer and Miller (2014) published a study detailing the types of consumer product injuries experienced by different age groups, as well as the frequency of hospitalization. The authors also link these frequency data to the ICM to determine the relative value of averted injuries by consumer product. Similarly, Schroeder and Rodgers (2013) use NEISS data to predict the likelihood of hospitalization by age and other demographic variables.

The information provided in NEISS also informs specific studies on risk factors for individual products. For example, Franklin and Rodgers (2008) present a review of unintentional child poisonings treated in emergency departments. The authors present summary statistics by age and sex, as well as specific products associated with poisonings. Such analyses provide starting points for the development of prevention strategies. Similarly, Rodgers and Adler (2001) present risk factors for injuries resulting

[2] NEISS also includes fatalities, which represent a minority of all cases.

[3] In cases where an individual in the NEISS sample sustains more than one diagnosed injury, NEISS coders are instructed to code the diagnosis that "seems to be the most severe." (See Page 7 of the NEISS 2016 Coding Manual (CPSC 2016)). For this reason, we refer to each entry in the NEISS database as a single "injury."

[4] U.S. Consumer Product Safety Commission. "National Electronic Injury Surveillance System." Retrieved 9 September 2016 at http://www.cpsc.gov/en/Research--Statistics/NEISS-Injury-Data/

from all-terrain vehicle usage, through an analysis of NEISS data and a survey of the general population of ATV users.

2.1.1 DATA ANALYSIS

We reviewed NEISS sample data for years 2011 through 2015 in order to characterize the types of injuries that are frequently associated with consumer products. The datasets for these years include a total of 1,894,432 entries, where each entry represents the most severe injury incurred by an individual in a single incident.[5] Applying the weights specified by NEISS, within the datasets, we find that these entries represent approximately 70,803,610 injuries initially treated in hospital emergency departments.

Using the NEISS coding manual, we estimate injuries by product category, diagnosis, and age group.[6] Exhibit 2-1 below summarizes injuries for the 20 most frequently mentioned products. Many of these products are not age-specific, meaning that they do not lend themselves to use by a specific population (e.g., they are not used solely by infants or children). The most frequent injuries are associated with stairs and steps, followed by floors and flooring materials.

EXHIBIT 2-1 CONSUMER PRODUCTS MOST FREQUENTLY ASSOCIATED WITH INJURIES, 2011-2015 NEISS DATABASE

RANK	PRODUCT CODE [1]	NATIONAL INJURIES (ESTIMATED BASED ON SAMPLE WEIGHTS) [2]	PERCENTAGE OF TOTAL ESTIMATED INJURIES (N=70,803,610)	DESCRIPTION OF PRODUCT OR ACTIVITY
1	1842	5,912,721	8.35%	Stairs or steps
2	1807	5,522,146	7.80%	Floors or flooring materials
3	4076	3,085,778	4.36%	Beds or bedframes, other or not specified
4	1205	2,619,453	3.70%	Basketball (activity, apparel or equipment)
5	5040	2,567,861	3.63%	Bicycles or accessories
6	1211	2,131,259	3.01%	Football (activity, apparel or equipment)
7	464	1,641,146	2.32%	Knives, not elsewhere classified
8	4074	1,577,488	2.23%	Chairs, other or not specified

[5] For example, if an individual broke his leg and sprained his wrist in a fall, the broken leg would be entered into the NEISS database. Furthermore, these entries include a small number of fatalities (i.e., 820 fatalities, or approximately 0.04 percent of entries). For simplification, throughout the rest of this discussion, we do not separately report fatalities and refer to all entries in the NEISS database as "injuries."

[6] U.S. Consumer Product Safety Commission. NEISS Coding Manual. Retrieved 8 September 2016 at http://www.cpsc.gov//Global/Neiss_prod/2016NonTraumaNEISSCodingManual.pdf

RANK	PRODUCT CODE [1]	NATIONAL INJURIES (ESTIMATED BASED ON SAMPLE WEIGHTS) [2]	PERCENTAGE OF TOTAL ESTIMATED INJURIES (N=70,803,610)	DESCRIPTION OF PRODUCT OR ACTIVITY
9	1884	1,490,981	2.11%	Ceilings and walls (interior part of completed structure)
10	611	1,455,162	2.06%	Bathtubs or showers
11	1893	1,432,396	2.02%	Doors, other or not specified
12	3299	1,415,845	2.00%	Exercise (activity and apparel without equipment)
13	4057	1,338,641	1.89%	Tables
14	1267	1,131,296	1.60%	Soccer (activity, apparel or equipment)
15	679	895,875	1.27%	Sofas, couches, davenports, divans or studio couches
16	4078	786,005	1.11%	Ladders, other or not specified
17	1615	740,361	1.05%	Footwear
18	5041	699,487	0.99%	Baseball (activity, apparel, or equipment)
19	1817	644,856	0.91%	Porches, balconies, open side floors or floor openings
20	1141	607,523	0.86%	Containers, not specified

Source: U.S. Consumer Product Safety Commission. 2015 NEISS Data. Retrieved 23 August 2016 at http://www.cpsc.gov/en/Research--Statistics/NEISS-Injury-Data/

Note:
[1] NEISS allows coders to enter in two involved products per database entry. We report these data based on the primary product involved. For most injuries, only one product is entered.
[2] Sum of national injury frequencies for the years 2011-2015; estimated from NEISS sample using recommended sample weights.

We compare our analysis of the 2011 through 2015 NEISS data with a previous analysis by Lawrence *et al.* (2014). The authors review NEISS injury data for the years 2009 through 2010 and identify products associated with the highest number of nonfatal injuries. In addition, the authors combine these frequency data with cost estimates from the ICM (described in detail in Chapter 3) in order to rank products by aggregate cost. Similar to our analysis, Lawrence *et al.* find that the six most frequently mentioned

products or activities resulting in injuries included stairs, floors, beds, bicycles, football and basketball.[7]

As noted earlier and discussed in more detail later in this report, CPSC values these injuries using its ICM, which includes estimates of medical costs, lost productivity, and values for pain and suffering derived from an analysis of jury awards. Applying these estimates, stairs, floors and beds have the highest aggregate costs associated with injuries, in addition to being the most frequently mentioned products. Exhibit 2-2 shows the top 20 products as they are presented in Lawrence *et al.* (2014), ranked by overall aggregate cost from the ICM. Lawrence *et al.* also report the mean cost of injury by product category. The average per injury cost for the top twenty products ranges from $47,000 to $105,000 (2009 dollars).

[7] Lawrence *et al.* (2014) include estimated injuries treated in settings outside of emergency departments. Our analysis of the NEISS data does not include this supplementary information from the ICM, rather, our analysis only includes injuries treated in emergency departments.

EXHIBIT 2-2 LAWRENCE, SPICER AND MILLER (2014) RANKING OF PRODUCTS BY AGGREGATE ANNUAL COST OF INJURY (2009$)[1]

RANK	PRODUCT	ANNUAL TOTAL COST (2009$)	ANNUAL INJURIES	MEAN COST PER INJURY (2009$)
1	Stairs	$92,294,000,000	1,231,619	$74,937
2	Floors	$81,233,000,000	941,256	$86,299
3	Beds	$44,192,000,000	612,658	$72,131
4	Bicycles	$38,898,000,000	536,360	$72,521
5	Football	$27,127,000,000	467,575	$58,016
6	Basketball	$25,677,000,000	508,167	$50,529
7	Chairs	$22,377,000,000	335,180	$66,761
8	Bathtubs/showers	$19,723,000,000	262,849	$75,037
9	Ladders	$18,662,000,000	179,195	$104,144
10	Exercise (w/o equipment)	$16,135,000,000	211,682	$76,224
11	Doors	$15,914,000,000	334,868	$47,522
12	Ceilings and walls	$15,545,000,000	288,755	$53,833
13	Baseball/softball	$14,492,000,000	280,869	$53,197
14	Tables	$13,908,000,000	284,042	$48,965
15	Soccer	$12,256,000,000	215,466	$56,880
16	All-terrain vehicles	$12,223,000,000	133,144	$91,805
17	Sofas	$11,663,000,000	168,029	$69,410
18	Wheelchairs	$10,102,000,000	123,839	$81,570
19	Porches/Balconies	$9,864,000,000	130,760	$75,435
20	Furniture, Unspecified	$9,753,000,000	113,685	$85,786

Source: Estimates taken from Table 2, Lawrence *et al.* (2014), p. 4

Notes:

[1] Estimates do not include fatalities.

In Exhibit 2-3, we report the total number of estimated injuries, by age group, for 2011 through 2015, from NEISS. Across each 10-year age group, the percentage of injuries ranges from 5 to 20 percent, with 39 percent of injuries occurring among individuals between 0 and 19 years old. Exhibit 2-3 also lists the most frequently reported products

associated with injuries by age group. Beds or bedframes are the product most commonly associated with injuries experienced by the youngest children, while bicycles and basketballs are associated with injuries among older children and teens. We also compare the injury counts to the number of people in each age group, based on U.S. population data. The injury rate is highest for children under the age of five (7.8 injuries for every 100 children in this age group) and adults 80 years or older (8.2 injuries for every 100 adults in this age group). Injury rates are lowest for adults in their 40's through 70's. Stairs, steps, floors, or flooring are the products identified most frequently in association with injuries. Lawrence *et al.*'s (2014) findings are similar.

EXHIBIT 2-3 ALLOCATION OF INJURIES ACROSS AGE GROUPS AND CONSUMER PRODUCTS, 2011-2015 NEISS DATABASE

AGE GROUP	NATIONAL INJURIES ESTIMATED BASED ON SAMPLE WEIGHTS [1]	INJURY RATE (PER 100 INDIVIDUALS) [2]	MOST FREQUENT PRODUCT CODE [3]	PRODUCT DESCRIPTION
0-1	3,002,208	7.8	4076	Beds or bedframes, other or not specified
2-4	4,800,592		4076	Beds or bedframes, other or not specified
5-9	5,698,281	5.6	5040	Bicycles or accessories
0-9 subtotal	***13,501,081***			
10-19	14,484,376	6.8	1205	Basketball (activity, apparel or equipment)
20-29	9,212,278	4.3	1842	Stairs or steps
30-39	7,293,601	3.5	1842	Stairs or steps
40-49	6,595,524	3.1	1842	Stairs or steps
50-59	6,297,096	3.0	1842	Stairs or steps
60-69	4,663,675	3.2	1807	Floors or flooring materials
70-79	3,737,538	4.1	1807	Floors or flooring materials
80+	5,016,490	8.2	1807	Floors or flooring materials
Not Reported	1,950	-	1842	Stairs or steps
Total	**70,803,610**			

Sources: U.S. Consumer Product Safety Commission. 2015 NEISS Data. Retrieved 23 August 2016 at http://www.cpsc.gov/en/Research--Statistics/NEISS-Injury-Data/. Injury rates calculated by IEc using the U.S. Census Bureau American Community Survey (ACS). Retrieved 6 January 2017 at https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_15_5YR_DP05&prodType=table.

Notes:
[1] Sum of national injury frequencies for the years 2011-2015, estimated from NEISS sample using recommended sample weights.
[2] ACS population estimates are provided in age groups that do not align precisely with the age groups provided in this table. We assume that the number of people within an ACS age group is equally distributed across the age range.
[3] We identify the product most frequently associated with injury for each age group.

We also report the top twenty injury diagnoses and body area combinations, as reported in NEISS, in Exhibit 2-4. Note that the rows represent the most frequently occurring *combinations* of diagnoses and body areas. Though the majority of these injuries appear to be relatively minor, severity can vary on a case-by-case basis. For example, the NEISS coding manual instructs coders to label an entry an "internal organ injury" in a case where an individual hit their head, but left the emergency department prior to when a diagnosis was recorded. Coders also use "internal organ injury" for any non-specific

blunt force head injury. At the same time, "internal organ injury" could also refer to more serious injuries, such as cerebral contusions and other forms of traumatic brain injury (see p. 10 of the NEISS 2016 coding manual (CPSC 2016)).

EXHIBIT 2-4 FREQUENTLY OCCURING INJURY DIAGNOSES/BODY LOCATION COMBINATIONS, 2011-2015 NEISS DATABASE

RANK	DIAGNOSIS/LOCATION ON BODY COMBINATION	NATIONAL INJURIES ESTIMATED BASED ON SAMPLE WEIGHTS [1] (N=70,803,610)	PERCENTAGE OF TOTAL INJURIES
1	Internal Organ Injury/Head	5,816,027	8.21%
2	Laceration/Face (including eyelid, eye area, and nose)	3,211,760	4.54%
3	Laceration/Finger	3,193,374	4.51%
4	Sprain or Strain/Ankle	3,029,709	4.28%
5	Sprain or Strain/Trunk (lower)	1,993,423	2.82%
6	Other/Not Stated/Trunk (lower)	1,730,926	2.44%
7	Laceration/Head	1,661,251	2.35%
8	Sprain or Strain/Knee	1,526,605	2.16%
9	Contusions/Abrasions/Face (including eyelid, eye area, and nose)	1,394,994	1.97%
10	Other/Not Stated/Trunk (upper)	1,357,055	1.92%
11	Laceration/Hand	1,327,273	1.87%
12	Concussion/Head	1,315,545	1.86%
13	Contusions/Abrasions/Trunk (lower)	1,275,111	1.80%
14	Contusions/Abrasions/Trunk (upper)	1,273,913	1.80%
15	Fracture/Trunk (lower)	1,096,808	1.55%
16	Contusions/Abrasions/Head	1,032,837	1.46%
17	Sprain or Strain/Shoulder	1,008,344	1.42%
18	Fracture/Arm (lower)	977,677	1.38%
19	Fracture/Wrist	962,202	1.36%
20	Contusions/Abrasions/Knee	952,870	1.35%

Source: U.S. Consumer Product Safety Commission. 2015 NEISS Data. Retrieved 23 August 2016 at http://www.cpsc.gov/en/Research--Statistics/NEISS-Injury-Data/

Notes:
[1] Sum of national injury frequencies for the years 2011-2015; estimated from NEISS sample using recommended sample weights.

Finally, Exhibit 2-5 reports the total number of injuries by age group and by disposition (e.g., whether the victim was hospitalized or not). Generally, the majority of victims are

treated in emergency departments, with only a relatively small percentage of individuals being admitted or to a hospital following treatment.[8]

2.1.2 SUMMARY OF FINDINGS

Our review of the NEISS data shows that younger individuals account for a larger proportion of product-related injuries than older individuals. However, individuals age 80 and older have the highest injury rates, followed by children under the age of five. The elderly and young are more likely to require hospitalization if injured. Consumer products most frequently associated with injuries are stairs or flooring. Beds and recreation equipment are more likely to be associated with youth injuries.

The majority of injuries appear to be relatively minor, including lacerations and sprains/strains. However, the ambiguity of the injury codes in NEISS may require evaluation on a case-by-case basis. It may also be important to review the types of common injuries that require hospitalization, to gain a better understanding of common severe injuries.

While the NEISS data provide some insights as to the types of injuries of interest to CPSC, it does not provide a complete picture. For example, it is clear that that basketball products account for a substantive percentage of injuries in the NEISS data and that ICM imputes a high value per injury. However, the NEISS data alone do not provide much guidance as to which specific injuries, if any, could be materially reduced by CPSC intervention. As a result, while the NEISS data indicate the characteristics of individuals injured and the types of injuries they experience, a more detailed analysis of the injuries would be needed to determine what proportion might be addressed by CPSC regulatory activities.

[8] Later in this report we discuss the approach used in the ICM to estimate additional injuries that occur and are treated outside of emergency departments.

EXHIBIT 2-5. DISPOSITION OUTCOMES BY AGE GROUP (NATIONAL ESTIMATES BASED ON RECOMMENDED SAMPLE WEIGHTS), 2011-2015 NEISS DATABASE

AGE GROUP	TREATED AND RELEASED, OR EXAMINED/ RELEASED W/O TREATMENT [1]	LEFT WITHOUT BEING SEEN/LEFT AGAINST MEDICAL ADVICE [1]	HELD FOR OBSERVATION [1]	TREATED AND ADMITTED FOR HOSPITALIZATIO N[1]	TREATED AND TRANSFERRED TO OTHER HOSPITAL [1]	NOT RECORDED [1]	FATALITY [1]	% HOSPITALIZED, NONFATAL INJURIES [2]
0-1	2,788,941	47,304	33,220	77,875	51,838	269	2,762	4%
2-4	4,553,860	59,943	31,826	96,683	56,747	247	1,286	3%
5-9	5,465,819	47,629	16,370	107,807	59,596	239	822	3%
10-19	14,023,710	108,744	31,781	216,745	101,763	499	1,133	2%
20-29	8,788,254	161,344	23,416	186,236	50,319	601	2,108	3%
30-39	6,930,373	107,167	19,080	192,339	42,801	408	1,434	3%
40-49	6,146,328	90,428	23,826	283,172	48,104	679	2,988	5%
50-59	5,641,941	79,048	35,808	467,487	68,006	223	4,584	9%
60-69	3,916,091	35,943	31,655	597,059	76,656	477	5,793	14%
70-79	2,886,134	18,427	33,845	713,850	80,943	160	4,179	21%
80+	3,414,076	12,846	59,734	1,400,625	124,160	333	4,716	30%
Not Reported	573	80	31	987	52	135	92	60%
Grand Total	**64,556,099**	**768,903**	**340,591**	**4,340,865**	**760,984**	**4,270**	**31,897**	**7%**

Source: U.S. Consumer Product Safety Commission. 2015 NEISS Data. Retrieved 23 August 2016 at http://www.cpsc.gov/en/Research--Statistics/NEISS-Injury-Data/

Note:
[1] Sum of national injury frequencies for the years 2011-2015; estimated from NEISS sample using recommended sample weights.
[2] Calculation does not include injuries resulting in fatalities, or cases where the disposition was not recorded.

2.2 REVIEW OF CPSC REGULATORY AGENDA

To better identify injuries of future interest, we reviewed the rulemakings and products listed in CPSC's Fall 2016 regulatory agenda.[9] The agenda includes 31 rules, of which 24 target specific types of consumer products. Of these 24 rules, 12 are infant products. Exhibit 2-6 lists each possible rule by title, its identifying number, whether it involves a specific product, the corresponding NEISS code we used to review related injuries, and the rulemaking stage (i.e., prerule, proposed, or final).

[9] We also reviewed CPSC's hazard reports, released in 2004 through 2006. These reports group products into different categories (e.g., housewares and kitchen appliances, home furnishings and fixtures, powertools and workshop equipment, etc.) and characterize the addressability of injuries resulting from each of these categories. The reports estimate the "maximum addressable cost" by product category but in many cases, they do not provide specific injury diagnoses associated with these costs. They were also released a decade ago, and CPSC's regulatory priorities may no longer reflect the findings of these reports. For this reason, we do not include them in our discussion.

EXHIBIT 2-6. CPSC REGULATORY AGENDA, FALL 2016

TITLE	RULE STAGE	RIN*	INVOLVES SPECIFIC PRODUCT? (Y/N)	NEISS PRODUCT CODE(S)
All-Terrain Vehicles	Prerule	3041-AC28	Y	3285, 3286, 3296, 3287
Petition on Crib Bumpers	Prerule	3041-AD23	Y	1542
Petition Requesting a Ban or Standard on Adult Portable Bed Rails	Prerule	3041-AD30	Y	4075
Petition Requesting Rulemaking on Residential Elevators	Prerule	3041-AD43	Y	1889
Rule Review of: Standard for the Flammability (Open Flame) of Mattress Sets	Prerule	3041-AD47	Y	4009, 4010
Petition for Rulemaking for Various Products Containing Organohalogen Flame Retardants	Prerule	3041-AD49	N	N/A
Petition Requesting Ban for Supplemental Mattresses for Play Yards With Non-Rigid Sides	Prerule	3041-AD52	Y	1542
Petition Requesting Labeling Requirements Regarding Slip Resistance of Hard Surface Flooring and Floor Coatings	Prerule	3041-AD56	Y	1807
Flammability Standard for Upholstered Furniture	Proposed Rule	3041-AB35	N[1]	Not Considered
Open-Flame Ignition of Bed Clothes	Proposed Rule	3041-AC26	Y	667, 4008, 689, 4051, 4054, 4002
Regulatory Options for Table Saws	Proposed Rule	3041-AC31	Y	0841
Fireworks Devices	Proposed Rule	3041-AC35	Y	1313
Petition for Rulemaking to Eliminate Accessible Cords on Window Covering Products	Proposed Rule	3041-AD31	Y	0638
Standard for Gates and Other Enclosures	Proposed Rule	3041-AD44	Y	1506
Standard for Infant Inclined Sleep Products	Proposed Rule	3041-AD45	Y	1537
Standards for Baby Changing Products	Proposed Rule	3041-AD48	Y	1502
Stationary Activity Centers	Proposed Rule	3041-AD53	Y	1520
Standard for Booster Seats	Proposed Rule	3041-AD58	Y	1556
Portable Generators	Final Rule	3041-AC36	Y	606
Voluntary Recall Notices	Final Rule	3041-AC73	N	N/A
Recreational Off-Road Vehicles	Final Rule	3041-AC78	Y	N/A
Standard for Sling Carriers	Final Rule	3041-AD28	Y	1527

TITLE	RULE STAGE	RIN*	INVOLVES SPECIFIC PRODUCT? (Y/N)	NEISS PRODUCT CODE(S)
Standard for Infant Bouncer Seats	Final Rule	3041-AD29	Y	1558
Standard for High Chairs	Final Rule	3041-AD33	Y	1555
Amendment to Regulation on Information Disclosure Under Section 6(b) of the CPSC	Final Rule	3041-AD36	N	N/A
Standard for Infant Bath Tubs	Final Rule	3041-AD37	Y	1544
Safety Standard for Children's Folding Chairs and Stools	Final Rule	3041-AD38	Y	1549
Phthalates Rule	Final Rule	3041-AD39	N	N/A
Protection of Human Subjects: Common Rule	Final Rule	3041-AD54	N	N/A
Rules of Practice for Adjudicative Proceedings	Final Rule	3041-AD57	N	N/A
Determinations Regarding Third Party Testing of Phthalates In Four Specified Plastics	Proposed Rule	3041-AD59	N	N/A

Source: Office of Management and Budget. "Agency Rule List-Spring 2016, Consumer Product Safety Commission." Retrieved 10 January 2017 at https://www.reginfo.gov/public/do/eAgendaMain;jsessionid=88CE478E3F676C0802A6571E1549BE9A?operation=OPERATION_GET_AGENCY_RULE_LIST&currentPub=true&agencyCode=&showStage=active&agencyCd=3041&Image58.x=52&Image58.y=20&Image58=Submit

Notes:
*RIN = Regulation Identifier Number. Every regulation entered into the Unified Regulatory Agenda is assigned a unique number so that the rule can be tracked through the development process.
[1] Due to the diversity of products involved, we did not attempt to identify specific product codes.

We then reviewed the most common injuries resulting from the product groups listed in the final column of Exhibit 2-6. Exhibit 2-7 below summarizes the number of resulting injuries. We report the estimated number of injuries over the five year period, as well as the most common injury type and age group by product.

For example, gates account for approximately 50,000 injuries during the time period of interest. Contusions and abrasions were the most common injury type of injury associated with this product, and individuals aged 20 to 29 years represented the highest frequency age group suffering these injuries. While these data suggest that valuation research might focus to some extent on deriving better benefit estimates for reducing risks of contusions and abrasions associated with these types of injuries, the information, by itself, does not provide clear research or policy guidance. However, the items on CPSC's regulatory agenda suggest infant products and motorized equipment and vehicles may receive more regulatory attention in the near term.

Recent discussions with CPSC economics staff suggest that products of interest to CPSC might be grouped into the following general categories:[10]

- Combustion appliances (e.g., furnaces, generators) where noxious fumes and fires are a hazard;
- Infant products, where injuries affect young children;
- Transportation products (e.g., recreational off-road vehicles, all-terrain vehicles) where injuries occur as a result of greater force than with other types of products);
- Recreation or sports equipment (e.g., mountain climbing, SCUBA);
- Flammable items (e.g., mattresses, fireworks);
- Chemicals (e.g., adhesives, paints) posing an acute hazard.[11]

Thus, at this time, we require additional guidance from CPSC regarding the types of injuries and affected populations that are likely to be most relevant and important for future CPSC regulatory analyses.

[10] Personal communication with the Consumer Product Safety Commission, Directorate for Economic Analysis, on December 22, 2016.

[11] Chemicals may also increase the risk of illnesses (e.g., cancer); however, this project is focused on injuries, rather than illnesses.

EXHIBIT 2-7 CPSC REGULATORY AGENDA, SPRING 2016, INJURIES BY PRODUCT GROUP, 2011-2015 NEISS DATABASE

PRODUCT [1]	NATIONAL INJURIES (ESTIMATED BASED ON SAMPLE WEIGHTS) [2]	MOST COMMON INJURY TYPE	HIGHEST FREQUENCY AGE GROUP
Portable Generators	11,218	Anoxia	30-39
Table Saws	163,560	Laceration	60-69
Fireworks	50,613	Burns (thermal from flames or hot surface)	10-19
Changing Tables	20,025	Internal organ injury	0-1
Gates	49,820	Contusions, Abrasions	20-29
Stationary Activity Center	956	Internal organ injury	0-1
Sling Carriers	3,433	Internal organ injury	0-1
Inclined Sleepers	4,084	Internal organ injury	0-1
Crib Bumper	455	Internal organ injury	0-1
Infant Bath Tubs	1,094	Laceration	0-1
Infant Seat	2,432	Contusions, Abrasions	0-1
High Chairs	45,292	Internal organ injury	0-1
Booster Seats	9,322	Internal organ injury	0-1
Bouncer Seats	15,195	Internal organ injury	0-1
Bed Clothes, Fire-related [3]	1,039	Burns (thermal from flames or hot surface)	50-59
Floor	5,522,146	Contusions, Abrasions	80+
Elevators	51,832	Contusions, Abrasions	80+
ATV	555,159	Concussions	10-19
Window Coverings	15,221	Laceration	80+
Mattress, Fire-related [3]	1,045	Burns (thermal from flames or hot surface)	50-59
Bed Rails	30,007	Laceration	80+

Source: U.S. Consumer Product Safety Commission. 2015 NEISS Data. Retrieved 23 August 2016 at http://www.cpsc.gov/en/Research--Statistics/NEISS-Injury-Data/

Notes:
[1] Refers to the product primarily associated with the industry, with the exception of fire-related injuries (see Note 3). NEISS allows coders to enter in two involved products per database entry. We report these data based on the primary product involved.
[2] Sum of national injury frequencies for the years 2011-2015, estimated from NEISS sample using recommended sample weights.
[3] For fire-related injuries, we include injuries that are related to the product codes of interest (primary cause), and those that NEISS indicates involved fire.

CHAPTER 3 | VALUATION APPROACHES

Valuing the nonfatal injury risk reductions associated with CPSC regulations is challenging for many reasons. Consistent with the framework for benefit-cost analysis, these values would ideally be based on estimates of individuals' WTP for the risk changes they are likely to experience. Because these risk reductions are not directly bought and sold in the marketplace, nonmarket methods must be used for valuation. However, few such studies estimate individual WTP to avert the types of nonfatal injuries addressed by CPSC regulations. Thus CPSC and other Federal agencies use proxy measures to estimate these values.

Below, we first describe the underlying conceptual framework and the nonmarket valuation methods and proxy measures that can be used to estimate individual WTP. We then discuss the approaches currently used by CPSC and other Federal agencies.[12]

3.1 CONCEPTUAL FRAMEWORK

Benefit-cost analysis provides information on how limited resources can be best allocated to maximize social welfare. Within this context, welfare is based on individual preferences, and money is used as a convenient and practical measure that describes the extent to which individuals are willing to reduce their consumption of other goods and services to achieve the policy outcomes. Within this framework, costs are measured by the value of forgone opportunities. In other words, costs are incurred when resources are used for one purpose, such as implementing a particular regulation, and hence cannot be used for another purpose. Opportunity costs are the value of the benefits that could have been provided by devoting the resources to their best alternative use. Benefit-cost analysis is rarely the sole basis for policy decisions; numerous other factors, such distributional consequences and statutory constraints, are also considered.

The approach for valuing reductions in nonfatal injury risks (as well as other policy impacts) in benefit-cost analysis is grounded in four basic assumptions that underlie the standard economic model. The first is that each individual is the best judge of his or her own welfare. This principal, often referred to as "consumer sovereignty," means that values should be based on the preferences of those affected by the policy. This framing

[12] Parts of this chapter are taken from previous work by Ms. Robinson and Dr. Hammitt for the U.S. Department of Homeland Security and the U.S. Department of Health and Human Services under subcontract to Industrial Economics, Incorporated (IEc). See, for example, IEc and Robinson (2011), Robinson and Hammitt (2012), IEc *et al.* (2014), and U.S. Department of Health and Human Services (2016). More information on these methods is also available in Robinson and Hammitt (2013).

allows analysts to provide decision-makers with information on how those affected weigh the benefits and costs of alternative policies.

The second is that individuals can be modeled as deriving utility (or well-being) from the goods and services they consume. If an individual chooses to buy a good or service, economists generally assume (consistent with consumer sovereignty) that he or she values the good or service more than he or she values the other goods or services which that money could buy. Thus our willingness to exchange money for different goods and services can be used to indicate the utility we receive from their consumption. In other words, the monetary value of a regulatory benefit is most appropriately measured by determining the change in wealth that has the same effect on utility as the benefit.

The third is that estimates of WTP provide a conceptually appropriate measure of value.[13] WTP is the maximum amount of money an individual would voluntarily exchange to obtain an improvement, given his or her budget constraints. In other words, it indicates the point at which the individual would be equally satisfied with having the good itself or with having the money to spend on other things. This theoretical framework mimics the actual trade-offs implicit in regulation. If we as a nation choose to spend more, for example, to implement a consumer product regulation that decreases the risk of injury, we will have less to spend on other goods or services, including other risk-reducing policies.

The fourth is that, for market goods, benefits are measured by the amount by which WTP exceeds the market price, generally referred to as "consumer surplus."[14] At an individual level, when WTP exceeds the price, the individual benefits from the fact that he or she can acquire the good or service for less than he or she is willing to pay. If price exceeds WTP, the individual would not purchase the good or service, choosing to use the money for other things. The difference between WTP and price can be aggregated across individuals to determine the consumer surplus associated with different price levels. Consumers generally benefit from price decreases, because WTP will then exceed price by a larger amount, and vice-versa.[15]

In applying these concepts, analysts must first clarify the outcome to be valued. In CPSC regulatory analysis, the goal is to estimate the total value of the associated nonfatal injury risk reductions (as well as other outcomes) on social welfare. This value should include both the pecuniary effects of the risk change (e.g., on medical expenses and earnings) and

[13] Estimates of willingness to accept compensation (WTA); i.e., of the least amount of money an individual would accept to forego an improvement, are also consistent with this framework. Because WTP is generally the appropriate concept for valuing regulatory benefits, which involve spending for improvements from the status quo, we refer to WTP throughout this report.

[14] For more detailed and technical discussion of the concept of consumer surplus, as well as the relationship of estimates of WTP and WTA to the underlying concepts of equivalent and compensating variation, see Freeman et al. (2014).

[15] Similarly, producer surplus is the benefit to producers who can supply units of a good for less than the market price.

the non-pecuniary effects (e.g., on quality of life including pain and suffering and the use of non-work time).[16]

If individuals were responsible for all of their own medical costs, their income depended only on their own work and they were free to set their own work hours, their health had no effect on others, and they had a reasonably good understanding of the effects of the risk reduction on their own well-being, then in theory we could simply sum the pecuniary effects and WTP for the nonpecuniary effects of a regulation. However, a number of market distortions affect related choices and hence the available estimates of the pecuniary effects, and also affect what individuals are likely to consider in estimating their WTP.

For example, as discussed below, the availability of health insurance may lead individuals to consume more medical treatment than they would be willing to pay for themselves, and income taxes and other labor market distortions affect the extent to which an individual chooses to engage in paid work. In addition, individuals may not fully comprehend the magnitude or impacts of many risks, and changes in risk will affect family members and friends as well as the individual. The valuation of risks affecting children raises particular difficulties, because they lack the autonomy, financial resources, and understanding needed to determine WTP.[17] In addition, the existence of altruism or other-regarding preferences more generally presents particular challenges in the context of benefit-cost analysis.[18] Finally, while individuals may include out-of-pocket costs and lost income in considering what they are willing to pay, they may not necessarily consider costs incurred by third parties, such as insured medical expenses and caretaking provided by family or friends. Thus these costs may need to be added to WTP estimates to reflect the total value of the risk reduction. In the sections that follow, we provide an overview of how key challenges are addressed in both the available literature and in the approaches used for valuation by major regulatory agencies, referencing other sources that provide more detailed information.

[16] For a more detailed and technical discussion of these concepts, see Freeman et al. (2014), Chapter 7.

[17] As discussed in Robinson and Hammitt (2016), studies that elicit parental WTP for reduced morbidity or mortality risks to children suggest that these values may be noticeably greater than adult WTP to reduce their own risk.

[18] For example, appropriately incorporating altruism requires determining whether it is pure or paternalistic: a pure altruist respects others' preferences for both the benefits they receive and the costs they incur, whereas a paternalistic altruist cares only about some aspects of others' well-being, such as their health (Jones-Lee 1991, Bergstrom 2006). In addition, valuation studies that explore altruistic preferences often find counterintuitive results: individuals report lower values for programs that benefit the community than for programs that benefit only themselves (e.g., Svensson and Johansson 2010, Lindhjem et al. 2011), suggesting that they may not understand or accept the valuation scenarios.

3.2 GENERAL APPROACHES TO VALUATION

Researchers generally rely on stated and revealed preference studies to estimate WTP to reduce injury or other risk. These methods can be used to value a risk reduction associated with a specific attribute, such as a particular safety improvement required by a CPSC regulation, or can be used to value a risk reduction that is described without attribution to a particular cause or source. When reasonably high quality, applicable WTP studies are not available, analysts at times rely on estimates of averted costs, monetized QALYs, and/or jury awards as rough proxies. We describe each of these approaches below.

Because they regulate diverse products with diverse risks, one of the challenges that CPSC and other Federal agencies face is the need for values for a range of injuries that can be applied across a variety of regulations, using a consistent valuation approach. Such consistency is desirable to enhance comparability of the results across regulations, and aids in communications with decision-makers and other stakeholders. A generic approach is also appealing because Federal agencies generally lack the time and resources needed to implement valuation studies that address the specific characteristics of each regulation.

As discussed in more detail below, the WTP literature does not currently provide consistently-derived values for a range of nonfatal injuries that vary in severity and duration; the proxy methods that CPSC and other agencies use provide a more generic approach but diverge in several respects from the conceptual framework that underlies benefit-cost analysis. New primary valuation research would be needed to provide generic WTP estimates that are applicable to a range of rulemakings.

3.2.1 WILLINGNESS TO PAY METHODS

For outcomes such as risk reductions, which are not traded in markets, economists generally estimate WTP using stated or revealed preference methods.

- **Stated preference** methods typically employ survey techniques to estimate what respondents would pay for the outcome of concern. A contingent valuation survey may directly elicit WTP for a particular scenario described by the researcher. Alternatively, a survey may present respondents with two or more scenarios involving different amenities or attributes and prices, in which case estimates of WTP are derived from the way in which respondents rank, rate, or construct equivalent sets of alternatives.[19]
- **Revealed preference** methods estimate the value of non-marketed goods based on observed behaviors or prices and preferences for related marketed goods. For

[19] In other words, as discussed in more detail in Carson and Louviere (2011), such surveys can be used refer to a single binary discrete choice task (e.g., a product without and with a risk-reducing attribute) and a discrete choice experiment with multiple choice sets each comprised of more than two choices (e.g., various product attributes, degrees of risk reduction, and costs).

example, some studies focus on averting behaviors or defensive measures that protect against perceived risks, such as the use of helmets to mitigate head injuries in cycling or sports. Other methods include wage-risk (or hedonic wage) studies which examine the additional compensation associated with jobs that involve higher risks. Property value studies may be used when an outcome (such as a change in environmental quality) affects housing prices, and travel cost studies are often used to value recreational opportunities. In these studies, researchers use statistical methods to separate the effects of the risk change on price from the effects of other product and consumer characteristics.

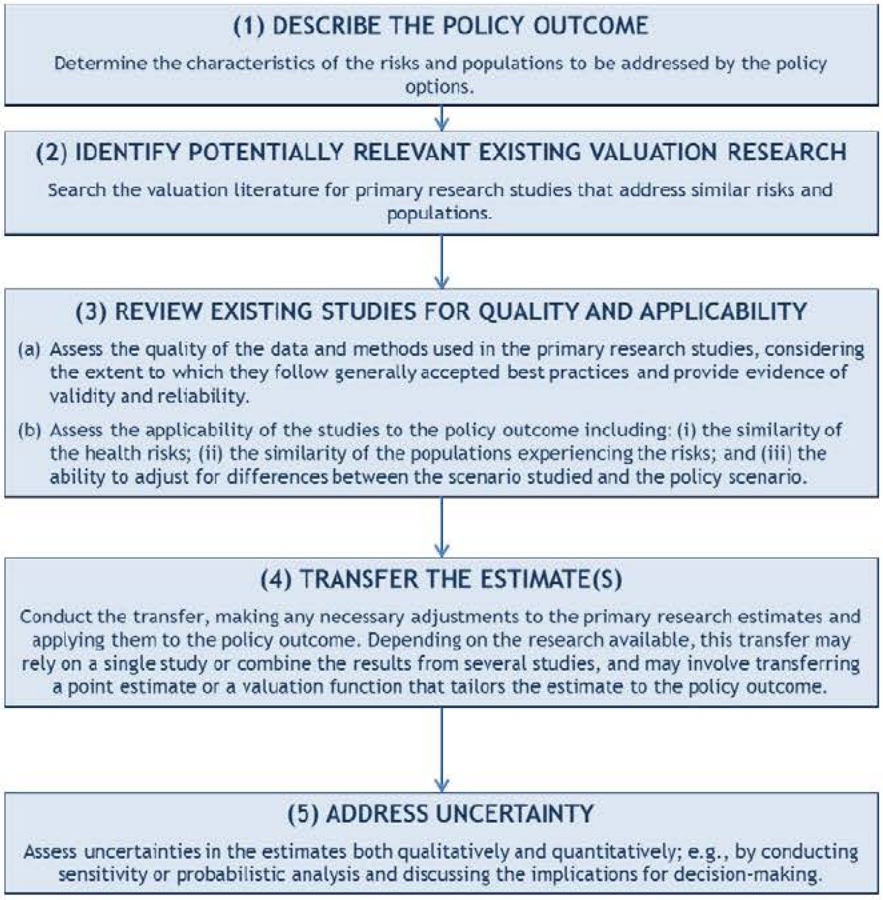
Stated preference methods are attractive because researchers can tailor surveys to directly value the outcomes of concern; e.g., a survey can describe particular types of injuries from particular types of consumer products. Such surveys must be carefully designed and administered as well as satisfy various tests for coherence to be considered reliable for use in policy analysis. Revealed preference methods have the advantage of relying on behavior with significant consequences. However, it may be difficult to find a market good that provides information on the regulatory outcome of concern. In addition, it is often challenging to separate the value of this outcome from the value of other attributes that affect choice, such as the value of time use when conducting averting behavior or travel cost studies.[20]

Application of these studies in regulatory analysis generally requires the use of the benefit transfer framework, illustrated in Exhibit 3-1. This framework involves searching the literature for potentially relevant studies, then evaluating them against criteria related to their quality and applicability. Such criteria often require, for example, that the studies be conducted in the United States, given the likelihood that preferences vary across cultural and socioeconomic contexts, and that they address outcomes that are similar to the regulatory outcome in terms of severity and duration.[21]

[20] Additional information on these methods, their relationship to theory, and their application is provided in numerous sources, including U.S. Environmental Protection Agency (2010b) as well as Freeman et al. (2014).

[21] Robinson and Hammitt (2016) provide an example of criteria used to evaluate the available WTP research on the value of fatality risk reductions.

EXHIBIT 3-1. BENEFIT TRANSFER FRAMEWORK



Source: HHS (2016), replication of Figure 3.1.

In the remainder of this section, we describe the conduct of stated and revealed preference studies in more detail and provide examples of the use of these methods to value nonfatal injuries. More information on the application of these methods to fatality risks is provided in Robinson and Hammitt (2015, 2016).

Stated Preference Methods

Implementing a stated preference study involves designing and pretesting the questionnaire, administering the survey, and analyzing and reporting the results, as illustrated in Exhibit 3-2. We provide an overview of related issues below, then briefly summarize available studies that address nonfatal injuries. More detailed information on methodological issues is provided in several texts and guidance documents, such as Bateman *et al.* (2002), Champ *et al.* (2003), Alberini and Kahn (2006), and Carson and

Hanemann (2005).[22] Carson (2012) provides a comprehensive history of stated preference studies.

EXHIBIT 3-2

STEPS FOR DEVELOPING AND IMPLEMENTING A STATED PREFERENCE STUDY TO VALUE RISK REDUCTIONS

1. Identify the goal of the study.
2. Determine the outcomes to be valued.
3. Choose whether to implement a single binary discrete choice contingent valuation study that asks respondents to choose between two options (e.g., the status quo or the risk reduction and cost of an intervention) or a more general discrete choice experiment that asks respondents to choose one of (or to rank) three or more options that differ in risk change, cost, and possibly other product or program attributes.
4. Identify relevant population (national or regional, general population or subgroup).
5. Develop sample frame.
6. Develop the valuation scenario, including the descriptions of:
    a) The risk context and cause under the baseline
    b) The attributes of the risk, and (if relevant) of the population affected
    c) The intervention and its expected effectiveness
    d) The funding mechanism (payment vehicle) for the intervention
    e) The WTP questions, including format, number, and range of dollar values.
7. Design other survey components:
    a) Educational or practice questions
    b) Checks for response validity
    c) Demographic and attitudinal data needed for statistical analysis.
8. Conduct pretesting; revise and refine survey instrument.
9. Develop experimental design.
10. Determine sample size and survey mode (in-person interviews, phone, internet), including follow-up with non-respondents.
11. Administer survey.
12. Clean data and conduct analysis, including validity checks.
13. Report results.

Source: Adapted from Robinson and Hammitt (2012)

[22] OMB also provides substantial guidance that reflects its role in reviewing regulatory analyses and approving information collection efforts undertaken by Federal agencies, such as OMB (2003), Graham (2006), OMB (2006), and Sunstein (2010).

Surveys typically begin by introducing the general purpose of the study then collecting information on the respondent's prior knowledge and experience as well as their attitudes towards the topic. For outcomes that are unfamiliar or particularly difficult to value, the survey may include an educational component. For instance, on an individual level, many consumer product safety regulations provide relatively small risk reductions, which many find difficult to comprehend.[23] A survey can present educational information to aid the respondent, and test their comprehension of differences in risk levels; for example, by asking which is the larger of two risk changes (e.g., 1 in 10,000 vs. 5 in 100,000). The survey can then provide further assistance to those needing it.

The survey instrument then typically defines the scenario to be valued. For example, it may describe an intervention to reduce the likelihood that a recreational vehicle will accidentally roll over, discussing baseline risks in the absence of the intervention and the intervention's likely effectiveness in reducing those risks. A key issue in developing this scenario is ensuring that respondents both understand and accept it. Rejection may occur, for example, if the respondent views the intervention as infeasible or believes that someone else should be responsible for its costs. The scenario description also includes the form in which payment will occur; i.e., the "payment vehicle." For a consumer product, it may be appropriate to compare a safer but higher-priced product with a less safe, lower-priced product. In other cases, the cost of the intervention may be represented as an increase in sales or other taxes or a general increase in the prices of goods and services.

The scenario description is followed by questions designed to elicit WTP, which may be followed by questions that probe the rationale for the responses. For a study that asks about a specific intervention, the valuation question is typically framed as a dichotomous choice; i.e., individuals are asked whether they would choose the intervention if the cost was a specified amount (often called a "bid"). This amount should be varied across respondents, so that researchers can estimate the distribution of WTP (i.e., the fraction of respondents whose WTP exceeds each of the bids). Respondents are often presented with a follow-up valuation question, in which the bid is increased for respondents who said they would choose the intervention at the initial bid and decreased for respondents who said they would not choose the intervention. The results of these two questions provide tighter bounds on a respondent's WTP than does the result of only the initial valuation question.

For choice experiments, the valuation question typically consists of three or more options (e.g., the status quo and two alternatives that differ in product characteristics and prices) and the respondent is asked to choose the option he or she most prefers. This is typically followed by additional questions that are similar in format but the prices and other

[23] See Corso, Hammitt and Graham (2001) for more discussion of this issue, including the use of visual aids to increase respondent understanding of small risk changes.

attributes options are changed, allowing researchers to estimate how respondents' preferences depend on the prices and attribute levels.

Typically, demographic information (e.g., on age, gender, and income) is collected at the end of the survey. Because longer surveys often require more effort and expense to achieve a reasonable response rate, surveys are frequently designed to be completed in a relatively short period; often less than 30 minutes.

Effectively addressing the challenges discussed above, as well as other challenges related to developing and implementing stated preference surveys, generally requires the involvement of experienced researchers. In addition, substantial effort is needed to pretest the survey instrument, and appropriate statistical methods must be used when analyzing the results.

For this and previous projects, we and others reviewed the academic literature to identify examples of studies that employ stated preference methods to estimate WTP to reduce nonfatal injury risks (ICF 2010, IEc and Robinson 2011, Robinson and Hammitt 2012). As introduced earlier, a key issue is whether this literature supports the development of a consistent, generic valuation approach that can be applied across CPSC regulations that address diverse risks. We found a small number of studies that provide estimates for injuries in different severity categories, but not at the level of disaggregation provided in NEISS.

The available studies are generally conducted outside of the United States and do not address consumer products. Many focus on transportation safety. For example, Jones-Lee *et al.* (1995) elicit WTP to reduce risk of fatality and of six injuries of varying severity from motor-vehicle crashes in the United Kingdom. Hensher *et al.* (2009) estimate WTP for permanent, major, or minor injuries per person per car trip in Australia, then combine these estimates with information on traffic flows to estimate the value for each injury type. Hensher *et al.* (2011) use a similar approach to assess fatal and nonfatal injuries to pedestrians. More recently, Haddak et al. (2016) survey a small sample of French residents to determine their WTP to avoid the risk of minor, moderate, or serious injuries from traffic accidents. A few studies have used these methods to address crime-related injuries. In particular, Atkinson (2005) conducted a stated preference study of crime risks in the United Kingdom, including assaults with no injury or with moderate or serious injuries. The resulting values are likely to reflect the emotional impact of being a crime victim as well as other attributes that are less relevant to valuation of injuries associated with consumer products. Thus new work would be needed to provide U.S. values for the types of injuries addressed by CPSC regulations.

Revealed Preference Methods

The starting point for the application of revealed preference methods involves identifying a market good or behavior that is related to the outcome of concern. The revealed preference methods most frequently used to value nonfatal injuries include wage-risk studies and averting-behavior studies. The details of the method vary depending on the

behavior or product considered and on the data available. In general, such studies often involving combining data from more than one source to estimate the effects of risks and other attributes on price, using statistical methods to separate the effects of risks of fatal and nonfatal injuries from the effects of other characteristics such as education or age. As is the case with stated preference research, a key issue is whether individuals understand the magnitude and effects of the risk reduction that is addressed.

Many of these studies focus on the valuation of mortality risk reductions (i.e., the VSL) but may also provide information on the value of nonfatal injuries. The largest body of such research examines the trade-offs between worker compensation and job-related risks. In these studies, researchers need to control for nonfatal risks, to separate the effects of fatalities from the effects of other types of injuries on wages. Typically, nonfatal risks are defined as aggregates of many types and severities of injuries, either the overall injury rate, the rate for injuries severe enough to result in a lost workday, or the rate of lost workdays.

A review by Viscusi and Aldy (2003) identified 40 studies from around the world that consider the relationship between nonfatal risks and wages, and found that most estimates were between about $20,000 to $70,000 per injury (2000 dollars), with several larger values. More recently, Viscusi (2013) summarized 16 U.S. studies that use improved data on fatality risks from the Census of Fatal Occupational Injuries (CFOI) as well as data on other worker characteristics from the Current Population Survey (CPS), Panel Study of Income Dynamics (PSID) or elsewhere; Robinson and Hammitt (2016) review the quality of these and other studies and their applicability to regulatory analysis. However, these reviews focus on the VSL estimates, and do not report the values for nonfatal injuries. A perhaps more useful source is Gentry and Viscusi (2016), who explicitly examined the effect of morbidity prior to death on VSL as well as the value of nonfatal injuries. They found that the morbidity component of fatality risks constituted between 6 percent and 25 percent of the VSL, based on the average amount of time the person lived with the injury. For nonfatal injuries, the values ranged from $152,000 to $158,000 (2008 dollars) per case. The values from these and other wage-risk studies cannot be easily adjusted to reflect the substantial variation in injury severities associated with different consumer products, given that they reflect the average value of a wide range of job-related injuries.

Alternatively, studies of averting behavior and protective measures can also be used to value injury risk reductions. Although such studies often focus on risks associated with products similar to those regulated by CPSC, the majority address fatalities rather than nonfatal injuries. For instance, Blomquist (2004) reviews a series of studies that consider decisions related to transportation safety and housing locations to estimate VSL. Examples of the choices addressed by these studies include driving speed and the use of bicycle helmets and seat belts. Such studies are often not recommended for use in benefit-cost analysis, because they have important limitations. One such challenge is that it is often difficult to estimate the size of the associated risk change; another is that it is often necessary to separately estimate the value of key inputs such as the time spent in the

activity. However, a well-designed study may be particularly useful to CPSC, given that such studies can be used to directly address the types of risks it regulates.[24]

3.2.2 AVERTED COST APPROACH

For nonfatal injuries, few direct estimates of WTP are available. Thus, regulatory analysts generally rely on other measures to value benefits. These approaches generally involve summing various impacts of injury, rather than using the methods described in the previous section to develop more holistic values.

One frequently applied approach involves estimating the averted costs associated with reduced injury incidence, including medical treatment and lost productivity. In cost of illness (COI) studies, medical costs may include those paid by patients, their families, and/or third parties (such as insurance companies) as well as employers. They typically include direct costs associated with physician services, medication, and hospital stays.

Many COI studies also include the indirect costs associated with lost productivity. These indirect costs may stem from absence from work or from decreased productivity while at work, and may also include employer costs such as those associated with idle assets or training replacement workers. Some studies consider unpaid work (e.g., volunteer and household services) as well as paid work. Productive time is generally valued using measures of compensation; often referred to as the "human capital" approach. Studies may also include other costs such as those related to litigation or to processing insurance claims.

The logic behind using averted costs to value benefits is that, if a regulation or policy allows society to avoid these costs, then the benefits of the regulation are at minimum equal to these averted expenditures. However, this approach does not yield estimates of WTP and is not entirely consistent with the benefit-cost analysis framework.

The most significant injury-related costs are often medical treatment and lost work time; thus we focus on the issues related to estimating these costs below.[25] The use of cost measures for valuing these impacts is problematic for several reasons. In the case of medical costs, the principles discussed in Section 3.1 are very challenging to implement. In competitive markets, prices usually provide reasonable estimates of opportunity costs. However, health care markets are significantly distorted by information gaps and asymmetries, government regulation (including insurance mandates), disproportionate market power, taxes, and other factors, which means that market prices may diverge significantly from opportunity costs. In addition, prices are not easily discernable due to

[24] Such studies may also be used to estimate WTP for all aspects of a safety warning, rather than for particular risk reductions that result. For example, Graff Zivin et al. (2011) consider the effect of tap water quality violations on purchases of bottled water, which likely captures related concerns about a variety of health risks as well as other attributes of alternative water sources.

[25] For examples of the other types of averted costs that may be considered, see Blincoe et al. (2014) for discussion of the impacts that the National Highway Traffic Safety Administration (NHTSA) includes in its estimates.

the bundling of services and cross-subsidization. There is no consensus on best practices for estimating medical costs in regulatory analyses, and different approaches can lead to significantly different estimates. We provide examples of key issues related to estimating these costs as well as the value of lost production below, and reference sources that provide more information.[26]

Medical costs may be partially paid by the consumer and partially paid by insurance, and hence will not necessarily reflect the individual's willingness to exchange his or her own income for improved health. The availability of insurance may lead individuals to seek treatment that they would not have willingly paid for themselves, in which case treatment costs will overstate their WTP for that treatment (although not necessarily their WTP to avoid the injury or other health condition).[27] However, treatment may not return an individual to his or her original health state, whereas a CPSC initiative may prevent an injury from occurring. Presumably, WTP for avoiding the injury entirely would exceed WTP for treatment, given that prevention eliminates the injury and treatment will not prevent the initial injury and may itself produce some discomfort. These effects may be counterbalancing in part; thus the relationship of treatment costs to individual WTP for risk reductions is uncertain.

Estimates of averted costs frequently include the value of lost production, typically calculated by multiplying an estimate of hourly compensation by the number of hours of productive work lost due to injury. At times, both paid and unpaid work (household or volunteer) is included, raising issues about how to appropriately value the latter. Valuing unpaid time raises particularly difficult issues for those who do not participate in the paid work force (including children and the elderly).[28]

The use of compensation measures to value injury-related productivity losses raises a number of other issues. In general, the opportunity cost of paid work time may be best approximated by the cost of labor to the employer. The standard economic model assumes that employers are willing to incur labor costs less than or equal to the value of workers' marginal product. Conceptually, this amount represents the value of what a worker would have produced if his or her efforts were not altered as a result of an injury. At minimum, from the employers' perspective, this value includes pre-tax wages and benefits.

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[26] Under a separate contract, IEc is currently developing general guidance for estimating medical costs and valuing changes in time use to support regulatory analyses conducted by the U.S. Department of Health and Human Services. This guidance will address the issues discussed in this section as well as other issues that arise in estimating these values.

[27] As noted elsewhere in this report, to the extent that third party costs (such as insured medical expenses) are not included in estimates of individual WTP estimates, they may be added to the WTP estimates to more fully reflect the total impact of the risk reduction on social welfare.

[28] Losses in leisure time are typically not included in cost of illness studies because these studies focus on the economic burden of illness or injury.

For unpaid productive time, such as household and volunteer work, determining how to most appropriately apply compensation measures is more difficult. Presumably, individuals choose to engage in nonmarket production, or in other leisure activities, when the value of this unpaid time exceeds the incremental income they would receive from paid work. Post-tax wages may be used to value this time (rather than full compensation) under the assumption that individuals focus on their take-home pay in their personal decision-making. It is unclear, however, whether they also consider employment-related benefits (such as health care) in these decisions.

The reliance on compensation measures under this human capital approach focuses on productivity and ignores any utility or disutility that individuals gain from different types of time use, aside from what is captured in the wage rate. Individuals' WTP may vary significantly from these compensation measures because the market often restricts their ability to trade-off different types of time use; e.g., it does not allow complete flexibility in the number of hours worked.

Averted costs do not include the value of avoiding pain and suffering nor other quality of life impacts. This leads many researchers to believe that such cost estimates may significantly understate WTP. However, the degree of understatement will vary depending on the characteristics of the health effect, the types of costs considered, and the design of the study. More work is needed to better understand how the challenges discussed above affect this comparison.[29]

Finally, although averted cost methods are often viewed as relatively easy to implement and interpret, comparison across studies suggests that they can lead to substantially different results depending on the details of the approach (e.g., Bloom *et al.* 2001; Akobundu *et al.* 2006). Recognizing the importance of this issue, the Agency for Healthcare Research and Quality (AHRQ) and the National Cancer Institute (NCI) co-sponsored a 2007 workshop on related issues. The resulting papers appear in a special issue of *Medical Care* (Yabroff *et al.* 2009). The researchers summarize the issues as follows:

> *"...the development of valid, reliable, feasible, and comparable (across studies) measures of health care cost has proved to be challenging, both in the United States and elsewhere. Substantial variation exists across studies in data and methods, even for cost studies with seemingly a similar intent.*
>
> *One major source of difficulty lies with the data. In most health cost analyses, the data for measuring and valuing resource use were created for purposes other than health care costing (primarily reimbursement) and hence are imperfectly designed for the task at hand. The alternative approach, to collect the cost data de novo, is often expensive, and there is not yet consensus on how best to do it.*

[29] To address pain and suffering and other quality of life impacts, some analysts add estimates of monetized QALYs or jury awards to averted cost measures, as discussed in more detail below.

> *Health care costs are inherently difficult to measure, whatever the choice of data source(s). For multiple reasons, the posted prices of health care goods and services often do not convey accurate or useful information about economic cost. The health care system produces literally thousands of heterogeneous products, whose individual "prices" are often not observed in the complex maze of pricing for bundled services. Moreover, observed prices may reflect differences in market power between buyers and sellers (as reflected, for example, in negotiated price discounts), efforts to cross-subsidize unprofitable services, and other market imperfections and idiosyncrasies.*
>
> *A second source of difficulties in health care costing is the absence of professional consensus on some data and methods issues. At a general level, there is universal agreement that the cost of any health care activity should be defined in terms of the "economic opportunity costs" of the component resources, with each resource valued in its next best use. In reality, there are substantial variations in how this textbook definition is applied because it provides little specific guidance on a number of practical issues. These include the components (or types) of cost to be included in the analysis, the assignment of opportunity cost values to these components, when and how to combine multiple data sources, key conceptual and study design issues (eg, identifying the cost attributable to a specific disease or activity), statistical challenges (eg, how best to handle heavily right-skewed cost data), and effective approaches for reporting findings." (Lipscomb et al., 2009, p. S1.)*

Several authors have reviewed the approaches used to estimate medical costs in the health care literature and discussed best practices for application in that context (e.g., Clabaugh and Ward 2008, Yabroff et al. 2009, Larg and Moss 2011, Onukwugha et al. 2016, Sanders et al. 2016). However, this work does not explicitly address the consistency of these approaches with the benefit-cost analysis context and the underlying conceptual framework introduced above, focusing instead largely on the conduct of cost-effectiveness analyses or costing studies.

Thus averted cost estimates are a widely-used and relatively easy to implement method for valuing injury risk reductions, but require careful application and interpretation given the issues raised above. While not a direct estimate of WTP, they estimate costs potentially averted by decreased injury incidence. More work is needed, however, to develop a consistent approach for estimating these costs that is appropriate for use in benefit-cost analysis and that addresses the implications of related uncertainties. Ideally, estimates of individual WTP would be developed to avoid the need to use such proxy measures. Any costs not included in the WTP estimate, such as medical costs paid by insurers, can then be added to this estimate.

3.2.3 MONETIZED QALY APPROACH

Another approach for valuing injury risk reductions in policy and regulatory analysis involves applying monetized QALYs, in addition to or instead of averted cost measures. QALYs are a non-monetary measure of the effects of injury or illness on the health-related quality of life over time. They allow analysts to combine the impacts of various conditions into a single measure, that can encompass fatalities as well as nonfatal health impacts. Originally developed for use in ranking or prioritizing public health problems and in analyzing the cost-effectiveness of health policy and medical treatment decisions, QALYs are at times assigned dollar values and used for valuation in regulatory benefit-cost analyses.

Conceptually, QALYs focus on an individual's willingness to trade-off different health states and longevity. These trade-offs are usually represented by placing the health-related quality of life (HRQL) impacts of each state on a scale anchored by death (a value of 0) and by perfect or full health (a value of 1.0). For example, a minor injury could lead to an HRQL value close to 1.0 (assuming the individual's health is not otherwise impaired), while a very severe injury could lead to an HRQL level closer to zero. The types of quality of life impacts considered depend on the approach used, but may include physical effects (e.g., mobility limitations) as well as psychological effects (e.g., pain and anxiety). These HRQL impacts are then multiplied by the duration of the health state to estimate the associated QALYs. Using QALY estimates in benefit-cost analysis requires an additional step to estimate their monetary value. Typically, this value is a constant, often based on estimates of the value per statistical life year (VSLY).

These calculations are illustrated in simple terms in Exhibit 3-3. In reality, each of these steps involves a number of complex assumptions and considerations, as briefly summarized below and discussed in more detail in IOM (2006) and in the other resources we reference.

EXHIBIT 3-3

SIMPLIFIED ILLUSTRATION OF THE CALCULATION OF MONETIZED QALY GAINS

1. If "with condition" HRQL is 0.8, and "without condition" HRQL is 0.9, then the HRQL decrement attributable to the condition is 0.1.
2. If this condition persists for 5 years, then the QALY gain associated with preventing the condition is 0.5 (HRQL decrement averted = 0.1 * 5 year duration).
3. If a QALY is valued at $400,000, then the value of this gain would be $200,000 (0.5 QALYs * $400,000 per QALY).

Note: For this simple example, the QALY gains are not discounted over time; however, they should be discounted when applying this approach in regulatory analysis.

Constructing QALY Measures

QALY estimates can be developed using new primary research; e.g., by surveying the affected population to estimate their HRQL for the injuries of concern then multiplying by the expected duration. However, analysts often rely on other approaches that require less time and funding to implement. A frequently used option is to apply one of several generic HRQL indices, which employ standardized classification systems with several dimensions. For example, the EuroQol (EQ)-5D includes the dimensions of mobility, self-care, usual activities, pain, and anxiety and depression. A particular health state is rated within each dimension; e.g., as causing no, some, or extreme problems. Each attribute of the health state (such as having "some" problems with mobility) is then weighted based on a survey developed especially for that index. Such indices have the advantage of standardizing the approach for describing each health state and including pre-established preference weights for each attribute. QALY estimates are available for a wide-range of conditions, due to the inclusion of HRQL indices in population data bases such as the Medical Expenditure Panel Survey (MEPS) and the large number of cost-effectiveness analyses that use QALYs as the outcome measure.[30]

A series of expert panels have addressed best practices for estimating QALYs. Of particular relevance to this project, an expert panel (convened by the Institute of Medicine (IOM) and funded by a consortium of Federal agencies) published a report on the use of QALYs in regulatory cost-effectiveness analysis (IOM 2006). That report includes recommendations for improving QALY measurement, which have not yet been integrated into the official OMB guidance (OMB 2003) nor fully implemented across the affected regulatory agencies. The recommendations related to the construction of QALY

[30] Completed studies are cataloged in a Cost-Effectiveness Analysis Registry maintained by the Tufts Center for the Evaluation of Value and Risk in Health; see http://healtheconomics.tuftsmedicalcenter.org/cear4/Home.aspx.

estimates are provided in Exhibit 3-4; the report also provides recommendations on how the results of cost-effectiveness analyses are reported and used, as well as recommendations for further research, including work to improve the approaches used to estimate impacts on children.[31]

EXHIBIT 3-4

RECOMMENDATIONS FOR DEVELOPING QALY ESTIMATES FOR USE IN REGULATORY ANALYSIS (IOM 2006)

Regulatory CEAs [cost-effectiveness analyses] that integrate morbidity and mortality impacts in a single effectiveness measure should use the QALY to represent net health effects.

- QALY estimates should be based, to the greatest possible extent, on research that considers the risk characteristics addressed and the population affected by the regulatory intervention.
- The index values estimated for health conditions or health states of interest should be based on information from the population affected by the costs, benefits, or other impacts of the regulatory intervention, which for most economically significant regulations will be best represented by the general U.S. population.
- In the absence of direct preference elicitation for health conditions of interest from the affected population, QALY estimates should be based on well-developed, generally accepted, and widely used generic HRQL indexes, whose valuation is based on general population samples.
- The characterization of the health states or conditions of interest using generic HRQL indexes should be based on information obtained from people who are familiar with the conditions, such as patients."

The life-year and QALY estimates used in regulatory analyses should reflect actual population health as closely as possible, comparing the predicted HRQL and life expectancy of the affected population in the absence of the intervention (i.e., the regulatory baseline) to the predicted postintervention HRQL and health-adjusted life expectancy."

Source: Extracts from IOM (2006), pp. 11-12.

These recommendations address three limitations of many previously developed QALY estimates. First, descriptions of the effects of a health condition on HRQL were often developed based on the opinions of medical experts or others, which may differ from the views of patients who have experienced the effect. Second, the weights placed on different health states (i.e., their placement on the zero-to-one scale) were often derived from small subpopulations or from non-U.S. samples, not from the populations likely to be affected by Federal regulations. Third, many studies compared health status with the

[31] The report recommended that QALYs not be monetized for use in benefit-cost analysis, but recognized that monetization may be necessary in the near-term given the lack of WTP estimates.

condition to perfect or full health (HRQL of 1.0), whereas the population affected may not be in perfect health even in the absence of the condition of concern. Newer work increasingly addresses these and other limitations of past approaches.

These and other issues related to estimating QALYs are also addressed in the recently released report of the Second Panel on Cost-Effectiveness in Health and Medicine (Sanders et al. 2016, Neumann et al. 2016). That report focuses on cost-effectiveness analyses of health-related interventions, rather than on benefit-cost analysis of the types of regulatory interventions discussed in this report. However, its recommendations are likely to be influential, and may have implications for regulatory benefit-cost analysis.

QALYs are consistent with the conceptual framework that underlies benefit-cost analysis only under certain restrictive assumptions. As discussed in more detail in Hammitt (2015), they are assumed to be independent of other factors that may affect an individuals' well-being. Several scholars have derived sets of conditions under which QALYs would reflect individual preferences (e.g., Pliskin et al. 1980, Bleichrodt et al. 1997). The two most important are that (1) the HRQL associated with a health state depends only on that state and is independent of its duration, prior or succeeding health states, and other factors such as wealth; and (2) preferences for patterns of mortality risk over time (given a constant health state) are consistent with restrictions related to the degree of risk aversion toward longevity.

Valuing QALYs

Another step is needed for benefit-cost analysis: the QALY estimates must be assigned a dollar value. Analysts often assume that the value of a QALY is a constant, derived from estimates of VSL. As discussed in more detail in Robinson and Hammitt (2016) and elsewhere, VSL is an individual's marginal rate of substitution between money and risk of dying in a defined time period, reflecting individual's willingness to spend on small increases in survival probability rather than purchasing other goods and services. Conventionally, VSL is calculated by estimating individuals' WTP for a small change in their own mortality risk and dividing by the risk change. For example, if an individual is willing to pay \$900 for a 1 in 10,000 reduction in his risk of dying in the current year, his or her VSL is \$9.0 million (\$900 WTP ÷ 1/10 000 risk change). It is not the value of saving an individual's life with certainty.

This VSL is then typically converted into a constant VSLY by dividing it by the expected number of life-years remaining for an individual of mean age in the underlying study. (In these calculations, life-years are usually discounted to reflect time preferences.) In other words, if a study yields a mean VSL of \$9.0 million, the mean individual in that study is age 40, and mean (population) life expectancy for an individual who reaches age 40 is an additional 35 years, the estimated VSLY would be about \$420,000 using a three percent discount rate. This VSLY is then multiplied by the expected QALY gains associated with a policy or regulation.

An alternative is to use a value that reflects how health varies with age. The VSLY approach implicitly incorporates future health. However, future QALYs are generally less than future life years because health tends to deteriorate with age. Dividing the VSL by the present value of future QALYs yields an average value per QALY larger than the VSLY (see Hirth et al. 2000).

Estimates based on QALYs monetized using a constant value are likely to be less accurate than approaches based on direct estimation of WTP. The limitations of this approach relate in part to the characteristics of the QALY measure and in part to the approach used for valuation. The construction of the QALY assumes that how individuals value health states is independent of the duration of the state, the age at which it is experienced, the individual's remaining life expectancy, and his or her wealth and income (Hammitt 2002, IOM 2006). Moreover, QALYs do not explicitly account for the changes in wealth or income that result from changes in health, nor for how individuals are willing to trade-off spending on particular risk reductions versus spending on other goods and services. While the approach used for valuation attempts to account for these trade-offs, relying on a constant value per QALY does not reflect the likely variation in value due to factors such as duration and severity.[32]

A promising approach involves developing a valuation function for QALYs that better approximates individual WTP for these risk reductions, taking into account characteristics of the health effect such as severity and duration as well as individual characteristics such as income, health status, and age. An increasing number of empirical studies elicit WTP for a change in QALYs associated with particular health states. A recent review of these studies (Ryen and Svensson 2015) finds that the value per QALY varies depending on whether the gain is associated with life extension or with quality of life improvements, and also depends on the size of the gain. Two recent studies, Haninger and Hammitt (2011) and Hammitt and Haninger (2017), explore these relationships in the context of WTP for acute and chronic illness, and find that marginal WTP decreases sharply with the severity and duration of the illness, supporting the conclusion that WTP per QALY is not a constant.[33] In general, they find that WTP per QALY is more sensitive to severity than to duration.

3.2.4 JURY AWARDS

At times, jury awards are used rather than monetized QALYs to value the quality of life impacts of nonfatal injuries, including related pain and suffering -- particularly in the cost

[32] Another issue that arises in this context is whether the QALY estimates include lost productivity. As noted by the Second Panel on Cost-Effectiveness in Health and Medicine (Sanders et al. 2016, Neumann et al. 2016), there is substantial uncertainty about this issue. However, the Panel recommends that productivity losses be included in the cost measure, because they are not likely to be included in the QALY estimates. As discussed earlier, VSLY and other WTP measures are likely to include earnings losses as well as other effects of the risk reduction.

[33] We are currently working on a meta-analysis of studies that address WTP per QALY under a separate contract, to explore the use of these and other studies to develop a valuation function for use in regulatory analysis.

of crime literature as well as in CPSC's ICM as discussed in more detail below (see also Rodgers 1993, Viscusi 2007, Aiken and Zamula 2009, and Cohen 2016 for more information). Compensation in such cases generally includes both economic and noneconomic damages; economic damages reflect concepts similar to those discussed in the averted cost section above. We focus on noneconomic damages here.

Payment of noneconomic damages is intended to compensate for the pain and suffering of the victim as well as the family in some cases. Like averted costs and monetized QALYs, these damages are *ex post* values for a condition that has already been experienced, rather than e*x ante* values for a risk reduction. These payments do not represent an individual's willingness to exchange his or her own income for a change in risk. Rather, they reflect a value calculated by a jury given the legal context and their view of the particular case. Because such damages vary depending on the circumstances of the case, researchers often develop statistical models to adjust for the characteristics of the injury and other factors when using jury awards for valuation.

Aiken and Zamula (2009) specifically address the relationship between jury awards for pain and suffering in product liability cases and QALYs, using QALY estimates developed using the Injury Impairment Index to support CPSC's ICM (*Miller et al.* 2000).[34] They find that injury severity, measured in terms of lost QALYs, is a key determinant of the size of the awards for pain and suffering. The implied mean value per QALY is about $50,000, substantially less than the VSLY estimates often used to monetize QALYs.

As is the case for averted costs and monetized QALYs, jury awards diverge from the principles that underlie the conceptual framework for benefit-cost analysis. In the absence of new primary WTP research, we simply cannot know the extent to which summing averted costs and jury awards leads to values that are similar to inidividual WTP for reductions in nonfatal injury risks.

3.3 APPROACHES USED IN FEDERAL REGULATORY ANALYSES

The approach used to value risk reductions in Federal regulatory analyses is determined, at least in part, by guidance issued by OMB to implement Executive Order 12866 (Clinton 2003), as supplemented by Executive Order 13563 (Obama 2011). This implementing guidance is contained in OMB's *Circular A-4*, *Regulatory Analysis* (2003), and clarified in OMB (2010) and Sunstein (2011), and discusses how to value health risk reductions in both benefit-cost and cost-effectiveness analysis. We recognize that, because CPSC is an independent commission, its regulations and the accompanying analyses are not subject to OMB review. However, CPSC generally develops its benefit-cost analyses in accordance with OMB guidance. It is also important to recognize that OMB's guidance is now more than 10 years old, and does not reflect recent research or

[34] As discussed in more detail below, CPSC does not currently use these QALY estimates in valuing nonfatal injuries.

the evolving standards for best practices. For example, as noted earlier, it has not been updated to reflect the IOM (2006) guidance on estimating QALYs, nor has it been updated to reflect the evolving VSL research and associated work on best practices (e.g., DOT 2016, Robinson and Hammitt 2016).[35]

For benefit-cost analysis, *Circular A-4* notes that estimates of WTP based on the preferences of the affected population are the most appropriate measure of benefits, consistent with the discussion in the prior section. OMB further indicates that estimates from well-conducted revealed preference studies may be preferable to those based on stated preference studies, but that professional judgment is needed to determine which approach is best. *Circular A-4* provides criteria for evaluating the quality and applicability of each type of study, based on the then-available understanding of key issues.

Circular A-4 also indicates that WTP estimates are preferred over COI measures. However, individual WTP may only include the private gains or losses that accrue directly to the individual who would receive the risk reduction. In such cases, *Circular A-4* suggests that it may be desirable to add the medical costs financed by third parties, and/or productivity costs not experienced by the affected individuals, to the estimates of WTP. *Circular A-4* also supports the use of monetized QALYs for valuation when WTP estimates are not available, and references its intent to commission the 2006 IOM report discussed above. As noted earlier, OMB has not formally accepted or rejected the recommendations that resulted from the IOM effort.

Circular A-4 provides Federal agencies with some flexibility in determining the valuation approaches they use in their regulatory analyses. The approach ultimately applied results from negotiation between OMB and the agency when OMB reviews a rule and the accompanying analysis prior to promulgation. Although increased standardization across agencies is one of the stated goals of *Circular A-4*, agencies subject to OMB review currently vary in the approaches used to value fatal and nonfatal risk reductions.[36]

3.3.1 MAJOR FEDERAL REGULATORY AGENCIES

Of the major Federal regulatory agencies, only the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Transportation (DOT) have issued guidance on valuing nonfatal risk reductions; the U.S. Department of Health and Human Services (HHS) is currently in the process of finalizing its guidance. Other agencies less frequently

[35] The 2006 IOM report was completed at the request of OMB and was funded by a consortium of Federal agencies. In its annual Reports to Congress (e.g., OMB 2015), OMB notes that it continues to work with the agencies on implementing the IOM recommendations.

[36] We focus on nonfatal injuries in this report. The approaches used to value fatalities are discussed in EPA (2014), DOT (2016) and Robinson and Hammitt (2016). EPA is currently working with its independent Science Advisory Board to finalize the approach for updating its values.

issue major regulations that require the valuation of nonfatal risks, and do not necessarily use consistent approaches across their analyses.

Both EPA and HHS regulations generally address nonfatal illnesses rather than injuries. EPA applies WTP estimates to the extent possible and relies on averted cost estimates when necessary (see, for example, EPA 2015). In contrast, when WTP estimates are not available, HHS combines estimates of averted costs and monetized QALYs to value nonfatal risk reductions. HHS agencies, such as the U.S. Food and Drug Administration (e.g., FDA 2015, Minor et al. 2015), typically first estimate the QALY gains associated with each regulatory option, then monetize them using a constant value per QALY, often testing the effects of a range of estimates to reflect associated uncertainties. They then add averted medical costs to these monetized QALYs to estimate the total value of the averted illness.

DOT is interested primarily in valuing nonfatal injuries rather than illnesses. Its approach typically includes two components. [37] First, at the departmental level (DOT 2016), DOT provides guidance on using monetized QALYs to value injuries of differing severities, noting that review and revision of its approach may be warranted. Second, its component agencies often add estimates of averted costs to the monetized QALY estimates. We discuss the DOT approach in more detail below. It was developed by some of the same researchers involved in the creation of CPSC's ICM, and is similar in many respects. Both agencies incorporate measures of averted costs and add the value of quality of life impacts; however, DOT relies on estimates of monetized QALYs for the latter, while CPSC relies on jury awards.

The DOT-wide guidance categorizes nonfatal injuries by severity using the Abbreviated Injury Scale (AIS), then calculates the monetized QALY losses associated with injuries in each AIS category. The AIS is published by the Association for the Advancement of Automotive Medicine (AAAM, 2008) and provides "an anatomically-based, consensus-driven, global severity scoring system that classifies each injury by body region according to its relative importance on a 6-point ordinal scale" (AAAM, 2008, p. 2). The six-point scale is used to categorize injuries from minor to unsurvivable.[38] The placement of injuries on the scale is determined by a group of experts who take into account factors such as the risk of death, the extent of tissue damage, the need for hospitalization, the effect on quality of life, and other issues. If an individual is affected by more than one injury, the Maximum AIS (MAIS) is used in categorizing the set of injuries.

DOT's QALY estimates were originally derived using the Injury Impairment Index, which focuses on changes in functional status over time, based on an approach described

[37] For a more detailed discussion of the history of this approach and its advantages and limitations, see Robinson (2004), IOM (2006), and IEc and Robinson (2011) as well as the sources cited in the text.

[38] In addition to the five categories illustrated in Exhibit 3-5, the AIS includes a sixth category that it describes "Currently Untreatable." DOT calls these injuries "Unsurvivable" and treats them as fatalities.

in Miller *et al.* (1991) and Miller *et al.* (1995). However, the preference weights for different health states that DOT currently uses are based on Spicer and Miller (2010, 2011). DOT estimates the median fraction of a QALY associated with injuries in each AIS category, then multiplies these fractions by its standard VSL estimate to determine the value of averting injuries in each category.[39] For example, if an injury is in an AIS category for which the fraction is five percent, this means that its dollar value is five percent of the value of a life saved, and averting 20 such injuries would have the same value as averting one fatality.

Exhibit 3-5 presents the current DOT VSL fractions (or relative disutility factors) for each AIS category.

EXHIBIT 3-5 DOT'S RELATIVE DISUTILITY FACTORS

MAIS CATEGORY	SEVERITY	FRACTION OF VSL
1	Minor	0.003
2	Moderate	0.047
3	Serious	0.105
4	Severe	0.266
5	Critical	0.593
6	Unsurvivable	1.000

Source: DOT (2016), p. 10.

DOT's component agencies generally add estimates of averted costs to these VSL fractions. An example of this approach is provided in a recent report on the total costs of motor vehicle crashes (Blincoe *et al.* 2014), prepared by the National Highway Traffic Safety Administration (NHTSA) within DOT. In that report, as in its regulatory analyses, the averted injury-related costs include medical costs, earnings losses, household productivity losses, workplace productivity losses, insurance administration, emergency services, and legal costs. When combined with estimates of QALY losses monetized using DOT's 2013 VSL estimates, the resulting comprehensive costs for nonfatal injuries (AIS 1 through 5), range from about $37,000 to $5.7 million per injury case (2010 dollars).[40] Generally, the averted cost estimates are dominated by the value of lost productivity and medical costs. Monetized QALYs account for a significant fraction of

[39] DOT currently uses a updated VSL of $9.6 million (2015 dollars) (DOT 2016).

[40] We exclude property damage and congestion effects from these estimates, because they are associated with the motor vehicle accident rather than with specific injuries.

the total values, ranging from 60 percent for the least severe injuries (AIS 1) to about 80 percent for the most critical (AIS 5).

3.3.2 CPSC'S INJURY COST MODEL

To value nonfatal injuries, CPSC applies an approach that is similar to the approach used by DOT. In 1996, CPSC created the Injury Cost Model (ICM) (Miller et al. 2000). The ICM uses a variety of sources and methods to calculate the costs associated with non-fatal injuries reported in NEISS. Specifically, it combines a number of categories, including medical costs, lost productivity, and reduced quality of life.

The medical cost component includes lifetime medical costs for patients treated at hospitals, emergency departments, and a doctor's office or clinic. Costs are based on Finkelstein *et al.* (2006). As noted earlier, the NEISS data are collected from emergency departments. The ICM uses empirical relationships between the characteristics of injuries and demographic information of the victims initially treated in hospital emergency departments, and those treated in other settings, to estimate numbers of injuries treated outside of emergency rooms. These incidence estimates in the ICM were last updated in 2014 based on work done by Lawrence (2013). Costs for each of the types of injuries are calculated separately.

The value of lost work time includes lost productivity resulting from lost days of market (i.e., paid work) and nonmarket production (e.g., household or school work). The model includes short-term losses associated with recovery time and long-term losses associated with permanent disability. It also includes productivity losses incurred by family members or nonmedical caregivers. Finally, the model also includes the employer productivity losses (e.g., friction costs).

CPSC's ICM relies on a regression analysis of jury awards to value reduced quality of life (e.g., pain and suffering). The regression analysis explores the relation between the component of jury awards for pain and suffering and the characteristics of the injury and the person suffering the injury. According to Miller *et al.* (2000), intangible losses account for approximately 65 to 80 percent of the total cost of injury presented in the ICM.

The jury awards data are derived from the Jury Verdict Research (JVR) reports, which collect data on civil court damage awards from all 50 states and for roughly 40 percent of all verdicts. Critics note that these data are not random and emphasize high, or outlier awards (Cohen and Miller 2003; Smith 2000; as referenced in Aiken and Zamula 2009). Thus, award values may not be representative of populations experiencing the benefits of CPSC regulations.

3.4 IMPLICATIONS FOR CPSC ANALYSES

The discussion in this chapter suggests that, ideally, nonfatal injury risk reductions should be valued in benefit-cost analyses using estimates of individual WTP, adding any third party costs (such as third party costs) not included in the WTP measure. WTP is the measure most consistent with theory, it captures the full suite of attributes associated with risk reductions, and it mimics the types of trade-offs implicit in policy or regulatory decisions. However, developing defensible estimates of WTP that are applicable to the range of injuries addressed by CPSC regulations and other policies would require new primary research using stated or revealed preference methods; available studies do not address the range of injuries of interest to CPSC. In the interim, further review and refinement of the approaches used in the ICM may be desirable, both to ensure that the averted cost estimates are consistent with current guidance on best practices, and to perhaps replace the use of jury awards with estimates of monetized QALYs -- following the guidance in IOM (2006) and elsewhere on the appropriate derivation of QALYs for use in regulatory analysis.

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