AD_____

GRANT NUMBER: DAMD17-95-1-5066

TITLE: Injury to Women in the Military

PRINCIPAL INVESTIGATOR: Gordon S. Smith, M.D., M.P.H.

CONTRACTING ORGANIZATION: Johns Hopkins University
Baltimore, MD 21205

REPORT DATE: October 1996

TYPE OF REPORT: Annual

PREPARED FOR: Commander
U.S. Army Medical Research and Materiel Command
Fort Detrick, Frederick, Maryland 21702-5012

DISTRIBUTION STATEMENT: Approved for public release;
distribution unlimited

The views, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision unless so designated by other documentation.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	October 1996	Annual (18 Sep 95 - 17 Sep 96)

4. TITLE AND SUBTITLE
Injury to Women in the Military

5. FUNDING NUMBERS
DAMD17-95-1-5066

6. AUTHOR(S)
Gordon S. Smith, M.D., M.P.H.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Johns Hopkins University
Baltimore, MD 21205

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Commander
U.S. Army Medical Research and Materiel Command,
Fort Detrick, Frederick, Maryland 21702-5012

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release;
distribution unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

Injuries are the most serious health problem facing women in the military today. The overall goal of this study is to provide a comprehensive understanding of injuries to women in the military and to develop the basis for effective means to prevent specific injury problems. This study will begin with an analysis of data for serious injury (deaths and hospitalizations) in collaboration with Army, and later Navy investigators. Our work will expand the scope of their earlier studies and will then include injuries to women in the Air Force. In addition, a series of in-depth analytical studies will address specific injury problems in women (injuries related to alcohol, pregnancy, sports, training, etc.), using the ability to link records both within a single database and across different sources of data.

Drawing on our extensive experience analyzing injuries in civilian databases, this study is the first in-depth analysis of injuries to women in the military and will combine denominator data with numerator data from hospitalizations, fatalities, and lost-time injuries. These analyses will provide a better understanding of the unique injury hazards to women in the military and will form the basis for the development of sound prevention policies.

14. SUBJECT TERMS	15. NUMBER OF PAGES
Defense Women's Health Research Program	74
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	Unlimited

GENERAL INSTRUCTIONS FOR COMPLETING SF 298

The Report Documentation Page (RDP) is used in announcing and cataloging reports. It is important that this information be consistent with the rest of the report, particularly the cover and title page. Instructions for filling in each block of the form follow. It is important to *stay within the lines* to meet *optical scanning requirements.*

Block 1. Agency Use Only *(Leave blank)*.

Block 2. Report Date. Full publication date including day, month, and year, if available (e.g. 1 Jan 88). Must cite at least the year.

Block 3. Type of Report and Dates Covered. State whether report is interim, final, etc. If applicable, enter inclusive report dates (e.g. 10 Jun 87 - 30 Jun 88).

Block 4. Title and Subtitle. A title is taken from the part of the report that provides the most meaningful and complete information. When a report is prepared in more than one volume, repeat the primary title, add volume number, and include subtitle for the specific volume. On classified documents enter the title classification in parentheses.

Block 5. Funding Numbers. To include contract and grant numbers; may include program element number(s), project number(s), task number(s), and work unit number(s). Use the following labels:

C	- Contract	PR	- Project
G	- Grant	TA	- Task
PE	- Program Element	WU	- Work Unit Accession No.

Block 6. Author(s). Name(s) of person(s) responsible for writing the report, performing the research, or credited with the content of the report. If editor or compiler, this should follow the name(s).

Block 7. Performing Organization Name(s) and Address(es). Self-explanatory.

Block 8. Performing Organization Report Number. Enter the unique alphanumeric report number(s) assigned by the organization performing the report.

Block 9. Sponsoring/Monitoring Agency Name(s) and Address(es). Self-explanatory.

Block 10. Sponsoring/Monitoring Agency Report Number. *(If known)*

Block 11. Supplementary Notes. Enter information not included elsewhere such as: Prepared in cooperation with...; Trans. of...; To be published in.... When a report is revised, include a statement whether the new report supersedes or supplements the older report.

Block 12a. Distribution/Availability Statement. Denotes public availability or limitations. Cite any availability to the public. Enter additional limitations or special markings in all capitals (e.g. NOFORN, REL, ITAR).

- **DOD** - See DoDD 5230.24, "Distribution Statements on Technical Documents."
- **DOE** - See authorities.
- **NASA** - See Handbook NHB 2200.2.
- **NTIS** - Leave blank.

Block 12b. Distribution Code.

- **DOD** - Leave blank.
- **DOE** - Enter DOE distribution categories from the Standard Distribution for Unclassified Scientific and Technical Reports.
- **NASA** - Leave blank.
- **NTIS** - Leave blank.

Block 13. Abstract. Include a brief *(Maximum 200 words)* factual summary of the most significant information contained in the report.

Block 14. Subject Terms. Keywords or phrases identifying major subjects in the report.

Block 15. Number of Pages. Enter the total number of pages.

Block 16. Price Code. Enter appropriate price code *(NTIS only)*.

Blocks 17. - 19. Security Classifications. Self-explanatory. Enter U.S. Security Classification in accordance with U.S. Security Regulations (i.e., UNCLASSIFIED). If form contains classified information, stamp classification on the top and bottom of the page.

Block 20. Limitation of Abstract. This block must be completed to assign a limitation to the abstract. Enter either UL (unlimited) or SAR (same as report). An entry in this block is necessary if the abstract is to be limited. If blank, the abstract is assumed to be unlimited.

FOREWORD

Opinions, interpretations, conclusions and recommendations are those of the author and are not necessarily endorsed by the U.S. Army.

Yes Where copyrighted material is quoted, permission has been obtained to use such material.

Yes Where material from documents designated for limited distribution is quoted, permission has been obtained to use the material.

Yes Citations of commercial organizations and trade names in this report do not constitute an official Department of Army endorsement or approval of the products or services of these organizations.

___ In conducting research using animals, the investigator(s) adhered to the "Guide for the Care and Use of Laboratory Animals," prepared by the Committee on Care and use of Laboratory Animals of the Institute of Laboratory Resources, national Research Council (NIH Publication No. 86-23, Revised 1985).

Yes For the protection of human subjects, the investigator(s) adhered to policies of applicable Federal Law 45 CFR 46.

Yes In conducting research utilizing recombinant DNA technology, the investigator(s) adhered to current guidelines promulgated by the National Institutes of Health.

Yes In the conduct of research utilizing recombinant DNA, the investigator(s) adhered to the NIH Guidelines for Research Involving Recombinant DNA Molecules.

Yes In the conduct of research involving hazardous organisms, the investigator(s) adhered to the CDC-NIH Guide for Biosafety in Microbiological and Biomedical Laboratories.

G. S. Eadie 10/16/96

PI - Signature Date

TABLE OF CONTENTS

- TITLE PAGE ---------- 5
- INTRODUCTION ---------- 6
- FIRST YEAR PROJECT ACTIVITIES: September 1995-1996 ---------- 6
  - Patient Confidentiality and Data Management ---------- 8
- METHODOLOGICAL CHARACTERISTICS of ARMY HOSPITALIZATION DATA ---------- 10
  - Hospital Record Flow and Database Format ---------- 11
  - Preliminary Analysis of Number and Type of Injuries ---------- 13
  - Denominators and Rate Calculations ---------- 13
  - Stratification by Subgroups ---------- 14
  - Evaluation of Cause of Injury Coding ---------- 15
  - Musculoskeletal Conditions ---------- 17
- SUMMARY OF TASKS COMPLETED ---------- 17
- CONCLUSION ---------- 19
- APPENDIX 1 - Frequency Tables (3 Sections) ---------- 20
- APPENDIX 2 - Graphs (2 Sections) ---------- 30
- APPENDIX 3 - "A Hidden Epidemic" (Chapter 3) ---------- 55

INJURIES TO WOMEN IN THE MILITARY -- GRANT # DAMD17-95-1-5066

YEAR 1. ANNUAL REPORT -- September 1996 - September 1997

INTRODUCTION

Injuries are the most serious health problem facing women in the military today. While the role of women has been increasing in the military, limited consideration has been given to how injuries to women may differ from their male counterparts. Injuries are the leading cause of death for all women less than 35 years of age, however the specific problems of injuries to women have not been well studied in either civilian or military populations. The comprehensiveness of the military data provide a unique opportunity for study that encompasses both occupationally-related injury as well as injuries that personnel incur while they are not on active duty. Both types of injuries result in significant costs to the military and may have major impacts on troop readiness.

FIRST YEAR PROJECT ACTIVITIES: September 1995-1996

Activities during the first year have primarily involved data acquisition, exploratory data analyses, understanding data strengths and weaknesses and familiarization with the unique

aspects of Army data. We have also resolved issues regarding personnel, organization, computer capabilities, human subjects, and confidentiality. The program manager and computer programmer/data analyst were hired for the Injuries to Women in the Military (IWM) project and office facilities established in the Fall of 1995.

Computer equipment capable of managing the extremely large and complex military data sets has been placed on line at the Hopkins Center for Injury Research and Policy. Given the necessary data linkage process, further computer data storage space will be needed and we are now exploring the availability of secondary hard drives and portable disk drives. The data analyst is currently using SAS as our primary statistical software.

The principal investigators and the investigative staff have worked closely with Col. Bruce Jones, U.S. Army CHPPM at Aberdeen Proving Ground and LTC Paul Amoroso at USARIEM, Natick, MA. We have had the opportunity to make several site visits which have both enlightened us as to the complex data systems within the Army's Medical Command and enabled us to provide advice and consultation to their ongoing activities. Future visits to the Naval Research Center in San Diego and Brooks Air Force Base in San Antonio will also add to our breadth of understanding as we expand our analyses to the other branches of military service.

Patient Confidentiality and Data Management

The initial human subjects review process was completed and the annual renewal approval has been received from the Johns Hopkins University Committee on Human Subjects. Because procedures for protecting the confidentiality of social security numbers for our study population have only recently been completed, we have not yet begun to develop linkages between the various data sources. We have instead concentrated our efforts in Year 1 on the analysis of the Army morbidity data, and are progressing with plans to continue the process with the Navy and Air Force hospitalization databases.

Considerable effort has been taken to ensure confidentially of our study population with work now being completed on a system that would allow social security numbers to be scrambled and therefore not identifiable to the Hopkins researchers. For the purposes of data quality assurance and correct record linkage, the formula will remain the same for all data sets. This includes the hospitalization, mortality, disability and Safety Center data for the three branches of the service. The Hopkins investigators have developed this confidentiality framework in concert with LTC Paul Amoroso of USARIEM.

Scrambling the social security number as a means of confidentiality preservation however, is not without complications. Specifically, the social security numbers in the Army hospital files do not always match directly with personnel records. Initial runs undertaken at USARIEM have yielded a 20% mismatch. However later more comprehensive analyses have shown that it is possible to overcome these obstacles. In addition, a probabilistic matching program that can set different parameters to enable matches to be made using partial social security numbers, age, and other variables such as date of birth may be useful in determining accuracy for any outlying cases. It is important that that we achieve resolution to this complex issue in order to link records across different databases.

The Hopkins research team is now working with the U.S. Army hospitalization data from 1979-1994. Because we have no patient identifiers, we have analyzed numbers of observations rather than numbers of patients or injuries. Once the scrambling method is in place, we will understand with greater accuracy the injury types for patients with multiple admissions. We have also provided advice to LTC Amoroso's group at USARIEM and they have been working with us on linking databases and developing rates of injury. To date, these analyses have all been done on their computers since the programming involves the use of confidential data that we cannot access. As discussed earlier, we have successfully resolved issues of confidentiality

and will soon have the ability to do these analyses at the Hopkins Center for Injury Research and Policy.

To facilitate the acquisition of data from appropriate military sources, the Hopkins investigators have taken steps to request a modification in the original Defense Women's Health Project grant. A number of options have been examined to expedite data transfer including a Cooperative Agreement, a Memorandum of Understanding, as well as a Proprietary Information Clause. The language that has met with approval by all branches of the military will soon be sent to our Grants Officer for final evaluation. It is our hope that this modification in language, changing certain of our military colleagues from "military advisor" to "co-investigator," will improve the ease and timeliness of data access. These officers include Col. Bruce Jones, U.S. Army CHPPM; LTC Paul Amoroso USARIEM; Dr. Frank Garland, Naval Health Research Center; and Col. James Wright, Office for Prevention and Health Services Assessment, USAF.

METHODOLOGICAL CHARACTERISTICS of ARMY HOSPITALIZATION DATA

Because the armed service databases often employ different methodology from civilian data sets, much effort has been applied to identifying aspects that particularly characterize the Army hospitalization data and the individual variables. Our work has been greatly facilitated by data dictionaries prepared by the staff at DWHRP and the DOD Ambulatory Hotline which

has responded to numerous queries concerning different variables within the database. In addition, we have worked closely with Army representatives in developing a better understanding of the components of the database and documenting procedures. In the subsequent section, we describe some of the components of the hospitalization database.

Hospital Record Flow and Database Format

The hospitalization database in the Army differs from civilian records in that it provides for a continuous episode of care rather than single hospitalizations at individual hospitals. There is a composite record maintained at a regional medical center known as the Medical Treatment Facility (MTF). There are seven MTFs in the Army system and each MTF is responsible for sending data to the central repository which is maintained in San Antonio, Texas. After five years the records are sent to the St. Louis Repository. The Army's community hospitals are required to keep medical records for one year, unless the patient is readmitted.

This MTF record contains information on multiple types of hospitalizations, including on and off duty occurrences, and hospitalizations outside of the federal system where a soldier might be treated at a civilian trauma center. The hospital database also includes certain recovery phase/post-discharge components such as convalescent leave. In addition the Army record also

notes the recommended days off that follow from sick leave. However, these days are not included in the patient's overall sick days.

Table 1. Days that Account for Total Sick Time for Active Duty Personnel

MTF Bed Days	Civilian Bed Days	Federal Days	Convalescent Days	Cooperative Care Days	Hold Days	Other Days	Supplemental Days

Patient types vary with respect to transfers to and from military hospitals, but the admissions categories (e.g., direct from ER, direct admit) are generally comparable to the civilian format. However, there are certain records that are known as "Carded for Record Only." This category of patients does not actually occupy a hospital bed, but is very important when evaluating the injury burden. These cases include, but are not limited to, some of the soldiers seen in the Emergency Department but not admitted to the hospital, and persons who die in the field or are dead on arrival.

The Army currently uses PASBA (form 2985) software to maintain its hospitalization database. Patient demographics, nature and cause of injury, treatment and outcome as well as the military occupational specialty and cost-related information are included among the approximately 90 variables.

There are quality assurance checks within PASBA which provide for injury screening, and if an external cause code is not documented, the record is returned to the admitting hospital for completion. All military E-Codes (STANAG Codes) must have an accompanying military Trauma Code to describe the intent and activity status of person injured.

Preliminary Analysis of Number and Type of Injuries

While awaiting denominator data for calculation of rates, extensive analyses of the numbers of injuries to army personnel in fiscal year 1993 were conducted. The frequency of injuries were examined by gender, by the STANAG E-Code, by the military Trauma Code, and by the nature of the injury. **Appendix 1** includes the frequencies for major injuries in female soldiers. An important part of these analyses has been to understand and evaluate the quality of the data and how it can best be used for injury research.

Denominators and Rate Calculations

Denominator data has been acquired with the assistance of LTC Paul Amoroso and the Defense Manpower Data Center (DMDC). Injury rates for the graphs located in **Appendix 2**

were derived using the person-months that each individual soldier was on active duty status. Those individuals joining the Army sometime after the start of the calendar year will have their time weighted accordingly. Likewise, those soldiers leaving during a given year (loss files) will be allotted their person-months spent in the service.

This approach gives the most accurate reflection of the population and it avoids the problem of end of year census decline, which may result in an under representation of the total person-time of exposure. Graphs for rate calculations for major disease categories and males were also prepared and are available for comparison with the graphs presented on injuries for women.

Stratification by Subgroups

Injury rates have to this point been drawn on gender, however multiple stratifications to reflect such variables as age, time in service, and occupational specialty will be forthcoming. A special sub-category of soldiers that will be evaluated are the activated reservists who served in the Gulf War and in other overseas deployments including Haiti and Bosnia. This group may have special risks particularly as they are likely to be less fit and less well trained.

Evaluation of Cause of Injury Coding

A unique feature of the military hospital discharge data is that it contains special cause of injury codes (STANAG "E" codes) that are unique to the military. An important step in examining the databases was to evaluate the completeness of cause coding and how these codes are used.

Using 1993 data, **Table 2** illustrates that injuries in the ICD Code 800-999 have almost universal STANAG E coding. This is important since it means we will be able to determine the causes of these injuries. However, the high number of ICD N-coded musculoskeletal injuries that have not been assigned an external cause code suggests that it will not be possible to examine the causes for these injuries, aside from the codes for reactions and complications. Among Army women hospitalized with injury diagnoses, all of the 1067 women had an applicable cause code for injury. In the same year, there were 2628 women with a primary admitting diagnosis of musculoskeletal origin, however over 90% had no external cause code.

While we are very encouraged that all of (except 0.03% of males) the conditions coded as injuries have an external cause code, the lack of cause coding of musculoskeletal conditions is disappointing. On further evaluation, it appears that there are coding rules that specifically

exclude coding of causes for musculoskeletal cases except in certain conditions. The last section of **Table 2** shows that almost all the cause codes are restricted to those that are used to describe "reactions, complications and misadventures in medical or surgical procedures and late complication or late effects" (i.e., 250-299 - STANAG). There were 216 women where a cause was coded for musculoskeletal injuries (i.e., 710-739 - ICD Code), with 90.3% being coded as complications or reactions to patient care.

Table 2. Evaluation of Completeness of Cause of Injury Codes (Stanag E-Codes) for 1993 Army Hospitalizations for Injuries and Musculoskeletal Conditions

Injury N Code: 800-999				Musculoskeletal Conditions Code: 710-739			Musculoskeletal Conditions Code: 710-739 with Stanag Cause (E) Code		
Sex	# Cases		%	# Cases		%	# Cases	# Cases	
	Total	No E Code	% No E	Total	No E Code	% No E	Cases with E Code	Coded Rx/Comp. 250-299	% coded Reaction/ Comp.
Female	1067	0	0	2844	2628	92.4	216	195	90.3
Male	9589	3	0.03	17044	14696	86.2	2348	2236	95.2

Musculoskeletal Conditions

Over the past 15 years, there has been an increase in the number of admissions for musculoskeletal and connective tissue disorders (N-Codes: 710-739) in the female military population. Cause for concern includes not only the potential for long-term disability, but also lost work time and attendant medical costs. We are now analyzing these conditions in more detail. A manuscript currently in preparation addresses the problems of musculoskeletal injuries.

SUMMARY OF TASKS COMPLETED

We have made significant progress in achieving the plan laid out in our **Statement of Work**. As outlined in the revised statement, the emphasis of the project has been on using the medical databases, particularly the hospital discharge database. This approach has been encouraged by our military collaborators and advisors.

TASK 1: We have confirmed access to the necessary databases and formally communicated with each of our collaborators to secure appropriate data resources. Our initial

efforts have concentrated on using Army data as a framework to understanding how military data are used. We have completed human subjects concerns as noted above.

TASK 2: Preliminary analyses of hospitalized injury data have been conducted and are attached as appendices 1 and 2. Issues regarding the determination of numerators and denominators were previously referenced in this document. Initial analyses of differences of rates between services have been conducted in collaboration with our military colleagues for the Armed Forces Epidemiological Board. This contribution "Hospitalization Due to Injury" is included in **Appendix 3.**

TASK 3: In collaboration with USARIEM investigators, we have begun the process of linking cases in the hospital discharge databases. We have demonstrated that this can be done successfully. Now that issues regarding personal identifiers have been resolved, we are developing procedures to do this at the Hopkins Injury Center.

TASK 4a: As discussed earlier, we are making good progress in preparing data for papers and monographs. The first product is the report on injury hospitalizations prepared for the Armed Forces Epidemiological Board. A monograph on the methodological issues regarding

the use of military hospital data is currently being developed in collaboration with LTC Paul Amoroso. A third document is being produced on musculoskeletal injuries.

CONCLUSION

Because of the length of time necessary to resolve the important concerns involving data acquisition and patient confidentiality, the investigators have had limited opportunity to explore the rich source of data that is available in the armed forces databases. We are looking forward to a year of inquiry and analysis of the epidemiological data sets across all services, elevating our understanding of the injury rates in women who serve in the armed forces.

3-WAY FREQUENCY TABLE OF GENDER BY TRAUMA CODE BY EXTERNAL CAUSE OF INJURY

DATA SOURCE: 1993 ARMY HOSPITALIZATION DATA
DATE OF PREPARATION: 07/15/96

TRAUMA BY ECI

CONTROLLING FOR SEX=Female

TRAUMAT(TRAUMA CODE) ECIT(EXTERNAL CAUSE OF INJURY - STANAG/E CODE)

Frequency Percent	AIR SPACE 000-059	LAND TRANSPRT 100-149	WATER TRANSPRT 150-199	SPORTS TRAINING 200-249	RXN/COMP MISADV 250-299	WAR/ WEAPON 300-599	MACHINES 60*	POISONS FIRE 70*	ENVIRON 80*	FALLS MISC 90*	Total
BATTLE DIRECT 0	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	1 0.05	0 0.00	0 0.00	0 0.00	0 0.00	1 0.05
OTHER BATTLE 1	0 0.00	1 0.05	0 0.00	0 0.00	0 0.00	2 0.10	0 0.00	0 0.00	0 0.00	2 0.10	5 0.24
INTENT. LEGAL/A 2	0 0.00	0 0.00	0 0.00	0 0.00	1 0.05	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	1 0.05
INTENT. OTHER/P 3	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	4 0.20	3 0.15	0 0.00	1 0.05	23 1.13	31 1.52
INTENT. SELF 4	0 0.00	0 0.00	0 0.00	1 0.05	0 0.00	1 0.05	24 1.17	101 4.94	0 0.00	3 0.15	130 6.36
ACCIDENT OFF DUTY 5	0 0.00	65 3.18	0 0.00	19 0.93	68 3.33	1 0.05	18 0.88	30 1.47	9 0.44	57 2.79	267 13.06
ACCIDENT SCHEMES 6	8 0.39	1 0.05	0 0.00	14 0.68	4 0.20	2 0.10	2 0.10	1 0.05	8 0.39	29 1.42	69 3.38

(Continued)

Frequency Percent	AIR SPACE 000-059	LAND TRANSPRT 100-149	WATER TRANSPRT 150-199	SPORTS TRAINING 200-249	RXN/COMP MISADV 250-299	WAR/ WEAPON 300-599	MACHINES 60*	POISONS FIRE 70*	ENVIRON 80*	FALLS MISC 90*	Total
ACCIDENT TRAINING 7	0 0.00	1 0.05	0 0.00	7 0.34	3 0.15	2 0.10	28 1.37	4 0.20	4 0.20	29 1.42	78 3.82
ACCIDENT ON DUTY 8	5 0.24	28 1.37	1 0.05	14 0.68	108 5.28	0 0.00	27 1.32	44 2.15	13 0.64	88 4.31	328 16.05
ACCIDENT OTHER 9	6 0.29	107 5.23	1 0.05	59 2.89	627 30.68	3 0.15	37 1.81	83 4.06	17 0.83	194 9.49	1134 55.48
NO TRAUMA CODE blank	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
Total	19 0.93	203 9.93	2 0.10	114 5.58	811 39.68	16 0.78	139 6.80	263 12.87	52 2.54	425 20.79	2044 100.00

Frequency Missing (without STANAG/E code) = 26252

3-WAY FREQUENCY TABLE OF GENDER BY DIAGNOSIS PRINCIPAL BY EXTERNAL CAUSE OF INJURY

DATA SOURCE: 1993 ARMY HOSPITALIZATION DATA
DATE OF PREPARATION: 07/16/96

DIAGP BY ECI
CONTROLLING FOR SEX=Female

DIAGP(DIAGNOSIS PRINCIPAL) (N-CODE) ECI(EXTERNAL CAUSE OF INJURY - STANAG/E CODE)

Frequency Percent	AIR SPACE 000-059	LAND TRANSPRT 100-149	WATER TRANSPRT 150-199	SPORTS TRAINING 200-249	RXN/COMP MISADV 250-299	WAR/ WEAPON 300-599	MACHINES 60*	POISONS FIRE 70*	ENVIRON 80*	FALLS MISC 90*	Total
INF/PARA D. 001-139	0 0.00	0 0.00	0 0.00	0 0.00	21 1.03	0 0.00	3 0.15	0 0.00	2 0.10	7 0.34	33 1.61
NEOPLASM 140-239	0 0.00	1 0.05	0 0.00	1 0.05	62 3.03	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	64 3.13
ENDO/IMMUNITY 240-279	0 0.00	0 0.00	0 0.00	0 0.00	9 0.44	0 0.00	0 0.00	0 0.00	3 0.15	0 0.00	12 0.59
BLOOD DISORDER 280-289	0 0.00	0 0.00	0 0.00	0 0.00	4 0.20	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	4 0.20
MENTAL DISORDER 290-319	0 0.00	3 0.15	0 0.00	1 0.05	13 0.64	1 0.05	26 1.27	92 4.50	0 0.00	12 0.59	148 7.24
NERVOUS SYSTEM 320-389	0 0.00	2 0.10	0 0.00	1 0.05	18 0.88	0 0.00	0 0.00	0 0.00	0 0.00	4 0.20	25 1.22
CIRC SYSTEM 390-459	0 0.00	0 0.00	0 0.00	0 0.00	9 0.44	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	9 0.44

(Continued)

Frequency Percent	AIR SPACE 000-059	LAND TRANSPRT 100-149	WATER TRANSPRT 150-199	SPORTS TRAINING 200-249	RXN/COMP MISADV 250-299	WAR/ WEAPON 300-599	MACHINES 60*	POISONS FIRE 70*	ENVIRON 80*	FALLS MISC 90*	Total
RESP SYSTEM 460-519	0 0.00	1 0.05	0 0.00	0 0.00	23 1.13	0 0.00	6 0.29	2 0.10	0 0.00	8 0.39	40 1.96
DIG SYSTEM 520-579	0 0.00	0 0.00	0 0.00	0 0.00	55 2.69	0 0.00	0 0.00	2 0.10	0 0.00	3 0.15	60 2.94
G.U. SYSTEM 580-629	0 0.00	0 0.00	0 0.00	0 0.00	99 4.84	0 0.00	2 0.10	0 0.00	0 0.00	0 0.00	101 4.94
OBSTETRICS 630-676	0 0.00	3 0.15	0 0.00	0 0.00	63 3.08	0 0.00	1 0.05	2 0.10	0 0.00	8 0.39	77 3.77
SKIN & SUBQ TISSUE 680-709	0 0.00	0 0.00	0 0.00	0 0.00	13 0.64	0 0.00	6 0.29	3 0.15	6 0.29	5 0.24	33 1.61
MS/CT DISORDER 710-739	0 0.00	2 0.10	0 0.00	3 0.15	195 9.54	0 0.00	2 0.10	2 0.10	1 0.05	11 0.54	216 10.57
CONGENITAL ANOMALY 740-759	0 0.00	0 0.00	0 0.00	0 0.00	2 0.10	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	2 0.10
MISC 780-798	0 0.00	0 0.00	0 0.00	0 0.00	35 1.71	0 0.00	0 0.00	1 0.05	1 0.05	8 0.39	45 2.20
UNKNOWN CAUSE 799	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
FRACTURE 800-829	14 0.68	55 2.69	0 0.00	29 1.42	0 0.00	2 0.10	7 0.34	0 0.00	0 0.00	114 5.58	221 10.81
DISLOCATION 830-839 (Continued)	0 0.00	3 0.15	0 0.00	24 1.17	0 0.00	1 0.05	0 0.00	0 0.00	0 0.00	31 1.52	59 2.89

Frequency Percent	AIR SPACE 000-059	LAND TRANSPRT 100-149	WATER TRANSPRT 150-199	SPORTS TRAINING 200-249	RXN/COMP MISADV 250-299	WAR/ WEAPON 300-599	MACHINES 60*	POISONS FIRE 70*	ENVIRON 80*	FALLS MISC 90*	Total
SPRAINS STRAINS 840-848	0 0.00	11 0.54	1 0.05	34 1.66	0 0.00	0 0.00	2 0.10	0 0.00	0 0.00	56 2.74	104 5.09
INTRACRANIAL 850-854	4 0.20	23 1.13	0 0.00	7 0.34	0 0.00	1 0.05	5 0.24	0 0.00	0 0.00	22 1.08	62 3.03
INTERNAL TRAUMA 860-869	0 0.00	12 0.59	0 0.00	0 0.00	0 0.00	1 0.05	3 0.15	0 0.00	0 0.00	2 0.10	18 0.88
OPEN WOUNDS 870-897	1 0.05	11 0.54	0 0.00	2 0.10	1 0.05	8 0.39	31 1.52	0 0.00	7 0.34	13 0.64	74 3.62
VASCULAR TRAUMA 900-904	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
SUPERFICIAL 910-924	0 0.00	15 0.73	0 0.00	2 0.10	0 0.00	1 0.05	28 1.37	1 0.05	1 0.05	38 1.86	86 4.21
CRUSH INJURY 925-929	0 0.00	1 0.05	1 0.05	0 0.00	0 0.00	0 0.00	1 0.05	0 0.00	0 0.00	0 0.00	3 0.15
FOREIGN BODIES 930-939	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	1 0.05	0 0.00	0 0.00	1 0.05	2 0.10
BURNS 940-949	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	1 0.05	0 0.00	5 0.24	1 0.05	1 0.05	8 0.39
SPINAL NERVES 950-957	0 0.00	4 0.20	0 0.00	0 0.00	1 0.05	0 0.00	8 0.39	0 0.00	0 0.00	4 0.20	17 0.83
COMPS.& UNSPEC.I 958-959	0 0.00	16 0.78	0 0.00	9 0.44	1 0.05	0 0.00	1 0.05	0 0.00	0 0.00	22 1.08	49 2.40

(Continued)

Frequency Percent	AIR SPACE 000-059	LAND TRANSPRT 100-149	WATER TRANSPRT 150-199	SPORTS TRAINING 200-249	RXN/COMP MISADV 250-299	WAR/ WEAPON 300-599	MACHINES 60*	POISONS FIRE 70*	ENVIRON 80*	FALLS MISC 90*	Total
POISONS OVERDOSE 960-979	0 0.00	0 0.00	0 0.00	0 0.00	3 0.15	0 0.00	0 0.00	116 5.68	0 0.00	1 0.05	120 5.87
TOXINS 980-989	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	31 1.52	0 0.00	3 0.15	34 1.66
ENVIRON OTHER 990-995	0 0.00	0 0.00	0 0.00	1 0.05	18 0.88	0 0.00	2 0.10	5 0.24	30 1.47	20 0.98	76 3.72
MED/SURG COMPS. 996-999	0 0.00	0 0.00	0 0.00	0 0.00	132 6.46	0 0.00	0 0.00	0 0.00	0 0.00	2 0.10	134 6.56
B700	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
B900	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
V-CODE	0 0.00	40 1.96	0 0.00	0 0.00	34 1.66	0 0.00	4 0.20	1 0.05	0 0.00	29 1.42	108 5.28
Total	19 0.93	203 9.93	2 0.10	114 5.58	811 39.68	16 0.78	139 6.80	263 12.87	52 2.54	425 20.79	2044 100.00

Frequency Missing (without STANAG/E code) = 26252

3-WAY FREQUENCY TABLE OF GENDER BY DIAGNOSIS PRINCIPAL BY TRAUMA

DATA SOURCE: 1993 ARMY HOSPITALIZATION DATA
DATE OF PREPARATION: 07/09/96

Total number of observations: 106573 observations, of which 28296 are females and 78277 are males.

DIAGP BY TRAUMA
CONTROLLING FOR SEX=Female

DIAGNOSIS PRINCIPAL (ICD-9 N-codes) Frequency Percent	TRAUMA(TRAUMA CODE) BATTLE DIRECT 0	OTHER BATTLE 1	INTENT. LEGAL/A 2	INTENT. OTHER/P 3	INTENT. SELF 4	ACCIDENT OFF DUTY 5	ACCIDENT SCHEMES 6	ACCIDENT TRAINING 7	ACCIDENT ON DUTY 8	ACCIDENT OTHER 9	Total
INF/PARA D. 001-139	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	2 0.10	0 0.00	4 0.20	6 0.29	21 1.03	33 1.61
NEOPLASM 140-239	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	4 0.20	0 0.00	1 0.05	2 0.10	57 2.79	64 3.13
ENDO/IMMUNITY 240-279	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	2 0.10	0 0.00	0 0.00	1 0.05	9 0.44	12 0.59
BLOOD DISORDERS 280-289	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	2 0.10	0 0.00	0 0.00	0 0.00	2 0.10	4 0.20
MENTAL DISORDER 290-319	0 0.00	0 0.00	0 0.00	0 0.00	57 2.79	19 0.93	0 0.00	1 0.05	18 0.88	53 2.59	148 7.24
NERVOUS SYSTEM 320-389	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	1 0.05	0 0.00	2 0.10	7 0.34	15 0.73	25 1.22
CIRC. SYSTEM 390-459 (continued)	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	2 0.10	7 0.34	9 0.44

Frequency Percent	BATTLE DIRECT 0	OTHER BATTLE 1	INTENT. LEGAL/A 2	INTENT. OTHER/P 3	INTENT. SELF 4	ACCIDENT OFF DUTY 5	ACCIDENT SCHEMES 6	ACCIDENT TRAINING 7	ACCIDENT ON DUTY 8	ACCIDENT OTHER 9	Total
RESP. SYSTEM 460-519	0 0.00	0 0.00	0 0.00	0 0.00	1 0.05	2 0.10	2 0.10	2 0.10	12 0.59	21 1.03	40 1.96
DIG. SYSTEM 520-579	0 0.00	0 0.00	0 0.00	0 0.00	1 0.05	10 0.49	1 0.05	0 0.00	4 0.20	44 2.15	60 2.94
G.U. SYSTEM 580-629	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	8 0.39	0 0.00	1 0.05	9 0.44	83 4.06	101 4.94
OBSTETRICS 630-676	0 0.00	0 0.00	1 0.05	0 0.00	0 0.00	10 0.49	0 0.00	0 0.00	9 0.44	57 2.79	77 3.77
SKIN & SUBQ TISSUE 680-709	0 0.00	1 0.05	0 0.00	0 0.00	0 0.00	4 0.20	1 0.05	2 0.10	4 0.20	21 1.03	33 1.61
MS/CT DISORDER 710-739	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	19 0.93	5 0.24	1 0.05	45 2.20	146 7.14	216 10.57
CONGENITAL ANOMALY 740-759	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	1 0.05	0 0.00	1 0.05	2 0.10
MISC 780-798	0 0.00	0 0.00	0 0.00	0 0.00	1 0.05	2 0.10	0 0.00	1 0.05	4 0.20	37 1.81	45 2.20
UNKNOWN CAUSE 799	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
FRACTURE 800-829	0 0.00	1 0.05	0 0.00	4 0.20	1 0.05	47 2.30	18 0.88	12 0.59	49 2.40	89 4.35	221 10.81
DISLOCATION 830-839 (continued)	0 0.00	1 0.05	0 0.00	0 0.00	1 0.05	9 0.44	5 0.24	3 0.15	12 0.59	28 1.37	59 2.89

Frequency Percent	BATTLE DIRECT 0	OTHER BATTLE 1	INTENT. LEGAL/A 2	INTENT. OTHER/P 3	INTENT. SELF 4	ACCIDENT OFF DUTY 5	ACCIDENT SCHEMES 6	ACCIDENT TRAINING 7	ACCIDENT ON DUTY 8	ACCIDENT OTHER 9	Total
SPRAINS STRAINS 840-848	0 0.00	0 0.00	0 0.00	1 0.05	0 0.00	19 0.93	6 0.29	8 0.39	22 1.08	48 2.35	104 5.09
INTRACRANIAL 850-854	0 0.00	0 0.00	0 0.00	2 0.10	0 0.00	16 0.78	4 0.20	2 0.10	13 0.64	25 1.22	62 3.03
INTERNAL TRAUMA 860-869	0 0.00	0 0.00	0 0.00	2 0.10	2 0.10	5 0.24	0 0.00	0 0.00	0 0.00	9 0.44	18 0.88
OPEN WOUNDS 870-897	1 0.05	0 0.00	0 0.00	3 0.15	5 0.24	13 0.64	4 0.20	3 0.15	13 0.64	32 1.57	74 3.62
VASCULAR TRAUMA 900-904	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
SUPERFICIAL 910-924	0 0.00	1 0.05	0 0.00	2 0.10	1 0.05	9 0.44	6 0.29	24 1.17	10 0.49	33 1.61	86 4.21
CRUSH INJURY 925-929	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	1 0.05	2 0.10	0 0.00	3 0.15
FOREIGN BODIES 930-939	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	2 0.10	2 0.10
BURNS 940-949	0 0.00	1 0.05	0 0.00	0 0.00	0 0.00	2 0.10	0 0.00	0 0.00	3 0.15	2 0.10	8 0.39
SPINAL NERVES 950-957	0 0.00	0 0.00	0 0.00	0 0.00	1 0.05	4 0.20	1 0.05	0 0.00	0 0.00	11 0.54	17 0.83
COMPS.& UNSPEC.I 958-959	0 0.00	0 0.00	0 0.00	6 0.29	0 0.00	7 0.34	2 0.10	1 0.05	7 0.34	26 1.27	49 2.40

(continued)

Frequency Percent	BATTLE DIRECT 0	OTHER BATTLE 1	INTENT. LEGAL/A 2	INTENT. OTHER/P 3	INTENT. SELF 4	ACCIDENT OFF DUTY 5	ACCIDENT SCHEMES 6	ACCIDENT TRAINING 7	ACCIDENT ON DUTY 8	ACCIDENT OTHER 9	Total
POISONS OVERDOSE 960-979	0 0.00	0 0.00	0 0.00	0 0.00	56 2.74	13 0.64	0 0.00	3 0.15	16 0.78	32 1.57	120 5.87
TOXINS 980-989	0 0.00	0 0.00	0 0.00	0 0.00	1 0.05	4 0.20	1 0.05	0 0.00	8 0.39	20 0.98	34 1.66
ENVIRON OTHER 990-995	0 0.00	0 0.00	0 0.00	3 0.15	2 0.10	6 0.29	13 0.64	5 0.24	20 0.98	27 1.32	76 3.72
MED/SURG COMPS. 996-999	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	10 0.49	0 0.00	0 0.00	21 1.03	103 5.04	134 6.56
B700	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
B900	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00	0 0.00
V-CODE	0 0.00	0 0.00	0 0.00	8 0.39	0 0.00	18 0.88	0 0.00	0 0.00	9 0.44	73 3.57	108 5.28
Total	1 0.05	5 0.24	1 0.05	31 1.52	130 6.36	267 13.06	69 3.38	78 3.82	328 16.05	1134 55.48	2044 100.00

Frequency Missing (without trauma codes) = 26252

GROUP OF EXTERNAL CAUSE OF INJURY (STANAG CODES) PER 100,000 PERSON-YEAR OVER TIME: 1980-1994

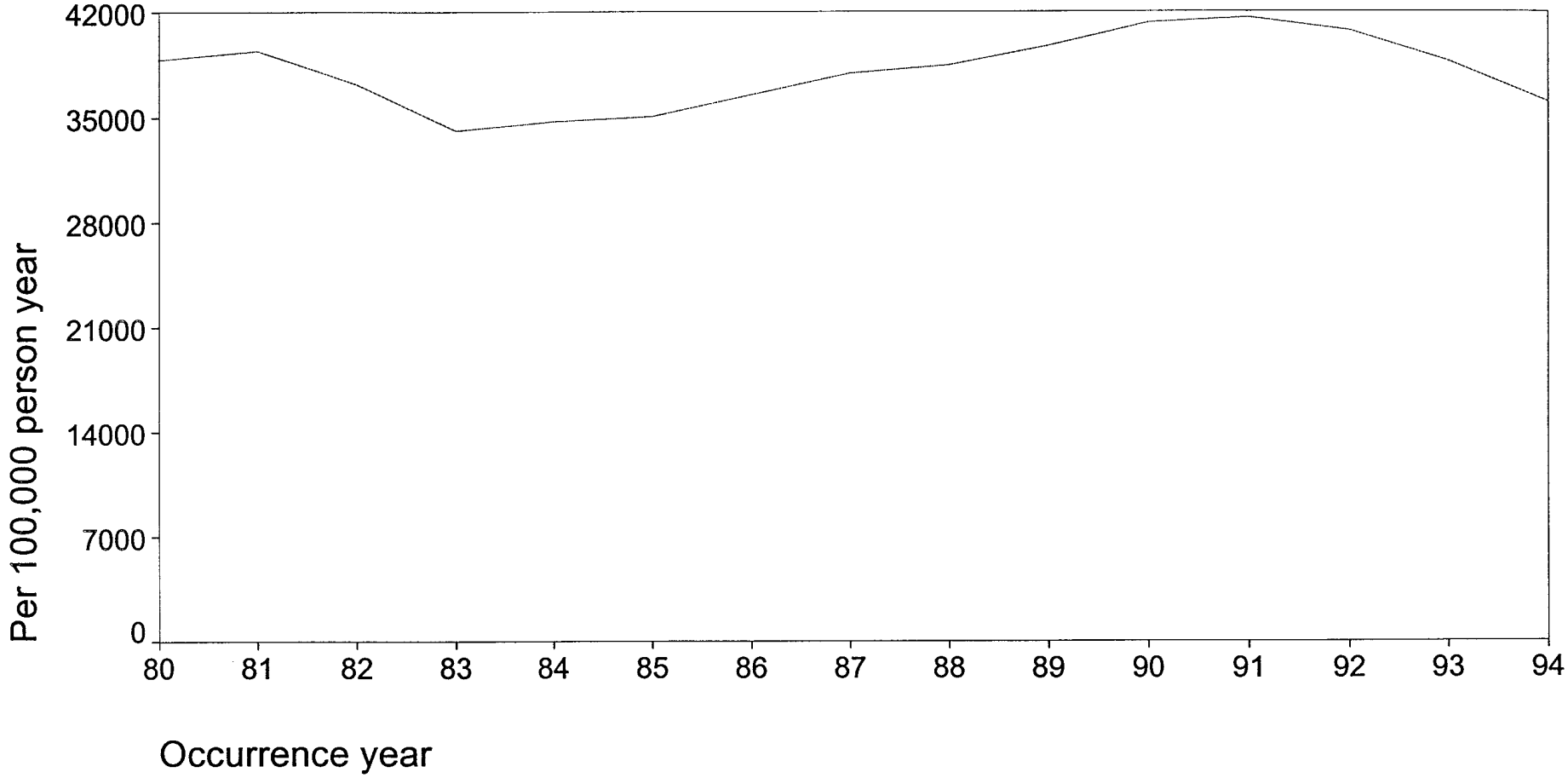
Female

***Data source*: 1980-1995 Army hospitalization data**
1980-1994 Army personnel data

***Date of preparation*: 10/14/96**

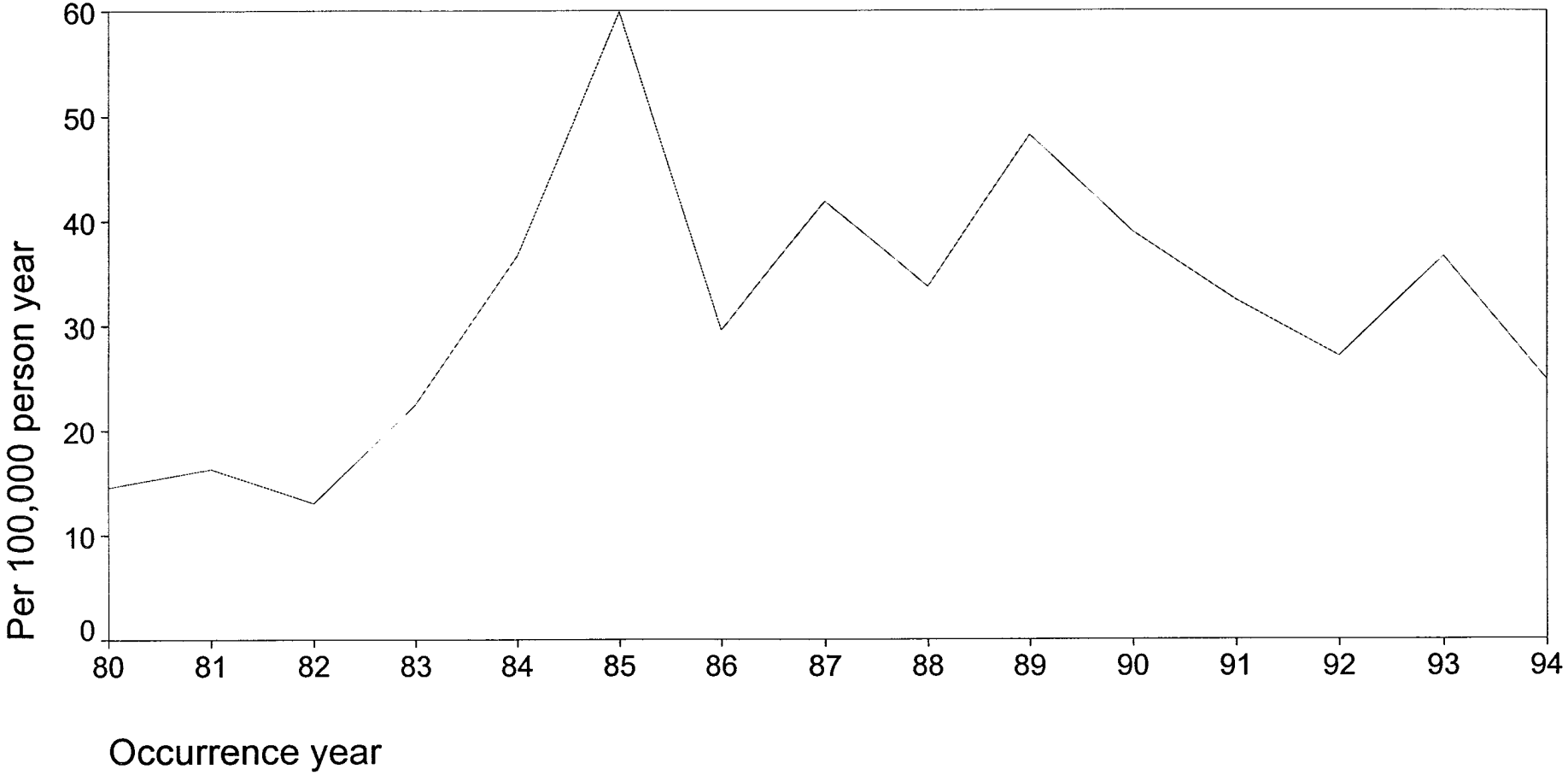
Non-injury - Female

STANAG: blank



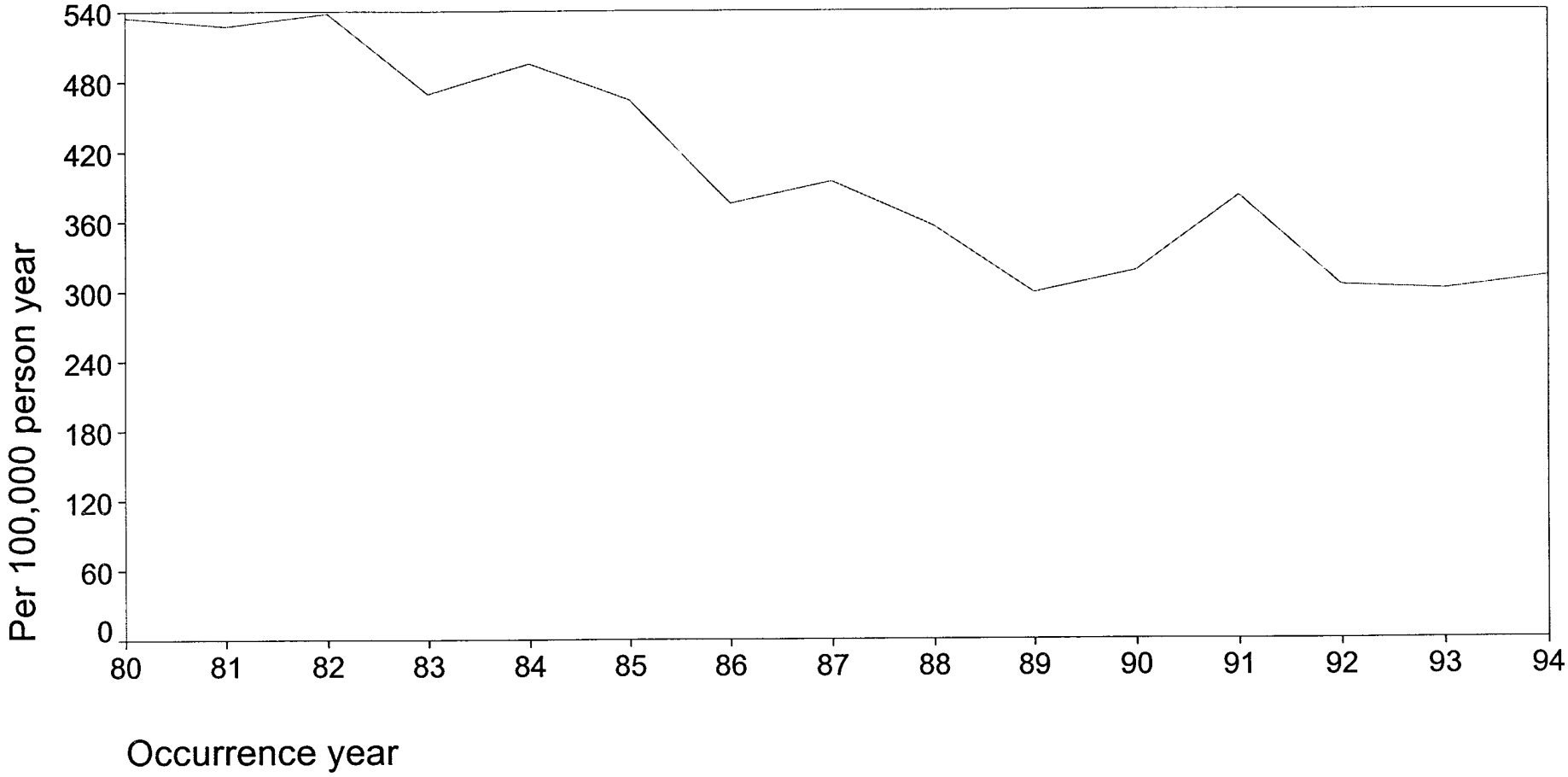
Accidents in air transport - Female

STANAG: 000-059



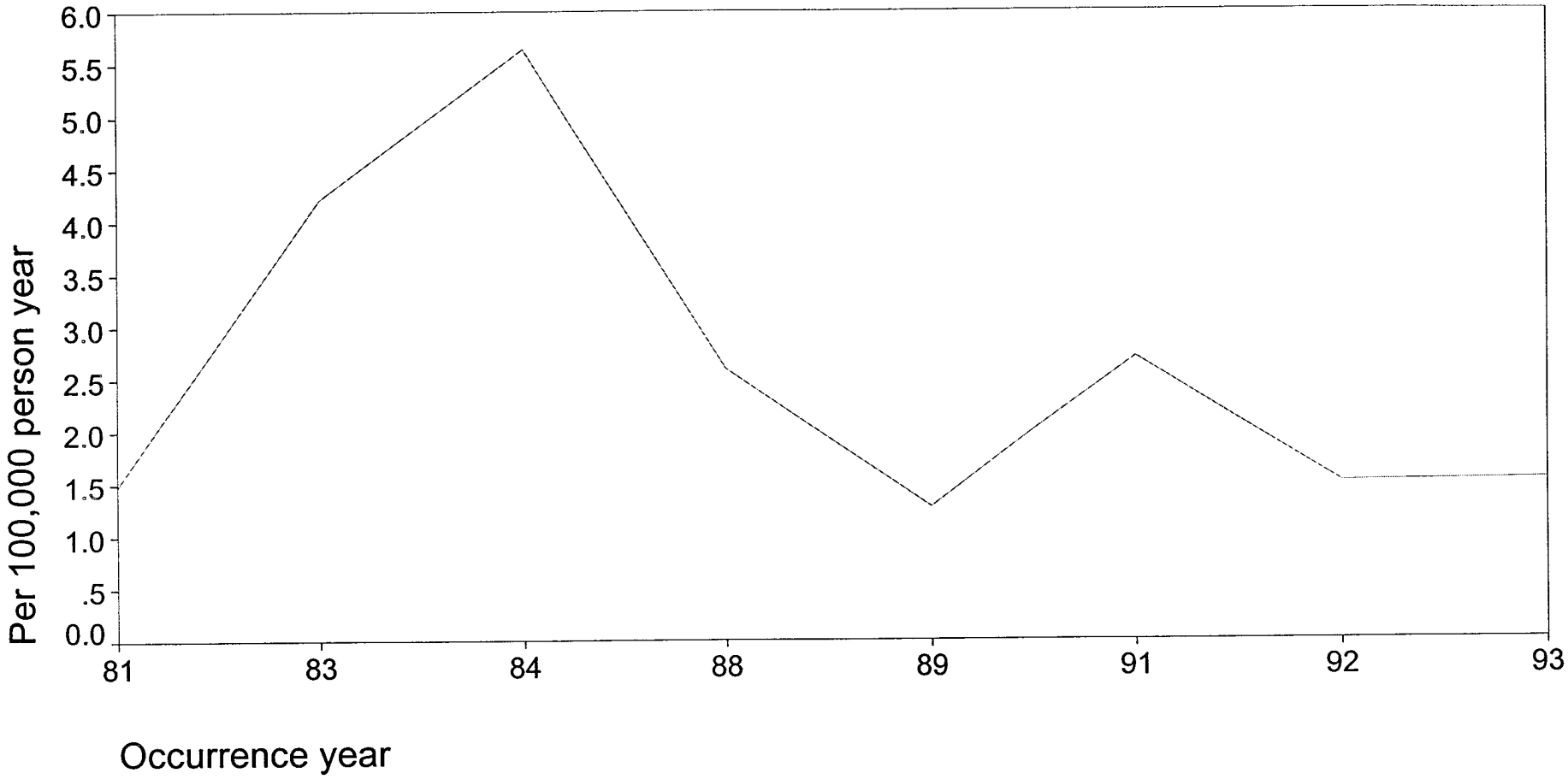
Motor vehicle traffic accidents - Female

STANAG: 100-149



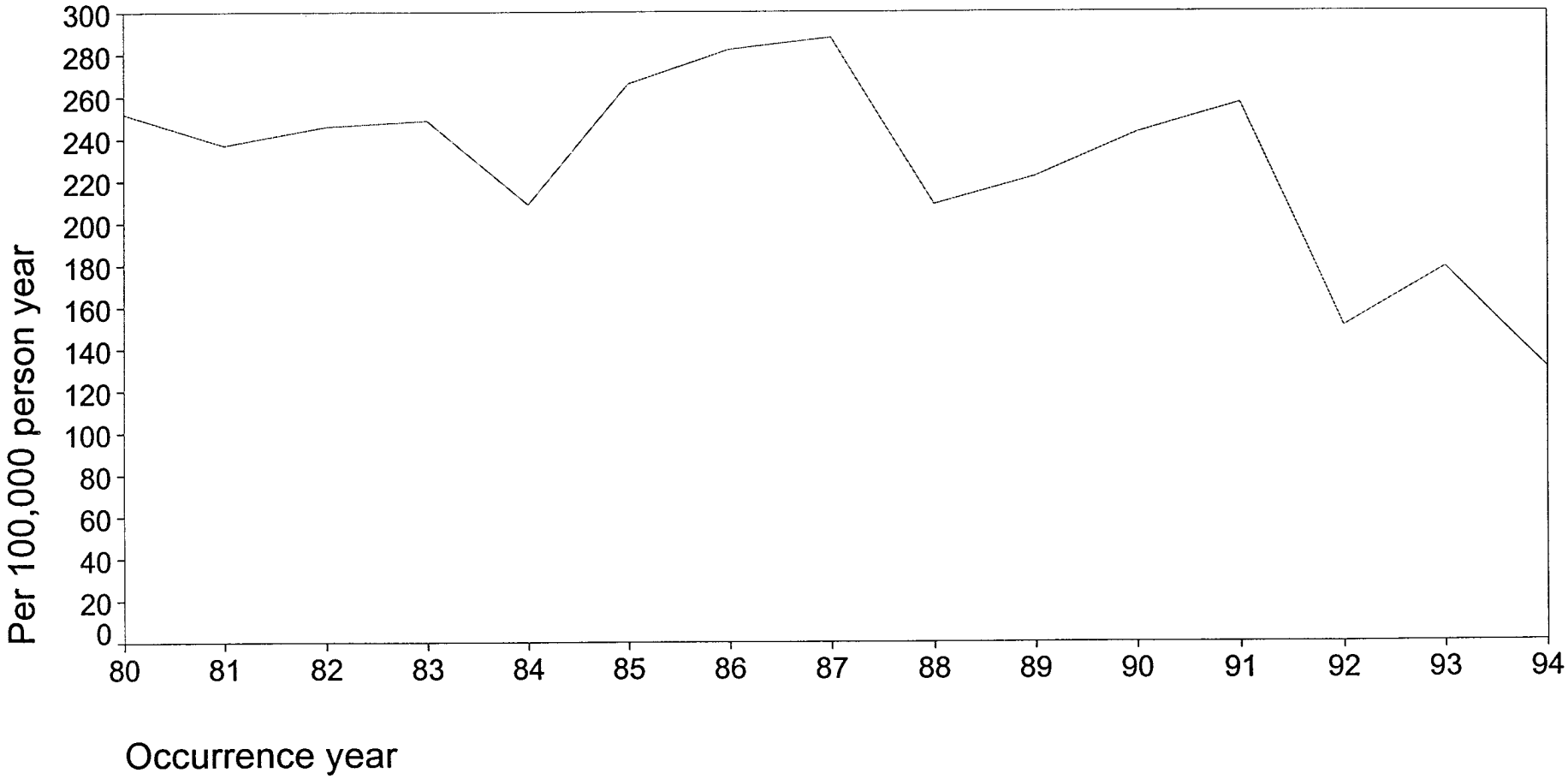
Accidents in water transport - Female

STANAG: 151-199



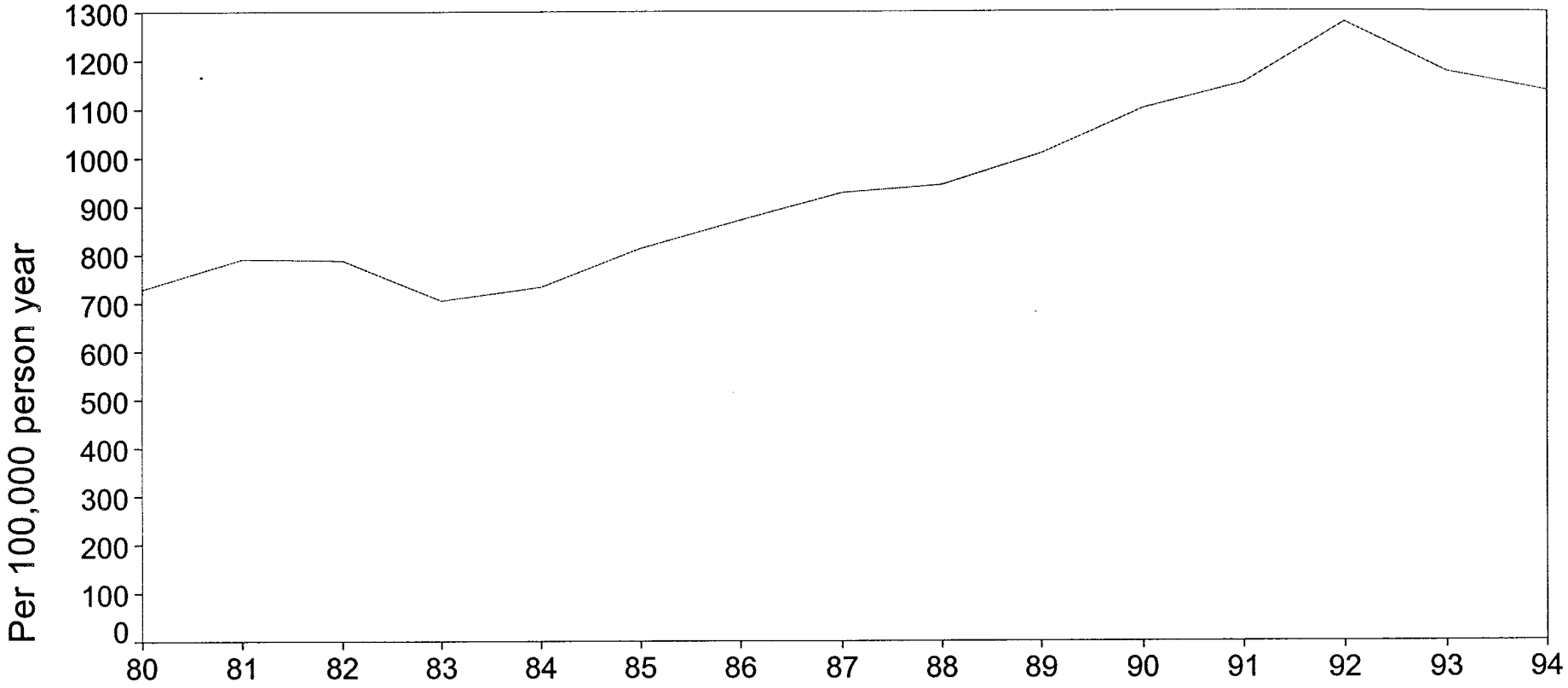
Athletics and sports, including physical training - Female

STANAG: 201-249



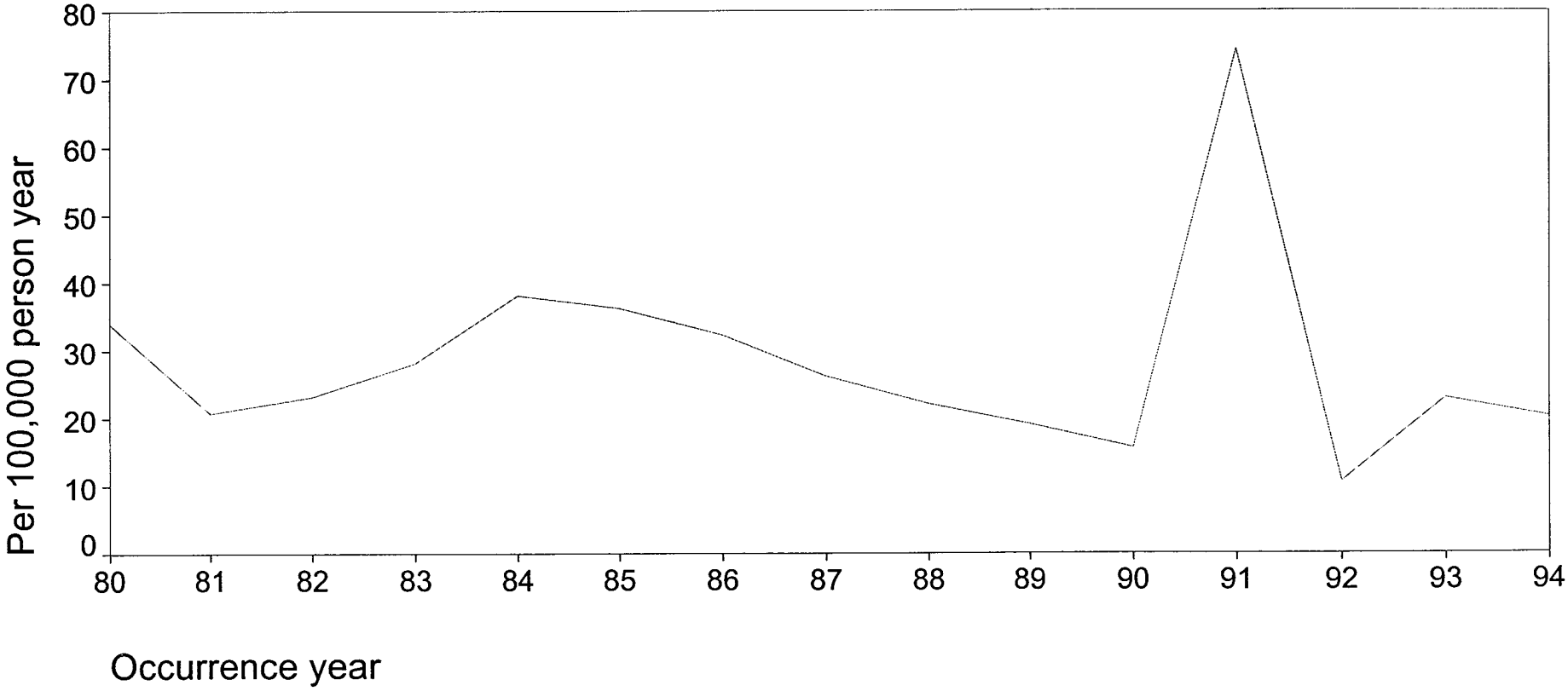
Reactions, complications and misadventures - Female

STANAG: 250-299



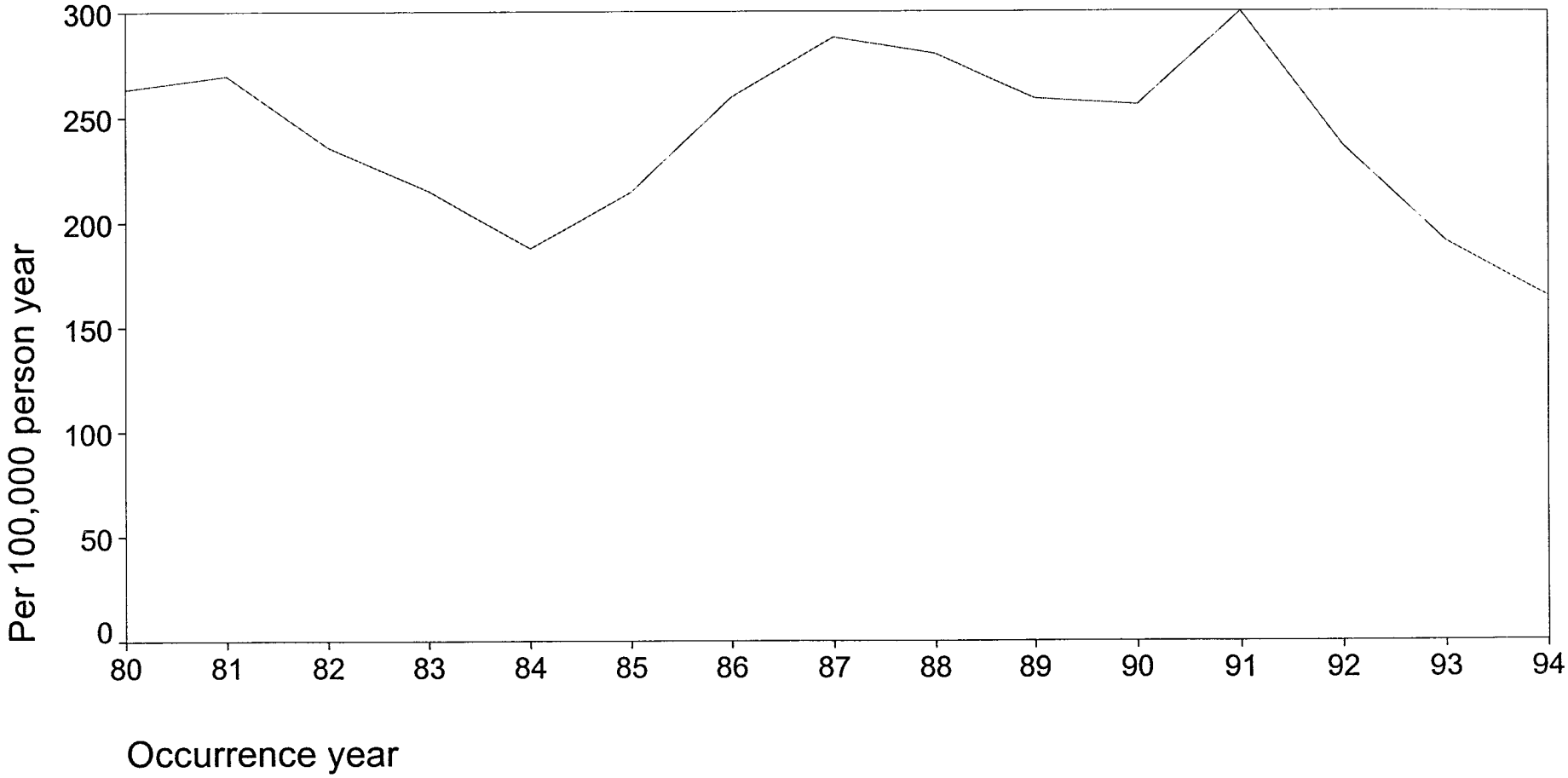
Instrumentalities of war and weapons used in peaceful time - Female

STANAG: 400-599



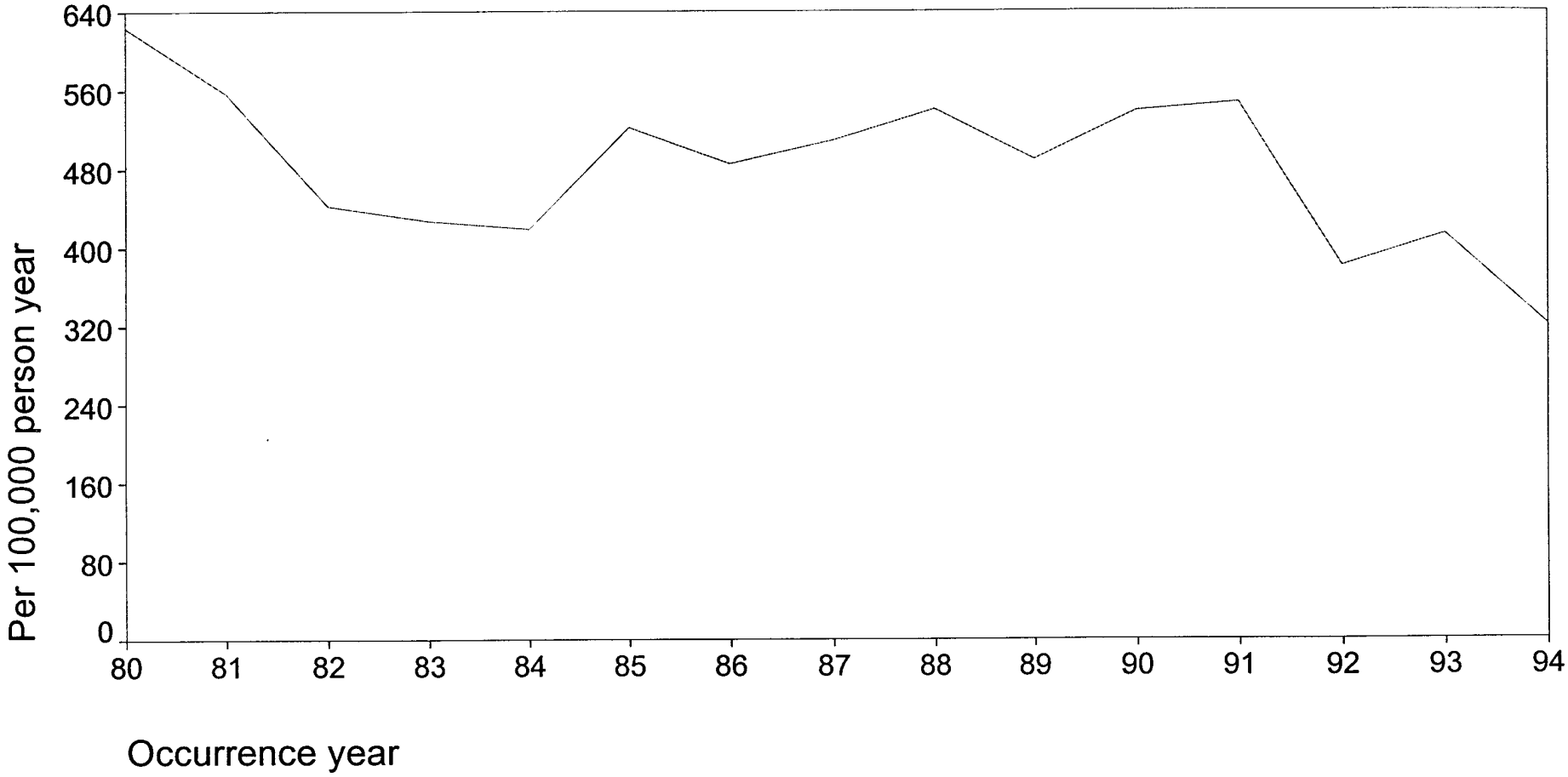
Machinery, tools, and selected agents - Female

STANAG: 600-699



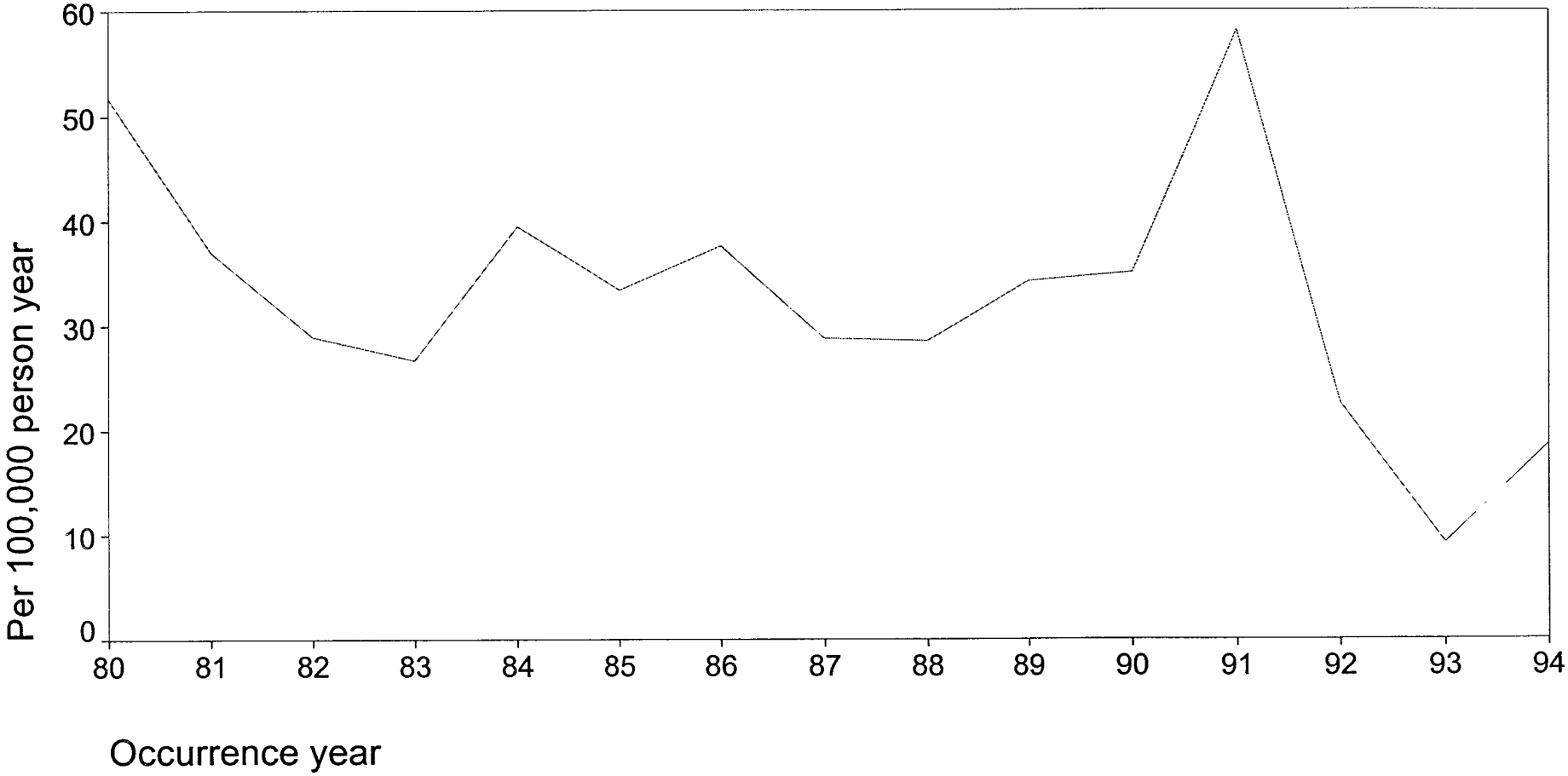
Poisons - Female

STANAG: 700-749



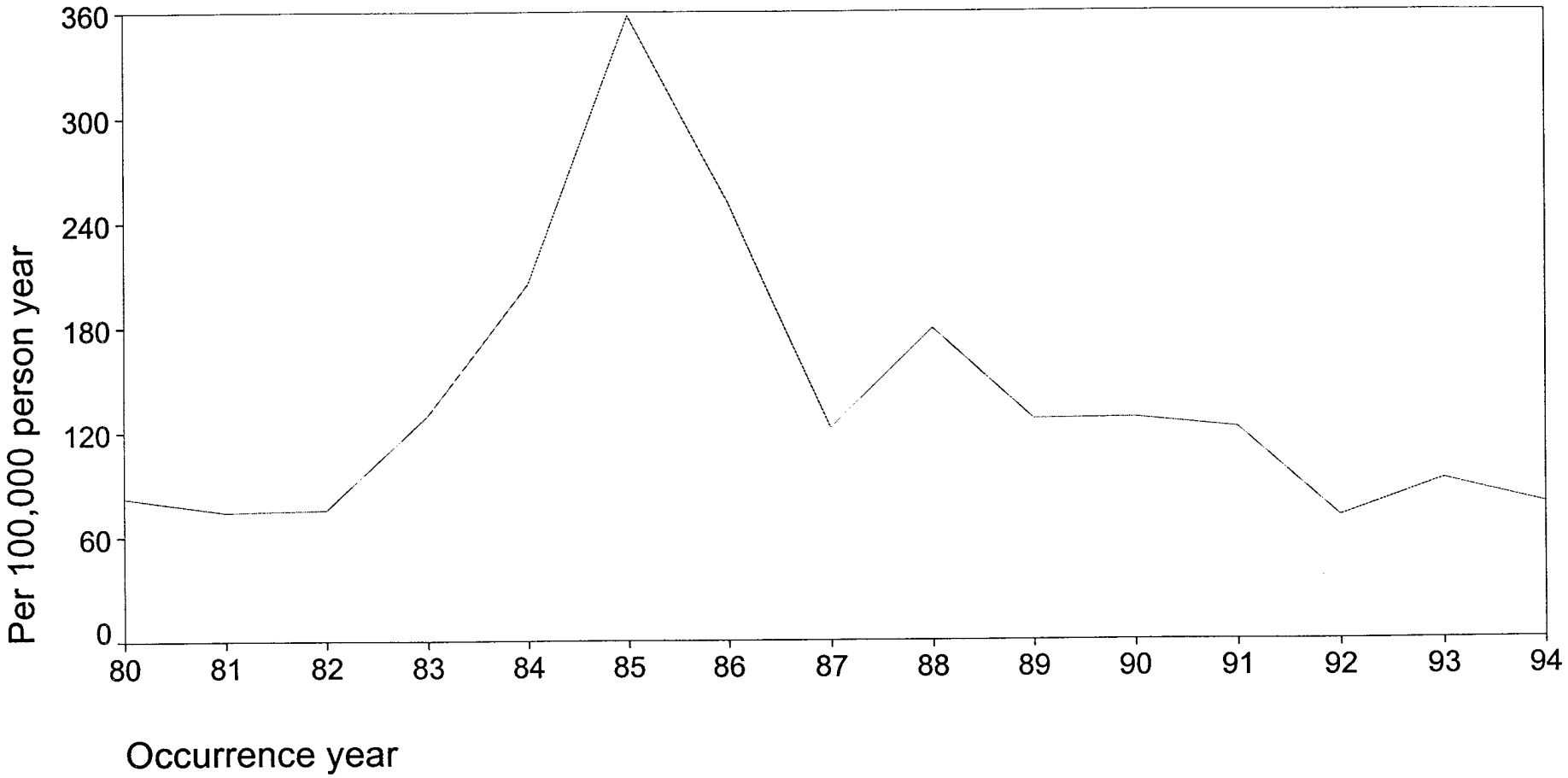
Fire, hot or corrosive substances - Female

STANAG: 750-799



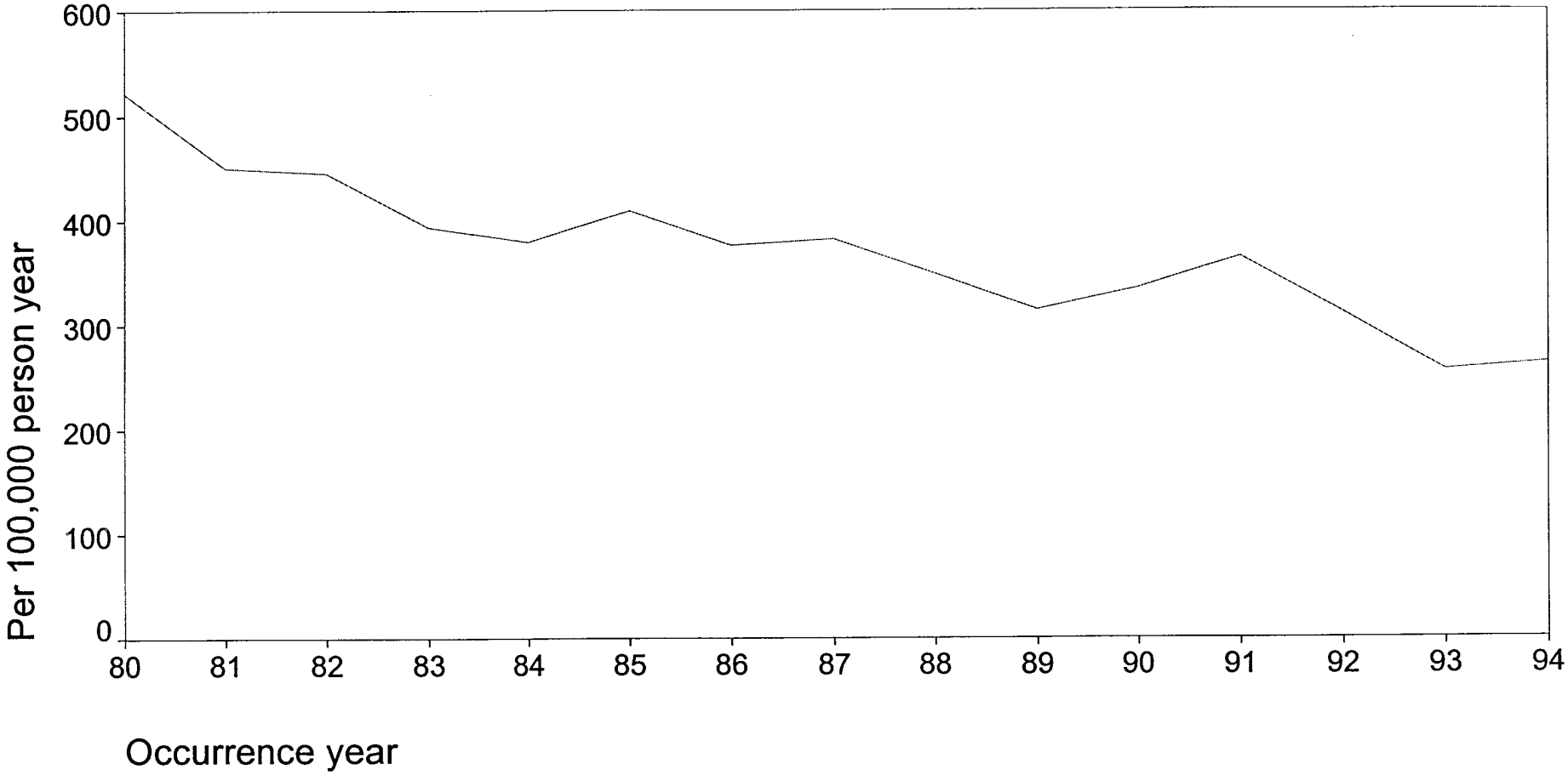
Specified environmental factors - Female

STANAG: 800-899



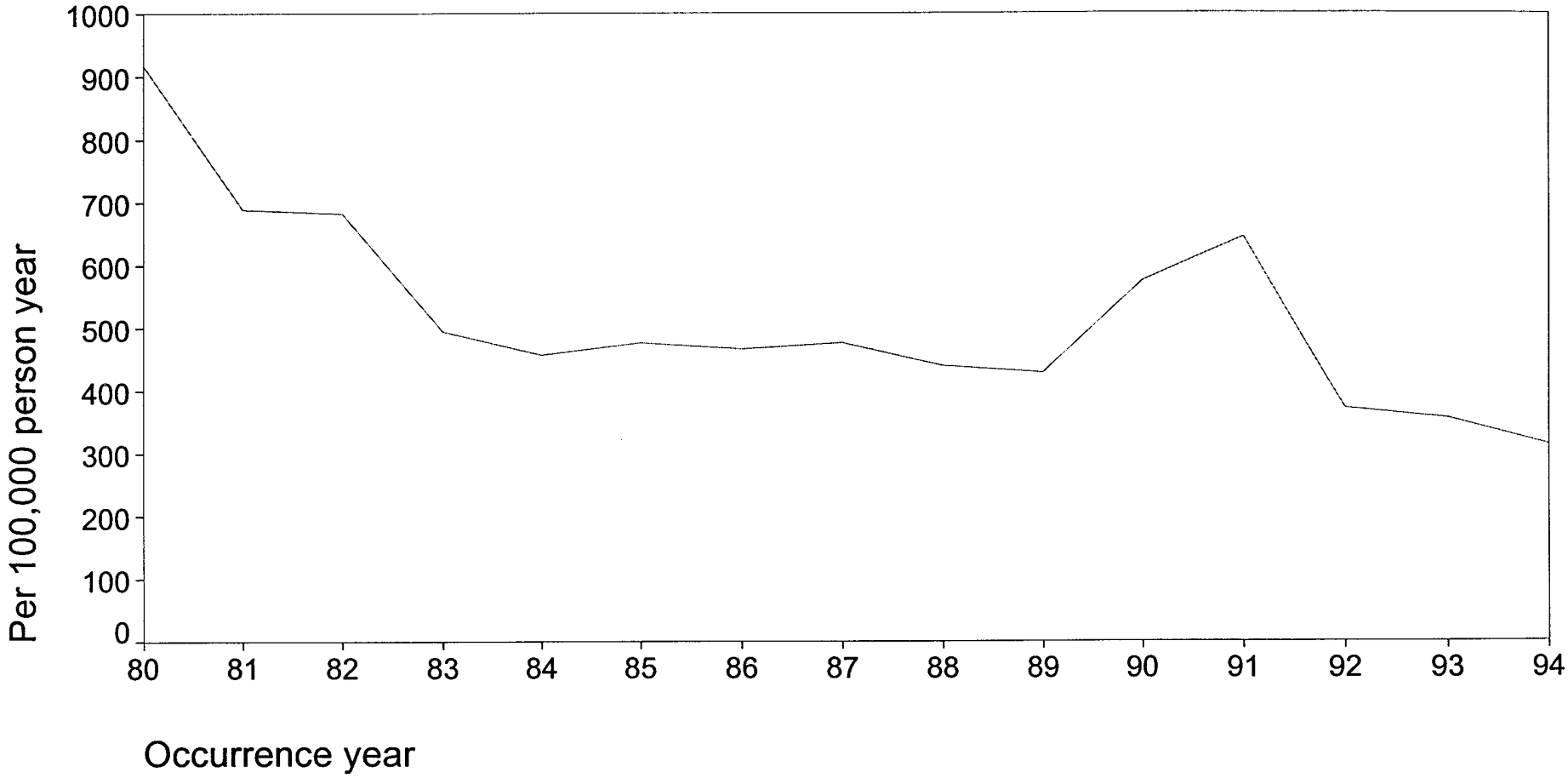
Falls - Female

STANAG: 900-929



Miscellaneous other or unspecified agents - Female

STANAG: 930-999



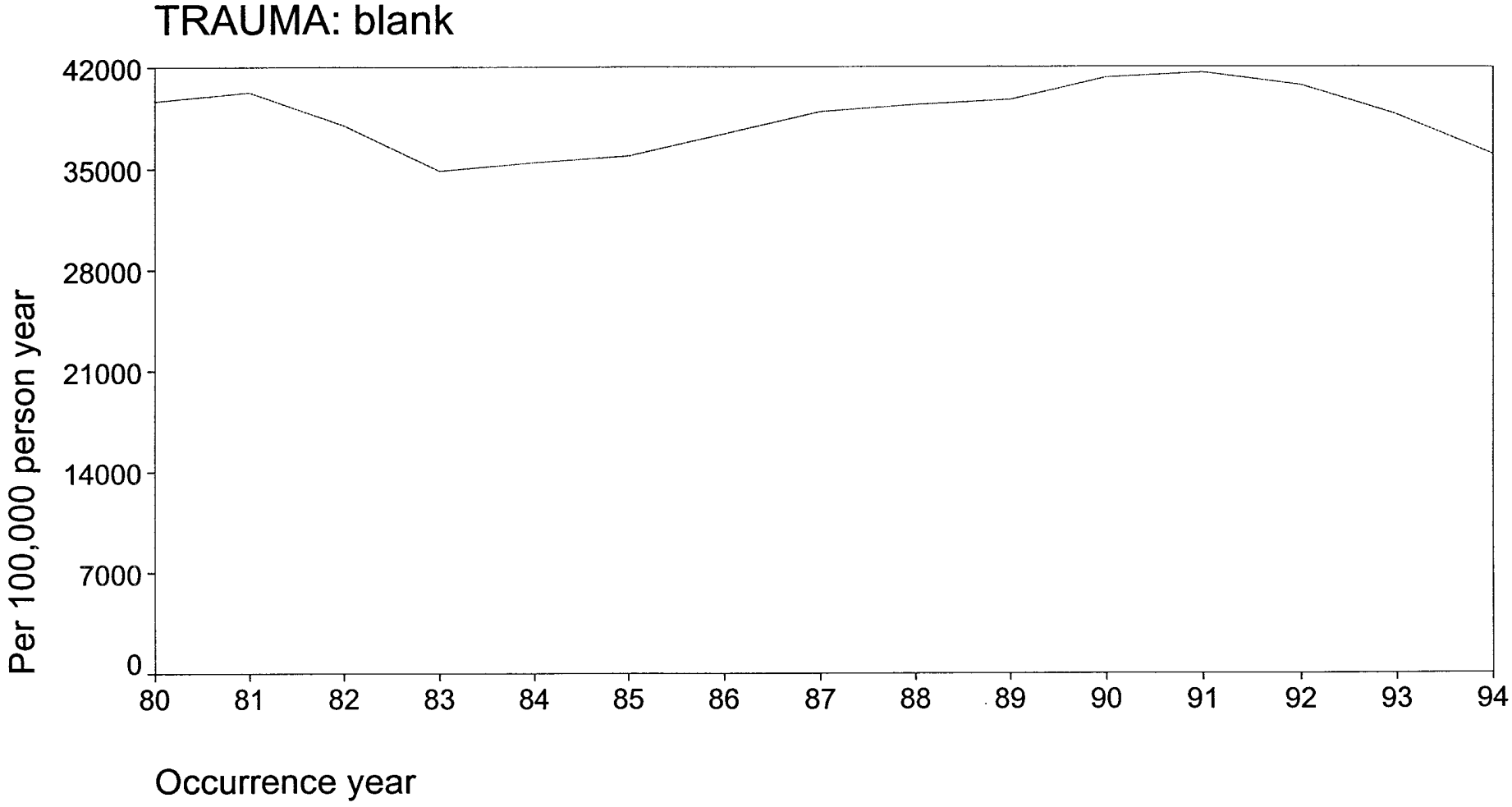
GROUP OF TRAUMA CODES PER 100,000 PERSON-YEAR OVER TIME: 1980-1994

Female

***Data source*: 1980-1995 Army hospitalization data**
1980-1994 Army personnel data

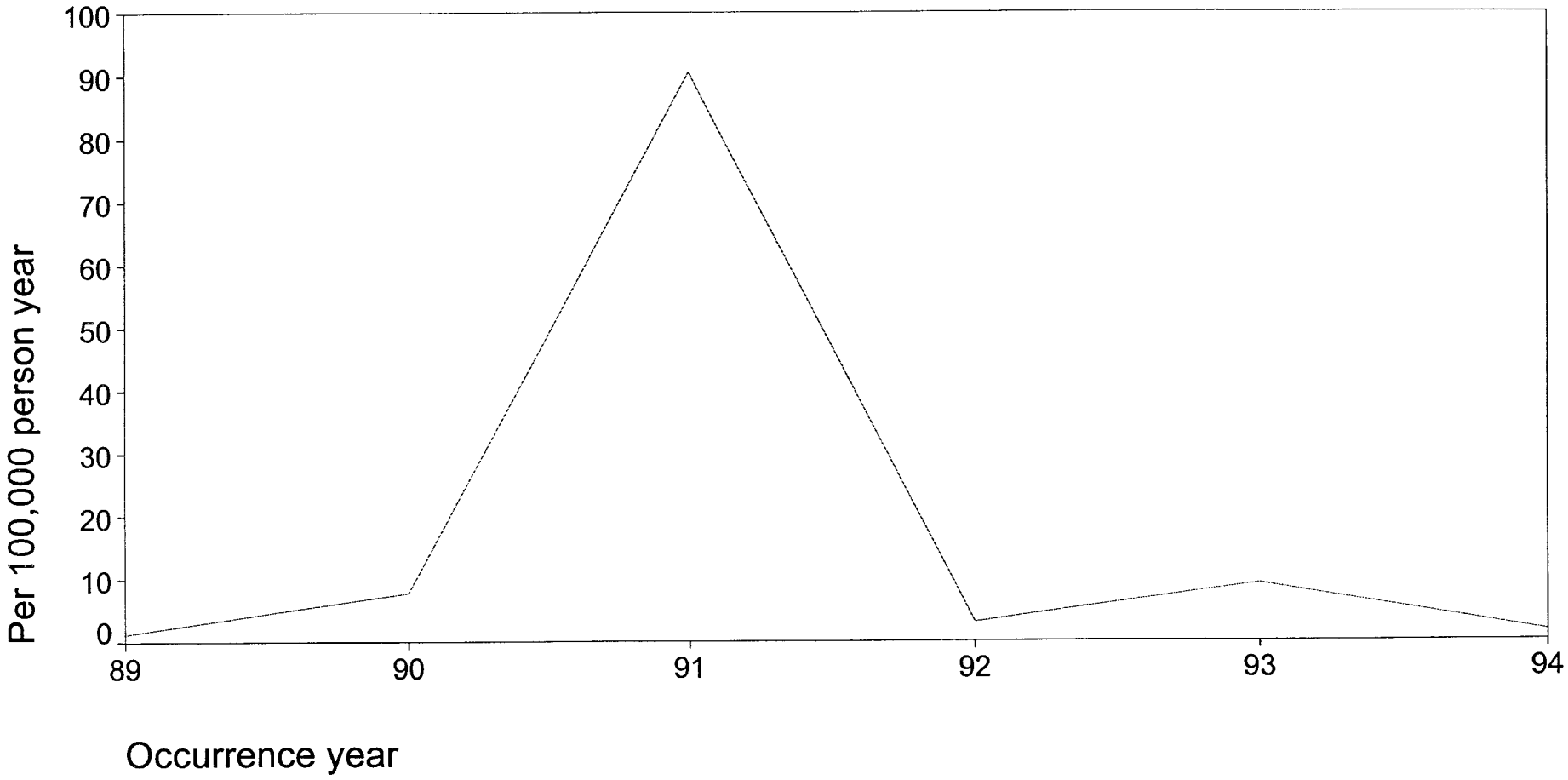
***Date of preparation*: 10/14/96**

No trauma code - Female



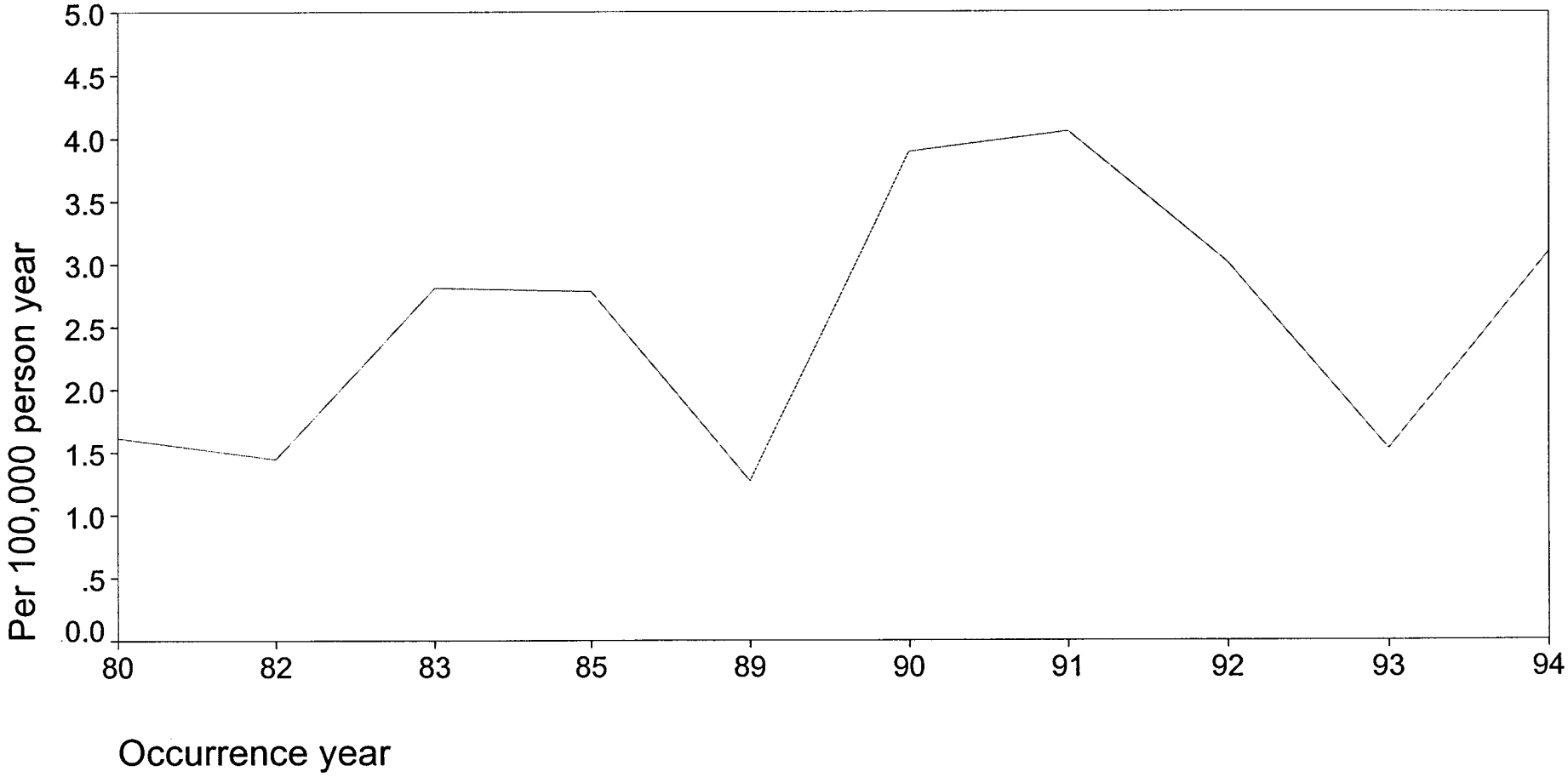
Other battle casualties - Female

TRAUMA: 1



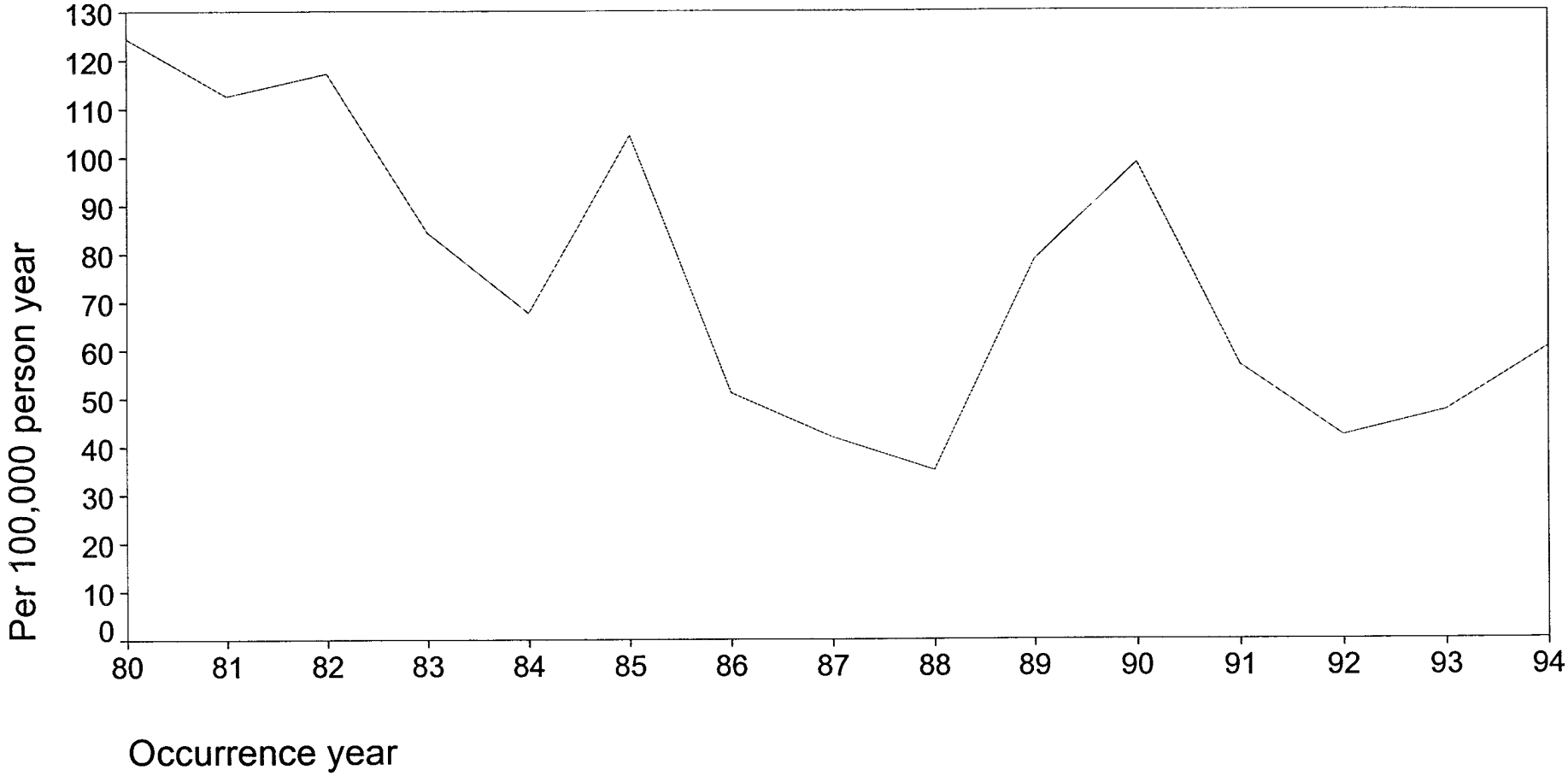
Result of intervention of legal authority - Female

TRAUMA: 2



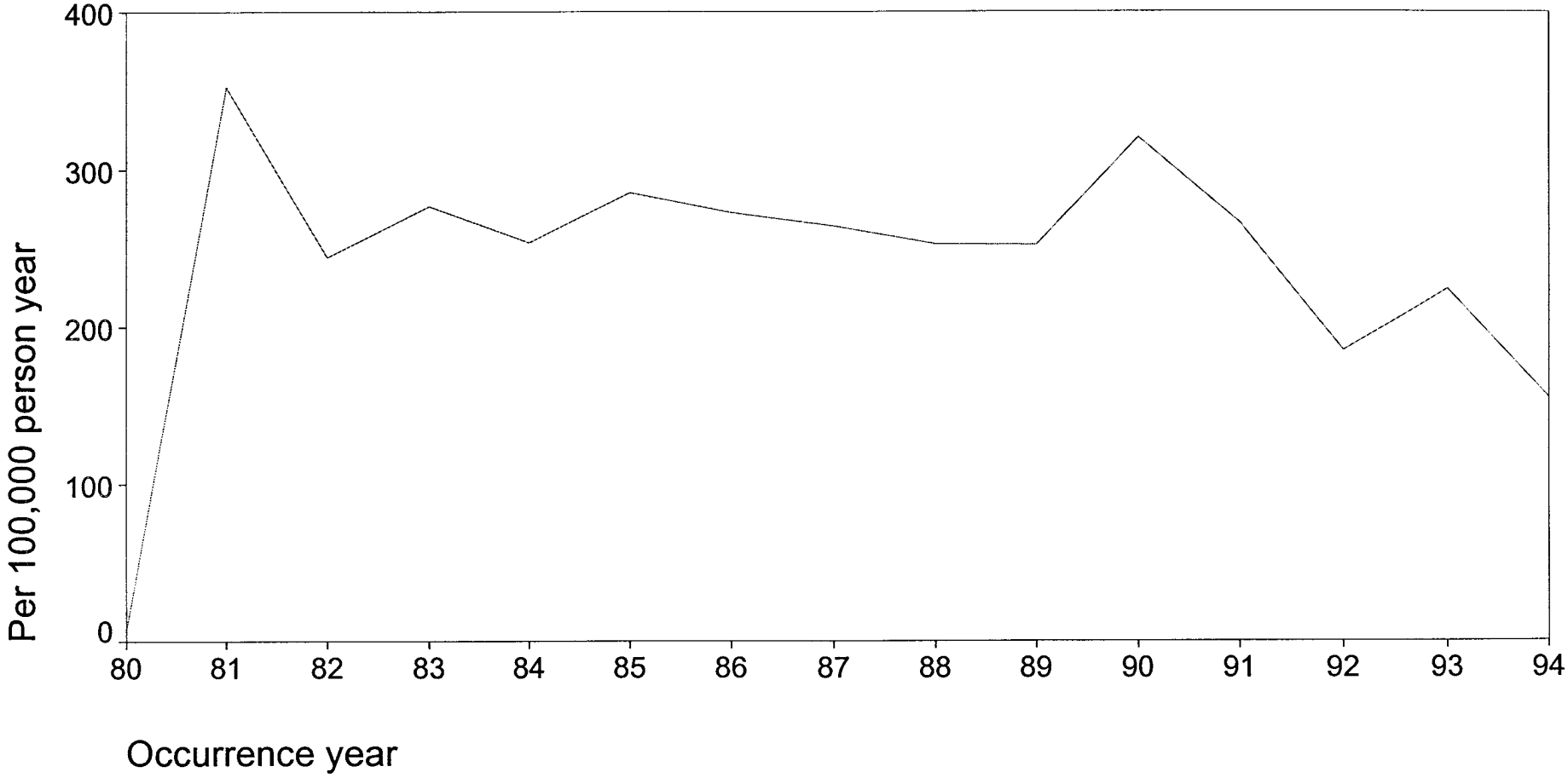
Assault of intentionally inflicted by another person - Female

TRAUMA: 3



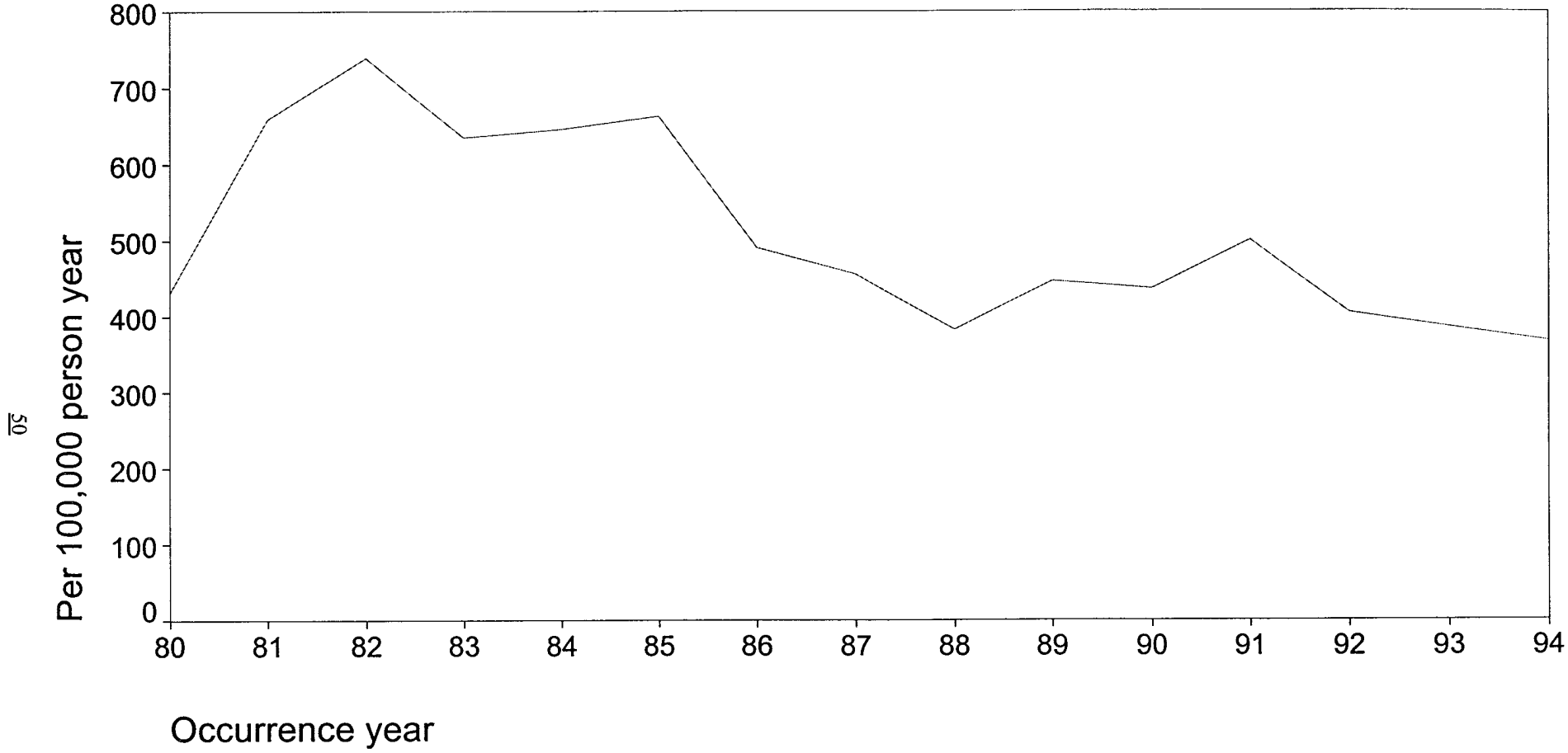
Intentionally self-inflicted - Female

TRAUMA: 4



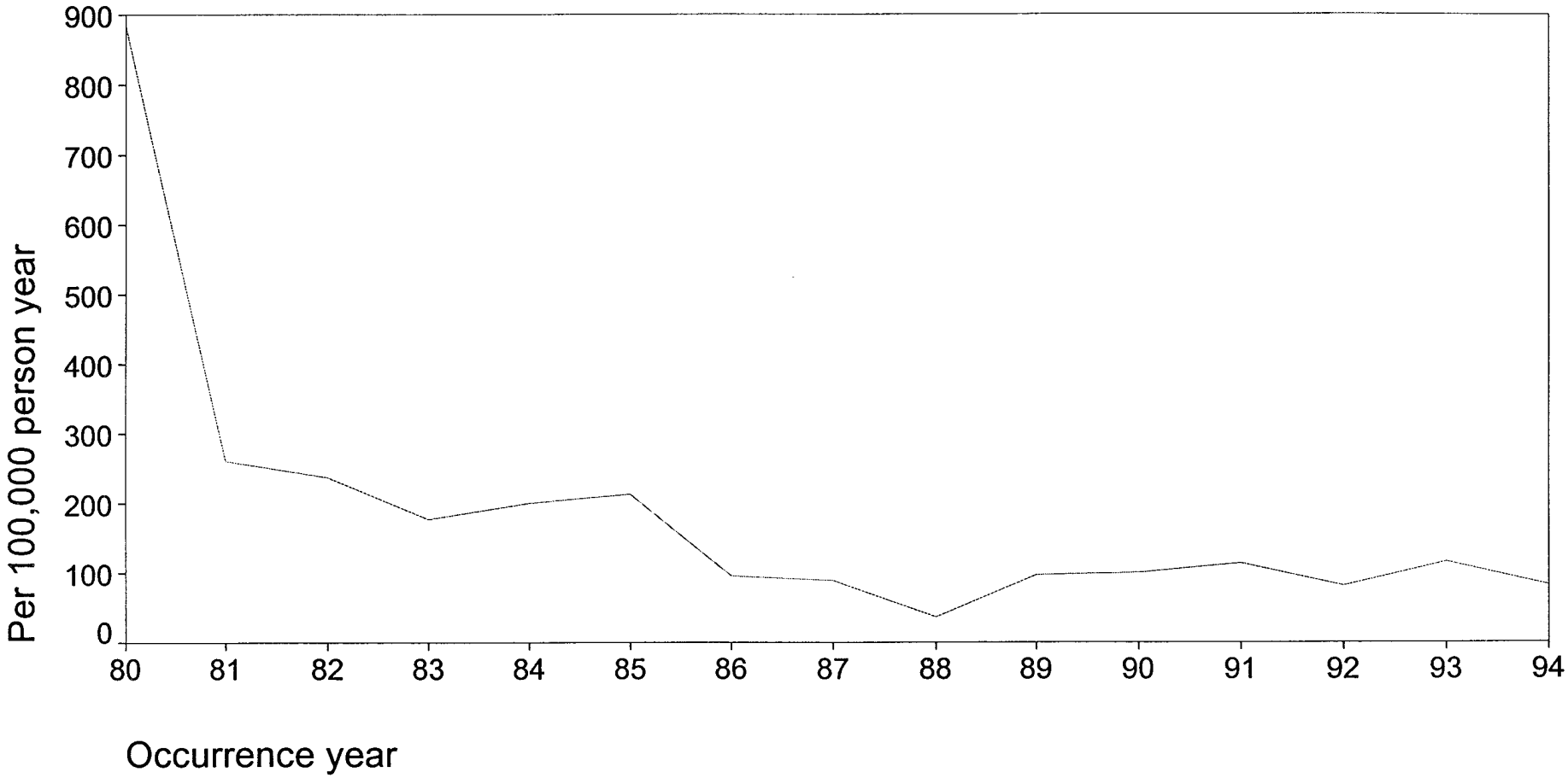
Occurring while off duty - Female

TRAUMA: 5



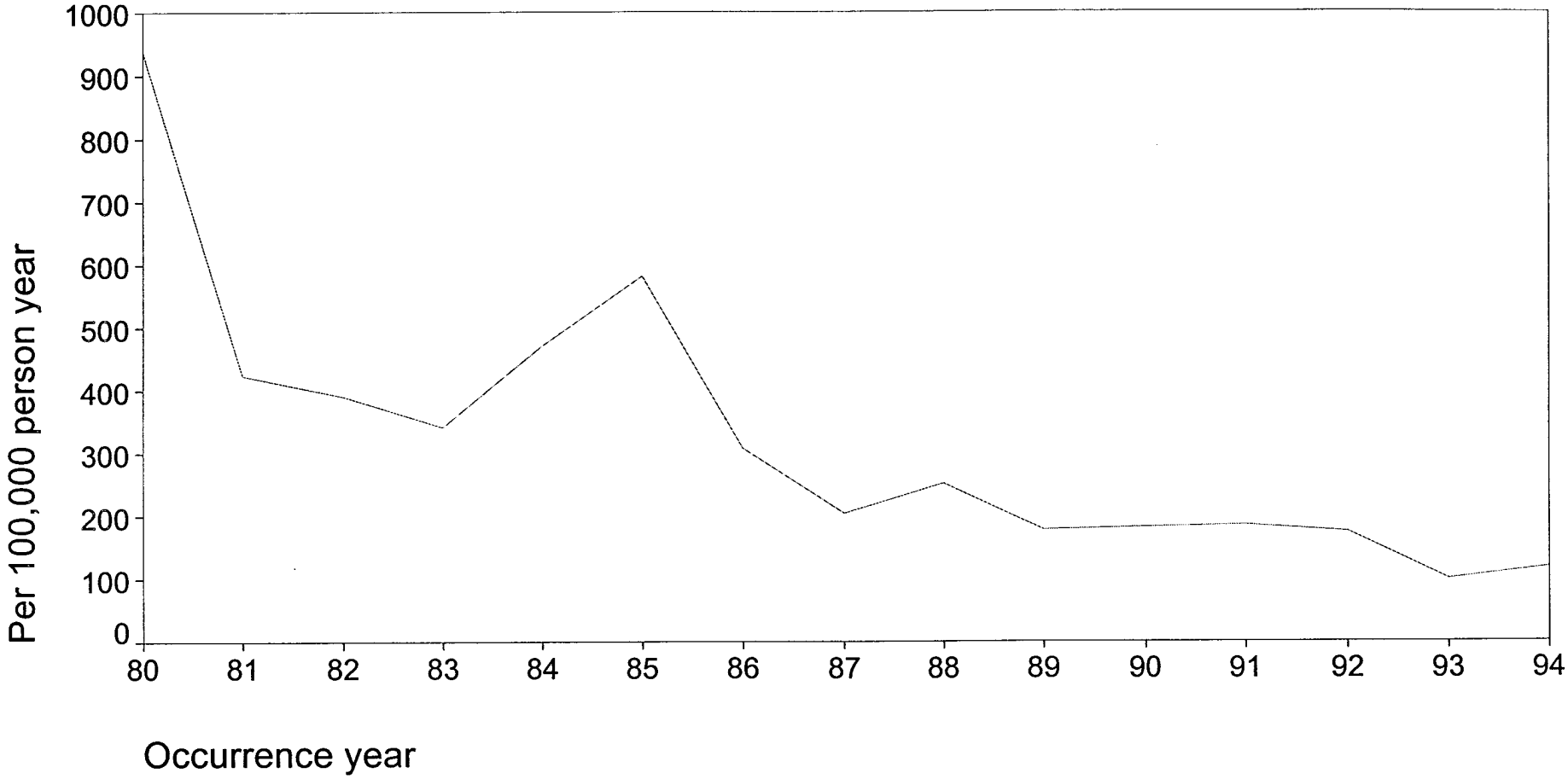
Schemes (maneuvers) / exercises - Female

TRAUMA: 6



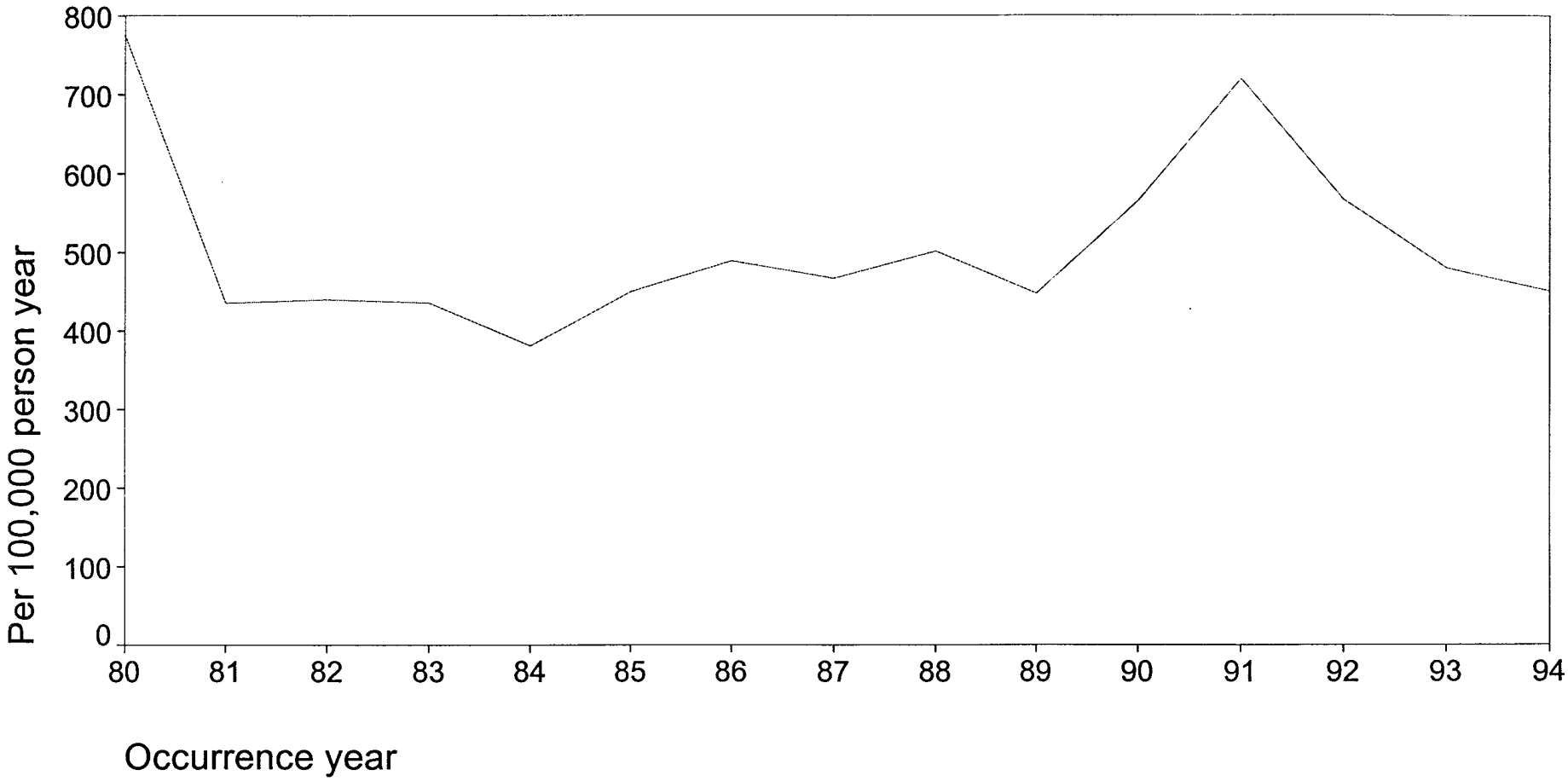
All other scheduled training - Female

TRAUMA: 7



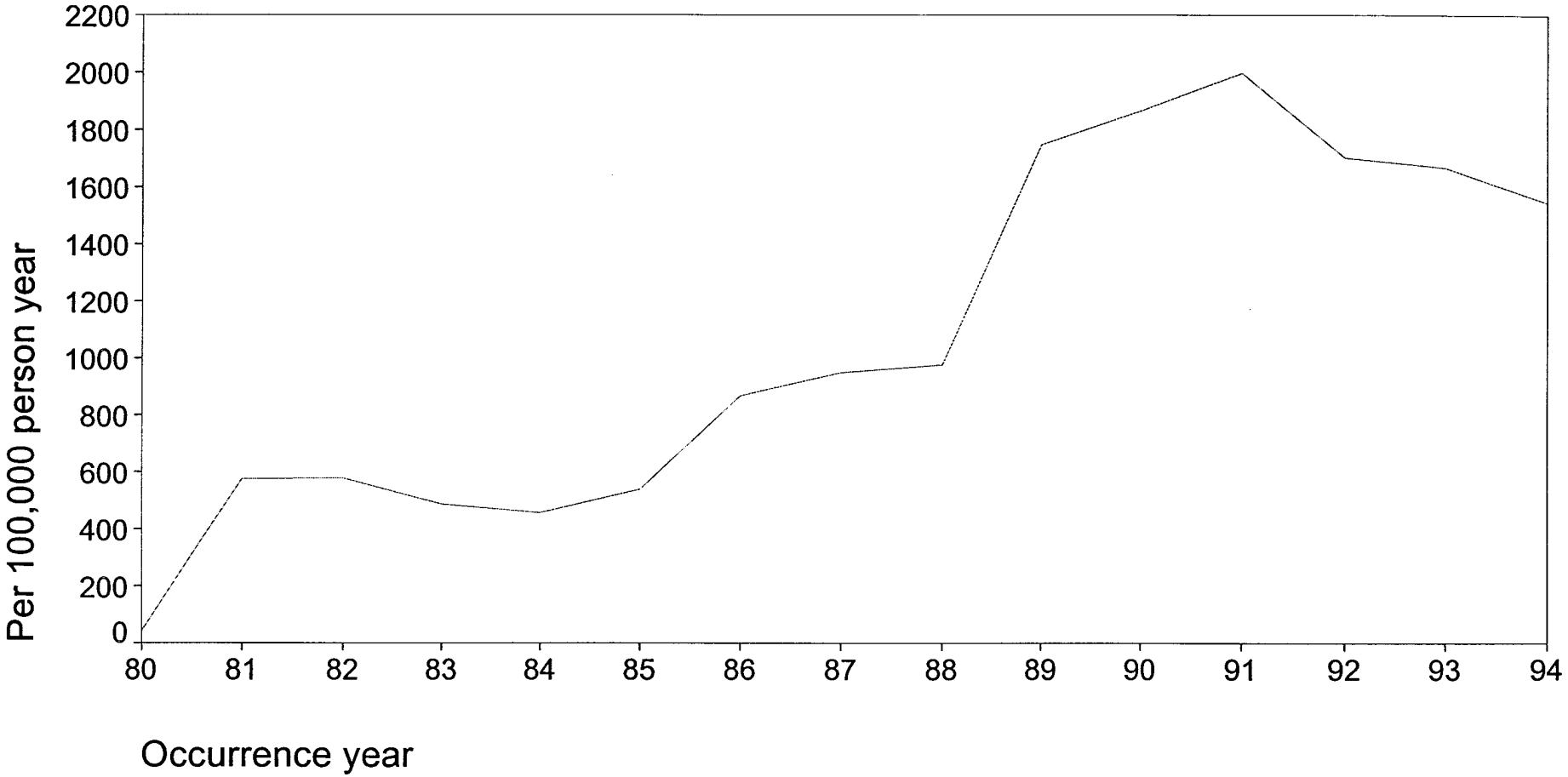
Occurring while on duty - Female

TRAUMA: 8



Unknown whether on or off duty; nonmilitary injuries - Female

TRAUMA: 9



CHAPTER 3
HOSPITALIZATION DUE TO INJURIES

Section 3-1. Introduction

a. While injury fatalities are an important problem, hospitalized injuries occur in much larger numbers and often result in long-term disability. The largest health impact on military populations in terms of hospitalization is injuries. Hospitalized injuries also result in the largest direct costs of medical care. Being the most serious of the nonfatal injuries, they also result in the most lost work days, include the largest proportion of disabling injuries, and have the largest impact on troop readiness. For the U.S. as a whole, hospitalized injuries are the most expensive group of injuries (based on severity), they incur the highest total (direct and indirect) lifetime costs ($80.1 billion in 1985), being almost twice the costs of fatal injuries ($49.4 billion) and almost three times the costs of nonhospitalized injuries ($28.2 billion) [Rice 1989]. Among persons ages 15-44 (the age group comparable to most service personnel), hospitalized injuries result in the most costs of any group. While similar cost data are not yet available for the military, hospitalized injuries clearly represent a major health problem and should be given high priority for prevention purposes.

b. Data from Desert Storm suggest that accidents, other acute injuries, and musculoskeletal conditions accounted for 43 percent of all hospitalizations during the operation, but only a small proportion of hospitalized injuries were due to combat (Writer, 1995). Thus, injury hospitalizations are an important cause of loss of readiness in military personnel. In addition, 14 percent of hospitalizations were due to musculoskeletal and connective tissue disorders (code group 710-739), many of which were the chronic or recurrent effects of injuries that occurred before deployment.

Section 3-2. Magnitude of the Problem

a. Injury hospitalization data are available for Army, Navy, Marine Corps, and Air Force active duty military personnel from computerized hospital medical record systems. In 1992, 17,718 injuries accounted for 7.9 percent to 11.6 percent of all hospitalizations in the three services (Table 3-1). Service-specific injury rates were 15.6 hospitalizations per 1,000 person-years (PY) for the Army, 8.3 per 1,000 PY for the Navy (enlisted), and 7.7 per 1,000 PY for the Air Force. In addition, a substantial proportion of the 28,472 hospitalizations for musculoskeletal conditions were due to recurrent or chronic effects of injuries such as lumbar and intervertebral disc disorders and internal knee derangements. Hospitalizations for musculoskeletal conditions

accounted for 12.3 percent to 19.7 percent of all hospitalizations in the three services in 1992 (Table 3-1). (Addendum Tables 3A-1 and 3A-2 on pages 3-16 and 3-17 show the distribution of hospital cases by ICD-9 Principle Diagnostic groups for the Air Force and Army in 1992.)

b. The rates of hospitalization for injuries and for musculoskeletal and connective tissue disorders (ICD-9 710-739) are substantially higher in the Army than in the other two services, possibly due to differences in risk exposure. From 1980/81 to 1992, the injury hospitalization rates decreased 38 percent in the Army (25.1 to 15.6 per 1000PY), 65 percent in the Navy (23.6 to 8.3), and 56 percent in the Air Force (17.7 to 7.7) (Table 3-1). Rates were calculated using mid-year service populations for each year. (Addendum Table 3A-3 shows the frequencies and rates of injury hospitalizations of Army personnel for the top 10 principle diagnosis group (PDG), 3 digit codes, for 1994. These top 10 code groups counted for 41 percent of all injuries in that year, page 3-18.) During the same period, the musculoskeletal hospitalization rates decreased 32 percent in the Navy (14.2 to 9.7) and 20 percent in the Air Force (15 to 12) but increased 75 percent in the Army (16.2 to 28.1). The increasing rate in the Army may be real or may relate to changes in nosologic coding practices. (Addendum Table 3A-4 displays the frequency and rates of hospitalization for the Top 10 musculoskeletal, PDG, 3 digit code groups among Army personnel in 1994. These Top 10 accounted for 88 percent of all musculoskeletal and connective tissue disorders in that year.)

Table 3-1. Hospitalizations for Injuries Among U.S. Active Duty Military Personnel

	Army (All active duty)		Navy (Enlisted only)		Air Force (All active duty)	
Year:	1981	1992	1980	1992	1980/81	1992
Total Hospitalizations						
Number	110404	91788	53707	34982	86100*	46059
Case Rate/1000 PY	142.1	142.8	117.1	71.6*	155*	97.3
Injury						
Number	19503	10011	10830	4053	10005	3654
% of all Hospitalizations	17.7	10.9	20.2*	11.6	11.6	7.9
Musculoskeletal						
Number	12553	18050	6512	4738	8400*	5684
% of all Hospitalizations	11.4	19.7	12.1	13.5	9.8*	12.3

*Data are based on best estimates currently available (Jones, 1995).

Section 3-3. Causes of Injury Hospitalization

a. The leading causes of hospitalization for injuries among Army and Air Force active duty military personnel in 1992 are listed in Table 3-2. Athletic and motor vehicle-related injuries are prominent in both services. In both the Army and Air Force, athletic injuries were more common than motor vehicle-related injuries in 1992; the reverse was true in both services in 1980 to 1981 [Jones, 1995 p 30, 31, 39]. The decrease in motor vehicle injuries in the military over the past decade mirrors a national trend that is due in part to safer vehicles and increased seat belt use. Late effects of injury in the Army and complications of medical or surgical procedures in both services are also among the four leading causes of hospitalized injury in 1992. Neither of these latter categories were among the four leading causes of injury in 1980 to 1981. (Addendum Table 3A-5, page 3-20, shows that all of the conditions cause coded as "late effects" of injury in 1994 for the Army were musculoskeletal and connective tissue conditions with ICD-9 diagnosis codes between 710 and 739.)

b. Based on 1992 data, hospitalizations for injuries were more common among males than females (16.1 vs. 11.9 hospitalizations per 1000PY in the Army; 8.5 vs. 6.5 in the Navy), while hospitalizations for musculoskeletal conditions were less common among males than females (27.2 vs. 34.4 in the Army; 9.4 vs. 12.0 in the Navy) [Jones, 1995, p 16, 28]. Similar patterns by gender were observed for both Army and Navy (enlisted personnel) hospitalizations in 1980. Overall for both acute injuries and musculoskeletal injuries combined, rates were higher in females in the Army and in the Navy.

c. Considering specific causes of injury hospitalization among Army personnel in 1992, males were more frequently hospitalized than females for athletic injuries (3.5 vs. 1.2 per 1000 PY) and for fighting (1.0 vs. 0.3). Females were more frequently hospitalized for complications of medical or surgical procedures (7.3 vs. 2.5 per 1000 PY) and for poisoning by ingestion (2.5 vs. 0.7) [Jones, 1995 p 30]. Similar patterns by gender were observed for Army personnel hospitalizations in 1980.

Table 3-2. Leading Causes of Hospitalization for Injuries Among U.S. Army and Air Force Active Duty Military Personnel, 1992

Cause of injury	Army		Air Force	
	No. of injuries	Case rate per 1000 person-years	No. of injuries	Case rate per 1000 person-years
Late effects of injury	2762	4.3	276	0.6
Athletics/sports	2045	3.2	1047	2.2
Complications med/surg procedure	1993	3.1	978	2.1
Motor vehicle	1629	2.5	714	1.5
Falls or jumps	1224	1.9	405	0.9
Unknown, unspecified	849	1.3	332	0.7
Machinery, tools, other agents	735	1.1	50	0.1
Cutting or piercing objects	659	1.0	163	0.3
Poisoning by ingestion	586	0.9	167	0.4
Fighting	583	0.9	107	0.2
All other	2300	3.6	785	1.7
Total	15365	23.9	5024	10.6

Note: The numbers and case rates for total injuries are different in Tables 3-1 and 3-2. Table 3-1 separates injuries from musculoskeletal conditions (a portion of which are injury-related). Table 3-2 includes under injuries those musculoskeletal and other conditions which received external cause codes for injury.

d. Based on 1992 data for the Navy enlisted personnel, hospitalization rates for injuries were 8.5 per 1,000 PY for Caucasians, 8.7 per 1,000 PY for African-Americans, and 4.7 per 1,000 PY for other races. Corresponding hospitalization rates by race for musculoskeletal conditions were 9.9, 10.2, and 5.3 per 1,000 PY, respectively [Jones, 1995, p. 16]. Similar patterns by race were observed for Navy enlisted personnel hospitalizations in 1980, except the hospitalization rates for injuries were higher for Caucasians (25.3 per 1,000 PY) than for African-Americans (18.6 per 1,000 PY) [Jones, 1995, p. 13].

e. An alternative method used to examine the impact of hospitalizations for injuries focuses on noneffective rates. These rates reflect the nonavailability for service of an

individual while in the hospital or on convalescent leave, and incorporate length of hospital stay as a measure of injury severity. A noneffective rate is calculated as the number of persons on the hospital rolls per 1,000 personnel per day. For example, in the Army in 1992, the noneffective rates for motor vehicle-related injury hospitalizations was higher than for athletic injuries (0.19 vs. 0.13 per 1,000 per day), but the case rate for motor vehicle injuries was lower than for athletic injuries (2.5 vs. 3.2 per 1,000 PY) [Jones, 1995, p. 30].

Section 3-4. Strengths and Limitations of Current Hospital Databases

a. Each of the three services has its own hospital discharge database with records of all hospitalizations for service members. Data include patient demographics, duty status, outcome, detailed cause and nature of injury codes (ICD9-CM, up to eight diagnosis fields and eight procedures), residual disability (about 300 codes) and a service-specific code for military occupation (about 1200 codes).

b. All three services maintain separate computerized hospital medical record databases that are coded using standard ICD-9 codes. All acute accidents and injuries in the ICD-9 code range, 800-999, are coded using standard NATO injury codes that also include codes on combat-related injuries. 100 percent of diagnoses in the 800-999 series are cause coded for the Army. More work is needed to examine other military databases as to the extent of external cause coding. Since 1989, the key database elements have been standardized among all three services. Hospital data can be used to calculate simple admission rates using denominator data or to calculate noneffective rates that reflect time unavailable for duty.

c. At present, both Army and Air Force hospital discharge databases are organized on the basis of each individual admission and service person. The Navy has made more use of the hospital data, but data were not available for this report. A major strength of military hospital discharge data is the inclusion of a unique personal identifier (Social Security Number) that make it possible to link information between databases, to link the individual records across multiple admissions for the same injury episode, and to distinguish the first admission for an injury from subsequent readmissions for the same problem or transfers between hospitals. Specific variables have been added to track readmissions since 1989. Medical records of dependents can be also linked to the common Social Security Number of the service person.

d. The existence of a unique identifier overcomes many of the problems encountered in our analyses of civilian databases, such as inability to measure true injury incidence because up to 20 percent of injury admissions to hospitals may be repeat admissions for the same problem [Smith, Langlois, Buechner, 1991]. The

identifier also permits indepth analytical approaches to risk factors such as alcohol-related diagnoses. Information on injury admissions could potentially be linked to the Safety Management Information System or to outpatient databases.

e. An important strength of military databases is that excellent denominator data are available from which accurate injury rates can be calculated. The Defense Manpower Data Center (DMDC) can provide extensive demographic data on all service members including age, race, gender, pay grade, date of enlistment, occupation, and hazardous duty pay. The DMDC database is updated semiannually and data by individual year are available. Many recruits enlist for only 2 to 4 years, so that accurate data on person-months will need to be calculated for each person and translated into person-years of exposure.

f. However military hospital record databases have not been routinely linked to denominator databases from which rates can be calculated. The Navy has had considerable experience analyzing hospital discharge data for a variety of health conditions [Helmkamp & Bone, 1987], and the Naval Health Research Center in San Diego, California, has created a database that allows linkage of denominator data and of repeated admissions for individual persons. Their model should be helpful for the use of hospital data by the other services for routine medical surveillance.

g. The Retrospective Case Mix Analysis System (RCMAS) combines several different hospital discharge databases and contains information (including DRGs) on hospitalized members of the Army, Air Force, Navy, and Marines and their dependents. It represents the first effort to establish a DOD-wide hospital discharge database for use in hospital planning and health service utilization review. It includes data on admissions to all military hospitals, as well as civilian hospitals reimbursed under CHAMPUS. This database may be useful for some analyses although retrieval of the entire patient record is difficult with the current version of RCMAS.

h. Another major strength of the military hospital discharge data is that it includes data on the external cause of injury that are not yet available on most civilian databases. Rather than standard E-codes, the military uses NATO E-codes (STANAG codes) which are modified E-codes that more fully describe the frequent military causes of injury. Unlike civilian E-codes, the military cause codes clearly identify sports injuries by specific types of codes, e.g., 200-249. Preliminary analysis of the military hospital discharge data indicates, at least in the Army, that all injury discharges have a corresponding NATO external cause code. These data are thus much better than any civilian database and will provide important information to develop prevention strategies.

i. An important determinant of injury risk is exposure to hazards that may vary widely by service, by rank, and by job tasks. The ability to use occupational title and pay grade to adjust for occupational exposures is one means to assess exposure and is enhanced by the recent development of a new DOD coding system for occupational titles. This coding system will allow comparison of injury rates for similar occupational groups in the different services. This is important in comparing injury rates between different groups such as males and females [Dannenberg, 1994]. For example, Zwerling [1993] demonstrated that when adjusted for work-related exposures using occupational titles, female postal workers have higher occupational injury rates than males. Similarly, such analyses of military hospital databases may lead to important insights into specific injury hazards in certain groups.

j. While existing databases can provide much useful information for injury prevention purposes, they have some limitations, particularly with regard to exposure issues, details of clinical care, and information on disability. More in-depth follow-up studies involving original data collection will be needed to look at specific problem areas that will be identified by future analyses. One such example is the lack of information on many of the long-term consequences of nonfatal injuries. By linking hospital data to existing disability databases, it may be possible to answer some of these questions.

k. A small proportion of hospitalizations of military personnel occur in civilian rather than military hospitals. It is our current understanding that any admission to a civilian hospital is captured by the military hospital discharge database as part of the reimbursement process. However, the quality and completeness of this data for injuries is unknown at this time.

l. Rates of injury hospitalizations for the services, particularly the Army, appear to be higher than those for civilian populations. However, military hospitalization rates may not be directly comparable to civilian rates. All service members have free health care so there is no potential barrier to hospitalization, i.e., incurring personal cost. In addition, some trainees, especially those living in group quarters such as barracks, may be hospitalized for conditions such as stress fractures or other more minor conditions that would not result in hospitalization in the civilian community. This is done because there is no one to care for such individuals who cannot participate in training during the day.

m. In addition to the above concerns, a number of important questions related to injury hospitalizations deserve further investigation:

(1) Can standard methods for ascertaining numerators and denominators for hospitalization rates be used for all services even though the databases depend on different data management systems?

(2) Which codes for musculoskeletal conditions should be included and excluded in calculations of hospitalized injury rates, so that a common definition can be used across all services?

(3) What factors account for the declining rates of hospitalized injuries in all three services? Are more injuries being treated in outpatient clinics?

(4) Are there changes in coding practices that account for the increasing rate of hospitalized musculoskeletal conditions in the Army while the same rate is decreasing in the Navy and Air Force?

(5) What accounts for the increasing rates over the past decade of reported complications of medical and surgical procedures and of late effects of injury?

(6) Do rates of hospitalized injuries vary by age after taking into account differences in risk exposure by age?

(7) Are data available for the Navy on causes of injury hospitalizations?

(8) Are injuries occurring on ships reported to the hospital data system?

(9) What is the quality of the data available in the various military hospital medical record systems?

(10) Are noneffective rates being calculated consistently across the services, and are such rates a better reflection of the true cost of injuries than hospitalization case rates?

(11) How well are data for military personnel hospitalized in civilian hospitals incorporated into the military data system?

(12) Are there differences in the threshold for hospitalization among the services or even within a service depending on geographic considerations?

Section 3-5. Use of Hospital Databases for Prevention

a. Hospital discharge data that include detailed injury information can be useful for injury prevention and surveillance purposes. The first step is to identify specific high risk groups or hazards for targeting prevention resources. Hospital discharge data can also be used to evaluate the effectiveness of interventions for reducing injury rates. The following examples illustrate some of the uses to which hospital discharge data could be put to develop and evaluate injury prevention strategies.

b. Comparisons of injury rates among different services may identify significant differences in injury risk and suggest new prevention strategies, since different injury prevention policies or practices may serve as natural experiments. Differences in rates for a particular injury may suggest areas for further research, as in studies comparing injury rates among countries [Rockett and Smith, 1987]. Ecological comparisons of disease rates between countries have been the basis for many important new insights into disease prevention, such as the relationship of diet and cancer. One injury example is the difference in injuries between two training centers that prompted follow-up studies on methods to reduce training injuries [Jones 1983, Jones 1993]. We may find similar situations when comparing rates of other types of injuries among different services.

c. Caution must be exercised in examining inter-service differences for two reasons. First, it is likely that there are important differences in exposure to various risks among the services. Second, there are variations in policies and reporting practices among the services. For example, a reportable injury to the Army Safety Center is one resulting in one or more days of limited duty, compared with 5 or more days for the Navy Safety Center. There may also be differences in admission practices for hospitalization among the services.

d. Analysis of injury trends can provide important insights into causes and prevention strategies for specific injury problems. One problem in analyzing trends is that external factors can influence injury rates. A change in practice related to admitting persons with minor head injuries, for example, can produce a dramatic change in the apparent rate of minor head injuries, but little change in the rate of serious head injury. One approach would be to examine certain injuries, such as skull fractures, that are always likely to be admitted and see how they have changed in relation to other injuries. Analyses using stratification by injury severity will be important in analyzing trend data.

e. The existence of a unique identifier provides a rare opportunity to conduct more indepth epidemiological studies of a variety of factors that may be related to being

injured. As an example, one could study recurrent injuries to the same individual. It is also possible to examine a cohort of persons with alcohol-related diagnoses in the hospital database and examine their injury rates over time compared with a group of persons having no alcohol-related diagnoses. The comparison group can be selected from the total military population and matched on age, gender, and length of service. Utilization of health services could be compared for the two groups. Similarly, a cohort of women who recently delivered a child could be used to examine the effect of pregnancy on injury risks.

f. Another possible study could use a nested case-control design within the longitudinal dataset with controls selected from the DMDC database. One could examine whether women with a prior hospitalization for assault are at an increased risk of homicide or a repeat hospitalization, and whether the risk increases exponentially with each subsequent hospitalization. This information could be used to develop interventions such as screening programs for women at risk with appropriate follow-up.

Section 3-6. Conclusions

a. Hospital discharge records indicate that injuries and musculoskeletal conditions are the largest cause of admission to hospitals in the military and the largest direct costs of medical care. They also have a major impact on troop readiness (larger than any other ICD-9 principle diagnostic group and the noneffective rate is higher). The combined categories of accidents/other injuries and musculoskeletal/connective tissue disorders accounted for slightly more than 30 percent of all Army hospitalizations in 1992.

b. Hospitalization rates for injury appear to be declining for all services over the past decade. For 1980 to 1992, rates of hospitalization for acute injuries (ICD-9 codes 800-999) decreased from about 28 per 1,000 PY to about 24 for the Army and from 21 per 1,000 PY to less than 14 for the Air Force.

c. Musculoskeletal injuries are increasing in the Army but declining in the other services. Reasons for these changes are not known at present and need further research.

d. Major causes of hospitalization include sports injuries, motor vehicle crashes, falls and jumps.

e. Major types of injuries include back and knee injuries as well as fractures.

f. Military hospital discharge databases are an important source of information on severe injuries and are more comprehensive than civilian databases. Although initially collected for administrative purposes and seldom used for epidemiologic studies, the military hospital databases provide a unique opportunity to overcome many of the problems encountered in the use of civilian hospital discharge databases to study injuries. The presence of good external cause codes and the ability to link repeat admissions and to link with other databases are important strengths of the hospital data. Unlike most civilian hospital databases, the military data can be used for separate analyses of both work-related and recreational injuries as well as off-duty motor vehicle injuries. Studies of military occupational injury problems have important implications for both civilian and military populations.

g. The existence of a unique personal identifier is one of the most important features of the military databases for use in medical surveillance and for subsequent research to address important injury problems in the military.

h. Good demographic data on military troop strength is available and can be combined with denominator data. However, other measures of exposure are more difficult to access and need more investigation.

i. Uniform data do exist among services for some variables but more attention needs to be paid to cross-service comparisons.

j. Future studies of hospital data for injury should focus on military readiness and costs.

k. In summary, the military hospital discharge databases provide tremendous potential for injury surveillance in addition to surveillance for other medical problems. To date, the data have been underutilized by the military. The data will be especially useful when they are linked with population-based denominator data from the DMDC. The establishment of a comprehensive surveillance database of hospitalized injuries should be a priority in any injury program in the military.

Section 3-7. Recommendations

As discussed earlier, the hospital discharge databases have perhaps the greatest potential of any medical databases for comprehensive injury surveillance. The following outlines our recommendations for both the increased use of these databases in their current format and recommendations on how to improve their usefulness for surveillance, research and prevention.

a. Use hospital records routinely for injury and medical surveillance and research both for activities within the military and for research by outside experts.

b. Implement consistent definitions and classifications across time, place and service (e.g., criteria for hospitalization, noneffective days, injury type/acute vs. musculoskeletal/late effects).

c. Improve quality of data collection in deployment and combat situations to make consistent with data collection in fixed facilities-especially for the cause of injury information.

d. Assess quality and consistency of coding and determine need for further training of coders

e. Focus research on prevention of sport injuries and falls which are both major causes of reduced troop readiness.

f. Develop strategies to more effectively link and use medical and safety data. Safety center data are an important source of information on injuries but are not linked in any way to hospital data.

g. Develop automated outpatient data system compatible with inpatient systems.

h. Investigate family violence and workplace violence using hospital databases.

i. Examine work vs. nonwork-related injury (cross-cutting all databases).

j. Evaluate process and quality of data for active duty military personnel treated in civilian hospitals.

k. Add a free text field to existing databases for detailed cause information to help design and evaluate prevention. There is increasing realization of the value of having a free text field in surveillance databases for injuries to better describe the causes and circumstances of injury. One of the limitations of current hospital databases is that the STANAG or E-codes provide only limited information on the specific causes of injury. The 90-character free text description on the cause of injury in the New Zealand hospital discharge database has proven valuable for identifying specific causes or hazardous products and has lead to the development of effective prevention strategies. The addition of a similar field to military hospital record databases would greatly increase their usefulness for prevention purposes.

Only through the implementation of these recommendations can we fully realize the large potential that hospital databases have to improve our understanding of injury problems and reduce the burden of injuries to the military. If previous research in the civilian world is to be used as an example, we can expect major reductions in injuries and significant improvements in troop readiness both in peace time and combat situations.

References

1. Dannenberg, A. L., S. P. Baker, G. Li. Intentional and unintentional injuries in women: an overview. Annals of Epidemiology. 1994; 4:133-139.

2. Helmkamp J. C., C. M. Bone. The effect of time in a new job on hospitalization rates for accidents and injuries in the U.S. Navy, 1977 through 1983. J Occup Med 1987; 29:653-659.

3. Jones B. H. Overuse injuries of the lower extremities associated with marching, jogging, and running: a review. Military Med 1983;148:783-787.

4. Jones B. H., M. W. Bovee, J. M. Harris III, D. N. Cowan. Intrinsic risk factors for exercise-related injuries among male and female army trainees. Amer Orthopedic Soc for Sports Medicine 1993;21:705-710.

5. Jones, B. H. Navy, Army and Air Force rates and trends of hospitalization among active duty personnel for injuries and other medical conditions. Unpublished document distributed at Armed Forces Epidemiological Board Injury Working Group meeting, Ogden, Utah, February 1995, 42 pages.

6. Rice, D. P., E. J. Mackenzie and Associates. Cost of Injury in the United States: A Report to Congress. San Francisco, CA: Institute for Health & Aging, University of California and Injury Prevention Center, Johns Hopkins University, 1989.

7. Rockett, I. R. H., G. S. Smith. Injuries in relation to chronic disease: An international view of premature mortality. Amer J Public Health 1987; 77:1345-1346.

8. Smith, G. S., J. A. Langlois, J. S. Buechner. Methodological issues in using hospital discharge data to determine the incidence of hospitalized injuries. Amer J Epidemiol 1991; 134:1146-1158.

9. Writer, J. V. Non-battle Injuries among U.S. Soldiers in Southwest Asia. Paper presented at Armed Forces Epidemiology Board Injury Prevention Working Group,

Great Lakes Naval Training Center, IL, 5 July 1995. Division of Preventive Medicine, Walter Reed Army Institute of Research, Washington, DC.

10. Zwerling, C., N. L. Sprince, J. Ryan, M. P. Jones. Occupational injuries: comparing the rates of male and female postal workers. Amer J Epidemiol 1993;138:46-55.

ADDENDUM FOR CHAPTER 3
Hospital Admissions Due to Injury

◆ Table 3A-1 presents data on the frequencies and rates of hospitalizations of Active Duty Air Force Personnel by Principle Diagnostic Groups (ICD-9 PDG codes) in order of decreasing frequency for CY 1992.

◆ Table 3A-2 presents similar data for Active Duty Army Personnel for CY 1992.

◆ Table 3A-3 lists the top 10 Injury and Poisoning Diagnostic Groups (ICD-9 Code Groups 800-900) for Active Duty Army Personnel hospitalized in 1994 in order by frequencies and rates.

◆ Table 3A-4 lists the top 10 Musculoskeletal and Connective Tissue Disorders Diagnostic Groups (ICD-9 Code Groups 710-739) for Active Duty Army Personnel Hospitalized in 1994 in order by frequencies and rates.

◆ Table 3A-5 lists the 23 Musculoskeletal and Injury ICD-9 Code Groups cause coded as "Late Effects of Injury" for Active Duty Army Personnel hospital admissions - CY 1994.

TABLE 3A-1. Hospitalizations for Active Duty Air Force Personnel CY 1992 by Principle Diagnosis Group in order of Descending Frequency

Principle Diagnosis Group	Frequency	Case Rate
Digestive System	10,243	21.63
Musculoskeletal	5,684	12.01
Pregnancy Related	5,392	11.39
Injury/ Poisoning	3,654	7.42
Mental Disorders	3,429	7.24
Genitourinary System	2,932	6.19
Respiratory System	2,748	5.80
Infections/ Parasitic	1,628	3.43
Symptoms	1,619	3.42
Nervous System/ Sensory	1,305	2.76
Circulatory System	1,285	2.71
Neoplasms	1,147	2.42
Skin	871	1.84
Endocrine	476	1.01
Congenital Anomalies	277	0.59
Blood	129	0.27
TOTAL	46,059	97.28

TABLE 3A-2. Hospitalizations for Active Duty Army Personnel CY 1992 by Principle Diagnosis Group in order of Descending Frequency

Principle Diagnosis Group	Frequency	Case Rate	NER
Diseases of the Musculoskeletal System and Connective Tissue	18050	28.08	1.57
Diseases of the Digestive System	13639	21.21	0.42
Accidents, Poisonings and Violence/Injury and Poisoning	10011	15.57	0.73
Complications of Pregnancy, Childbirth, and the Puerperium	9617	14.96	0.42
Diseases of the Respiratory System	7331	11.40	0.20
Mental Disorders	6636	10.32	0.79
Diseases of the Genitourinary System	5221	8.12	0.17
Infective and Parasitic Diseases	4982	7.75	0.16
Symptoms and Ill defined Conditions	3675	5.72	0.12
Diseases of the Nervous System and Sense Organs	3148	4.90	0.26
Diseases of the Circulatory System	3003	4.67	0.27
Neoplasms	2299	3.58	0.23
Diseases of the Skin and Subcutaneous Tissue	2236	3.48	0.08
Endocrine, Nutritional and Metabolic Disease	892	1.39	0.07
Congenital Anomalies	742	1.15	0.06
Diseases of the Blood and Blood-forming Organs	306	0.48	0.01
TOTAL	91788	142.77	5.56

Table 3A-3. Top 10 Injury and Poisoning Diagnostic Groups (ICD-9 Code Groups 800-900) for Active Duty Army Personnel Hospitalized in 1994

Diagnostic Code Group	ICD-9 Three Digit Code	Frequency	Rate*
Fx of ankle	824	452	0.8
Intracranial inj of oth/unspec nature	854	355	0.6
Oth complications of procedures, NEC	998	337	0.6
Fx of face bones	802	330	0.6
Sprains/strains of knee/leg	844	283	0.5
Dislocation of knee	836	280	0.5
Compl peculiar to certain spec procedures	996	227	0.4
Fx of radius/ulna	813	216	0.4
Fx of one or more phalanges of hand	816	213	0.4
Open wound of finger	883	179	0.3
TOTAL	---	2872	5.1

* Rates are calculated per 1000 soldiers per year based on mid-interval 1994 DMDC Data.

TABLE 3A-4. Top 10 Musculoskeletal and Connective Tissue Disorders Diagnostic Groups (ICD-9 Code Groups 710-739) for Active Duty Army Personnel Hospitalized in 1994

Diagnostic Code Group	ICD-9 Three Digit Code	Frequency	Rate
Internal derangement of knee	717	2924	5.3
Oth derangement of joint	718	1412	2.6
Oth/unspec disorder of joint	719	1276	2.3
Oth disorders of synovium, tendon/bursa	727	1258	2.3
Intervertebral disc disorders	722	979	1.8
Oth/unspec disorders of back	724	861	1.6
Acquired deformities of toe	735	859	1.6
Oth disorders of bone/cartilage	733	852	1.6
Peripheral enthesopathies/allied syndromes	726	814	1.5
Osteoarthrosis/allied disorders	715	580	1.1
TOTAL	---	11815	21.7

* Rates are calculated per 1000 soldiers per year based on mid-interval 1994 DMDC Data.

TABLE 3A-5. Musculoskeletal and Injury ICD-9 Diagnostic Code Groups listed as Caused by "Late Effects of Injury" for Hospital Admissions of Active Duty Army Personnel - CY 1994

Diagnostic Code Group	ICD-9 Code	Frequency	% Total
Internal derangement of knee	717	554	24
Other disorders of bone/ cartilage	733	403	18
Other derangement of joint	718	344	15
Other/ unspec disorder of joint	719	274	12
Osteoarthrosis/allied disorders	715	111	5
Other/ unspec disorders of back	724	110	5
Other/ unspec arthropies	716	92	4
Peripheral enthesopathies/ allied syndromes	726	79	3
Other disorders of synovium, tendon/bursa	727	69	3
Other disorders of soft tissues	729	61	3
Disorders of muscle, ligament/ fascia	728	47	2
Intervertebral disc disorders	722	41	2
Other acquired deformity	738	29	1
Other acquired deformities of toe	736	28	1
Other disorders of cervical region	723	18	1
Osteochondropathies	732	15	1
Spondylosis/ allied disorders	721	7	0
Osteomyelitis, periostitis/ oth infect invol bone	730	7	0
Acquired deformities of toe	735	5	0
Arthropathy associated with infections	711	3	0
Flat foot	734	2	0
Curvature of spine	737	2	0
Ankylosing spondylitis/ oth inflam spondylopathies	720	2	0
	TOTAL	2303	100