

AIR FORCE HEALTH STUDY
AN EPIDEMIOLOGIC INVESTIGATION OF HEALTH EFFECTS
IN AIR FORCE PERSONNEL FOLLOWING EXPOSURE

TO HERBICIDES

MORTALITY STUDY

1989

AIR FORCE SYSTEMS COMMAND
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USAF SCHOOL OF AEROSPACE MEDICINE
HUMAN SYSTEMS DIVISION (AFSC)



OVERVIEW

- BASED ON MORTALITY DATA THROUGH 31 DECEMBER 1987
- 1,261 RANCH HANDS AND 19,101 COMPARISONS
- 5.9% OF RANCH HANDS AND 5.4% OF COMPARISONS HAVE DIED
- OVERALL DEATH RATES

RANCH HAND 2.8 PER 1000 PERSON-YEARS

COMPARISON 2.9 PER 1000 PERSON-YEARS

- OVERALL ADJUSTED STANDARDIZED MORTALITY RATE (SMR) IS 1.0



SUMMARY COUNTS OF DEATHS

ALL PERSONNEL

GROUP	NUMBER AT RISK	NUMBER DEAD	PERSON-YEARS	RATE PER 1000 PERSON-YEARS
RANCH HAND	1261	74	24964	3.0
COMPARISON	19101	1039	413726	2.5

OFFICERS

GROUP	NUMBER AT RISK	NUMBER DEAD	PERSON-YEARS	RATE PER 1000 PERSON-YEARS
RANCH HAND	467	26	9248	2.8
COMPARISON	5531	334	116489	2.9



SUMMARY COUNTS OF DEATHS (CONT)

ENLISTED FLYERS

GROUP	NUMBER AT RISK	NUMBER DEAD	PERSON-YEARS	RATE PER 1000 PERSON-YEARS
RANCH HAND	207	12	4112	2.9
COMPARISON	2833	202	60292	3.4

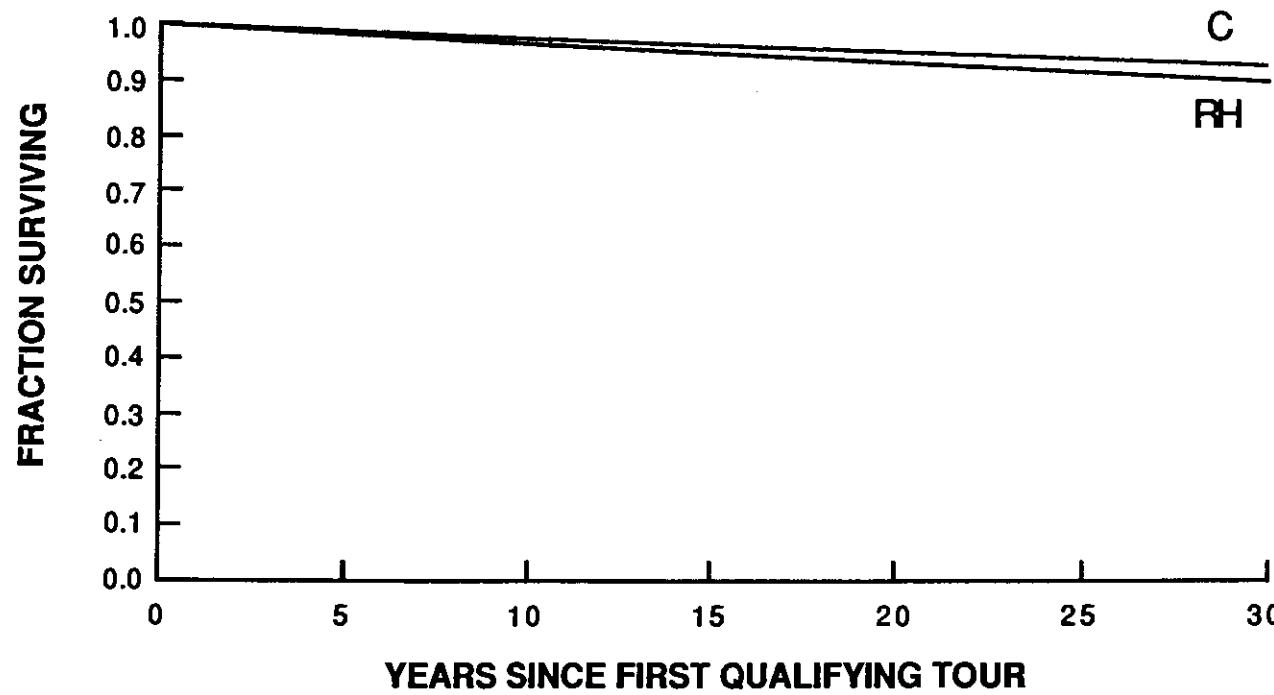
GROUND ENLISTED

GROUP	NUMBER AT RISK	NUMBER DEAD	PERSON-YEARS	RATE PER 1000 PERSON-YEARS
RANCH HAND	587	36	11604	3.1
COMPARISON	10737	503	236945	2.1



ADJUSTED SURVIVAL CURVE ESTIMATES

ALL RANCH HANDS AND ALL COMPARISONS
SURVIVAL FROM START OF TOUR





ADJUSTED* ANALYSES OF CUMULATIVE DEATHS

RANCH HANDS VERSUS ALL COMPARISONS

STRATUM	NUMBER DEAD	EXPECTED DEATHS	SMR	95% CONFIDENCE INTERVAL
OFFICERS	26	27.4	1.0	0.6 - 1.3
ENLISTED	48	45.6	1.1	0.8 - 1.4
GROUND ENLISTED	36	29.1	1.2	0.8 - 1.6
FLYERS	37	43.2	0.9	0.6 - 1.1
NONFLYERS	37	30.1	1.2	0.8 - 1.6
ALL PERSONNEL	74	73.6	1.0	0.8 - 1.3

* ADJUSTMENTS MADE FOR RANK, AGE AND OCCUPATION



RANCH HAND MORTALITY FIVE-YEAR TREND

NUMBER OF DEATHS

YEAR	FLYING OFFICERS	OTHER OFFICERS	ENLISTED FLYERS	GROUND ENLISTED	ALL PERSONNEL
1983	0	0	1	2	3
1984	1	0	0	0	1
1985	1	0	1	2	4
1986	5	0	1	3	9
1987	4	0	1	1	6



RANCH HAND MORTALITY FIVE-YEAR TREND

STANDARDIZED MORTALITY RATIO (SMR)

YEAR	FLYING OFFICERS	OTHER OFFICERS	ENLISTED FLYERS	GROUND ENLISTED	ALL PERSONNEL
1983	0.0	0.0	1.0	1.6	0.8
1984	0.6	0.0	0.0	0.0	0.2
1985	0.7	0.0	1.1	0.9	0.9
1986	2.8	0.0	0.8	1.6	1.8
1987	1.8	0.0	1.4	0.5	1.2

TRENDS FOR FLYING OFFICERS AND FOR ALL PERSONNEL
ARE STATISTICALLY SIGNIFICANT



UNADJUSTED DEATHS BY CAUSE

	RANCH HAND	COMPARISONS
ACCIDENTAL	22	290
SUICIDE	3	74
HOMICIDE	2	20
CANCER	12	226
CIRCULATORY SYSTEM	25	309
DIGESTIVE SYSTEM	6	37
OTHER CAUSES	4	83
TOTAL	74	1039



UNADJUSTED ANALYSES BY CAUSE OF DEATH

CAUSE	DEAD	EXPECTED	SMR	95% CONFIDENCE INTERVAL
ACCIDENTAL	22	17.5	1.3	0.7 - 1.8
CANCER	12	13.6	0.9	0.4 - 1.4
CIRCULATORY SYSTEM	25	18.6	1.3	0.8 - 1.9
DIGESTIVE SYSTEM	6	2.2	2.7	1.0 - 5.8



DIGESTIVE SYSTEM MORTALITY

NUMBER OF DEATHS

TYPE OF DISEASE	RANCH HANDS	COMPARISONS
ESOPHAGUS, STOMACH AND DUODENUM	0	4
APPENDICITIS	0	3
ACUTE ALCOHOLIC HEPATITIS	1	0
OTHER DISEASES	5	30
TOTAL	6	37



ADJUSTED ANALYSES OF DEATH BY CAUSE

ACCIDENTAL

STRATUM	DEAD	EXPECTED	SMR	CONFIDENCE INTERVAL
OFFICERS	9	7.4	1.2	0.4 - 2.0
ENLISTED	13	11.0	1.2	0.5 - 1.8
FLYERS	13	11.9	1.1	0.5 - 1.7
NONFLYERS	9	7.0	1.3	0.5 - 2.1
ALL PERSONNEL	22	18.0	1.2	0.6 - 2.4

MALIGNANCY

STRATUM	DEAD	EXPECTED	SMR	CONFIDENCE INTERVAL
OFFICERS	5	7.0	0.7	0.1 - 1.3
ENLISTED	7	9.9	0.7	0.2 - 1.2
FLYERS	6	10.5	0.6	0.1 - 1.0
NONFLYERS	6	6.4	0.9	0.2 - 1.7
ALL PERSONNEL	12	17.0	0.7	0.4 - 1.2



ADJUSTED ANALYSES OF DEATH BY CAUSE (CONT)

CIRCULATORY

STRATUM	DEAD	EXPECTED	SMR	CONFIDENCE INTERVAL
OFFICERS	8	8.6	0.9	0.3 - 1.6
ENLISTED	17	14.6	1.2	0.6 - 1.7
FLYERS	10	13.2	0.8	0.3 - 1.2
NONFLYERS	15	9.8	1.5	0.8 - 2.3
ALL PERSONNEL	25	23.7	1.1	0.7 - 1.6



CANCER MORTALITY BY SITE OF TUMOR

SITE OF TUMOR	NUMBER OF DEATHS	
	RANCH HANDS	COMPARISONS
DIGESTIVE SYSTEM; INCLUDING COLON	3	50
RESPIRATORY SYSTEM; INCLUDING LUNG	5	85
BONE, SKIN, AND SOFT TISSUE	1	12
GENITOURINARY SYSTEM; INCLUDING PROSTATE AND TESTICLES	1	8
LYMPHATIC SYSTEM; INCLUDING HODGKINS DISEASE, LEUKEMIA AND LYMPHOMA	0	22
OTHER	2	52
TOTAL	12	229



SUMMARY OF ADJUSTED ANALYSES

CAUSE OF DEATH	SMR
ACCIDENTAL DEATHS	1.2
MALIGNANCY DEATHS	0.7
CIRCULATORY SYSTEM DEATHS	1.1



CONCLUSIONS

- OVERALL CUMULATIVE MORTALITY IS INDISTINGUISHABLE
- INCREASING TREND IN RANCH HAND FLYING OFFICERS SINCE 1983
 - CUMULATIVE DEATH RATES ARE EQUIVALENT
 - IMPACT OF THIS TREND IS UNCLEAR
 - DOES NOT FIT LEVELS OF DIOXIN EXPOSURE
 - FURTHER FOLLOW-UP IS INDICATED
- INCREASE IN DIGESTIVE SYSTEM DEATHS IN THE RANCH HANDS
 - NUMBER IS SMALL; N=6
 - PATTERNS BY SITE DO NOT INDICATE A HERBICIDE EFFECT
- RANCH HANDS ARE EQUIVALENT TO COMPARISONS IN:
 - ACCIDENTAL DEATHS
 - MALIGNANCY DEATHS
 - CIRCULATORY SYSTEM DEATHS



SERUM DIOXIN STUDIES

ASSAY DEVELOPED AT CDC TO DETECT DIOXIN IN SERUM
AT PARTS PER TRILLION LEVEL

JOINT USAF/CDC EFFORTS:
HALF-LIFE STUDIES (7.1 YEARS)
ASSAY OF AFHS PARTICIPANTS

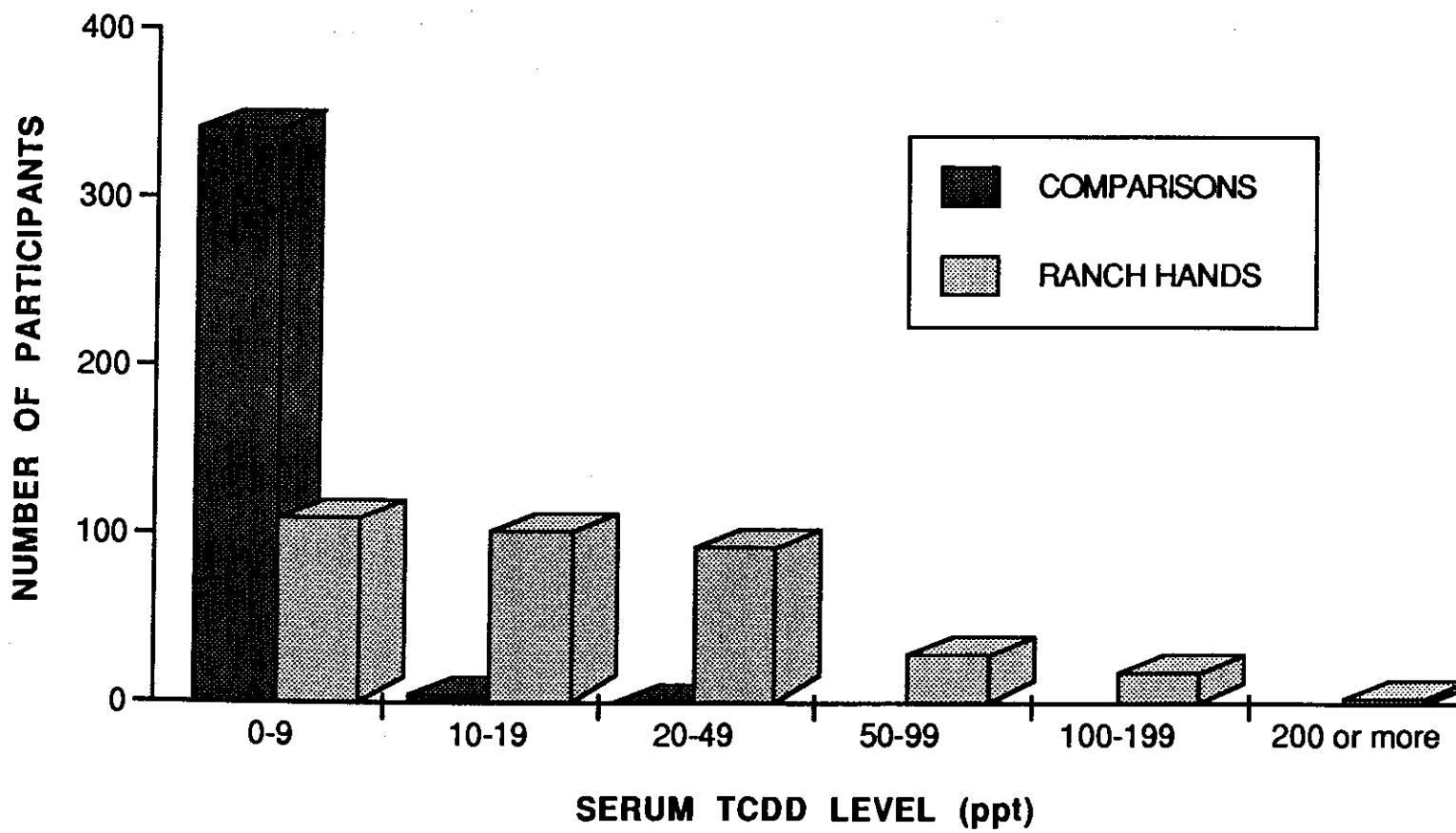
PRETEST OF 200 DEMONSTRATED ASSAY VALIDITY
RANCH HAND MEAN = 48.0 PPT
COMPARISON MEAN = 4.8 PPT

EXPANDED STUDY OF 1999 PARTICIPANTS

TO BE COMPLETED IN 1989
FUNDDED BY HQ AFSC WITH REIMBURSEMENT FROM
EXCESS VA FUNDS (S.11)
FUNDS TO COVER COST OF ASSAYS AND ANALYSIS



SERUM DIOXIN





SE [REDACTED] RUM DIOXIN LEVELS

GROUP	NUMBER	MEAN	RANGE
RANCH HANDS	374	32.1	0 - 313
COMPARISONS	352	4.8	0 - 26.0



SERUM DIOXIN VALUES (CONT)

OCCUPATION	NUMBER	MEAN	RANGE
PILOTS	72	9.8	1.6 - 41.5
NAVIGATORS	16	11.2	2.9 - 36.0
OTHER OFFICERS	6	7.1	3.3 - 12.6
ENLISTED FLYERS	57	21.6	3.6 - 127
GROUND ENLISTED	223	44.2	0 - 313



SCHEDULE OF REPORTS

<u>REPORT</u>	<u>PUBLICATION DATE</u>
1989 MORTALITY UPDATE COMPARISON COHORT EXPANDED (N=19, 101)	MARCH 1989
BIRTH DEFECT REANALYSIS BASED ON FULLY VERIFIED DATA	FALL/WINTER 1989
THIRD MORBIDITY REPORT	FALL/WINTER 1989



FUTURE PLANS

- 1989 COMPLETE SERUM DIOXIN ASSAYS**
- 1990 ANALYZE SERUM DIOXIN DATA AND PUBLISH REPORT**
- 1991 PREPARE FOR AWARD OF CONTRACT FOR THIRD FOLLOW-UP EXAMINATIONS**
- 1992 CONDUCT PHYSICAL EXAMINATIONS**
- 1993 ANALYZE DATA**
- 1994 PUBLISH REPORT**



SPIN-OFFS

VA MORTALITY STUDY OF TWINS

CDC DIOXIN VALIDATION STUDY

NIOSH AND CDC STUDY DESIGNS

AUSTRALIAN AGENT ORANGE STUDY DESIGNS

DATA BASE AND STATISTICAL ADVANCES

GENERAL EPIDEMIOLOGY

EPIDEMIOLOGY OF HIV INFECTION

ESTABLISHED QC STANDARDS IN IMMUNOLOGY