Chapter Three

SURVEY RESULTS

In this chapter, we present the major results of the survey in tables summarizing the findings by pesticides' form and active ingredient. We begin with a general discussion of our recall bias findings. Then we describe the pests that were observed and summarize the differences in pesticide form use in the services. We then present detailed tabulations for each form of personal- and field-use pesticide asked about in the survey.

Unless otherwise indicated, the proportions and percentages presented in this chapter are our best estimates—based on the 2,005 survey respondents' responses—for the 469,047 in-theater Gulf War personnel on the ground.[1]

RECALL BIAS RESULTS

As described in Chapter Two, we administered a second survey to a small sample (n = 193) of initial survey respondents, in order to study potential recall bias. In particular, the second survey assessed the stability of respondents' answers over time. Appendix D provides the details of our analysis. We summarize the relevant findings here to put the main survey results in the proper context.

Overall, we found that the types of pesticides reported increased in the resurvey by about 13 percent, largely because of increased reporting of field-use pesticides such as No-Pest strips or sprays. Answers about use of personal pesticides, such as number of sprays used or how many times a spray was used, were stable across the surveys.

We also examined the data to see if some groups changed their answers more than other groups. We did not find strong patterns by education, rank, self-

[1]The in-theater Gulf War population consists of all Army and Marine Corps personnel located in Saudi Arabia, Kuwait, Bahrain; all Air Force personnel located in Saudi Arabia, Kuwait, Bahrain, Qatar, the United Arab Emirates, and Oman; and Navy personnel in units that can be identified as being ashore in Saudi Arabia, Kuwait, and Bahrain. Details of the statistical methodology are contained in Appendix C.

reported health status, or a number of other factors. The only group whose answers changed in statistically significant ways for all three variables were junior enlisted personnel (pay grades E-1 to E-5), who remembered more pesticides, both personal and field use. A "worst case" interpretation of these findings is that the incidence of pesticides reporting may have been underestimated in the initial survey but that the effect is not large. Thus, the results presented in this chapter could be considered conservative, in the sense that they may underestimate the fraction of the population that used each form.

PESTS AND PESTICIDES

We found that personnel in the Gulf encountered a wide variety of pests, often in significant concentrations. The percentage of the population that observed various types of pests is given in Table 3.1. As discussed in the previous section, this is the one area in which veterans tended to initially overestimate and, upon further reflection, remembered fewer types of pests. Even so, it is clear that many types of pests were quite commonly present.

Fly swarms were ubiquitous throughout the region—93 percent of the population experienced them. Veterans relate that there were so many flies that it was often difficult to eat. Roughly half of the population also experienced other flying insects, most notably mosquitoes. Crawling pests were widespread, with a majority of the population experiencing scorpions, spiders, and ants. Rodents were also quite frequent, with half the population reporting them.

Table 3.1 also shows that members of each service had relatively similar pest encounters. Somewhat fewer Marines and Navy personnel reported spiders, mosquitoes, and, fleas,[2] whereas more Air Force personnel reported spiders and roaches, and fewer rodents, lice, and ticks. All these differences were statistically significant. The only pests without statistically significant differences among the service groups were ants, wasps, centipedes, and "other."

Although not shown in Table 3.1, there were also statistically significant differences for some pests among personnel in urban locations and in food service occupations. In particular, personnel in urban locations were more likely to have seen roaches (28 percent) and wasps (14 percent) and less likely to have seen scorpions (55 percent) and "other" pests (27 percent). Food service personnel were more likely to report flies (97 percent) and scorpions (82 percent), and less likely to report ants (36 percent).

---

[2]Fleas were actually very unlikely in this region. While service members often referred to "sand fleas," there is no such species. The pests were probably phlebotomine sand flies, which are so small they could have been confused with fleas when they bite.

Table 3.1

Percentage of Gulf War Veterans Who Reported Seeing Each Type of Pest for the Total Population and by Service

	Percentage (s.e.)[a]			
Pest	All Services	Army	Marine Corps/Navy	Air Force
Flies	93(1)	95(1)	90(1)	91(1)
Scorpions	69(2)	71(2)	65(2)	62(2)
Spiders	61(2)	62(2)	52(2)	71(2)
Rodents	52(2)	52(2)	55(2)	46(2)
Ants	45(2)	45(2)	44(2)	48(2)
Mosquitoes	45(2)	48(2)	37(2)	44(2)
Fleas[b]	44(2)	46(2)	37(2)	45(2)
Other pests	35(2)	37(2)	30(2)	32(2)
Centipedes	26(1)	27(2)	26(2)	25(2)
Roaches	16(1)	14(2)	17(2)	27(2)
Lice	11(1)	12(2)	10(1)	6(1)
Ticks	11(1)	13(2)	8(1)	5(1)
Wasps	10(1)	10(1)	10(1)	10(1)
No pests	1(<1)	1(<1)	1(<1)	1(<1)

[a]"s.e." stands for "standard error," a commonly used statistical measure of the variability of the estimated quantity. The larger the standard error, the greater the actual (unknown) value for the population may deviate from the value estimated from the survey data. It is accepted practice to consider that the true value is highly likely to be within two standard errors of the estimated value. Thus, in this table, although we estimate that 95 percent of Army personnel saw flies, we expect the true but unknown percentage to be between 93 and 97.

[b]Fleas were actually very rare in this region. Service members often referred to "sand fleas," but there is no such species. The pests were probably phlebotomine sand flies, which are so small they could have been confused with fleas when they bite.

Table 3.2 shows the percentage of personnel who reported each form of personal-use pesticide and Table 3.3 shows the percentage who reported each form of field-use pesticide. Use of personal pesticides clearly differed by service more than the reports of pests. The only form that was not significantly different was the flea collar. In particular, Air Force personnel were less likely to use all forms of personal pesticides, and Army personnel much more likely to use powders. Over one-third of the population did not use any personal pesticides.

Table 3.3 shows that statistically detectable differences between field-use pesticides occurred between services for all forms of field-use pesticides except pellets, No-Pest strips, and "other." In particular, the Marine Corps/Navy showed much lower observed use of aerosols, whereas the Air Force observed a higher use of other sprays and a lower observed use of liquids. About one-half of the total population did not use or observe any field pesticides.

Table 3.2

Percentage of Gulf War Veterans Who Used Each Form of Personal Pesticide for the Total Population and by Service

	Percentage (s.e.)			
Pest	All Services	Army	Marine Corps/Navy	Air Force
Spray	44(2)	48(2)	38(2)	36(2)
Lotion	26(2)	28(2)	23(2)	19(2)
Liquid	23(1)	25(2)	24(2)	9(1)
Powder	7(1)	10(2)	2(1)	1(1)
Flea collar	3(1)	3(1)	3(1)	1(1)
Other form	2(<1)	1(1)	1(<1)	4(1)
None	38(2)	33(2)	43(2)	52(2)

Table 3.3

Percentage of Gulf War Veterans Who Used or Observed the Use of Each Form of Field Pesticide for the Total Population and by Service

	Percentage (s.e.)			
Pest	All Services	Army	Marine Corps/Navy	Air Force
Aerosol	28(2)	31(2)	20(2)	27(2)
Other spray	20(1)	15(2)	23(2)	36(2)
Powder	13(1)	15(2)	12(2)	8(1)
Pellets, etc.	12(1)	12(2)	10(1)	11(1)
No-Pest strips	7(1)	7(1)	5(1)	6(1)
Liquid	4(1)	4(1)	5(1)	1(<1)
Other form	3(1)	3(1)	3(1)	3(1)
None	51(2)	49(2)	57(2)	50(2)

PERSONAL PESTICIDE TABULATIONS

This section presents our summary tabulations of personal pesticide use. We were able to tabulate personal-use pesticides in two ways: (1) by common active ingredients, and (2) by form. The next section presents tabulations for field pesticides by form only because most respondents could not provide sufficient identifying information. These tabulations (and the subsequent field-use tables) represent the fundamental survey results.

Personal-Use Pesticide Tabulations by Form

In Tables 3.4 to 3.9, we quantify the reported usage by the various forms of personal-use pesticides, including sprays, liquids, lotions, powders, flea collars, and “other” forms. These tables contain our best estimates of use from the survey data for the entire in-theater Gulf War population. In the tables we list:

Table 3.4

Tabulations for the Use of Personal Sprays by Self
(possible active ingredients include DEET, permethrin)

Percentage (s.e.) Who Used Personal Sprays

Total Population (n = 469,047)	Army (n = 305,002)	Marines/Navy (n = 94,984)	Air Force (n = 69,061)
44(2)	48(2)	38(2)	36(2)

Average Frequency of Use (s.e.) and Percentiles for Frequency of Use Among Those Who Used Personal Sprays[a]

	Total GW Population (n = 207,414)		Army (n= 146,101)		Marines/Navy (n = 36,334)		Air Force (n = 24,981)	
	Times/mo	Times/day	Times/mo	Times/day	Times/mo	Times/day	Times/mo	Times/day
Average	45(2)	2(<1)	46(3)	2(<1)	47(4)	2(<1)	38(3)	2(<1)
Percentile								
5	4	1	4	1	4	1	2	1
25	10	1	14	1	10	1	8	1
50	30	2	30	2	30	2	28	1
75	60	3	63	3	60	3	60	3
95	150	6	150	6	153	6	150	6
100	450	12	360	12	360	12	450	8
Unknown	15	11	16	11	15	12	14	10

[a]The columns labeled "Times/day" indicate the number of times per day f*or the days used.*

Source of Pesticides Among Those Who Used Personal Sprays

Source	Total Population % (s.e.)	Army % (s.e.)	Marines/Navy % (s.e.)	Air Force % (s.e.)
Military issue	69(2)	72(3)	58(4)	69(3)
From PX	24(2)	23(3)	31(3)	18(3)
From United States	25(2)	24(3)	29(3)	25(3)
Fellow U.S. soldiers	18(2)	18(3)	21(3)	17(3)
International soldiers	5(1)	5(2)	3(1)	6(2)
Other source	1(<1)	1(<1)	2(1)	2(1)
Don't know	2(1)	1(1)	2(1)	1(1)

NOTE: Columns may sum to more than 100 percent because respondents could give multiple answers.

Details of Use Among Those Who Used Personal Sprays

	Total Population	Army	Marines/ Navy	Air Force
Number of different sprays used, # (s.e.)	1(<1)	1(<1)	1(<1)	1(<1)
Where used, % (s.e.)				
Body	9(2)	8(2)	10(2)	10(2)
Uniform	29(2)	28(3)	30(3)	33(3)
Body and uniform	68(2)	69(3)	66(3)	65(3)
Reasons for ceasing use, % (s.e.)				
Pests stopped being a problem	13(2)	12(2)	13(2)	16(3)
Ran out of pesticides	16(2)	18(3)	16(3)	10(2)
Another reason	13(2)	12(2)	15(2)	14(3)
Side effects, % (s.e.)				
Reported experiencing side effects	10(1)	9(2)	11(2)	10(2)
Stopped using or reduced amount because of side effects	5(1)	5(1)	6(2)	3(1)

NOTE: Columns may sum to more than 100 percent because respondents could give multiple answers or because of rounding.

- The estimated percentage of the population who used a particular form in total and by service;
- For those who used a particular form, the estimated average frequency of use, in terms of the average number of times per month and the average number of times per day, and the percentiles of use;
- For those who used a particular form, an estimated percentage breakdown of the source of pesticides;
- For those who used a particular form, the reasons they stopped using the pesticides;
- For those who used a particular form, the estimated percentage who reported experiencing side effects and the percentage who stopped or reduced using the pesticide because of side effects;
- The estimated average number of products used; and
- Where the products were used.

Tables 3.4 through 3.9 show that sprays were clearly the most common form of pesticide used. Sprays were used by almost half of Army personnel and more than one-third of the personnel in the other services. Those who used sprays used them about one and one-half times a day on average in the Army and Marine Corps/Navy and about once a day in the Air Force.[3] Personnel at the 95th percentile of those who used sprays applied them about six times a day, and the maximum reported use was 12 times a day[4] (slightly less in the Air Force).

Many personnel reported acquiring their sprays via "military issue," although they were also frequently acquired from other sources such as a military PX, via mail from friends and relatives, and from fellow U.S. soldiers. Two-thirds of the respondents using sprays reported applying them to both body and uniform, another third to just the uniform, and fewer to just the body.[5] About 10 percent of the population using sprays believed that they experienced side effects from a spray, and about one-half of these individuals stopped using the spray because of the perceived side effects.

---

[3]Frequency of use is the combined frequency from all sprays reported.

[4]A 95th percentile for frequency of use at six times a day means that 5 percent of the population applied sprays at least six times a day.

[5]The only personal-use spray available in the military supply system during ODS/DS was a permethrin product intended for use on uniforms only. Thus, sprays acquired as "military issue" and used on the body represent either a recall error on the part of the respondent, a definition of "military issue" more liberal than just the "military supply system," or a misuse of the pesticide. See Chapter Five on possible misuse of pesticides.

Liquids and lotions (Tables 3.5 and 3.6) were the next most frequently reported forms. About one-quarter of Army and Marine Corps/Navy personnel reported their use. Use in the Air Force differed, with about 10 percent using liquids and about 20 percent using lotions. In all services, the average among those who used them was about thirty times per month, but about twice per day for both forms on the days they were used. The maximum use was about six times per day for the liquids and slightly higher for lotions.

Both forms were principally military issue, with most of the balance coming from fellow U.S. soldiers.[6] As might be expected, lotions were used mainly on the body, with a much smaller percentage of soldiers using them on both body and uniform. Liquids were used on the body by about one-half of the population, on the body and uniform by about one-third, and on only the uniform by about 5 percent of the population. As with the sprays, roughly 10 percent of the population perceived side effects from each of these forms, and about one-half of these stopped using the form because of the perceived side effects.[7]

Fewer than 10 percent of the population used personal powders,[8] as Table 3.7 shows. These personnel were largely Army, with only 1 to 2 percent of personnel in the other services using powders. Those who used powders used them on average about once per day; the 95th percentile for those who used powders was about three times per day, and the maximum reported use was five times per day. Compared to sprays, liquids, and lotions, powders were more likely to lead to perceived side effects, and more powder users stopped their use because of the perceived side effects.[9]

From Table 3.8, we find that about 3 percent of the population in the Army and Marine Corps/Navy and only about 1 percent in the Air Force used flea or tick collars. Among those who wore flea or tick collars, the median user wore the collar every day. Unlike the other forms of pesticides, most flea or tick collars were acquired either directly from the United States or from a military PX.[10] A

---

[6]Gambel et al. (1998) found that more than 60 percent of the soldiers used commercial repellents. Our results show a much higher use of military issue products. This differential may be due to a restricted availability of commercial products during ODS/DS, recall error, perhaps the use of the response "military issue" to mean more than just the military supply system, or some combination of all of these and other factors.

[7]The survey did not solicit specific details about side effects.

[8]Survey respondents did report powders that did not contain pesticides, such as talcum powder. Data on these nonpesticides were removed as much as possible.

[9] The survey did not solicit specific details about side effects.

[10]Despite the fact that 6 percent of the population indicated that their flea collars were military issue, these products are not now, nor have they ever been, available through the military supply system. This may reflect respondents' perception of military issue as encompassing more than the military supply system. For example, one respondent stated, "flea collars [were] used by [the] whole unit (22 people) and these collars were U.S. military issued."

Table 3.5

Tabulations for the Use of Personal Liquids by Self
(possible active ingredients include DEET, permethrin, benzocaine)

Percentage (s.e.) Who Used Personal Liquids

Total Population (n = 469,047)	Army (n = 305,002)	Marines/Navy (n = 94,984)	Air Force (n = 69,061)
23(1)	25(2)	24(2)	9(1)

Average Frequency of Use (s.e.) and Percentiles for Frequency of Use Among Those Who Used Personal Liquids[a]

	Total GW Population (n = 105,425)		Army (n= 75,844)		Marines/Navy (n = 23,104)		Air Force (n = 6,476)	
	Times/mo	Times/day	Times/mo	Times/day	Times/mo	Times/day	Times/mo	Times/day
Average	35(2)	2(<1)	36(3)	2(<1)	35(3)	2(<1)	30(4)	2(<1)
Percentile								
5	2	1	2	1	4	1	2	1
25	8	1	8	1	8	1	8	1
50	30	1	30	2	30	1	16	1
75	60	2	63	2	60	2	30	2
95	120	4	120	5	92	4	96	4
100	180	6	180	6	122	6	152	6
Unknown	9	6	9	6	11	5	11	6

[a]The columns labeled "Times/day" indicate the number of times per day f*or the days used.*

Source of Pesticides Among Those Who Used Personal Liquids

Source	Total Population % (s.e.)	Army % (s.e.)	Marines/Navy % (s.e.)	Air Force % (s.e.)
Military issue	92(2)	92(3)	91(3)	87(5)
From PX	3(1)	2(1)	6(2)	4(3)
From United States	6(2)	7(2)	5(2)	8(4)
Fellow U.S. soldiers	13(2)	12(3)	17(4)	9(4)
International soldiers	1(1)	1(1)	2(1)	3(3)
Other source	<1(<1)	0	1(1)	0
Don't know	1(<1)	<1(<1)	1(1)	2(2)

NOTE: Columns may sum to more than 100 percent because respondents could give multiple answers.

Details of Use Among Those Who Used Personal Liquids

	Total Population	Army	Marines/ Navy	Air Force
Number of different liquids used, # (s.e.)	1(<1)	1(<1)	1(<1)	1(<1)
Where used, % (s.e.)				
Body	56(4)	53(5)	61(5)	67(6)
Uniform	6(2)	6(3)	5(2)	8(4)
Body and uniform	39(4)	41(5)	36(4)	25(6)
Reasons for ceasing use, % (s.e.)				
Pests stopped being a problem	14(3)	14(3)	17(3)	12(4)
Ran out of pesticides	9(2)	7(2)	12(3)	13(4)
Another reason	17(3)	19(4)	13(3)	12(4)
Side effects, % (s.e.)				
Reported experiencing side effects	12(3)	13(3)	9(3)	10(4)
Stopped using or reduced amount because of side effects	4(2)	4(2)	4(2)	7(3)

NOTE: Columns may sum to more than 100 percent because respondents could give multiple answers or because of rounding.

Table 3.6

Tabulations for the Use of Personal Lotions by Self
(possible active ingredients include DEET, benzocaine)

Percentage (s.e.) Who Used Personal Lotions

Total Population (n = 469,047)	Army (n = 305,002)	Marines/Navy (n = 94,984)	Air Force (n = 69,061)
26(2)	28(2)	23(2)	19(2)

Average Frequency of Use (s.e.) and Percentiles for Frequency of Use Among Those Who Used Personal Lotions[a]

	Total GW Population (n = 120,460)		Army (n= 85,729)		Marines/Navy (n = 21,413)		Air Force (n = 13,318)	
	Times/mo	Times/day	Times/mo	Times/day	Times/mo	Times/day	Times/mo	Times/day
Average	45(2)	2(<1)	46(3)	2(<1)	47(4)	2(<1)	38(3)	2(<1)
Percentile								
5	2	1	2	1	2	1	2	1
25	8	1	8	1	10	1	5	1
50	20	1	16	1	27	1	15	1
75	30	2	60	2	30	2	30	2
95	90	4	114	4	90	4	87	4
100	180	8	180	7	132	8	147	6
Unknown	6	4	5	3	9	6	9	6

[a]The columns labeled "Times/day" indicate the number of times per day f*or the days used.*

Source of Pesticides Among Those Who Used Personal Lotions

Source	Total Population % (s.e.)	Army % (s.e.)	Marines/Navy % (s.e.)	Air Force % (s.e.)
Military issue	84(2)	88(3)	79(4)	69(5)
From PX	5(1)	3(1)	12(3)	6(2)
From United States	8(2)	6(2)	13(3)	8(3)
Fellow U.S. soldiers	16(2)	12(3)	26(4)	21(4)
International soldiers	2(1)	2(1)	3(2)	3(2)
Other source	2(1)	2(1)	1(1)	2(2)
Don't know	1(<1)	1(1)	1(1)	2(1)

NOTE: Columns may sum to more than 100 percent because respondents could give multiple answers.

Details of Use Among Those Who Used Personal Lotions

	Total Population	Army	Marines/ Navy	Air Force
Number of different lotions used, # (s.e.)	1(<1)	1(<1)	1(<1)	1(<1)
Where used, % (s.e.)				
Body	86(2)	86(3)	85(3)	87(3)
Uniform	<1(<1)	<1(<1)	<1(<1)	1(1)
Body and uniform	14(2)	14(3)	16(4)	12(3)
Reasons for ceasing use, % (s.e.)				
Pests stopped being a problem	17(3)	17(3)	18(4)	16(4)
Ran out of pesticides	7(1)	6(2)	13(3)	6(3)
Another reason	18(3)	19(4)	15(3)	21(4)
Side effects, % (s.e.)				
Reported experiencing side effects	8(2)	8(2)	9(3)	11(3)
Stopped using or reduced amount because of side effects	5(2)	5(2)	5(2)	9(3)

NOTE: Columns may sum to more than 100 percent because respondents could give multiple answers or because of rounding.

Table 3.7

Tabulations for the Use of Personal Powders by Self
(possible active ingredients include lindane)

Percentage (s.e.) Who Used Personal Powders

Total Population (n = 469,047)	Army (n = 305,002)	Marines/Navy (n = 94,984)	Air Force (n = 69,061)
7(1)	10(2)	2(1)	1(1)

Average Frequency of Use (s.e.) and Percentiles for Frequency of Use Among Those Who Used Personal Powders[a]

	Total GW Population (n = 33,790)		Army (n= 30,860)		Marines/Navy (n = 1,956)		Air Force (n = 974)	
	Times/mo	Times/day	Times/mo	Times/day	Times/mo	Times/day	Times/mo	Times/day
Average	21(3)	1(<1)	20(3)	1(<1)	39(12)	2(<1)	10(5)	1(<1)
Percentile								
5	2	1	2	1	3	1	1	1
25	5	1	7	1	8	1	3	1
50	16	1	16	1	30	1	8	1
75	30	2	30	2	31	2	12	1
95	80	3	80	3	120	4	30	2
100	150	5	150	5	120	4	30	2
Unknown	5	5	4	4	22	22	0	0

[a]The columns labeled "Times/day" indicate the number of times per day f*or the days used.*

Source of Pesticides Among Those Who Used Personal Powders

Source	Total Population % (s.e.)	Army % (s.e.)	Marines/Navy % (s.e.)	Air Force % (s.e.)
Military issue	88(5)	88(5)	93(7)	68(18)
From PX	7(4)	8(4)	0	0
From United States	5(3)	6(4)	0	0
Fellow U.S. soldiers	13(5)	10(5)	33(14)	41(19)
International soldiers	1(1)	1(1)	0	0
Other source	3(2)	3(3)	0	0
Don't know	1(1)	1(1)	0	0

NOTE: Columns may sum to more than 100 percent because respondents could give multiple answers.

Details of Use Among Those Who Used Personal Powders

	Total Population	Army	Marines/ Navy	Air Force
Number of different powders used, # (s.e.)	1(<1)	1(<1)	1(<1)	1(<1)
Where used, % (s.e.)				
Body	28(7)	30(7)	13(10)	0
Uniform	31(7)	31(7)	18(12)	72(16)
Body and uniform	41(7)	40(8)	69(14)	28(16)
Reasons for ceasing use, % (s.e.)				
Pests stopped being a problem	4(2)	3(2)	8(7)	30(18)
Ran out of pesticides	23(7)	24(7)	23(13)	1(2)
Another reason	22(6)	22(7)	14(10)	22(14)
Side effects, % (s.e.)				
Reported experiencing side effects	13(5)	14(6)	3(3)	0
Stopped using or reduced amount because of side effects	9(4)	9(5)	3(3)	0

NOTE: Columns may sum to more than 100 percent because respondents could give multiple answers or because of rounding.

Table 3.8

Tabulations for the Use of Flea or Tick Collars by Self
(possible active ingredients include carbaryl, permethrin, chlorpyrifos, propuxor)

Percentage (s.e.) Who Used Flea or Tick Collars

Total Population (n = 469,047)	Army (n = 305,002)	Marines/Navy (n = 94,984)	Air Force (n = 69,061)
3(1)	3(1)	3(1)	1(1)

Average Frequency of Use (s.e.) and Percentiles for Frequency of Use Among Those Who Used Flea or Tick Collars

	Total GW Population (n = 13,291)	Army (n= 9,745)	Marines/Navy (n = 2,606)	Air Force (n = 940)
	Times/mo	Times/mo	Times/mo	Times/mo
Average	21(2)	21(3)	21(3)	15(4)
Percentile				
5	2	3	1	1
25	14	14	14	8
50	26	26	30	20
75	30	30	30	30
95	30	30	30	30
100	30	30	30	30
Unknown	6	8	1	0

Source of Pesticides Among Those Who Used Flea or Tick Collars

Source	Total Population % (s.e.)	Army % (s.e.)	Marines/Navy % (s.e.)	Air Force % (s.e.)
Military issue	6(3)	7(4)	0	15(10)
From PX	37(10)	41(13)	14(9)	53(17)
From United States	54(10)	51(13)	69(12)	33(16)
Fellow U.S. soldiers	12(6)	11(8)	14(9)	9(9)
International soldiers	4(2)	4(3)	2(2)	15(10)
Other source	0	0	0	0
Don't know	<1(<1)	0	0	2(2)

NOTE: Columns may sum to more than 100 percent because respondents could give multiple answers.

Details of Use Among Those Who Used Flea or Tick Collars

	Total Population	Army	Marines/ Navy	Air Force
Where worn, % (s.e.)				
Directly on the skin	21(8)	22(11)	22(12)	8(6)
Over clothes or shoes	87(5)	92(5)	68(13)	90(7)
Some other way	7(3)	3(3)	24(11)	11(9)
Reasons for ceasing use, % (s.e.)				
Pests stopped being a problem	15(9)	19(12)	2(2)	8(8)
Ran out of pesticides	11(9)	13(12)	0	28(15)
Another reason	23(7)	17(9)	43(13)	27(18)
Side effects, % (s.e.)				
Reported experiencing side effects	5(3)	6(4)	5(4)	2(2)
Stopped using or reduced amount because of side effects	3(2)	5(3)	0	0

NOTE: Columns may sum to more than 100 percent because respondents could give multiple answers.

large majority who used flea or tick collars wore them over clothes or shoes, although about 20 percent wore them directly on the skin.

The AFPMB issued a message specifying that flea or tick collars are not safe for human use (AFPMB, 1990). Although this message was transmitted in early December 1990, we found that personnel continued to wear these collars through the end of the survey period, July 1991.

Table 3.9 compiles the remaining "other" products reported, which comprise mainly various stick forms of pesticides. These were used by only a small fraction of the population, mostly in the Air Force.

Personal-Use Pesticide Tabulations by Active Ingredient

Tables 3.10 to 3.12 contain our best estimates of use by active ingredient (DEET, permethrin, and sulfur) for the in-theater Gulf War population. To make these estimates, we imputed the active ingredients from the limited information given in some responses. For responses that indicated multiple active ingredients, we estimated the probability of each candidate ingredient based on answers given by similar respondents who gave enough information to allow the ingredients to be identified. The probability of use for each ingredient was then used to apportion the sampling weights, and the statistics in the table were calculated from these values. Additional detail about the imputation and standard error calculations are provided in Appendix C. The tables list:

- The percentage of the population who used an active ingredient in total and by service; and
- Among those who used a product with the active ingredient, the average frequency of use, in terms of the average number of times per month and the average number of times per day, and the percentiles of usage.

We find that DEET was the most common personal pesticide active ingredient (see Table 3.10). DEET was used by half of the Army and Marine Corps/Navy population and slightly more than a third of the Air Force population.[11] Among those who used DEET, on average it was used about three times a day for 15 days a month in the Army, and twice a day in the Marine Corps/Navy and Air Force for similar periods. The 95th percentile for frequency of use among

[11]These results are consistent with reports on the use of insect repellents by Army personnel in surveys conducted by Gambel et al. (1998). Gambel et al. found that 56.5 percent of the personnel they surveyed who were deployed in Bosnia applied insect repellents to the skin. However, our results show higher use than Gambel et al. found from their survey of about 200 Army personnel deployed to Kuwait in 1994 during Operation Vigilant Warrior, where only 26.2 percent of the personnel said they used insect repellents on the skin. Yet, in a similar survey of soldiers deployed to Haiti, they found that 94.3 percent of the personnel used insect repellents on their skin.

Table 3.9

Tabulations for the Use of Other Personal Products by Self
(possible active ingredients include DEET, ethyl hexanediol)

Percentage (s.e.) Who Used Other Products

Total Population (n = 469,047)	Army (n = 305,002)	Marines/Navy (n = 94,984)	Air Force (n = 69,061)
2(<1)	1(1)	1(<1)	4(1)

Average Frequency of Use (s.e.) and Percentiles for Frequency of Use Among Those Who Used Other Products[a]

	Total GW Population (n = 7,440)		Army (n= 3,836)		Marines/Navy (n = 921)		Air Force (n = 2,683)	
	Times/mo	Times/day	Times/mo	Times/day	Times/mo	Times/day	Times/mo	Times/day
Average	16(4)	1(<1)	13(6)	1(<1)	28(15)	2(1)	17(3)	2(<1)
Percentile								
5	2	1	1	1	2	1	2	1
25	5	1	2	1	6	1	5	1
50	12	1	5	1	15	1	12	1
75	20	2	60	2	88	4	20	2
95	88	4	60	2	120	6	60	3
100	120	6	60	2	120	6	120	4
Unknown	5	3	0	0	21	21	7	7

[a]The columns labeled "Times/day" indicate the number of times per day f*or the days used.*

Source of Pesticides Among Those Who Used Other Products

Source	Total Population % (s.e.)	Army % (s.e.)	Marines/Navy % (s.e.)	Air Force % (s.e.)
Military issue	87(9)	82(17)	68(22)	100
From PX	<1(<1)	0	3(3)	0
From United States	13(9)	18(17)	26(22)	0
Fellow U.S. soldiers	5(3)	0	21(18)	8(6)
International soldiers	<1(<1)	0	3(3)	0
Other source	0	0	0	0
Don't know	0	0	0	0

NOTE: Columns may sum to more than 100 percent because respondents could give multiple answers.

Details of Use Among Those Who Used Other Products

	Total Population	Army	Marines/ Navy	Air Force
Number of different powders used, # (s.e.)	1(<1)	1(<1)	1(<1)	1(<1)
Where used, % (s.e.)				
Body	64(13)	63(23)	36(22)	74(10)
Uniform	8(4)	0	43(22)	8(5)
Body and uniform	28(13)	37(23)	21(18)	19(9)
Reasons for ceasing use, % (s.e.)				
Pests stopped being a problem	7(4)	0	0	19(9)
Ran out of pesticides	12(6)	0	51(22)	16(8)
Another reason	43(14)	77(15)	0	10(6)
Side effects, % (s.e.)				
Reported experiencing side effects	<1(<1)	0	0	1(1)
Stopped using or reduced amount because of side effects	0	0	0	0

NOTE: Columns may sum to more than 100 percent because respondents could give multiple answers or because of rounding.

Table 3.10

Tabulations for the Use of DEET by Self and Others

Percentage (s.e.) Who Used DEET

Total Population (n = 469,047)	Army (n = 305,002)	Marines/ Navy (n = 94,984)	Air Force (n = 69,061)
50(2)	54(3)	46(2)	38(2)

Average Frequency of Use (s.e.) and Percentiles for Frequency of Use Among Those Who Used DEET[a]

	Total GW Population (n = 235,962)		Army (n=165,584)		Marines/Navy (n = 44,069)		Air Force (n = 26,396)	
	Times/mo	Times/day	Times/mo	Times/day	Times/mo	Times/day	Times/mo	Times/day
Average	47(2)	3(<1)	48(3)	3(<1)	49(4)	2(<1)	36(3)	2(<1)
Percentile								
5	4	1	4	1	4	1	3	1
25	12	1	12	1	12	1	8	1
50	30	2	30	2	30	2	21	2
75	60	3	68	3	60	4	60	3
95	167	7	180	7	180	8	120	6
100	480	16	450	16	480	16	450	10

NOTE: Forms included sprays, liquids, lotions, other.

[a]The columns labeled "Times/day" indicate the number of times per day f*or the days used*.

those who used DEET was about seven times a day, although the maximum was 16 times a day (for the Army and Marine Corps/Navy; slightly less for the Air Force).

As shown in Table 3.11, permethrin was used by about 6 percent of the ODS/DS population, with a slightly higher percentage in the Army, and a slightly lower percentage in the other services.[12] Frequency of use among those who used permethrin averaged almost 30 times a month, although it tended to be used twice a day for two weeks out of four. The 95th percentile for frequency for those who used permethrin was four times a day, although the maximum was 14 times a day for the Army; it was slightly less for the Marine Corps/Navy, and for the Air Force the maximum was only four times per day.[13]

[12]These results are also consistent with those of Gambel et al. (1998). In their surveys, they found that only 7.6 percent of troops deploying to Kuwait in 1994, Haiti in 1995, and Bosnia in 1996 treated their uniforms before deployment. They found that only 13.1 percent treated their uniforms while in Kuwait, 29.4 percent while in Haiti, and 18.9 percent while in Bosnia.

[13]The only permethrin product available from the military supply system at the time of ODS/DS was an aerosol for treating uniforms. With proper application, that product should have lasted in a uniform for about six weeks or six launderings. Thus, the average level of reported use was well in excess of the recommended amount. This result may indicate misclassification or misuse (or both) of the pesticide. See Chapter Five on possible misuse of pesticides.

Table 3.11

Tabulations for the Use of Permethrin for Personal Use by Self and Others
(forms included sprays, liquids)

Percentage (s.e.) Who Used Permethrin			
Total Population (n = 469,047)	Army (n = 305,002)	Marines/ Navy (n = 94,984)	Air Force (n = 69,061)
6(1)	7(2)	5(1)	5(1)

Average Frequency of Use (s.e.) and Percentiles for Frequency of Use Among Those Who Used Permethrin

	Total GW Population (n = 30,032)		Army (n= 21,932)		Marines/Navy (n = 4,898)		Air Force (n = 3,357)	
	Times/mo	Times/day	Times/mo	Times/day	Times/mo	Times/day	Times/mo	Times/day
Average	28(4)	2(<1)	30(5)	2(<1)	26(4)	2(<1)	14(2)	1(<1)
Percentile								
5	2	1	4	1	3	1	1	1
25	8	1	10	1	8	1	6	1
50	20	1	26	2	24	1	10	1
75	48	2	60	2	48	2	30	1
95	120	4	120	5	120	5	60	3
100	420	14	420	14	360	12	93	4

NOTE: The columns labeled "Times/day" indicate the number of times per day *for the days used.*

As Table 3.12 shows, sulfur was used by about 3 percent of the population—slightly higher in the Army and slightly lower in the Marine Corps/Navy and Air Force. Among those who used them, sulfur products were used on average slightly more than 30 times a month, except in the Air Force where they were used only 20 times a month. When sulfur was used, it was used about twice a day on average. At the 95th percentile, it was used about three times a day, although the maximum daily usage was ten times a day in the Army and six times a day in the Marine Corps/Navy and Air Force.

FIELD-USE PESTICIDE TABULATIONS BY FORM

In general, we were not able to classify field-use pesticides by specific active ingredients because the information provided by respondents was too sparse. For example, very few respondents could actually name the field pesticide they reported. Among those who could not provide a name, most could not provide much, if any, specific identifying information, such as color or smell. Because of this, we tabulated field-use pesticides only by form.

We expected that field-use pesticides would be both underreported and reported with sparse information because, unlike the personal-use pesticides, field-use pesticides were generally not applied by the survey respondent. Thus, the respondent could generally provide information only on observed applications, which is most likely a subset of all the applications that occurred.

Table 3.12

Tabulations for the Use of Sulfur (Benzocaine) for Personal Use by Self and Others

Percentage (s.e.) of Population That Used Benzocaine

Total Population (n = 469,047)	Army (n = 305,002)	Marines/ Navy (n = 94,984)	Air Force (n = 69,061)
3(1)	4(1)	2(1)	1(1)

Average Frequency of Use (s.e.) and Percentiles for Frequency of Use Among Those Who Used Benzocaine[a]

	Total GW Population (n = 15,437)		Army (n=12,749)		Marines/Navy (n = 2,047)		Air Force (n = 827)	
	Times/mo	Times/day	Times/mo	Times/day	Times/mo	Times/day	Times/mo	Times/day
Average	35(5)	2(<1)	35(6)	2(<1)	39(7)	2(<1)	23(6)	2(<1)
Percentile								
5	2	1	2	1	2	1	2	1
25	8	1	8	1	8	1	5	1
50	15	1	15	1	20	1	12	1
75	30	2	60	2	30	2	30	2
95	90	3	91	4	74	3	60	3
100	260	10	260	10	134	6	90	6

NOTE: Forms included sprays, liquids, lotions.

[a]The columns labeled "Times/day" indicate the number of times per day f*or the days used.*

Tables 3.13 through 3.19 contain our best estimates of use from the survey data for the entire in-theater Gulf War population. The tables list, for those who used or observed the use of a particular field pesticide form:

- The estimated percentage for the total population and by service;
- For those who used a particular form, the estimated average frequency of use in terms of the average number of times per month, and the percentiles of use for number of times per month;
- An estimated percentage breakdown of the source of pesticides;
- The reasons they stopped using the pesticide(s);
- The percentage who reported experiencing side effects; for those who experienced side effects, the percentage who stopped or reduced use of the pesticide;
- The average number of products used or observed; and
- Where the products were used or observed to be used.

The most frequently used or observed field pesticides were aerosols; Table 3.13 shows that slightly less than one-third in each service reported using aerosols in the field. Whereas a smaller percentage of the population used or observed aerosols, those who reported them indicated heavier use in the sleeping, eating,

Table 3.13

Tabulations for the Field Use of Aerosols by Self and Others
(possible active ingredients include allethrin, permethrin, resmethrin, chlorpyrifos, DEET, malathion, phenothrin, propoxur)

Percentage (s.e.) Who Used or Observed the Use of Aerosols

Total Population (n = 469,047)	Army (n = 305,002)	Marines/Navy (n = 94,984)	Air Force (n = 69,061)
28(2)	31(2)	20(2)	27(2)

Average Frequency of Use (s.e.) and Percentiles for Frequency of Use Among Those Who Used or Observed the Use of Aerosols

	Total GW Population (n = 13,291)	Army (n= 95,610)	Marines/Navy (n = 19,133)	Air Force (n = 18,586)
	Times/mo	Times/mo	Times/mo	Times/mo
Average	40(3)	43(3)	44(7)	25(2)
Percentile				
5	2	3	2	1
25	8	12	6	4
50	30	30	30	16
75	60	60	60	40
95	120	120	118	90
100	533	240	533	210
Unknown	5	5	6	5

Source of Pesticides Among Those Who Used or Observed the Use of Aerosols

Source	Total Population % (s.e.)	Army % (s.e.)	Marines/Navy % (s.e.)	Air Force % (s.e.)
Military issue	68(4)	69(5)	61(7)	71(5)
From PX	22(4)	22(5)	30(7)	16(4)
From United States	11(3)	12(4)	14(5)	7(3)
Fellow U.S. soldiers	12(3)	10(4)	25(7)	13(4)
International soldiers	11(3)	11(4)	13(5)	9(3)
Other source	1(1)	1(1)	0	1(1)
Don't know	1(<1)	1(<1)	1(1)	2(2)

NOTE: Columns may sum to more than 100 percent because respondents could give multiple answers.

Details of Use Among Those Who Used or Observed the Use of Aerosols

	Total Population % (s.e.)	Army % (s.e.)	Marines/ Navy % (s.e.)	Air Force % (s.e.)
Where used				
Sleeping area	84(2)	86(3)	82(4)	72(4)
Eating area	47(3)	49(4)	46(5)	37(4)
Working area	63(3)	59(4)	72(4)	71(4)
Latrine	57(3)	62(4)	54(5)	36(4)
Other area	49(3)	51(4)	51(5)	39(4)
Who used aerosols				
U.S. military troops	97(1)	97(1)	96(2)	98(1)
International soldiers	3(1)	2(1)	3(2)	6(2)
Local source	7(2)	9(2)	3(2)	5(2)
Other	1(<1)	<1(<1)	0	2(1)
Side effects				
Reported experiencing side effects from own aerosols	10(3)	11(4)	8(4)	7(3)
Stopped using or reduced amount because of side effects	7(2)	7(3)	5(3)	3(2)
Reported experiencing side effects from others' aerosols	6(2)	6(2)	9(3)	3(1)

NOTE: Columns may sum to more than 100 percent because respondents could give multiple answers.

Table 3.14

Tabulations for the Field Use of Other Sprays by Self and Others

Percentage (s.e.) of Those Who Used or Observed the Use of Other Sprays

Total Population (n = 469,047)	Army (n = 305,002)	Marines/ Navy (n = 94,984)	Air Force (n = 69,061)
20(1)	15(2)	23(2)	36(2)

Average Frequency of Use (s.e.) and Percentiles for Frequency of Use Among Those Who Used or Observed the Use of Other Sprays

	Total GW Population (n = 92,083)	Army (n= 45,634)	Marines/Navy (n = 21,826)	Air Force (n = 24,623)
	Times/mo	Times/mo	Times/mo	Times/mo
Average	11(1)	14(2)	8(1)	9(1)
Percentile				
5	1	1	1	1
25	2	2	2	2
50	4	4	4	4
75	8	13	7	8
95	30	42	30	30
100	90	90	64	90
Unknown	6	6	5	6

Source of Pesticides Among the Those Who Used or Observed the Use of Other Sprays

Source	Total Population % (s.e.)	Army % (s.e.)	Marines/ Navy % (s.e.)	Air Force % (s.e.)
Military issue	77(14)	79(16)	71(24)	43(35)
From PX	0	0	0	0
From United States	0	0	0	0
Fellow U.S. soldiers	21(14)	18(16)	29(24)	57(35)
International soldiers	1(1)	0	0	43(35)
Other source	0	0	0	0
Don't know	6(5)	3(3)	26(22)	0

Details of Use Among Those Who Used or Observed the Use of Other Sprays

	Total Population % (s.e.)	Army % (s.e.)	Marines/ Navy % (s.e.)	Air Force % (s.e.)
Where used				
Over the camp	68(14)	94(7)	42(17)	100
Around the camp	92(2)	90(5)	96(2)	91(2)
Sleeping, eating, or working areas	94(2)	96(2)	90(5)	91(4)
Other area	84(4)	88(6)	76(7)	79(5)
Who used aerosols				
U.S. military troops	52(3)	54(6)	54(5)	47(4)
International soldiers	5(1)	5(3)	3(2)	7(2)
Local source	34(3)	36(6)	30(4)	36(3)
Other	3(1)	2(1)	5(2)	4(2)
Side effects				
Reported experiencing side effects from own sprays	22(14)	26(17)	0	0
Stopped using or reduced amount because of side effects	15(14)	18(16)	0	0
Reported experiencing side effects from others' sprays	16(3)	19(5)	16(3)	12(2)

NOTES: Columns may sum to more than 100 percent because respondents could give multiple answers.

working, and other areas. "Other" sprays in Table 3.14 were similarly ubiquitous and used or observed by about 20 percent of the population. This is the only form in which the fraction of Air Force personnel using or observing the form is significantly higher than in the other services. "Other" sprays were sprays applied by a hand-held sprayer, a truck sprayer, or a plane sprayer.

Of those who saw or used sprayers, we estimate that 40 percent were hand-held sprayers (by service: 47 percent in the Army, 36 percent in the Marine Corps/Navy, and 29 percent in the Air Force), 69 percent were truck sprayers (by service: 60 percent in the Army, 71 percent in the Marine Corps/Navy, and 81 percent in the Air Force), and 4 percent were plane sprayers (by service: 4 percent in the Army, 10 percent in the Marine Corps/Navy, and 1 percent in the Air Force).[14] The percentages sum to more than 100 because respondents could give answers for up to three sprayers.

Tables 3.15 and 3.16 show that slightly more than 10 percent of the population used or observed pellets, crystals, granules, and field powders, respectively. Field liquids were used or observed by about 4 percent of the population (Table 3.17). On average, among those who reported them, these forms were used or observed about 20 times per month, with the 95th percentile at about 60 times per month. All of these forms were predominantly military issue, used by U.S. military troops, and observed or used roughly equally in all areas.

Table 3.18 demonstrates that about 7 percent of the population used or observed No-Pest strips. It also shows that in most of the locations (sleeping, eating, work, latrine, and "other"), the density of No-Pest strips was less than or about equal to the recommended density of one per 100 square feet of floor area.[15] However, 30 percent of latrines and other eating areas (non-mess hall and other areas not designated specifically for eating) exceeded this standard. Other eating areas had an average density of about two per 100 square feet and latrines had an average density of about four per 100 square feet.

---

[14]Despite respondents' perceptions that aerial application of pesticides occurred, no known applications were made by any of the services during the Gulf War.

[15]The recommended density is one per 1,000 cubic feet, which the survey simplified by assuming a fixed ten-foot ceiling height, in which case the recommended density reduces to one per 100 square feet of floor space.

Table 3.15

Tabulations for the Field Use of Pellets, Crystals, and Granules by Self and Others
(possible active ingredients include azamethiphos, brodifacoum, bromadiolon, chlorpyrifos, methomyl, pyrethrum)

Percentage (s.e.) Who Used or Observed the Use of Pellets, Crystals, and Granules

Total Population (n = 469,047)	Army (n = 305,002)	Marines/Navy (n = 94,984)	Air Force (n = 69,061)
12(1)	12(2)	10(1)	11(1)

Average Frequency of Use (s.e.) and Percentiles for Frequency of Use Among Those Who Used or Observed the Use of Pellets, Crystals, and Granules

	Total GW Population (n = 54,548)	Army (n= 37,623)	Marines/Navy (n = 9,134)	Air Force (n = 7,791)
	Times/mo	Times/mo	Times/mo	Times/mo
Average	24(2)	24(2)	28(3)	22(2)
Percentile				
5	1	1	2	1
25	5	6	8	4
50	30	30	30	16
75	30	30	31	30
95	60	60	60	60
100	90	90	90	74
Unknown	5	5	5	5

Source of Pesticides Among Those Who Used or Observed the Use of Pellets, Crystals, and Granules

Source	Total Population % (s.e.)	Army % (s.e.)	Marines/Navy % (s.e.)	Air Force % (s.e.)
Military issue	75(8)	76(11)	75(12)	18(15)
From PX	0	0	0	0
From United States	1(1)	0	0	16(15)
Fellow U.S. soldiers	9(6)	8(8)	17(10)	0
International soldiers	9(4)	9(5)	0	35(16)
Other source	1(1)	0	7(7)	0
Don't know	3(2)	1(1)	10(10)	2(2)

NOTE: Columns may sum to more than 100 percent because respondents could give multiple answers.

Details of Use Among Those Who Used or Observed the Use of Pellets, Crystals, and Granules

	Total Population % (s.e.)	Army % (s.e.)	Marines/ Navy % (s.e.)	Air Force % (s.e.)
Where used				
Sleeping area	60(5)	57(7)	66(7)	64(6)
Eating area	42(5)	40(7)	52(7)	45(6)
Working area	59(5)	56(7)	69(7)	58(6)
Latrine	52(5)	49(7)	62(7)	57(6)
Other area	29(4)	23(5)	45(7)	39(6)
Who used				
U.S. military troops	86(3)	86(5)	92(4)	78(5)
International soldiers	3(1)	2(1)	4(3)	12(4)
Local source	11(3)	10(4)	3(3)	26(6)
Other	2(2)	3(3)	0	2(2)
Side effects				
Reported experiencing side effects from own pellets, etc.	5(3)	6(4)	2(2)	1(1)
Stopped using or reduced amount because of side effects	1(1)	2(2)	0	0
Reported experiencing side effects from others' pellets, etc.	3(2)	3(2)	3(2)	2(2)

NOTE: Columns may sum to more than 100 percent because respondents could give multiple answers

Table 3.16

Tabulations for the Field Use of Powders by Self and Others
(possible active ingredients include lindane, carbaryl dust, diazinon dust)[a]

Percentage (s.e.) Who Used or Observed the Use of Field Powders

Total Population (n = 469,047)	Army (n = 305,002)	Marines/Navy (n = 94,984)	Air Force (n = 69,061)
13(1)	15(2)	12(1)	8(1)

Average Frequency of Use (s.e.) and Percentiles for Frequency of Use Among Those Who Used or Observed the Use of Powders

	Total GW Population (n = 62,150)	Army (n= 45,246)	Marines/Navy (n = 11,746)	Air Force (n = 5,147)
	Times/mo	Times/mo	Times/mo	Times/mo
Average	22(2)	23(3)	24(3)	15(2)
Percentile				
5	2	2	2	2
25	4	8	7	4
50	16	30	14	8
75	30	30	30	30
95	60	60	60	60
100	156	156	90	60
Unknown	8	10	4	1

Source of Pesticides Among Those Who Used or Observed the Use of Powders

Source	Total Population % (s.e.)	Army % (s.e.)	Marines/Navy % (s.e.)	Air Force % (s.e.)
Military issue	81(8)	83(10)	82(9)	58(16)
From PX	3(2)	0	7(6)	21(14)
From United States	14(7)	17(10)	10(8)	6(6)
Fellow U.S. soldiers	4(3)	4(4)	6(6)	0
International soldiers	9(5)	10(8)	2(2)	27(14)
Other source	0	0	0	0
Don't know	0	0	0	0

NOTE: Columns may sum to more than 100 percent because respondents could give multiple answers.

Details of Use Among Those Who Used or Observed the Use of Powders

	Total Population % (s.e.)	Army % (s.e.)	Marines/ Navy % (s.e.)	Air Force % (s.e.)
Where used				
Sleeping area	74(4)	76(5)	68(6)	73(7)
Eating area	41(5)	40(6)	50(6)	36(7)
Working area	49(5)	48(6)	61(6)	40(7)
Latrine	64(5)	66(6)	58(6)	55(7)
Other area	40(5)	39(6)	40(6)	46(8)
Who used				
U.S. military troops	88(3)	90(4)	83(5)	77(7)
International soldiers	5(2)	5(3)	4(3)	8(4)
Local source	9(3)	8(3)	6(3)	24(7)
Other	1(<1)	<1(<1)	2(2)	1(1)
Side effects				
Reported experiencing side effects from own powders	6(3)	6(3)	7(6)	0
Stopped using or reduced amount because of side effects	1(1)	2(2)	0	0
Reported experiencing side effects from others' powders	5(2)	5(3)	6(3)	2(2)

NOTE: Columns may sum to more than 100 percent because respondents could give multiple answers

[a]Lime was also used to control pests. However, since it is not a pesticide, we removed it from these tabulations whenever we could identify it.

Table 3.17

Tabulations for the Field Use of Liquids by Self and Others
(possible active ingredients include azamethiphos, bendiocarb, diazinon, propuxor, pyrethrum, pentachlorophenol, cypermethrin)

Percentage (s.e.) Who Used or Observed the Use of Field Liquids

Total Population (n = 469,047)	Army (n = 305,002)	Marines/Navy (n = 94,984)	Air Force (n = 69,061)
4(1)	4(1)	5(1)	1(<1)

Average Frequency of Use (s.e.) and Percentiles for Frequency of Use Among Those Who Used or Observed the Use of Liquids

	Total GW Population (n = 18,242)	Army (n= 13,207)	Marines/Navy (n = 4,337)	Air Force (n = 698)
	Times/mo	Times/mo	Times/mo	Times/mo
Average	27(4)	23(4)	41(10)	18(11)
Percentile				
5	1	1	1	1
25	4	8	4	1
50	21	27	24	5
75	30	30	30	30
95	60	60	60	90
100	150	120	150	90
Unknown	1	0	4	0

Source of Pesticides Among Those Who Used or Observed the Use of Liquids

Source	Total Population % (s.e.)	Army % (s.e.)	Marines/Navy % (s.e.)	Air Force % (s.e.)
Military issue	90(6)	96(5)	83(11)	100
From PX	8(5)	0	16(10)	81(21)
From United States	0	0	0	0
Fellow U.S. soldiers	9(5)	0	20(11)	81(21)
International soldiers	3(3)	4(5)	0	0
Other source	0	0	0	0
Don't know	0	0	0	0

NOTE: Columns may sum to more than 100 percent because respondents could give multiple answers.

Details of Use Among Those Who Used or Observed the Use of Liquids

	Total Population % (s.e.)	Army % (s.e.)	Marines/ Navy % (s.e.)	Air Force % (s.e.)
Where used				
Sleeping area	72(8)	73(10)	74(9)	52(18)
Eating area	42(9)	36(11)	60(10)	31(16)
Working area	55(9)	50(12)	65(10)	78(13)
Latrine	50(9)	51(12)	45(11)	58(18)
Other area	50(9)	43(12)	71(9)	36(16)
Who used				
U.S. military troops	86(4)	93(4)	75(10)	33(15)
International soldiers	7(3)	7(4)	4(4)	36(19)
Local source	9(3)	5(3)	14(8)	39(18)
Other	2(1)	0	5(5)	9(9)
Side effects				
Reported experiencing side effects from own liquids	2(2)	3(3)	0	19(21)
Stopped using or reduced amount because of side effects	0	0	0	0
Reported experiencing side effects from others' liquids	16(8)	18(11)	14(8)	0

NOTE: Columns may sum to more than 100 percent because respondents could give multiple answers

Table 3.18

Tabulations for the Use of No-Pest Strips by Self and Others
(possible active ingredients include dichlorvos)

Percentage (s.e.) Who Used or Observed the Use of No-Pest Strips

Total Population (n = 469,047)	Army (n = 305,002)	Marines/Navy (n = 94,984)	Air Force (n = 69,061)
7(1)	7(1)	5(1)	6(1)

Percentage (s.e.) Reporting on Density[a] of No-Pest Strips Among Those Who Used Them or Observed Their Use

	Total GW Population (n = 30,530)				Army (n = 21,912)				Marines/Navy (n = 4,604)				Air Force (n = 4,014)			
	<1	~1	>1	?	<1	~1	>1	?	<1	~1	>1	?	<1	~1	>1	?
1	45(7)	13(4)	5(2)	37(6)	51(9)	15(6)	4(2)	31(8)	29(9)	6(4)	12(6)	53(10)	30(8)	12(6)	6(3)	52(9)
2	13(4)	16(5)	8(2)	63(6)	13(5)	20(7)	4(2)	62(8)	11(6)	2(2)	19(8)	69(9)	18(6)	9(6)	13(6)	61(8)
3	46(9)	26(8)	27(8)	<1(<1)	49(13)	26(10)	25(11)	0	11(5)	40(13)	49(13)	0	78(10)	7(7)	8(6)	7(7)
4	19(8)	1(1)	1(1)	79(8)	22(11)	1(1)	0	77(11)	12(9)	3(3)	0	85(10)	12(5)	1(1)	6(6)	82(7)
5	6(2)	11(3)	30(6)	53(6)	5(2)	10(4)	30(8)	55(8)	3(3)	19(8)	27(9)	51(10)	18(7)	8(4)	28(8)	46(9)
6	2(1)	9(4)	2(1)	87(4)	1(1)	12(6)	0	87(6)	1(1)	0	11(7)	89(7)	9(5)	7(5)	4(4)	80(7)

NOTES The numbers in the first column identify the location used. 1 = sleeping quarters; 2 = mess halls and other designated eating areas; 3 = other eating areas; 4 = work area; 5 = latrine; 6 = other. Column headings identify the density. <1 = less than 1 per 10 x 10 feet; ~1 = about 1 per 10 x 10 feet; > 1 = more than 1 per 10 x 10 feet; ? = don't know.

[a]Density is calculated as 10 ft by 10 ft of space.

Source of Pesticides Among Those Who Used or Observed the Use of No-Pest Strips

Source	Total Population % (s.e.)	Army % (s.e.)	Marines/Navy % (s.e.)	Air Force % (s.e.)
Military issue	46(6)	49(9)	24(8)	55(9)
From PX	14(5)	14(6)	12(6)	15(6)
From United States	13(5)	15(7)	9(4)	10(5)
Fellow U.S. soldiers	11(5)	12(6)	3(2)	12(6)
International soldiers	8(3)	8(4)	5(3)	12(6)
Other source	<1(<1)	0	0	3(3)
Don't know	34(6)	30(7)	56(10)	24(7)

NOTE: Columns may sum to more than 100 percent because respondents could give multiple answers.

Details of Use Among Those Who Used or Observed the Use of No-Pest Strips

	Total Population	Army	Marines/ Navy	Air Force
Number of No-Pest strips used, # (s.e.)	1(<1)	1(<1)	1(<1)	1.5(<1)
Where used, % (s.e.)				
Sleeping area	64(6)	70(8)	48(10)	51(9)
Eating area	68(9)	68(14)	84(10)	61(9)
Working area	50(6)	49(9)	49(10)	62(8)
Vehicle	19(5)	22(7)	20(7)	7(5)
Latrine	47(6)	45(8)	49(10)	54(9)
Other area	14(4)	13(6)	11(7)	20(7)
Where used in vehicle, % (s.e.)				
Enclosed space	7(3)	5(3)	20(7)	3(3)
Open space	12(5)	16(7)	0	4(4)
Don't know	81(5)	78(7)	81(7)	93(5)

NOTE: Columns may sum to more than 100 percent because respondents could give multiple answers or because of rounding.

Table 3.19

Tabulations for the Field Use of Other Pesticides by Self and Others
(possible active ingredients include TBD)

Percentage (s.e.) Who Used or Observed the Use of Other Pesticides

Total Population (n = 469,047)	Army (n = 305,002)	Marines/Navy (n = 94,984)	Air Force (n = 69,061)
3(1)	3(1)	3(1)	3(1)

Average Frequency of Use (s.e.) and Percentiles for Frequency of Use Among Those Who Used or Observed the Use of Other Field Pesticides

	Total GW Population (n = 12,872)	Army (n= 7.995)	Marines/Navy (n = 3,119)	Air Force (n = 1,757)
	Times/mo	Times/mo	Times/mo	Times/mo
Average	28(4)	26(5)	28(7)	37(9)
Percentile				
5	2	2	2	1
25	8	8	5	12
50	30	30	22	30
75	60	30	60	54
95	90	90	90	180
100	180	90	90	180
Unknown	11	11	12	12

Source of Pesticides Among Those Who Used or Observed the Use of Other Pesticides

Source	Total Population % (s.e.)	Army % (s.e.)	Marines/Navy % (s.e.)	Air Force % (s.e.)
Military issue	58(13)	68(19)	57(20)	19(15)
From PX	5(4)	0	0	37(22)
From United States	15(7)	4(5)	23(15)	41(23)
Fellow U.S. soldiers	23(12)	21(18)	18(15)	44(23)
International soldiers	9(5)	7(7)	4(4)	32(20)
Other source	1(1)	0	2(2)	0
Don't know	4(4)	0	0	29(23)

NOTE: Columns may sum to more than 100 percent because respondents could give multiple answers.

Details of Use Among Those Who Used or Observed the Use of Other Pesticides

	Total Population % (s.e.)	Army % (s.e.)	Marines/ Navy % (s.e.)	Air Force % (s.e.)
Where used				
Sleeping area	58(9)	58(13)	61(13)	54(13)
Eating area	30(8)	30(11)	37(12)	17(9)
Working area	33(9)	30(13)	41(13)	33(12)
Latrine	25(7)	24(11)	30(12)	20(10)
Other area	36(9)	35(13)	31(12)	45(13)
Who used				
U.S. military troops	96(2)	99(1)	100	77(12)
International soldiers	5(3)	4(4)	9(8)	4(4)
Local source	6(3)	4(3)	10(8)	11(10)
Other	0	0	0	0
Side effects				
Reported experiencing side effects from own pesticides	25(15)	33(24)	23(18)	0
Stopped using or reduced amount because of side effects	0	0	0	0
Reported experiencing side effects from others' pesticides	4(2)	0	8(8)	14(10)

NOTE: Columns may sum to more than 100 percent because respondents could give multiple answers