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USAARL Report No. 94-36



**Aviation Epidemiology Data Register:
Gender-Specific Attrition From the Trained
U.S. Army Aviator Cohort of 1988**

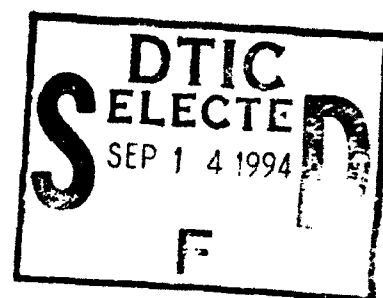
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July 1994

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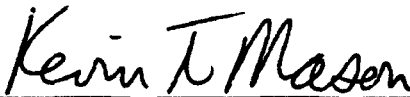
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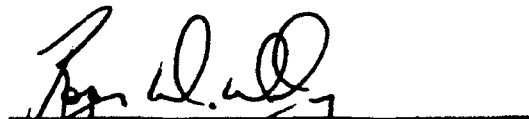
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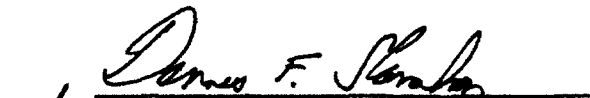


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Women have been involved in U.S. Army aviation for more than two decades. Little has been written about the integration of women into this traditionally male occupation. One indicator of successful integration of women is their retention rate in aviation service. The Aviation Epidemiology Data Register was queried to find out the attrition rate among trained U.S. Army male and female aviators from 1988 to 1992. Results: In the trained aviator cohort of 1988, male aviators were significantly older than female aviators (Mantel-Haenszel χ^2, $p < 0.001$), whatever the component of service. The crude attrition rate for all age groups was 55.4 percent (11847 of 21395) for males, compared to 54.1 percent (265 of 490) for females. Based on male attrition and after controlling for the age difference between male and female aviators, the observed attrition of females (265) exceeded the expected attrition (243) by 22 females (9.1 percent excess attrition). For the age groups 18 to 44 years old, there was a significantly higher risk for attrition among female aviators (Mantel-Haenszel OR=1.23, CI_{0.95}=1.025,1.470). This increased attrition rate was found primarily in the age groups of 18 to 34 years old. The cause for the observed excess attrition of female Army aviators is unknown and requires further study of factors affecting retention in aviation service.					
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Background

Although women have piloted balloons and aircraft since the 1780s, U.S. Army aviation did not begin training female rotary wing aviators until 1973 (Ludowese, 1992; Brooks, 1990). From 1973 until 1993, women were restricted to flying noncombat aviation missions. Today, women may train and fly combat aviation missions, expanding their aviation career opportunities.

Armywide during 1970 to 1988, the percentage of female soldiers increased by more than sevenfold to 11 percent from 1.5 percent (Defense Manpower Center, 1989). Between 1986 and 1988, the number of female Army aviators increased by 79 percent to 483 from 270 (Mason and Shannon, 1994). Despite this increase, women accounted for only 2.49 percent of all Army aviators in 1992. Since 1988, the number and percentage of female aviators in the Army have not changed much (Tables 1 and A-1).

Table 1.
Number and percent female U.S. Army aviators from 1986 to 1992*.

Year	1986	1987	1988	1989	1990	1991	1992
Number	270	457	483	499	494	492	475
Percent	1.44	2.14	2.22	2.33	2.34	2.34	2.49

* Computed from data in Mason and Shannon, 1994.

The cost of training an Army aviator ranges from \$225,000 to more than \$1,000,000, depending on the type of aircraft flown. To recoup these costs, federal regulations require a period of mandatory service obligation for each trainee. Since 1974, the length of this service obligation has varied from 4 to 8 years (Office of the Law Revision Counsel of the House of Representatives, 1990). Given these significant costs, personnel managers need information on attrition from service to plan training budgets.

We wanted to find out if the male and female attrition rates from U.S. Army aviator duties are significantly different. This study uses the Aviation Epidemiology Data Register to follow the trained U.S. Army aviator cohort of 1988. An estimate of gender-specific attrition was derived by determining who left aviation service by failure to maintain medical certification for Army flying.

Only one article specifically addressing attrition among female aviators was identified. A study of U.S. Navy pilots reported the Navy's experience was that the retention rate for females was greater than for males, 53 percent versus 38 percent (Hutton, 1990). The method on how these rates were derived was not described. Analysis of confounders, such as age, was not done.

Hutton said that women made excellent aviators with good safety records. They maintained high degrees of motivation and training success with appropriate flying aggressiveness. Although Navy women could not match male strength in ground testing, women had identical abilities in all modes of flying, including combat maneuvers. Women were helping to fill the void left by a declining male applicant pool.

Other authors compared gender-specific performance during flight training (Siem and Sawin, 1990; Blower, Dolgin, and Shull, 1990). Poor performance in flight training is a factor contributing to the total attrition rate. One study reported that while there were slight scholastic differences between males and females entering flight school, gender did not predict failure during flight training. The authors concluded that once candidates were admitted into flight school, scores from prematriculation testing were not predictors of success or failure in flight training (Blower, Dolgin, and Shull, 1990).

Aviation Epidemiology Data Register

Data was obtained from the Aviation Epidemiology Data Register (AEDR). The AEDR is a family of databases storing medical history and physical parameters of student and trained aviators. One component is a flying duty medical examination (FDME) database. All U.S. Army aviators and flight training applicants are required to submit a FDME upon application, and then annually within 90 days of the end of their birth month (Department of the Army, 1989). Another component is the waiver and suspension file (WSF), a mortality and morbidity index of flight physical disqualifications, casualty reports, and aeromedical board outcomes. The WSF references a medical document archive, containing the details of WSF cases.

Method

All AEDR FDME records for trained Army aviators completed between 1 January 1988 and 1 March 1994 were extracted. A cohort of trained aviators was compiled for the calendar year 1988 based on a FDME being accomplished in that year. Civilian aviators were excluded. The gender, age, and component of service were determined. If an aviator had an FDME in 1993, and/or early 1994, they were counted as remaining in aviation service. Otherwise, they were counted as lost to aviation service due to failure to maintain medical certification to fly Army aircraft.

Univariate analyses were derived with SAS® PROC FREQ statistical software (SAS Institute, 1993). The data was stratified by gender, age, and component of service. Gender-specific attrition was cross-tabulated into 5-year age groups based upon an individual's age in 1988. Expected female attrition was calculated from observed male attrition rates. Expected female attrition rates were compared to observed female attrition rates.

Results

In the 1988 trained aviator cohort, male aviators were significantly older than female aviators (Mantel-Haenszel χ^2 , $p < 0.001$), whatever the component of service. Figure 1 and Figures A-1 through A-3 show the cumulative percentage of male and female aviators by age for each service component. Fifty percent of female aviators were 28 years or older, compared with 80 percent of males. Only 5 percent of female aviators were 35 years or older, compared to 51 percent of male aviators. By age 40, the differences are more striking, with only 1.4 percent of female aviators 40 years or older compared to 25 percent of male aviators.

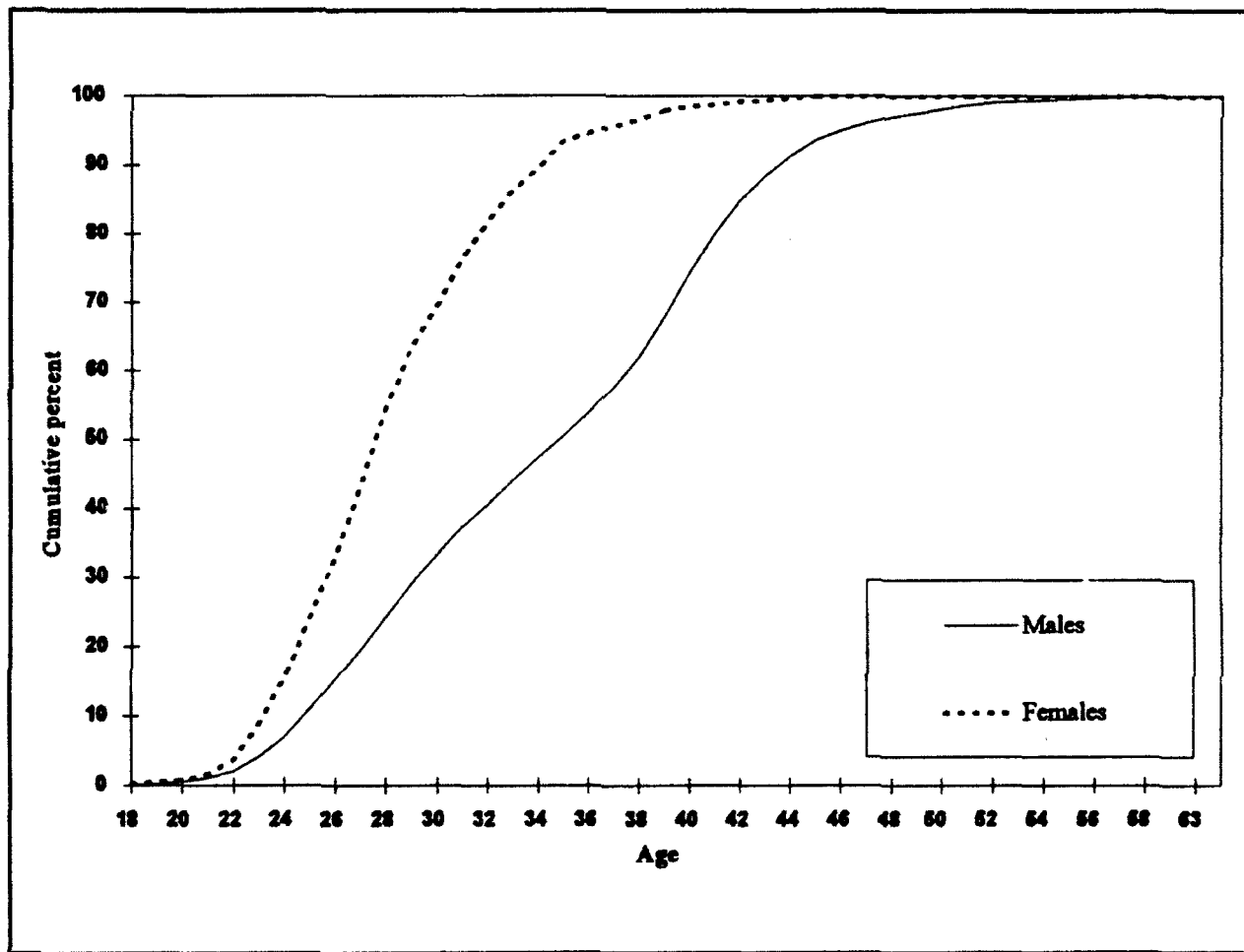


Figure 1. Gender-specific age distribution of all aviators in 1988.

Table 2 shows the attrition from aviation service stratified by the aviator's age in 1988. The ages were unknown in 15 males excluded from this table. The overall attrition rate for male aviators was 55.4 percent (11847 of 21395) compared to 54.1 percent (265 of 490) for females. Based on male attrition and after controlling for the age difference between male and female aviators, the observed attrition of females (265) exceeded the expected attrition (243) by 22 females (9.1 percent).

Table 2.
Gender-specific attrition from aviation service.

Age	Males		Females			
	1988	Observed attrition	1988	Observed attrition	Expected attrition	Excess attrition
18-24	1505	739	76	41	38	3
25-29	4755	2319	235	128	116	12
30-34	3903	1797	127	68	60	8
35-39	4394	2387	42	22	22	0
40-44	5005	3265	9	5	6	-1
45-49	1313	919	1	1	1	0
50-54	413	317	0	0	0	0
55-59	105	102	0	0	0	0
>59	2	2	0	0	0	0
Total	21395	11847	490	265	243	22

Table 3 shows the age-stratified prevalence of attrition for selected age groups that had sufficient numbers for a comparison of male and female attrition from aviation service. Overall for the age groups 18 to 44 years old, there was a significantly higher risk for attrition among female aviators (Mantel-Haenszel OR=1.23, CI₉₅=1.025,1.470). This increased risk was found primarily in the age groups of 18 to 34 years old.

Table 3.
Age-stratified prevalence of attrition from the 1988 aviator cohort.

Age Group	Total Population			Males			Females			Odds ratio
	<i>n</i>	<i>Loss</i>	%	<i>n</i>	<i>Loss</i>	%	<i>n</i>	<i>Loss</i>	%	
18-24	1581	780	49.3	1505	739	49.1	76	41	54.0	1.22
25-29	4990	2447	49.0	4755	2319	48.8	235	128	54.5	1.25
30-34	4030	1865	46.3	3903	1797	46.0	127	68	53.5	1.35
35-39	4436	2409	54.3	4394	2387	54.3	42	22	52.4	0.93
40-44	5014	3270	65.2	5005	3265	65.2	9	5	55.6	0.67
Overall	20051	3270	53.7	19562	10507	53.7	489	264	53.7	1.23*

* Mantel-Haenszel OR (Kahn and Sempos, 1989).

Discussion

Female aviators are significantly younger than male aviators. One reason is that female aviators entered Army aviation in proportionately larger numbers only in the last decade. Few have reached their 20-year retirement. In contrast, about 25 percent of male aviators have been in aviation service since the Vietnam War and are now eligible for retirement.

Since female aviators as a group have not reached retirement age, we would expect the total number of female aviators to be increasing continuously into this decade. However, a previous population study (Mason and Shannon, 1994) showed the total number of U.S. Army female aviators peaked in 1989 and has been declining. During the same interval, the number of male aviators also peaked and has been declining. However, this study documents U.S. Army female aviators are leaving aviation service in greater numbers than expected compared to male aviators, even when controlling for differences in age distribution. Female aviators who are less than 35 years old are at highest risk for age-adjusted, excess attrition from aviation service. The cause of excess attrition among female aviators is unknown.

Aviation is a combat arms asset. With U.S. laws excluding women from combat missions, women aviators had less opportunities in aviation service due to restrictions, than Army women in nonaviation units who had a broader choice of noncombat duties, such as medical care and clerical support. This might account for some observed differences in percentages of women serving in Army occupations.

Conclusions

Female aviators have entered U.S. Army aviation service since 1973, but most entered aviation service in the last decade. Since less than 1 percent of female Army aviators have reached retirement age, we would expect the number of female aviators to increase until a steady state between recruitment, retention, and retirement is attained. However, the number of female aviators has been decreasing since 1989 (Mason and Shannon, 1994). Due to Army force reductions, the number of male aviators also has been declining since 1989. Are female aviators attriting from aviation service at the same rate as male aviators?

In the trained aviator cohort of 1988, male aviators were significantly older than female aviators (Mantel-Haenszel χ^2 , $p < 0.001$), whatever the component of service. The crude attrition rate for all age groups was 55.4 percent (11847 of 21395) for males, compared to 54.1 percent (265 of 490) for females. Based on male attrition and after controlling for the age difference between male and female aviators, the observed attrition of females (265) exceeded the expected attrition (243) by 22 females (9.1 percent excess attrition). For the age groups 18 to 44 years old, there was a significantly higher risk for attrition among female aviators (Mantel-Haenszel OR=1.23, CI_{0.95}=1.025, 1.470). This increased attrition rate was found primarily in the age groups of 18 to 34 years old. The cause for the observed excess attrition of female Army aviators is unknown and requires further study of factors affecting retention in aviation service.

Recommendations

Understanding the composition of our work force is helpful in planning for recruitment, training, and retention of aviation personnel, and for the development of aviation equipment. We believe that the opportunities to become a female aviator in the U.S. Army will increase, even when the total military force is being reduced significantly. Future aircraft designs will fit a wider range of female anthropometric sizes. Today, women fly most Army combat- and support-aviation missions. But controversy still exists since we do not know if society is ready to accept women in expanded combat roles and Selective Service. We do not know if women can be attracted to and retained in combat aviation in sufficient numbers to bring the percentage of women in aviation up to the percentage of women in the total Army.

Further work is required to understand and correct the excess attrition of trained female aviators. The gold standard is to conduct a prospective study. We would develop a special database to assay, store, and characterize a broader spectrum of factors not found in the medically-oriented AEDR. We would follow female aviators and matched male aviators through training, aviation service, and after separation from Army aviation service. This approach is expensive and will take many years to reach conclusions. An inexpensive alternative is to conduct a retrospective life table analysis of a cohort of aviators exposed to a similar experience, such as a class of aviator graduates. Analysis of AEDR data might show gender-specific differences that contribute to gender-specific excess in attrition, such as pregnancy.

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Appendix A.

Table and figure supplement.

Table A-1.

U. S. Army aviators, by military component and gender, from 1986 to 1992*.

Year	Active duty		Army Reserve		National Guard		Totals	
	Male	Female	Male	Female	Male	Female	Male	Female
1986	12,169	204 (1.65%)	1,693	22 (1.28%)	4,619	44 (0.94%)	18,481	270 (1.44%)
1987	13,054	323 (2.41%)	2,674	61 (2.23%)	5,626	73 (1.28%)	21,354	457 (2.14%)
1988	12,380	321 (2.53%)	2,751	82 (2.89%)	6,115	80 (1.29%)	21,246	483 (2.22%)
1989	12,187	327 (2.61%)	2,570	77 (2.91%)	6,138	95 (1.52%)	20,895	499 (2.33%)
1990	12,074	319 (2.57%)	2,473	69 (2.71%)	6,103	106 (1.71%)	20,650	494 (2.34%)
1991	12,439	330 (2.58%)	2,003	66 (3.19%)	6,126	96 (1.54%)	20,568	492 (2.34%)
1992	11,116	306 (2.68%)	1,779	62 (3.37%)	5,727	107 (1.83%)	18,622	475 (2.49%)

* Extracted from data in Mason and Shannon, 1994.

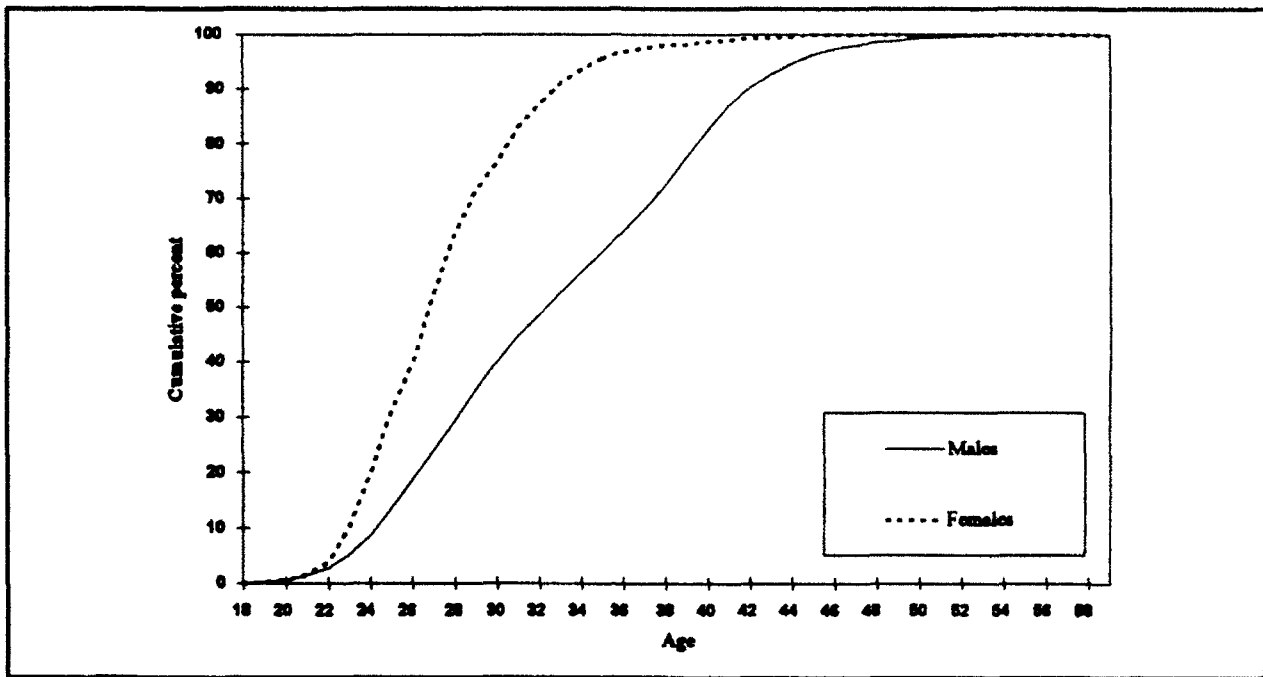


Figure A-1. Gender-specific age distribution of active duty aviators in 1988.

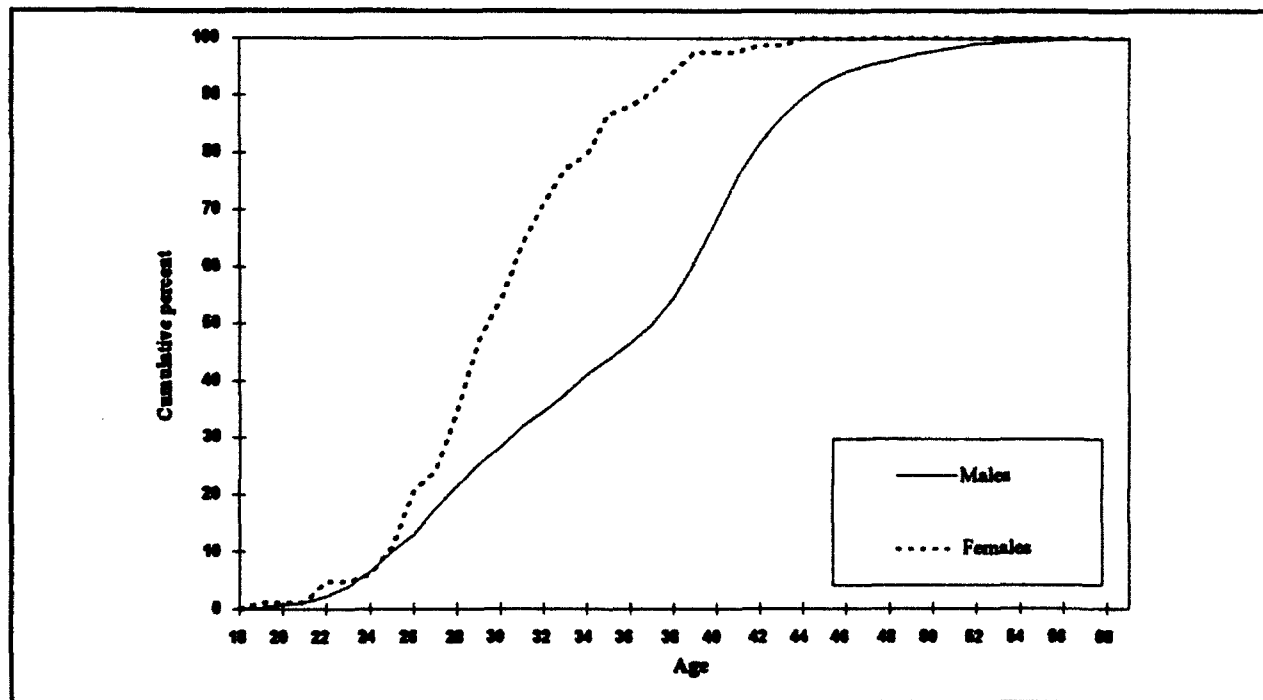


Figure A-2. Gender-specific age distribution of USAR aviators in 1988.

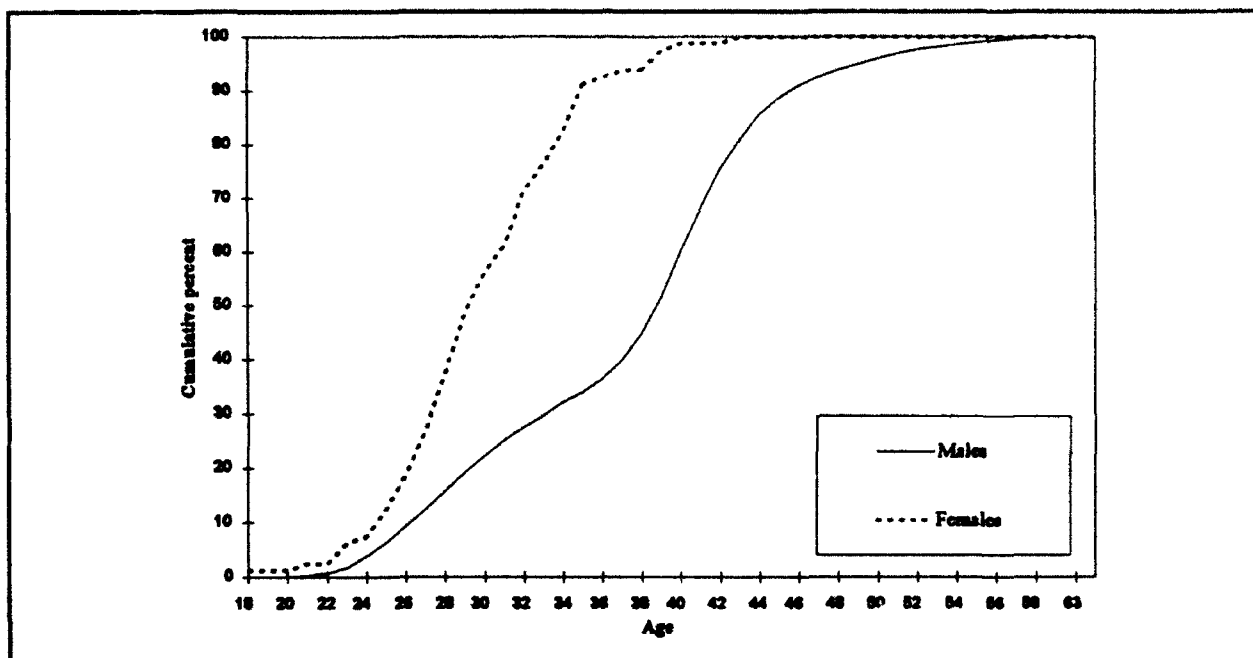


Figure A-3. Gender-specific age distribution of ARNG aviators in 1988.

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