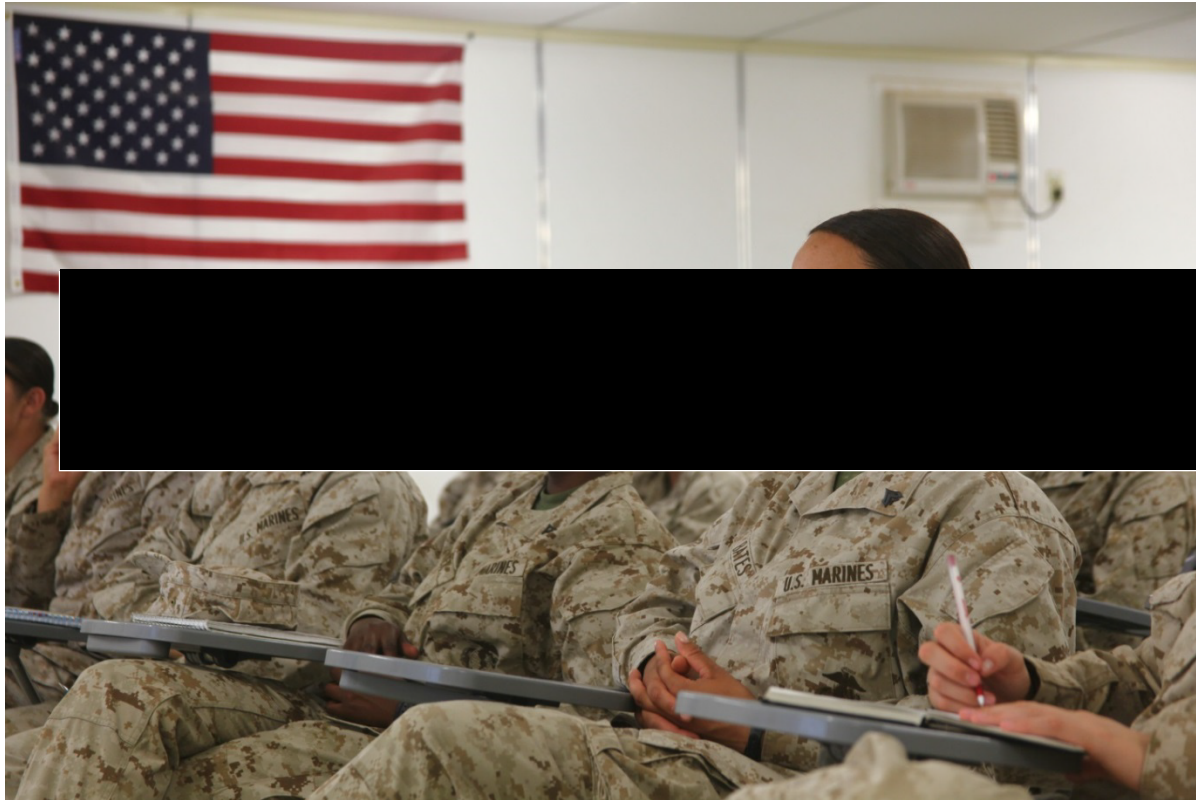# Relationship between Initial Strength Test (IST) and attrition, injury, and physical performance

November 19, 2014

Purpose of the study

- Analyze IST score relationships to attrition, injuries, and PFT/CFT scores and how they vary by gender (FY05-FY13)

    o Goal is to understand how early fitness relates to in-service performance

    o Potential policy change may use physical fitness tests administered during DEP to determine recruit classification

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IST score relationship to attrition and injuries

- High IST scores predict lower attrition rates in recruit training; before 24 month of service; and before 45 months of service.

- High IST scores predict lower injury rates during recruit training

Recruit training attrition

	Men		Women	
	Total recruits	Attrition	Total recruits	Attrition
IST top third	84,440	4.7%	7,244	9.8%
IST middle third	86,395	7.1%	7,319	14.3%
IST bottom third	86,563	10.9%	7,360	20.2%
Total	257,398	7.6%	21,923	14.8%

24-month attrition

	Men		Women	
	Total recruits	Attrition	Total recruits	Attrition
IST top third	63,815	10.0%	5,427	16.2%
IST middle third	69,222	13.2%	5,771	21.9%
IST bottom third	74,327	17.1%	6,113	28.1%
Total	207,364	13.6%	17,311	22.3%

45-month attrition

	Men		Women	
	Total recruits	Attrition	Total recruits	Attrition
IST top third	44,003	15.7%	3,758	23.4%
IST middle third	52,545	19.6%	4,279	29.4%
IST bottom third	63,077	24.2%	4,901	35.2%
Total	159,625	20.3%	12,938	29.9%

Recruit training injuries

	Men		Women	
	Total recruits	Injuries	Total recruits	Injuries
IST top third	33,833	2.4%	5,931	4.6%
IST middle third	34,706	3.6%	5,985	5.8%
IST bottom third	34,770	4.6%	6,058	7.6%
Total	103,309	3.6%	17,974	6.0%

IST score relationship to PFT and CFT scores

High IST scores predict higher PFT and CFT scores, but …

- A significant number of recruits with high DEP IST scores later score poorly on the PFT and CFT

    - 13.5 percent of women and 9.8 percent of men who score in the top third of the IST later score in the bottom third of the recruit training PFT

    - 20.1 percent of women and 21.5 percent of men who score in the top third of the IST later score in the bottom third of the recruit training CFT

    - A similar pattern holds for PFT and CFT taken after one and two years

- A significant number of recruits with low DEP IST scores later score well on the PFT and CFT

    - 13.2 percent of women and 11 percent of men who score in the bottom of the IST later score in the top third of the recruit training PFT

    - 18.4 percent of women and 18.2 percent of men who score in the bottom third of the IST later score in the top third of the recruit training CFT

    - A similar pattern holds for PFT and CFT taken after one and two years

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Recommendations

- DEP IST score should be used with caution as a criterion for early enlistment program assignment

- If DEP IST scores are used to support MOS classification, there should be reclassification opportunities to take into account whether recruit training PFT/CFT scores vary significantly from the DEP IST score

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Questions?

Backup slides

Four DEP IST score relationships studied

- IST and attrition
  - DEP (data did not support analysis)
  - Recruit training
  - 24-month
  - 45-month

- IST and injuries (medical discharges or medical recycles – only Parris Island)

- IST and PFT/CFT scores
  - Recruit training
  - First annual
  - Second annual

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Approach

- Use first IST recorded in DEP

  o Calculate gender-normed IST scores, scaled to PFT score

- Categorize IST, PFT, and CFT scores by:

  o 300

  o Top third

  o Middle third

  o Bottom third

- Apply regression techniques to estimate the relationship between IST and attrition, injury, PFT and CFT

  o Controlling for other recruit characteristics

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Estimating outcomes controlling for multiple factors

- DEP IST

- High quality ($\geq$ 50 AFQT and high school graduate)

- DEP months

- Waivers

- Age

- Enlistment bonus

- Accession trimester

- Race/ethnicity

- Recruit depot

- Accession year

The challenge of classifying Marines based on DEP IST scores: recruit training PFT (FY05 -13)

	Men					Women				
	Total recruits	PFT 300 (%)	PFT top third (%)	PFT middle third (%)	PFT bottom third (%)	Total recruits	PFT 300 (%)	PFT top third (%)	PFT middle third (%)	PFT bottom third (%)
IST 300	778	21.7%	71.7%	4.1%	2.4%	85	23.5%	65.9%	9.4%	1.2%
IST top third (but not 300)	74,706	1.7%	57.9%	30.7%	9.8%	5,503	2.1%	52.2%	32.3%	13.5%
IST middle third	77,550	0.2%	26.2%	41.9%	31.7%	5,624	0.4%	28.3%	38.3%	33.0%
IST bottom third	76,602	0.1%	10.9%	28.5%	60.5%	5,612	0.1%	13.1%	30.4%	56.3%
Total	229,636	0.7%	31.5%	33.6%	34.1%	16,824	1.0%	31.3%	33.5%	34.2%

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DEP IST score relationship to first annual PFT (FY05-12)

	Women					Men				
	Total recruits	PFT 300 (%)	PFT top third (%)	PFT middle third (%)	PFT bottom Third (%)	Total recruits	PFT 300 (%)	PFT top third (%)	PFT middle third (%)	PFT bottom third (%)
IST 300	66	18.2%	69.7%	9.1%	3.0%	627	18.3%	74.2%	5.7%	1.8%
IST top third	4,222	2.4%	50.0%	32.7%	15.0%	58,749	2.2%	55.2%	31.2%	11.4%
IST middle third	4,375	0.6%	28.5%	36.6%	34.3%	58,875	0.4%	27.4%	39.7%	32.5%
IST bottom third	4,371	0.2%	16.7%	30.7%	52.4%	61,036	0.2%	12.7%	29.6%	57.6%
Total	13,034	1.1%	31.7%	33.2%	34.0%	179,287	1.0%	31.7%	33.3%	34.0%

DEP IST score relationship to second annual PFT (FY05-11)

	Women					Men				
	Total recruits	PFT 300 (%)	PFT top third (%)	PFT middle third (%)	PFT bottom third (%)	Total recruits	PFT 300 (%)	PFT top third (%)	PFT middle third (%)	PFT bottom third (%)
IST 300	63	17.5%	66.7%	15.9%	0.0%	584	18.8%	70.6%	8.6%	2.1%
IST top third	4,041	2.7%	48.9%	32.7%	15.7%	55,324	2.9%	52.9%	32.2%	12.0%
IST middle third	4,125	1.3%	28.4%	36.3%	33.9%	57,418	0.7%	27.8%	38.8%	32.7%
IST bottom third	4,128	0.4%	17.3%	29.6%	52.7%	57,730	0.3%	13.7%	29.7%	56.3%
Total	12,357	1.5%	31.6%	32.8%	34.1%	171,056	1.4%	31.3%	33.5%	33.9%

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The challenge of classifying Marines based on DEP IST scores: recruit training CFT (FY05 -13)

	Men					Women				
	Total recruits	CFT 300 (%)	CFT top third (%)	CFT middle third (%)	CFT bottom third (%)	Total recruits	CFT 300 (%)	CFT top third (%)	CFT middle third (%)	CFT bottom third (%)
IST 300	419	31.7%	36.0%	22.2%	10.0%	44	34.1%	36.4%	15.9%	13.6%
IST top third (but not 300)	35,147	11.8%	33.2%	33.5%	21.5%	3,046	11.8%	32.8%	35.3%	20.1%
IST middle third	35,841	5.4%	24.8%	37.2%	32.5%	3,101	4.5%	25.4%	36.7%	33.5%
IST bottom third	36,019	2.5%	15.7%	34.3%	47.5%	3,096	1.8%	16.6%	33.4%	48.2%
Total	107,426	6.6%	24.6%	35.0%	33.9%	9,287	6.1%	25.0%	35.1%	33.9%

DEP IST score relationship to first annual CFT (FY05-12)

	Women					Men				
	Total recruits	CFT 300 (%)	CFT top third (%)	CFT middle third (%)	CFT bottom third (%)	Total recruits	CFT 300 (%)	CFT top third (%)	CFT middle third (%)	CFT bottom third (%)
IST 300	54	31.5%	29.6%	25.9%	13.0%	449	41.9%	27.8%	19.4%	10.9%
IST top third	3,087	17.1%	29.0%	31.1%	22.8%	39,730	20.7%	26.4%	32.3%	20.6%
IST middle third	3,071	7.7%	23.5%	35.9%	32.9%	40,521	10.8%	21.2%	35.8%	32.3%
IST bottom third	3,220	3.4%	14.8%	34.5%	47.4%	40,429	5.4%	14.1%	33.2%	47.3%
Total	9,432	9.4%	22.4%	33.8%	34.4%	121,129	12.4%	20.6%	33.7%	33.4%

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DEP IST score relationship to second annual CFT (FY05-11)

	Women					Men				
	Total recruits	CFT 300 (%)	CFT top third (%)	CFT middle third (%)	CFT bottom third (%)	Total recruits	CFT 300 (%)	CFT top third (%)	CFT middle third (%)	CFT bottom third (%)
IST 300	43	39.5%	20.9%	27.9%	11.6%	395	41.8%	23.8%	25.1%	9.4%
IST top third	2,707	18.5%	27.3%	30.7%	23.6%	37,666	22.8%	21.8%	35.0%	20.4%
IST middle third	2,761	9.0%	22.9%	35.0%	33.1%	38,065	12.5%	17.3%	38.1%	32.1%
IST bottom third	2,808	4.8%	14.9%	33.8%	46.5%	39,167	6.2%	11.2%	34.4%	48.2%
Total	8,319	10.8%	21.6%	33.2%	34.4%	115,293	13.8%	16.7%	35.8%	33.7%

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Predicted attrition rates for different IST score categories based on logistic regressions (FY05 -13)

	Men			Women		
	Recruit training attrition	Attrition before 24 months of service, conditional on completing recruit training	Attrition before 45 months of service, conditional on completing 24 months of service	Recruit training attrition	Attrition before 24 months of service, conditional on completing recruit training	Attrition before 45 months of service, conditional on completing 24 months of service
IST top third	5.0%	6.1%	5.8%	10.1%	7.4%	7.2%
IST middle third	7.1%	6.8%	6.6%	14.1%	8.7%	7.6%
IST bottom third	10.2%	7.1%	7.8%	19.6%	9.8%	8.0%
Average attrition (actual)	7.6%	6.7%	6.8%	14.7%	8.7%	7.6%
Number of observations	257,385	190,026	134,880	21,910	14,530	9,676

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Predicted recruit training injury rates for different IST score categories based on a logistic regression (FY05 - 13)

	Men	Women
	Injuries	Injuries
IST top third	2.5%	4.7%
IST middle third	3.7%	5.9%
IST bottom third	4.7%	7.7%
Average injury rate (actual)	3.6%	6.0%
Number of observations	103,127	17,933

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Predicted PFT scores by IST score categories based on two limit censored regression estimates (FY05 - 13)

	Men			Women		
	Recruit training PFT	First year PFT	Second year PFT	Recruit training PFT	First year PFT	Second year PFT
300 IST	291	289	289	291	286	285
IST top third (but not 300)	264	260	264	267	255	259
IST middle third	244	240	245	251	234	240
IST bottom third	224	220	225	232	215	222
Average (actual)	244	240	244	250	235	241
Number of observations	229,635	179,287	171,055	16,824	13,034	12,357

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Predicted CFT scores by IST score categories based on two limit censored regression estimates (FY05 - 13)

	Men			Women		
	Recruit Training CFT	First year CFT	Second year CFT	Recruit Training CFT	First year CFT	Second year CFT
300 IST	296	300	300	294	298	300
IST top third (but not 300)	287	289	290	286	286	287
IST middle third	282	281	281	280	279	277
IST bottom third	277	273	271	274	270	267
Average (actual)	282	281	281	280	278	277
Number of observations	107,425	121,128	115,292	9,287	9,432	8,319

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Findings for women and men

- Attrition rates increase as DEP IST scores decrease

- Injury rates increase as DEP IST scores decrease

- How do early DEP IST thirds predict recruit training PFT thirds? Results for women/men:

  - Top third: 52/58% remain; 32/31% drop to middle third; 14/10% drop to bottom third

  - Middle third: 38/42% remain; 28/26% improve to top third; 33/32% drop to bottom third

  - Bottom third: 56/61% remain; 30/29% improve to middle third; 13/11% improve to top third
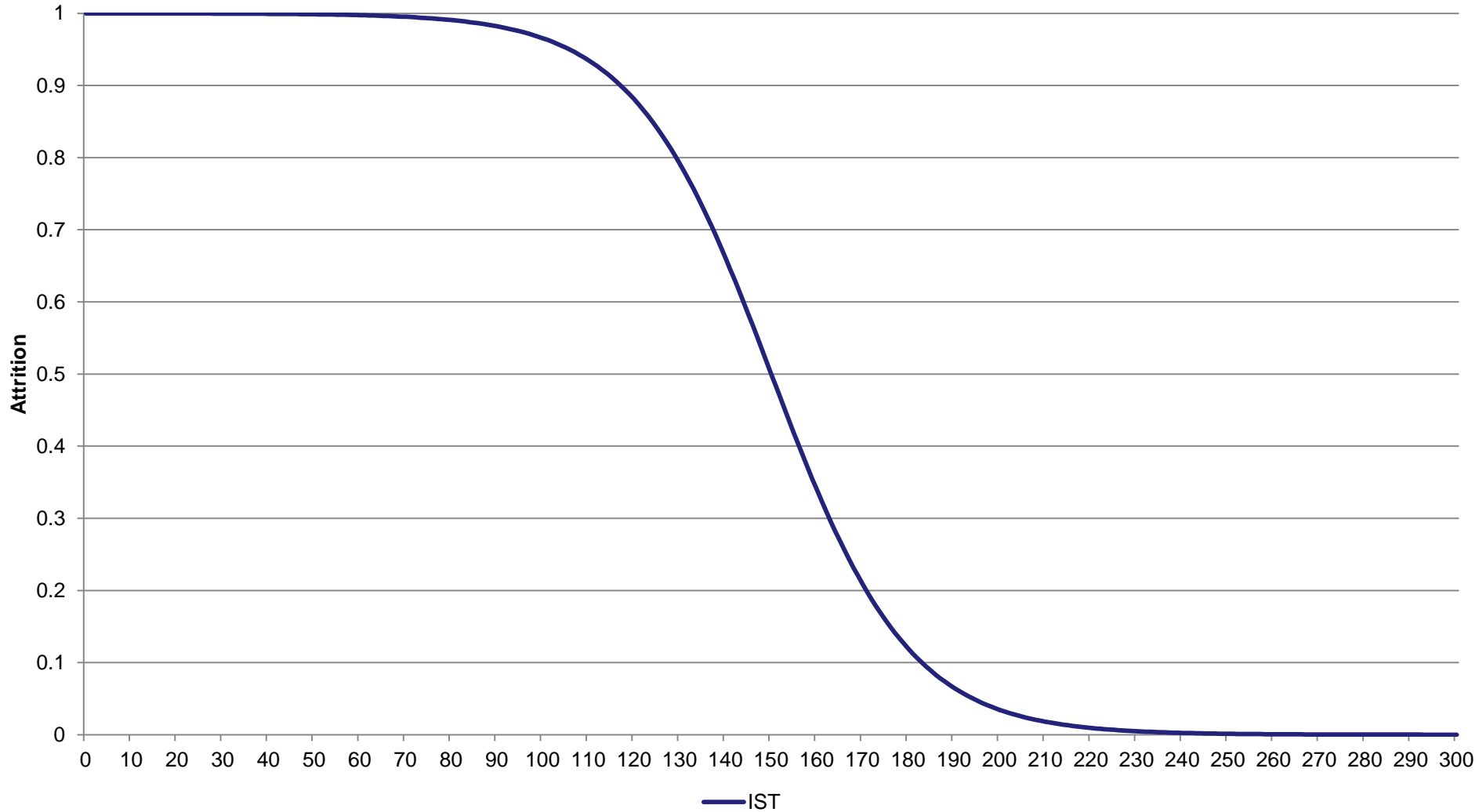
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Findings for women and men (cont.)

- How do early DEP IST thirds predict recruit training CFT thirds? Results for women/men:

  - Top third: 33/33% remain; 35/34% drop to middle third; 20/22% drop to bottom third

  - Middle third: 37/37% remain; 25/25% improve to top third; 34/33% drop to bottom third

  - Bottom third: 48/48% remain; (33/34% improve to middle third; 17/16% improve to top third)

- How do early DEP IST thirds predict first and second year PFT/CFT thirds?

  - Findings are similar to those for recruit training PFT/CFT thirds (somewhat weaker)

DEP IST score relationship to DEP attrition (FY05-13)

- 48 percent of DEP attrites have no IST score

  o This may cause biased estimates

  o Analysis of those with IST scores indicates high IST scores lead to lower DEP attrition

Logistic functional form

Two-limit censored regression (notional data)