Military Career Outcome and Lifespan of 6 Classes of Annapolis and West Point graduates: causation and selection effects.

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Abstract:

Among military officers higher rank associates with life expectancy. This may be causation: benefits of higher rank may cause life to last longer - or selection: robust health helps making it to top ranks. We investigate graduates of 1949, 1950, 1951 of the US Naval Academy (n=2206) and US Military Academy (n=1719), with 42%, 49%, 49% equally distributed survivors, focussing on men with 20+ years service, when men could retire with benefits. Variation in major intervening variables in this sample is minimal. Beyond the expected positive association between final rank and life span we find mortality differentials by rank peaking around age 80 then decreasing. This pattern supports selection hypothesis. Modelling unobserved heterogeneity by a frailty variable suggests that levelling off of differential mortality at higher ages is caused by differential loss rate by final rank. Trajectories to different final ranks and different lifespans start drifting apart early.

1.Background

Among military officers, as in many comparable civilian settings, a higher final rank usually is associated with a higher life expectancy or better health conditions (Bedard and Deschênes, 2003, Magerøy et al. 2007, Silva et al. 2007, Edwards, 2008, Martins and Lopez, 2012, Loehr and O'Hara, 2013). This can be causation: material and immaterial benefits of a higher rank in active service and thereafter may cause life to last longer. Alternatively, there may be selection: those with a robust health may have a greater chance to make it to the top ranks. We study the graduates of 1949, 1950, 1951 of the US Naval Academy (n=2206) and of the US Military Academy (n=1719), with app. 40%, 49%, 49% equally distributed survivors to this date. Furthermore, we focus on subjects with at least 20 years of active military service, when men could retire with benefits. Deaths before the according age in most cases would be violent or accident caused.

We do have branch of service, final rank and attendance years for CGS College / College NCS (intermediate level service preparing for senior level) and War College (senior level service preparing for top level), indicating speed of career; dates of birth, retirement and death. Men are from a population in which variation in several major intervening variables is kept at a minimum. (1) Virtually all men came from a stable middle class background with a European ancestry, grew up in peacetime, and apparently experienced no extreme hardship in childhood. (2) All men were highly screened for physical and mental fitness, and intelligence before admission to USNA and USMA. (3) All men remained healthy and fit at least until their late 40s; otherwise they would not have stayed on active duty. (4) Men's weight would have conformed with the *United States Army Maximum Allowable Weight (MAW) Table*, with MAWs corresponding to a BMI of 29.9 for the shortest and 27.9 for the tallest men. (5) in the microcosm of military compounds, rank differences have no impact on nutrition, sanitation, or exercise facilities, with free and excellent health care, and regular mandatory check-ups for all. (6) Income inequality is moderate. The basic monthly salary of a four-star general / admiral at present is about twice the salary for a major / lieutenant commander, the lowest final rank observed among those with 20+ years of service in the sample, and in any case, well above the poverty line.

Beyond the expected positive association between final rank and life span / survival we find the mortality differential by rank to reach a maximum around age 75 but then to decrease. This pattern supports the selection hypothesis. Modelling unobserved heterogeneity suggests that the levelling off of differential mortality rates at higher ages is caused by the differential loss rate of subjects by final rank from the sample with advancing age. The trajectories leading to different final ranks, and indirectly also to different lifespans seem to drift apart already in early careers. This fits in with the deliberate sorting candidates for leadership positions starting in hierarchies like the military already at around age 30.

2. Methods:

For Survival analysis we are using the Gompertz-(Gamma)Hazard Model (PH) with Frailty. Semi- and full-parametric frailty models become popular to account for unobserved heterogeneity. The influence of unobserved covariates in a PH model can be treated by a positive latent random variable, the frailty Z.

The frailty concept implies a mixture of individuals in population varying in their susceptibility to common risks (Vaupel, 1979). The frailty variable requires for the parametric paradigm, the specification of one parametric distribution. The most popular parametric specification for the frailty variance follows the gamma distribution. This is one of the most flexible statistical distributions and can be used as an approximation for any other parametric version. It must be mentioned, that there are no biological or empirical arguments justifying the use of the gamma distribution, its simply computational or mathematical convenience that determines the preferences of any parametric version for the frailty (Yashin et al. 2001, Wienke, 2011).

Follow the Perks Model (Butt und Habermann, 2004, Vaupel et al. 2009) we will provide a parametric frailty model, with Gompertz-specification for the baseline and Gamma for the frailty.

$$\lambda(t) = a + \frac{ae^{bt}}{1 + \frac{\sigma^2 za}{b}(e^{bt} - 1)}$$

with $\lambda_0(t) = ae^{bt}$ and $\Lambda_0(t) = \frac{a}{b}(e^{bt} - 1)$

For the final analysis we have to exclude the individuals didn't serve the minimum of 20 years for the military. A very small number of recruits have quite their active service in the first years before the graduation. Also some individuals died before that specific age, such events may be caused by accidents e.g. pilot trainings, violence and kills in action (KIA) in Korea and Vietnam conflict, this is mostly affecting lower officer ranks.

Also the age distribution through doesn't differ, also the mortality through branches (US army and US navy) was not statistical significant. Consequently we use for the Rank comparison three subgroups, following the NATO Rank Classification (OF1-OF10):

- in STAFF (Army: 2LT, 1tLT, CPT, MAJ; Navy: ENS, LTJG, LT, LCDR

- in COLONELS /CAPTAINS (Army: LTC, COL, Navy: CDR, CPT)

- in GENERALS/ADMIRALS (Army: BG, MG, LTG, GEN, Navy: RDML, RADM, VADM, ADM)

3. Results

Table 1 Mean age at graduation for military ranks

	Mean	N	SE	Min	Max
STAFF	23.75	850	1.15	21.37	28.91
COLONELS/CAPTAINS	23.65	1699	1.03	20.87	28.20
GENERALS/ADMIRALS	23.43	203	0.95	21.46	26.48
Total	23.67	2752	1.07	20.87	28.91

The Staff being the reference for the parametric survival analysis, the years as officer was also include as covariate for every model. The Survival estimates provide lower significant Hazards for Admirals/Generals in the comparison to Staff. The Hazard between Staff and Captains/Colonels are not statistical significant. The level of relative Survival benefit will be the greatest for Admirals/Generals in comparison to Staff.

Model 1 Gompertz-Gamma Modell for Ranks

	HR	SE	p	95% CI	
CPT/COL vs. STAFF	0,885	0,072	0,135	0,754	1,039
ADM/GEN vs. STAFF	0,610***	0,100	0,003	0,443	0,841
Years as officer	0,979***	0,005	0,000	0,969	0,990
LL	-832,640	Prob > chi²= 0.000			
theta	0,648	0,418		0,183	2,294
LR Test of theta	2.51	Prob> chi²= 0.057			

The hazards for Admirals/Generals will be also lower statistical significant in comparison to Captains/Colonels. The relative survival benefit for Admirals/Generals refer to the survival of Captains/Colonels is comparable to the level of their advances in comparison to Staff.

As a conclusion only the final top ranks will provide the least vulnerability, so it is more plausible that only the fittest individuals will survive longer and make it to the top ranks.

Model 2 Gompertz-Gamma Modell for Ranks

	HR	SE	p	95% CI	
ADM/GEN vs. CPT/COL	0,668**	0,108	0,012	0,488	0,917
Years as officer	0,979	0,006	0,000	0,967	0,990
LL	-621,4486	Prob > chi²= 0,0000			
theta	0,888	0,530		0,275	2,859
LR Test of theta	2.98	Prob chi² >= 0,042			

4. Discussion:

The highest benefit in Survival will be defined for Admirals/Generals in comparison to Staff. The benefit for the highest officer ranks may be caused in length of their active service time. MacLean and Edwards (2010) showed that veterans who served as officers have better health outcomes than veterans who served in the enlisted ranks, even after taking their higher levels of education and income into account.

No benefit in survival was shown between Colonels/Captains and Staff. This could be explained by the different exposure of psychosocial stress for those working in a lower in a bureaucratic hierarchy (Marmot et al. 1978).

Another plausible explanation for that phenomenon is described by Martins and Lopez (2012) who found higher prevalence of common mental disorders (CMD) among those officers holding the rank of a lieutenant. The lowest commissioned ranks (also include the lieutenants) may be higher effected by psychosocial stress in certain differing and concomitant directions (Fear et al. 2009). In relation to the hierarchy, the need for esteem and approval may be directed towards both superiors and subordinates, given that it is quite common for the highest non- commissioned ranks (Sergeant-Majors in US Army and the Warrant officers in Navy) to have served many more years in the armed forces than the lowest commissioned ranks, nearly all of whom have been performing military duties for only a few years.

Also, the possibility of undesirable changes at work, which is greater at the lower commissioned ranks, this could be also a cause of stress (Siegrist, 1996).

Otherwise the higher risk in vulnerability for the lower commissioned ranks vanished with the higher age (see Graph2). This is pattern supports the selection hypothesis.

The trajectories in lifespan between lowest and mid commission and the highest rank category start drifting apart earlier, so only the fittest individuals will make it to the top final ranks.

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6. Appendix

Graph1 Kaplan-Meier Estimates for Ranks
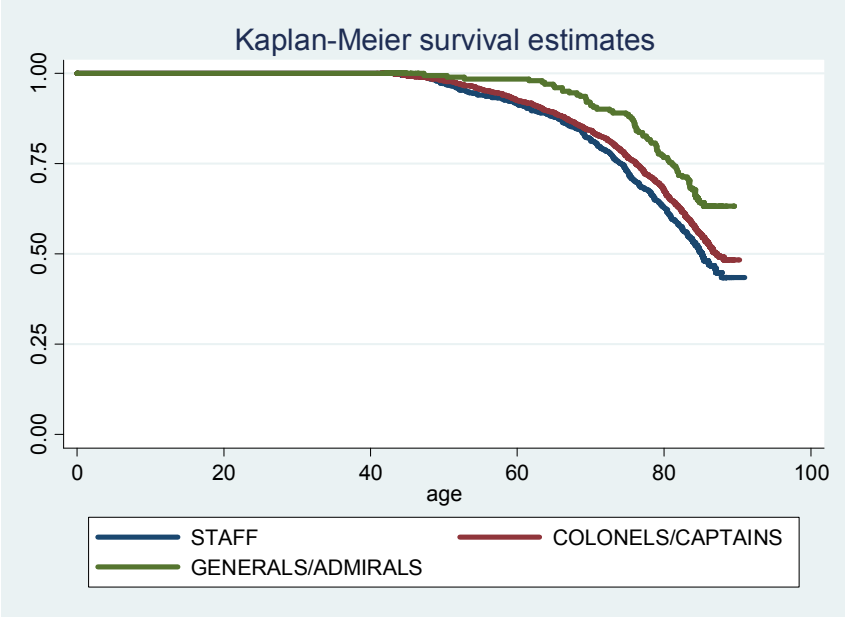
Graph2 Kaplan-Meier Estimates for Ranks for Age 80*