Vanguards of longevity: The case of Brazilian Air Force military

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Background

Growing attention in demographic studies to population subgroups that are more likely to first benefit from mortality progress or benefit more intensively than others, denominated Vanguard populations.

- SES, demographic, and health factors such as income, educational attainment, occupational status, gender, race, marital status and health measures (Hayward 2015; Mackenbach 2003; Evgueni et al. 2014a)
- Selected population subgroups living in special contexts (vanguard), such as learned societies (members of Academy of Sciences); (Winkler-Dworak and Kaden 2014), master athletes (Lemez and Baker 2015; Teramoto and Bungum 2010), religious groups (Enstrom and Breslow 2008; Luy, Flandorfer, and Di Giulio 2015; Luy 2003), and the military (D. L. Costa 2012; D. L. Costa and Kahn 2010)
MORTALITY FRAMEWORK

Because they enable:

- To isolate specific risk factors
- Grasp distribution of mortality gains
- Tackle increasing mortality differentials

Vanguard subgroups

MILITARY IS ONE OF THEM

Why the military?

Strategic
Opportunity

- Little or problematic information on SES gradients in mortality in the Brazilian context (Turra 2016a; Silva 2016)
- Longitudinal dataset with high-quality vital registration.
- Previous evidence that Brazilian military officers present survival advantages relative to their national male counterparts and other low mortality countries (di Lego, Turra, Cesar 2017)
Research Question

Given a highly selected (vanguard) population subgroup in a developing country, what is the degree of survival selection among its members and what are the factors associated to it? Can the mortality trajectory of highly selected groups provide further understanding of the underlying mechanisms of lower mortality?

- Estimate adult mortality rates for military personnel in Brazil
- Compare with other population subgroups that experience survival advantage
- Evaluate factor associated to mortality gradients within the military
Data

Total sample:  
N=13,341  
Deaths=3,084  
Survivors=10,257

Tertiary officers  
Total=2,641 (20%)

Core of military duty  
Eligible for the highest rank  
Eligible for high stake commanding positions

Academy officer  
n=4,672 (35%)

Tertiary higher officer  
n=1,360 (10%)

Eligible for higher ranks (but not the highest)  
Eligible for commanding positions

Tertiary lower officer  
n=1,281 (10%)

Not eligible for higher ranks (limit is Colonel)  
Not eligible for managing positions

Secondary service  
n=6,028 (46%)

Service staff: cleaning and cooking  
Not eligible for higher ranks  
Not eligible for managing positions

Source: SIGPES/DIRSA (2015)
Cox regression

\[ h(t, X) = h_0(t) \exp \left( \sum_{i=1}^{p} \beta_i X_i \right) \] (1)

Where \( X = (X_1, X_2, X_3, \ldots X_p) \) represent the explanatory variables and \( h_0 \) is the unspecified baseline hazard.
The proportionality in hazards are tested using the scaled Schoenfeld residuals. Deviations from proportionality are considered as

$$\beta_l(t) = \beta_l + \theta_l f(t),$$

with $f(t)$ a function of time. The null hypothesis for proportionality to be tested is $H_0 : \theta_l = 0$. 

$$\exp \left( \sum_{i=1}^{p} \beta_i X_i \right)$$ (2)
Analytical Approach

Transforming rates into probabilities:

\[ q_{x+1} = 1m_{x+1}/1 + (1 - 0.5m_{x+1}) \]  

(3)

Where \( 1m_{x+1} \) represent the death rates estimated by single year ages and the 0.5 in the formula represents the assumption that people are dying approximately halfway over the period.
Results

Hazard ratio

<table>
<thead>
<tr>
<th>Career</th>
<th>Academy (N=5014)</th>
<th>reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary (N=6122)</td>
<td>1.48 (1.34 - 1.60)</td>
<td>&lt;0.001 ***</td>
</tr>
<tr>
<td>Tertiary (N=2600)</td>
<td>0.85 (0.76 - 0.95)</td>
<td>0.005 **</td>
</tr>
<tr>
<td>Age_Entrance (N=13796)</td>
<td>1.02 (1.01 - 1.02)</td>
<td>&lt;0.001 ***</td>
</tr>
<tr>
<td>region_group</td>
<td>Northern (N=6639)</td>
<td>reference</td>
</tr>
<tr>
<td></td>
<td>Southern (N=66557)</td>
<td>0.87 (0.81 - 0.94)</td>
</tr>
</tbody>
</table>

# Events: 3084; Global p-value (Log-Rank): 0  
AIC: 52554.66; Concordance Index: 0.50
Concluding remarks

1. corroborate previous estimates that showed how selective the military are relative to their average male national counterpart, and also to neighboring countries.

2. Education and place of birth, here defined as part of a person’s background, are still important to explain mortality differentials, even in a selective setting.

3. Background seems to matter more for survival advantage (i.e., higher educational levels, which in turn is a proxy for life conditions) than the military training and tough screening/selecting at the recruitment process.
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THANK YOU
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