Vanguards of longevity: The case of Brazilian Air Force military

Vanessa di Lego (VID/ÖAW)
Cassio M. Turra (CEDEPLAR-UFMG)
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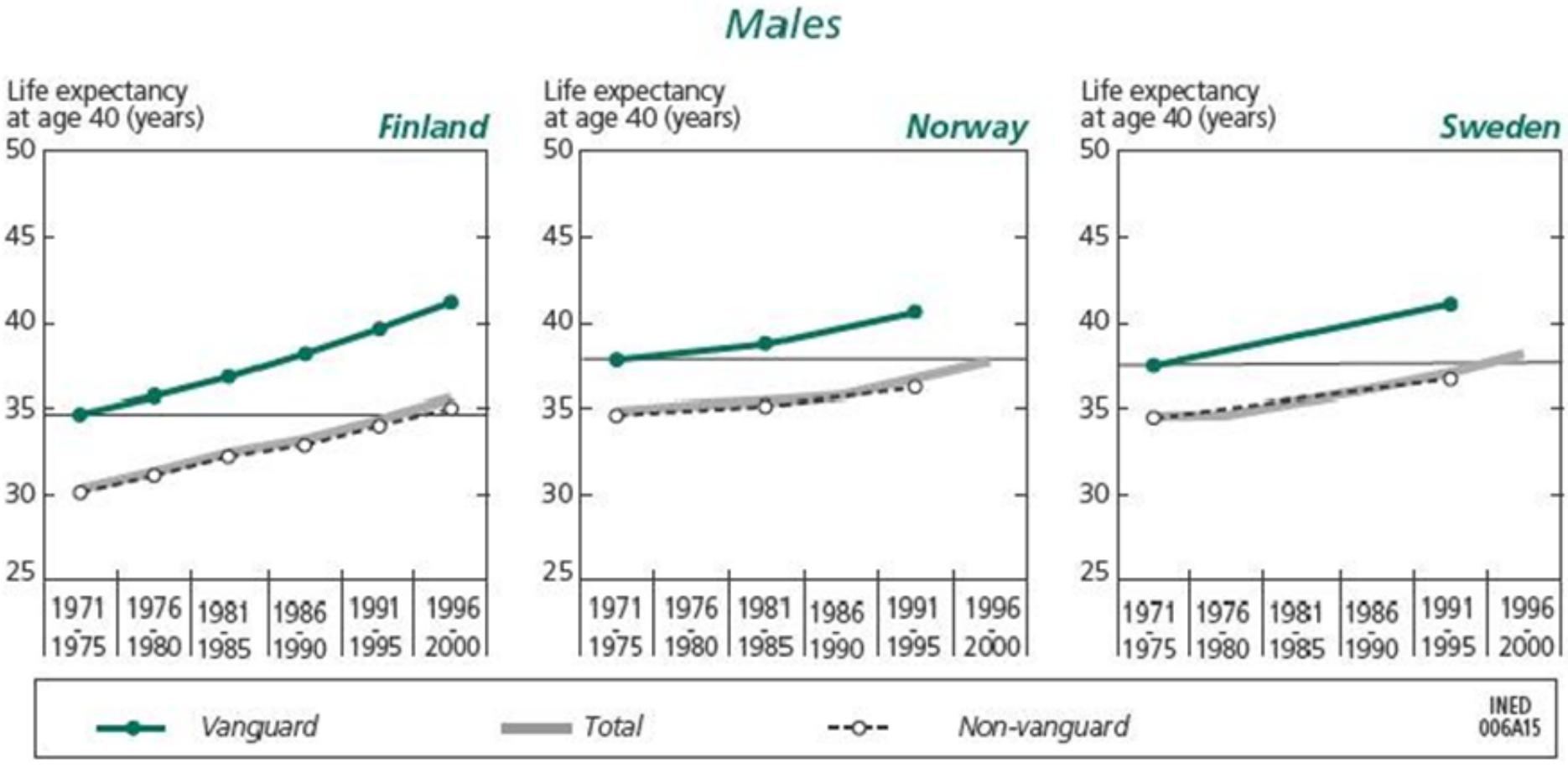
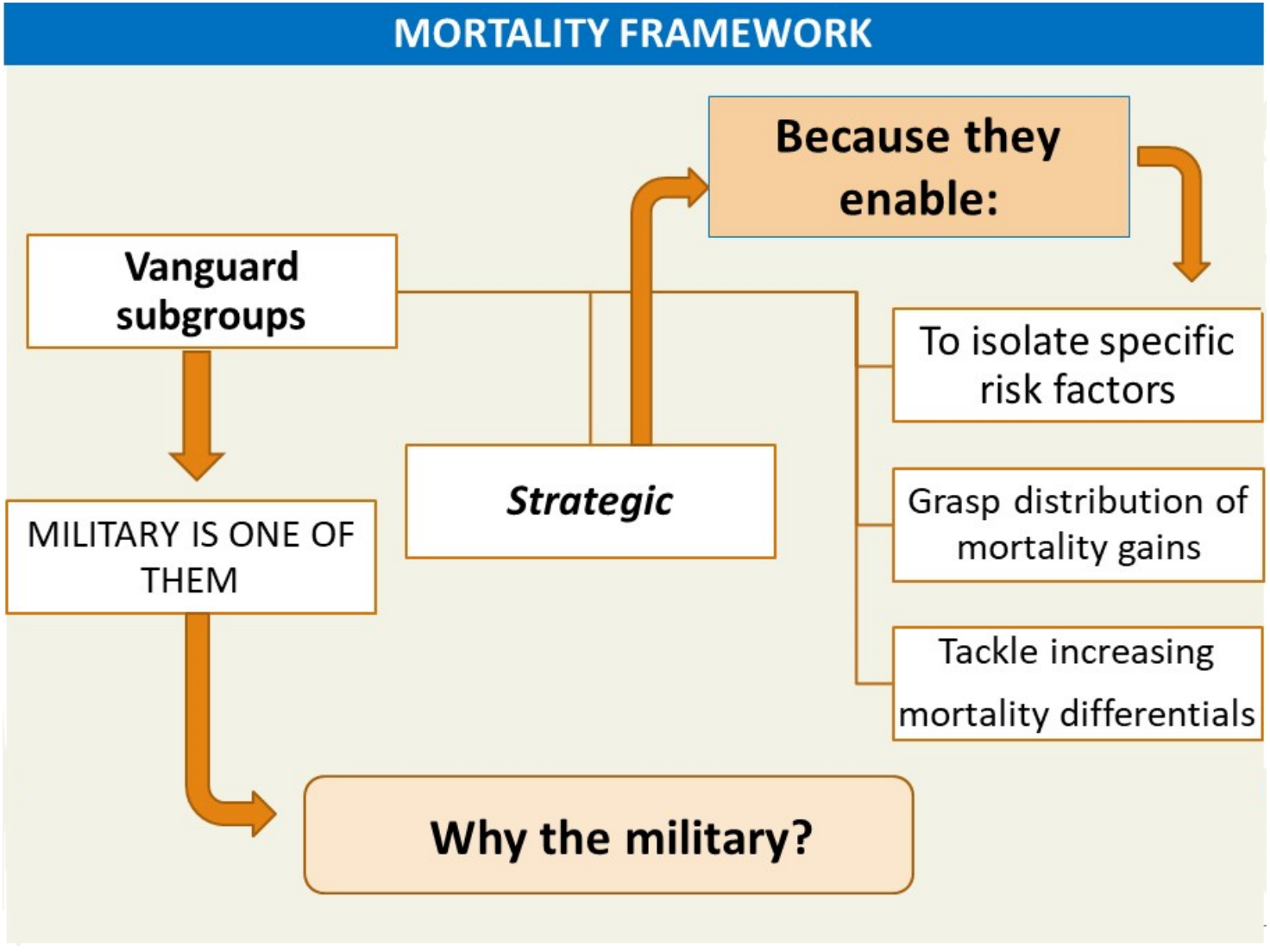
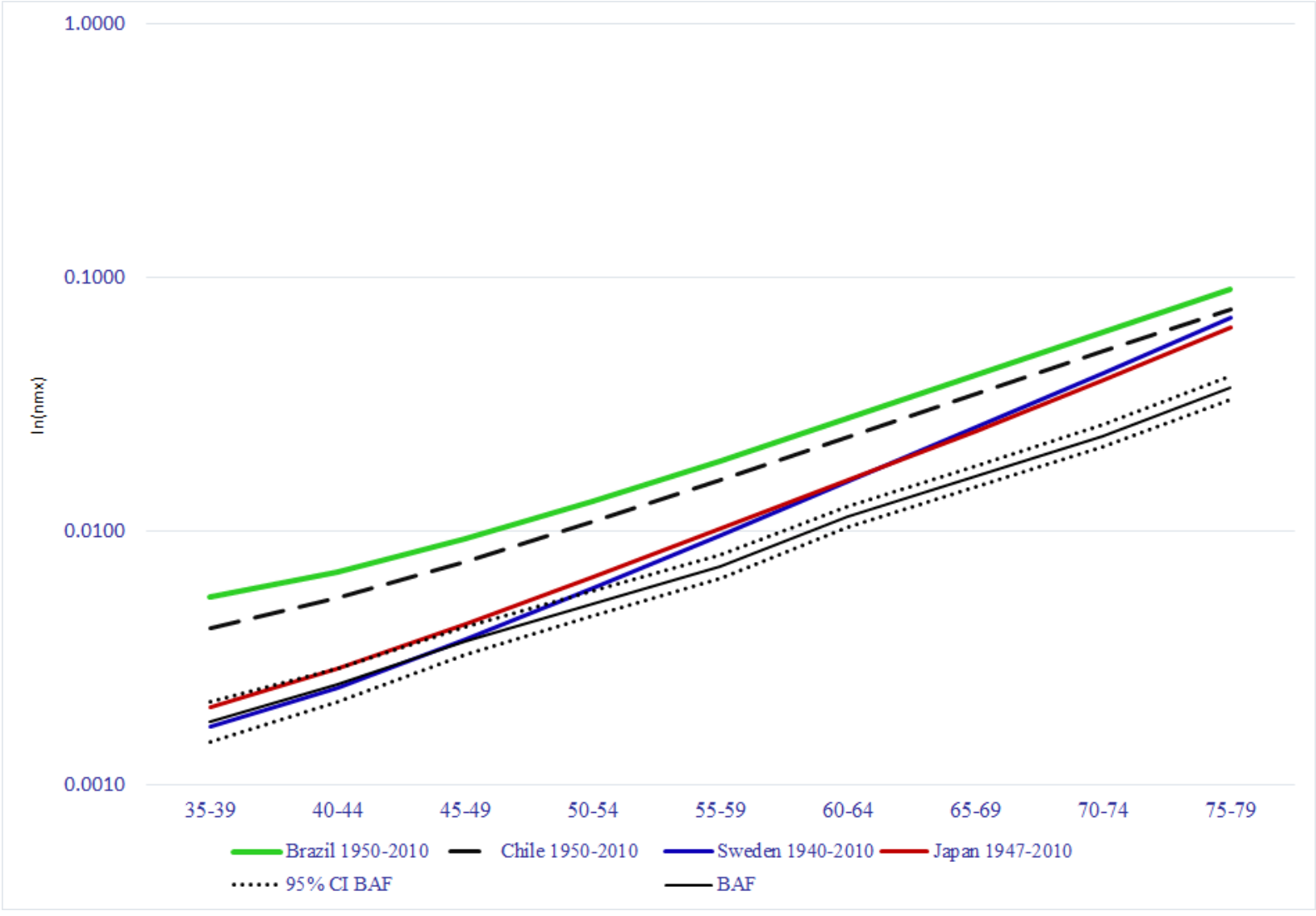
Background

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)


Males
Life expectancy at age 40 (years)
Finland
Norway
Sweden
50
45
40
35
30
25
1971-1975
1976-1980
1981-1985
1986-1990
1991-1995
1996-2000
Vanguard
Total
Non-vanguard
INED 006A15


MORTALITY FRAMEWORK
Because they enable:
Vanguard subgroups
MILITARY IS ONE OF THEM
Strategic
To isolate specific risk factors
Grasp distribution of mortality gains
Tackle increasing mortality differentials
Why the military?


1.0000
0.1000
0.0100
0.0010
ln(nmx)
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-79
Brazil 1950-2010
Chile 1950-2010
Sweden 1940-2010
Japan 1947-2010
95% CI BAF
BAF

Opportunity

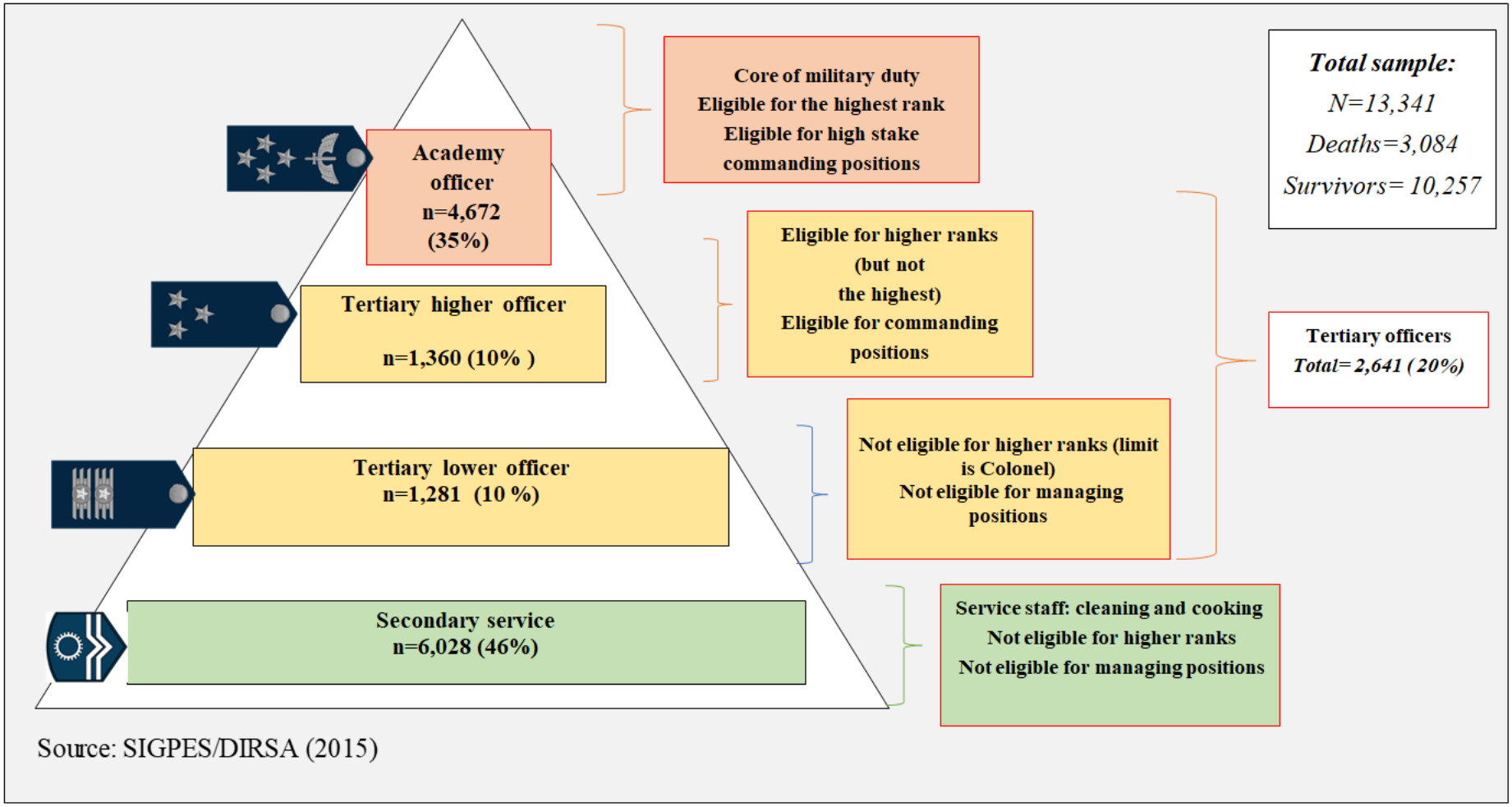
- Little or problematic information on SES gradients in mortality in the Brazilian context (Turra 2016a; Silva 2016)
- Longitudinal dataset with high-quality vital resgistration.
- Previous evidence that Brazilian military officers present survival advantages relative to their national male counterparts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

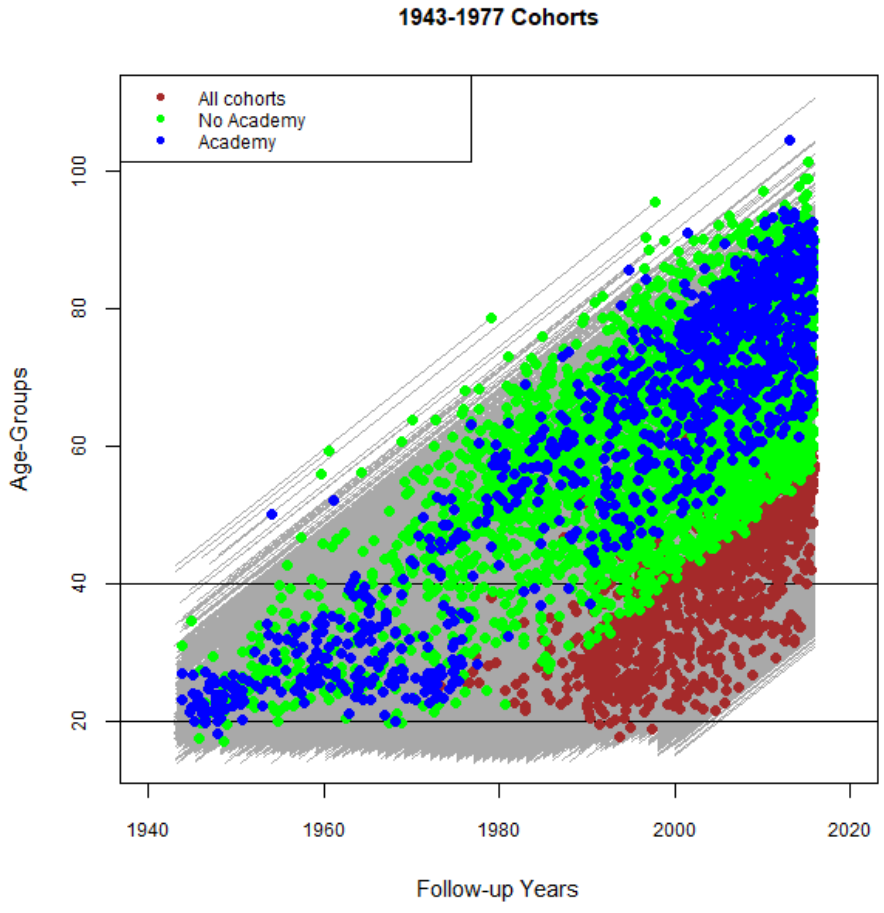
Research Question

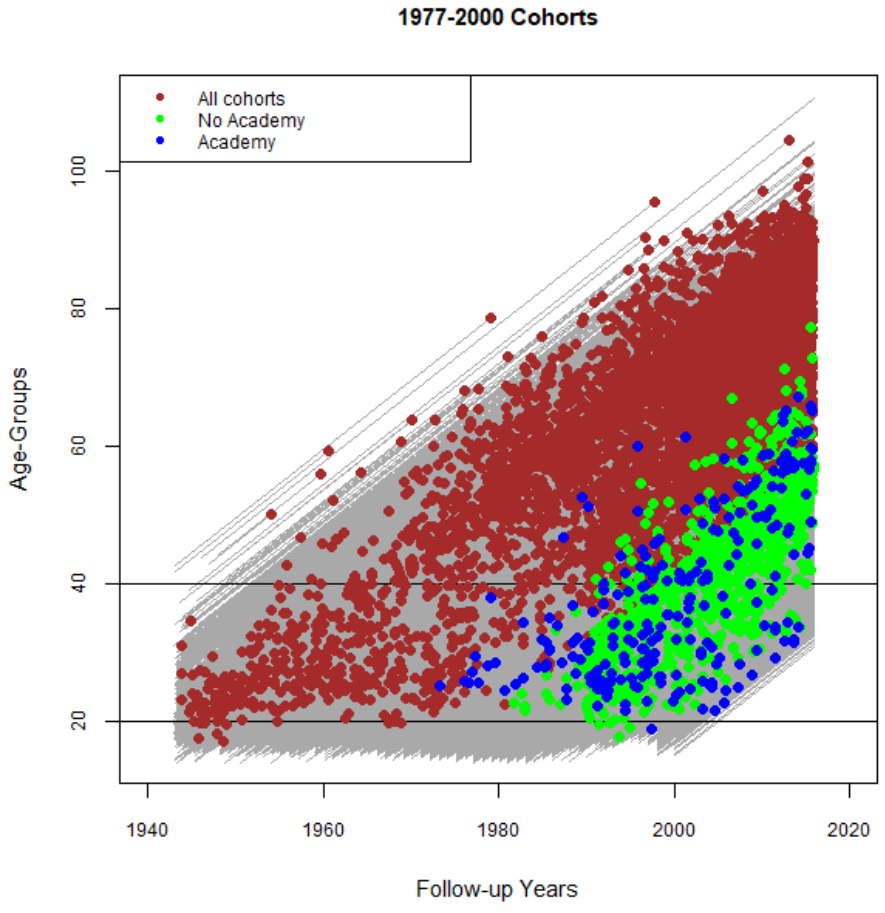
Given a highly selected (vanguard) population subgroup in a developing country, what is the degree of survival selection among its members and what are the factors associated to it? Can the mortality trajectory of highly selected groups provide further understanding of the underlying mechanisms of lower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


Academy officer n=4,672 (35%)
Tertiary higher officer n=1,360 (10%)
Tertiary lower officer n=1,281 (10 %)
Secondary service n=6,028 (46%)
Core of military duty
Eligible for the highest rank
Eligible for high stake commanding positions
Eligible for higher ranks (but not the highest)
Eligible for commanding positions
Not eligible for higher ranks (limit is Colonel)
Not eligible for managing positions
Service staff: cleaning and cooking
Not eligible for higher ranks
Not eligible for managing positions
Total sample:
N=13,341
Deaths=3,084
Survivors= 10,257
Tertiary officers
Total= 2,641 (20%)
Source: SIGPES/DIRSA (2015)


1943-1977 Cohorts
All cohorts
No Academy
Academy
Age-Groups
20
40
60
80
100
1940
1960
1980
2000
2020
Follow-up Years


1977-2000 Cohorts
All cohorts
No Academy
Academy
Age-Groups
20
40
60
80
100
1940
1960
1980
2000
2020
Follow-up Years

Analytical Approach

Cox regression

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

Where $X = (X_1, X_2, X_3, ...X_p)$ represent the explanatory variables and h_0 is the unspecified baseline hazard.

Analytical Approach

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

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 $H_0 : \theta_l = 0$.

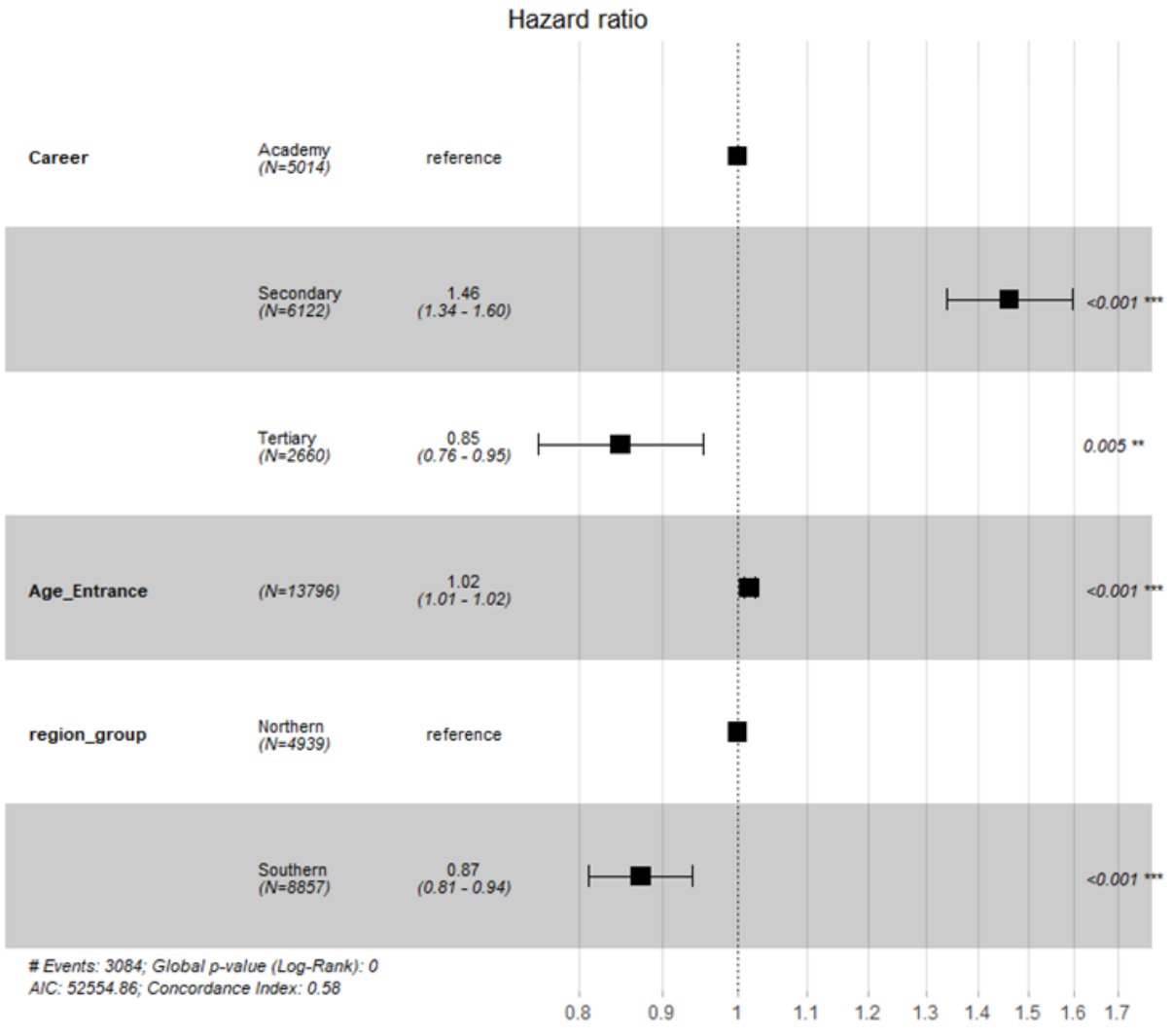
Analytical Approach

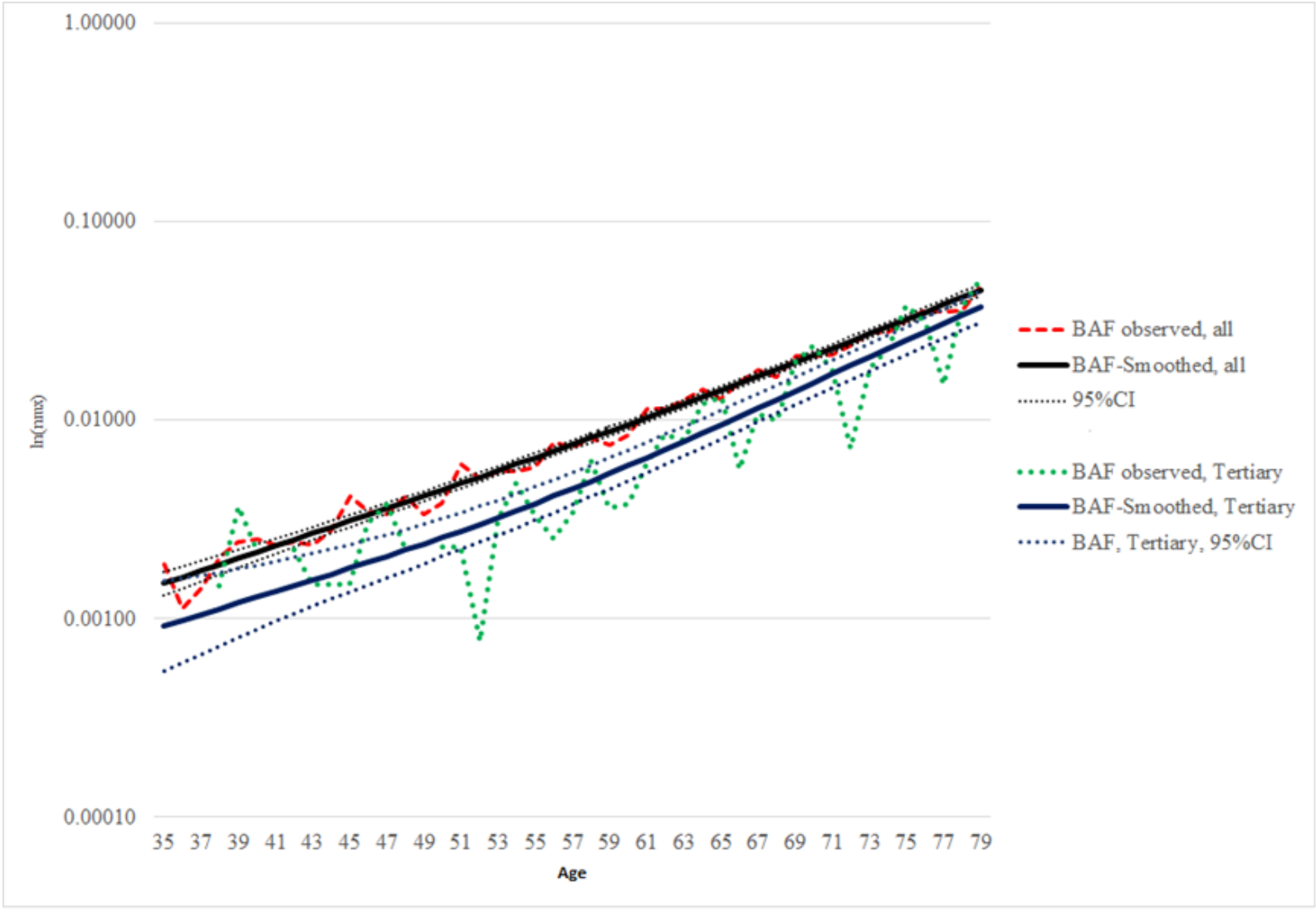
Transforming rates into probabilities:

$$q_{x+1} = 1m_{x+1}/1 + (1 - 0.5m_{x+1}) \tag{3}$$

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
Career
Academy (N=5014)
reference
Secondary (N=6122)
1.46 (1.34 - 1.60)
<0.001 ***
Tertiary (N=2660)
0.85 (0.76 - 0.95)
0.005 **
Age_Entrance
(N=13796)
1.02 (1.01 - 1.02)
<0.001 ***
region_group
Northern (N=4939)
reference
Southern (N=8857)
0.87 (0.81 - 0.94)
<0.001 ***
Events: 3084; Global p-value (Log-Rank): 0
AIC: 52554.86; Concordance Index: 0.58
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7


1.00000
0.10000
0.01000
0.00100
0.00010
ln(mux)
35 37 39 41 43 45 47 49 51 53 55 57 59 61 63 65 67 69 71 73 75 77 79
Age
BAF observed, all
BAF-Smoothed, all
95%CI
BAF observed, Tertiary
BAF-Smoothed, Tertiary
BAF, Tertiary, 95%CI

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 diferentials, 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

Vienna Institute of Demography
ÖAW AUSTRIAN ACADEMY OF SCIENCES
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Vanessa.DiLego@oeaw.ac.at