The Causal Effect of Serving in Army on Health: Evidence from Regression Kink Design and Russian Data

David Card and Evgeny Yakovlev

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Our paper

- Analysis of the effect of compulsory military service on health based on Russian micro-level data
- Contribute to the growing literature that studies consequences of conscription in different countries
  - New evidence came from quasi-natural experiment (Gorbachev’ demilitarization reform)
- Contribute to the analysis of health consequences of military service: first evidence from peaceful-era drafts
- Apply RKD
Effect on

- Earning (Angrist, 1990, Angrist, Chen, and Song, 2011); Health (Hearst et al. 1986, Autor et al., 2011); Education (Angrist and Chen, 2011, Card and Lemieux 2010); Household Stability (Conley and Heerwig, 2011); Crime (Galiani et al., 2011)

Evidence from different countries

- Recent elimination of compulsory service in many countries + new data/methods available renewed interest to this question
Most studies find negative effect

Death rates, suicides, car accidents: Hearst et al. 1986, Vietnam War veterans

Mortality, smoking and related to smoking diseases (lung cancer) for World War II and Korean War veterans: Bedard and Deschenes, 2006

Post traumatic syndrome, stress

Decrease in employment and rise of disability welfare transfers for Vietnam War veterans: Autor et al., 2011

No effect: Angrist et al, 2010

Negative but insignificant effect: Dobkin and Shabani, 2009

Previous studies: Mainly evidence from war era drafts, Our paper: evidence from peaceful draft
Use Russian micro level data (RLMS survey, 1994-2012)

Find strong effect of compulsory military service on smoking, alcohol consumption and related to smoking and alcohol diseases

Serving in army results in

- increase in daily alcohol consumption (in days when drinks) by 45 ml (of pure alcohol)
- increase in daily cigarettes consumption by 5 cigarettes
- 13% higher chance of getting tuberculosis / hepatitis / chronic lung or liver
- 13% higher chance of having general health problems
Rich data, can expect some other interesting results
Provides quasi-natural experiment that can answer many interesting questions
Demilitarization reform started in 1988 with the end of Cold War
  In December 1988, in the UN General Assembly, Gorbachev announced a unilateral reduction of Soviet armed forces to 500 thousands Man, 10 thousands Tanks, 8,500 artillery pieces and 800 combat aircraft
  In 1989 Mikhail Gorbachev and George Busch signed arms control treaty and Soviet troops withdrew from Afghanistan
Next decade: gradual decrease in chance of being conscripted
There is clear kink in probability of being conscripted

Regression Kink Design: use kink to identify causal relationship between serving in army and health
Alcohol and Smoking

- Log (daily hard alcohol intake)
- # of cigarettes per day
- Share of smokers: 30 yo - 17 yo

Start smoking when 18–21 yo}

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Serving in army and health: How to identify causal relationship?

Selection:
- those who go to army are selected based on health status, so generally healthier
- those who go to army usually from poor families and so easier involved in risky behavior (smoking, alcohol consumption, drugs)

Ideal case:

In absence of randomization
- IV: Bedard and Deschenes (2006) and Dobkin and Shabani (2009)
- RKD: our paper
Idea behind RKD

- Similar to regression discontinuity intuition
- Look on date-of-birth profile
- Look on change in slope before and after threshold
- Under assumption that other factors change smoothly in neighborhood of kink (with respect to assignment variable), we identify causal relationship
(Fuzzy) RK estimand

- $Y$ : outcome
  - alcohol consumption, smoking, related chronic diseases, hepatitis, tuberculosis
- $A$ is a dummy variable indicating whether individual $i$ went to compulsory military service
- $v = a_{18} - 1989$, where $a_{18}$ is a date $(\text{year} + \frac{\text{month}}{12} + \frac{\text{day}}{365})$ when person turned 18
- RK estimand
  \[ \lim_{v_0 \to 0} + \left. \frac{dE(Y|v)}{dv} \right|_{v=v_0} - \lim_{v_0 \to 0} - \left. \frac{dE(Y|v)}{dv} \right|_{v=v_0} \]
  \[ \lim_{v_0 \to 0} + \left. \frac{dE(A|v)}{dv} \right|_{v=v_0} - \lim_{v_0 \to 0} - \left. \frac{dE(A|v)}{dv} \right|_{v=v_0} \]
- see Card, Lee, Pei, and Weber, 2015
Estimation (Main specification)

- Use females as a control group
  - If some factors that 1) affect young people more than old people and can persist till today; 2) change non-smoothly around kink then problem
  - $\Rightarrow$ Use females as a control group

- Hepatitis, tuberculosis, chronic diseases are rare events
  - $\Rightarrow$ global polynomial approximation
  - Repeat analysis for smoking & alcohol with local polynomial approximation
Estimation (Main specification)

- Two groups of population, females \((j = 0)\) and males \((j = 1)\)
- System of two equations with group-specific coefficients

\[
y_{it} = A_i \delta_j + f_j(a18_i) + D_{1988} g(a18_i) + X_{it} \alpha_j + u_{it}
\]

\[
A_i = h_j(a18_i) + D_{1988} k_j(a18) + X_{it} \gamma_j + \varepsilon_{it}
\]

Note: \(g()\) is not gender-specific; \(k_j()\) is gender-specific

- \(y_{it}\) health outcomes; \(A_i\) is a indicator that person went to army; \(a18_i\) is a date when person turned 18
- \(D_{1988}\) is Dummy for person turned 18 in or after 1988
- \(f(), g(), k(), h()\) are smooth function (polynomials)
- \(X_{it}\) set of observable characteristics: smooth function of age, \(l(\text{live in city})\), income, marital status, \(\delta_t, \delta_r\)
<table>
<thead>
<tr>
<th>$I(served)$</th>
<th>hard intake</th>
<th>Log hard alcohol intake</th>
<th># of cigarettes per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>47.0***</td>
<td>54.6***</td>
<td>0.476**</td>
<td>4.921***</td>
</tr>
<tr>
<td>[10.836]</td>
<td>[8.564]</td>
<td>[0.238]</td>
<td>[1.435]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$I(smokes)$</th>
<th>start smoking at 18-21</th>
<th>hep/tub/chronic diseases</th>
<th>Health problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I(served)$</td>
<td>0.103</td>
<td>0.199***</td>
<td>0.130**</td>
</tr>
<tr>
<td></td>
<td>[0.075]</td>
<td>[0.052]</td>
<td>[0.053]</td>
</tr>
</tbody>
</table>

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Local polynomial implementation

- Deal with panel data, clustered errors
- Bandwidth may be too small if work with pooled data
- Start with data on averages within a18 X gender cells
- Choose bandwidths according to CCT (Calonico, Cattaneo and Titiunik, 2015), and IK (Imbents, Kalyanaraman, 2012)
- Local linear regressions
### Local polynomial implementation

<table>
<thead>
<tr>
<th></th>
<th>hard alcohol intake</th>
<th>alcohol intake</th>
<th>Smokes?</th>
<th># of cigarettes per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>l(served)</td>
<td>48.9***</td>
<td>57.2***</td>
<td>0.213**</td>
<td>4.4***</td>
</tr>
<tr>
<td></td>
<td>[11.2]</td>
<td>[9.1]</td>
<td>[0.07]</td>
<td>[1.2]</td>
</tr>
<tr>
<td>BW</td>
<td>IK for first stage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BW size</td>
<td>9.7</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Local Polynomials: Starting from $bw=3-5$ years most results are similar

**Figure:** RK Estimates with Varying Bandwidths

**Males–Females**

- Daily alcohol intake
- Daily hard alcohol intake
- Share of hard drinks
- Log (daily hard alcohol intake)
- Liver/lung ch. dis./hep./tub.
- Health problems last month?
- Start smoking when 18–21
- # of cigs per day

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Alcohol and Smoking

Why more smoking & alcohol?
- Initiating (facilitation) smoking & alcohol in army: cigarettes subsidies, peer influence
- Post traumatic stress syndrome, depression
- worse labor market conditions/family outcomes etc...

![Graph showing the trend of smoking initiation over years.](image)

- start smoking when 18–21 yo
- start smoking before 18 or after 21 yo

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AGE PROFILE, YOUNG MALES: Increase in alcohol consumption and smoking after compulsory service

Note: date fixed effects are excluded from # of cigarettes and alcohol consumption.

Dif-in-Dif estimates: Serving in army increases chance of smoking on 8%; consumption of hard alcohol by 22% and consumption of cigarettes by 1.35 cigarettes per day
Robustness

RD around 1st January
FALL DRAFT dates November - December 31
Quite similar point estimates, (noisy for alcohol consumption)

Table: RD around January 1st

<table>
<thead>
<tr>
<th></th>
<th>hard alcohol intake</th>
<th>alcohol intake</th>
<th># of cigarettes per day</th>
<th>I(smokes)</th>
<th>Served in Army</th>
</tr>
</thead>
<tbody>
<tr>
<td>Served in Army</td>
<td>77.10</td>
<td>53.65</td>
<td>10.02</td>
<td>0.192</td>
<td></td>
</tr>
<tr>
<td>robust se</td>
<td>[72.60]</td>
<td>[59.90]</td>
<td>[9.596]</td>
<td>[0.443]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[35.48]</td>
<td>[30.35]</td>
<td>[3.274]</td>
<td>[0.140]</td>
<td></td>
</tr>
<tr>
<td>I(after NY)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.077***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>[0.0280]</td>
</tr>
<tr>
<td>BW size</td>
<td>2 months</td>
<td>2 months</td>
<td>2 months</td>
<td>2 months</td>
<td>2 months</td>
</tr>
</tbody>
</table>

Note: Robust st.errors clustered at age18 level
Robustness

- Sample of 2000-2011 dates only: similar results
- Look only on males: results are higher in magnitude
- Look on averages within (gender)\(\times\)18 cells rather than on individual level data: same results
- Add national averages of alcohol (beer, vodka, and ratio of beer to vodka) and cigarettes consumption at age 18 (with gender-specific coefficients): similar results (higher in magnitude)
- Add national GNP per capita, death rates etc at age 18 (with gender-specific coefficients): similar results
- Look only males who become 18 age old before 1998 (Expansion of beer industry): similar results with smaller magnitude and bigger standard errors
- RKD within 3-years neighborhood of kink: similar - with higher in magnitude results
Identification assumption: Placebo for kink

Placebo for kink: moving 20-year window of year-turned-18 profile

\[ y_{ij} = \beta_0 + \beta_1 a_{18i} + \xi(D_{\text{central year}_k}(a_{18i} - \text{central year}_k)) + \beta_2 \text{age} + \beta_3 \text{age}^2 + I(\text{Male})(\alpha_0 + \alpha_1 a_{18i} + \theta(D_{\text{central year}_k}(a_{18i} - \text{central year}_k))) + u_{it} \]

• Kink in risk of conscription around 1989
Placebo for kink

- No kinks in pre-determinant characteristics (parents demographics, education, location, height, early age diseases)

- No discontinuity in distribution of pre-determinant character-cs
Graphical analysis: males vs females

- Indeed for females we do not observe kinks
Alcohol consumption profiles

Males: daily alcohol intake

Females: daily alcohol intake

Males–Females: daily alcohol intake

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Hard Alcohol Consumption

Males: daily hard alcohol intake

Females: daily hard alcohol intake

Males–Females: daily hard alcohol intake

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Smoking

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Hepatitis/Tuberculosis/Liver/Lung chronic diseases

Males: liver/lung/hepatisis/tuberculosis

Females: liver/lung/hepatisis/tuberculosis

Males–Females: liver/lung/hepatisis/tuberculosis

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-20 -10 0 10 20
year turned 18 years –1988

-2 -1 0 1 2
-20 -10 0 10 20
year turned 18 years –1988

-2 -1 0 1 2
Conclusion

- Analysis of the effect of compulsory military service on health
  - New evidence came from natural experiment (Russian/USSR Demilitarization Reform)
- Contribute to the analysis of health consequences of military service: first evidence from peaceful-era drafts
  - Strong effect on alcohol consumption, smoking, and related diseases
- Introduce new method (RKD) in health (and development) economics
 RKD implementation (not main specification)

\[ y_{it} = A_i \delta + f(a_{18})_i + X_{it} \alpha + u_{it} \]

- \( y_{it} \) is a outcome (health outcomes)
- \( A_i \) is a indicator that person went to compulsory military service
- \( f(a_{18}) \) is a smooth function (polynomial) representing the date-turned-18 profile of the outcome \( y \)
- \( X_{it} \) set of observable characteristics (smooth function of age, \( l(\text{live in city}), \text{income}, \text{marital status}, \text{time\&regional FE} \))
- \( a_{18} \) is a date (year+month/12+day/365) when person turned eighteen
A\textsubscript{i} is endogenous

Use kink (in year 1988) as an instrument for A\textsubscript{i}

\[ A_i = k(a_{18i}) + (D_{1988}g(a_{18}))_i + X_{it}\alpha + \varepsilon_{it} \]

D\textsubscript{1988} indicator that person turned 18 years in or later than 1988

k(a\textsubscript{18i}), g(a\textsubscript{18})\textsubscript{i}; smooth functions of date when person turned 18,

\( g(1988) = 0 \)

D\textsubscript{1988}g(a\textsubscript{18})\textsubscript{i} captures the kink
2 stage (fuzzy) RKD

\[
\begin{align*}
    y_{it} &= A_{it} \delta + X_{it} \alpha + f(a_{18}) + \delta_t + \delta_r + u_{it} \\
    A_{it} &= X_{it} \alpha + f(a_{18}) + (D_{1988}g(a_{18}))_{it} + \delta_t + \delta_r + \epsilon_{it}
\end{align*}
\]
Figure: Date-turned-18 profile of ratio of Males to Females

2010 census

Note: labels on the graph correspond to month of birth. 1=January, ..., 12=December.