Quality of mortality data in developed countries

International seminar
Demography and Health
Availability of reliable population data across the globe

For most of the world population, complete and accurate data on mortality and fertility are not available.

To produce such data an expensive and well-organized system for registration of vital events and also censuses or population registers are needed. This is something that majority of developing nations have been unable to achieve. Good death registration does not exist or is very fragmentary in most of the developing world including its most populated parts (China, India, Indonesia) and also in countries that are facing the greatest health challenges (Sub-Saharan Africa).

Vital registration that can be used to calculate life tables over the whole range of ages exist in about 60-65 countries. In about 15 to 20 of these countries, quality of these data is a serious concern. For other 45-50 countries, data quality can still be problematic during some time periods or at some ages. That is why one should care about data quality even when working on data from an industrialized country.
Human Mortality Database, Russia: update 2015

Life expectancy at age 90

Year
Males Females

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Human Mortality Database, Russia: update 2015

The graph shows the life expectancy at age 90 for males and females from 1980 to 2015. The life expectancy for males (Standard HMD) and females (Standard HMD) is represented by dashed lines, while the life expectancy for males (SR80) and females (SR80) is represented by solid lines.

- Males (Standard HMD) shows a slight increase in life expectancy from 2.5 to 4.5 over the years.
- Females (Standard HMD) starts at 2.7 and also shows an increase to around 4.5.
- Males (SR80) starts at 3.1 and shows a steady increase to 4.5.
- Females (SR80) starts at 3.2 and shows a similar increase to around 4.6.

The data suggests a steady improvement in life expectancy for both males and females over the years.
Human Mortality Database, Russia: update 2017

Life expectancy at age 90

Year
Males (Standard HMD)
Females (Standard HMD)
males (SR80)
females (SR80)

SR coeff. males = 1.26
SR coeff. females = 1.10

D. Jdanov: Quality of mortality data, Moscow, HSE, November 2017
Human Mortality Database, Russia: update 2017

Life expectancy at age 80

<table>
<thead>
<tr>
<th>Year</th>
<th>Males (Standard HMD)</th>
<th>Females (Standard HMD)</th>
<th>Males (SR80)</th>
<th>Females (SR80)</th>
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<tbody>
<tr>
<td>1980</td>
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<td>1985</td>
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<tr>
<td>2015</td>
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</table>
Trends in death rates at age 90+, calculated from the official population estimates, for the West and East Germany, males and females, 1956-2008.
Germany: old ages (cont.)

To correct population estimates for West Germans at older ages in 2010, the HMD team used data by the *Deutscher Rentenversicherung Bund* (DRV), the German Pension Scheme.

Ratio of DRV records by age based on own pensions to estimates based on official data, West and East Germany, 2009.

\[\text{Ratio DRV / HMD population estimates}\]

<table>
<thead>
<tr>
<th>Age</th>
<th>Ratio DRV / HMD population estimates</th>
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<tbody>
<tr>
<td>70</td>
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<td>75</td>
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<td>80</td>
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<td>90</td>
<td>0.9</td>
</tr>
<tr>
<td>95</td>
<td>0.9</td>
</tr>
<tr>
<td>100</td>
<td>0.9</td>
</tr>
</tbody>
</table>

**West Germany**

- **Males**
- **Females**

**East Germany**

- **Males**
- **Females**

D. Jdanov: Quality of mortality data, Moscow, HSE., November 2017
Life expectancy and probability of death for the corrected and the original data, W. Germany, 1990-2008

- **e80**: For the corrected data, the life expectancy at age 80 shows a steady increase from 1990 to 2006, with slight variations over the years.
- **q80**: The probability of death at age 80 decreases over the years, showing fluctuations.
- **e90**: Similarly, the life expectancy at age 90 increases steadily, with some minor fluctuations.
- **q90**: The probability of death at age 90 also decreases over the years, with more pronounced fluctuations.

The graphs illustrate the trends in life expectancy and probability of death for both males and females for the corrected and original data sets.
Russia: death count ratios at old ages

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<td>Deaths 100+</td>
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<tr>
<td>Females</td>
<td>2178</td>
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<tr>
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<tr>
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<td>4894</td>
<td>7194</td>
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<td>6692</td>
<td>6874</td>
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<td>1760</td>
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</table>

D. Jdanov: Quality of mortality data, Moscow, HSE., November 2017
Censuses and inter-censal population estimates

Assuming good quality of census data:

After a new census the post-censal population estimates should be replaced by inter-censal estimates (backward from this census).

Four components:
• Census counts
• Death counts
• Births
• Migration

Developed countries with high quality vital registration system which do/did NOT produce inter-censal estimates: Germany, Italy, Czech Republic, ....
In the 2000s, Poland faced a massive out-migration that followed the EU enlargement of 2004. It was expected that the population counts will be corrected downward after the next population census of 2011. But Statistics Poland has unexpectedly decided to change the official definition of the population status from the permanently resident (acting in 2010 and earlier) to the usually resident (from 2011 onward). Statistics Poland did not re-estimate age-specific population counts back to previous census. Due to irregular migration pattern the standard HMD inter-censal method for reconstruction of annual population estimates is not applicable.

Source: Jasilionis (2017)
Inter-censal estimates. Bulgaria: correction of population series over the 1990s and the 2000s

1961-2003. Official population estimates (left) and HMD data (right).
Germany: three decades between censuses

Before the 2011 census, East Germany had a census 30 years ago and West Germany - 24 years ago. Whereas before the 2011 census Germany's population was estimated to be 81.7 million, the census corrected this down to 80.2 millions, a difference of 1.5 million people (~ 1.8%). The statistical office of Germany decided not to produce adjusted inter-censal population estimates by age.

Figure: difference between current population estimates and census counts of 2011
The HMD inter-censal estimates for Germany

D. Jdanov: Quality of mortality data, Moscow, HSE, November 2017
Russia: net migration in 1980 – 2010, ages 80-10
Russia: net migration in 1980 – 2010, ages 60-10
## Mortality rate sex ratio by region, 2016

<table>
<thead>
<tr>
<th>Region</th>
<th>Republic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Belgorod oblast</td>
<td>42 Republic of Bashkortostan</td>
</tr>
<tr>
<td>2 Bryansk oblast</td>
<td>43 Republic of Mariy El</td>
</tr>
<tr>
<td>3 Vladimir oblast</td>
<td>44 Republic of Mordovia</td>
</tr>
<tr>
<td>4 Voronezh oblast</td>
<td>45 Republic of Tatarstan</td>
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<tr>
<td>5 Ivanovo oblast</td>
<td>46 Udmurt Republic</td>
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<td>6 Kaluga oblast</td>
<td>47 Chuvash Republic</td>
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<tr>
<td>7 Kostroma oblast</td>
<td>48 Perm kray</td>
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<tr>
<td>8 Kursk oblast</td>
<td>49 Kirov oblast</td>
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<tr>
<td>9 Lipetzk oblast</td>
<td>50 Nizhny Novgorod oblast</td>
</tr>
<tr>
<td>10 Moscow oblast</td>
<td>51 Orenburg oblast</td>
</tr>
<tr>
<td>11 Oryol oblast</td>
<td>52 Penza oblast</td>
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<tr>
<td>12 Ryazan oblast</td>
<td>53 Samara oblast</td>
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<td>13 Smolensk oblast</td>
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<td>14 Tambov oblast</td>
<td>55 Ulyanovsk oblast</td>
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<td>15 Tver oblast</td>
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<td>16 Tula oblast</td>
<td>57 Sverdlovsk oblast</td>
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<td>17 Yaroslavl oblast</td>
<td>58 Tyumen oblast</td>
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<td>18 Moscow</td>
<td>59 Chelyabinsk oblast</td>
</tr>
<tr>
<td>19 Republic of Karelia</td>
<td>60 Republic of Altai</td>
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<tr>
<td>20 Republic of Komi</td>
<td>61 Republic of Buryatia</td>
</tr>
<tr>
<td>21 Arkhangelsk oblast</td>
<td>62 Republic of Tuva</td>
</tr>
<tr>
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<td>23 Kaliningrad oblast</td>
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<td>26 Novgorod oblast</td>
<td>67 Irkutsk oblast</td>
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<td>27 Pskov oblast</td>
<td>68 Kemerovo oblast</td>
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<tr>
<td>28 St.-Petersburg</td>
<td>69 Novosibirsk oblast</td>
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<td>29 Republic of Adygeya</td>
<td>70 Omsk oblast</td>
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<td>30 Republic of Kalmykia</td>
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<tr>
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<td>32 Astrakhan oblast</td>
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<td>34 Rostov oblast</td>
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<td>35 Republic of Dagestan</td>
<td>76 Amur oblast</td>
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<td>36 Republic of Ingushetia</td>
<td>77 Magadan oblast</td>
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<td>37 Kabardian-Balkar Rep.</td>
<td>78 Sakhalin oblast</td>
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<td>38 Karachaev-Cherc. Rep.</td>
<td>79 Jewish autonomous obl</td>
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<tr>
<td>39 Republic of North Ossetia</td>
<td>80 Chukchi autonomous area</td>
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<tr>
<td>40 Chechen Republic</td>
<td>81 Republic of Crimea</td>
</tr>
<tr>
<td>41 Stavropol kray</td>
<td>82 Sevastopol</td>
</tr>
</tbody>
</table>
Normalized deviation from the average proportion in total population, females, 2016
Mortality rates by region: deviation from the total population, females, per cent, 2016

1. Belgorod oblast
2. Bryansk oblast
3. Vladimir oblast
4. Voronezh oblast
5. Ivanovo oblast
6. Kaluga oblast
7. Kostroma oblast
8. Kursk oblast
9. Lipetsk oblast
10. Moscow oblast
11. Oryol oblast
12. Ryazan oblast
13. Smolensk oblast
14. Tambov oblast
15. Tver oblast
16. Tula oblast
17. Yaroslavl oblast
18. Moscow
19. Republic of Karelia
20. Republic of Komi
21. Arkhangelsk oblast
22. Vologda oblast
23. Kaliningrad oblast
24. Leningrad oblast
25. Murmansk oblast
26. Novgorod oblast
27. Pskov oblast
28. St.-Petersburg
29. Republic of Adygeya
30. Republic of Kalmykia
31. Krasnodar kray
32. Astrakhan oblast
33. Volgograd oblast
34. Rostov oblast
35. Republic of Dagestan
36. Republic of Ingushetia
39. Republic of North Ossetia
40. Chechen Republic
41. Stavropol kray
42. Republic of Bashkortostan
43. Republic of Mariy El
44. Republic of Mordovia
45. Republic of Tatarstan
46. Udmurt Republic
47. Chuvash Republic
48. Perm kray
49. Kirov oblast
50. Nizhny Novgorod oblast
51. Orenburg oblast
52. Penza oblast
53. Samara oblast
54. Saratov oblast
55. Ulyanovsk oblast
56. Kurgan oblast
57. Sverdlovsk oblast
58. Tyumen oblast
59. Chelyabinsk oblast
60. Republic of Altai
61. Republic of Buryatia
62. Republic of Tuva
63. Republic of Khakasia
64. Altai kray
65. Zabaikalsk kray
66. Krasnoyarsk kray
67. Novosibirsk oblast
68. Kemerovo oblast
69. Khabarovsk kray
70. Omsk oblast
71. Tomsk oblast
72. Yakutia
73. Kamchatka kray
74. Primorsky kray
75. Khabarovsk kray
76. Amur oblast
77. Magadan oblast
78. Sakhalin oblast
79. Jewish autonomous obl
80. Chukchi autonomous area
81. Republic of Crimea
82. Sevastopol
Mortality rates by region: deviation from the total population, males, per cent, 2016

1. Belgorod oblast 42. Republic of Bashkortostan
2. Bryansk oblast 43. Republic of Mariy El
3. Vladimir oblast 44. Republic of Mordovia
4. Voronezh oblast 45. Republic of Tatarstan
5. Ivanovo oblast 46. Udmurt Republic
6. Kaluga oblast 47. Chuvash Republic
8. Kursk oblast 49. Kirov oblast
9. Lipetsk oblast 50. Nizhny Novgorod oblast
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12. Ryazan oblast 53. Samara oblast
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15. Tver oblast 56. Kurgan oblast
16. Tula oblast 57. Sverdlovsk oblast
17. Yaroslavl oblast 58. Tyumen oblast
18. Moscow 59. Chelyabinsk oblast
19. Republic of Karelia 60. Republic of Altai
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23. Kaliningrad oblast 64. Altai kray
24. Leningrad oblast 65. Zabaikalsk kray
25. Murmansk oblast 66. Krasnoyarsk kray
27. Pskov oblast 68. Kemerovo oblast
28. St.-Petersburg 69. Novosibirsk oblast
29. Republic of Adygeya 70. Omsk oblast
30. Republic of Kalmykia 71. Tomsk oblast
31. Krasnodar kray 72. Yakutia
32. Astrakhan oblast 73. Kamchatka kray
33. Volgograd oblast 74. Primorsky kray
34. Rostov oblast 75. Khabarovsk kray
35. Republic of Dagestan 76. Amur oblast
36. Republic of Ingushetia 77. Magadan oblast
37. Kabardian-Balkar Rep. 78. Sakhalin oblast
39. Republic of North Ossetia 80. Chukchi autonomous area
40. Chechen Republic 81. Republic of Crimea
41. Stavropol kray 82. Sevastopol
Mortality rate sex ratio, Russia, 1959-2016
## Correction of LE in Moscow

### Life expectancy at birth

<table>
<thead>
<tr>
<th>Year</th>
<th>Males, official</th>
<th>Males, corrected</th>
<th>Diff</th>
<th>Females, official</th>
<th>Females, corrected</th>
<th>Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>64.9</td>
<td>64.7</td>
<td>-0.2</td>
<td>74.0</td>
<td>74.0</td>
<td>-0.0</td>
</tr>
<tr>
<td>2005</td>
<td>66.7</td>
<td>66.2</td>
<td>-0.5</td>
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<td>76.1</td>
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<tr>
<td>2010</td>
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<td>-0.8</td>
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<td>78.1</td>
<td>-0.0</td>
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<tr>
<td>2015</td>
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<td>80.3</td>
<td>79.9</td>
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### Life expectancy at age 60

<table>
<thead>
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<th>Males, official</th>
<th>Males, corrected</th>
<th>Diff</th>
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<th>Diff</th>
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<tr>
<td>1990</td>
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<td>-0.3</td>
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<td>-0.2</td>
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<td>-2.0</td>
<td>28.3</td>
<td>27.7</td>
<td>-0.6</td>
</tr>
</tbody>
</table>

Source: Папанова et al. (2017)

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D. Jdanov: Quality of mortality data, Moscow, HSE, November 2017
Growing problems at advanced ages: emerging migrants

*Sweden 2014:*

<table>
<thead>
<tr>
<th>Age group</th>
<th>Males</th>
<th>Females</th>
<th>Males foreign born (%)</th>
<th>Females foreign born (%)</th>
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<tbody>
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<td>90-94</td>
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<td>52,869</td>
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<tr>
<td>95-99</td>
<td>3,941</td>
<td>12,585</td>
<td>0.05</td>
<td>0.02</td>
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<tr>
<td>105+</td>
<td>12</td>
<td>74</td>
<td>33.3</td>
<td>5.4</td>
</tr>
</tbody>
</table>

A steep increase in the proportion of foreign-born individuals in the population denominator that does not match with a similar increase in the death numerator is a signal of problematic population estimates, and of a numerator-denominator bias at extreme ages. In light of this new problem, Statistics Sweden has decided to use an aggregated open age interval 100+ instead of showing individual ages above 100.
Conclusion

• Data are of high quality if they are “Fit for Use” in their intended operational, decision-making and other roles (Juran and Godfrey, 1999). This is why the understanding of problems hidden in the data is important in any demographic estimation, forecast or study.

• We discussed several approaches which allow us to increase significantly utility of the data even if data quality is problematic.

• Standard demographic methods which work well with data from developing countries or historical data series are often not applicable to problematic data from countries with functioning statistical systems.

• Country-specific approaches in combination with usage of additional and alternative data sources are needed. They should be combined with certain general principles that are applied in all countries to ensure comparability of data series across time and space.