Chernyavskiy V, Wenzel H, Mikhailova J, Ivanova A, Zemlyanova E, Bjegovic-Mikanovic V, Mikhailov A, Laaser U. Successful reduction of premature mortality in the Russian Federation and the countries around the Baltic Sea working together on Health and Social Well-being (Original research). SEEJPH 2019, posted: 25 October 2019. DOI 10.4119/seejph-3129

ORIGINAL RESEARCH

Successful reduction of premature mortality in the Russian Federation and the countries around the Baltic Sea working together on Health and Social Well-being

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Abstract

Context: The 'Northern Dimension on Public Health and Social Well-being' is a platform for dialogue and cooperation of countries around the Baltic Sea, established in 2003, guided by the Sustainable Development Goal 3 on Health and Social Well-being and the Strategy for the Baltic Sea Region of the European Union adopted in 2009. In this paper we determine the overall progress of the Russian Federation and its North West Federal Okrugin in particular, with regard to the reduction of mortality.

Methods: For the purpose of inter-country comparison and progress over time we make use of age-standardised Potential Years of Life Lost (PYLL) applied to quantifiable strategic targets, the Sustainable Development Goal 3 on Health and Social Well-being and the European Union Strategy of the Baltic Sea Region. A gap analysis is performed to determine whether the target achievement is in delay or on track.

Results: With reference to the baseline of 2009 – corresponding to the most relevant recent period 2009-2020 respectively 2009-2030 – the Russian Federation as a whole is on track achieving the two strategic targets in advance by 2.7 years. For the North West Federal Okrug around St. Petersburg and Kaliningrad bordering the Baltic Sea the target achievement is estimated to be 4.8 and 10.8 years in advance of the deadlines 2020 and 2030. In comparison to the Baltic Sea states the Russian Federation takes a middle position after Estonia, Latvia and Finland. The early target achievement is confirmed if the period 2003-2020 respectively 2003-2030 is considered.

Conclusion: Although the region is progressing there may be a slowdown towards 2030. A careful analysis is required to determine to which degree the activities of the Partnership for Health and Social Well-being have contributed to the success and what should be proposed to increase the impact on premature mortality.

Keywords: *gap analysis, northern dimension, North West Federal Okrug, premature mortality, public health, Russian Federation.*

Introduction

Since 1999 the countries around the Baltic Sea (figure 1) initiated in several steps a platform for cooperation the 'Northern Dimension'(ND) (1,2) with meanwhile four Partnerships on Culture, Environment, Health and Social Well-being, and Transport. The 'Northern Dimension Partnership on Public Health and Social Well-being' (NDPHS) (2) was formally established at a ministerial-level meeting on 27 October 2003, in Oslo, Norway. Today the membership comprises ten countries characterised by very diverse population size, history, health status and culture: Estonia, Finland, Germany, Iceland, Latvia, Lithuania, Norway, Poland, the Russian Federation, and Sweden (Denmark is not included) as well as related international organisations, the European Union (EU), the Baltic Sea States Sub-regional Cooperation (BSSSR), the Northern Dimension Institute (NDI), the World Health Organisation (WHO-EURO) and several more. Coordinated by a secretariat in Stockholm the NDPHS promotes dialogue, practical cooperation and development (3) in two priority fields:

> *I. To reduce the spread of major communicable diseases, and*
> *II. To prevent life-style related non-communicable diseases. Emphasis is placed on encouraging proper nutrition, physical exercise, safe sexual behaviour, ensuring good social and work environments, as well as supporting alcohol, drug and smoke-free leisure activities.*

During the decade 2010-2020 two strategies for development of the Baltic Sea region have been most relevant:

I. The Sustainable Development Goals (SDG), especially SDG 3 on Health and Social Well-being (4):

> *SDG target 3.4, by 2030: Reduce by one third premature mortality from Non-Communicable Diseases (NCDs) through prevention and treatment and promote mental health and well-being.*

II. The EU Strategy for the Baltic Sea Region (EU-SBSR) adopted by the European Council October 2009 (5):

EU-SBSR action target, by 2020

> *1) Reduce by at least 10% premature preventable mortality determined as Potential Years of Life Lost (PYLL) in the countries of the Baltic Sea region.*
> *2) Reduce by at least 10% the difference between the lowest (best) and the highest (worst) PYLL rates for women and men in the countries of the Baltic Sea region.*

In this framework, the Russian Federation (RUF) is fully engaged as an entire member state and especially regarding its North-West Federal Okrug (NWO) including St. Petersburg and Kaliningrad and stretching from the Baltic to the Barents Sea with a territory of 1,686,970 km^2.

Figure 1. The geographical area of the Northern Dimension Partnership on Health and Social Well-being

Figure 2. The geographical area of the North West Federal Okrug of the Russian Federation

With our analysis, we attempt to determine to which extent it is possible for the RUF and the NWO to achieve the targets of the EU-SBSR and SDG. In addition, we try to identify the Russian Federation's rank of target achievement in comparison with the other Baltic Sea states. For the NWO a specific Strategy and Action Plan of Social and Economic Development has been developed. It lists 109 activities together with the responsible institutions and timelines ending at the 4th quarter 2020: 12 activities relate to the health of the population, of which 3 are linked to maternal and child health (activities 63, 68, and 74). Activity 71 refers to primary health care, and activity 77 to HIV. Health related activities can also be found in other sections, e.g. activities 79 and 80 aiming at elderly services and 81 to rehabilitation. Of interest is also activity 40 on the implementation of cross-border cooperation programmes.

Methods

Losses of years of life up to the age of 69 years inclusive are predominantly preventable. It is in this sense that we will use the terms "premature" and "preventable" losses as synonyms. The Preventable Years of Life Lost (PYLL) were calculated by Vienonen et al. (6) for all countries except the Russian Federation up to the age of 69, based on the method of Haenszel (7) i.e. calculating the "...number of deaths in a theoretical standard population obtained by multiplying the specific death rates by the standard population". To standardize the rates the OECD 1980 Standard Population (8) was applied. For age standardisation the direct method was used as recommended e.g. by Armitage (9).

The likelihood of achieving the SDG targets (4) and EU-SBSR (5) is determined by the indicators' time gap (G), i.e. the time needed to achieve an agreed target deadline related to the time remaining between the year of observation and the target year. To this end we use the mathematical model of the United Nations Development Program (UNDP) originally employed to assess advancement towards the target year of the Millennium Development Goals (MDG) (10), based on linear progress between the value of an earlier 'baseline year' and the year of observation; for details of the calculation see Bjegovic-Mikanovic et al. (11,12). We applied the EU-SBSR targets for 2020 with an intended reduction of 10% (4) and for 2030 of 33% (5). As non-communicable conditions make up for more than 2/3 of premature mortality, it seems to be justified for the purpose of intercountry comparison to apply the SDG-3 target to the calculated PYLL rates.

A positive time gap G indicates that the respective country is "On Track" to achieve the target on time or even earlier; a negative value indicates that it may still be "Likely" or even "Unlikely" to achieve the target within the targeted timeframe i.e. here in 2020 respectively 2030. A country is still considered likely to achieve the target as long as a negative value does not make up for more than 25% of the remaining time (gap ratio). The gap ratio multiplied by the remaining time since the year of observation i.e. 2020-2013 = 7 or 2030-2013 = 17 indicates the number of years in advance or delay given the target year. Table 1 provides details of the calculation using the year of observation 2013 and the Russian Federation as an example. The demographic data have been provided by the Federal Research Institute for Health Organization and Informatics of the Russian Ministry of Health (Annex 1).

Table 1. Calculation of Premature Years of Life Lost before age 70 (PYLL) in 2013 for the Russian Federation (RUF)

Standardized death rates 2013 Direct standardization						
	Study Population (Russian Federation)		Standard Population			
Age Groups	Deaths	Population	(OECD 1980)	Crude Rate	Expected deaths (study pop.)	PYLL
	d_i	p_i	$STD\ P_i$	$r_i = d_i/p_i$	$D_i = r_i * STD\ P_i$	D_i * (Remaining Years to Upper Age Limit)
0-4	18,549	8,793,034	80,269,483	0.00211	169,329	11,429,730
5-9	1,878	7,551,502	84,285,393	0.00025	20,961	1,310,070
10-14	1,930	6,755,920	85,828,597	0.00029	24,519	1,409,849
15-19	5,479	7,053,780	87,597,591	0.00078	68,041	3,572,160
20-24	15,314	10,409,826	82,619,776	0.00147	121,543	5,773,282
25-29	29,730	12,539,043	77,252,661	0.00237	183,166	7,784,539
30-34	44,424	11,503,329	73,604,119	0.00386	284,247	10,659,271
35-39	51,039	10,536,321	61,676,142	0.00484	298,765	9,709,877
40-44	53,882	9,656,787	57,394,499	0.00558	320,244	8,806,717
45-49	68,120	9,365,912	54,245,506	0.00727	394,538	8,877,095
50-54	111,658	11,310,281	52,537,987	0.00987	518,669	9,076,699
55-59	146,852	10,508,048	48,323,994	0.01398	675,337	8,441,714
60-64	177,781	8,819,230	36,727,063	0.02016	740,356	5,552,674
65-69	126,245	4,861,125	36,887,734	0.02597	957,986	2,394,966
Sum	**852,881**	**129,664,138**	**919,250,545**	**0.00706**	**4,777,702**	**94,798,643**
Standardized rate (per 100 000)					***520***	***10,313***

Results

Table 2 presents the Premature Years of Life Lost (PYLL) for the Russian Federation (RUF). The data are used below for the calculation of the gap status for the target years 2020 and 2030 (for further details see Annex 2).

Table 2. Overview of age standardized PYLL rates of the Russian Federation, based on the OECD 1980 Standard Population

Age groups	PYLL 2003	PYLL 2009	PYLL 2013
0-4	18,229,269	12,183,235	11,429,730
5-9	2,215,671	1,612,951	1,310,070
10-14	2,146,975	1,681,090	1,409,849
15-19	5,589,625	4,317,138	3,572,160
20-24	9,726,159	6,893,909	5,773,282
25-29	12,106,799	9,949,936	7,784,539
30-34	13,094,532	11,961,014	10,659,271
35-39	12,824,630	9,977,662	9,709,877
40-44	14,212,643	10,036,011	8,806,717
45-49	15,208,226	10,587,880	8,877,095
50-54	16,014,381	11,134,913	9,076,699
55-59	13,353,138	10,139,068	8,441,714
60-64	8,350,403	6,339,159	5,552,674
65-69	3,546,838	2,902,400	2,394,966
Sum of PYLL	**146,619,290**	**109,716,365**	**94,798,643**
Age standardised rate/100,000	**15,950**	**11,935**	**10,313**

We see in table 2 an impressive reduction of Premature Years of Life lost from 15,950 in 2003 to 10,313 in 2013, which translates if continued at the same speed into a positive Gap ratio for 2020 and 2030 standing for an early target achievement ranking 4th among the member states of NDPHS (table 3).

The Gap ratios for the RUF based on 2009 of 0.39 for the target year 2020 and 0.16 for 2030 correspond to 2.7 years in advance of either target (calculated from 0.39 * 7 years and 0.16 * 17 years up to the corresponding target year).

If 2003 is used as the baseline year the gap analysis shows the following results:

PYLL 2003 / 100,000 15,950
PYLL 2013 / 100,000 10,313
Target 2020 (-10%) = 9,282
Target 2030 (-33%) = 6,875
Gap value 2020 = 0.62
(4.4 years in advance)
Gap value 2030 = 0.40
(6.8 years in advance)

Table 4 presents the corresponding data for the NOW (for details see Annex 3). Progress between 2003 and 2009 is very slow but accelerates considerably between 2009 and 2013.

Table 3. Gap Analysis of the mortality in the Russian Federation and NDPHS member states *(ESTonia, LATvia, FINland, POLand, GERmany, RUssian Federation, SWEden, LIThuania, Ru)*

Countries ranked according to achievement 2009-2013 **-2020**	**Change of country ranks** 2009-**2030**	Baseline value 2009 All Death: PYLL/ 100,000	Observed value 2013 All Death: PYLL/ 100,000	Target value 2020 (-10% as of 2013) All death: PYLL/ 100,000	Target value 2030 (-33% as of 2013) All death: PYLL/ 100,000	**Gap ratio 2020 according to baseline 2009**	**Gap ratio 2030 according to baseline 2009**
1) EST	EST→1	6247	4979	4481	3319	0.557	0.299
2) LAT	LAT→2	8247	6837	6153	4558	0.487	0.237
3) FIN	FIN→3	3741	3115	2803	2077	0.477	0.229
4) RUF	**RUF→4**	**11935**	**10313**	**9282**	**6875**	**0.390**	**0.160**
5) POL	POL→5	5649	4901	4411	3267	0.379	0.152
6) GER	GER→7	3219	3008	2707	2005	0.076	-0.021
7) SWE	SWE→8	2670	2511	2260	1674	0.039	-0.038
8) LIT	LIT→6	8351	7369	6632	4913	0.033	0.118
LIT - SWE		5681	4858	4372	3239	0.420	0.181

Table 4. Overview of age standardized PYLL rates of the North West Federal Okrug, based on the OECD 1980 Standard Population

Age groups	**PYLL 2003**	**PYLL 2009**	**PYLL 2013**
0-4	15,994,997	9,627,834	8,660,105
5-9	2,279,635	2,512,981	1,189,746
10-14	2,066,224	2,939,012	1,180,353
15-19	5,248,957	5,051,446	2,998,759
20-24	9,630,348	7,584,853	4,984,555
25-29	13,542,067	12,095,659	6,912,712
30-34	15,222,446	16,309,283	10,162,831
35-39	15,455,366	16,274,079	9,581,213
40-44	17,978,711	17,318,045	8,800,723
45-49	18,879,238	16,853,065	9,053,049
50-54	19,914,378	18,018,859	9,311,518
55-59	15,444,599	17,242,066	8,640,291
60-64	9,238,993	12,450,710	5,528,433
65-69	3,712,069	6,661,087	2,323,054
Sum of PYLL	**164,608,028**	**160,938,978**	**89,399,156**
Age standardised rate/100,000	**17,907**	**17,508**	**9,725**

The demographic and mortality data in **table 4** provided for the NWO allow for the following calculation of the PYLL target achievement for 2020 and 2030 (reduction of PYLL, 0-69 years of age, direct age-standardisation, population base 2003, 2009 and 2013):

Baseline value 2009 (PYLL NWO)	17,508
Observed value 2013 (PYLL NWO)	9,725
Target value 2020 (-10% of 2013)	8,753
Target value 2030 (-33% of 2013)	6,483
GAP 2020	0.69
	(4.8 years in advance)
GAP 2030	0.64
	(10.8 years in advance)

If 2003 is used as the baseline year the gap analysis shows the following results:

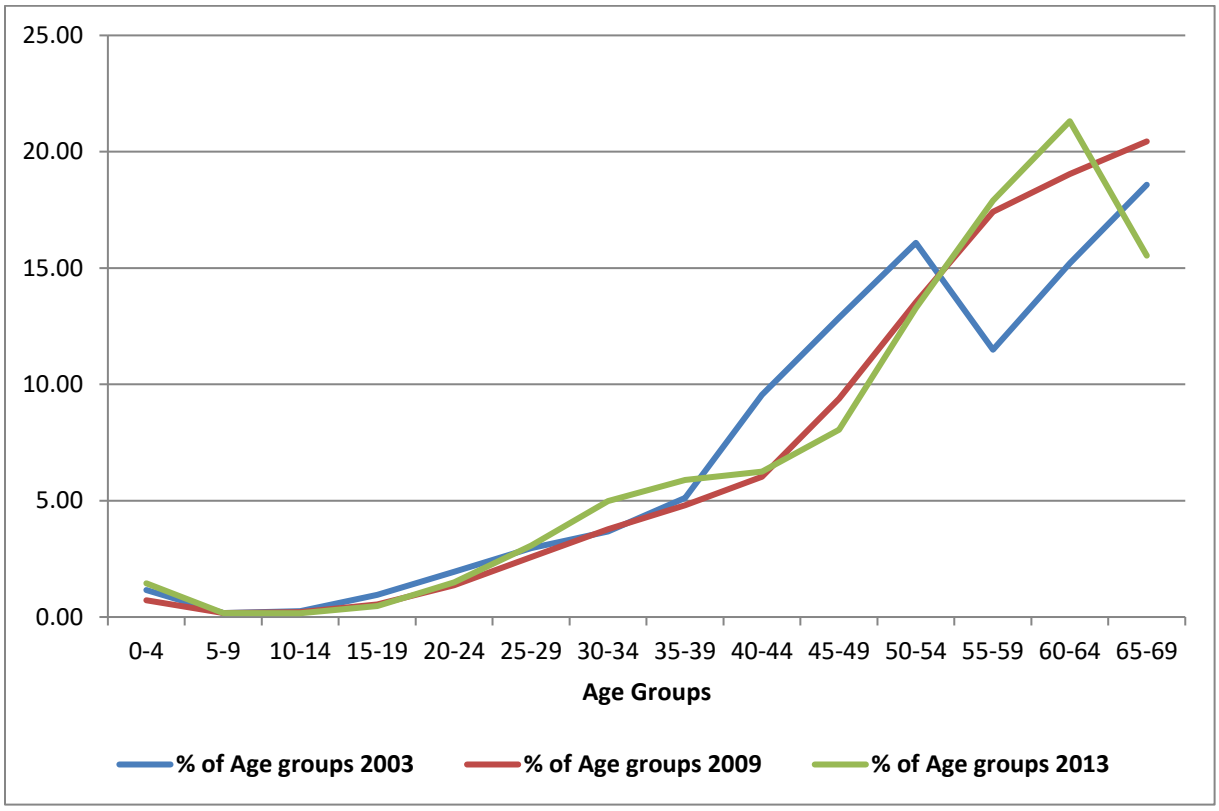
PYLL 2003 / 100,000	17,907
PYLL 2013 / 100,000	9,725
Target 2020 (-10%)	= 8,753
Target 2030 (-33%)	= 6,483
GAP 2020	= 0.31
	(2.2 years in advance)
GAP 2030	= 0.55
	(9.3 years in advance)

Discussion

With reference to the baseline of 2009 - corresponding to the most relevant recent period 2009-2020 respectively 2009-2030 - the Northern Dimension and all its member states including the RUF and the NOW are on track or are likely to achieve the targets in time (Sweden and Germany with slight delays regarding the SDG targets [The borderline for "not likely" is a gap status <-0.25. The status "likely" is indicated by a gap status <0 and >= -0.25]). This can be considered a success to which the NDPHS contributed. However for all countries the positive gap (indicating achievement before the targeted time) is smaller for the SDG targets of 2030 than for 2020. This may indicate a slowing down of the dynamics in reducing mortality. The analysis is confirmed if the period 2003-2020 respectively 2003-2030 is considered.

The Russian Federation keeps throughout the years a middle position among the NDPHS member states included in **table 3** whereas the NWO would even take a top position for its more than 12 million inhabitants in front of the neighbouring Estonia. This relative good positioning is unlikely to be due to data inconsistencies as **figure 3** shows an impressive homogeneity of mortality development throughout age groups in 2003, 2009 and 2013. Nevertheless the NWO shows accelerated progress.

Figure 3. Percentage of deaths by age-groups in the Russian Federation 2003, 2009 and 2013



Limitations

The straight projection of past progress into the future may be modified by the realities of historical development with its unpredictable interference in positive as well as negative direction. However, advanced achievement of targets may encourage to continue along the path of success whereas delays should stimulate to add up efforts. For the target year 2020 most ND member states have already achieved the target one or two years ago, so did the Russian Federation. Also in this paper we applied the targeted SDG-3 reduction by one third for non-communicable diseases to the PYLL rates which include to a minor degree communicable diseases too.

The Russian Government's activities during the last decade were marked by big investments in healthcare (around 10bln US dollars per year) with main focus to reconstruction of old health facilities including purchasing of modern medical equipment for diagnostics and treatment. A model of avoidable mortality was used to analyze causes of death related to insufficient diagnostics and treatment (healthcare factor), and causes associated with behavioural risks (lifestyle factor) (13). A comparison of regions of North-Western Russia and neighbouring European countries confirmed that the higher the mortality levels the stronger the contribution of avoidable causes i.e. up to 50% in average in

North-Western Russia, varying between 45% in St. Petersburg and 67% in Pskov and Novgorod. Healthcare does substantially contribute to mortality reduction, however its role is not the leading one.

For this moment our analysis could include only one Federal Okrug but it would be a fascinating task to analyse target achievement for all Okrugs of the huge territory of the Russian Federation. As the Russian Federation borders the Near and Far East this may induce dynamic exchange and a more global than national perspective (14), especially if combined with a more precise sub-grouping according to gender and to specific disease groups.

The very good ranking of the Russian Federation and its NWO are encouraging although it will be difficult to keep the pace of improvement as it started from very high levels of premature mortality in 2009 and even worse in 2003. A national strategy may be considered in this regard. Also for the European Union (15) a technical cooperation in this area may be of mutual interest.

Conflicts of interest: None declared.

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ANNEX 1: Population and mortality data of the Russian Federation for 2003, 2009, and 2013

Annex 1a: Population and mortality in the Russian Federation 2003						
Age-group	Total population	Males	Females	Total mortality	Males	Females
00-04	6,565,695	3,364,592	3,201,103	22,090	12,754	9,336
05-09	6,818,772	3,486,662	3,332,110	2,868	1,791	1,077
10-14	9,760,069	4,985,362	4,774,707	4,246	2,778	1,468
15-19	12,669,554	6,432,752	6,236,802	15,399	11,128	4,271
20-24	11,713,409	5,913,034	5,800,375	29,030	23,001	6,029
25-29	10,717,142	5,360,243	5,356,899	39,519	31,466	8,053
30-34	9,963,892	4,973,305	4,990,587	47,270	37,095	10,175
35-39	9,888,714	4,863,197	5,025,517	63,268	49,281	13,987
40-44	12,324,267	5,972,742	6,351,525	110,977	85,938	25,039
45-49	11,777,383	5,564,681	6,212,702	146,751	111,219	35,532
50-54	10,316,215	4,737,479	5,578,736	179,688	131,720	47,968
55-59	5,976,065	2,638,995	3,337,070	132,107	91,857	40,250
60-64	7,045,054	2,854,945	4,190,109	213,572	141,469	72,103
65-69	6,718,590	2,573,559	4,145,031	258,403	155,124	103,279
00-69	**132,254,821**	**63,721,548**	**68,533,273**	**1,265,188**	**886,621**	**378,567**

Annex 1b: Population and mortality in the Russian Federation 2009						
Age-group	Total population	Males	Females	Total mortality	Males	Females
00-04	7,793,807	3,994,295	3,799,512	17,525	10,064	7,461
05-09	6,887,915	3,530,220	3,357,695	2,109	1,273	836
10-14	6,784,360	3,470,481	3,313,879	2,311	1,416	895
15-19	9,274,152	4,699,081	4,575,071	8,706	6,073	2,633
20-24	12,354,120	6,242,785	6,111,335	21,702	16,795	4,907
25-29	11,788,055	5,916,062	5,871,993	35,724	27,844	7,880
30-34	10,751,459	5,306,042	5,445,417	46,591	36,183	10,408
35-39	9,997,601	4,903,848	5,093,753	49,765	37,620	12,145
40-44	9,307,938	4,493,889	4,814,049	59,185	44,056	15,129
45-49	11,415,509	5,393,625	6,021,884	99,028	73,183	25,845
50-54	11,292,748	5,136,151	6,156,597	136,765	98,957	37,808
55-59	9,821,361	4,274,188	5,547,173	164,853	113,724	51,129
60-64	6,497,033	2,694,911	3,802,122	149,520	100,238	49,282
65-69	5,059,895	1,869,565	3,190,330	159,249	94,717	64,532
00-69	**129,025,953**	**61,925,143**	**67,100,810**	**953,033**	**662,143**	**290,890**

Annex 1c: Population and mortality in the Russian Federation 2013						
Age-group	Total population	Males	Females	Total mortality	Males	Females
00-04	8,793,034	4,513,291	4,279,743	18,549	10,567	7,982
05-09	7,551,502	3,865,465	3,686,037	1,878	1,120	758
10-14	6,755,920	3,462,420	3,293,500	1,930	1,234	696
15-19	7,053,780	3,608,295	3,445,485	5,479	3,930	1,549
20-24	10,409,826	5,300,627	5,109,199	15,314	12,034	3,280
25-29	12,539,043	6,323,822	6,215,221	29,730	22,980	6,750
30-34	11,503,329	5,734,090	5,769,239	44,424	33,885	10,539
35-39	10,536,321	5,145,842	5,390,479	51,039	38,699	12,340
40-44	9,656,787	4,689,062	4,967,725	53,882	39,702	14,180
45-49	9,365,912	4,444,475	4,921,437	68,120	49,808	18,312
50-54	11,310,281	5,204,736	6,105,545	111,658	80,673	30,985
55-59	10,508,048	4,587,151	5,920,897	146,852	101,408	45,444
60-64	8,819,230	3,635,352	5,183,878	177,781	118,451	59,330
65-69	4,861,125	1,877,877	2,983,248	126,245	76,787	49,458
00-69	**129,664,138**	**62,392,505**	**67,271,633**	**852,881**	**591,278**	**261,603**

ANNEX 2: Complete Gap Analysis based on the demographic data of the Russian Federation for 2003, 2009, and 2013

Annex 2a: Standardized death rates 2003, direct standardization

	Study Population (Russian Federation)		Standard Population			
	Deaths	Population	(OECD 1980)	Crude Rate	Expected deaths (Standard Pop.)	PYLL
Age Groups	d_i	p_i	*STD* P_i	$r_i = d_i/p_i$	$D_i = r_i * STD\ P_i$	D_i * *(Remaining Years to Upper Age Limit)*
0-4	22,090	6,565,695	80,269,483	0.00336	270,063	18,229,269
5-9	2,868	6,818,772	84,285,393	0.00042	35,451	2,215,671
10-14	4,246	9,760,069	85,828,597	0.00044	37,339	2,146,975
15-19	15,399	12,669,554	87,597,591	0.00122	106,469	5,589,625
20-24	29,030	11,713,409	82,619,776	0.00248	204,761	9,726,159
25-29	39,519	10,717,142	77,252,661	0.00369	284,866	12,106,799
30-34	47,270	9,963,892	73,604,119	0.00474	349,188	13,094,532
35-39	63,268	9,888,714	61,676,142	0.00640	394,604	12,824,630
40-44	110,977	12,324,267	57,394,499	0.00900	516,823	14,212,643
45-49	146,751	11,777,383	54,245,506	0.01246	675,921	15,208,226
50-54	179,688	10,316,215	52,537,987	0.01742	915,108	16,014,381
55-59	132,107	5,976,065	48,323,994	0.02211	1,068,251	13,353,138
60-64	213,572	7,045,054	36,727,063	0.03032	1,113,387	8,350,403
65-69	258,403	6,718,590	36,887,734	0.03846	1,418,735	3,546,838
Sum	**1,265,188**	**132,254,821**	**919,250,545**	**0.01089**	**7,390,966**	**146,619,290**
Standardized rate (per 100,000)					***804***	***15,950***

Annex 2b: Standardized death rates 2003, direct standardization						
	Study Population (Russian Federation)		Standard Population			
	Deaths	Population	(OECD 1980)	Crude Rate	Expected deaths (Standard Pop.)	PYLL
Age Groups	d_i	p_i	*STD* P_i	$r_i = d_i/p_i$	$D_i = r_i$ * *STD* P_i	D_i * *(Remaining Years to Upper Age Limit)*
0-4	17,525	7,793,807	80,269,483	0.00225	180,492	12,183,235
5-9	2,109	6,887,915	84,285,393	0.00031	25,807	1,612,951
10-14	2,311	6,784,360	85,828,597	0.00034	29,236	1,681,090
15-19	8,706	9,274,152	87,597,591	0.00094	82,231	4,317,138
20-24	21,702	12,354,120	82,619,776	0.00176	145,135	6,893,909
25-29	35,724	11,788,055	77,252,661	0.00303	234,116	9,949,936
30-34	46,591	10,751,459	73,604,119	0.00433	318,960	11,961,014
35-39	49,765	9,997,601	61,676,142	0.00498	307,005	9,977,662
40-44	59,185	9,307,938	57,394,499	0.00636	364,946	10,036,011
45-49	99,028	11,415,509	54,245,506	0.00867	470,572	10,587,880
50-54	136,765	11,292,748	52,537,987	0.01211	636,281	11,134,913
55-59	164,853	9,821,361	48,323,994	0.01679	811,125	10,139,068
60-64	149,520	6,497,033	36,727,063	0.02301	845,221	6,339,159
65-69	159,249	5,059,895	36,887,734	0.03147	1,160,960	2,902,400
Sum	**953,033**	**129,025,953**	**919,250,545**	**0.00831**	**5,612,089**	**109,716,365**
Standardized rate (per 100,000)					***611***	***11,935***

Annex 2c: Standardized death rates 2013, direct standardization						
	Study Population (Russian Federation)		Standard Population			
	Deaths	Population	(OECD 1980)	Crude Rate	Expected deaths (Study Pop.)	PYLL
Age Groups	d_i	p_i	$STD\ P_i$	$r_i = d_i/p_i$	$D_i = r_i * STD\ P_i$	D_i * (Remaining Years to Upper Age Limit)
0-4	18,549	8,793,034	80,269,483	0.00211	169,329	11,429,730
5-9	1,878	7,551,502	84,285,393	0.00025	20,961	1,310,070
10-14	1,930	6,755,920	85,828,597	0.00029	24,519	1,409,849
15-19	5,479	7,053,780	87,597,591	0.00078	68,041	3,572,160
20-24	15,314	10,409,826	82,619,776	0.00147	121,543	5,773,282
25-29	29,730	12,539,043	77,252,661	0.00237	183,166	7,784,539
30-34	44,424	11,503,329	73,604,119	0.00386	284,247	10,659,271
35-39	51,039	10,536,321	61,676,142	0.00484	298,765	9,709,877
40-44	53,882	9,656,787	57,394,499	0.00558	320,244	8,806,717
45-49	68,120	9,365,912	54,245,506	0.00727	394,538	8,877,095
50-54	111,658	11,310,281	52,537,987	0.00987	518,669	9,076,699
55-59	146,852	10,508,048	48,323,994	0.01398	675,337	8,441,714
60-64	177,781	8,819,230	36,727,063	0.02016	740,356	5,552,674
65-69	126,245	4,861,125	36,887,734	0.02597	957,986	2,394,966
Sum	**852,881**	**129,664,138**	**919,250,545**	**0.00706**	**4,777,702**	**94,798,643**
Standardized rate (per 100,000)					***520***	***10,313***

ANNEX 3. Demographic and mortality data and the resulting PYLL rates of the North West Federal Okrug (NWO) of the Russian Federation for 2003, 2009 and 2013

	Study Population (NWO District)		Standard Population			
Annex 3a	Deaths	Population	(OECD 1980)	Crude Rate	Expected deaths (Standard Pop.)	PYLL
Age Groups	d_i	p_i	*STD* P_i	$r_i = d_i/p_i$	$D_i = r_i$ * *STD* P_i	D_i* *(Remaining Years to Upper Age Limit)*
0-4	1,666	564,500	80,269,483	0.00295	236,963	15,994,997
5-9	244	564,321	84,285,393	0.00043	36,474	2,279,635
10-14	357	852,259	85,828,597	0.00042	35,934	2,066,224
15-19	1,362	1,193,690	87,597,591	0.00114	99,980	5,248,957
20-24	2,787	1,135,751	82,619,776	0.00245	202,744	9,630,348
25-29	4,238	1,027,373	77,252,661	0.00412	318,637	13,542,067
30-34	5,264	954,497	73,604,119	0.00552	405,932	15,222,446
35-39	7,347	952,804	61,676,142	0.00771	475,550	15,455,366
40-44	13,686	1,201,468	57,394,499	0.01139	653,771	17,978,711
45-49	18,436	1,191,875	54,245,506	0.01547	839,077	18,879,238
50-54	23,048	1,064,075	52,537,987	0.02166	1,137,964	19,914,378
55-59	16,456	643,591	48,323,994	0.02557	1,235,568	15,444,599
60-64	21,782	649,414	36,727,063	0.03354	1,231,866	9,238,993
65-69	26,624	661,425	36,887,734	0.04025	1,484,828	3,712,069
Sum	143,296	12,657,040	919,250,545	0.01233	8,395,289	164,608,028.34
Standardized rate (per 100,000)					***913.28***	***17,906.76***

2009	Study Population (NWO District)		Standard Population			
Annex 3b	Deaths	Population	(OECD 1980)	Crude Rate	Expected deaths (Standard Pop.)	PYLL
Age Groups	d_i	p_i	*STD* P_i	$r_i = d_i/p_i$	$D_i = r_i$ * *STD* P_i	D_i* *(Remaining Years to Upper Age Limit)*
0-4	1,178	662,703	80,269,483	0.00178	142,635	9,627,834
5-9	281	590,035	84,285,393	0.00048	40,208	2,512,981
10-14	335	561,830	85,828,597	0.00060	51,113	2,939,012
15-19	880	801,242	87,597,591	0.00110	96,218	5,051,446
20-24	2,238	1,157,868	82,619,776	0.00193	159,681	7,584,853
25-29	4,207	1,141,931	77,252,661	0.00368	284,604	12,095,659
30-34	6,185	1,046,782	73,604,119	0.00591	434,914	16,309,283
35-39	7,872	969,565	61,676,142	0.00812	500,741	16,274,079
40-44	9,872	899,724	57,394,499	0.01097	629,747	17,318,045
45-49	15,352	1,111,823	54,245,506	0.01381	749,025	16,853,065
50-54	22,146	1,129,981	52,537,987	0.01960	1,029,649	18,018,859
55-59	28,516	999,024	48,323,994	0.02854	1,379,365	17,242,066
60-64	31,156	689,278	36,727,063	0.04520	1,660,095	12,450,710
65-69	33,458	463,209	36,887,734	0.07223	2,664,435	6,661,087
Sum	163,675	12,224,992	919,250,545	0.01528	9,822,430	160,938,978.09
Standardized rate (per 100,000)					***1,068.53***	***17,507.63***

2013	Study Population (NWO District)		Standard Population			
Annex 3c	Deaths	Population	(OECD 1980)	Crude Rate	Expected deaths (Standard Pop.)	PYLL
Age Groups	d_i	p_i	*STD* P_i	$r_i = d_i/p_i$	$D_i = r_i$ * *STD* P_i	D_i* *(Remaining Years to Upper Age Limit)*
0-4	1,220	757,156	80,269,483	0.00161	129,362	8,731,919
5-9	145	642,852	84,285,393	0.00023	19,036	1,189,746
10-14	137	573,546	85,828,597	0.00024	20,528	1,180,353
15-19	394	603,558	87,597,591	0.00065	57,119	2,998,759
20-24	1,252	985,677	82,619,776	0.00127	104,938	4,984,555
25-29	2,587	1,228,690	77,252,661	0.00211	162,652	6,912,712
30-34	4,193	1,138,908	73,604,119	0.00368	271,009	10,162,831
35-39	4,956	1,036,737	61,676,142	0.00478	294,807	9,581,213
40-44	5,259	943,130	57,394,499	0.00558	320,026	8,800,723
45-49	6,779	913,922	54,245,506	0.00742	402,358	9,053,049
50-54	11,182	1,104,138	52,537,987	0.01013	532,087	9,311,518
55-59	15,070	1,053,570	48,323,994	0.01430	691,223	8,640,291
60-64	17,942	893,981	36,727,063	0.02007	737,124	5,528,433
65-69	13,078	519,162	36,887,734	0.02519	929,222	2,323,054
Sum	84,195	12,395,023	919,250,545	0.00695	4,671,490	89,399,155.82
Standardized rate (per 100,000)					***508.18***	***9,725.22***