

The Burden of Diseases and Injury through The Lens of Standard Expected Years of Life Lost: The Lost Productivity and The Distribution of Health Attainment in Countries of Different Health Systems

Eduardo Daniel López-Vila⁽¹⁾ , Pavitra Paul⁽²⁾ 

(1) University of Zaragoza, Gran Vía 2, 50005, Zaragoza, Spain.

(2) Independent researcher and Development practitioner.

CORRESPONDING AUTHOR: Dr. Pavitra PAUL, 62d Boulevard Jacques Faucheux, 35300 Fougères, France.
e-mail: pavitra.paul@mail.fr

SUMMARY

Background: The productivity loss attributable to the burden of diseases in different country contexts reflect the effectiveness of the context specific measures for population health development. So, this study provides insights into the productivity loss from the burden of diseases.

Methods: Using country specific subnational level data, we have quantified the burden of diseases and the consequential lost productivity in two lower middle-income countries i.e., India and Kyrgyzstan; three upper middle-income countries i.e., Belarus, Kazakhstan and the Russian Federation; and one high income country, France. We have computed standard expected years of life lost (SEYLL) as the measure of disease burden, and quantified the present value of lost earnings (PVLE) using our 3P approach (population, participation and productivity).

Results: Our subnational level analysis finds an overall declining trend of SEYLL across regions in each country except in Belarus from 2017 onwards, and in France. We also find that the cumulative percentage loss of PVLE per SEYLL mostly exceeds cumulative GDP per capita growth of the country during the study years.

Conclusion: We have captured the value of earnings and quantified the avoidable loss for the society/ country in different contexts and thus, this study demonstrates the potential contribution of population health development to the poverty alleviation programme in low – and middle -income countries.

Keywords: 3P approach; lost earnings; lost life; person years lived; poverty alleviation.

INTRODUCTION

Macroeconomic research on productivity has established the importance of human capital. Like physical capital, human capital in the form of education and health is durable, and accumulates overtime [1, 2]. The linkage between population health and economic productivity is a major policy concern. A 10-percentage-point increase in adult survival rates raises productivity by 6.7 to 13.4 percent, depending

on the microeconomic estimates used for calibration [3]. Evidence suggests that older workers in high income countries (HICs) are no less productive than their younger counterparts [4].

Whilst the burden of disease may be a function of poverty, a high disease burden is also likely to adversely affect a nation's productivity, growth and, ultimately, economic development. Between 21 and 47.5 percent of Gross Domestic Product (GDP) growth per working-age population over the time horizon of

25 to 30 years can be explained by improvements in the health of populations at the country level [5–8]. Bloom et al. [9] also found that each extra year of life expectancy is estimated to increase a country's GDP by 4 percent.

Health is difficult to quantify. Life expectancy at birth is considered to be a positive and an important determinant of economic growth rates. It has been widely acknowledged that a 10% increase in life expectancy is associated with a rise in annual economic growth of 0.3%–0.4% [10]. Summary Measures of Population Health (SMPH) combine mortality and morbidity information of a definite population [11, 12]. Disability Adjusted Life Year (DALY) is one such SMPH. A DALY is the sum of standard expected years of life lost (SEYLL) and years of life lived with disability. Studies have concluded that the SEYLL [12] is a more comprehensive measure of the impact of premature death on health state of the population. The measure of SEYLL puts a relatively higher weight affecting younger population [13, 14].

For realising the health policy goals, it is a necessity to have insights of productivity loss attributable to the burden of diseases in the context of the respective health system. An array of studies have estimated lost productivity caused by cancer [15–17]. Studies have also estimated economic burden of chronic diseases [18, 19]. Rumisha et al. [20] have assessed productivity lost from cancer, chronic disease, infectious disease and injury in a lower-middle income economy and one study of a HIC has also reported productivity lost from hepatitis C [21]. In addition, the COVID – 19 outbreak has triggered to compute economic value per human life lost from such a pandemic [22].

There are three broad approaches that are used for estimating the economic burden of a disease - (1) the “cost-of-illness” [23] that includes the direct costs of the illness for a particular population in a specific period, and the indirect costs of the illness as well. These indirect costs emerge from the human capital approach, which focuses on the years of labour lost due to the disease in a country; (2) the “economic growth model” [18, 24] where the impact of chronic diseases on the GDP of a country is assessed through changes in the model's inputs (e.g., savings rate, labour supply, skills); and (3) the full-income approach [25], which estimates the societal value of welfare losses or gains associated with poor health, early death, or increases in life expectancy valued in monetary terms.

Following the human capital model [26], the average earnings of a worker are considered to be a reasonable measure of labour productivity. Therefore, wages are used for estimating labour productivity losses associated with leaving the labour market prematurely as a result of an illness [21].

GDP per capita minus current health expenditure per person is also used as a measure of value per human life lost [22]. The willingness to pay for an additional year of life is also used to have average value of life lost from illness [27].

Although GDP per capita is widely used [28] as a measure of productivity, it does not capture differences in the earning patterns. Years of life lost (YLL), a measure of premature mortality [29] that considers both the frequency of deaths and the age at which death occurs is the dominant approach to estimate cost of mortality, so, YLL is used to estimate the number of discounted years of productive life lost. YLL for the population is calculated by multiplying the number of deaths by the expected life years remaining for an individual. SEYLL addresses the issue of arbitrary age threshold selection [30] that is practised for computing YLL. The SEYLL compares the age of death to the standard life expectancy of an individual at each age and incorporates time discounting and age weighting. The present value of future lost productivity are calculated using age and gender-specific mortality, wages, and employment rates [31] and so, a discount rate is applied for estimating the present value of the productivity forgone.

In “human capital approach” [32–34] economic value is imputed in YLL due to premature death by assigning average age-specific and gender-specific earnings to those lost years. The value of earnings over a person's lifetime is the most important component of wealth globally and is the central driver of sustainable growth and poverty reduction [35]. So, this study takes an approach that includes, population, participation and productivity, thus, the 3P approach, and estimates the present value of lifetime earnings forgone.

Although the use of YLL for computing lost productivity cost is well documented, we have used disease specific SEYLL for determining allocation decision at the sub national level in six different country contexts. We address policy relevant empirical questions that are (1) burden (SEYLL) and trend of non-communicable diseases, infectious diseases and injury with illustrations from countries with different levels of development and public policy space, (2) mortality pattern that prevails across all age groups, and (3) productivity lost per SEYLL.

The use of subnational data has unfolded in-country differences in population health development (health attainment) and so, we have also considered the productivity dimension of health disaggregated into subnational level for different economies.

METHODS

Data used in this study comes from Belarus, France, India, Kazakhstan, Kyrgyzstan, and Russia. The choice of six countries was guided by the motivation to include countries with (1) different levels of development, (2) population exposed to different health systems and (3) differential participation of genders in the labour force. Thus, following the World Bank classification of countries, 2022, this study has included two lower middle income countries (LMICs), three upper middle

income countries (UMICs) and one high income country (HIC).

The sources of subnational level data from the statistical office / public domain of the respective country were

1. Belarus: <https://belstat.gov.by/> and <http://data-portal.belstat.gov.by/>
2. France: <http://www.ecosante.fr/> and <https://www.scoresante.org/>
3. India: <https://data.gov.in/resources/> and <https://censusindia.gov.in/>
4. Kazakhstan: <https://stat.gov.kz/> and <https://tal-dau.stat.gov.kz/>
5. Kyrgyzstan: <http://www.stat.kg/>
6. The Russian Federation: <https://rosstat.gov.ru/> ; <https://minzdrav.gov.ru/> ; <https://mednet.ru/> and http://demogr.nes.ru/index.php/ru/demogr_indicat/data

This study has also used the data from Global Health Observatory of WHO, <https://platform.who.int/mortality/themes/theme-details/MDB/all-causes>; <https://www.who.int/data/gho/data/themes/mortality-and-global-health-estimates/ghe-leading-causes-of-death> and <https://www.healthdata.org/research-analysis/gbd>

Information about labour force participation rate and average per capita income comes from

International Labour Organization <https://ilostat.ilo.org/data/>. The average per capita income is an extrapolated information derived from monthly gross minimum wage in PPP (purchasing power parity constant at 2017 USD) of the country multiplied by 12.

The regions in France had been reorganised in 2014 and so, our data of 2017 and of 2011–2014 (in consideration of the merged regions) is from 6 regions in France; in Kazakhstan, the number of regions between 2013–2017 was 16, in 2018 South Kazakhstan oblast had been split into Turkestan oblast and the city of republican significance Shymkent, thus, number of regions in 2018 and 2019 was 17. Similarly, the number of states in India was 28 until 2013, Telengana has been carved out as a separate state from Andhra Pradesh in 2014; however, the data was available from 19 states and the capital city, Delhi till 2013, and from 2014 onwards the data was from 21 states of India and Delhi.

Acknowledging the differences of the disease burden in the study countries, we have studied the effect of a mix of noncommunicable diseases, infectious diseases and injuries. Countries were different and so the data for the diseases / disorders by the countries was often not the same, and also the data points were not similar (Table 1).

Our measure, SEYLL [36, 37] quantified and compared the impact of different diseases and injuries. ILO Convention No. 138 has established the minimum

Table 1. Disease / disorders and Injury in the study countries with the respective data points

Problems/ Disorders	Belarus (UMIC) 2013-2018	France (HIC) 2011-2014 and 2017	India (LMIC) 2013-2019	Kazakhstan (UMIC) 2013-2019	Kyrgyzstan (LMIC) 2013-2019	The Russian Federation (UMIC) 2013-2019
Cardiovascular diseases			√			
Circulatory diseases	√	√		√	√	√
Diabetes and Kidney diseases			√			
Digestive diseases	√	√	√	√	√	√
Endocrine system					√	
Genitourinary system					√	
Heart disease		√				
Infectious diseases	√			√	√	
Injuries	√		√	√	√	
Liver		√				
Mental and behavioural			√		√	
Musculoskeletal			√		√	
Neoplasms	√		√	√	√	√
Neurological diseases			√		√	

(continued)

Table 1. Disease / disorders and Injury in the study countries with the respective data points (continued)

Problems/ Disorders	Belarus (UMIC) 2013-2018	France (HIC) 2011-2014 and 2017	India (LMIC) 2013-2019	Kazakhstan (UMIC) 2013-2019	Kyrgyzstan (LMIC) 2013-2019	The Russian Federation (UMIC) 2013-2019
Other diseases	√	√	√	√	√	√
Other non-communicable diseases			√			
Skin and subcutaneous diseases			√			
Substance use			√			
Respiratory diseases	√	√	√	√	√	√

age for admission to employment at 15. ILO – 134th Session, 2022, judgment no. 4527 has further set the mandatory age of separation from any active employment at 65 years.

For our analysis, we used the number of deaths, the population, and the mortality for different age groups, gender, and year (the year of data availability) of these 6 countries to construct the life tables at the national and the subnational (regional) levels. From these life tables, we estimated the remaining life expectancy for a defined age range and thus, standard expected years of life lost (SEYLL) was computed. In the next step, SEYLL was used to estimate the productivity losses due to early death. Our approach has also enabled us to present the number of person-years lived after exact age x .

Estimation methods

A. Standard Expected Years of Life Lost (SEYLL)

$SEYLL = \sum_{x=1}^X d_x e_x$, where x is the age groups at

5-year interval when the person died at being in age X i.e., during the last period at the age interval of 5-years, d_x indicates the number of deaths of people at the age range x , e_x is the number of expected years of life that remain to be lived by a person at the age range x . In addition, dividing SEYLL by the total number of deaths, we estimated the number of years of life lost per death as

$$SEYLL_d = \frac{\sum_{x=1}^X d_x e_x}{\sum_{x=1}^X d_x}$$

B. With our 3P approach, we computed the present value of lost earnings (i.e., lost productivity) attributable to the SEYLL for population of different working age groups. Present value of lost earnings (PVLE)

$$PVLE = \sum_{i=1}^I \frac{SEYLL_i \times Annual\ wage \times l_i}{(1+r)^i}, \text{ where } i = 1,$$

2, 3, ..., I are the age groups at a definite intervals for working age population (15years-64years), l_i denotes labour force participation rate for age groups (15–24, 25–54, 55–64) distributed by gender, r represents the discount rate [38], and t is the average number of years left for attaining the retirement age. Here, we assumed that the mean age of death was at the middle for the age group.

C. We calculated PVLE per SEYLL distributed by gender for each of the six countries.

D. We also presented the mortality pattern that prevailed across all age groups in terms of person years lived above age x (T_x). Thus, total time lived

beyond age x i.e., $T_x = \sum_{i=x}^X L_{x_i} L_{x_{i+1}} \dots L_{x_X}$, where L_x is

the cumulative years lived through age x , L_x denotes number of people alive at the beginning of the respective age interval.

RESULTS

Disease specific SEYLL decreased in countries except in France (+6%), Kazakhstan (+23%) and the Russian Federation (+7%) for both the genders, although such a trend was not consistent over the years. SEYLL decreased by almost 7% in Belarus and 11% for female in Kyrgyzstan during the study period (Table 2). SEYLL from digestive diseases, infectious and injuries reduced in Belarus but SEYLL from neoplasms increased in males. The substantially high increase in SEYLL of Kazakhstan was from other diseases (+51% in males and +46% in females) followed by respiratory diseases (+32% in males and +17% in females). Although, declining trend in SEYLL of Kyrgyzstan was found across all diseases and disorders in the population, the top three were infectious diseases, mental and behavioural diseases, and musculoskeletal diseases for both the genders. In the Russian Federation, the substantial reduction (+32% in males and +82% in females) in SEYLL from respiratory diseases was offset

Table 2. Disease specific SEYLLs for each country

	2013			2014			2015			2016			2017			2018		
	Both	Male	Female	Both	Male	Female	Both	Male	Female	Both	Male	Female	Both	Male	Female	Both	Male	Female
Circulatory disease	1137637.0	539238.9	598398.1	1191089.8	621940.5	569149.3	1083358.2	536637.9	546720.3	1054237.2	520748.2	533489.0	1039984.9	511322.1	528662.7	1068488.7	505062.4	563426.2
Digestive disease	71332.5	40430.0	30902.4	69465.1	42546.5	26918.6	59173.9	34265.0	24909.0	56496.6	33141.7	23354.9	53689.0	29599.6	24089.3	54910.7	29237.3	25673.4
Infectious disease	16310.6	11969.4	4341.2	16377.2	12583.1	3794.1	12983.9	9625.9	3358.0	12507.6	8926.5	3581.1	11667.3	8112.1	3555.2	11801.8	8012.8	3788.9
Injuries	176286.5	136418.1	39868.4	178726.6	144448.7	34277.8	146054.0	116068.6	29985.4	134974.7	105967.8	29006.8	126577.0	99760.0	26817.0	127119.1	98538.7	28580.4
Neoplasms	295973.4	165842.9	130130.5	310608.4	193334.4	117274.0	290989.2	176880.9	114108.3	288330.1	174404.7	113925.4	294997.1	177002.3	117994.8	300589.3	174835.4	125753.8
Other diseases	417519.4	124814.4	292704.9	350574.5	122404.5	228170.0	334985.2	109448.7	225536.5	334113.2	108006.3	226106.9	316815.7	103413.6	213402.0	375443.3	111082.6	264360.7
Respiratory disease	36014.5	28377.5	7637.0	34545.3	28707.0	5838.4	31197.1	25584.7	5612.4	29391.1	23754.8	5636.3	30188.0	24610.0	5577.9	30253.5	24308.8	5944.7
Total	2151074	1047091.4	1103982.6	2151386.9	1165964.7	985422.2	1958741.6	1008511.8	950229.8	1910050.6	974950.1	935100.5	1873918.9	953819.9	920099	1968606.2	951078	1017528.2

France	2017			2014			2013			2012			2011		
	Both	Male	Female	Both	Male	Female	Both	Male	Female	Both	Male	Female	Both	Male	Female
Circulatory disease	1438697.4	789176.4	649521.0												
Digestive disease	195361.9	97892.8	97469.0												
Heart disease	386467.7	246333.2	140134.5												
Liver disease	117270.6	84037.4	33233.2												
Other diseases	9025191.0	4916091.3	4109099.7												
Respiratory disease	246399.0	243990.2	2408.8												
Total	11409387.5	6377521.4	5031866.2	11279965.3	6350321.1	4929644.2	11095560.6	6258958.8	4836601.8	10918649	6157294.9	4761354.1	10744003.6	6061412.6	4682590.9

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India	2013			2014			2015			2016			2017			2018			2019		
	Both	Male	Female	Both	Male	Female	Both	Male	Female	Both	Male	Female	Both	Male	Female	Both	Male	Female	Both	Male	Female
Total	252276899	133860566.8	117385806.5	235821208	123459696.4	111679335	236178788.5	123953262.9	111478212.3	228059498.5	124353744.4	103369728.6	226035298.3	124915635.5	100654333.5	218971239.5	121773685.1	96731674.6	213837177.8	100473480.1	113223506

(continued)

Table 2. Disease specific SEYLLs for each country (continued)

Kazakhstan	2013			2014			2015			2016			2017			2018			2019		
	Both	Male	Female	Both	Male	Female	Both	Male	Female	Both	Male	Female	Both	Male	Female	Both	Male	Female	Both	Male	Female
Circulatory disease	749268.2	395164.4	354103.7	659233.7	350380.5	308853.2	684718.2	365823.0	318895.3	638383.4	356698.3	281685.2	639520.2	355462.5	284057.7	679341.7	384001.0	289940.6	675055.9	392208.8	282847.2
Digestive disease	245016.0	137114.7	107901.2	250009.2	139563.9	110445.2	259899.4	147871.4	112028.0	253151.7	145970.6	109181.1	235021.4	128451.6	106569.8	252819.1	142938.1	110460.9	265257.2	150017.4	115239.8
Infectious disease	32287.7	21770.8	10516.9	29633.4	19467.6	10165.8	30642.5	20060.2	10582.3	27751.4	18186.8	9564.6	28614.6	18677.6	9937.1	29252.0	18979.6	10272.4	30463.9	19176.8	11287.1
Injuries	295874.5	228782.2	67092.2	280083.8	219107.3	60976.5	288995.7	225682.5	63313.2	267789.4	208436.6	59352.8	254287.1	197220.0	57067.1	268293.7	207916.1	60377.7	270397.9	211436.9	58960.9
Neoplasms	311353.1	168197.9	143155.2	300397.0	161697.1	138699.9	330943.5	175803.1	155140.4	321848.6	172323.6	149524.9	313909.4	166334.1	147575.3	333961.9	179612.0	154349.9	335572.3	180950.7	154621.6
Other diseases	1707938.8	976039.0	731899.7	1841115.3	1044038.0	797077.3	2019395.7	1146239.1	873156.6	2108407.8	1216984.4	891423.4	2211622.3	1265730.4	945891.9	2472552.3	1432339.7	1040212.6	2537533.4	1471252.9	1066280.6
Respiratory disease	290337.4	161384.4	128952.9	306849.5	168884.9	137964.6	368152.3	202108.2	166044.0	364378.0	206892.6	157485.4	337352.7	194502.5	142850.2	350164.0	202030.4	148133.6	363689.4	212286.2	151403.1
Total	3632075.5	2088453.6	1543621.9	3667332	2103139.3	1564182.6	3982747.3	2283587.5	1699159.9	3981710.4	2332493	1658217.4	4020327.7	2326378.7	1693949	4380984.6	2567236.9	1813747.7	4477970	2637329.6	1840640.3

Kyrgyzstan	2013			2014			2015			2016			2017			2018			2019		
	Both	Male	Female	Both	Male	Female	Both	Male	Female	Both	Male	Female	Both	Male	Female	Both	Male	Female	Both	Male	Female
Circulatory disease	628858.3	323177.7	305680.6	640585.0	324245.6	316339.4	654252.8	323234.8	312191.0	626232.0	307084.4	319147.5	610183.0	309219.9	300963.1	588507.9	301492.5	287015.4	605447.7	309974.6	295473.1
Digestive disease	87159.3	57520.7	29638.6	82862.2	54155.3	28707.0	81650.5	51824.3	29826.2	77655.1	49671.6	27983.6	74378.7	48804.5	25574.2	72831.3	47948.3	24883.1	71179.3	45744.0	25435.3
Diseases of genitourinary system	18341.0	10859.0	7482.0	18063.1	9799.2	8264.0	17380.6	10367.1	7013.5	16845.5	9699.0	7146.6	15347.2	9104.7	6242.5	14482.8	8371.5	6111.3	12272.0	7692.4	4579.5
Endocrinal disease	15391.1	6209.9	9181.1	16000.8	7214.0	8786.8	14285.5	6139.3	8146.1	16751.9	6641.0	10110.8	16043.9	7156.8	8887.1	17045.6	7349.4	9696.1	17021.4	7711.8	9309.5
Infectious disease	36012.2	24667.3	11345.0	32694.3	21781.1	10913.1	31909.3	21179.6	10729.7	28705.9	18652.6	10053.3	28363.0	18108.8	10254.1	25974.3	17465.6	8508.6	22798.3	14081.2	8717.0
Injuries	110423.5	85151.6	25271.9	107282.9	82264.7	25018.2	109565.9	83154.9	26411.0	98320.8	74225.2	24095.6	98394.6	75025.9	23366.7	87792.3	68324.6	19467.7	87419.1	69689.8	17729.3
Mental and behavioral disease	2128.9	1395.7	733.2	1806.0	1132.7	673.3	1552.8	883.1	669.7	1512.3	959.2	553.1	1672.3	1068.8	603.5	1632.4	848.8	783.6	667.1	423.9	243.2
Musculoskeletal disease	3963.2	1154.6	2808.6	3236.3	843.4	2392.9	2926.6	923.7	2002.9	2674.4	940.7	1733.7	2661.2	778.6	1882.6	2154.2	774.6	1379.6	2443.4	592.8	1850.6
Neoplasms	124219.6	64074.5	60145.1	133663.6	69574.6	64089.0	138106.9	70951.0	67155.9	143478.2	74376.4	69101.8	137232.9	71183.9	66049.0	145404.3	73772.2	71632.1	144966.6	74028.4	70938.3
Neurological disease	18321.0	11605.3	6715.7	19751.1	11631.2	8119.9	18260.3	11431.0	6829.3	19048.2	11435.9	7612.3	16803.1	10701.4	6101.7	16207.6	10060.2	6147.4	16126.8	10299.2	5827.6
Other diseases	585270.2	317302.3	267967.9	606535.8	326356.0	280179.8	599091.6	328305.3	270786.3	545767.0	307504.0	238263.0	538565.7	308257.0	230308.7	488966.5	281878.0	207088.5	496621.6	284543.5	212078.1
Respiratory disease	76564.2	44963.4	31602.9	78421.5	44881.9	33539.5	65325.4	37073.5	28251.8	71935.9	39481.2	32454.7	67161.8	38307.3	28854.5	60953.6	35971.2	24982.4	64535.3	37876.1	26659.2
Total	1706654.5	948081.9	758572.6	1740902.6	953879.7	787022.8	1715481.2	945467.7	770013.5	1648927.3	900671.3	748256.1	1606807.3	897717.7	709089.6	1521952.7	854256.9	667695.8	1541498.7	865657.8	678840.9

(continued)

Table 2. Disease specific SEYLLs for each country (continued)

	2013			2014			2015			2016			2017			2018			2019		
	Both	Male	Female	Both	Male	Female	Both	Male	Female	Both	Male	Female	Both	Male	Female	Both	Male	Female	Both	Male	Female
The Russian Federation																					
Circulatory disease	13729788.4	6888841.3	6840947.1	13578375.9	6782012.9	6796363.0	14004204.8	7127141.8	6877063.0	14655093.2	7625787.6	7029305.6	13504392.4	7021029.5	6483362.9	15109757.8	8014791.8	7094965.9	13551852.2	6966126.4	6585725.8
Digestive disease	705163.1	488443.3	216719.8	1418640.3	845872.7	572767.5	1574274.4	943649.0	630625.4	1621859.4	978761.1	643078.3	1481256.9	881798.1	599458.8	1660931.1	1007255.2	653676.0	803055.8	559891.3	243164.5
Neoplasms	3484718.8	2311745.8	1172973.1	4193417.0	2404842.2	1788574.8	4563379.4	2656955.4	1906424.0	4871459.0	2886631.1	1984827.9	4624511.3	2721301.8	1903209.4	5181641.0	3104278.4	2077362.6	3769639.4	2623243.2	1146396.2
Other diseases	7334796.1	4312437.0	3022359.1	6765618.2	4089717.9	2675900.2	7638889.3	4505216.3	3133673.0	7806870.3	4483804.2	3323066.1	7369678.2	4107421.9	3262256.3	8252922.2	4683160.5	3569761.7	9648877.3	5112147.3	4536730.0
Respiratory disease	1069333.8	428566.9	640766.9	1171241.4	830763.1	340478.3	1206927.7	862211.2	344716.5	1193356.7	862416.3	330940.4	1018564.2	735008.0	283556.2	1145773.9	838083.8	307690.1	409514.0	292037.2	117476.9
Total	26323800.3	14430034.3	11893765.9	27127292.8	14953208.9	12174083.9	28987675.6	16095173.7	12892501.8	30148618.6	16837400.4	13311218.2	27998402.9	15466559.3	12531843.6	31351026.1	17647569.7	13703456.4	28182938.8	15553445.3	12629493.5

by the increase in digestive diseases, neoplasms and other diseases in the population (Table 2).

The subnational level data revealed a declining trend in Year-on-Year SEYLL across all regions in Belarus till 2017 but this was not so in most of the regions in France, SEYLL of Centre region in France increased noticeably in 2017 compared to the earlier years. Most of India registered a declining trend in SEYLL consistently albeit with an wide variations across Indian states. In Kyrgyzstan, Jalal-Abad oblast and Issyk-Kul oblast registered an increased SEYLL in the population from 2018 onwards (Table 3).

SEYLL per single death for the agegroup 35 years to 64 years was the highest in France (in 2017) for both the genders followed by India for male and in The Russian Federation for female in 2019. The lowest SEYLL per single death for the agegroup 35 years to 64 years was registered in Kazakhstan in 2013 but in 2019, although Kazakhstan still had the same glory for the men, it was India for the women (Table 4).

When considered all the years, SEYLL per single death for the agegroup 15 years to 64 years was the highest in India for male, and in France for female. The lowest SEYLL per single death for the agegroup 15 years to 64 years was registered in Kazakhstan and remained so throughout this study period (Table 5). Keeping aside France, PVLE per SEYLL was the highest in Belarus for both the agegroups in 2018 and this was the lowest consistently for Kyrgyzstan (Table 4 and Table 5).

Overall total person-years of life lived after attaining age x for all agegroups (T_x) was positive across regions in Belarus except in Mogilev region ($\cong -2\%$). The pattern did register almost uniform across states in India except in Chhattisgarh and Tamil Nadu where T_x was strikingly positive, and negative in Kerala in 2019 compared to the earlier years (Appendix: Table 1).

In 2019, the T_x for female in India did have a quantum positive leaps in Chhattisgarh (+4.7%), Jammu & Kashmir (+9%) and in Tamil Nadu (+3.17%), but negative T_x for male was the highest in Kerala (-2.57%) compared to the earlier years. The year-on-year T_x was consistently positive with some minor fluctuations across all regions in France and in Kyrgyzstan. Pays de la Loire region of France had the highest T_x (+6.50) in 2017 compared to the earlier years. The year-on-year T_x was consistently positive across all regions in the Russian Federation over the years except in Siberian federal district where it registered "negative" in 2019 (Appendix: Table 1).

Graph 1 presents that the countries followed consistently the similar trend over the years where SEYLL of working age was led by India followed by Russia, France and Kazakhstan in that order. SEYLL of working age in Belarus always remained low throughout over the years when SEYLL started increasing after the age of 44 years in France and such an increase became consistently higher from the age of 50 years for the remaining years of the working age. Graph 1 also confirmed that the pattern of SEYLL for different age

groups remained consistent over the years in all the countries except in the Russian Federation.

In-country distribution of SEYLL was not static except for the agegroup 60 and 64 years in all the countries, and for all agegroups in Kazakhstan and also in France (Graph 2). SEYLL of agegroup 20–24 years increased consistently while that of agegroup 25–29 years decreased over the years in Belarus. SEYLL of 55 years and above, and that of agegroup 20–24 years together contributed maximum to the total SEYLL in India for all the years. SEYLL of agegroups 20–24 years and that of 50–59 years were having an upward trend in Kyrgyzstan. SEYLL of 55 years and below was increasing from 2017 onwards in the Russian Federation (Graph 2).

Graph 3 presents distribution of diseases and health disorders in the study countries. Belarus, Kyrgyzstan and The Russian Federation were having a relatively higher proportion of circulatory diseases, India and Kazakhstan were having relatively higher prevalence of respiratory diseases. Neoplasms were of concern in all the countries except in France. More than 30% of total diseases was not captured with an appropriate diagnosis in France, Kazakhstan, The Russian Federation and in Kyrgyzstan. Injuries were of significant proportion in Belarus, India, Kazakhstan and Kyrgyzstan (Graph 3).

The trend of the person years lived above age x registered an incremental upward trend in Kazakhstan and a consistent downward trend, in France. The position of the female in regard to the person years lived above age x was higher than the total in all the countries. T_x for all agegroups was highest in France for both the genders, T_x of male population for the agegroup 35–64 years was highest in India amongst the study countries.

DISCUSSION

This investigation of intertwined relationship between the population health and the development unfolded three important insights.

First, the burden measured as SEYLL with the consequential trend of such burden was not aligned with the level of economic development of the country. We found that the disease specific SEYLL increased in France, Kazakhstan and the Russian Federation, on the contrary SEYLL decreased in Belarus and Kyrgyzstan during the study period. Furthermore, reduction of subnational level SEYLL was not uniform across all the regions in France. Moreover, more than 30% of total diseases were captured as “other diseases” without any appropriate diagnosis in the country statistics of France, Kazakhstan, The Russian Federation and in Kyrgyzstan indicating the absence of targeted allocation of health resources and so, the intervention for the population health development with sufficiency apparently remained unmeasured. This revelation

also unfolded more of an apparent governance deficit where the health system was decentralised rather than the reasons attributable to the constrained resources. Our findings from the Russian Federation supported the importance of primary healthcare approach where the gain in SEYLL was offset by increasing digestive diseases, neoplasms and other diseases.

Our measure of the total time lived beyond age x for each age group had assessed the mortality pattern that prevailed across all age groups. Thus, we captured effectiveness of the measures for population health development at the subnational level for each country. Our finding of a negative T_x in 2019 compared to the earlier years in one of the states in India, Kerala suggested that an overall better health indices could not ensure more person years of life beyond age x . Here, the evidence from Pays de la Loire and Provence-Alpes Côte d’Azur regions of France, Jammu & Kashmir states of India, and Siberian federal district of the Russian Federation further supported that the positive influence of living environment and individual behaviour add years to life [39]. Olejnik and Zóltaszek [40] argued that after crossing the health economic threshold of around 20 thousand euros per capita, the trend changes by stabilising or reversing. So, a consistent downward trend in T_x of France was in alignment with the notion of mortality rising with prosperity. Here, this empirics from France and India further confirm that higher T_x is associated with higher income of the country, and also with labour force participation of the population. Moreover, our computation of T_x provided a practical approach of establishing the relationship between life expectancy and economic growth [41, 42].

Second, our measure of SEYLL captured the obvious gap between the appropriateness of healthcare service provision and other objectives of the national health systems like accessibility and affordability. Although the typology of the health systems was diverse, the accessibility and the affordability principles were at the core of every health system in the study countries. SEYLL per single death was highest for all the years in France compared to other countries in the study. India, a country with a mixed health system and a high out-of-pocket health expenditure demonstrated a widespread reduction of SEYLL albeit differences existed across Indian states in recent years.

Our third empirical finding was that the cumulative percentage loss of PVLE per SEYLL mostly exceeded cumulative GDP per capita growth of the corresponding years. Between 2013 and 2018, the cumulative PVLE per SEYLL for the population of agegroup 35–64 years increased by 55.6% in Belarus; between 2011 and 2017, 53.1% in France, 8.5% in India, 40.5% in Kazakhstan, 157.5% in Kyrgyzstan; and between 2013 and 2019, 77.9% in the Russian Federation while the cumulative GDP per capita growth during the same period was 0.9% in Belarus, 4% in France, 38.4% in India, 11% in Kazakhstan, 13.5% in Kyrgyzstan, and 3.5% in the Russian Federation (World Bank, 2022). The

Table 3. Region specific SEYLLs (male, female and total) for each country with year-on-year change in percentage

Belarus		SEYLL			Year-on-Year (%) change		
Region	Year	Male	Female	Both	Male	Female	Both
Brest Region	2013	151043.8	155351.6	306395.4	-	-	-
	2014	147449.8	152441.2	299891.1	-2.38	-1.87	-2.12
	2015	139440.4	150512.6	289953	-5.43	-1.27	-3.31
	2016	138462	144900	283362.1	-0.7	-3.73	-2.27
	2017	136058.2	144576	280634.2	-1.74	-0.22	-0.96
	2018	137979.6	146024.1	284003.6	1.41	1	1.20
Vitebsk region	2013	143021.3	157023.4	300044.7	-	-	-
	2014	139768.6	151295.3	291063.9	-2.27	-3.65	-2.99
	2015	133167.7	147083.8	280251.6	-4.72	-2.78	-3.71
	2016	128489.2	144664.6	273153.8	-3.51	-1.64	-2.53
	2017	125143.8	140847	265990.9	-2.6	-2.64	-2.62
	2018	126749	140216.7	266965.7	1.28	-0.45	0.37
Gomel region	2013	162430.8	172405.4	334836.2	-	-	-
	2014	157450.8	166921.4	324372.3	-3.07	-3.18	-3.13
	2015	153240.7	161858	315098.7	-2.67	-3.03	-2.86
	2016	145840.6	157952.9	303793.5	-4.83	-2.41	-3.59
	2017	144288	154380.3	298668.4	-1.06	-2.26	-1.69
	2018	145082.1	153611.2	298693.3	0.55	-0.5	0.01
Grodno region	2013	121538.4	131895.8	253434.2	-	-	-
	2014	115118.9	126734	241852.9	-5.28	-3.91	-4.57
	2015	113084.5	121744.9	234829.4	-1.77	-3.94	-2.9
	2016	107776.8	122708.4	230485.1	-4.69	0.79	-1.85
	2017	105248.4	118869.7	224118	-2.35	-3.13	-2.76
	2018	109169.9	118523.8	227693.7	3.73	-0.29	1.6
Minsk city	2013	170178.6	178937.1	349115.7	-	-	-
	2014	170313	180911.3	351224.3	0.08	1.10	0.6
	2015	161278.4	173673.8	334952.1	-5.3	-4	-4.63
	2016	161623	164997.2	326620.3	0.21	-5	-2.49
	2017	154693.4	173084.1	327777.5	-4.29	4.9	0.35
	2018	157624.3	176132.4	333756.7	1.89	1.76	1.82
Minsk region	2013	173691	178482.9	352173.9	-	-	-
	2014	170809	174578	345387	-1.66	-2.19	-1.93
	2015	160806.7	168431.3	329238	-5.86	-3.52	-4.68
	2016	161623	164997.2	326620.3	0.51	-2.04	-0.80
	2017	157398.8	164282.5	321681.3	-2.61	-0.43	-1.51
	2018	160899.2	166018.2	326917.4	2.22	1.06	1.63
Mogilev region	2013	125187.4	129886.4	255073.8	-	-	-
	2014	120021.2	125110.7	245131.9	-4.13	-3.68	-3.9
	2015	114865.8	119028.2	233894	-4.3	-4.86	-4.58
	2016	111485.4	118047.6	229533	-2.94	-0.82	-1.86
	2017	109022.1	117086.8	226108.9	-2.21	-0.81	-1.49
	2018	113574	117001.8	230575.8	4.18	-0.07	1.98

(continued)

Table 3. Region specific SEYLLs (male, female and total) for each country with year-on-year change in percentage (continued)

France		SEYLL			Year-on-Year (%) change		
	Region	Year	Male	Female	Both	Male	Female
Ile-de-France	2011	995675.4	799498.4	1795173.9	–	–	–
	2012	997502.9	791361.1	1788864	0.18	–1.02	–0.35
	2013	994030.7	794918.6	1788949.4	–0.35	0.45	0
	2014	988709.7	794789.7	1783499.4	–0.54	–0.02	–0.3
	2017	945564.5	797415.8	1742980.2	–1.45	0.11	–0.76
Centre	2011	267395.8	205064.2	472460	–	–	–
	2012	266322.9	201829.6	468152.4	–0.4	–1.58	–0.91
	2013	264348	203514.9	467863	–0.74	0.84	–0.06
	2014	267366.4	204675.8	472042.2	1.14	0.57	0.89
	2017	346933.8	255544	602477.8	9.92	8.28	9.21
Pays de la Loire	2011	345511.5	251504.9	597016.4	–	–	–
	2012	345710.1	255544.7	601254.8	0.06	1.61	0.71
	2013	346898.9	256974.3	603873.1	0.34	0.56	0.44
	2014	350124.4	260330.9	610455.3	0.93	1.31	1.09
	2017	362993.5	271947	634940.5	1.23	1.49	1.34
Bretagne	2011	342728	249952.4	592680.4	–	–	–
	2012	344834	251214.9	596048.9	0.61	0.51	0.57
	2013	346898.9	256974.3	603873.1	0.6	2.29	1.31
	2014	348366.8	254019	602385.7	0.42	–1.15	–0.25
	2017	355694.1	269415.3	625109.4	0.7	2.02	1.26
Provence-Alpes-Côte d’Azur	2011	484279.2	392738.2	877017.5	–	–	–
	2012	485503.3	392206.2	877709.5	0.25	–0.14	0.08
	2013	486129.3	392757.4	878886.7	0.13	0.14	0.13
	2014	487307.2	393327.2	880634.3	0.24	0.15	0.2
	2017	504782	413215.7	917997.7	1.2	1.69	1.41
Corse	2011	33853.1	25341.2	59194.3	–	–	–
	2012	33395.2	25069.9	58465	–1.35	–1.07	–1.23
	2013	34103	24830	58933	2.12	–0.96	0.8
	2014	33704.4	25091.7	58796.2	–1.17	1.05	–0.23
	2017	36973.1	25203.6	62176.8	3.23	0.15	1.92

India		SEYLL			Year-on-Year (%) change		
State	Year	Male	Female	Both	Male	Female	Both
Andrah Pradesh	2013	9647195.5	7662377	17388954.3	–	–	–
	2014	8586020.1	7551766.4	16177190	–11	–1.44	–6.97
	2015	9056171.2	7890587.2	16990941.4	5.48	4.49	5.03
	2016	9090856.3	7422166.3	16543158.6	0.38	–5.94	–2.64
	2017	9579235.1	7097271.9	16711472.2	5.37	–4.38	1.02
	2018	9160844.9	7337457.8	16558633.9	–4.37	3.38	–0.91
	2019	8657522.2	6907446.5	15638526.8	–5.49	–5.86	–5.56

(continued)

Table 3. Region specific SEYLLs (male, female and total) for each country with year-on-year change in percentage (continued)

India		SEYLL			Year-on-Year (%) change		
State	Year	Male	Female	Both	Male	Female	Both
Assam	2013	4113177.1	3740149.5	7852847.6	–	–	–
	2014	3900670.3	3510946.4	7424580.9	–5.17	–6.13	–5.45
	2015	3871331.3	3152664.1	7032145.8	–0.75	–10.2	–5.29
	2016	3781886.8	3329588.7	7114352.6	–2.31	5.61	1.17
	2017	3699998.8	3161777.3	6868838.2	–2.17	–5.04	–3.45
	2018	3350442.3	3025196.4	6366121.2	–9.45	–4.32	–7.32
	2019	3173160.6	2944864.6	6114838.3	–5.29	–2.66	–3.95
Bihar	2013	11668846.5	10746694.9	22415541.4	–	–	–
	2014	11383768.6	9800361.9	21184130.5	–2.44	–8.81	–5.49
	2015	11064435.4	10237011.4	21301446.7	–2.81	4.46	0.55
	2016	9205402.6	9139507.5	18344910.1	–16.8	–10.72	–13.88
	2017	9697548.2	8354508.7	18052057	5.35	–8.59	–1.6
	2018	9011614.8	8201736.8	17213351.6	–7.07	–1.83	–4.65
	2019	8359695.3	8081957.1	16441652.4	–7.23	–1.46	–4.48
Chhattisgarh	2013	2917877.4	3019471.4	5937348.8	–	–	–
	2014	2707280.1	2319953.7	5001131.9	–7.22	–23.17	–15.77
	2015	2712592.3	2596032.7	5308624.9	0.2	11.9	6.15
	2016	2934064.9	2707123.8	5641188.7	8.16	4.28	6.26
	2017	3064634.1	2593018.9	5657653.1	4.45	–4.21	0.29
	2018	2975684.8	2542776.9	5518461.7	–2.9	–1.94	–2.46
	2019	2996849.8	2382353	5379202.8	0.71%	–6.31	–2.52
Delhi	2013	1274937.7	977976.8	2252914.5	–	–	–
	2014	1269704.7	830434.4	2100139.1	–0.41	–15.09	–6.78
	2015	1017526.4	825925.7	1843452.1	–19.86	–0.54	–12.22
	2016	1185832.1	825861.3	2011693.4	16.54	–0.01	9.13
	2017	1073393.7	908131.2	1981524.9	–9.48	9.96	–1.5
	2018	1022090.3	768126.2	1790216.5	–4.78	–15.42	–9.65
	2019	911567.7	726028.1	1637595.8	–10.81	–5.48	–8.53
Gujarat	2013	6792808.5	5185393.3	11978201.8	–	–	–
	2014	6068714.4	5119077.1	11187791.5	–10.66	–1.28	–6.6
	2015	6192094.3	5146233.5	11338327.8	2.03	0.53	1.35
	2016	5917648.7	4728460.7	10646109.4	–4.43	–8.12	–6.11
	2017	5989225.9	4495293	10484518.9	1.21	–4.93	–1.52
	2018	5918697.5	4441468.6	10360166	–1.18	–1.2	–1.19
	2019	5389407.9	4440003.8	9829411.7	–8.94	–0.03	–5.12
Haryana	2013	2933474.1	2190240.8	5123714.9	–	–	–
	2014	2520524.3	1978907.3	4499431.7	–14.08	–9.65	–12.18
	2015	2736181.3	2070355.6	4806536.9	8.56	4.62	6.83
	2016	2693441.7	2147863.4	4841305.1	–1.56	3.74	0.72
	2017	2744666.5	1938650.2	4683316.7	1.9	–9.74	–3.26
	2018	2821468.3	1970448	4791916.3	2.8	1.64	2.32
	2019	2558316.8	1777529.2	4335846	–9.33	–9.79	–9.52

(continued)

Table 3. Region specific SEYLLs (male, female and total) for each country with year-on-year change in percentage (continued)

India		SEYLL			Year-on-Year (%) change		
State	Year	Male	Female	Both	Male	Female	Both
Himachal Pradesh	2013	665286.1	602475.3	1267761.3	–	–	–
	2014	748496.6	504490.6	1252987.2	12.51	–16.26	–1.17
	2015	779015.9	469428.7	1248444.6	4.08	–6.95	–0.36
	2016	658162.1	516893.5	1175055.6	–15.51	10.11	–5.88
	2017	614685.8	405511.7	1020197.6	–6.61	–21.55	–13.18
	2018	637489.6	437606.8	1075096.4	3.71	7.91	5.38
	2019	676534.7	438523.5	1115058.2	6.12	0.21	3.72
Jammu & Kashmir	2013	1174685.5	972277.3	2146962.7	–	–	–
	2014	1199276.5	966328.4	2165604.9	2.09	–0.61	0.87
	2015	1097888.8	863218.4	1961107.2	–8.45	–10.67	–9.44
	2016	1117865.2	923058.2	2040923.4	1.82	6.93	4.07
	2017	1214953.2	829052.2	2044005.4	8.69	–10.18	0.15
	2018	1153997.6	827517.8	1981515.4	–5.02	–0.19	–3.06
	2019	1130893.1	939259.6	2070152.7	–2	13.5	4.47
Jharkhand	2013	3346762.8	3292720.2	6639483	–	–	–
	2014	3322389.2	3225748.7	6548138	–0.73	–2.03	–1.38
	2015	3032832.2	2802318.6	5835150.8	–8.72	–13.13	–10.89
	2016	2842862.8	2892179.8	5735042.6	–6.26	3.21	–1.72
	2017	2739836.3	2649777.4	5389613.7	–3.62	–8.38	–6.02
	2018	2684190	2669799.5	5353989.5	–2.03	0.76	–0.66
	2019	2692781	2488808.6	5181589.6	0.32	–6.78	–3.22
Karnataka	2013	6001477.7	5154909.4	11156387.1	–	–	–
	2014	5480796.3	4777686.3	10258482.6	–8.68	–7.32	–8.05
	2015	5525719.4	4739172.3	10264891.8	0.82	–0.81	0.06
	2016	5848363.3	4608079.1	10456442.4	5.84	–2.77	1.87
	2017	6107255.7	4417226.8	10524482.5	4.43	–4.14	0.65
	2018	5691168	4424928.9	10116097	–6.81	0.17	–3.88
	2019	5493033	4327879.6	9820912.6	–3.48	–2.19	–2.92
Kerala	2013	2495065.1	1875337.5	4370402.6	–	–	–
	2014	2361179.4	2383963.7	4745143.1	–5.37	27.12	8.57
	2015	2435127.3	2222337.7	4657465	3.13	–6.78	–1.85
	2016	2426340.9	1958275.6	4384616.4	–0.36	–11.88	–5.86
	2017	2315136.4	1728622.6	4043759	–4.58	–11.73	–7.77
	2018	2319914.2	1842651.8	4162566	0.21	6.6	2.94
	2019	2541272.3	2119085.3	4660357.7	9.54	15	11.96
Madhya Pradesh	2013	10344856.1	9003313.4	19348169.5	–	–	–
	2014	9706767.5	8985873.1	18692640.6	–6.17	–0.19	–3.39
	2015	9583740.4	8324821.8	17908562.2	–1.27	–7.36	–4.19
	2016	9756233.8	7175373.7	16931607.5	1.8	–13.81	–5.46
	2017	9751972.4	7236050.4	16988022.7	–0.04	0.85	0.33
	2018	9500957.7	6908276	16409233.6	–2.57	–4.53	–3.41
	2019	9196668.1	6932284.5	16128952.7	–3.2	0.35	–1.71

(continued)

Table 3. Region specific SEYLLs (male, female and total) for each country with year-on-year change in percentage (continued)

India		SEYLL			Year-on-Year (%) change		
State	Year	Male	Female	Both	Male	Female	Both
Maharashtra	2013	9715847.8	7329654.8	17045502.6	–	–	–
	2014	9979797	7666835.5	17646632.5	2.72	4.6	3.53
	2015	10042200.9	7780388	17822588.9	0.63	1.48	1
	2016	9538337.3	7345259.2	16883596.5	–5.02	–5.59	–5.27
	2017	9043802.6	6735928.1	15779730.7	–5.18	–8.3	–6.54
	2018	9757863.2	6878231.2	16636094.4	7.9	2.11	5.43
	2019	9593292.1	7077425.8	16670717.9	–1.69	2.9	0.21
Odisha	2013	5342276.2	4961907.6	10304183.9	–	–	–
	2014	5144443	4689273.5	9833716.5	–3.7	–5.49	–4.57
	2015	5091702.8	4470563.9	9562266.6	–1.03	–4.66	–2.76
	2016	4932993	4189238.2	9122231.1	–3.12	–6.29	–4.6
	2017	5102825.4	4249589.5	9352415	3.44	1.44	2.52
	2018	5116801.6	4060684.3	9177485.9	0.27	–4.45	–1.87
	2019	5020499.5	4193078.2	9213577.7	–1.88	3.26	0.39
Punjab	2013	2535636.6	1993915.9	4529552.4	–	–	–
	2014	2602343.3	2283958.6	4886301.9	2.63	14.55	7.88
	2015	2867021.6	2181841.7	5048863.3	10.17	–4.47	3.33
	2016	2866771.9	2195972.1	5062744.1	–0.01	0.65	0.27
	2017	3196995.7	2158423.7	5355419.4	11.52	–1.71	5.78
	2018	3031813.5	2005565.2	5037378.8	–5.17	–7.08	–5.94
	2019	2891845.5	1997439.7	4889285.1	–4.62	–0.41	–2.94
Rajasthan	2013	7984832.8	7192180.6	15177013.4	–	–	–
	2014	7949321.6	6501305.9	14450627.5	–0.44	–9.61	–4.79
	2015	7346575.6	6491631	13838206.7	–7.58	–0.15	–4.24
	2016	7416322.1	6072308.5	13488630.6	0.95	–6.46	–2.53
	2017	7259910.9	5821962.1	13081872.9	–2.11	–4.12	–3.02
	2018	7178684.9	5837994.8	13016679.7	–1.12	0.28	–0.5
	2019	6816587.9	5935366.9	12751954.8	–5.04	1.67	–2.03
Tamil Nadu	2013	6897526.8	5408471.9	12305998.8	–	–	–
	2014	5831293.5	4965058	10796351.4	–15.46	–8.2	–12.27
	2015	6248949	5188153.6	11437102.6	7.16	4.49	5.93
	2016	6251447.4	4848595.4	11100042.8	0.04	–6.54	–2.95
	2017	6953777.8	4845094.4	11798872.1	11.23	–0.07	6.3
	2018	7229494.9	4897889.5	12127384.4	3.96	1.09	2.78
	2019	7030066.1	4685984.8	11716050.9	–2.76	–4.33	–3.39
Telengana	2014	3299576.3	2781720	6081296.2	–	–	–
	2015	3225247.7	2842340.7	6067588.4	–2.25	2.18	–0.23
	2016	3531005.6	2780146.7	6311152.3	9.48	–2.19	4.01
	2017	3495546.2	2579881.9	6075428.1	–1	–7.2	–3.74
	2018	3470043.3	2645299.8	6115343.1	–0.73	2.54	0.66
	2019	3230579.1	2579943.9	5810523	–6.9	–2.47	–4.98

(continued)

Table 3. Region specific SEYLLs (male, female and total) for each country with year-on-year change in percentage (continued)

India		SEYLL			Year-on-Year (%) change		
State	Year	Male	Female	Both	Male	Female	Both
Uttar Pradesh	2013	26290753.8	24622375.7	50913129.5	–	–	–
	2014	23438412.7	22319158.5	45757571.2	–10.85	–9.35	–10.13
	2015	23205163.4	21824006.7	45029170	–1	–2.22	–1.59
	2016	23438760.2	20637863.9	44076624.1	1.01	–5.44	–2.12
	2017	23217601.4	21947180	45164781.3	–0.94	6.34	2.47
	2018	22452016.5	19697869.1	42149885.6	–3.3	–10.25	–6.68
	2019	21881326.7	19968442.3	41849769	–2.54	1.37	–0.71
Uttarakhand	2014	96016.8	88534.1	184550.9	–	–	–
	2015	109178	88169.4	197347.4	13.71	–0.41	6.93
	2016	116498.4	85202.5	201701	6.71	–3.36	2.21
	2017	114155	83410.8	197565.8	–2.01	–2.1	–2.05
	2018	106613.8	83482.3	190096.1	–6.61	0.09	–3.78
	2019	100942.8	79316.9	180259.7	–5.32	–4.99	–5.17
West Bengal	2013	7519628.3	6369617.6	13889245.9	–	–	–
	2014	7320959.5	6393660.9	13714620.4	–2.64	0.38	–1.26
	2015	7656556.1	6649618.3	14306174.4	4.58	4	4.31
	2016	7620128.5	6115381	13735509.5	–0.48	–8.03	–3.99
	2017	7557451.5	6355476.6	13912928.1	–0.82	3.93	1.29
	2018	7541341	5666258	13207599	–0.21	–10.84	–5.07
	2019	7576412.2	5602380.5	13178792.7	0.47	–1.13	–0.22

Kyrgyzstan		SEYLL			Year-on-Year (%) change		
Region	Year	Male	Female	Both	Male	Female	Both
Batken oblast	2013	77556.3	71827.6	149383.8	–	–	–
	2014	76685.2	64910.5	141595.7	–1.12	–9.63	–5.21
	2015	74959.5	67271.7	142231.3	–2.25	3.64	0.45
	2016	73439.4	62190.5	135629.9	–2.03	–7.55	–4.64
	2017	73432.9	63455.1	136888	–0.01	2.03	0.93
	2018	65113.2	53167.8	118281	–11.33	–16.21	–13.59
	2019	72048	62474.5	134522.4	–1.89	–1.55	13.73
Bishkek city	2013	146650.1	113130.9	259781	–	–	–
	2014	159668.6	139981.4	299649.9	8.88	23.73	15.35
	2015	154946.7	141397.4	296344.1	–2.96	1.01	–1.1
	2016	161163.3	132192.2	293355.5	4.01	–6.51	–1.01
	2017	168558.6	135765.9	304324.5	4.59	2.7	3.74
	2018	161940.8	132635.9	294576.8	–3.93	–2.31	–3.2
	2019	151029.1	125724.9	276754	–10.4	–7.4	–6.05
Chuy oblast	2013	142179.5	111869.4	254049	–	–	–
	2014	135056.3	109834.2	244890.5	–5.01	–1.82	–3.61
	2015	138078.3	101559.5	239637.8	2.24	–7.53	–2.14
	2016	129244	108581.3	237825.3	–6.4	6.91	–0.76
	2017	119429.9	98755.9	218185.9	–7.59	–9.05	–8.26
	2018	120305.6	94946.3	215252	0.73	–3.86	–1.34
	2019	123937.9	95373.4	219311.3	3.77	–3.43	1.89

(continued)

Table 3. Region specific SEYLLs (male, female and total) for each country with year-on-year change in percentage (continued)

Kyrgyzstan	SEYLL				Year-on-Year (%) change		
Region	Year	Male	Female	Both	Male	Female	Both
Issyk-Kul oblast	2013	74871.1	58444.9	133316.1	–	–	–
	2014	73422.7	49506.7	122929.4	–1.93	–15.29	–7.79
	2015	74415.1	57232.2	131647.3	1.35	15.6	7.09
	2016	57346.4	57430.1	114776.5	–22.94	0.35	–12.82
	2017	69621.5	46469	116090.5	21.41	–19.09	1.14
	2018	67364.6	47627	114991.6	–3.24	2.49	–0.95
	2019	75596.6	55015.5	130612.1	8.58	18.39	13.58
Jalal-Abad oblast	2013	160080.7	141510.5	301591.2	–	–	–
	2014	172819.3	147377	320196.3	7.96	4.15	6.17
	2015	173019.1	143323.4	316342.6	0.12	–2.75	–1.2
	2016	168429.5	141265	309694.6	–2.65	–1.44	–2.1
	2017	160810	125450.2	286260.2	–4.52	–11.2	–7.57
	2018	145528.7	124028	269556.7	–9.5	–1.13	–5.84
	2019	147641.3	128830.8	276472.1	–8.19	2.69	2.57
Naryn oblast	2013	49748.5	33650.3	83398.8	–	–	–
	2014	47439	41720.8	89159.8	–4.64	23.98	6.91
	2015	47503	27730.6	75233.6	0.13	–33.53	–15.62
	2016	44277.4	31590.7	75868.2	–6.79	13.92	0.84
	2017	44061.5	32904.8	76966.3	–0.49	4.16	1.45
	2018	39492.2	29008	68500.2	–10.37	–11.84	–11
	2019	36143.8	26704.6	62848.4	–17.97	–7.94	–8.25
Osh city	2013	81728.2	63464.9	145193.1	–	–	–
	2014	84117.5	76541.4	160658.9	2.92	20.6	10.65
	2015	84712.9	82841.7	167554.5	0.71	8.23	4.29
	2016	84225.1	66567.5	150792.6	–0.58	–19.64	–10
	2017	82870.2	62145.2	145015.4	–1.61	–6.64	–3.83
	2018	66143.2	51074.6	117217.7	–20.18	–17.81	–19.17
	2019	72058.7	54343.4	126402.1	–13.05	6.4	7.84
Osh oblast	2013	163058.7	129561.1	292619.8	–	–	–
	2014	156200.4	122988.6	279189	–4.21	–5.07	–4.59
	2015	154542.5	124883.7	279426.2	–1.06	1.54	0.08
	2016	143017.2	115451.2	258468.3	–7.46	–7.55	–7.5
	2017	143134.2	114580	257714.1	0.08	–0.75	–0.29
	2018	142163.3	103524.8	245688.1	–0.68	–9.65	–4.67
	2019	143839.5	97881.1	241720.6	0.49	–5.45	–1.61
Talas oblast	2013	52208.8	35112.9	87321.7	–	–	–
	2014	48470.7	34162.3	82633	–7.16	–2.71	–5.37
	2015	43290.6	23773.2	67063.8	–10.69	–30.41	–18.84
	2016	39528.9	32987.5	72516.4	–8.69	38.76	8.13
	2017	35798.8	29563.5	65362.3	–9.44	–10.38	–9.87
	2018	46205.3	31683.4	77888.7	29.07	7.17	19.16
	2019	40362.9	32492.7	72855.6	–12.64	2.55	–6.46

(continued)

Table 3. Region specific SEYLLs (male, female and total) for each country with year-on-year change in percentage (continued)

The Russian Federation		SEYLL			Year-on-Year (%) change		
Region	Year	Male	Female	Both	Male	Female	Both
Central Federal District	2013	4639607.9	3729004	8368611.5	–	–	–
	2014	4679760.1	3721784	8401543.9	0.87	–0.19	0.39
	2015	4500201.1	3695434	8195635.5	–3.84	–0.71	–2.45
	2016	4431723.1	3678614	8110337.5	–1.52	–0.46	–1.04
	2017	4288077.9	3593321	7881399.1	–3.24	–2.32	–2.82
	2018	4337293.8	3601275	7938568.8	1.15	0.22	0.73
	2019	4312731.2	3559796	7872527	0.57	–0.93	–0.11
Far Eastern Federal District	2013	820547.5	585538.7	1406086.2	–	–	–
	2014	805215	582787.5	1388002.5	–1.87	–0.47	–1.29
	2015	772926.3	574215.6	1347141.9	–4.01	–1.47	–2.94
	2016	758291.5	559594.8	1317886.3	–1.89	–2.55	–2.17
	2017	720247.8	539152.2	1259400	–5.02	–3.65	–4.44
	2018	707440.4	548780.5	1256220.9	–1.78	1.79	–0.25
	2019	711759.9	547430.4	1259190.3	–1.18	1.54	–0.02
North Caucasian Federal District	2013	788356.7	588795.5	1377152.2	–	–	–
	2014	799646.1	587681.7	1387327.8	1.43	–0.19	0.74
	2015	779189.5	574286.2	1353475.7	–2.56	–2.28	–2.44
	2016	761016.4	571327.2	1332343.6	–2.33	–0.52	–1.56
	2017	729640.9	555522	1285162.8	–4.12	–2.77	–3.54
	2018	730546.4	546377.1	1276923.5	0.12	–1.65	–0.64
	2019	723301.5	552346.7	1275648.2	–0.87	–0.57	–0.74
Northwestern Federal District	2013	1626256.6	1353970	2980226.5	–	–	–
	2014	1644594.3	1363964	3008558.1	1.13	0.74	0.95
	2015	1621803.2	1364189	2985992	–1.39	0.02	–0.75
	2016	1590903.4	1349673	2940576	–1.91	–1.06	–1.52
	2017	1532389	1305069	2837457.7	–3.68	–3.3	–3.51
	2018	1534703	1304842	2839544.9	0.15	–0.02	0.07
	2019	1520187	1302697	2822884	–0.8	–0.18	–0.51
Siberian federal district	2013	2298602.3	1737131	4035733.3	–	–	–
	2014	2302938.9	1752662	4055600.6	0.19	0.89	0.49
	2015	2281186	1741553	4022739.1	–0.94	–0.63	–0.81
	2016	2232454	1723807	3956261.3	–2.14	–1.02	–1.65
	2017	2108719.7	1644951	3753670.8	–5.54	–4.57	–5.12
	2018	2066546.8	1646517	3713063.8	–2	0.1	–1.08
	2019	2192386.3	1798531	3990917.4	3.97	9.34	6.32
Southern Federal District	2013	1589816.3	1260857	2850672.9	–	–	–
	2014	1613044.3	1267774	2880818.4	1.46	0.55	1.06
	2015	1581225.9	1268017	2849242.5	–1.97	0.02	–1.1
	2016	1559811.1	1257046	2816856.8	–1.35	–0.87	–1.14
	2017	1502097	1214283	2716379.5	–3.7	–3.4	–3.57
	2018	1483341.1	1209627	2692968.1	–1.25	–0.38	–0.86
	2019	1496343	1197567	2693909.6	–0.38	–1.38	–0.83

(continued)

Table 3. Region specific SEYLLs (male, female and total) for each country with year-on-year change in percentage (continued)

The Russian Federation		SEYLL			Year-on-Year (%) change		
Region	Year	Male	Female	Both	Male	Female	Both
Ural federal district	2013	1462337.1	1103712	2566049.1	–	–	–
	2014	1468853.5	1115459	2584312.3	0.45	1.06	0.71
	2015	1458661.5	1110094	2568755.6	–0.69	–0.48	–0.6
	2016	1430729.2	1101194	2531922.8	–1.91	–0.8	–1.43
	2017	1354693.9	1053013	2407707.3	–5.31	–4.38	–4.91
	2018	1331973.5	1056214	2388187.8	–1.68	0.3	–0.81
	2019	1309386.7	1031217	2340603.6	–3.34	–2.07	–2.79
Volga Federal District	2013	3710287.3	2882399	6592686.1	–	–	–
	2014	3707978.2	2891838	6599815.7	–0.06	0.33	0.11
	2015	3588095.2	2832192	6420287	–3.23	–2.06	–2.72
	2016	3463560.8	2770993	6234553.9	–3.47	–2.16	–2.89
	2017	3283715.3	2677954	5961669.6	–5.19	–3.36	–4.38
	2018	3258697.8	2666487	5925185	–0.76	–0.43	–0.61
	2019	3210629.4	2610712	5821341.4	–2.23	–2.51	–2.35

Table 4. SEYLL_d (male, female and total) for the age range 35 years to 64 years and the present value of lost earnings (PVLE) for each country over the years

					Productivity losses					
SEYLL _d					PVLE (million USD PPP 2017)			PVLE/SEYLL (USD per SEYLL)		
Country	Year	Male	Female	Both	Male	Female	Both	Male	Female	Both
Belarus	2013	20.99	28.43	23.04	1431.8	580.82	2012.62	2616.03	2060.76	3677.25
	2014	21.11	28.79	23.22	1367.98	562	1929.98	2591.62	2062.74	4654.36
	2015	21.15	28.33	23.08	1357.12	530.84	1887.97	2679.22	2123.84	4803.06
	2016	21.06	28.36	23.06	1302.38	530.69	1833.07	2679.13	2138.70	4817.83
	2017	20.91	28.09	22.87	1344.55	524.81	1869.36	2810.98	2182.73	4993.71
	2018	20.94	28.11	22.89	1589.87	610.9	2200.77	3232.72	2488.57	5721.28
France	2011	29.4	35.54	31.36	31484.82	15874.43	47359.25	9788.10	8735.17	14723.19
	2012	29.22	35.36	31.17	33582.45	16854.92	50437.37	10357.33	9234.74	19592.07
	2013	29.09	35.23	31.04	34853.37	17673.45	52526.82	10744.92	9666.42	20411.34
	2014	29.01	35.17	30.97	35456.36	18214.69	53671.05	10889.38	9909.76	20799.14
	2017	29.61	35.47	31.51	38081.64	19905.68	57987.33	11800.97	10742.60	22543.57
India	2013	24.79	26.58	25.47	60705.11	13323.23	74028.34	1469.09	489.79	1958.88
	2014	24.88	26.29	25.47	53536.72	12969.95	66506.66	1398.23	452.65	1850.89
	2015	30.74	34.19	32.15	64119.13	15308.88	79428.01	1583.38	493.97	2077.36
	2016	24.64	26.39	25.31	65175.81	13642.24	78818.05	1522.54	479.31	2001.85
	2017	25.01	26.55	25.59	68982.29	12926.17	81908.46	1595.20	463.79	2059
	2018	24.57	26.09	25.16	65347.34	12131.19	77478.54	1571.89	437.76	2009.65
	2019	26.21	24.59	25.25	45758.79	20106.94	65865.74	1611.97	512.94	2124.90

(continued)

Table 4. SEYLL_d (male, female and total) for the age range 35 years to 64 years and the present value of lost earnings (PVLE) for each country over the years (continued)

					Productivity losses					
SEYLL _d					PVLE (million USD PPP 2017)			PVLE/SEYLL (USD per SEYLL)		
Country	Year	Male	Female	Both	Male	Female	Both	Male	Female	Both
Kazakhstan	2013	16.57	20.3	18.43	1072.27	1095.28	2167.56	1410.21	1175.40	2850.67
	2014	17.13	20.97	19.05	1103.89	1118.51	2222.4	1403.76	1162.19	2565.95
	2015	18.95	22.94	20.95	1197.63	1189.73	2387.36	1376.89	1129.72	2506.61
	2016	19.3	23.21	21.26	1184.16	1173.82	2357.98	1336.90	1101.59	2438.48
	2017	19.7	23.58	21.64	1205.47	1194.31	2399.78	1333.12	1103.57	2436.69
	2018	21.49	25.62	23.56	1475.02	1460.22	2935.24	1495.12	1241.81	2736.94
	2019	21.78	26.01	23.9	2182.25	2177.24	4359.49	2182.48	1823.87	4006.35
Kyrgyzstan	2013	24.16	28.36	25.52	58.55	20.46	79	295.06	183.91	398.16
	2014	23.57	27.77	24.91	58.08	20.81	78.89	300.52	193.39	493.91
	2015	27.64	32.26	29.13	60.9	22.32	83.23	316.02	202.26	518.28
	2016	24.22	28.1	25.51	66.78	24.21	90.98	360.52	225.82	586.34
	2017	24.36	28.74	25.79	78.9	27.48	106.38	412.23	251.13	663.37
	2018	24.82	28.81	26.11	111.07	38.02	149.09	570.16	351.77	921.93
	2019	24.58	28.83	25.96	121.96	43.32	165.28	627.37	398	1025.38
The Russian Federation	2013	21.47	28.08	23.44	12168.25	5422.31	17590.56	1504.59	1211.69	2716.28
	2014	22.05	28.41	23.94	12693.72	5557.32	18251.04	1531.66	1229.48	2761.14
	2015	25.79	33.1	27.83	13264.92	5721.6	18986.52	1482.19	1191.27	2673.46
	2016	22.28	28.43	24.1	17139.78	7323.92	24463.7	1844.58	1484.05	3328.64
	2017	22.57	28.56	24.34	18361.68	7747.66	26109.34	1916.01	1536.93	3452.94
	2018	22.8	28.65	24.52	26760.39	11235.28	37995.67	2779.43	2235.06	5014.48
	2019	23.05	29.19	24.89	23025.33	10109.44	33134.77	2674.30	2158.47	4832.77

Table 5. SEYLL_d (male, female and total) for the age range 15 years to 64 years and the present value of lost earnings (PVLE) for each country over the years

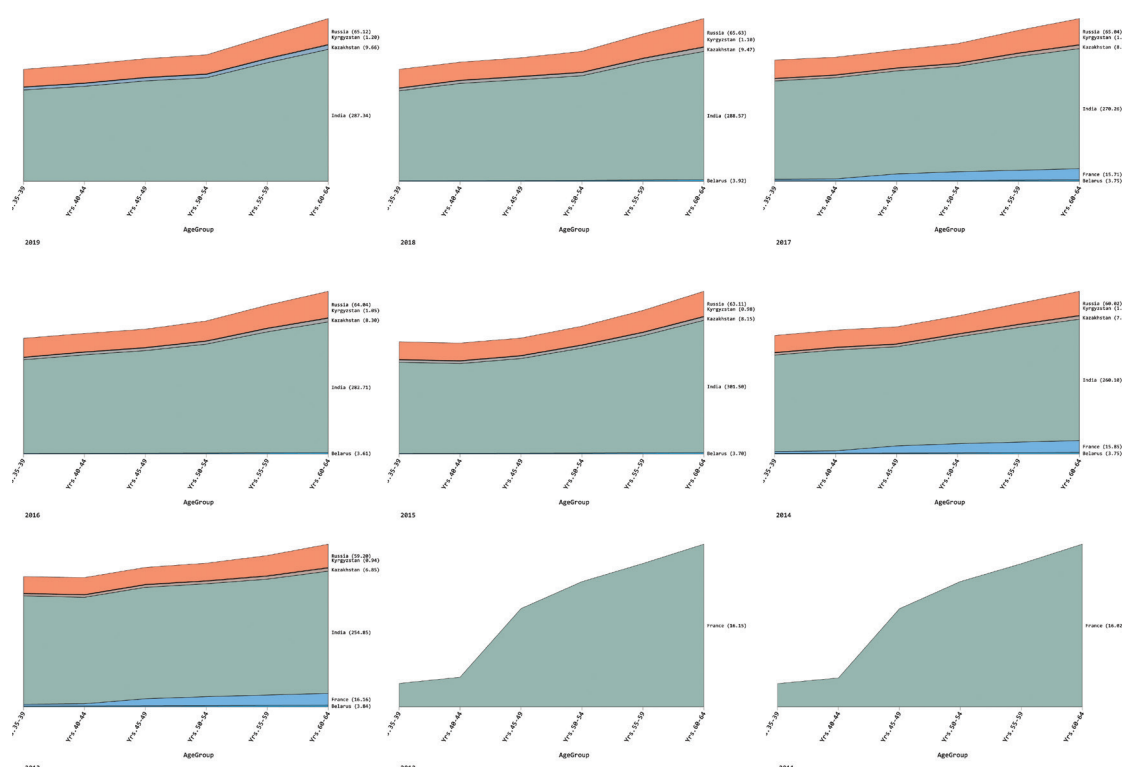
					Productivity losses					
SEYLL _d					PVLE (million USD PPP 2017)			PVLE/SEYLL (USD per SEYLL)		
Country	Year	Male	Female	Both	Male	Female	Both	Male	Female	Both
Belarus	2013	22.97	30.25	24.95	1583.02	635.05	2218.07	2400.96	1965.68	4366.64
	2014	23.09	30.47	25.08	1509.95	611.54	2121.49	2380.20	1977.45	4357.65
	2015	23.09	30.47	25.08	1480.39	577.03	2057.42	2489.98	2038.46	4528.44
	2016	22.72	29.96	24.7	1413.68	574.93	1988.62	2495.56	2053.63	4549.18
	2017	22.41	29.55	24.34	1491.19	574.2	2065.38	2718.78	2141.51	4860.29
	2018	22.37	29.47	24.28	1707.05	655.3	2362.35	3044.05	2409.83	5453.88
France	2011	30.4	36.41	32.3	32640.28	16325.33	48965.61	9387.56	8458.31	17845.87
	2012	30.26	36.25	32.15	34827.81	17341.99	52169.8	9907.05	8925.10	18832.15
	2013	30.18	36.15	32.06	36193.93	18191.21	54385.14	10252.85	9331.27	19584.12
	2014	30.12	36.11	32.01	36839.7	18755.04	55594.74	10371.95	9554.60	19926.55
	2017	30.54	36.28	32.39	39312.35	20404.68	59717.03	11333.95	10402.58	21736.53
India	2013	29.5	32.8	30.79	73309.51	16645.26	89954.77	1180.04	374.81	1554.85
	2014	29.77	31.79	30.61	64468.09	15707.6	80175.7	1116.23	356.30	1472.53
	2015	29.01	30.39	29.59	75825.53	18033.23	93858.75	1289.61	398.25	1687.86
	2016	28.75	31.43	29.79	76598.5	16261.89	92860.39	1260.19	384.94	1645.12
	2017	29.41	32.11	30.45	81700.95	15791.7	97492.65	1302.87	365.27	1668.14
	2018	29.02	30.88	29.73	77614.04	14332.73	91946.78	1283.26	356.03	1639.29
	2019	31.16	28.86	29.8	54093.97	23715.11	77809.08	1298.52	422.78	1721.30

(continued)

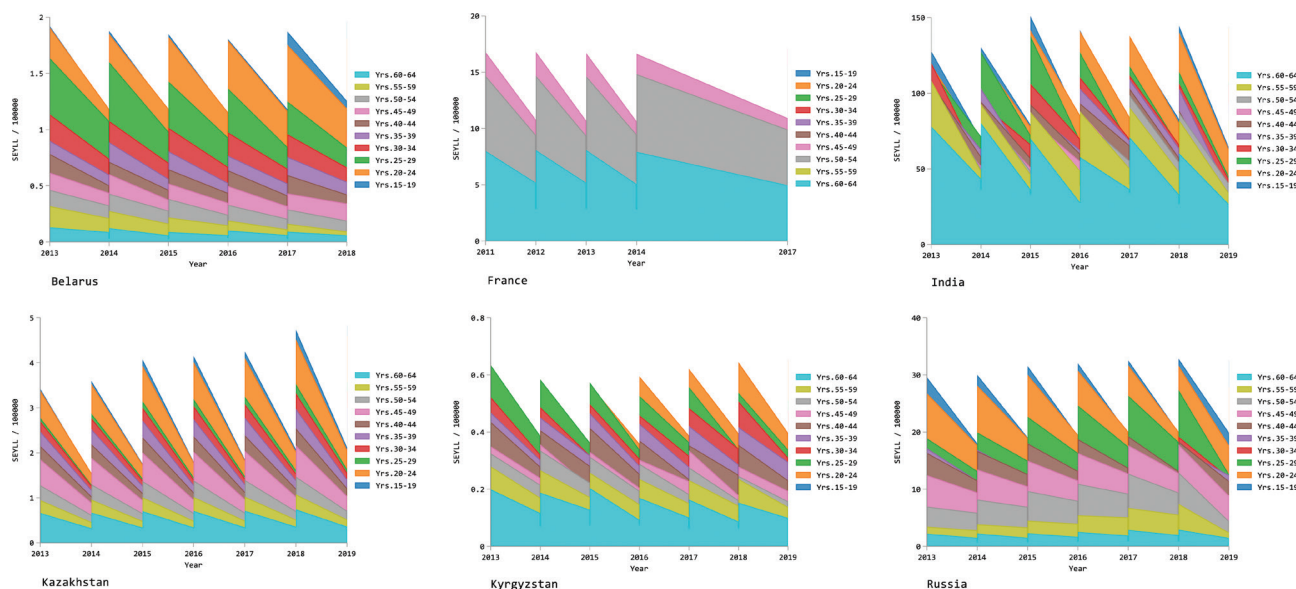
Table 5. SEYLL_d (male, female and total) for the age range 15 years to 64 years and the present value of lost earnings (PVLE) for each country over the years (continued)

					Productivity losses					
SEYLL _d					PVLE (million USD PPP 2017)			PVLE/SEYLL (USD per SEYLL)		
Country	Year	Male	Female	Both	Male	Female	Both	Male	Female	Both
Kazakhstan	2013	19.01	22.7	20.85	1218.03	1248.3	2466.33	1233.08	1058.18	2291.26
	2014	19.57	23.36	21.46	1253.43	1276.33	2529.76	1232.64	1051.49	2284.13
	2015	21.43	25.38	23.4	1355.5	1356.86	2712.37	1217.25	1028.76	2246.01
	2016	21.77	25.65	23.71	1337.33	1335.79	2673.13	1181.78	1002.02	2183.80
	2017	22.18	26.01	24.09	1358.24	1355.85	2714.09	1178.52	1002.92	2181.44
	2018	24.01	28.09	26.05	1654.56	1650.59	3305.15	1326.02	1130.51	2456.53
	2019	24.3	28.48	26.39	2444.75	2456.19	4900.94	1935.98	1659.50	3595.48
Kyrgyzstan	2013	27.84	32.23	29.24	69.63	23.98	93.6	251.70	160.02	411.72
	2014	27.2	31.93	28.72	68.77	24.74	93.51	256.37	166.74	423.11
	2015	28.04	32.06	29.35	71.56	25.96	97.51	267.99	175.47	443.46
	2016	27.65	31.97	29.08	77.58	27.9	105.48	310.37	194.79	505.16
	2017	27.82	32.4	29.3	91.59	31.47	123.06	354.31	218.29	572.60
	2018	27.87	32.58	29.41	125.84	43.08	168.91	498.21	301.58	799.78
	2019	27.74	32.25	29.19	138.22	48.39	186.61	544.24	345.37	889.61
The Russian Federation	2013	23.5	30.07	25.43	13625.28	5989.83	19615.11	1384.65	1144.99	2529.64
	2014	24.27	30.52	26.1	14350.51	6181.98	20532.48	1400.03	1158.96	2558.99
	2015	24.33	30.6	26.15	15073.97	6403.83	21477.8	1348.86	1118.35	2467.21
	2016	24.72	30.8	26.48	19649.77	8235.52	27885.29	1664.71	1385.57	3050.28
	2017	25.25	31.08	26.93	21308.33	8774.41	30082.74	1707.62	1427.36	3134.99
	2018	25.55	31.25	27.19	31039.07	12729.09	43768.16	2462.44	2066.35	4528.79
	2019	24.98	31.03	26.77	25492.52	11045.47	36537.99	2468.27	2044.19	4512.46

Graph 1. SEYLL/100,000 over the years for age group between 35 years and 64 years



Graph 2. SEYLL/100,000 between 15 years and 64 years for each country



observed low cumulative percentage loss of PVLE per SEYLL while high cumulative GDP per capita growth could be attributed to extremely low labour force participation rate in India combined with the relatively low wage rate. So, we found that PVLE for the population of age group 35–64 years (Table 5) accounted an enormous amount ranging from 4.33% (reference: size of Kyrgyzstan economy, 9.37 billions USD in 2019) to 19.55% (reference: size of Belarus economy, 60 billions USD in 2018), in other countries this avoidable loss was around 10% of the size of the respective economy in the corresponding last year of this study. India was an outlier for this computation for the reasons explained earlier. Thus, this empirical study contributes to the contestation over population health development with the consent for balancing sustainability of the economy and alleviation of the poverty.

The uniqueness of this study is in the demonstration of the use of SEYLL for allocation decisions and computing productivity loss. Our 3P approach is relatively more robust than considering GDP per capita while computing productivity of the citizen because GDP per capita does not include standard (cost) of living at the individual level and also ignores income inequality.

Our computation of PVLE in million USD PPP constant at 2017 provided an important insight that can be incorporated into the poverty alleviation programme in low – and middle – income countries.

Further, using SEYLL with gender responsiveness was also consistent with the intergenerational actions for populational health development when the mandate of public health is not only for prolonging life but also promoting good health. Here, we nuanced gender disaggregation to extract value from SEYLL for decision making.

Despite the age of the data, the use of the subnational data introduced an approach to capture the differential effects of the determinants on population health

development. The subnational level data availability constrained this study for the limited number of years and that was also not uniform across the study countries. The most thwarting limitations of this study were (1) short-term horizon with gaps in data points and (2) paucity of disease specific data availability with consistency across study countries. Since we presented here PVLE per SEYLL only for the population during peak working age, such findings were to be inferred with the contextual approach in consideration. However, not with standing these limitations, this study updated and expanded the use of SEYLL for a prudent health policy planning with an efficient allocation of available resources where the sufficiency component of healthcare service provision ought to be embedded with the equity in outcome.

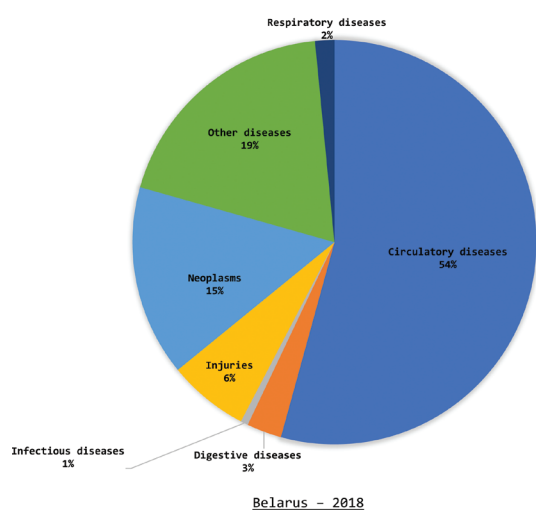
CONCLUSIONS

Our approach demonstrates relevance and usability of the data for health policy while addressing navigational problem of the information overload, generates also evidence for the legislation and provides solution for handling of the uncertainty. Such an approach further contributes to build consensus for the policy making.

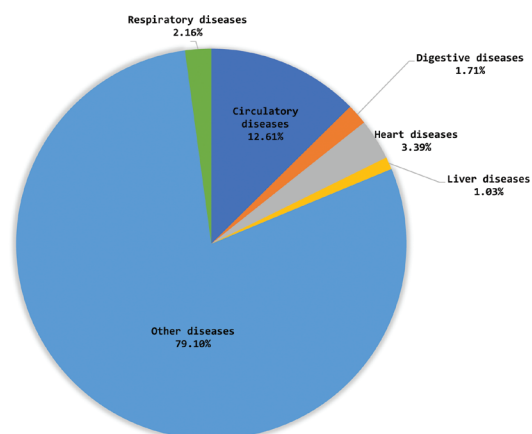
We have captured the value of earnings and quantified the avoidable loss for the society / country in different contexts and thus, this study circumvents the paradoxes and the pitfalls of valuing investment for population health development with no “one size – fits all” construct.

We conclude with the note that this study has established the need to strengthen data (inputs for health policy) at the country level to adjust the effects from the determinants and the contexts through (1) establishing the synergies among the interventions and (2) demonstrating the actions that balance the trade-offs and address the negative spill-over effects.

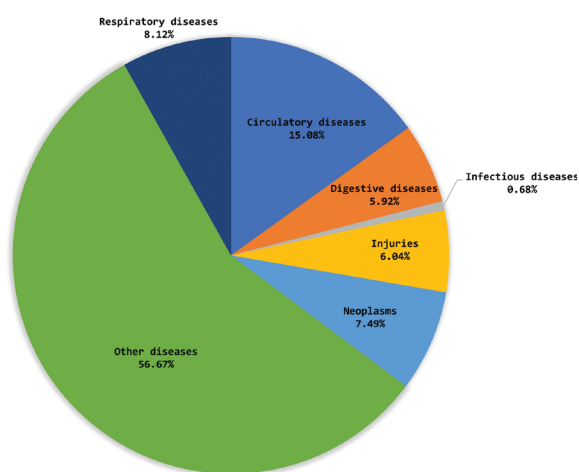
Graph 3. Distribution of SEYLL by diseases / disorders in the latest year



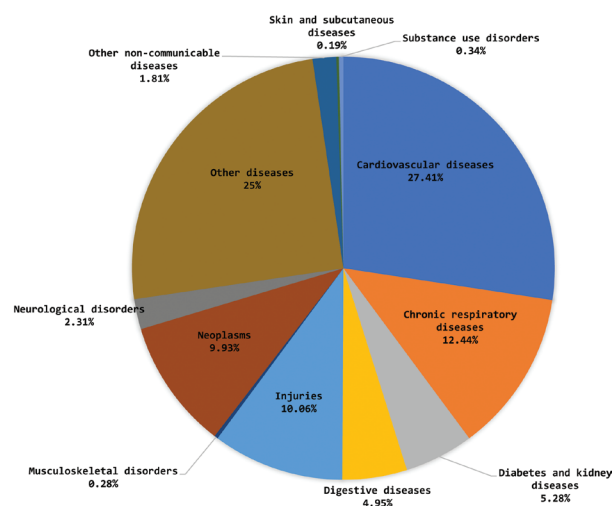
Belarus – 2018



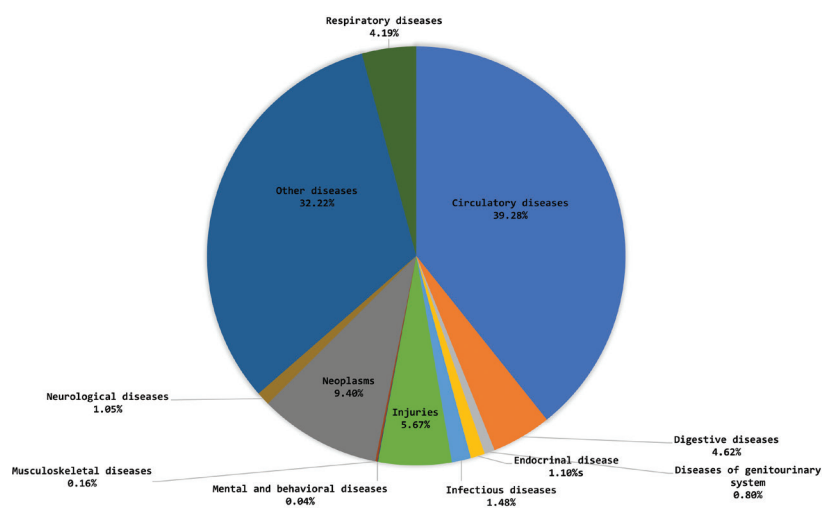
France – 2017



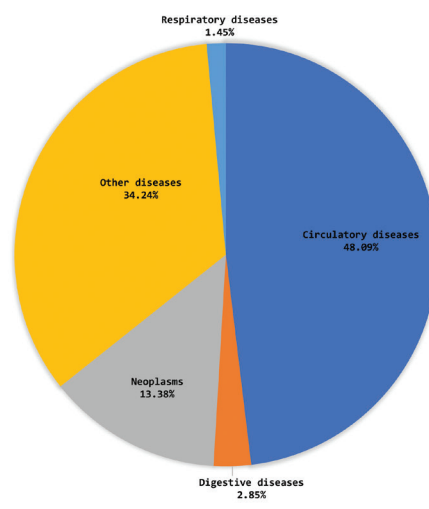
India – 2019



Kazakhstan – 2019

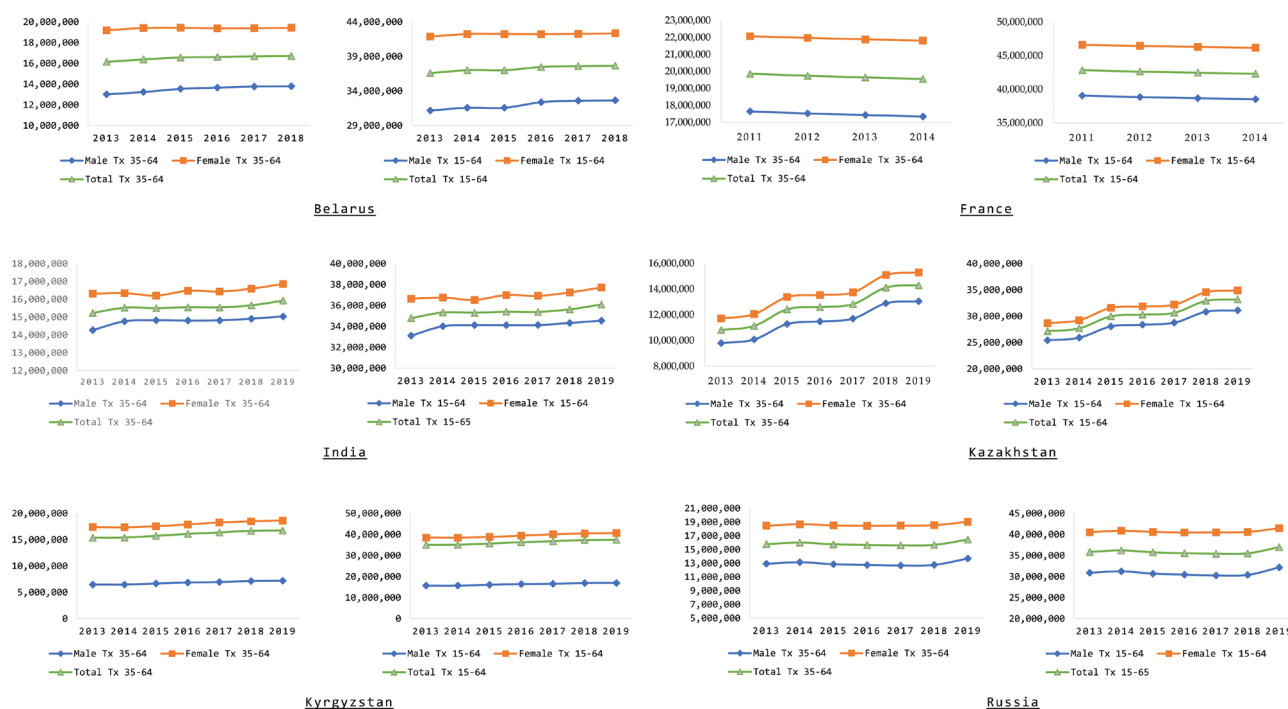


Kyrgyzstan – 2019



Russia – 2019

Graph 4. Distribution of person years lived above age x (T_x) for different years



AUTHORS CONTRIBUTIONS

Both the authors contributed to conceptualisation, methodology, formal analysis and interpretation, data curation and writing the manuscript.

COMPETING INTERESTS

The authors declare no competing interests.

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APPENDIX

Table 1. Person-years lived above age x across age groups

Belarus		T_x			Year-on-Year (%) change		
Region	Year	Male	Female	Both	Male	Female	Both
Brest Region	2013	51830078.4	66752113.5	59364113.4	–	–	–
	2014	52587814.4	67439772.9	60130577.4	1.46	1.03	1.29
	2015	53126615.7	66986400	60236205.4	1.02	–0.67	0.18
	2016	53589032.1	67106120.1	60545360.3	0.87	0.18	0.51
	2017	53090016.1	66927122.3	60159682.6	–0.93	–0.27	–0.64
	2018	53660750.1	67087942.1	60568739.4	1.08	0.24	0.68
Vitebsk region	2013	49748190.1	64811400.1	57346889.4	–	–	–
	2014	50483871.7	65622235.4	58169469.4	1.48	1.25	1.43
	2015	51070312.6	65584216.8	58492724.2	1.16	–0.06	0.56
	2016	51479629.9	65387065.3	58647036.4	0.8	–0.3	0.26
	2017	51988368.9	65820463.1	59137816.4	0.99	0.66	0.84
	2018	52156479.7	65935305.9	59255931.6	0.32	0.17	0.2
Gomel region	2013	50044560.5	65746838.6	57945370	–	–	–
	2014	50274512.1	66010724.8	58193169	0.46	0.4	0.43
	2015	51352591.6	66004257.3	58845553.4	2.14	–0.01	1.12
	2016	51721836.4	65894803.4	59015250.6	0.72	–0.17	0.29
	2017	52125611.3	66276533.1	59417283.8	0.78	0.58	0.68
	2018	52018084.7	66558711.8	59464066.7	–0.21	0.43	0.08
Grodno region	2013	50146045.9	66024674.9	58074780.4	–	–	–
	2014	51653046	67001364.3	59437706.1	3.01	1.48	2.35
	2015	51994884.6	67029368.5	59630999.9	0.66	0.04	0.33
	2016	52134914.3	66378175.9	59428337.8	0.27	–0.97	–0.34
	2017	52466053	66777707.6	59781789.7	0.64	0.6	0.59
	2018	52356899.3	66507618.6	59578246.9	–0.21	–0.40	–0.34
Minsk city	2013	55656908.9	71141869.4	63870928.5	–	–	–
	2014	55691017.3	71294106	63980702.3	0.06	0.21	0.17
	2015	56581263.4	71817838	64753847.8	1.6	0.73	1.21
	2016	56888676	71602649.5	64846078.6	0.54	–0.3	0.14
	2017	57356209.8	71633449.1	65124242.3	0.82	0.04	0.43
	2018	57582094.6	71688992	65273543.6	0.39	0.08	0.23
Minsk region	2013	49251327.4	65169781.3	57095783.4	–	–	–
	2014	49839665	66151427.4	57881145.4	1.19	1.51	1.38
	2015	51111549.9	65746621.4	58451432.3	2.55	–0.61	0.99
	2016	51276881.8	66079646.1	58686293.8	0.32	0.51	0.4
	2017	51605433.7	65889401.9	58793573.5	0.64	–0.29	0.18
	2018	51952458.7	65828961.4	58940065.9	0.67	–0.09	0.25

(continued)

Table 1. Person-years lived above age x across age groups (continued)

Belarus		T_x			Year-on-Year (%) change		
Region	Year	Male	Female	Both	Male	Female	Both
Mogilev region	2013	49869071.4	65087166.1	57473192.1	–	–	–
	2014	50465226.6	65272683.6	57921939.8	1.2	0.29	0.78
	2015	51252571.5	66057257.6	58744908.3	1.56	1.2	1.42
	2016	51623136.6	65514309.9	58722327.4	0.72	–0.82	–0.04
	2017	52123170.5	64849387.3	58708893.6	0.97	–1.01	–0.02
	2018	51312865.7	65359077	58440306.9	–1.55	0.79	–0.46
France		T_x			Year-on-Year (%) change		
Region	Year	Male	Female	Both	Male	Female	Both
Ile-de-France	2011	65942893.3	76950954.6	71622393.5	–	–	–
	2012	66139614	77227228.8	71851788.4	0.3	0.36	0.32
	2013	66565690.2	77590579.4	72242454.5	0.64	0.47	0.54
	2014	67088201.4	78019485.4	72725345	0.78	0.55	0.67
	2017	67432164.6	77918715.4	72813147.5	0.17	–0.04	0.04
Centre	2011	63053812.1	75676672.3	69245161.8	–	–	–
	2012	63600034	76410521.7	69878746.1	0.87	0.97	0.91
	2013	64091960.7	76658206.4	70262279.7	0.77	0.32	0.55
	2014	64270270.9	76970481.9	70494707.7	0.28	0.41	0.33
	2017	64279192.1	76365589.7	70209766.8	0	–0.26	–0.13
Pays de la Loire	2011	64046180	77346815.1	70617123.8	–	–	–
	2012	64472714.4	77535492.7	70936871.3	0.67	0.24	0.45
	2013	64741896.3	77723048.6	71164300.1	0.42	0.24	0.32
	2014	65049037.7	77968075.6	71439912.2	0.47	0.32	0.39
	2017	77730601.6	77730601.6	71227424.9	6.5	–0.1	–0.1
Bretagne	2011	61924679.8	75595110.8	68654946.5	–	–	–
	2012	62108872.6	75728578.2	68789658.9	0.3	0.18%	0.2
	2013	62246666.2	75921059.8	69281075.9	0.22	0.25%	0.71
	2014	62739433.2	76105661.8	69292251.3	0.79	0.24%	0.02
	2017	63241962.4	76143194.8	69564611.9	0.27%	0.02%	0.13
Provence-Alpes-Côte d'Azur	2011	64614675.1	76687018.7	70722946.1	–	–	–
	2012	64850170.6	76835797.6	70905844.8	0.36	0.19	0.26
	2013	65247663.4	77069722.2	71220787.9	0.61	0.3	0.44
	2014	65756541.2	77240402.1	71568030.4	0.78	0.22	0.49
	2017	77256392.5	77256392.5	71553025.3	5.83	0.01	–0.01
Corse	2011	64576435.2	75326612.9	69847083.5	–	–	–
	2012	65163900.8	75705537.4	70347786.8	0.91	0.5	0.72
	2013	64795867	76505767.6	70510744.4	–0.56	1.06	0.23
	2014	65265995.4	76889773.9	70960934.5	0.73	0.5	0.64
	2017	66506196.2	77769475.6	72091479.6	0.63	0.38	0.53

(continued)

Table 1. Person-years lived above age x across age groups (continued)

	India		T_x		Year-on-Year (%) change		
State	Year	Male	Female	Both	Male	Female	Both
Andrah Pradesh	2013	55077775	61127053	57933937	–	–	–
	2014	56154220	59597678	57856655	1.95	–2.5	–0.13
	2015	56657275	60257716	58449907	0.9	1.11	1.03
	2016	57762724	60888793	59239458	1.95	1.05	1.35
	2017	55654608	59334944	57362871	–3.65	–2.55	–3.17
	2018	57638113	61547140	59523692	3.56	3.73	3.77
	2019	58551889	61720999	60197058	1.59	0.28	1.13
Assam	2013	50889510	54586152	52525444	–	–	–
	2014	52840708	56576243	54601181	3.83	3.65	3.95
	2015	53594743	56671224	55036546	1.43	0.17	0.8
	2016	54133152	58730483	56114899	1	3.63	1.96
	2017	54738845	58244274	56325831	1.12	–0.83	0.38
	2018	54910230	57850681	56107171	0.31	–0.68	–0.39
	2019	54926030	57391216	55998606	0.03	–0.79	–0.19
Bihar	2013	56190611	57011695	56603567	–	–	–
	2014	58088458	57831509	57957473	3.38	1.44	2.39
	2015	58466068	55816045	57147987	0.65	–3.49	–1.4
	2016	56900449	57346652	57100843	–2.68	2.74	–0.08
	2017	56898202	57018342	56855887	0	–0.57	–0.43
	2018	56731641	56043252	56460718	–0.29	–1.71	–0.7
	2019	57233500	56859265	57092443	0.88	1.46	1.12
Chhattisgarh	2013	50144109	54700459	52451223	–	–	–
	2014	50219727	52892802	50980848	0.15	–3.3	–2.8
	2015	50658817	55405542	52959408	0.87	4.75	3.88
	2016	50985363	55770432	53320595	0.64	0.66	0.68
	2017	50039998	55286184	52527962	–1.85	–0.87	–1.49
	2018	49447521	52997954	51264779	–1.18	–4.14	–2.4
	2019	50430680	55505073	52907072	1.99	4.73	3.2
Delhi	2013	61052633	63830459	62277901	–	–	–
	2014	62622138	68065852	64948097	2.57	6.64	4.29
	2015	62207305	68148170	64921185	–0.66	0.12	–0.04
	2016	59339859	67319354	62378481	–4.61	–1.22	–3.92
	2017	60361416	70390765	64126514	1.72	4.56	2.8
	2018	61893084	70013588	65076718	2.54	–0.54	1.48
	2019	61551923	70835013	64968791	–0.55	1.17	–0.17
Gujarat	2013	55428280	63002380	58935236	–	–	–
	2014	56538164	63781520	59729399	2	1.24	1.35
	2015	56549932	63417813	59703440	0.02	–0.57	–0.04
	2016	56301503	63488415	59508681	–0.44	0.11	–0.33
	2017	55276037	62493484	58544274	–1.82	–1.57	–1.62
	2018	55698273	64926083	59687297	0.76	3.89	1.95
	2019	56547257	64684017	60226034	1.52	–0.37	0.9

(continued)

Table 1. Person-years lived above age x across age groups (continued)

	India		T_x		Year-on-Year (%) change		
State	Year	Male	Female	Both	Male	Female	Both
Haryana	2013	54758499	62556184	58431763	–	–	–
	2014	55114343	61720779	58151504	0.65	–1.34	–0.48
	2015	55640781	62644355	58934998	0.96	1.5	1.35
	2016	56296524	63927259	59815746	1.18	2.05	1.49
	2017	55533676	63505695	59115779	–1.36	–0.66	–1.17
	2018	54034225	64534715	58661793	–2.7	1.62	–0.77
	2019	53664242	63280183	58054606	–0.68	–1.94	–1.04
Himachal Pradesh	2013	59297859	66454408	62637374	–	–	–
	2014	58597284	70277828	63474056	–1.18	5.75	1.34
	2015	58811579	69272216	63528684	0.37	–1.43	0.09
	2016	57490139	67274394	61799869	–2.25	–2.88	–2.72
	2017	58938995	67201663	62596612	2.52	–0.11	1.29
	2018	57206988	66627723	61313023	–2.94	–0.85	–2.05
	2019	57531687	65986416	61447422	0.57	–0.96	0.22
Jammu & Kashmir	2013	61474358	72532991	65520163	–	–	–
	2014	62179704	73659788	66212723	1.15	1.55	1.06
	2015	63025455	72366503	66901582	1.36	–1.76	1.04
	2016	63421992	73988046	67597474	0.63	2.24	1.04
	2017	65293704	71168360	67807303	2.95	–3.81	0.31
	2018	63962641	71798895	67199630	–2.04	0.89	–0.9
	2019	65131721	78249323	70092201	1.83	8.98	4.3
Jharkhand	2013	52857876	55802784	54332692	–	–	–
	2014	56927191	56926553	57043443	7.7	2.01	4.99
	2015	56370225	56584508	56417168	–0.98	–0.6	–1.1
	2016	58448190	56599069	57544753	3.69	0.03	2
	2017	58263027	56107361	57194023	–0.32	–0.87	–0.61
	2018	57874840	56039513	56932851	–0.67	–0.12	–0.46
	2019	57499461	56451370	56894243	–0.65	0.73	–0.07
Karnataka	2013	54185256.7	60174566.6	57142889.5	–	–	–
	2014	55314036.8	59447387.8	57352233.6	2.08	–1.21	0.37
	2015	55118265.7	58777928.1	56925165.8	–0.35	–1.13	–0.74
	2016	54146566.5	58765257.9	56350150.1	–1.76	–0.02	–1.01
	2017	54476663.1	59210689.8	56706578.2	0.61	0.76	0.63
	2018	55031813	59812745.9	57291665.7	1.02	1.02	1.03
	2019	54440961.5	61041493.7	57549749.1	–1.07	2.05	0.45
Kerala	2013	59220034.3	68039071.1	63611565.3	–	–	–
	2014	59840593.5	68452669.1	64054800.8	1.05	0.61	0.7
	2015	59580537.1	68601242.5	64075935.5	–0.43	0.22	0.03
	2016	57840116.7	66083009.7	61885784.3	–2.92	–3.67	–3.42
	2017	59378433.6	67709181.5	63435081	2.66	2.46	2.5
	2018	58944047.9	67576344.7	63115335.5	–0.73	–0.2	–0.5
	2019	57429342	67352705.8	62215869.5	–2.57	–0.33	–1.43

(continued)

Table 1. Person-years lived above age x across age groups (continued)

	India		T_x		Year-on-Year (%) change		
State	Year	Male	Female	Both	Male	Female	Both
Madhya Pradesh	2013	50859113	57409683	53924473	–	–	–
	2014	51604200	57463810	54322108	1.47	0.09	0.74
	2015	52371936	57237244	54666054	1.49	–0.39	0.63
	2016	53131770	58661398	55667161	1.45	2.49	1.83
	2017	53930511	59233506	56324922	1.5	0.98	1.18
	2018	54409778	59206215	56668986	0.89	–0.05	0.61
	2019	54502043	59102352	56733956	0.17	–0.18	0.11
Maharashtra	2013	57769653	63722075	60567132	–	–	–
	2014	58226832	63628993	60737597	0.79	–0.15	0.28
	2015	59655703	62771098	61167127	2.45	–1.35	0.71
	2016	58759202	62693555	60578794	–1.5	–0.12	–0.96
	2017	59382290	62418499	60804122	1.06	–0.44	0.37
	2018	59091884	64294375	61476598	–0.49	3.01	1.11
	2019	59398931	64790749	61872986	0.52	0.77	0.64
Odisha	2013	53358534	56699896	54931998	–	–	–
	2014	55127245	60392753	57498021	3.31	6.51	4.67
	2015	55293122	60411274	57632977	0.3	0.03	0.23
	2016	55998665	59901579	57719171	1.28	–0.84	0.15
	2017	56853389	60436779	58493569	1.53	0.89	1.34
	2018	58120589	61176135	59541786	2.23	1.22	1.79
	2019	58649846	62008447	60262147	0.91	1.36	1.21
Punjab	2013	59191542	64916753	61857455	–	–	–
	2014	59550439	65857998	62424923	0.61	1.45	0.92
	2015	60899811	65844665	63262599	2.27	–0.02	1.34
	2016	61550061	68108143	64520285	1.07	3.44	1.99
	2017	57071241	63567865	59940529	–7.28	–6.67	–7.1
	2018	57751153	64708777	60881562	1.19	1.79	1.57
	2019	58099121	63614113	60712063	0.6	–1.69	–0.28
Rajasthan	2013	54119805	62344742	58035707	–	–	–
	2014	53683468	61831097	57528438	–0.81	–0.82	–0.87
	2015	53842296	61678045	57275321	0.3	–0.25	–0.44
	2016	54301340	62818928	58088618	0.85	1.85	1.42
	2017	54181636	63040461	58047784	–0.22	0.35	–0.07
	2018	54520382	62507478	58117797	0.63	–0.85	0.12
	2019	54932776	63203652	58725880	0.76	1.11	1.05
Tamil Nadu	2013	55538141	62032273	58623936	–	–	–
	2014	56792465	61808812	59146198	2.26	–0.36	0.89
	2015	56718621	62396360	59339254	–0.13	0.95	0.33
	2016	57523396	63655551	60470285	1.42	2.02	1.91
	2017	57685914	63054668	60198645	0.28	–0.94	–0.45
	2018	59011322	64907690	61662600	2.3	2.94	2.43
	2019	60271825	66966585	63490141	2.14	3.17	2.96

(continued)

Table 1. Person-years lived above age x across age groups (continued)

State	India	T_x			Year-on-Year (%) change		
	Year	Male	Female	Both	Male	Female	Both
Telengana	2014	55930526	59180866	57425343	–	–	–
	2015	55725040	59471317	57209040	–0.37	0.49	–0.38
	2016	56623978	61663593	58698840	1.61	3.69	2.6
	2017	55061179	58563338	56668564	–2.76	–5.03	–3.46
	2018	55399776	59768906	57307184	0.61	2.06	1.13
	2019	55839829	60274677	57828233	0.79	0.85	0.91
Uttar Pradesh	2013	51374061	56533362	53690189	–	–	–
	2014	53082428	55830775	54427470	3.33	–1.24	1.37
	2015	52955624	55348825	54084165	–0.24	–0.86	–0.63
	2016	53218310	56238722	54621754	0.5	1.61	0.99
	2017	53170848	56880378	54887740	–0.09	1.14	0.49
	2018	53712560	56739087	55128471	1.02	–0.25	0.44
	2019	54186292	57663990	55859446	0.88	1.63	1.33
Uttarakhand	2014	55949762	66852592	60815227	–	–	–
	2015	54469847	62968333	58493493	–2.65	–5.81	–3.82
	2016	52710322	63270161	57485245	–3.23	0.48	–1.72
	2017	52544844	61903148	56647159	–0.31	–2.16	–1.46
	2018	54640248	63020572	58314509	3.99	1.81	2.94
	2019	53787936	62747868	58123209	–1.56	–0.43	–0.33
West Bengal	2013	56045846	59698923	57716818	–	–	–
	2014	57398962	60830836	58949472	2.41	1.9	2.14
	2015	58798361	61703681	60169887	2.44	1.43	2.07
	2016	59170220	61732767	60349742	0.63	0.05	0.3
	2017	59017904	61210811	60077811	–0.26	–0.85	–0.45
	2018	58212971	62928110	60333345	–1.36	2.81	0.43
	2019	59309752	64457226	61643025	1.88	2.43	2.17
Kyrgyzstan		T_x			Year-on-Year (%) change		
Region	Year	Male	Female	Both	Male	Female	Both
Batken oblast	2013	58770926.6	63001765	58682333.2	–	–	–
	2014	58693278.3	62167040.2	60425867.6	–0.13	–1.32	2.97
	2015	58885498.1	63022643	60968320.3	0.33	1.38	0.9
	2016	55382128.6	62839141.7	59003725.2	–5.95	–0.29	–3.22
	2017	56380447	65398242.7	60742765.8	1.8	4.07	2.95
	2018	57348443.2	65554233.8	61310171.5	1.72	0.24	0.93
	2019	58000148.3	66443446.6	62087002.1	2.87	1.6	1.27
Bishkek city	2013	55554061.9	67594061.1	62140007.1	–	–	–
	2014	55607787	67252656.5	61987770.7	0.1	–0.51	–0.24
	2015	57555521.2	67990270.2	63386326	3.5	1.1	2.26
	2016	59590227.1	69343862.6	65032205.7	3.54	1.99	2.6
	2017	59715690	70090466.6	65473100.4	0.21	1.08	0.68
	2018	61063275.3	70918572.4	66333309.8	2.26	1.18	1.31
	2019	60955153.6	71352975.4	66690932.1	2.08	1.8	0.54

(continued)

Table 1. Person-years lived above age x across age groups (continued)

Kyrgyzstan		T_x			Year-on-Year (%) change		
Region	Year	Male	Female	Both	Male	Female	Both
Chuy oblast	2013	48810477.5	61550368.7	55010018.3	–	–	–
	2014	49322979.3	61281669	55226158.4	1.05	–0.44	0.39
	2015	51177910.6	62725050.3	56967290.9	3.76	2.36	3.15
	2016	51599677.2	63508875.8	57530100.7	0.82	1.25	0.99
	2017	52341659.2	64146256	58251075.6	1.44	1	1.25
	2018	53074606.8	64162419.5	58590761.5	1.4	0.03	0.58
	2019	53917178.7	65463764.2	59689468	3.01	2.05	1.88
Issyk-Kul oblast	2013	47165797.2	60903469.5	53732768.5	–	–	–
	2014	48193791.8	62265784.4	54898348.5	2.18	2.24	2.17
	2015	48789166.6	61816040.3	55083652	1.24	–0.72	0.34
	2016	51081778.7	63384414.6	57167345.6	4.7	2.54	3.78
	2017	50455704.3	65316251	57610813.3	–1.23	3.05	0.78
	2018	51304904.3	65187179.2	58201987	1.68	–0.2	1.03
	2019	51882550	65009341.1	58326225	2.83	–0.47	0.21
Jalal-Abad oblast	2013	53241605	62111931.9	57609234.1	–	–	–
	2014	52714594.5	61637813.3	57113089.3	–0.99	–0.76	–0.86
	2015	52988592.4	61832844.3	57296639.5	0.52	0.32	0.32
	2016	54428072.1	62983145.6	58681395.5	2.72	1.86	2.42
	2017	55068520.7	64049552.1	59524440.1	1.18	1.69	1.44
	2018	56642994.5	64450807.7	60587085.4	2.86	0.63	1.79
	2019	56311067.3	64202749	60247503.3	2.26	0.24	–0.56
Naryn oblast	2013	47476648.8	61630919.8	53924216.5	–	–	–
	2014	47789581.7	61975817.1	54248265.5	0.66	0.56	0.6
	2015	48507603.1	61596632.7	54531069.3	1.5	–0.61	0.52
	2016	49840854.5	62833485.9	55857765.7	2.75	2.01	2.43
	2017	51624627.6	63471786.3	57211169.8	3.58	1.02	2.42
	2018	50723855.8	64528515.6	58196799.3	–1.74	1.66	1.72
	2019	50724351.1	64085917.2	56932127.9	–1.74	0.97	–2.17
Osh city	2013	50940947.4	58924476.7	54996516.2	–	–	–
	2014	51487423.8	58361856.5	55103978.6	1.07	–0.95	0.2
	2015	51962081.8	60602612.7	56373753.5	0.92	3.84	2.3
	2016	52499334.3	61026635.4	56916144.4	1.03	0.7	0.96
	2017	54947257.4	61186019.1	58200437.6	4.66	0.26	2.26
	2018	55588287.7	63319839.4	59714098.6	1.17	3.49	2.6
	2019	56081561.6	64450494.5	60520011.8	2.06	5.34	1.35
Osh oblast	2013	54275884.8	62579367.7	58316897.1	–	–	–
	2014	53709828.3	62332103.6	57946770.3	–1.04	–0.4	–0.63
	2015	54803899.2	62289003.3	58476827.5	2.04	–0.07	0.91
	2016	56202608.9	63496818.5	59830999.7	2.55	1.94	2.32
	2017	56225908.6	64542107.6	60326900.2	0.04	1.65	0.83
	2018	56912544.3	65491480.7	61394302.7	1.22	1.47	1.77
	2019	56750815.1	65770742.1	61196283.8	0.93	1.9	–0.32

(continued)

Table 1. Person-years lived above age x across age groups (continued)

Kyrgyzstan		T_x			Year-on-Year (%) change		
Region	Year	Male	Female	Both	Male	Female	Both
Talas oblast	2013	51313173.2	61963857.4	56381415.3	–	–	–
	2014	49483847.9	62961911.9	55752194.3	–3.57	1.61	–1.12
	2015	51528019.3	64163767.6	57528902.1	4.13	1.91	3.19
	2016	52713757	63493375.6	57875353.1	2.3	–1.04	0.6
	2017	53675406.9	64667194.4	59015833.1	1.82	1.85	1.97
	2018	55636800.7	65428692	60460220.9	3.65	1.18	2.45
	2019	54406938.2	65408912.5	59716333	1.36	1.15	–1.23
The Russian Federation		T_x			Year-on-Year (%) change		
Region	Year	Male	Female	Both	Male	Female	Both
Central Federal District	2013	51432430	66673841	59243019	–	–	–
	2014	51521199	66878784	59375701	0.17	0.31	0.22
	2015	52571876	67149927	60091731	2.04	0.41	1.21
	2016	53529324	67607213	60818863	1.82	0.68	1.21
	2017	54621885	68415646	61801304	2.04	1.2	1.62
	2018	54794002	68501047	61904983	0.32	0.12	0.17
	2019	55624789	69063301	62593576	1.84	0.95	1.28
Far Eastern Federal District	2013	46004818	61815417	53703150	–	–	–
	2014	46391829	62110250	54072309	0.84	0.48	0.69
	2015	46926469	62368667	54504742	1.15	0.42	0.8
	2016	47846622	63186267	55397595	1.96	1.31	1.64
	2017	48767095	63932733	56288976	1.92	1.18	1.61
	2018	49158326	63893817	56516892	0.8	–0.06	0.4
	2019	49164600	63973139	56522626	0.82	0.06	0.42
North Caucasian Federal District	2013	56258972	67979979	62363944	–	–	–
	2014	56426418	68106740	62490044	0.3	0.19	0.2
	2015	57121614	68732948	63167456	1.23	0.92	1.08
	2016	58239869	69419617	64088016	1.96	1	1.46
	2017	59122625	70104801	64881564	1.52	0.99	1.24
	2018	59553382	70595272	65340229	0.73	0.7	0.71
	2019	60456078	70707644	65832788	2.26	0.86	1.47
Northwestern Federal District	2013	50094443	65643234	58132865	–	–	–
	2014	50367184	65865597	58365529	0.54	0.34	0.4
	2015	50815976	65920321	58639887	0.89	0.08	0.47
	2016	51787642	66613229	59501442	1.91	1.05	1.47
	2017	52801970	67378423	60422683	1.96	1.15	1.55
	2018	53196025	67839151	60865147	0.75	0.68	0.73
	2019	54000720	68231237	61473529	2.27	1.27	1.74
Siberian federal district	2013	48300163	64841711	56647097	–	–	–
	2014	48378762	64862170	56701570	0.16	0.03	0.1
	2015	48609230	64914575	56843188	0.48	0.08	0.25
	2016	49583482	65705856	57771750	2	1.22	1.63
	2017	50849920	66563334	58911714	2.55	1.31	1.97
	2018	51034612	66424465	58940495	0.36	–0.21	0.05
	2019	49822709	65024628	57576185	–2.02	–2.31	–2.27

(continued)

Table 1. Person-years lived above age x across age groups (continued)

The Russian Federation		T_x			Year-on-Year (%) change		
Region	Year	Male	Female	Both	Male	Female	Both
Southern Federal District	2013	51526775	65987275	58885011	–	–	–
	2014	51356751	65844464	58710880	–0.33	–0.22	–0.3
	2015	51884614	66099930	59136427	1.03	0.39	0.72
	2016	52770697	66712226	59908185	1.71	0.93	1.31
	2017	53831810	67375027	60803448	2.01	0.99	1.49
	2018	54429067	67646397	61245976	1.11	0.4	0.73
	2019	54429344	67909625	61355785	1.11	0.79	0.91
Ural federal district	2013	48300163	64841711	56647097	–	–	–
	2014	48378762	64862170	56701570	0.16	0.03	0.1
	2015	48609230	64914575	56843188	0.48	0.08	0.25
	2016	49583482	65705856	57771750	2	1.22	1.63
	2017	50849920	66563334	58911714	2.55	1.31	1.97
	2018	51034612	66424465	58940495	0.36	–0.21	0.05
	2019	51709869	66943724	59557519	1.69	0.57	1.1
Volga Federal District	2013	48079060	65025852	56568232	–	–	–
	2014	48182663	65230848	56722405	0.22	0.32	0.27
	2015	48865028	65434029	57212574	1.42	0.31	0.86
	2016	50247743	66274859	58399830	2.83	1.29	2.08
	2017	51374899	66949339	59370358	2.24	1.02	1.66
	2018	51479339	66973697	59426541	0.2	0.04	0.09
	2019	52186371	67671274	60153010	1.58	1.08	1.32