Expanding the Life Tables to Include the Healthy Life Expectancy.

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Abstract

We provide a method to expand the Life Tables to include the Healthy Life Years Lost to Disability (HLYL), to estimate the Proportion with Disability and then apply the Sullivan Method to estimate the Healthy Life Expectancy (HLE) and the Healthy Life Years Lost (HLYL). The main Template is provided in Excel. The Template is based on the ten column life table from the Human Mortality Database (HMD) expanded by adding another seven columns for estimating the proportion of disability and another four columns to apply the Sullivan method for calculating the HLE and the HLYL. In the Template only the first five columns from the life table from HMD are inserted, while the next sixteen columns are automatically calculated. Applications in Czechia and Hungary are presented while the conference power point is included in the Appendix.

See https://doi.org/10.1007/978-3-030-44695-6_3 for details and ask about the related programs in Excel from the authors or download at http://www.asmda.es/demographics2023.html .

Key words: Life Expectancy, Healthy Life Expectancy, Life Tables, Health Parameters, Healthy Life Years Lost.

Introduction and Model Building

We provide a method to expand the Life Tables in Czechia and Hungary, to include the Healthy Life Years Lost to Disability (HLYL), to estimate the Proportion with Disability and then apply the Sullivan Method (Sullivan, 1971) to estimate the Disability Free Life Expectancy (DFLE) or the Healthy Life Expectancy (HLE) and the Healthy Life Years Lost (HLYL). The main part of the theory appears in: Skiadas, C. H., & Skiadas, C. (2020). Direct healthy life expectancy estimates from life tables with a Sullivan extension. Bridging the gap between HALE and Eurostat estimates. In The Springer series on demographic methods and population analysis 50. https://doi.org/10.1007/978-3-030-44695-6_3 .

The Life Tables are provided by the Human Mortality Database (HMD) at the related website https://www.mortality.org/ . The first five columns are included in the HMD life table, and the rest sixteen columns are completed by the authors of this paper following the theory presented by Skiadas and Skiadas in 2018a, b and 2020a, b, c.

Both life table applications in the Czechia and Hungary provide important information for the health of the population. However, more information is provided by estimating not only the life expectancy but also the healthy life expectancy and the healthy life years lost and the disability percentage, by expanding the provided life tables as we do in the present paper.

Estimates of HLYL and HLE (C H Skiadas and C Skiadas, 2016, first version). TEMPLATE
Add mortality data in this Excel file and do not change the supporting files as they run automatically

http://www.asmda.es/demographics2023.html | **Country** | **Czechia** | **Males** | **2019** | **26-Oct-22**

Add the first 5 columns from Human Mortality Database - The Life Expectancy (LE), the Healthy Life Expectancy (HLE) and the Healthy Life Years Lost (HLYL) are calculated in the next 16 columns of this Template - See Czechia, males (1950-2019) and Spain (1908-2020)

Cumulative mortality Mx=Σ(dx/lx) | **Average Cumulative Mortality Mx/x** | **Years of disability influence at age x** | **bx HLYL Indicator PLYL/lx** | **Disability Parameter** | **Person life years lost PLYL** | **Proportion with disability**

Sullivan Method

Year	Age	mx	qx	ax	lx	dx	Lx	Tx	ex	Cumulative mortality Mx=Σ(dx/lx)	Average Cumulative Mortality Mx/x	Years of disability influence at age x xdx/Mx	bx HLYL Indicator PLYL/lx bx=(xdx)/(lxMx)	Disability Parameter kD	Person life years lost PLYL (xdx/Mx)*kD	Proportion with disability PxD	Person Years Lived whthout disability LxD	Total Years Lived without disability TxD	Disability free life expectancy (HLE) exD	Healthy Life Years Lost HLYL
2019	0	0.00285	0.00284	0.14	100000	284	99756	7634085	**76.34**	0.003	0.012	24000	0.24	0.0364	874	0.009	98884	6783576	**67.84**	8.51
2019	1	0.0002	0.0002	0.5	99716	20	99706	7534330	**75.56**	0.003	0.002	9840	0.10	0.0364	359	0.004	99348	6684693	**67.04**	8.52
2019	2	0.00015	0.00015	0.5	99696	15	99689	7434624	**74.57**	0.003	0.001	11720	0.11	0.0364	427	0.004	99273	6585345	**66.05**	8.52
2019	3	0.00012	0.00012	0.5	99681	12	99675	7334935	**73.58**	0.003	0.001	12648	0.12	0.0364	461	0.004	99236	6486072	**65.07**	8.52
2019	4	0.00009	0.00009	0.5	99669	9	99665	7235260	**72.59**	0.003	0.001	11872	0.14	0.0364	433	0.005	99156	6386836	**64.08**	8.51
2019	5	0.00011	0.00011	0.5	99660	11	99655	7135595	**71.60**	0.004	0.001	17178	0.21	0.0364	626	0.008	98903	6287680	**63.09**	8.51
2019	6	0.00018	0.00018	0.5	99649	18	99640	7035941	**70.61**	0.004	0.001	31596	0.19	0.0364	1151	0.007	98960	6188777	**62.11**	8.50
2019	7	0.00004	0.00004	0.5	99631	4	99629	6936300	**69.62**	0.004	0.000	8013	0.19	0.0364	292	0.007	98932	6089818	**61.12**	8.50
2019	8	0.00008	0.00008	0.5	99627	8	99623	6836671	**68.62**	0.004	0.000	17781	0.15	0.0364	648	0.006	99071	5990886	**60.13**	8.49
2019	9	0.00008	0.00008	0.5	99619	8	99615	6737048	**67.63**	0.004	0.000	19463	0.22	0.0364	709	0.008	98808	5891815	**59.14**	8.48
2019	10	0.00011	0.00011	0.5	99611	11	99606	6637432	**66.63**	0.004	0.000	28763	0.31	0.0364	1048	0.011	98470	5793007	**58.16**	8.48
2019	11	0.00016	0.00016	0.5	99600	16	99592	6537827	**65.64**	0.004	0.000	44054	0.38	0.0364	1605	0.014	98213	5694536	**57.17**	8.47
2019	12	0.00014	0.00014	0.5	99584	14	99577	6438234	**64.65**	0.004	0.000	40529	0.39	0.0364	1477	0.014	98150	5596323	**56.20**	8.45
2019	13	0.00011	0.00011	0.5	99571	11	99565	6338657	**63.66**	0.004	0.000	33529	0.35	0.0364	1222	0.013	98281	5498173	**55.22**	8.44
2019	14	0.0001	0.0001	0.5	99560	10	99555	6239092	**62.67**	0.005	0.000	32009	0.40	0.0364	1166	0.015	98103	5399893	**54.24**	8.43
2019	15	0.00016	0.00016	0.5	99550	16	99542	6139537	**61.67**	0.005	0.000	52866	0.47	0.0364	1926	0.017	97841	5301790	**53.26**	8.42
2019	16	0.00016	0.00016	0.5	99534	16	99526	6039995	**60.68**	0.005	0.000	54403	0.96	0.0364	1982	0.035	96055	5203949	**52.28**	8.40
2019	17	0.0005	0.0005	0.5	99518	50	99493	5940470	**59.69**	0.005	0.000	163373	1.29	0.0364	5952	0.047	94814	5107894	**51.33**	8.37
2019	18	0.0005	0.0005	0.5	99468	50	99443	5840977	**58.72**	0.006	0.000	157818	1.89	0.0364	5750	0.069	92604	5013080	**50.40**	8.32
2019	19	0.00077	0.00077	0.5	99418	77	99380	5741534	**57.75**	0.007	0.000	226177	2.00	0.0364	8240	0.073	92131	4920475	**49.49**	8.26
2019	20	0.00075	0.00075	0.5	99342	75	99304	5642154	**56.80**	0.007	0.000	207807	2.04	0.0364	7571	0.074	91919	4828344	**48.60**	8.19
2019	21	0.00068	0.00068	0.5	99267	68	99233	5542849	**55.84**	0.008	0.000	180733	1.87	0.0364	6585	0.068	92470	4736425	**47.71**	8.12
2019	22	0.00067	0.00067	0.5	99200	66	99166	5443616	**54.88**	0.009	0.000	171889	1.85	0.0364	6262	0.067	92486	4643955	**46.81**	8.06
2019	23	0.00079	0.00079	0.5	99133	78	99094	5344449	**53.91**	0.009	0.000	193931	1.83	0.0364	7065	0.067	92498	4551469	**45.91**	8.00
2019	24	0.00075	0.00075	0.5	99055	74	99018	5245355	**52.95**	0.010	0.000	177747	1.73	0.0364	6476	0.063	92763	4458971	**45.02**	7.94
2019	25	0.00064	0.00064	0.5	98981	63	98949	5146337	**51.99**	0.011	0.000	148471	1.53	0.0364	5409	0.056	93449	4366207	**44.11**	7.88
2019	26	0.00057	0.00057	0.5	98917	56	98889	5047389	**51.03**	0.011	0.000	130493	1.52	0.0364	4754	0.055	93430	4272758	**43.20**	7.83
2019	27	0.00075	0.00075	0.5	98861	74	98824	4948499	**50.06**	0.012	0.000	167132	1.58	0.0364	6089	0.057	93150	4179329	**42.27**	7.78
2019	28	0.00077	0.00077	0.5	98787	76	98749	4849676	**49.09**	0.013	0.000	167145	1.75	0.0364	6089	0.064	92467	4086178	**41.36**	7.73
2019	29	0.00086	0.00086	0.5	98711	85	98668	4750927	**48.13**	0.014	0.000	181077	1.63	0.0364	6597	0.059	92798	3993711	**40.46**	7.67
2019	30	0.00067	0.00067	0.5	98626	66	98593	4652259	**47.17**	0.015	0.000	138994	1.70	0.0364	5064	0.062	92470	3900913	**39.55**	7.62
2019	31	0.0009	0.0009	0.5	98560	89	98515	4553666	**46.20**	0.015	0.000	181439	1.64	0.0364	6610	0.060	92630	3808443	**38.64**	7.56
2019	32	0.00083	0.00083	0.5	98471	82	98430	4455151	**45.24**	0.016	0.000	163663	1.80	0.0364	5963	0.065	91987	3715814	**37.74**	7.51
2019	33	0.00097	0.00096	0.5	98389	94	98342	4356720	**44.28**	0.017	0.001	184072	1.83	0.0364	6706	0.067	91789	3623827	**36.83**	7.45
2019	34	0.00102	0.00102	0.5	98295	100	98245	4258378	**43.32**	0.018	0.001	189950	1.96	0.0364	6920	0.071	91227	3532038	**35.93**	7.39
2019	35	0.00112	0.00112	0.5	98195	110	98140	4160134	**42.37**	0.019	0.001	201977	1.97	0.0364	7358	0.072	91110	3440811	**35.04**	7.33
2019	36	0.00107	0.00107	0.5	98085	105	98032	4061994	**41.41**	0.020	0.001	187779	1.95	0.0364	6841	0.071	91069	3349700	**34.15**	7.26
2019	37	0.00108	0.00108	0.5	97980	106	97927	3963962	**40.46**	0.021	0.001	184738	1.95	0.0364	6730	0.071	90986	3258631	**33.26**	7.20
2019	38	0.00119	0.00119	0.5	97874	116	97816	3866035	**39.50**	0.023	0.001	197798	2.04	0.0364	7206	0.074	90540	3167646	**32.36**	7.14
2019	39	0.00133	0.00133	0.5	97757	130	97692	3768220	**38.55**	0.024	0.001	213987	2.24	0.0364	7796	0.082	89707	3077106	**31.48**	7.07
2019	40	0.00156	0.00156	0.5	97627	152	97551	3670527	**37.60**	0.026	0.001	241318	2.32	0.0364	8792	0.085	89303	2987398	**30.60**	7.00
2019	41	0.0015	0.0015	0.5	97475	146	97402	3572976	**36.66**	0.027	0.001	224236	2.50	0.0364	8169	0.091	88519	2898095	**29.73**	6.92
2019	42	0.00183	0.00183	0.5	97329	178	97240	3475574	**35.71**	0.029	0.001	262020	2.57	0.0364	9546	0.094	88138	2809576	**28.87**	6.84
2019	43	0.00191	0.0019	0.5	97151	185	97058	3378334	**34.77**	0.031	0.001	260783	2.68	0.0364	9501	0.097	87595	2721438	**28.01**	6.76
2019	44	0.00195	0.00195	0.5	96966	189	96872	3281276	**33.84**	0.033	0.001	257002	2.88	0.0364	9363	0.105	86713	2633843	**27.16**	6.68
2019	45	0.00249	0.00249	0.5	96777	241	96657	3184404	**32.90**	0.035	0.001	311222	3.03	0.0364	11339	0.110	85993	2547130	**26.32**	6.58
2019	46	0.00259	0.00258	0.5	96536	249	96412	3087748	**31.99**	0.038	0.001	306306	3.33	0.0364	11159	0.121	84702	2461137	**25.49**	6.49
2019	47	0.00305	0.00305	0.5	96287	294	96140	2991336	**31.07**	0.041	0.001	341399	3.48	0.0364	12438	0.127	83958	2376435	**24.68**	6.39
2019	48	0.00333	0.00333	0.5	95993	320	95833	2895196	**30.16**	0.044	0.001	350835	3.70	0.0364	12782	0.135	82902	2292477	**23.88**	6.28
2019	49	0.00374	0.00373	0.5	95674	357	95495	2799363	**29.26**	0.048	0.001	368629	4.07	0.0364	13430	0.148	81338	2209575	**23.09**	6.16
2019	50	0.00474	0.00473	0.5	95317	451	95091	2703867	**28.37**	0.053	0.001	432438	4.26	0.0364	15755	0.155	80347	2128237	**22.33**	6.04
2019	51	0.00484	0.00483	0.5	94866	458	94637	2608776	**27.50**	0.057	0.001	410533	4.45	0.0364	14957	0.162	79303	2047891	**21.59**	5.91
2019	52	0.00533	0.00532	0.5	94408	502	94157	2514139	**26.63**	0.063	0.001	419874	4.48	0.0364	15297	0.163	78795	1968588	**20.85**	5.78
2019	53	0.00592	0.0059	0.5	93906	554	93628	2419983	**25.77**	0.069	0.001	431460	4.40	0.0364	15719	0.160	78622	1889793	**20.12**	5.65
2019	54	0.00574	0.00572	0.5	93351	534	93084	2326354	**24.92**	0.074	0.001	391043	4.51	0.0364	14247	0.164	77780	1811171	**19.40**	5.52
2019	55	0.00688	0.00685	0.5	92817	636	92500	2233270	**24.06**	0.081	0.001	434193	4.49	0.0364	15819	0.164	77360	1733391	**18.68**	5.39
2019	56	0.00717	0.00714	0.5	92182	658	91853	2140770	**23.22**	0.088	0.002	420620	4.66	0.0364	15324	0.170	76271	1656031	**17.96**	5.26
2019	57	0.00788	0.00785	0.5	91524	718	91164	2048917	**22.39**	0.096	0.002	429165	4.91	0.0364	15635	0.179	74867	1579760	**17.26**	5.13
2019	58	0.00965	0.00961	0.5	90805	873	90369	1957753	**21.56**	0.106	0.002	482188	5.15	0.0364	17567	0.188	73411	1504892	**16.57**	4.99
2019	59	0.01051	0.01046	0.5	89932	941	89462	1867384	**20.76**	0.116	0.002	481142	5.48	0.0364	17529	0.200	71602	1431482	**15.92**	4.85
2019	60	0.0121	0.01203	0.5	88992	1,071	88456	1777922	**19.98**	0.128	0.002	504593	5.46	0.0364	18383	0.199	70857	1359880	**15.28**	4.70
2019	61	0.01231	0.01224	0.5	87921	1,076	87383	1689466	**19.22**	0.141	0.002	470722	5.63	0.0364	17149	0.205	69453	1289022	**14.66**	4.55
2019	62	0.01443	0.01432	0.5	86845	1,244	86223	1602083	**18.45**	0.155	0.002	501719	5.80	0.0364	18279	0.211	68017	1219569	**14.04**	4.40
2019	63	0.01661	0.01647	0.5	85601	1,410	84896	1515860	**17.71**	0.171	0.003	522351	6.07	0.0364	19030	0.221	66109	1151552	**13.45**	4.26
2019	64	0.0185	0.01833	0.5	84192	1,543	83420	1430963	**17.00**	0.190	0.003	524659	6.09	0.0364	19114	0.222	64898	1085442	**12.89**	4.10
2019	65	0.01912	0.01894	0.5	82648	1,565	81866	1347543	**16.30**	0.209	0.003	491378	6.13	0.0364	17902	0.223	63592	1020544	**12.35**	3.96
2019	66	0.02147	0.02124	0.5	81083	1,722	80222	1265678	**15.61**	0.230	0.003	498157	6.03	0.0364	18149	0.220	62589	956953	**11.80**	3.81
2019	67	0.02259	0.02234	0.5	79361	1,773	78474	1185456	**14.94**	0.252	0.004	474437	6.17	0.0364	17285	0.225	60826	894363	**11.27**	3.67
2019	68	0.0259	0.02556	0.5	77588	1,983	76596	1106982	**14.27**	0.278	0.004	489004	6.17	0.0364	17815	0.225	59385	833538	**10.74**	3.52
2019	69	0.02744	0.02707	0.5	75605	2,047	74581	1030385	**13.63**	0.305	0.004	466559	6.25	0.0364	16998	0.228	57604	774153	**10.24**	3.39
2019	70	0.02998	0.02954	0.5	73558	2,173	72472	955804	**12.99**	0.334	0.005	458090	6.17	0.0364	16689	0.225	56185	716549	**9.74**	3.25
2019	71	0.0316	0.03111	0.5	71385	2,221	70275	883332	**12.37**	0.366	0.005	434413	6.26	0.0364	15827	0.228	54245	660364	**9.25**	3.12
2019	72	0.03592	0.03529	0.5	69164	2,441	67944	813058	**11.76**	0.401	0.006	441503	6.39	0.0364	16085	0.233	52136	606119	**8.76**	2.99
2019	73	0.04019	0.0394	0.5	66724	2,629	65409	745114	**11.17**	0.440	0.006	438938	6.45	0.0364	15991	0.235	50030	553983	**8.30**	2.86
2019	74	0.04206	0.04119	0.5	64095	2,640	62775	679705	**10.60**	0.481	0.006	408567	6.51	0.0364	14885	0.237	47876	503953	**7.86**	2.74
2019	75	0.04667	0.04561	0.5	61455	2,803	60053	616930	**10.04**	0.527	0.007	401553	6.40	0.0364	14629	0.233	46056	456077	**7.42**	2.62
2019	76	0.04823	0.04709	0.5	58652	2,762	57271	556877	**9.49**	0.574	0.008	368030	6.47	0.0364	13408	0.236	43771	410020	**6.99**	2.50
2019	77	0.05431	0.05287	0.5	55890	2,955	54412	499606	**8.94**	0.627	0.008	365255	6.50	0.0364	13307	0.237	41522	366250	**6.55**	2.39
2019	78	0.05943	0.05772	0.5	52935	3,055	51407	445194	**8.41**	0.685	0.009	350303	6.63	0.0364	12762	0.242	38991	324728	**6.13**	2.28
2019	79	0.06479	0.06276	0.5	49879	3,130	48314	393787	**7.89**	0.747	0.009	332958	6.73	0.0364	12130	0.245	36462	285737	**5.73**	2.17
2019	80	0.07178	0.06929	0.5	46749	3,239	45129	345473	**7.39**	0.817	0.010	319268	6.90	0.0364	11632	0.251	33791	249275	**5.33**	2.06
2019	81	0.0808	0.07766	0.5	43510	3,379	41820	300343	**6.90**	0.894	0.011	307900	7.08	0.0364	11217	0.258	31036	215483	**4.95**	1.95
2019	82	0.08972	0.08587	0.5	40131	3,446	38408	258523	**6.44**	0.980	0.012	290020	7.22	0.0364	10566	0.263	28301	184447	**4.60**	1.85
2019	83	0.09836	0.09375	0.5	36685	3,439	34965	220115	**6.00**	1.074	0.013	267381	7.41	0.0364	9741	0.270	25523	156146	**4.26**	1.74
2019	84	0.11212	0.10616	0.5	33246	3,529	31481	185150	**5.57**	1.180	0.014	252699	7.74	0.0364	9206	0.282	22605	130623	**3.93**	1.64
2019	85	0.13217	0.12398	0.5	29716	3,684	27874	153669	**5.17**	1.304	0.015	241535	7.92	0.0364	8800	0.288	19834	108018	**3.63**	1.54
2019	86	0.14117	0.13186	0.5	26032	3,433	24316	125795	**4.83**	1.436	0.017	206765	7.97	0.0364	7533	0.290	17255	88184	**3.39**	1.44
2019	87	0.15163	0.14094	0.5	22599	3,185	21007	101479	**4.49**	1.577	0.018	176734	7.98	0.0364	6439	0.291	14902	70930	**3.14**	1.35
2019	88	0.17174	0.15816	0.5	19414	3,071	17879	80472	**4.15**	1.735	0.020	156614	8.13	0.0364	5706	0.296	12580	56027	**2.89**	1.26
2019	89	0.1965	0.17892	0.5	16344	2,924	14882	62593	**3.83**	1.914	0.021	136736	8.27	0.0364	4982	0.301	10396	43447	**2.66**	1.17
2019	90	0.21399	0.1933	0.5	13419	2,594	12122	47712	**3.56**	2.107	0.023	111399	8.37	0.0364	4059	0.305	8426	33051	**2.46**	1.09
2019	91	0.23725	0.21209	0.5	10825	2,296	9678	35589	**3.29**	2.319	0.025	90575	8.56	0.0364	3300	0.312	6658	24625	**2.27**	1.01
2019	92	0.27969	0.24538	0.5	8530	2,093	7483	25912	**3.04**	2.565	0.028	75483	8.58	0.0364	2750	0.313	5143	17967	**2.11**	0.93
2019	93	0.29377	0.25615	0.5	6437	1,649	5612	18429	**2.86**	2.821	0.030	54646	8.59	0.0364	1991	0.313	3856	12824	**1.99**	0.87
2019	94	0.31983	0.27574	0.5	4788	1,320	4128	12817	**2.68**	3.097	0.033	40288	8.42	0.0364	1468	0.307	2862	8969	**1.87**	0.80
2019	95	0.34633	0.29521	0.5	3468	1,024	2956	8689	**2.51**	3.392	0.036	28822	8.33	0.0364	1050	0.304	2058	6107	**1.76**	0.74
2019	96	0.37619	0.31663	0.5	2444	774	2057	5733	**2.35**	3.709	0.038	20136	8.24	0.0364	734	0.300	1439	4048	**1.66**	0.69
2019	97	0.40702	0.3382	0.5	1670	565	1388	3676	**2.20**	4.047	0.042	13609	8.15	0.0364	496	0.297	976	2609	**1.56**	0.64
2019	98	0.4386	0.35972	0.5	1105	398	906	2288	**2.07**	4.406	0.045	8888	8.04	0.0364	324	0.293	641	1634	**1.48**	0.59
2019	99	0.47069	0.38102	0.5	708	270	573	1382	**1.95**	4.787	0.048	5604	7.92	0.0364	204	0.289	408	993	**1.40**	0.55
2019	100	0.50302	0.40193	0.5	438	176	350	809	**1.85**	5.189	0.052	3410	7.78	0.0364	124	0.284	251	585	**1.34**	0.51
2019	101	0.53533	0.42229	0.5	262	111	207	459	**1.75**	5.612	0.055	2001	7.64	0.0364	73	0.278	149	334	**1.28**	0.48
2019	102	0.56734	0.44197	0.5	151	67	118	252	**1.67**	6.054	0.059	1133	7.48	0.0364	41	0.273	86	185	**1.22**	0.44
2019	103	0.5988	0.46083	0.5	84	39	65	134	**1.59**	6.515	0.063	618	7.32	0.0364	23	0.267	48	99	**1.18**	0.41
2019	104	0.62946	0.47878	0.5	46	22	35	69	**1.52**	6.993	0.067	326	7.15	0.0364	12	0.261	26	52	**1.14**	0.39
2019	105	0.65912	0.49574	0.5	24	12	18	35	**1.46**	7.489	0.071	166	6.98	0.0364	6	0.254	13	26	**1.10**	0.36
2019	106	0.68758	0.51167	0.5	12	6	9	17	**1.41**	8.001	0.075	82	6.81	0.0364	3	0.248	7	13	**1.07**	0.34
2019	107	0.71469	0.52654	0.5	6	3	4	8	**1.36**	8.527	0.079	39	6.63	0.0364	1	0.242	3	6	**1.04**	0.32
2019	108	0.74034	0.54033	0.5	3	1	2	4	**1.32**	9.068	0.084	18	6.46	0.0364	1	0.235	2	3	**1.02**	0.30
2019	109	0.76444	0.55305	0.5	1	1	1	2	**1.29**	9.621	0.088	8	6.19	0.0364	0	0.226	1	1	**1.00**	0.29
2019	110+	0.78695	1	1.27	1	1	1	1	**1.27**	10.621	0.095	6	6.02	0.0364	0	0.219	1	1	**0.99**	0.28

Fig. 1. Full Expanded Life Table with Disability Section and Sullivan Section for the Healthy Life Expectancy estimation for males in 2050 in Czechia. The Life Table is provided by the HMD. The first five columns are included in the HMD life table and the rest sixteen columns are completed by the authors of this paper following the theory presented by Skiadas and Skiadas in 2018a, b and 2020a, b, c.

The Life Table for Czechia is provided from the Human Mortality Database. Ten columns are provided starting from the age column, the number of persons dx died in the interval (x, x+1), the probability qx dying in (x, x+1), the Mean fraction ax of last year of life lived by persons died in [x, x + 1), the Number of person-years Lx lived in [x, x + 1), the Number of person-years Tx lived beyond x and the Life expectancy ex at x. This is the classical Life Table provided for the human population. A few years ago we expanded this life table to include the estimates of the Proportion with Disability, followed by four columns for the Sullivan Method (see Jagger et al., 2014) to estimate the Healthy Life Expectancy (HLE) and the Healthy Life Years Lost (HLYL).

First, we calculate the years of disability influence at age x (YDIx) as

$$YDIx = \frac{(x + a_x)d_x}{\sum_0^x q_x}$$

Figure 2 illustrates the form of the curve expressing the years with disability influence adopted for persons in Czechia. Then the Healthy Life Years Lost Indicator bx is calculated by dividing the YDIx by lx, the numbers of people living at x.

$$b_x = \frac{YDIx}{lx}$$

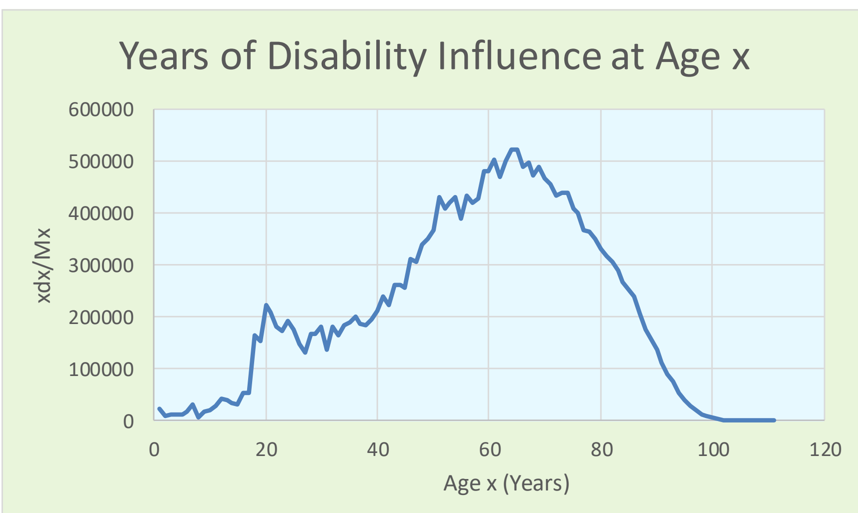


Fig. 2. Years of Disability Influence at age x to calculate bx.

The last formula is equal to the following to calculate to proportion with disability to form the Healthy Life Years Lost Indicator:

$$bx = \frac{(x + a_x)q_x}{\sum_0^x q_x}$$

This formula provides the average of dying probability qx over the mean probability at age x.

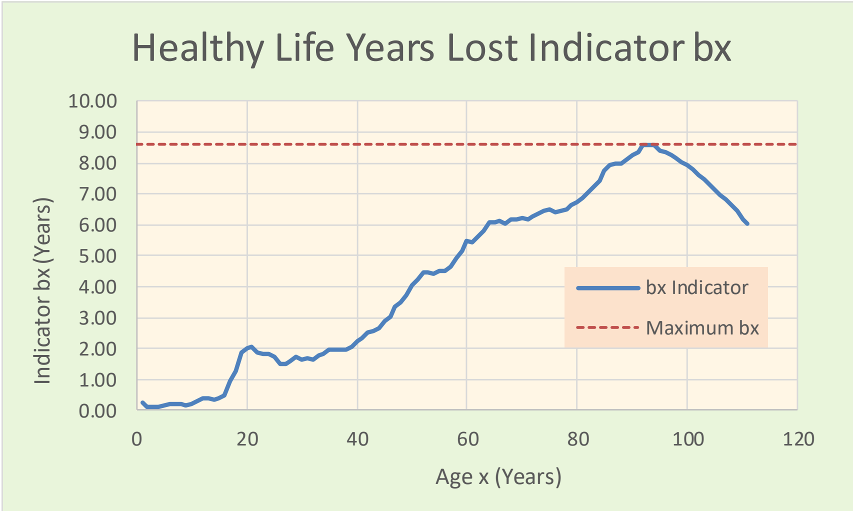


Fig. 3. Healthy Life Years Lost Indicator bx and maximum level.

The next column provides the disability parameter kD so that the maximum of bx=8.51 for males in Czechia in 2019 is the Healthy Life Years Lost (HLYL)=8.51 at age (0-1) years.
The proportion with disability (PxD) is

$$PxD = kb_x$$

After this stage the Person Years Lived without Disability (LxD) are estimated with the Sullivan method as

$$LxD = (1 - kb_x)L_x$$

The Total Years Lived without Disability (TxD) are then provided in the next column.

The Disability Free Life Expectancy or the Healthy Life Expectancy (HLE) at age x is given by

$$HLEx = \frac{TxD}{lx}$$

And the Healthy Life Years Lost (HLYL) at age x are provided by

$$HLYLx = LEx - HLEx$$

Where the life expectancy at age x is LEx=ex

The Survival vs Mortality space graph is used to provide bx to form the Healthy Life Years Lost Indicator. More information and details for the formula needed to estimate the healthy life years lost appear in several papers by Skiadas and Skiadas in 2018a, b and 2020a, b, c.

The survival curve Lx and the disability-free survival LxD are provided in Figure 1 and illustrated in Figure 4 for males the 2019 in Czechia. The space between the survival curve and the disability free survival curve (with orange color) corresponds to the disability period for males, while the space below the disability free survival curve (blue curve) is the healthy period for males in 2019.

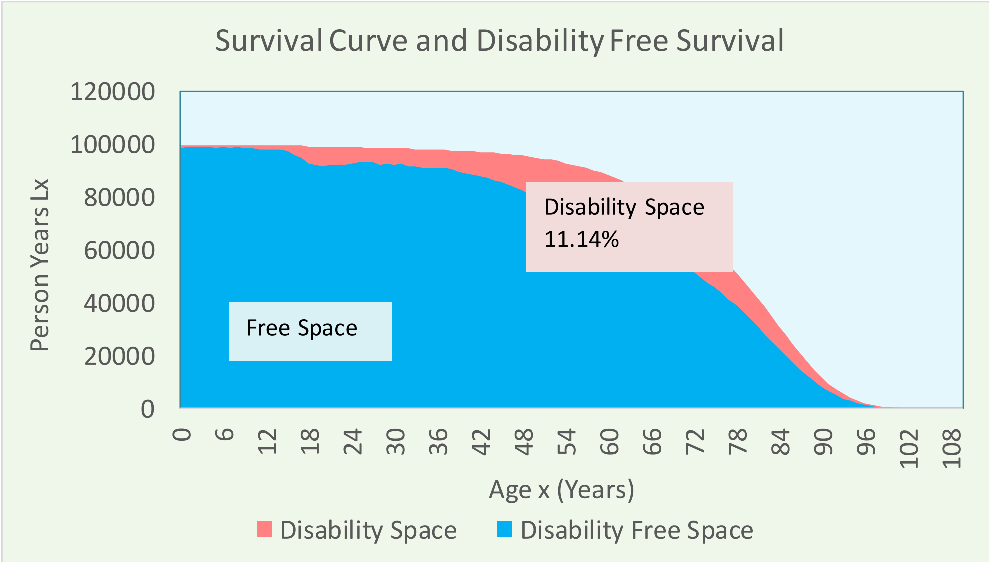


Fig. 4. Survival Curve and Disability Free Survival for males in Czechia, 2019 (Data from Figure 1).

Morbidity data

Following our estimates from the expanded Czechia's life table provided in Figure 1 the males's percentage lived with disability is 11.14%, which is around 11% (it is 9.59% for Hungary, males, 2019).

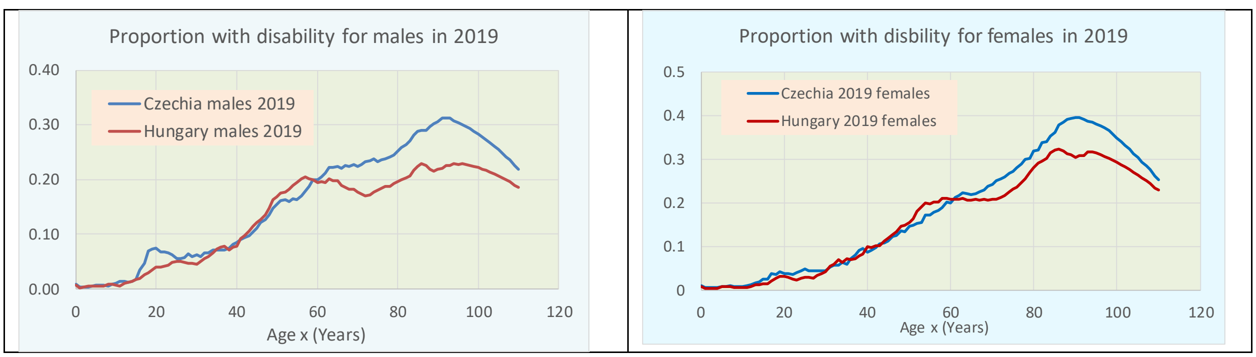


Fig. 5. Proportion with disability for males and females in Czechia and Hungary in 2019

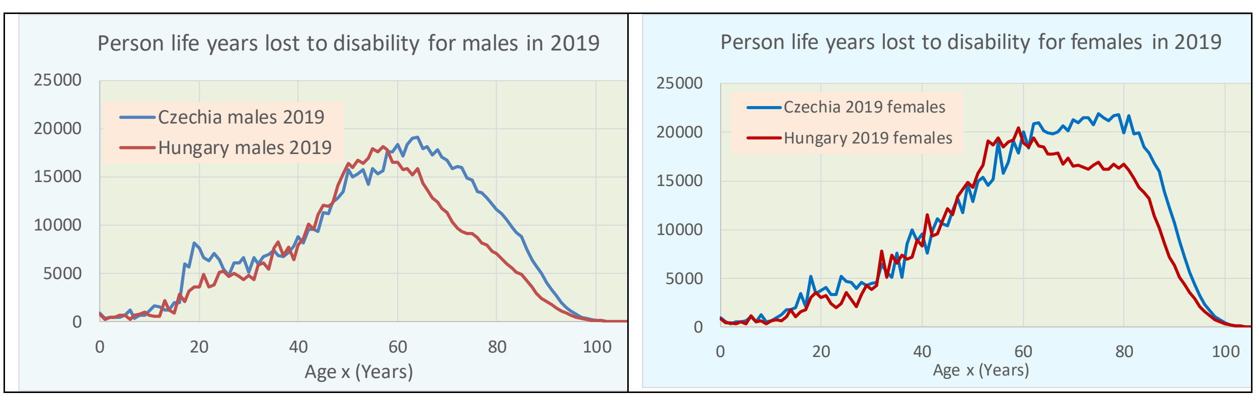


Fig. 6. Person life years lost to disability for males and females in Czechia and Hungary in 2019

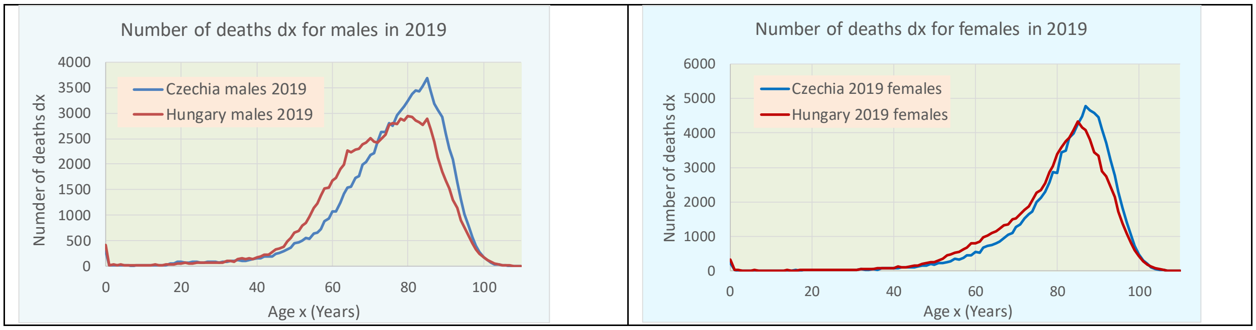


Fig. 7. Number of deaths dx for males and females in Czechia and Hungary in 2019

Summary and Conclusions

Our study has produced the expanded life tables for Czechia and Hungary, providing annual life expectancy and healthy life expectancy for Czechia and Hungary population. The construction and application of expanded form of life tables offers great support for the health and welfare sciences. Expanded life tables generated in the current study promote not only a better understanding of the life span and related health status, but also offer several applications for the healthy life estimation and research to improve the health and welfare professions. A main achievement was the presentation of the disability space for health state with characteristic graphs.

References

Jagger, C., Van Oyen, H., & Robine, J.-M. (2014). Health expectancy calculation by the Sullivan method: A practical guide. Newcastle upon Tyne: Institute for Ageing, Newcastle University.

Skiadas, C.H. and Skiadas, C. (2018a). The Health-Mortality Approach in Estimating the Healthy Life Years Lost Compared to the Global Burden of Disease Studies and Applications in World, USA and Japan. In Exploring the Health State of a Population by Dynamic Modeling Methods. The Springer Series on Demographic Methods and Population Analysis 45, Springer, Chum, Switzerland, pp 67-124. https://doi.org/10.1007/978-3-319-65142-2_4

Skiadas, C.H. and Skiadas, C. (2018b). Demography and Health Issues: Population Aging, Mortality and Data Analysis. The Springer Series on Demographic Methods and Population Analysis 46. Springer, Chum, Switzerland. https://doi.org/10.1007/978-3-319-76002-5

Skiadas C.H., Skiadas C. (2020a). Relation of the Weibull Shape Parameter with the Healthy Life Years Lost Estimates: Analytical Derivation and Estimation from an Extended Life Table. In: Skiadas C.H., Skiadas C. (eds) Demography of Population Health, Aging and Health Expenditures. The Springer Series on Demographic Methods and Population Analysis, vol 50. Springer, Cham. https://doi.org/10.1007/978-3-030-44695-6_2

Skiadas C.H., Skiadas C. (2020b). Direct Healthy Life Expectancy Estimates from Life Tables with a Sullivan Extension. Bridging the Gap Between HALE and Eurostat Estimates. In: Skiadas C.H., Skiadas C. (eds) Demography of Population Health, Aging and Health Expenditures. The Springer Series on Demographic Methods and Population Analysis, vol 50. Springer, Cham. https://doi.org/10.1007/978-3-030-44695-6_3

Skiadas C. H., Skiadas C. (2020c). How the unsolved problem of finding the Healthy Life Expectancy (HLE) in the far past was resolved: The case of Sweden (1751-2016) with forecasts to 2060 and comparisons with HALE. https://doi.org/10.31235/osf.io/akf8v

Sullivan, D. F. (1971). "A single index of mortality and morbidity." Health Services Mental Health Administration Health Reports 86: 347-354.

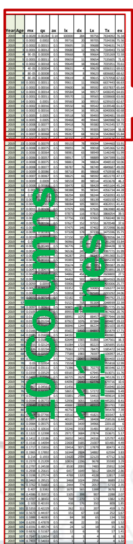
APPENDIX

The Conference Presentation is included herewith to support a better understanding of the theory and the very important applications.

OUTLINE

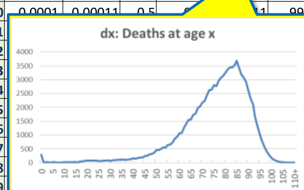
1. **Data**: Life Tables from www.mortality.org
2. An Excel template for estimation: **Healthy Life Expectancy** (HLE) and **Healthy Life Years Lost to disability (HLYL)** : Method Skiadas, C. H., & Skiadas, C. (2018-20)
3. Application to **Czechia** and **Hungary** for **2019** (Males & Females)
4. **Conclusions-Suggestions**

Data: Life Tables from Mortality.org



10 columns of Mortality Data,
111 Lines: Age x=0, 1, 2, …, 109, 110+

Year	Age	mx	qx	ax	lx	dx	Lx	Tx	ex
2019	0	0.0029	0.00284	0.14	100000	284	99756	7634092	76.34
2019	1	0.0002	0.0002	0.5	99716	20	99705	7534336	75.56
2019	2	0.0002	0.00015	0.5	99695	15	99688	7434631	74.57
2019	3	0.0001	0.00012	0.5	99680	12	99674	7334943	73.58
2019	4	0.0001	0.00009	0.5	99668	9	99664	7235269	72.59
2019	5	0.0001	0.00011	0.5	99659	11	99654	7135605	71.6
2019	6	0.0002	0.00018	0.5	99649	18	99640	7035951	70.61
2019	7	0.0000	0.00004	0.5	99631	4	99629	6936311	69.62
2019	8	0.0001	0.00008	0.5	99628	8	99623	6836682	68.62
2019	9	0.0001	0.00008	0.5	[illegible]	8	99615	6737058	67.63
2019	10	0.0001	0.00011	0.5	[illegible]	[illegible]	99606	6637443	66.63
2019	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6537837	65.64
2019	12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6438245	64.65
2019	13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6338668	63.66
2019	14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6239103	62.67
2019	15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6139548	61.67
2019	16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6040006	60.68
2019	17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5940481	59.69
2019	18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5840988	58.72
2019	19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5741545	57.75
2019	20	0.0008	0.00075	0.5	99342	75	99305	5642164	56.8



Year	Year or range of years (for both period & cohort data)
Age	Age group for *n*-year interval from exact age *x* to just before exact age *x+n*, where *n*=1, 4, 5, or ∞ (open age interval)
m(x)	Central death rate between ages *x* and *x+n*
q(x)	Probability of death between ages *x* and *x+n*
a(x)	Average length of survival between ages *x* and *x+n* for persons dying in the interval
l(x)	Number of survivors at exact age *x*, assuming l(0) = 100,000
d(x)	Number of deaths between ages *x* and *x+n*
L(x)	Number of person-years lived between ages *x* and *x+n*
T(x)	Number of person-years remaining after exact age *x*
e(x)	Life expectancy at exact age *x* (in years)

ESTIMATION: Years of Disability Influence

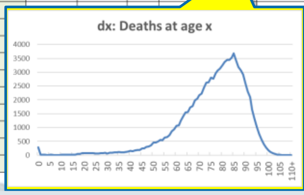
Skiadas & Skiadas Method (2020)

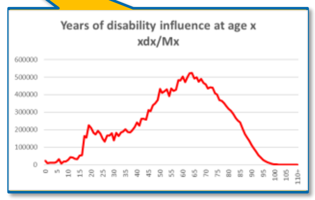
Years of Disability Influence at age *x* (*YDIx*)

$$YDIx = \frac{(x + a_x)d_x}{\sum_0^x q_x}$$

Mortality Data www.mortality.org

Year	Age	mx	qx	ax	lx	dx	Lx	Tx	ex	1 Cumulative mortality Mx=Σ(dx/lx)	2 Average Cumulative Mortality Mx/x	3 Years of disability influence at age x xdx/Mx
2019	0	0.0029	0.00284	0.14	100000	284	99756	7634092	76.34	0.003	0.012	24000
2019	1	0.0002	0.0002	0.5	99716	20	99705	7534336	75.56	0.003	0.002	9867
2019	2	0.0002	0.00015	0.5	99695	15	99688	7434631	74.57	0.003	0.001	11752
2019	3	0.0001	0.00012	0.5	99680	12	99674	7334943	73.58	0.003	0.001	12683
2019	4	0.0001	0.00009	0.5	99668	9	99664	7235269	72.59	0.003	0.001	11906
2019	5	0.0001	0.00011	0.5	99659	11	99654	7135605	71.6	0.004	0.001	17226
2019	6	0.0002	0.00018	0.5	99649	18	99640	7035951	70.61	0.004	0.001	31684
2019	7	0.0000	0.00004	0.5	99631	4	99629	6936311	69.62	0.004	0.000	8037
2019	8	0.0001	0.00008	0.5	99628	8	99623	6836682	68.62	0.004	0.000	17833
2019	9	0.0001	0.00008	0.5	99619	8	99615	6737058	67.63	0.004	0.000	19520
2019	10	0.0001	0.00011	0.5	[illegible]	[illegible]	99606	6637443	66.63	0.004	0.000	28847
2019								6537837	65.64	0.004	0.000	44182
2019								6438245	64.65	0.004	0.000	40649
2019								6338668	63.66	0.004	0.000	33631
2019								6239103	62.67	0.005	0.000	32108
2019								6139548	61.67	0.005	0.000	53028
2019								6040006	60.68	0.005	0.000	54573
2019								5940481	59.69	0.005	0.000	163859
2019								5840988	58.72	0.006	0.000	155420
2019								5741545	57.75	0.007	0.000	224647
2019								5642164	56.8	0.007	0.000	209127





ESTIMATION: Healthy Life Years Lost Indicator

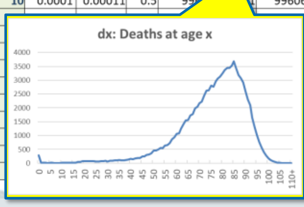
Skiadas & Skiadas Method (2020)

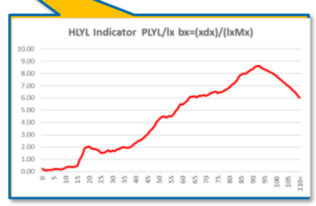
Healthy Life Years Lost Indicator b_x

$$b_x = \frac{YDIx}{lx}$$

Mortality Data www.mortality.org

Year	Age	mx	qx	ax	lx	dx	Lx	Tx	ex	1 Cumulative mortality Mx=Σ(dx/lx)	2 Average Cumulative Mortality Mx/x	3 Years of disability influence at age x xdx/Mx	4 bx HLYL Indicator PLYL/lx bx=(xdx) / (lxMx)
2019	0	0.0029	0.00284	0.14	100000	284	99756	7634092	76.34	0.003	0.012	24000	0.24
2019	1	0.0002	0.0002	0.5	99716	20	99705	7534336	75.56	0.003	0.002	9867	0.10
2019	2	0.0002	0.00015	0.5	99695	15	99688	7434631	74.57	0.003	0.001	11752	0.11
2019	3	0.0001	0.00012	0.5	99680	12	99674	7334943	73.58	0.003	0.001	12683	0.12
2019	4	0.0001	0.00009	0.5	99668	9	99664	7235269	72.59	0.003	0.001	11906	0.14
2019	5	0.0001	0.00011	0.5	99659	11	99654	7135605	71.6	0.004	0.001	17226	0.21
2019	6	0.0002	0.00018	0.5	99649	18	99640	7035951	70.61	0.004	0.001	31684	0.19
2019	7	0.0000	0.00004	0.5	99631	4	99629	6936311	69.62	0.004	0.000	8037	0.19
2019	8	0.0001	0.00008	0.5	99628	8	99623	6836682	68.62	0.004	0.000	17833	0.15
2019	9	0.0001	0.00008	0.5	99619	8	99615	6737058	67.63	0.004	0.000	19520	0.22
2019	10	0.0001	0.00011	0.5	[illegible]	[illegible]	99606	6637443	66.63	0.004	0.000	28847	0.31
2019								6537837	65.64	0.004	0.000	44182	0.38
2019								6438245	64.65	0.004	0.000	40649	0.39
2019								6338668	63.66	0.004	0.000	33631	0.35
2019								6239103	62.67	0.005	0.000	32108	0.40
2019								6139548	61.67	0.005	0.000	53028	0.47
2019								6040006	60.68	0.005	0.000	54573	0.96
2019								5940481	59.69	0.005	0.000	163859	1.29
2019								5840988	58.72	0.006	0.000	155420	1.89
2019								5741545	57.75	0.007	0.000	224647	2.00
2019								5642164	56.8	0.007	0.000	209127	2.04





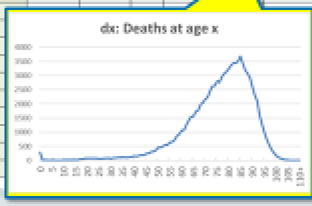
ESTIMATION: Person Life Years Lost

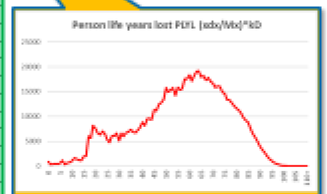
Skiadas & Skiadas Method (2020)

Person Life Years Lost PLYL (xdx/Mx)*kD

Mortality Data www.mortality.org

Year	Age	mx	qx	ax	lx	dx	Lx	Tx	ex	1 Cumulative mortality Mx=Σ(dx/lx)	2 Average Cumulative Mortality Mx/x	3 Years of disability influence at age x xdx/Mx	4 bx HLYL Indicator PLYL/lx bx=(xdx)/(lxMx)	5 Disability Parameter kD	Person life years lost PLYL (xdx/Mx)*kD
2019	0	0.0029	0.00284	0.14	100000	284	99756	7634092	76.34	0.003	0.012	24000	0.24	0.0364	875
2019	1	0.0002	0.0002	0.5	99716	20	99705	7534336	75.56	0.003	0.002	9867	0.10	0.0364	360
2019	2	0.0002	0.00015	0.5	99695	15	99688	7434631	74.57	0.003	0.001	11752	0.11	0.0364	428
2019	3	0.0001	0.00012	0.5	99680	12	99674	7334943	73.58	0.003	0.001	12683	0.12	0.0364	462
2019	4	0.0001	0.00009	0.5	99668	9	99664	7235269	72.59	0.003	0.001	11906	0.14	0.0364	434
2019	5	0.0001	0.00011	0.5	99659	11	99654	7135605	71.6	0.004	0.001	17226	0.21	0.0364	628
2019	6	0.0002	0.00018	0.5	99649	18	99640	7035951	70.61	0.004	0.001	31684	0.19	0.0364	1155
2019	7	0.0000	0.00004	0.5	99631	4	99629	6936311	69.62	0.004	0.000	8037	0.19	0.0364	293
2019	8	0.0001	0.00008	0.5	99628	8	99623	6836682	68.62	0.004	0.000	17833	0.15	0.0364	650
2019	9	0.0001	0.00008	0.5	99619	8	99615	6737058	67.63	0.004	0.000	19520	0.22	0.0364	711
2019	10	0.0001	0.00011	0.5	99	1	99606	6637443	66.63	0.004	0.000	28847	0.31	0.0364	1051
2019								6537837	65.64	0.004	0.000	44182	0.38	0.0364	1610
2019								6438245	64.65	0.004	0.000	40649	0.39	0.0364	1481
2019								6338668	63.66	0.004	0.000	33631	0.35	0.0364	1226
2019								6239103	62.67	0.005	0.000	32108	0.40	0.0364	1170
2019								6139548	61.67	0.005	0.000	53028	0.47	0.0364	1932
2019								6040006	60.68	0.005	0.000	54573	0.96	0.0364	1989
2019								5940481	59.69	0.005	0.000	163859	1.29	0.0364	5971
2019								5840988	58.72	0.006	0.000	155420	1.89	0.0364	5664
2019								5741545	57.75	0.007	0.000	224647	2.00	0.0364	8186
2019								5642164	56.8	0.007	0.000	209127	2.04	0.0364	7621





ESTIMATION: Proportion with Disability

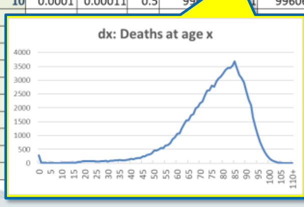
Skiadas & Skiadas Method (2020)

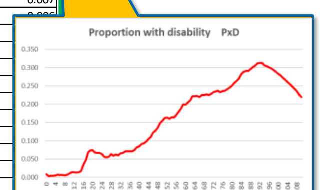
Proportion with Disability (*PxD*)

$$PxD = kb_x$$

Mortality Data www.mortality.org

Year	Age	mx	qx	ax	lx	dx	Lx	Tx	ex	1 Cumulative mortality Mx=Σ(dx/lx)	2 Average Cumulative Mortality Mx/x	3 Years of disability influence at age x xdx/Mx	4 bx HLYL Indicator PLYL/lx bx=(xdx) / (lxMx)	5 Disability Parameter kD	6 Person life years lost PLYL (xdx/Mx)*kD	Proportion with disability PxD
2019	0	0.0029	0.00284	0.14	100000	284	99756	7634092	76.34	0.003	0.012	24000	0.24	0.0364	875	0.009
2019	1	0.0002	0.0002	0.5	99716	20	99705	7534336	75.56	0.003	0.002	9867	0.10	0.0364	360	0.004
2019	2	0.0002	0.00015	0.5	99695	15	99688	7434631	74.57	0.003	0.001	11752	0.11	0.0364	428	0.004
2019	3	0.0001	0.00012	0.5	99680	12	99674	7334943	73.58	0.003	0.001	12683	0.12	0.0364	462	0.004
2019	4	0.0001	0.00009	0.5	99668	9	99664	7235269	72.59	0.003	0.001	11906	0.14	0.0364	434	0.005
2019	5	0.0001	0.00011	0.5	99659	11	99654	7135605	71.6	0.004	0.001	17226	0.21	0.0364	628	0.008
2019	6	0.0002	0.00018	0.5	99649	18	99640	7035951	70.61	0.004	0.001	31684	0.19	0.0364	1155	0.007
2019	7	0.0000	0.00004	0.5	99631	4	99629	6936311	69.62	0.004	0.000	8037	0.19	0.0364	293	0.007
2019	8	0.0001	0.00008	0.5	99628	8	99623	6836682	68.62	0.004	0.000	17833	0.15	0.0364	650	[illegible]
2019	9	0.0001	0.00008	0.5	99619	8	99615	6737058	67.63	0.004	0.000	19520	0.22	0.0364	711	
2019	10	0.0001	0.00011	0.5	99	1	99606	6637443	66.63	0.004	0.000	28847	0.31	0.0364	1051	
2019								6537837	65.64	0.004	0.000	44182	0.38	0.0364	1610	
2019								6438245	64.65	0.004	0.000	40649	0.39	0.0364	1481	
2019								6338668	63.66	0.004	0.000	33631	0.35	0.0364	1226	
2019								6239103	62.67	0.005	0.000	32108	0.40	0.0364	1170	
2019								6139548	61.67	0.005	0.000	53028	0.47	0.0364	1932	
2019								6040006	60.68	0.005	0.000	54573	0.96	0.0364	1989	
2019								5940481	59.69	0.005	0.000	163859	1.29	0.0364	5971	
2019								5840988	58.72	0.006	0.000	155420	1.89	0.0364	5664	
2019								5741545	57.75	0.007	0.000	224647	2.00	0.0364	8186	0.073
2019								5642164	56.8	0.007	0.000	209127	2.04	0.0364	7621	0.074





ESTIMATION: Person Years without Disability

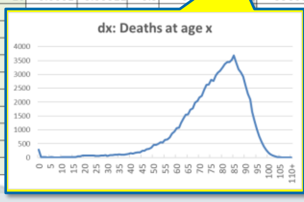
Skiadas & Skiadas (2020): Sullivan Method

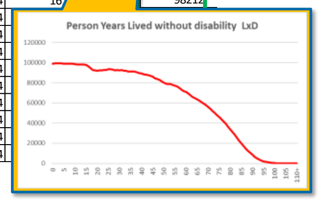
Person Years Lived without Disability (LxD)

$$LxD = (1 - kb_x)L_x$$

Mortality Data www.mortality.org

Year	Age	mx	qx	ax	lx	dx	Lx	Tx	ex	1 Cumulative mortality Mx=Σ(dx/lx)	2 Average Cumulative Mortality Mx/x	3 Years of disability influence at age x xdx/Mx	4 bx HLYL Indicator PLYL/lx bx=(xdx) / (lxMx)	5 Disability Parameter kD	6 Person life years lost PLYL (xdx/Mx)*kD	7 Proportion with disability PxD	Person Years Lived without disability LxD
2019	0	0.0029	0.00284	0.14	100000	284	99756	7634092	76.34	0.003	0.012	24000	0.24	0.0364	875	0.009	98883
2019	1	0.0002	0.0002	0.5	99716	20	99705	7534336	75.56	0.003	0.002	9867	0.10	0.0364	360	0.004	99346
2019	2	0.0002	0.00015	0.5	99695	15	99688	7434631	74.57	0.003	0.001	11752	0.11	0.0364	428	0.004	99272
2019	3	0.0001	0.00012	0.5	99680	12	99674	7334943	73.58	0.003	0.001	12683	0.12	0.0364	462		99235
2019	4	0.0001	0.00009	0.5	99668	9	99664	7235269	72.59	0.003	0.001	11906	0.14	0.0364	434		99154
2019	5	0.0001	0.00011	0.5	99659	11	99654	7135605	71.6	0.004	0.001	17226	0.21	0.0364	628		98902
2019	6	0.0002	0.00018	0.5	99649	18	99640	7035951	70.61	0.004	0.001	31684	0.19	0.0364	1155		98959
2019	7	0.0000	0.00004	0.5	99631	4	99629	6936311	69.62	0.004	0.000	8037	0.19	0.0364	293		98931
2019	8	0.0001	0.00008	0.5	99628	8	99623	6836682	68.62	0.004	0.000	17833	0.15	0.0364	650		99070
2019	9	0.0001	0.00008	0.5	99619	8	99615	6737058	67.63	0.004	0.000	19520	0.22	0.0364	711		98807
2019	10	0.0001	0.00011	0.5			99606	6637443	66.63	0.004	0.000	28847	0.31	0.0364	1051		98470
2019								6537837	65.64	0.004	0.000	44182	0.38	0.0364			98212
2019								6438245	64.65	0.004	0.000	40649	0.39	0.0364			
2019								6338668	63.66	0.004	0.000	33631	0.35	0.0364			
2019								6239103	62.67	0.005	0.000	32108	0.40	0.0364			
2019								6139548	61.67	0.005	0.000	53028	0.47	0.0364			
2019								6040006	60.68	0.005	0.000	54573	0.96	0.0364			
2019								5940481	59.69	0.005	0.000	163859	1.29	0.0364			
2019								5840988	58.72	0.006	0.000	155420	1.89	0.0364			
2019								5741545	57.75	0.007	0.000	224647	2.00	0.0364			
2019								5642164	56.8	0.007	0.000	209127	2.04	0.0364			





ESTIMATION: Healthy Life Expectancy

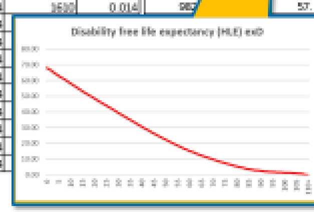
Skiadas & Skiadas Method (2020): Sullivan Method

Healthy Life Expectancy (HLE)

$$HLEx = \frac{TxD}{lx}$$

Mortality Data www.mortality.org

Year	Age	mx	qx	ax	lx	dx	Lx	Tx	ex	1 Cumulative mortality Mx=Σ(dx/lx)	2 Average Cumulative Mortality Mx/x	3 Years of disability influence at age x xdx/Mx	4 bx HLYL Indicator PLYL/lx bx=(xdx) / (lxMx)	5 Disability Parameter kD	6 Person life years lost PLYL (xdx/Mx)*kD	7 Proportion with disability PxD	Person Years Lived without disability LxD	Total Years Lived without disability TxD	Disability free life expectancy (HLE) exD
2019	0	0.0029	0.00284	0.14	100000	284	99756	7634092	76.34	0.003	0.012	24000	0.24	0.0364	875	0.009	98883	6783339	67.88
2019	1	0.0002	0.0002	0.5	99716	20	99705	7534336	75.56	0.003	0.002	9867	0.10	0.0364	360	0.004	99346	6684456	67.05
2019	2	0.0002	0.00015	0.5	99695	15	99688	7434631	74.57	0.003	0.001	11752	0.11	0.0364	428	0.004	99272	6585110	66.05
2019	3	0.0001	0.00012	0.5	99680	12	99674	7334943	73.58	0.003	0.001	12683	0.12	0.0364	462	0.004	99235		65.07
2019	4	0.0001	0.00009	0.5	99668	9	99664	7235269	72.59	0.003	0.001	11906	0.14	0.0364	434	0.005	99154		64.08
2019	5	0.0001	0.00011	0.5	99659	11	99654	7135605	71.6	0.004	0.001	17226	0.21	0.0364	628	0.006	98902		63.09
2019	6	0.0002	0.00018	0.5	99649	18	99640	7035951	70.61	0.004	0.001	31684	0.19	0.0364	1155	0.007	98959		62.10
2019	7	0.0000	0.00004	0.5	99631	4	99629	6936311	69.62	0.004	0.000	8037	0.19	0.0364	293	0.007	98931		61.12
2019	8	0.0001	0.00008	0.5	99628	8	99623	6836682	68.62	0.004	0.000	17833	0.15	0.0364	650	0.006	99070		60.13
2019	9	0.0001	0.00008	0.5	99619	8	99615	6737058	67.63	0.004	0.000	19520	0.22	0.0364	711	0.008	98807		59.14
2019	10	0.0001	0.00011	0.5			99606	6637443	66.63	0.004	0.000	28847	0.31	0.0364	1051	0.011			58.15
2019								6537837	65.64	0.004	0.000	44182	0.38	0.0364	1610	0.014			57.17
2019								6438245	64.65	0.004	0.000	40649	0.39	0.0364					
2019								6338668	63.66	0.004	0.000	33631	0.35	0.0364					
2019								6239103	62.67	0.005	0.000	32108	0.40	0.0364					
2019								6139548	61.67	0.005	0.000	53028	0.47	0.0364					
2019								6040006	60.68	0.005	0.000	54573	0.96	0.0364					
2019								5940481	59.69	0.005	0.000	163859	1.29	0.0364					
2019								5840988	58.72	0.006	0.000	155420	1.89	0.0364					
2019								5741545	57.75	0.007	0.000	224647	2.00	0.0364					
2019								5642164	56.8	0.007	0.000	209127	2.04	0.0364					



ESTIMATION: Healthy Life Years Lost (HLYL)

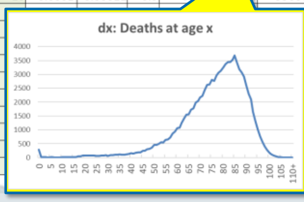
Skiadas & Skiadas Method (2020): Sullivan Method

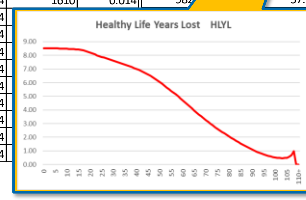
Healthy Life Years Lost
($HLYLx$)

$$HLYLx = LEx - HLEx$$

Mortality Data www.mortality.org

Year	Age	mx	qx	ax	lx	dx	Lx	Tx	ex	Cumulative mortality Mx=Σ(dx/lx)	Average Cumulative Mortality Mx/x	Years of disability influence at age x xdx/Mx	bx HLYL Indicator PLYL/lx bx=(xdx) / (lxMx)	Disability Parameter kD	Person life years lost PLYL (xdx/Mx)*kD	Proportion with disability PxD	Person Years Lived without disability LxD	Total Years Lived without disability TxD	Disability free life expectancy (HLE) exD	Healthy Life Years Lost HLYL
2019	0	0.0029	0.00284	0.14	100000	284	99756	7634092	76.34	0.003	0.012	24000	0.24	0.0364	875	0.009	98883	6783339	67.83	8.51
2019	1	0.0002	0.0002	0.5	99716	20	99705	7534336	75.56	0.003	0.002	9867	0.10	0.0364	360	0.004	99346	6684456	67.03	8.53
2019	2	0.0002	0.00015	0.5	99695	15	99688	7434631	74.57	0.003	0.001	11752	0.11	0.0364	428	0.004	99272	6585110		8.52
2019	3	0.0001	0.00012	0.5	99680	12	99674	7334943	73.58	0.003	0.001	12683	0.12	0.0364	462	0.004	99235	6485838		8.51
2019	4	0.0001	0.00009	0.5	99668	9	99664	7235269	72.59	0.003	0.001	11906	0.14	0.0364	434	0.005	99154	6386603		8.51
2019	5	0.0001	0.00011	0.5	99659	11	99654	7135605	71.6	0.004	0.001	17226	0.21	0.0364	628	0.008	98902	6287449		8.51
2019	6	0.0002	0.00018	0.5	99649	18	99640	7035951	70.61	0.004	0.001	31684	0.19	0.0364	1155	0.007	98959			8.51
2019	7	0.0000	0.00004	0.5	99631	4	99629	6936311	69.62	0.004	0.000	8037	0.19	0.0364	293	0.007	98931		61.12	8.50
2019	8	0.0001	0.00008	0.5	99628	8	99623	6836682	68.62	0.004	0.000	17833	0.15	0.0364	650	0.006	99070		60.13	8.49
2019	9	0.0001	0.00008	0.5	99619	8	99615	6737058	67.63	0.004	0.000	19520	0.22	0.0364	711	0.008	98807		59.14	8.49
2019	10	0.0001	0.00011	0.5			99606	6637443	66.63	0.004	0.000	28847	0.31	0.0364	1051	0.011	98470		58.15	8.48
2019								6537837	65.64	0.004	0.000	44182	0.38	0.0364	1610	0.014			57.17	8.47
2019								6438245	64.65	0.004	0.000	40649	0.39	0.0364						8.46
2019								6338668	63.66	0.004	0.000	33631	0.35	0.0364						8.44
2019								6239103	62.67	0.005	0.000	32108	0.40	0.0364						8.43
2019								6139548	61.67	0.005	0.000	53028	0.47	0.0364						8.41
2019								6040006	60.68	0.005	0.000	54573	0.96	0.0364						8.40
2019								5940481	59.69	0.005	0.000	163859	1.29	0.0364						8.37
2019								5840988	58.72	0.006	0.000	155420	1.89	0.0364						8.32
2019								5741545	57.75	0.007	0.000	224647	2.00	0.0364						8.26
2019								5642164	56.8	0.007	0.000	209127	2.04	0.0364						8.20

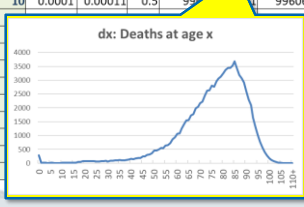


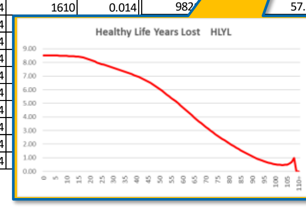


ESTIMATION: Excel Template

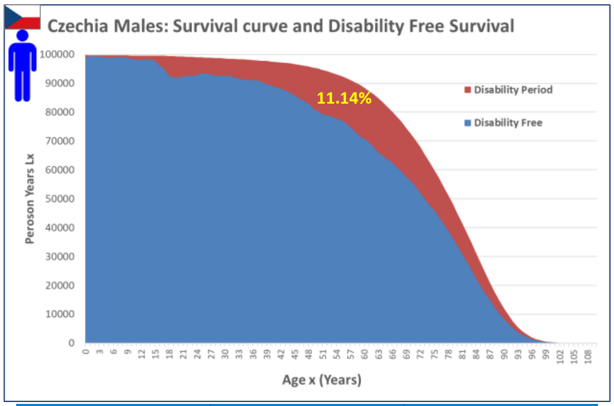
Mortality Data www.mortality.org 10 Columns	Expansion: 7 Columns Skiadas & Skiadas Method (2020)	Sullivan Method 4 Columns

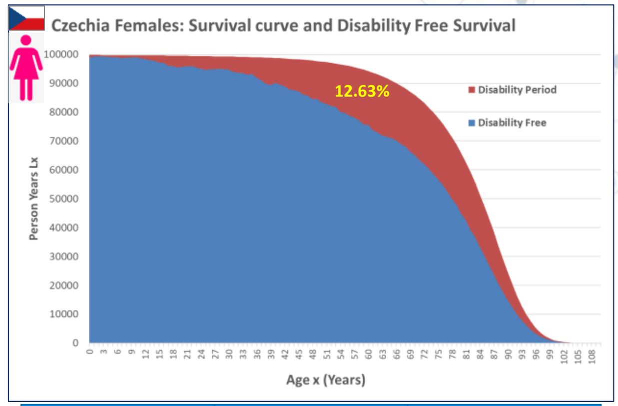
Year	Age	mx	qx	ax	lx	dx	Lx	Tx	ex	Cumulative mortality Mx=Σ(dx/lx)	Average Cumulative Mortality Mx/x	Years of disability influence at age x xdx/Mx	bx HLYL Indicator PLYL/lx bx=(xdx) / (lxMx)	Disability Parameter kD	Person life years lost PLYL (xdx/Mx)*kD	Proportion with disability PxD	Person Years Lived without disability LxD	Total Years Lived without disability TxD	Disability free life expectancy (HLE) exD	Healthy Life Years Lost HLYL
2019	0	0.0029	0.00284	0.14	100000	284	99756	7634092	76.34	0.003	0.012	24000	0.24	0.0364	875	0.009	98883	6783339	67.83	8.51
2019	1	0.0002	0.0002	0.5	99716	20	99705	7534336	75.56	0.003	0.002	9867	0.10	0.0364	360	0.004	99346	6684456	67.03	8.53
2019	2	0.0002	0.00015	0.5	99695	15	99688	7434631	74.57	0.003	0.001	11752	0.11	0.0364	428	0.004	99272	6585110		8.52
2019	3	0.0001	0.00012	0.5	99680	12	99674	7334943	73.58	0.003	0.001	12683	0.12	0.0364	462	0.004	99235	6485838		8.51
2019	4	0.0001	0.00009	0.5	99668	9	99664	7235269	72.59	0.003	0.001	11906	0.14	0.0364	434	0.005	99154	6386603		8.51
2019	5	0.0001	0.00011	0.5	99659	11	99654	7135605	71.6	0.004	0.001	17226	0.21	0.0364	628	0.008	98902	6287449		8.51
2019	6	0.0002	0.00018	0.5	99649	18	99640	7035951	70.61	0.004	0.001	31684	0.19	0.0364	1155	0.007	98959			8.51
2019	7	0.0000	0.00004	0.5	99631	4	99629	6936311	69.62	0.004	0.000	8037	0.19	0.0364	293	0.007	98931		61.12	8.50
2019	8	0.0001	0.00008	0.5	99628	8	99623	6836682	68.62	0.004	0.000	17833	0.15	0.0364	650	0.006	99070		60.13	8.49
2019	9	0.0001	0.00008	0.5	99619	8	99615	6737058	67.63	0.004	0.000	19520	0.22	0.0364	711	0.008	98807		59.14	8.49
2019	10	0.0001	0.00011	0.5			99606	6637443	66.63	0.004	0.000	28847	0.31	0.0364	1051	0.011	98470		58.15	8.48
2019								6537837	65.64	0.004	0.000	44182	0.38	0.0364	1610	0.014			57.17	8.47
2019								6438245	64.65	0.004	0.000	40649	0.39	0.0364						8.46
2019								6338668	63.66	0.004	0.000	33631	0.35	0.0364						8.44
2019								6239103	62.67	0.005	0.000	32108	0.40	0.0364						8.43
2019								6139548	61.67	0.005	0.000	53028	0.47	0.0364						8.41
2019								6040006	60.68	0.005	0.000	54573	0.96	0.0364						8.40
2019								5940481	59.69	0.005	0.000	163859	1.29	0.0364						8.37
2019								5840988	58.72	0.006	0.000	155420	1.89	0.0364						8.32
2019								5741545	57.75	0.007	0.000	224647	2.00	0.0364						8.26
2019								5642164	56.8	0.007	0.000	209127	2.04	0.0364						8.20





CZECHIA 2019 Disability Period

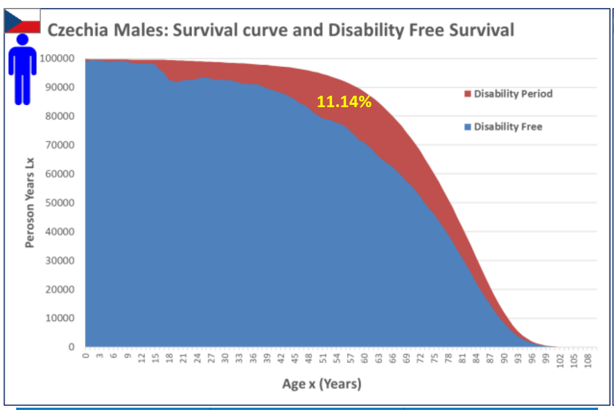


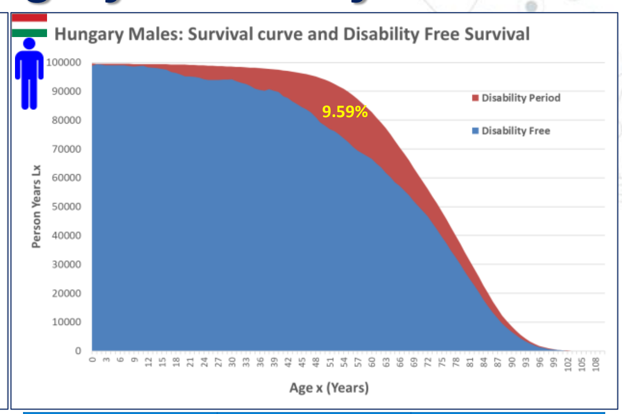


Life Expectancy	Healthy Life Expectancy	Healthy Life Years Lost
76.34	67.83	8.51

Life Expectancy	Healthy Life Expectancy	Healthy Life Years Lost
82.11	71.74	10.36

Males Czechia vs Hungary Disability Period

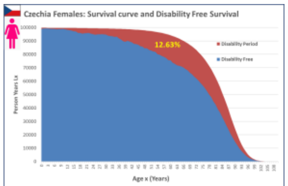




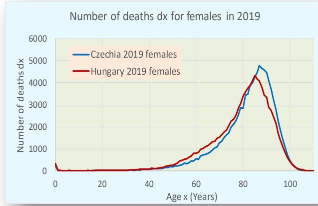
Life Expectancy	Healthy Life Expectancy	Healthy Life Years Lost
76.34	67.83	8.51

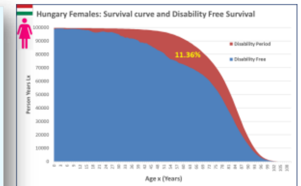
Life Expectancy	Healthy Life Expectancy	Healthy Life Years Lost
73.05	66.04	7.01

Czechia vs Hungary Disability Period (2019)

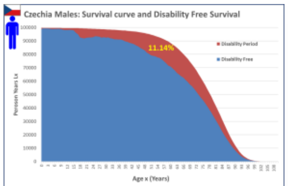


Life Expectancy	Healthy Life Expectancy	Healthy Life Years Lost
82.11	71.74	10.36

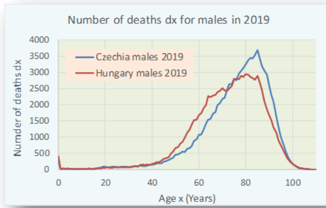


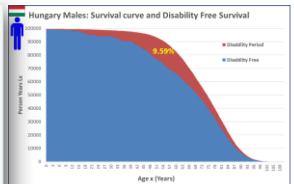


Life Expectancy	Healthy Life Expectancy	Healthy Life Years Lost
79.68	70.63	9.05



Life Expectancy	Healthy Life Expectancy	Healthy Life Years Lost
76.34	67.83	8.51





Life Expectancy	Healthy Life Expectancy	Healthy Life Years Lost
73.05	66.04	7.01

	LE	HLE	HLYL
	82.11	71.74	10.36
	79.68	70.63	9.05
	76.34	67.83	8.51
	73.05	66.04	7.01