85 歳以上ではいずれの国も女性の死亡率が高くなっている。

不慮の事故による死亡率をみると、男女とも 60 歳代までの死亡率は低く、男性は 75 歳以上から、女性は 80 歳以上から急激に上昇している。1990 年からの変化をみると、フランスの死亡率だけは男女とも低下傾向にあるが、他の国ではあまり低下していない。死亡率が最高の国と最低の国の差をみると、男女とも 0.003 以下に過ぎず、国による相違は小さい。男女の死亡率を比較すると、いずれの国も 50～60 歳代では男性の死亡率が女性の死亡率を２～３倍上回っており、男性に特徴的な死因といえる。

最後に自殺による死亡率は、全ての国において 65 歳以上では６死因中で４番目以降であり、死亡率の水準も 0.001 と低い。年齢別にみると、他の死因と異なり高年齢ほど水準が高くなるという傾向は弱く、年齢による水準の差は小さい。また 1990 年からの変化をみると、いずれの国も 0.001 未満であり、1990 年の水準からほとんど変化していない。死亡率が最高の国と最低の国の差をみると、男女とも 0.001 以下であり、国による相違はほとんどみられない。男女の死亡率水準を比較すると、全ての国のいずれの年齢においても男性の死亡率が上回っているが、特に 85 歳以上の死亡率をみると、男性の死亡率が女性の 2.7 倍以上と大きく上回っている。

ここまでの分析結果から、各国に共通した結果として、以下のことが明らかになった。第一に、いずれも循環器系疾患の一つである心疾患ならびに脳血管疾患の死亡率が高かった。とりわけ心疾患はほぼ全ての国・年齢で死因順位が１位と死亡率の水準が高いことに加え、低下幅および男女差も大きいことから、今後の死亡動向が注目される。第二に、脳血管疾患および結核は高年齢になるほど死亡率が急速に上昇しており、現在ではとりわけ 80 歳以上などの高年齢に特徴的な死因となっていることが示された。

５．日本の死因構造の特徴

前述のように、日本の高年齢における死亡率は長寿国と比べても低い水準にある。そこで、他の長寿国における死亡率の平均値と比較しながら、日本の死亡率がどの死因で異なっているのかを探りたい。

はじめに大分類について、他の長寿国よりも死亡率が低い死因は、特に男女の循環器系疾患と、女性の悪性新生物である。循環器系疾患による死亡率を他の長寿国と比較すると、84 歳以下での差は男女とも 0.010 未満とほとんど相違がないのに対し、85 歳以上では男性は 0.025、女性は 0.023 低くなっている。したがって日本の死亡率は、男女とも特に高年齢で低い水準であることが分かる。女性の悪性新生物による死亡率は、他の３か国における死亡率の平均と比べると全年齢で下回るものの、その差は最大でも 75～84 歳の 0.002 に過ぎない。したがって、悪性新生物による死亡率は長寿国との差を大きくする要因とはいえない。

反対に、長寿国よりも死亡率が高い死因は、特に男性の呼吸器系疾患である。男性の呼吸器系疾患による死亡率を他の長寿国と比較すると、85 歳以上では 0.025 高くなっている。この呼吸器系疾患の高さは、前述した循環器系疾患の低さによる差をほとんど帳消しにしている。女性の呼吸器系疾患も他の長寿国より高いものの、他の長寿国との差は 0.010 と小さい。他に日本の死亡率が長寿国よりも高い死因として、感染症および外因がある。しかしどちらも死亡率の水準が低いため、他の長寿国との差は大きくない。

次に死因中分類について他の長寿国と比べると、死亡率が低い死因は男女とも心疾患である。特に85歳以上では長寿国の平均との差が男性0.024、女性0.018と大きく、高年齢になるほど他の長寿国より死亡率が顕著に低くなっている。これとは反対に死亡率が高い死因は、男女とも肺炎と老衰である。肺炎による死亡率を長寿国の平均と比べると、84歳以下での差は0.001未満であるが、85歳以上では男性は0.022、女性は0.010と大きく上回っている。したがって肺炎による死亡率は、男女とも特に高年齢で長寿国よりも顕著に高いことが分かる。また、老衰による死亡率を他の長寿国と比較すると、男女とも85歳以上で0.005～0.006高くなっている。このほか、自殺、男性の脳血管疾患も長寿国と比べてやや高い。しかし、この中で長寿国との差が大きい男性の脳血管疾患でも老衰における差よりも小さく、死亡率全体の動向を左右するほどの相違はみられない。

1990年からの変化について、大分類における死因別死亡率の変化を他国と比べると、悪性新生物の死亡率は男女とも、1990年から若干上昇している。また循環器系疾患の85歳以上では、同期間に男性が0.037、女性も0.035低下しているが、この低下幅は表2で取り上げている6死因の国別・年齢別死亡率の中で最大である。中分類における低下幅をみると、脳血管疾患と老衰の低下幅は他国を上回っている。また心疾患も、85歳以上における死亡率の低下幅は他の3か国よりも大きい。

以上のように、長寿国の死因別死亡率と日本の死因別死亡率の比較から、日本は循環器系疾患、中でも心疾患と、女性ではさらに悪性新生物の死亡率が相対的に低いことが明らかになった。逆に死亡率が高い死因は呼吸器系疾患、特に肺炎であった。なお、日本は心疾患による死亡率が低いことについては、既にGordonが指摘している（Gordon 1957）。したがって同様の死因構造が、生活様式などの面でかなり欧米化している現在においても、日本と長寿国の間で観察されたことになる。このことから、日本の死因構造は潜在的に長寿国とは若干異なっていることが示唆される。

6．おわりに

以上、50歳以上の死亡率について、長寿国を対象に死因別死亡率の分析を行った。はじめに最新年次を対象に死因大分類による分析を行った結果、特に高年齢の主要死因は循環器系疾患であるなど、大分類でみた死因構造はほとんどが長寿国に共通していることが分かった。

死因区分を中分類とした場合をみると、取り上げた死因の中で最も死亡率が高い死因は心疾患であり、悪性新生物とならび現代の高年齢における主要死因であることが示された。そして、脳血管疾患と結核は高年齢になるほど死亡率が急速に上昇し、高年齢に特徴的な死因となっていた。

日本の死因構造を他の長寿国の死因構造と比べると、日本は循環器系疾患、中でも心疾患と、女性ではさらに悪性新生物の死亡率が相対的に低いことが明らかになった。特に日本の心疾患による死亡率の低さは長期に渡って観察されており、日本の死因構造の大きな特徴といえる。

以上の分析結果から、日本における今後の死亡動向を他の長寿国と比較して考える際は、とりわけ心疾患による死亡の動向に留意する必要があるといえる。それと同時に、日本は長寿国の中でも肺炎による死亡率の高さが目立っており、男女ともこの動向次第では更に死亡率が低下していく可能性も示唆される。

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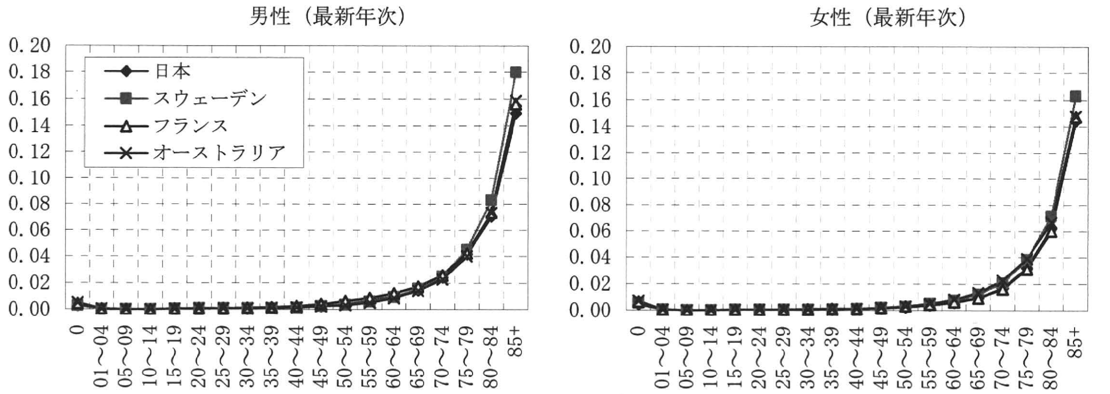
図１．最新年次における長寿国の男女・年齢別死亡率



資料：WHO, *WHO Mortality Database*（オンライン版）。

表１．最新年次における長寿国の男女・年齢別死亡率

男女／年齢	男性				女性			
	日本	フランス	スウェーデン	オーストラリア	日本	フランス	スウェーデン	オーストラリア
50～54	0.00405	0.00622	0.00368	0.00331	0.00199	0.00273	0.00229	0.00204
55～59	0.00659	0.00877	0.00574	0.00514	0.00291	0.00371	0.00371	0.00313
60～64	0.00978	0.01192	0.00952	0.00856	0.00401	0.00511	0.00589	0.00506
65～69	0.01455	0.01707	0.01543	0.01387	0.00595	0.00721	0.00989	0.00785
70～74	0.02398	0.02569	0.02514	0.02269	0.01048	0.01183	0.01561	0.01344
75～79	0.04170	0.04251	0.04505	0.04010	0.01882	0.02126	0.02893	0.02437
80～84	0.07040	0.07324	0.08287	0.07328	0.03587	0.04159	0.05512	0.04740
85+	0.14947	0.15640	0.18025	0.15855	0.10461	0.12443	0.15146	0.13026

資料：WHO, *WHO Mortality Database*（オンライン版）。

表２．長寿国における男女・年齢・死因（大分類）別死亡率：男性

死因	年齢	日本		フランス		スウェーデン		オーストラリア	
		1990年	2008年	1990年	2007年	1990年	2007年	1990年	2006年
感染症									
	50～54	0.00008	0.00008	0.00007	0.00012	0.00002	0.00008	0.00004	0.00008
	55～59	0.00014	0.00012	0.00011	0.00014	0.00004	0.00009	0.00003	0.00010
	60～64	0.00022	0.00019	0.00017	0.00018	0.00009	0.00010	0.00011	0.00013
	65～69	0.00040	0.00029	0.00027	0.00028	0.00015	0.00017	0.00010	0.00017
	70～74	0.00062	0.00053	0.00051	0.00041	0.00029	0.00030	0.00018	0.00029
	75～79	0.00101	0.00094	0.00081	0.00081	0.00038	0.00079	0.00045	0.00059
	80～84	0.00150	0.00155	0.00148	0.00149	0.00072	0.00161	0.00077	0.00108
	85+	0.00205	0.00282	0.00267	0.00300	0.00121	0.00372	0.00111	0.00212
悪性新生物									
	50～54	0.00182	0.00136	0.00316	0.00264	0.00136	0.00100	0.00184	0.00126
	55～59	0.00373	0.00271	0.00540	0.00414	0.00268	0.00193	0.00360	0.00228
	60～64	0.00597	0.00447	0.00805	0.00593	0.00439	0.00359	0.00593	0.00407
	65～69	0.00829	0.00681	0.01059	0.00831	0.00710	0.00602	0.00916	0.00656
	70～74	0.01200	0.01069	0.01377	0.01134	0.01107	0.00916	0.01275	0.00992
	75～79	0.01640	0.01625	0.01912	0.01556	0.01522	0.01403	0.01790	0.01461
	80～84	0.02149	0.02223	0.02499	0.02133	0.02023	0.02042	0.02345	0.02199
	85+	0.02443	0.03010	0.03228	0.02992	0.02730	0.02743	0.03111	0.03120
呼吸器系疾患									
	50～54	0.00017	0.00013	0.00020	0.00015	0.00015	0.00009	0.00020	0.00008
	55～59	0.00039	0.00029	0.00039	0.00025	0.00040	0.00019	0.00044	0.00019
	60～64	0.00086	0.00055	0.00072	0.00041	0.00058	0.00036	0.00108	0.00043
	65～69	0.00185	0.00119	0.00134	0.00076	0.00096	0.00059	0.00219	0.00096
	70～74	0.00455	0.00279	0.00236	0.00144	0.00223	0.00148	0.00414	0.00189
	75～79	0.01014	0.00685	0.00499	0.00301	0.00574	0.00300	0.00689	0.00394
	80～84	0.02022	0.01525	0.00973	0.00613	0.01129	0.00576	0.01200	0.00778
	85+	0.04127	0.04117	0.02425	0.01533	0.02636	0.01480	0.02216	0.01845
循環器系疾患									
	50～54	0.00141	0.00105	0.00135	0.00096	0.00175	0.00097	0.00194	0.00084
	55～59	0.00226	0.00161	0.00226	0.00145	0.00375	0.00172	0.00362	0.00125
	60～64	0.00353	0.00234	0.00403	0.00217	0.00672	0.00301	0.00640	0.00221
	65～69	0.00564	0.00339	0.00666	0.00349	0.01179	0.00546	0.01119	0.00366
	70～74	0.01083	0.00580	0.01090	0.00618	0.02157	0.00937	0.01902	0.00632
	75～79	0.02145	0.01086	0.02100	0.01163	0.03797	0.01856	0.03328	0.01300
	80～84	0.04056	0.01964	0.03734	0.02279	0.06146	0.03752	0.05293	0.02666
	85+	0.08240	0.04556	0.07239	0.05539	0.11574	0.08804	0.09724	0.06710
外因									
	50～54	0.00076	0.00078	0.00112	0.00080	0.00083	0.00076	0.00056	0.00046
	55～59	0.00086	0.00093	0.00111	0.00074	0.00089	0.00071	0.00069	0.00044
	60～64	0.00091	0.00095	0.00125	0.00071	0.00101	0.00078	0.00070	0.00045
	65～69	0.00101	0.00103	0.00147	0.00087	0.00096	0.00074	0.00069	0.00044
	70～74	0.00141	0.00128	0.00184	0.00121	0.00116	0.00094	0.00090	0.00060
	75～79	0.00194	0.00179	0.00283	0.00193	0.00190	0.00129	0.00124	0.00090
	80～84	0.00283	0.00279	0.00494	0.00335	0.00284	0.00289	0.00217	0.00180
	85+	0.00414	0.00498	0.01058	0.00799	0.00605	0.00695	0.00464	0.00479
その他									
	50～54	0.00081	0.00064	0.00157	0.00155	0.00091	0.00078	0.00070	0.00060
	55～59	0.00133	0.00093	0.00226	0.00205	0.00126	0.00110	0.00102	0.00088
	60～64	0.00172	0.00127	0.00301	0.00252	0.00160	0.00167	0.00160	0.00129
	65～69	0.00230	0.00183	0.00389	0.00337	0.00224	0.00245	0.00257	0.00208
	70～74	0.00383	0.00289	0.00598	0.00512	0.00378	0.00389	0.00383	0.00366
	75～79	0.00699	0.00501	0.01020	0.00957	0.00690	0.00738	0.00730	0.00706
	80～84	0.01349	0.00894	0.01889	0.01815	0.01357	0.01468	0.01275	0.01397
	85+	0.03444	0.02485	0.04326	0.04477	0.02888	0.03932	0.02921	0.03489

資料:WHO, *WHO Mortality Database*（オンライン版)。

表２（つづき）．長寿国における男女・年齢・死因（大分類）別死亡率：女性

死因	年齢	日本 1990年	日本 2008年	フランス 1990年	フランス 2007年	スウェーデン 1990年	スウェーデン 2007年	オーストラリア 1990年	オーストラリア 2006年
感染症									
	50～54	0.00003	0.00003	0.00003	0.00005	0.00001	0.00004	0.00003	0.00003
	55～59	0.00006	0.00005	0.00005	0.00006	0.00002	0.00008	0.00002	0.00003
	60～64	0.00010	0.00010	0.00007	0.00007	0.00005	0.00007	0.00005	0.00005
	65～69	0.00016	0.00017	0.00012	0.00011	0.00008	0.00013	0.00012	0.00010
	70～74	0.00026	0.00035	0.00023	0.00025	0.00015	0.00025	0.00013	0.00019
	75～79	0.00044	0.00065	0.00046	0.00047	0.00030	0.00051	0.00019	0.00037
	80～84	0.00071	0.00101	0.00093	0.00082	0.00053	0.00109	0.00040	0.00074
	85+	0.00131	0.00186	0.00197	0.00224	0.00094	0.00270	0.00102	0.00170
悪性新生物									
	50～54	0.00119	0.00112	0.00148	0.00140	0.00149	0.00119	0.00182	0.00119
	55～59	0.00176	0.00167	0.00219	0.00202	0.00264	0.00208	0.00261	0.00189
	60～64	0.00248	0.00216	0.00305	0.00280	0.00342	0.00322	0.00374	0.00285
	65～69	0.00363	0.00290	0.00410	0.00362	0.00520	0.00505	0.00525	0.00406
	70～74	0.00527	0.00437	0.00552	0.00501	0.00676	0.00672	0.00685	0.00569
	75～79	0.00741	0.00634	0.00794	0.00682	0.00885	0.00985	0.00863	0.00807
	80～84	0.01019	0.00924	0.01074	0.00961	0.01135	0.01151	0.01083	0.01127
	85+	0.01268	0.01452	0.01562	0.01400	0.01415	0.01440	0.01468	0.01518
呼吸器系疾患									
	50～54	0.00009	0.00006	0.00008	0.00006	0.00012	0.00009	0.00016	0.00005
	55～59	0.00016	0.00010	0.00013	0.00009	0.00017	0.00011	0.00027	0.00015
	60～64	0.00031	0.00016	0.00020	0.00014	0.00027	0.00026	0.00058	0.00038
	65～69	0.00067	0.00036	0.00038	0.00026	0.00067	0.00060	0.00099	0.00062
	70～74	0.00160	0.00086	0.00080	0.00051	0.00099	0.00119	0.00164	0.00113
	75～79	0.00367	0.00216	0.00187	0.00120	0.00251	0.00216	0.00258	0.00221
	80～84	0.00838	0.00526	0.00432	0.00255	0.00571	0.00365	0.00375	0.00413
	85+	0.02166	0.02039	0.01450	0.00926	0.01541	0.00939	0.00993	0.01120
循環器系疾患									
	50～54	0.00058	0.00035	0.00037	0.00029	0.00049	0.00035	0.00063	0.00031
	55～59	0.00092	0.00051	0.00070	0.00041	0.00118	0.00060	0.00118	0.00040
	60～64	0.00162	0.00078	0.00126	0.00064	0.00211	0.00113	0.00251	0.00079
	65～69	0.00305	0.00132	0.00247	0.00123	0.00436	0.00218	0.00507	0.00149
	70～74	0.00650	0.00276	0.00521	0.00257	0.00951	0.00447	0.01071	0.00351
	75～79	0.01450	0.00570	0.01236	0.00585	0.02092	0.00989	0.02132	0.00796
	80～84	0.03059	0.01251	0.02655	0.01370	0.04184	0.02441	0.04047	0.01875
	85+	0.07343	0.03991	0.06518	0.04757	0.10023	0.07803	0.09436	0.06425
外因									
	50～54	0.00029	0.00023	0.00042	0.00028	0.00032	0.00024	0.00020	0.00016
	55～59	0.00032	0.00026	0.00044	0.00031	0.00042	0.00026	0.00019	0.00017
	60～64	0.00038	0.00031	0.00050	0.00033	0.00041	0.00029	0.00029	0.00017
	65～69	0.00050	0.00041	0.00060	0.00039	0.00033	0.00031	0.00035	0.00019
	70～74	0.00075	0.00058	0.00089	0.00053	0.00060	0.00035	0.00047	0.00034
	75～79	0.00114	0.00091	0.00165	0.00091	0.00085	0.00060	0.00081	0.00053
	80～84	0.00172	0.00140	0.00323	0.00193	0.00187	0.00151	0.00117	0.00119
	85+	0.00276	0.00285	0.00943	0.00607	0.00415	0.00459	0.00303	0.00345
その他									
	50～54	0.00030	0.00021	0.00066	0.00065	0.00046	0.00039	0.00039	0.00157
	55～59	0.00050	0.00031	0.00090	0.00082	0.00065	0.00058	0.00062	0.00250
	60～64	0.00082	0.00050	0.00128	0.00113	0.00104	0.00092	0.00086	0.00432
	65～69	0.00138	0.00078	0.00184	0.00159	0.00142	0.00162	0.00157	0.00741
	70～74	0.00252	0.00156	0.00328	0.00295	0.00279	0.00264	0.00292	0.01183
	75～79	0.00485	0.00305	0.00671	0.00601	0.00488	0.00591	0.00534	0.02097
	80～84	0.01051	0.00645	0.01407	0.01298	0.01013	0.01294	0.01004	0.03720
	85+	0.03251	0.02508	0.04049	0.04530	0.02798	0.04234	0.02463	0.06277

資料:WHO, *WHO Mortality Database* (オンライン版)。

表３．長寿国における男女・年齢・死因（中分類）別死亡率：男性

死因	年齢	日本 1990年	日本 2008年	フランス 1990年	フランス 2007年	スウェーデン 1990年	スウェーデン 2007年	オーストラリア 1990年	オーストラリア 2006年
肺炎									
	50～54	0.00010	0.00008	0.00008	0.00001	0.00006	0.00004	0.00004	0.00002
	55～59	0.00022	0.00017	0.00017	0.00004	0.00010	0.00006	0.00005	0.00003
	60～64	0.00049	0.00031	0.00017	0.00008	0.00014	0.00010	0.00014	0.00005
	65～69	0.00106	0.00066	0.00028	0.00009	0.00028	0.00015	0.00021	0.00012
	70～74	0.00277	0.00158	0.00083	0.00018	0.00056	0.00030	0.00049	0.00019
	75～79	0.00667	0.00402	0.00313	0.00076	0.00134	0.00069	0.00067	0.00066
	80～84	0.01401	0.00937	0.00685	0.00181	0.00299	0.00176	0.00179	0.00145
	85+	0.03019	0.02795	0.01882	0.00748	0.00892	0.00575	0.00558	0.00574
心疾患									
	50～54	0.00077	0.00059	0.00094	0.00065	0.00146	0.00078	0.00161	0.00068
	55～59	0.00127	0.00093	0.00155	0.00097	0.00304	0.00133	0.00307	0.00100
	60～64	0.00201	0.00135	0.00275	0.00142	0.00542	0.00228	0.00509	0.00172
	65～69	0.00322	0.00191	0.00447	0.00223	0.00952	0.00389	0.00883	0.00274
	70～74	0.00598	0.00310	0.00701	0.00386	0.01651	0.00650	0.01422	0.00443
	75～79	0.01159	0.00557	0.01284	0.00726	0.02728	0.01252	0.02375	0.00875
	80～84	0.02189	0.01003	0.02203	0.01433	0.04276	0.02594	0.03679	0.01794
	85+	0.04565	0.02471	0.04210	0.03633	0.07973	0.06298	0.06498	0.04588
脳血管疾患									
	50～54	0.00059	0.00039	0.00027	0.00015	0.00021	0.00013	0.00024	0.00012
	55～59	0.00091	0.00055	0.00043	0.00024	0.00048	0.00022	0.00039	0.00016
	60～64	0.00137	0.00081	0.00077	0.00037	0.00081	0.00039	0.00083	0.00031
	65～69	0.00210	0.00121	0.00131	0.00064	0.00148	0.00087	0.00148	0.00055
	70～74	0.00426	0.00224	0.00248	0.00128	0.00320	0.00173	0.00318	0.00122
	75～79	0.00865	0.00438	0.00541	0.00249	0.00728	0.00386	0.00653	0.00297
	80～84	0.01632	0.00789	0.01048	0.00498	0.01234	0.00749	0.01158	0.00640
	85+	0.03161	0.01745	0.02039	0.01093	0.02254	0.01620	0.02315	0.01531
老衰									
	50～54	…	…	…	…	…	…	…	…
	55～59	…	…	…	…	…	…	…	…
	60～64	0.00000	0.00000	…	…	…	…	0.00000	…
	65～69	0.00002	0.00001	0.00001	0.00000	…	…	0.00000	…
	70～74	0.00009	0.00004	0.00007	0.00001	…	0.00001	0.00000	…
	75～79	0.00054	0.00019	0.00017	0.00005	0.00004	0.00006	0.00001	0.00000
	80～84	0.00263	0.00081	0.00073	0.00021	0.00055	0.00023	0.00007	0.00001
	85+	0.01522	0.00727	0.00447	0.00225	0.00429	0.00387	0.00031	0.00029
不慮の事故									
	50～54	0.00037	0.00023	0.00060	0.00038	0.00032	0.00034	0.00032	0.00026
	55～59	0.00047	0.00031	0.00066	0.00037	0.00044	0.00033	0.00037	0.00024
	60～64	0.00056	0.00038	0.00079	0.00041	0.00050	0.00047	0.00042	0.00025
	65～69	0.00064	0.00052	0.00095	0.00049	0.00048	0.00042	0.00042	0.00028
	70～74	0.00094	0.00079	0.00125	0.00071	0.00067	0.00064	0.00059	0.00039
	75～79	0.00137	0.00127	0.00194	0.00123	0.00131	0.00091	0.00098	0.00063
	80～84	0.00204	0.00219	0.00362	0.00232	0.00221	0.00218	0.00177	0.00140
	85+	0.00309	0.00400	0.00868	0.00646	0.00518	0.00575	0.00406	0.00394
自殺									
	50～54	0.00034	0.00052	0.00042	0.00038	0.00033	0.00032	0.00023	0.00017
	55～59	0.00034	0.00057	0.00038	0.00032	0.00029	0.00026	0.00028	0.00016
	60～64	0.00031	0.00051	0.00039	0.00024	0.00036	0.00019	0.00024	0.00016
	65～69	0.00033	0.00043	0.00045	0.00029	0.00036	0.00023	0.00023	0.00012
	70～74	0.00042	0.00040	0.00051	0.00038	0.00043	0.00022	0.00028	0.00016
	75～79	0.00050	0.00038	0.00078	0.00050	0.00050	0.00020	0.00023	0.00014
	80～84	0.00070	0.00041	0.00114	0.00073	0.00055	0.00037	0.00036	0.00013
	85+	0.00091	0.00059	0.00160	0.00103	0.00069	0.00048	0.00053	0.00036

資料:WHO, *WHO Mortality Database*（オンライン版)。

表３（つづき）．長寿国における男女・年齢・死因（中分類）別死亡率：女性

死因	年齢	日本		フランス		スウェーデン		オーストラリア	
		1990年	2008年	1990年	2007年	1990年	2007年	1990年	2006年
肺炎									
	50～54	0.00004	0.00003	0.00004	0.00003	0.00002	0.00001	0.00001	0.00001
	55～59	0.00008	0.00005	0.00003	0.00003	0.00003	0.00002	0.00002	0.00002
	60～64	0.00017	0.00009	0.00006	0.00001	0.00004	0.00003	0.00005	0.00004
	65～69	0.00039	0.00020	0.00013	0.00005	0.00007	0.00006	0.00009	0.00006
	70～74	0.00101	0.00051	0.00034	0.00011	0.00020	0.00011	0.00023	0.00010
	75～79	0.00253	0.00135	0.00142	0.00037	0.00059	0.00030	0.00045	0.00025
	80～84	0.00625	0.00351	0.00402	0.00116	0.00150	0.00079	0.00095	0.00100
	85+	0.01671	0.01482	0.01227	0.00538	0.00591	0.00377	0.00483	0.00479
心疾患									
	50～54	0.00026	0.00014	0.00020	0.00014	0.00030	0.00023	0.00039	0.00016
	55～59	0.00045	0.00024	0.00040	0.00021	0.00080	0.00031	0.00084	0.00025
	60～64	0.00085	0.00037	0.00073	0.00034	0.00150	0.00069	0.00182	0.00051
	65～69	0.00164	0.00070	0.00149	0.00065	0.00319	0.00135	0.00372	0.00096
	70～74	0.00350	0.00147	0.00313	0.00144	0.00643	0.00274	0.00758	0.00214
	75～79	0.00774	0.00310	0.00715	0.00335	0.01372	0.00597	0.01431	0.00471
	80～84	0.01626	0.00680	0.01487	0.00787	0.02570	0.01569	0.02577	0.01133
	85+	0.03939	0.02236	0.03758	0.02921	0.06178	0.05173	0.05658	0.03972
脳血管疾患									
	50～54	0.00030	0.00018	0.00012	0.00008	0.00016	0.00010	0.00019	0.00010
	55～59	0.00043	0.00023	0.00021	0.00011	0.00028	0.00018	0.00026	0.00011
	60～64	0.00070	0.00034	0.00036	0.00015	0.00045	0.00026	0.00050	0.00019
	65～69	0.00127	0.00051	0.00068	0.00033	0.00083	0.00057	0.00098	0.00034
	70～74	0.00271	0.00104	0.00148	0.00069	0.00225	0.00112	0.00234	0.00097
	75～79	0.00603	0.00212	0.00379	0.00155	0.00529	0.00260	0.00551	0.00234
	80～84	0.01259	0.00473	0.00850	0.00362	0.01164	0.00595	0.01141	0.00569
	85+	0.02858	0.01473	0.01933	0.01034	0.02474	0.01711	0.02793	0.01863
老衰									
	50～54	…	…	…	…	…	…	…	…
	55～59	…	…	…	…	…	…	…	…
	60～64	0.00000	0.00000	…	…	…	…	…	…
	65～69	0.00001	0.00000	0.00001	0.00000	…	…	0.00000	…
	70～74	0.00008	0.00003	0.00003	0.00001	0.00002	0.00001	…	…
	75～79	0.00041	0.00012	0.00018	0.00004	0.00009	0.00007	0.00001	0.00001
	80～84	0.00235	0.00075	0.00077	0.00026	0.00043	0.00032	0.00004	0.00003
	85+	0.01630	0.00992	0.00561	0.00374	0.00513	0.00619	0.00058	0.00036
不慮の事故									
	50～54	0.00010	0.00007	0.00020	0.00012	0.00008	0.00010	0.00012	0.00008
	55～59	0.00013	0.00010	0.00022	0.00014	0.00014	0.00011	0.00011	0.00009
	60～64	0.00017	0.00012	0.00028	0.00018	0.00016	0.00012	0.00019	0.00011
	65～69	0.00026	0.00020	0.00039	0.00024	0.00015	0.00015	0.00026	0.00012
	70～74	0.00042	0.00036	0.00064	0.00036	0.00039	0.00017	0.00036	0.00022
	75～79	0.00066	0.00065	0.00131	0.00069	0.00060	0.00045	0.00070	0.00040
	80～84	0.00112	0.00109	0.00289	0.00159	0.00166	0.00123	0.00108	0.00100
	85+	0.00208	0.00235	0.00906	0.00556	0.00406	0.00409	0.00295	0.00303
自殺									
	50～54	0.00016	0.00014	0.00019	0.00014	0.00016	0.00010	0.00006	0.00005
	55～59	0.00017	0.00014	0.00019	0.00014	0.00018	0.00009	0.00006	0.00006
	60～64	0.00018	0.00016	0.00018	0.00013	0.00016	0.00011	0.00007	0.00004
	65～69	0.00022	0.00018	0.00017	0.00012	0.00014	0.00008	0.00008	0.00003
	70～74	0.00030	0.00018	0.00020	0.00012	0.00014	0.00009	0.00008	0.00006
	75～79	0.00042	0.00019	0.00026	0.00013	0.00019	0.00007	0.00008	0.00005
	80～84	0.00052	0.00020	0.00026	0.00014	0.00015	0.00009	0.00009	0.00005
	85+	0.00058	0.00022	0.00025	0.00015	0.00007	0.00005	0.00007	0.00004

資料:WHO, *WHO Mortality Database* (オンライン版)。

付表１．本稿で取り上げる国々の人口並びに平均寿命

年次	日本	フランス	ｽｳｪｰﾃﾞﾝ	ｵｰｽﾄﾗﾘｱ
人口（1,000人）				
1990	122,721	56,735	8,559	17,065
2006	126,154	61,598	9,081	20,395
2007	126,085	61,963	9,148	…
2008	125,947	…	9,220	…
平均寿命（年）				
男				
1990	75.99	73.27	74.81	74.04
2008	79.37	77.69	79.15	79.49
女				
1990	82.04	81.48	80.40	80.22
2008	86.15	84.73	83.10	84.02

資料：人口はWHO, *WHO Mortality Database*（オンライン版），平均寿命はWHO, *Life tables for WHO Member States, 1990, 2000, 2010 - by country and region*（オンライン版）。

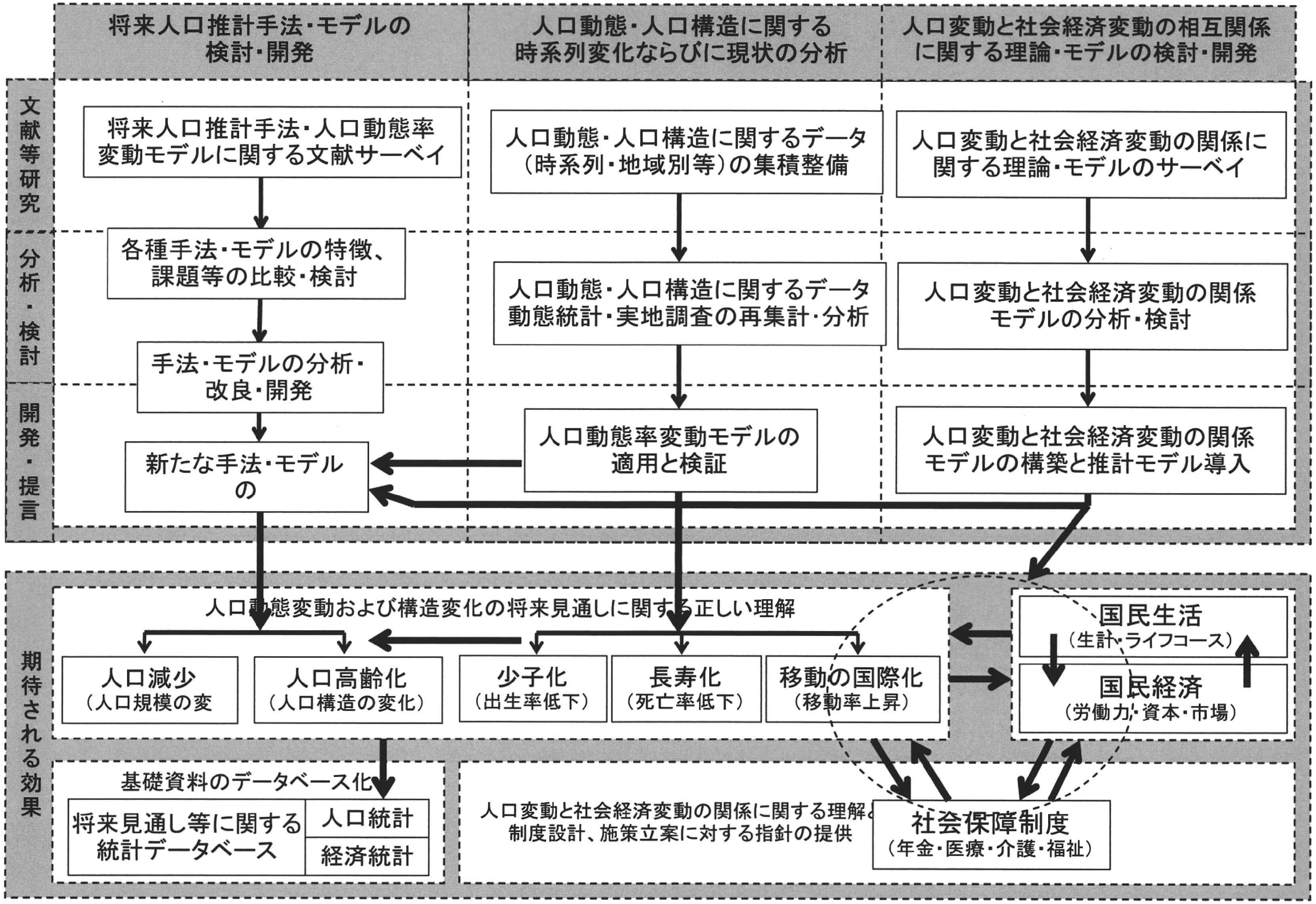
付表２．本稿における死因の区分ならびに死因分類番号

死因	ICD-9	ICD-10
【大分類】		
感染症	B01－B07	A00－B99
悪性新生物	B08－B14	C00－C97
呼吸器系疾患	B31－B32	J00－J99
循環器系疾患	B25－A30	I00－I99
外因	B47－B56	V00－Y98
その他	上記以外	上記以外
【中分類】		
肺炎	B321	J12－J18
心疾患	B251, B27－B28	I01-I09, I20-I25, I27, I30-I51
脳血管疾患	B29	I60－I69
老衰	B465	R54
不慮の事故	B47－B53	V01－X59
自殺	B54	X60－X84

資料：WHO, *WHO Mortality Database*（オンライン版）。
死因の区分については厚生労働省『人口動態統計』を参考にしている。

Ⅲ.　資 料 編

1　人口動態変動および構造変化の見通しとその推計手法に関する総合的研究 研究行程の流れ図



2　欧州連合統計局(Eurostat)・国連欧州経済委員会(UNECE) 将来人口推計に関する合同ワークセッションに関する報告

2010年4月28～30日、リスボンのポルトガル統計局において、欧州連合統計局(Eurostat)・国連欧州経済委員会(UNECE)主催、ポルトガル統計局協賛による将来人口推計に関する標記の会議(原題: Joint Eurostat/UNECE Work Session in Demographic Projections)が開催された。これは、将来人口推計に関する研究者、推計担当者、および将来推計のユーザーである政策担当者、統計の専門家が出席し、欧米を中心とした国レベルまたは国際レベルの人口推計の実施状況・方法論の報告、新たなアプローチや研究戦略などの討議を行うもので、1988年にスタートし、前回2007年10月に開かれたルーマニアのブカレストでの会議以来3年ぶりの開催となる。今回は、各国の公的統計機関、人口学に関する研究所、大学等を中心に、アルバニア、オーストリア、ボスニア・ヘルツェゴビナ、カナダ、カーボヴェルデ、クロアチア、チェコ、デンマーク、フィンランド、ドイツ、イスラエル、イタリア、日本、ラトビア、モンテネグロ、ノルウェー、ポーランド、ポルトガル、ロシア、セルビア、スロバキア、スロベニア、スペイン、スウェーデン、スイス、トルコ、イギリス、アメリカの全28か国から約90名の参加となった。また、欧州委員会の代表として、欧州連合統計局(Eurostat)、地域政策理事会(Directorate General for Regional Policy)及び経済財政理事会(Directorate General for Economic and Financial Affairs)が出席し、OECD、国連人口部、国際応用システム分析研究所(International Institute for Applied Systems Analysis, IIASA)、ならびにルーヴァン・カトリック大学(Université catholique de Louvain)の各組織からも代表として参加があった。

会議は、最初にAlda de Carvalho（ポルトガル統計局）、Inna Steinbuka (Eurostat)、Paolo Valente (UNECE)からの開会挨拶に続き、Victoria Velkoff (United States)が議長に選出された。その後、基調講演として、Ronald Hall (DG REGIO)による「地域人口変化と団結政策」、Maria Filomena Mendes (Portuguese Demographic Association)による「人口動態の変化、将来人口推計」が行われた。

個々の分野に関するセッションのテーマは以下の通りであった(括弧内は各セッションの座長名である)。

[1]　人口推計の挑戦と活用(Vanda Cunha, Ministry of Finance and Public Administration, Portugal)

[2]　死亡仮定の設定：データ・方法・分析(Graziella Caselli ,University of Rome “La Sapienza”, Italy)

[3]　出生仮定の設定：データ・方法・分析(Maria Filomena Mendes, Portuguese Demographic Association)

[4]　人口変動要因の推計：出生(Maria Filomena Mendes, Portuguese Demographic Association)

[5]　人口変動要因の推計：死亡(Graziella Caselli ,University of Rome “La Sapienza”, Italy)

[6] 移動仮定の設定：データ・方法・分析(Michel Poulain, Université catholique de Louvain, Belgium)

[7] 人口変動要因の推計：移動(Michel Poulain, Université catholique de Louvain, Belgium)

[8] 小規模人口及び国内地域人口の推計(João Peixoto, Universidade Técnica de Lisboa, Portugal)

[9] 年齢・性別人口推計を超えて(Jorge Muguel Bravo, Universidade de Évora, Portugal)

[10] 人口推計における確率的手法(Jutta Gampe, Max Planck Institute of Demographic Research, Rostock, Germany)

[11] 国レベルの確率的人口推計(Jutta Gampe, Max Planck Institute of Demographic Research, Rostock, Germany)

今回は報告数の増加のためか、前回までとはセッションの形式が異なり、初日午後および二日目については、2つのセッションが同時並行で行われる形となった。以下、その概要を述べる。

[1]では、人口推計の挑戦と活用として、スペインの国家統計研究所(Instituto Nacional de Estadística, INE)における人口推計の新たな戦略、Eurostatの人口推計をベースとしたEUの労働力・社会保障支出に関する推計、ポルトガルにおける教育水準と健康水準の関係などについての報告があった。[2]では、長期の死亡データが把握されているスウェーデンのコーホート死亡率に関する報告、イタリアの死亡率の男女格差に関するコーホート死亡率を利用した分析、スペインの生命表算定法に関する検討、ポルトガルの小地域の生命表を作成するための平滑法の応用に関する報告がなされた。[3],[4]の出生に関するセッションでは、本事業から岩澤美帆と金子隆一が、2005年以降の出生率回復に関する分析についての報告、また、金子隆一が、出生率のピリオド効果に出生推計システムを応用する研究についての報告を行った。[5]では本事業から石井太が、日本の死亡率推計への年齢変換アプローチの応用に関する報告を行った他、リー・カーター・モデルに死亡率の極限値を仮定するモデルの報告、また、このモデルをポルトガルの死亡率推計に応用した例についての報告があった。[6][7]の移動に関するセッションでは、国際人口移動データの概観の報告に続き、イギリスの移動仮定の不確実性に対するベイジアンアプローチの応用、イスラエルの人口移動推計、スウェーデン出身者の再移入推計についてのモデル、国際人口移動推計におけるエージェントベースアプローチ、経済モデルを利用したノルウェーの人口移動推計に関する報告がなされた。特に、イスラエルの人口移動推計においては他国在住のユダヤ人が、また、スウェーデン出身者の再移入推計においては他国在住のスウェーデン出身者が考慮されており、両者とも人口移動推計について自国以外の人口の流れを考慮している点が特徴的とのコメントが討論においてあった。[10]では決定論的推計と確率推計の組合せ、マイクロシミュレーションモデルにおけるメイトマッチングアルゴリズム、MicMacというプロジェクトにおけるMicソフトウェアを用いたマイクロシミュレーションについての報告があった。[11]ではカナダの労働力推計へのマイクロシミュレーションの応用、イギリスの人口推計への確率的手法の導入に関する進捗状況と今後の

課題についての報告があった。

これらの個別問題を討議するセッションに続き、「人口学的推計、特に人口推計において、『フィードバックメカニズム』を組み込むことは必要か、またどの程度必要か」と題する円卓討論がなされた後、今後の進め方に関する提案が議論され、報告書の採択が行われた。今後の進め方については、次回会議を3年以内に行うこととされ、今回と同様の議題に加え、人口推計の利用者の役割や行動モデルを人口推計に応用するアプローチなどが新たな議題案として提案された。

欧州においてもわが国と同様、今後、高齢化や人口減少が社会・経済に及ぼす影響は小さくないものと考えられ、人口学研究者や推計の担当者のみならず、政策立案者をはじめとする人口推計の利用者にとっても、将来人口推計の精度や信頼性の向上は関心が高いものと考えられる。本ワークセッションは、これらの者が一堂に会して科学的な方法論や先端的な技術に関する討議に参加するという点で、意義が高いものであった。現在、残念ながら、わが国において同様の議論が活発に行われているとは必ずしもいえない状況にある。本会議への参加を通じ、今後、わが国においても、人口推計に関する研究者と利用者が一体となり、推計に関する科学的な方法論からその利活用法に到るまでの包括的な議論を行うことのできる機会があることが望ましいのではないかと考えられる。

なお、欧州統計局による本会議の報告書、及び、本事業から報告を行った研究論文については以下の通りである。

○ 日本（本プロジェクト）からの参加

(1)事務局報告書およびリスボン報告書目次

2 June 2010

UNITED NATIONS STATISTICAL COMMISSION and ECONOMIC COMMISSION FOR EUROPE

STATISTICAL OFFICE OF THE EUROPEAN UNION (EUROSTAT)

CONFERENCE OF EUROPEAN STATISTICIANS

Joint Eurostat/UNECE Work Session on Demographic Projections
(28-30 April 2010, Lisbon, Portugal)

REPORT OF THE WORK SESSION ON DEMOGRAPHIC PROJECTIONS

I. INTRODUCTION

A. Participation

1. The joint UNECE/Eurostat Work Session on Demographic Projections was held in Lisbon, Portugal, on 28-30 April 2010 at the invitation of Statistics Portugal. It was attended by participants from national statistical organisations, demographic research institutes, universities, and other institutions representing the following countries: Albania, Austria, Bosnia and Herzegovina, Canada, Cape Verde, Croatia, Czech Republic, Denmark, Finland, Germany, Israel, Italy, Japan, Latvia, Luxembourg, Montenegro, Norway, Poland, Portugal, Russian Federation, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom and United States of America. The European Commission was represented by Eurostat, the Directorate General for Regional Policy and the Directorate General for Economic and Financial Affairs. The Organisation for Economic Cooperation and Development (OECD), the United Nations Population Division, the International Institute for Applied Systems Analysis (IIASA) and the Université catholique de Louvain (Belgium) were also represented.

B. Organization of the meeting

2. Ms. Alda de Caetano Carvalho, President of Statistics Portugal, Ms. Inna Šteinbuka, Director of Social and Information Society Statistics of Eurostat, and Paolo Valente, UNECE Statistical Division opened the meeting and welcomed the participants.

3. The agenda of the work session consisted of the following substantive topics:

(a) Challenges and use of population projections;

(b) Constructing assumptions for mortality: data, methods and analysis;

(c) Constructing assumptions for fertility: data, methods and analysis;

(d) Forecasting demographic components: fertility;

(e) Forecasting demographic components: mortality;

(f) Constructing assumptions for migration: data, methods and analysis;

(g) Forecasting demographic components: migration;

(h) Small population and sub-national population projections;

(i) Beyond population projections by age and sex;

(j) Stochastic techniques for demographic projections;

(k) Stochastic national demographic projections;

(l) Round-table discussion on “Is it necessary, and to what extent, to incorporate "feedback mechanisms" in demographic projections, in particular in population projections?

4. Ms. Victoria Velkoff (United States) was elected as Chair of the meeting. The following participants acted as session organizers: Ms. Vanda Cunha (Portugal) for topic (a), Ms. Graziella Caselli (Italy) for topics (b) and (e), Ms. Maria Filomena Mendes (Portugal) for topics (c), (d) and (l), Mr. Michel Poulain (Université catholique de Louvain, Belgium) for topics (f) and (g), Mr. Joao Peixoto (Portugal) for topic (h), Mr. Jorge Miguel Bravo for topic (i), Ms. Jutta Gampe (Germany) for topics (j) and (k).

5. Keynote lectures were given by Mr. Ronald Hall, Director of the Directorate General for Regional Policy of the European Commission, on "Regional population change and cohesion policy", and Ms. Maria Filomena Mendes, President of the Executive Board of the Portuguese Demographic Association, on "Demographic changes, demographic projections".

II. SUMMARY OF DISCUSSION OF SUBSTANTIVE TOPICS

A. Challenges and use of population projections

6. Spain presented the strategy developed to monitor the important demographic changes taking place in the country. It is based on the preparation of monthly population nowcasts, annual short-term and triennial long-term population projections.

7. The Directorate General for Economic and Financial Affairs of the European Commission presented the main economic and budgetary implications of demographic changes in the long term in the European Union (EU) as a whole and at Member State level, based on Eurostat projections EUROPOP2008 and the 2009 Ageing Report. The policy options that could mitigate the effects of these changes were also addressed.

8. Portugal presented the main characteristics of the dynamics of the Portuguese population and discussed how the future evolution of the population structure by age, sex, and educational level could affect the average health status of the population.

9. In the discussion, it was noted that the average life-span of the population is changing, and this has various implications for population projections. On average, people start to work and have children later than in the past, and they are also in better health conditions at old ages. Therefore, it could be assumed that the retirement age may increase in the future from 65 to 70-75, which would have very important implications for population projections.

10. The issue of convergence or divergence of demographic behaviours in the different countries was also discussed. This issue has important methodological implications but is also politically sensitive, and is expected to be a topic of discussion for the next round of EU projections.

11. The participants discussed the need to conduct sensitivity tests for different assumptions and scenarios concerning the various components of the projections, such as mortality, fertility, migration, but also health care provision or other relevant factors.

B. Constructing assumptions for mortality: data, methods and analysis

12. Sweden presented a method for mortality projections where rates are expressed as a function of age, period and cohort. This method takes advantage of the long time series of mortality rates available in Sweden from year 1861, which are used from both a period and a cohort perspective.

13. The Italian study looked at increasing longevity and decreasing gender mortality differentials from a cohort perspective, concluding that in Italy men seem to imitate female positive mortality models, while women do not seem to imitate the negative male behaviours, contrarily to what is happening in other countries.

14. Spain presented the results of studies conducted on advanced methods for computing life tables, at the national and sub-national level. At the national level, a method using observational data from on the date of occurrence of recorded death seems to be the most accurate. At the regional level a method that assumes uniform distribution of deaths over the year at each age within a given generation seems to be the most suitable.

15. The Portuguese presentation focused on the estimation of life expectancy for small population areas. The use of graduation methods in smoothing mortality data was presented as a feasible solution. The results of empirical testing using data from the Lisbon region show that the methodology is robust and can be used to construct life tables and estimate life expectancy.

16. In the discussion, reference was made to different results that may emerge when considering the life expectancy at birth or at adult ages like 50 or 60. Differences in life expectancy at 50 years could provide a lot of information in many countries. In Italy, no significant differences can be found when considering life expectancy at birth, 50 or 60 years of age.

17. It was noted that considering mortality for period and cohort at the same time, as in the approach presented by Sweden, may lead to result more complex to analyse. Italy favoured a linear approach based on cohorts, and it was suggested to consider also a non-linear approach.

18. The role of mortality at very old ages was discussed. Sweden reported that the mortality at old ages, above 80, do not affect significantly the projections. In Spain this is considered as a relevant issue given that the number of centenarians in the country has tripled since 1990.

19. Migration may affect mortality projections, especially in countries that experienced significant migrations flows. In Spain, for instance, the important immigration experienced influence exposure to risk and probability of dying. Projection models normally assume closed populations, and it could be interesting to look at the effect of migration actually experienced on the results.

20. In order to analyse mortality in small populations – around 10'000 – standard methods are not suitable and may lead to significant over-estimation of mortality. According to the experience of Portugal, for small populations parametric methods are preferable or relational models. Other possible solutions include using abridged life-tables (5 or 10 year age intervals) or aggregate data for long periods (i.e. 3 or 5 years).

C. Constructing assumptions for fertility: data, methods and analysis

21. Sweden presented a study of recent trends in childlessness, which provides evidence against the assumption that childlessness will continue to increase in the future as a result of childbearing postponement. Decreasing levels of childlessness have been observed over the last few years in Sweden and the analysis of this recent trend may be interesting for other countries, as Sweden is often considered as a forerunner in demographic behaviour.

22. The presentation by Eurostat addressed the issue of fertility convergence across the Member States of the EU. A new indicator of relative convergence was used to assess the existence of convergence within the whole EU and the impact of the successive enlargements on the fertility trends in the new Member States.

23. Japan presented an analysis of the upturn in fertility observed over the last few years, after the Total Fertility Rate (TFR) reached its record low level at 1.26 in 2005. Similar trends have been observed in other countries with lowest-low fertility, e.g. Italy, Spain, some Central and Eastern European countries and other East Asian countries. In Japan, the recent upturn seems to be mainly due to an increase in late fertility.

24. In the discussion, it was noted that the analysis of fertility convergence within the EU was based on period data, rather than cohort data, mainly because of better availability of the first type of data. It would, however, be useful to expand the analysis to cohort fertility. Further studies are also planned to cover mortality convergence.

25. The impact of education level on fertility patterns was also discussed. Access to child-care may be an important factor to explain childlessness, but not in a country such as Sweden where everyone has access to a highly-developed child-care system. The possibility to get access to infecundity treatment is another factor that strongly depends on education level. In Sweden, it has been shown that the highly educated have better access to IVF treatments. Women's intention to have children according to education level should also be considered in fertility studies, as women with higher education want to have more children.

26. The importance of the tempo effect in explaining the fertility upturn in lowest-low fertility countries was highlighted, but it was noted that this effect may change in the future.

D. Forecasting demographic components: fertility

27. The UNPD presented the initial results of the probabilistic population projections carried out for the first time for all countries of the world. The main advantage of using a probabilistic model, rather than the deterministic approach used in the World Population Prospects, is that the uncertainty is derived from estimates based on empirical data, not expert opinion of uncertainty. But a major problem remains: no theory or model has yet been developed for future fertility trends in the countries that have reached sub-replacement fertility, which will soon represent more than 50% of the world population.

28. Japan showed how fertility projections can be used to analyse the period effect in past and current fertility trends.

29. Portugal presented an attempt to forecast births in Portugal using ARIMA models with regression variables allowing for seasonal effects. The number of marriages was used as regression factor, but it was noted that the number of births occurring outside marriages should also be taken into account.

30. The question of the advantage of using a seasonal model to forecast fertility was raised. There is a clear link between the seasonal patterns observed in the number of births and in the number of marriages. However, the model could be improved by using better data.

31. It was noted that the Bayesian model applied in the UN probabilistic population projections uses the whole range of empirical data available around the world. The fertility transition is well captured, but not what is outside the transition.

E. Forecasting demographic components: mortaliy

32. Japan presented the methodology adopted for the mortality projections in the country. The Lee-Carter (LC) model and a Linear Difference (LD) model were compared to examine whether it is more plausible to understand the recent Japanese mortality as a decline or shift. The results suggested that LD's performance is better than over LC's, and that shift is more strongly supported as recognition of the recent mortality improvement in Japan than decline.

33. The presentation by the University of Evora (Portugal) focused on the widely used Lee-Carter method for projecting mortality, and in particular on the asymptotic behaviour of mortality rates projected, considered unsatisfactory. A variant of the model was presented, in which mortality projections are bounded by a limit life table to which future mortality improvements converge over time.

34. A second presentation by the University of Evora and Statistics Portugal described the methodology used in the projection of the component mortality within the 2008 Portuguese Population Projections exercise. The methodology is based on a combination of extrapolative and expert-opinion based methods.

35. In the discussion, attention was paid to setting targets for future evolution of mortality in terms of life expectancy. Some participants observed that setting fixed targets is difficult and may limit the possibility of conducting sensibility testing, and suggested that dynamics targets could be considered. In Japan, no targets are set, but the projections are based on an extrapolation of the current trends.

36. It was noted that mortality improvements normally vary across different ages, and in general larger improvements can be expected at the ages where mortality is far from what can be considered the limits.

37. With regard to the mortality projections in Portugal, it was noted that the method adopted to smooth the estimates at older ages seems to result in an acceleration of mortality after age 80, and that alternative smoothing procedures could be adopted.

F. Constructing assumptions for migration: data, methods and analysis

38. The presentation discussed international migration data needed for national population projections, focussing on what data should be used and issues related to data availability, reliability and comparability. The effects on time series of changes in administrative rules or the data collection and production process were also discussed.

39. In the discussion, the variable to be used to identify migrants was discussed. The presentation recommended the use of citizenship, which is the most policy-relevant characteristic. However, some countries may prefer to choose other variables depending on the national context. For instance, in Norway the country of birth is considered preferable to the citizenship.

40. The effect of regularizations on time series was also discussed. It was noted that when regularizations are included in immigration figures it affect significantly the time series. In such cases it would be recommended to conduct a backward redistribution in order to smooth the time series.

G. Forecasting demographic components: migration

41. The presentation by the University of Southampton (United Kingdom) focused on the uncertainty of international migration predictions and their consequences for population projections. The limits of predictions were discussed, from the point of view of forecast users, and an interactive approach was proposed, based on an increased dialogue between forecasters and users.

42. Israel presented the work conducted to estimate the expected immigration of Jewish population to the country within the next decades, including size of flows, countries of origin, and possible demographic implications. For this an estimation of the Jewish population living abroad is produced. Future immigration to Israel is difficult to predict also because it will be largely affected by political and economic developments in Israel and the sending countries.

43. The presentation by Statistics Sweden described a model developed to estimate return immigration of Swedish-born persons for the projections "The Future Population of Sweden 2009-2060". Information on immigration and emigration of Swedish-born persons for 1851-2007 has been used to estimate the population of Swedish-born persons abroad and its evolution. In the forecasting model, re-immigration of Swedish-born persons is based on the projection of the number of Swedish-born living abroad, combined with information on emigration flows of Swedish-born persons considering that the best predictor is the size of the emigration flow three years earlier.

44. In the Portuguese study, a Multi-Agent System is used to simulate social networks of migrants and analyse the impact of the structure of these networks in the flow of migrants. The model proposed uses information on immigrants in the United States extracted from the UPIMS database, focusing on selected countries of origin and variables. The study concluded that the agents that stay in the U.S. (and do not go away to their country of origin), have network connections that are weaker than those of other agents.

45. Norway presented a forecast of migration flows to and from the country made using an econometric model. This model estimates net immigration flows to Norway from the EEA as a function of the unemployment rate in Norway and the income level in the country relative to the average of OECD countries, adjusted for purchasing power differences. The estimation yields stable parameters and these are consequently used to forecast net immigration to Norway, based on forecasts of unemployment and level and relative income.

46. In the discussion, several aspects of the particular situation of Israel compared to other countries were touched. Restricting the analysis of immigration to the Jewish population depend on the fact that in principle only Jewish people can become permanent residents in the country. Future migration trends depend in this country (even more than in other countries) on the policies that will be adopted in various fields. For instance, in the 1990s the policy of accepting immigrants from countries of the former Soviet Union resulted in one million of immigrants in a relatively short period, and this was quite unexpected.

47. With regard to the migration estimates in Sweden, it was noted that Statistics Sweden produces projections for the officially registered population. Persons who live the country without de-registering (an issue that is common to virtually all countries) would not be reflected in these statistics. Even the best register-based statistical systems are not perfect, and include some errors.

H. Small population and sub-national population projections

48. The presentation by Slovakia argued that more attention should be given to sub-national forecasts within the EU, in view of the large regional disparities still observed within most countries. The integration of geographical approaches in regional projection models would greatly improve the quality of regional population forecasts.

49. The presentation by Portugal discussed the methodological challenges related to forecasting future population trends in small island states. Cape Verde, with less than half a million inhabitants living in 10 islands, was used as a case study presenting different population projections at national and regional (island) levels.

50. Austria presented the population projections carried out for 124 regions below NUTS-3 level. The results showed that Vienna should have the youngest population in the future due to positive net migration.

51. Spain presented the new population projections for Andalusia, its largest region in population size (8 million inhabitants). In view of the increasing importance of immigration, the place of birth has been introduced in the forecasting model. The results showed that the increase of the foreign-born population is likely to continue in the future, but the ageing process will also affect the immigrant population.

52. The issue of regional convergence or divergence was discussed. In a convergence scenario, the uncertainty lies in the level of TFR that should be reached by all regions: below replacement level (e.g. 1.6) or close to replacement level (e.g. 2.0) following the recent trends in Nordic countries? As in other European countries and regions, the fertility patterns in Andalusia are showing signs of convergence between the foreign-born and the population born in Spain.

53. It would be interesting to distinguish between first and second immigrant generations in the population projections for Andalusia. This will be done when the data are available.

54. It was noted that the population projections for Andalusia (carried out by the Statistical Institute of Andalusia) are completely independent from the national projections for Spain (carried out by the National Statistical Institute). The results are, however, very similar. The availability of population projections produced by many different organisations, e.g. UNPD, Eurostat, the national and regional statistical institutes, may be confusing for the users. Which results should be used? It was suggested that the users should select the projection and assumptions that best fit their needs.

55. The impact of the population age structure on future migration trends was discussed. Cape Verde has a young population and a very important diaspora, which means that the population projections should take into account the effect of the young age structure on future emigration.

I. Beyond population projections by age and sex

56. The presentation by the IIASA examined to what extent the religiosity (i.e. religious intensity) of a population can affect its fertility patterns, population size and age structure. Cohort-component projections by religious affiliation and religious intensity were carried out for Austria, Germany and Spain. The main outcome is an increasing polarization, with growing numbers of both highly religious and secular persons.

57. Canada presented the Demosim micro-simulation model that allows to project a large number of characteristics, e.g. place of residence, generation status, place of birth, religious denomination, visible minority group, mother tongue, highest level of schooling, labour force participation, etc. The ethno-cultural diversity of the population is likely to increase in the future, in particular within the Canadian-born population, and to remain concentrated geographically.

58. Latvia presented forecasts of future student enrolment in higher education. Using the enrolment ratio method, three alternative scenarios were developed, which all project falling enrolment in the next 10 years with a decrease of 18-38% in the number of students. These results should lead to informed policy decisions, as they question the future sustainability of the very large number of higher education institutions (65 for 4 million inhabitants).

59. The presentation by the United States Census Bureau discussed the importance of race and ethnicity for the development of assumptions in their population projections and examined the impact of net international migration. With its younger age structure and higher fertility, the Hispanic population is likely to increase in the future, irrespective of immigration levels.

60. The correlation between religiosity and age was discussed. The IIASA study considers the effect of religious transition only for teenagers and young adults (15-29 years old), as empirical data and research have shown that transitions are most likely to occur in this age group.

61. The concepts of race and ethnicity in the United States were also discussed. The term "Hispanic" refers to persons who trace their origin or descent to Mexico, Puerto Rico, Cuba, Central and South America, and other Spanish cultures. The Hispanic population can be of any race. The U.S. Census Bureau has several experimental panels testing different ways of collecting information on race and Hispanic origin on the 2010 Census.

62. The new approaches to population forecasting presented and discussed in this session were considered interesting and innovative. However, there are a number of drawbacks in using more complicated projection models, including the possible lack of data availability and the need to make assumptions about future trends of non-demographic characteristics such as religiosity.

J. Stochastic techniques for demographic projections

63. The presentation by the University of Rome and Eurostat focused on the quantification of uncertainty in population forecasting. A mixed approach was presented which integrates deterministic projections within a stochastic framework, adopting a micro-simulation approach.

64. The Max Planck Institute for Demographic Research presented a stochastic mate-matching algorithm for continuous-time micro-simulation. The algorithm was tested using data on fertility and marriage behaviour of the contemporary Netherlands. The results were presented, and possible developments of the algorithm were discussed.

65. The University of Southampton presented an application of Bayesian time series models to obtain future population estimates with uncertainty for England and Wales. The advantages of predictive distributions from Bayesian forecasting models over those obtained using more traditional stochastic models were also discussed.

66. A second presentation by the Max Planck Instituted was dedicated to an application of the MicMac-Software for population forecasting. The various steps for producing the projections were presented in detail, using as example data for Italy from the 2003 Family and Fertility survey and the EuroPop2004 projections.

67. In the discussion, the question was raised whether micro-simulation could also be used to model situations where an unbalanced sex-ratio among individuals of marriageable age (typically a higher number of males) would lead to an increase in marriage-related immigration.

68. It was also suggested that approaches used in organisational studies (firm collaboration or merges) could be useful to model compatibility measures of individuals in a marriage market.

69. The importance of incorporating expert opinions as prior information in a fully Bayesian approach was stressed. The proper translation of such expert knowledge into prior distributions for the parameters of the projection model was emphasized as an important research topic.

70. In the study of future health trajectories and their impact on mortality, it is of importance to investigate whether the sequence of health states or also the duration of the different states has an impact. It was discussed under which assumptions it is possible to use currently available micro-simulation tools to study such questions.

K. Stochastic national demographic projections

71. The Canadian study used a micro-simulation model to evaluate the impact of immigration and ethno-cultural diversity on the future composition of the Canadian labour force. The results were presented in terms of future labour force population, participation rates, proportion of immigrants in the labour force and other indicators.

72. The United Kingdom Office for National Statistics presented the provisional results of a stochastic forecasting model being developed for the United Kingdom. Uncertainty about future demographic behaviour is been taken into account by expressing fertility, mortality and migration assumptions in terms of their assumed probability distributions. Three approaches for determining the probability distributions have been used.

73. In the discussion the issue was raised in how far demographic change will show feedback on the labour force participation rates in the different ethno-cultural groups. In particular, the impact of a rise in retirement age due to population aging was discussed. Also it was discussed in how far the projected increase of people,