図1．フラミンガムスコア

文献3より

Executive Summary of The Third Report of The National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, And Treatment of High Blood Cholesterol In Adults (Adult Treatment Panel III). *JAMA* 2001; 285: 2497 in Appendix

Table B1. Estimate of 10-Year Risk for **Men** (Framingham Point Scores)

Age, y	Points
20-34	−9
35-39	−4
40-44	0
45-49	3
50-54	6
55-59	8
60-64	10
65-69	11
70-74	12
75-79	13

Total Cholesterol, mg/dL	Points				
	Age 20-39 y	Age 40-49 y	Age 50-59 y	Age 60-69 y	Age 70-79 y
<160	0	0	0	0	0
160-199	4	3	2	1	0
200-239	7	5	3	1	0
240-279	9	6	4	2	1
≥280	11	8	5	3	1

	Points				
	Age 20-39 y	Age 40-49 y	Age 50-59 y	Age 60-69 y	Age 70-79 y
Nonsmoker	0	0	0	0	0
Smoker	8	5	3	1	1

HDL, mg/dL	Points
≥60	−1
50-59	0
40-49	1
<40	2

Systolic BP, mm Hg	If Untreated	If Treated
<120	0	0
120-129	0	1
130-139	1	2
140-159	1	2
≥160	2	3

Point Total	10-Year Risk, %
<0	<1
0	1
1	1
2	1
3	1
4	1
5	2
6	2
7	3
8	4
9	5
10	6
11	8
12	10
13	12
14	16
15	20
16	25
≥17	≥30

Table B2. Estimate of 10-Year Risk for **Women** (Framingham Point Scores)

Age, y	Points
20-34	−7
35-39	−3
40-44	0
45-49	3
50-54	6
55-59	8
60-64	10
65-69	12
70-74	14
75-79	16

Total Cholesterol, mg/dL	Points				
	Age 20-39 y	Age 40-49 y	Age 50-59 y	Age 60-69 y	Age 70-79 y
<160	0	0	0	0	0
160-199	4	3	2	1	1
200-239	8	6	4	2	1
240-279	11	8	5	3	2
≥280	13	10	7	4	2

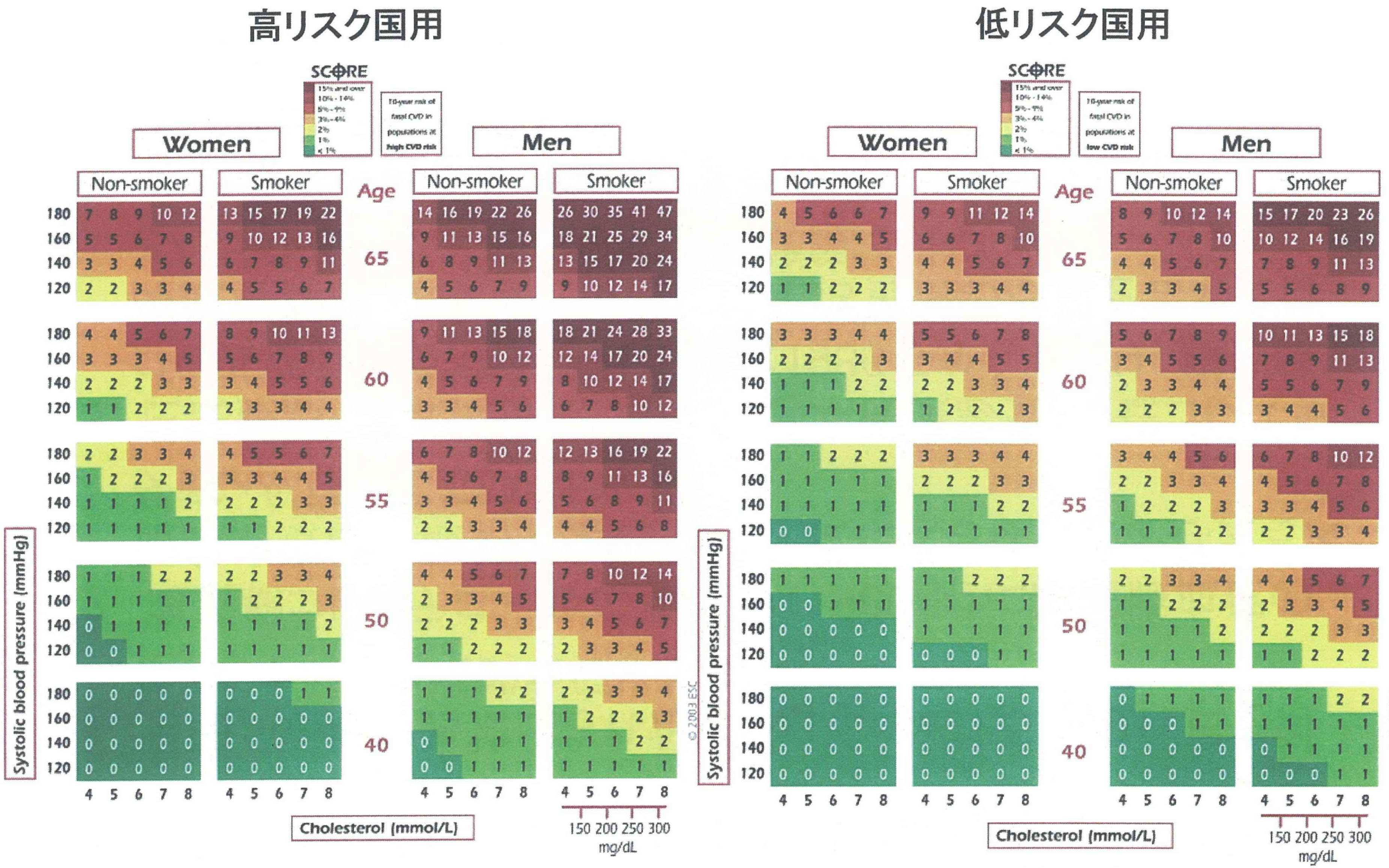
	Points				
	Age 20-39 y	Age 40-49 y	Age 50-59 y	Age 60-69 y	Age 70-79 y
Nonsmoker	0	0	0	0	0
Smoker	9	7	4	2	1

HDL, mg/dL	Points
≥60	−1
50-59	0
40-49	1
<40	2

Systolic BP, mm Hg	If Untreated	If Treated
<120	0	0
120-129	1	3
130-139	2	4
140-159	3	5
≥160	4	6

Point Total	10-Year Risk, %
<9	<1
9	1
10	1
11	1
12	1
13	2
14	2
15	3
16	4
17	5
18	6
19	8
20	11
21	14
22	17
23	22
24	27
≥25	≥30

図2. SCOREチャート



文献4より（Atherosclerosis 2011; 217S: S1-S44）

表1. NIPPONDATA80の選定理由

1. 全国から無作為抽出された300地域の約1万人の住民を対象としており地域的な偏りがない。
2. 血清総コレステロールの測定時(1980年)には高脂血症の服薬治療は一般的でなく、特に予後に大きな影響を与えるスタチンが存在していない。
3. 住民健診(老人保健法に基づく基本健康診査)で総コレステロールの測定が開始されたのは1986年からであり、測定時の血清総コレステロール値には生活習慣の改善を含めてほとんど介入が入っておらず自然状態に近い。
4. 住民基本台帳を分母とした場合のベースライン調査への参加率が約75%と高い。
5. 追跡率が90%を超えている。
6. 総コレステロールの測定はCDCを通じて国際的に標準化されている。

図3. LDLコレステロール管理目標設定のためのフローチャート

脂質異常症の診断

冠動脈疾患の既往があるか？ → Yes → **二次予防**

↓ No

以下のいずれかがあるか?

1)糖尿病（耐糖能異常は含まない）
2)慢性腎臓病（CKD）
3)非心原性脳梗塞（脳血管障害）
4)末梢動脈疾患（PAD）

→ Yes → **カテゴリーⅢ**

↓ No

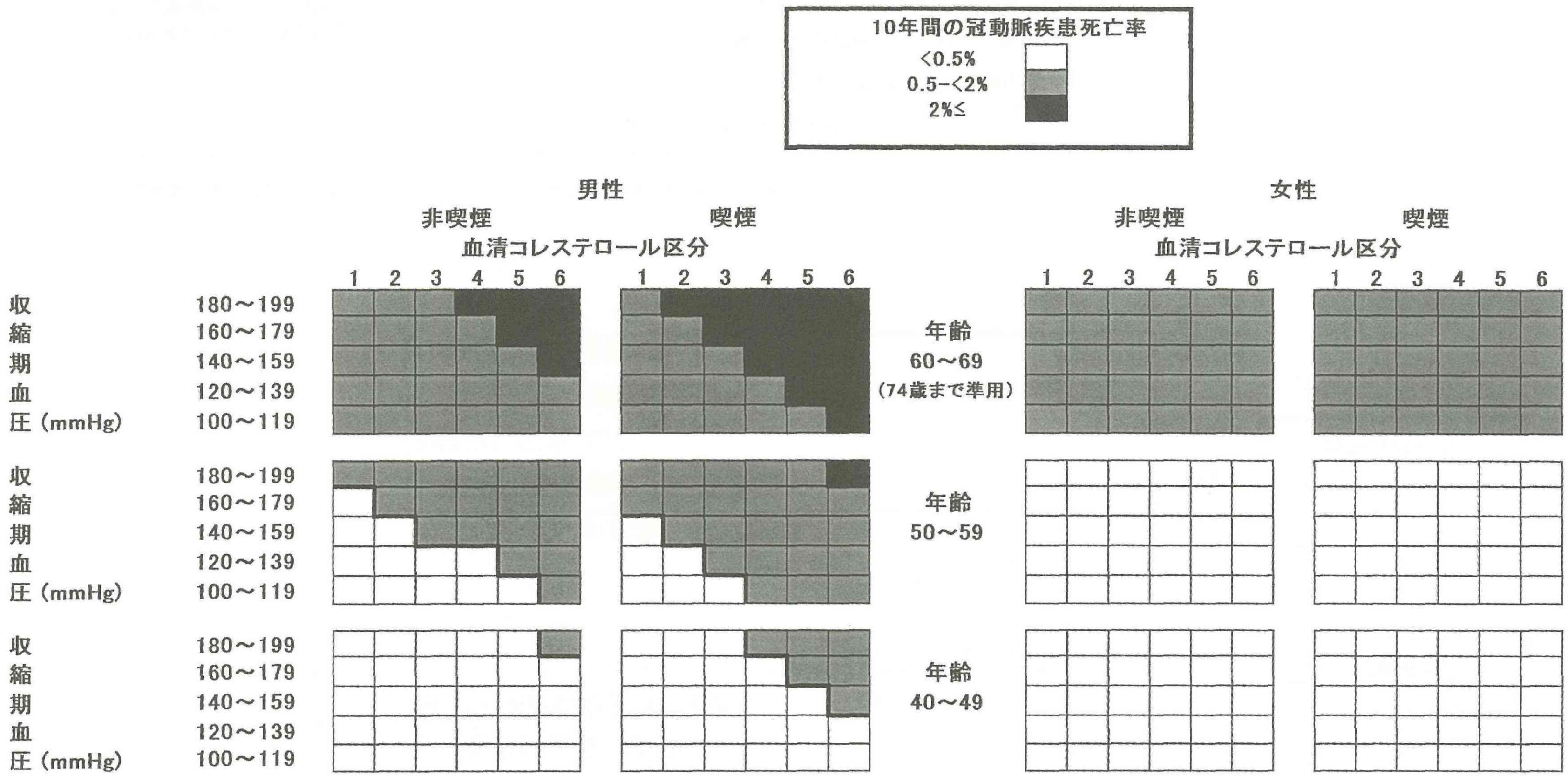
冠動脈疾患の一次予防のための絶対リスクに基づく管理区分（絶対リスクは図2参照）

NIPPON DATA80による10年間の冠動脈疾患による死亡確率（絶対リスク）	追加リスクの有無	
	追加リスクなし	以下のうちいずれかあり 1) 低HDL-C血症（HDL-C<40 mg/dl） 2) 早発性冠動脈疾患家族歴 （第1度近親者かつ男性 55歳未満、女性 65歳未満） 3) 耐糖能異常（糖尿病は含まない）
<0.5%	カテゴリーⅠ	カテゴリーⅡ
0.5-1.9%	カテゴリーⅡ	カテゴリーⅢ
2.0%-	カテゴリーⅢ	カテゴリーⅢ

動脈硬化性疾患予防ガイドライン2012年版から引用

図4. 冠動脈疾患絶対リスク評価チャート（一次予防）

絶対リスクは危険因子の変化や加齢で変化するため少なくとも年に1回は絶対リスクの再評価を行うこと。



＊血清コレステロール区分：

総コレステロール：1=160～179, 2=180～199, 3=200～219, 4=220～239, 5=240～259, 6=260～279（mg/dL）

動脈硬化性疾患予防ガイドライン2012年版から引用

図5. SCOREによるリスク評価に基づく脂質管理戦略

SCOREチャートによる動脈硬化性疾患死亡確率(%)	LDLコレステロールのレベル(mg/dl)				
	< 70 mg/dl	70 to <100 mg/dl	100 to <155 mg/dl	155 to <190 mg/dl	>190 mg/dl
< 1%	治療不要	治療不要	生活習慣の改善	生活習慣の改善	生活習慣の改善、コントロール不良なら服薬治療を考慮
≥ 1% to < 5%	生活習慣の改善	生活習慣の改善	生活習慣の改善、コントロール不良なら服薬治療を考慮	生活習慣の改善、コントロール不良なら服薬治療を考慮	生活習慣の改善、コントロール不良なら服薬治療を考慮
> 5% to <10%, or high risk	生活習慣の改善、服薬治療も考慮	生活習慣の改善、服薬治療も考慮	生活習慣の改善に加えてただちに服薬治療を開始	生活習慣の改善に加えてただちに服薬治療を開始	生活習慣の改善に加えてただちに服薬治療を開始
≥ 10% or very high risk	生活習慣の改善、服薬治療も考慮	生活習慣の改善に加えてただちに服薬治療を開始	生活習慣の改善に加えてただちに服薬治療を開始	生活習慣の改善に加えてただちに服薬治療を開始	生活習慣の改善に加えてただちに服薬治療を開始

注）Very high risk: CVDの既往、糖尿病（Ⅱ型、1型で臓器障害あり）、CKD（eGFR<60ml/mim/1.73m^2）
High risk: 一つの危険因子のレベルが極端に高い場合（家族性脂質異常や重症高血圧）

文献4より（**Atherosclerosis 2011; 217S: S1-S44**）

表2. 日米欧のガイドラインの違い
-同一所見の患者X氏を判定した場合-

地域	コホート名	予測対象のイベント(10年以内)	X氏の推計リスク 注1)
日本	NIPPONDATA80(冠動脈疾患)[5]	冠動脈疾患死亡	1～2%
	NIPPONDATA80(全循環器疾患)[5]	循環器疾患死亡(脳卒中含む)	1～3%
欧州	SCORE (高リスク国)[4]	動脈硬化性疾患死亡(脳卒中含む)	6%
	SCORE (低リスク国)[4]	同上	3%
米国	フラミンガムスコア[3]	冠動脈疾患死亡と非致死性心筋梗塞	20%

注1)仮想患者X氏は、男性、52歳、総コレステロール 255mg/dl、HDLコレステロール 45mg/dl、収縮期血圧 153 mmHg(服薬なし)、喫煙者、糖尿病なし、と設定。

Ⅱ．分担研究報告

④NIPPON DATA80/90および2010
分析報告

(1) 日本人における糖尿病と平均余命: NIPPON DATA80

研究協力者　Tanvir C Turin (University of Calgary　ﾘｻｰﾁﾚｼﾞﾃﾞﾝﾄ)
研究分担者　村上　義孝　(滋賀医科大学社会医学講座医療統計学部門　准教授)
研究代表者　三浦　克之　(滋賀医科大学社会医学講座公衆衛生学部門　教授)
研究協力者　Nahid Rumana　(前滋賀医科大学社会医学講座公衆衛生学部門　特別研究員)
研究分担者　門田　文　(大阪教育大学養護教育講座　准教授)
研究分担者　大久保孝義　(滋賀医科大学社会医学講座公衆衛生学部門　准教授)
研究分担者　岡村　智教　(慶應義塾大学医学部衛生学公衆衛生学　教授)
研究分担者　岡山　明　((公財)結核予防会第一健康相談所　所長)
研究分担者　上島　弘嗣　(滋賀医科大学生活習慣病予防センター　特任教授)

糖尿病が平均余命に及ぼす影響を日本人において検討した。年齢階級別死亡率は、NIPPON DATA80の追跡データより人年法で算出した。40歳時の平均余命は、非糖尿病男性で41.1歳、女性で47.5歳であったが、糖尿病男性では32.3歳、女性では40.9歳と、男性で8.8年、女性で6.6年、糖尿病者で短かった。糖尿病は日本人の余命短縮と関連していた。耐糖能以上についても傾向は同様であった。

Contents available at Sciverse ScienceDirect

Diabetes Research and Clinical Practice

journal homepage: www.elsevier.com/locate/diabres

International Diabetes Federation

Brief report

Diabetes and life expectancy among Japanese – NIPPON DATA80

Tanvir Chowdhury Turin [a,b,*], *Yoshitaka Murakami* [c], *Katsuyuki Miura* [b], *Nahid Rumana* [b], *Aya Kadota* [b], *Takayoshi Ohkubo* [b], *Tomonori Okamura* [d], *Akira Okayama* [e], *Hirotsugu Ueshima* [b,f]

for the NIPPON DATA80 Research Group

[a] *Department of Medicine, University of Calgary, Calgary, Alberta, Canada*
[b] *Department of Health Science, Shiga University of Medical Science, Otsu, Shiga, Japan*
[c] *Department of Medical Statistics, Shiga University of Medical Science, Otsu, Shiga, Japan*
[d] *Department of Preventive Medicine and Public Health, Keio University, Tokyo, Japan*
[e] *The First Institute for Health Promotion and Health Care, Tokyo, Japan*
[f] *Life-style Related Disease Prevention Center, Shiga University of Medical Science, Otsu, Shiga, Japan*

ARTICLE INFO

Article history:
Received 12 December 2011
Received in revised form
15 December 2011
Accepted 3 January 2012
Published on line 31 January 2012

Keywords:
Life expectancy
Diabetes
Japan

ABSTRACT

Life expectancy (LE) among the Japanese population with or without diabetes mellitus was estimated. LE in 40-year old men and women was 41.1 and 47.5 years in those without diabetes and 32.3 and 40.9 years in those with diabetes. The LE of 40-year old men and women with diabetes was 8.8 and 6.6 years shorter than in those without diabetes. Diabetes mellitus leads to a decrease in LE. The presence of impaired glucose tolerance also affected LE inversely.

1. Introduction

Life expectancy (LE) at birth in Japan is now the longest in the world [1,2]. Along with the demographic transition of the aging population, epidemiologic and nutritional transitions are underway causing non-communicable diseases like diabetes mellitus to be on the rise in Japan [3–5]. Studies measuring the impact of diabetes mellitus on LE have been predominantly performed in Western populations [6,7]. On the other hand the effect of diabetes mellitus on LE has not been reported in the Japanese population. This information will be of importance for this aging society as it is unclear how diabetes affects LE in this population with the highest longevity in the world. In the present study, we estimated the LE among Japanese with or without diabetes mellitus.

* *Corresponding author at:* Department of Medicine, University of Calgary, Calgary, Alberta, Canada. Tel.: +1 403 210 7199; fax: +1 403 210 9180.
E-mail addresses: turin.chowdhury@ucalgary.ca, dr.turin@gmail.com (T.C. Turin).
0168-8227/$ – see front matter © 2012 Elsevier Ireland Ltd. All rights reserved.
doi:10.1016/j.diabres.2012.01.003

2. Data source

We analyzed data from the NIPPON DATA80 (National Integrated Project for Prospective Observation of Non-communicable Disease And its Trends in the Aged) cohort, whose participants were selected in 1980 using a stratified random sampling method of residents aged 30 years or older in 300 census tracts throughout Japan. The details of this cohort have been reported elsewhere [8–11]. In brief, a total of 10,546 residents participated in the survey. After excluding those who had missing information at baseline or were lost to follow-up ($n = 941$), the remaining 9605 (4228 men and 5377 women) were included in the current analysis.

3. Diabetes mellitus

After obtaining blood samples at the baseline survey, plasma samples were collected into siliconized tubes containing sodium fluoride and shipped to a central laboratory (Osaka Medical Center for Health Science and Promotion, Osaka, Japan). Plasma concentrations of glucose were measured by the cupric-neocuproline method and the values were converted to the value of glucose oxidase method [12]. Diabetes mellitus was defined as any casual serum glucose level ≥200 mg/dL, fasting serum glucose level ≥126 mg/dL, use of antihyperglycemic medications, or self-reported history of diabetes. Participants with casual blood glucose concentrations between 140 and <200 mg/dL or whose fasting blood glucose concentrations fell between 110 and <126 mg/dL were categorized as having impaired glucose tolerance (IGT).

4. Statistical analysis

Age-specific mortality rates, stratified by diabetes status, were calculated for the NIPPON DATA80 cohort with the person-year method [13]. Age bands used in this calculation were set at five years. The age categories began at 40–44 years and the highest age category was set at age 85 years and over. The abridged life table method was used to calculate LE. The fraction of the last age interval of life [9,14] was used to construct an abridged life table. We also calculated 95% confidence intervals of LE in each age group using Byer's method [15].

5. Results

The proportion with diabetes in the baseline survey was 5.4% in men and 2.9% in women. IGT was present among 5.0% men and 3.6% women. Table 1 shows the LEs and Table 2 shows the corresponding mortality rates among the participants with different diabetes status from age 40 until age 85 year and over. LE in 40-year old men and women was 41.1 years and 47.5 years in those without diabetes and was 32.3 years and 40.9 years in those with diabetes. The LE of 40-year old men and women with diabetes was 8.8 and 6.6 years shorter than in those without diabetes (Table 3). The LEs for men and women with IGT was also shorter than in those without diabetes. The longer LE for participants without diabetes in comparison to the participants with IGT or diabetes was observed across all the age groups for both genders.

Table 1 – Diabetes status and life expectancies in Japanese men and women. NIPPON DATA80.

Gender	Index age (year)	Diabetes status					
		No diabetes		Impaired glucose tolerance		Diabetes	
		LE	(95%CI)	LE	(95%CI)	LE	(95%CI)
Men	40	41.1	(40.6–41.7)	36.9	(34.7–39.2)	32.3	(27.3–37.4)
	45	36.3	(35.7–36.8)	31.9	(29.7–34.2)	31.9	(30.1–33.7)
	50	31.8	(31.3–32.3)	27.4	(25.3–29.5)	26.9	(25.1–28.7)
	55	27.2	(26.7–27.7)	23.8	(21.9–25.6)	22.3	(20.5–23.9)
	60	22.9	(22.4–23.4)	20.6	(19.0–22.1)	18.9	(17.5–20.4)
	65	18.8	(18.4–19.3)	16.5	(15.1–17.9)	15.4	(14.2–16.8)
	70	15.0	(14.6–15.5)	12.3	(11.0–13.6)	12.2	(11.0–13.4)
	75	11.7	(11.3–12.1)	9.4	(8.2–10.6)	9.5	(8.4–10.6)
	80	9.1	(8.7–9.4)	6.9	(5.9–8.1)	6.8	(5.8–7.9)
	85	6.9	(6.7–7.1)	5.8	(5.2–6.3)	6.0	(5.4–6.6)
Women	40	47.5	(47.0–48.0)	45.8	(43.47–48.04)	40.9	(38.1–43.7)
	45	42.7	(42.2–43.1)	40.8	(38.47–43.04)	35.9	(33.1–38.7)
	50	37.9	(37.5–38.4)	36.7	(35.18–38.15)	30.9	(28.1–33.7)
	55	33.2	(32.8–33.7)	31.7	(30.18–33.15)	26.7	(24.3–29.1)
	60	28.7	(28.3–29.1)	26.7	(25.18–28.15)	23.1	(21.3–25.01)
	65	24.3	(23.9–24.7)	21.9	(20.44–23.32)	18.4	(16.6–20.2)
	70	20.0	(19.6–20.4)	17.9	(16.62–19.15)	15.7	(14.2–17.2)
	75	16.1	(15.7–16.4)	13.7	(12.51–14.83)	11.5	(10.0–12.9)
	80	12.5	(12.2–12.8)	10.2	(9.16–11.16)	9.5	(8.3–10.8)
	85	9.8	(9.6–10.0)	7.1	(6.43–7.71)	7.9	(7.1–8.6)

LE, Life expectancy.

Table 2 – Diabetes and mortality rates in Japanese men and women. NIPPON DATA80.

Gender	Age group (year)	Diabetes categories											
		No diabetes				IGT				DM			
		PY	*n*	MR	95%CI	PY	*n*	MR	95%CI	PY	*n*	MR	95%CI
Men	40–44	6322	4	0.6	(0.2–1.5)	239	0	0.0	–	105	3	28.6	(7.7–75.4)
	45–49	8785	28	3.2	(2.2–4.5)	341	1	2.9	(0.2–12.8)	197	0	0.0	–
	50–54	11,100	31	2.8	(1.9–3.9)	448	5	11.2	(4.2–24.4)	375	1	2.7	(0.2–11.6)
	55–59	11,374	63	5.5	(4.3–7.0)	495	8	16.2	(7.6–30.4)	541	9	16.6	(8.2–30.3)
	60–64	10,188	91	8.9	(7.2–10.9)	497	5	10.1	(3.8–22.0)	618	11	17.8	(9.4–30.8)
	65–69	8755	126	14.4	(12.0–17.1)	526	6	11.4	(4.7–23.4)	664	17	25.6	(15.5–40.0)
	70–74	7100	177	24.9	(21.5–28.8)	486	19	39.1	(24.3–59.8)	596	25	41.9	(27.8–60.9)
	75–79	4954	227	45.8	(40.1–52.1)	366	23	62.8	(40.9–92.6)	434	25	57.6	(38.2–83.6)
	80–84	3017	214	70.9	(61.9–80.9)	220	26	118.2	(79.0–170.4)	254	33	129.9	(91.0–180.1)
	85+	1837	267	145.3	(128.7–163.6)	115	20	173.9	(109.5–263.2)	138	23	166.7	(108.5–245.7)
Women	40–44	8218	7	0.9	(0.4–1.7)	149	0	0.0	–	72	0	0.0	–
	45–49	11,320	15	1.3	(0.8–2.1)	212	1	4.7	(0.3–20.6)	129	0	0.0	–
	50–54	14,439	23	1.6	(1.0–2.3)	306	0	0.0	–	190	1	5.3	(0.4–23.0)
	55–59	14,792	47	3.2	(2.4–4.2)	442	0	0.0	–	251	3	12.0	(3.2–31.5)
	60–64	13,938	60	4.3	(3.3–5.5)	561	1	1.8	(0.1–7.8)	336	1	3.0	(0.2–13.0)
	65–69	12,470	81	6.5	(5.2–8.0)	587	6	10.2	(4.2–21.0)	410	11	26.8	(14.2–46.4)
	70–74	10,493	126	12.0	(10.0–14.2)	598	6	10.0	(4.1–20.6)	451	5	11.1	(4.2–24.2)
	75–79	7854	163	20.8	(17.7–24.1)	513	13	25.3	(14.2–42.1)	405	24	59.3	(38.9–86.7)
	80–84	5184	209	40.3	(35.1–46.1)	335	15	44.8	(26.1–72.0)	274	21	76.6	(48.8–114.9)
	85+	3895	399	102.4	(92.8–112.9)	198	28	141.4	(96.0–201.4)	165	21	127.3	(81.1–190.8)

PY, person-years, *n*, number of events, MR, mortality rate (per 1000), CI, confidence intervals. Mortality rates were estimated by person-year methods.

6. Discussion

In this study we observed a significant reduction of LE in those with diabetes mellitus. We observed that the LE of participants with diabetes was seven to nine years shorter than the LE of people without diabetes for both genders in middle age group categories. The presence of IGT also was associated with shorter LE than for the non-diabetic population.

The differences in LE observed between diabetes and non-diabetic people was similar to that found in other studies. Franco et al. [6], studying the participants from the

Table 3 – Difference in life expectancy by diabetes status in Japanese men and women. NIPPON DATA80.

Gender	Index age (year)	Difference in life expectancy (95%CI)			
		No diabetes vs. impaired glucose tolerance		No diabetes vs. diabetes	
Men	40	4.2	(1.9, 6.5)	8.8	(3.7, 13.9)
	45	4.3	(2.0, 6.6)	4.4	(2.4, 6.2)
	50	4.4	(2.2, 6.6)	4.9	(3.0, 6.8)
	55	3.4	(1.5, 5.3)	4.9	(3.2, 6.8)
	60	2.3	(0.7, 3.9)	4.0	(2.4, 5.5)
	65	2.3	(0.9, 3.8)	3.4	(2.0, 4.7)
	70	2.7	(1.3, 4.1)	2.8	(1.5, 4.1)
	75	2.3	(1.0, 3.5)	2.2	(1.0, 3.4)
	80	2.2	(0.9, 3.2)	2.3	(1.1, 3.3)
	85	1.1	(0.5, 1.7)	0.9	(0.3, 1.5)
Women	40	1.7	(-0.6, 4.1)	6.6	(3.8, 9.4)
	45	1.9	(-0.4, 4.2)	6.8	(4.0, 9.6)
	50	1.2	(-0.3, 2.8)	7.0	(4.2, 9.8)
	55	1.5	(0.0, 3.1)	6.5	(4.1, 9.0)
	60	2.0	(0.5, 3.6)	5.6	(3.7, 7.5)
	65	2.4	(0.9, 3.9)	5.9	(4.0, 7.7)
	70	2.1	(0.8, 3.4)	4.3	(2.7, 5.8)
	75	2.4	(1.2, 3.6)	4.6	(3.1, 6.1)
	80	2.3	(1.3, 3.4)	3.0	(1.7, 4.3)
	85	2.7	(2.0, 3.4)	1.9	(1.1, 2.7)

Framingham Heart Study, reported that men and women aged 50 years with diabetes lived on average 7.5 and 8.2 years less than their nondiabetic equivalents. Gu et al. [16] observed that the median LE was 8 years lower for diabetic subjects aged 55–64 years. Similarly, Narayan et al. [17] estimated that the presence of diabetes among non-Hispanic, 50-year-old men would result in a loss of 8 years in LE. Though all these studies have shown a reduction in LE in association with diabetes mellitus, it is important to note that direct comparability across studies needs caution due to differences in methodology, data used, reporting year, and characteristics of the populations studied.

There are several limitations in this study. As classification of diabetes status was only made with the information available in the baseline survey and with the assumption that the diabetes status of individuals did not change during the follow-up period, possible misclassification of diabetes mellitus related categories might influence our results. It is not possible to be certain how much change of diabetes status would occur during this 24-year period. The influence of this misclassification might affect the difference of LE among groups. It also needs to be recognized that the differences in mortality risks may not be instigated by diabetes alone. Clustering of other metabolic risk factors as hypertension and obesity will also influence risk [10].

In conclusion, LEs of participants with and without diabetes mellitus were examined using data from a representative Japanese cohort and a substantial decrease in LE was observed in both men and women with diabetes mellitus.

Conflict of interest

The authors declare that they have no conflict of interest.

Acknowledgments

This study was supported by the grant-in-aid of the Ministry of Health, Labor and Welfare under the auspices of Japanese Association for Cerebro-cardiovascular Disease Control, the Research Grant for Cardiovascular Diseases (7A-2) from the Ministry of Health, Labor and Welfare, and the Health and Labor Sciences Research Grant, Japan (Comprehensive Research on Aging and Health [H11-Chouju-046, H14-Chouju-003, H17-Chouju-012, H19-Chouju-Ippan-014] and Comprehensive Research on Life-Style Related Diseases including Cardiovascular Diseases and Diabetes Mellitus [H22-Jyunkankitou-Seisyu-Sitei-017]). Nahid Rumana is supported by the Research Fellowship and Research Grants-In-Aid (P-21.09139) from the Japan Society of Promotion of Science (JSPS), Tokyo, Japan. Dr. Tanvir Chowdhury Turin is supported by Fellowship Awards from the Canadian Institutes of Health Research (CIHR), Canadian Diabetes Association (CDA), and the Interdisciplinary Chronic Disease Collaboration (ICDC) team grant funded by Alberta Innovates – Health Solutions (AI-HS). We appreciate the members of the NIPPON DATA80/90 Research Group which is listed in Appendix A.

Appendix A

The NIPPON DATA80/90 Research Group

Chairperson: Hirotsugu Ueshima (Department of Health Science, Shiga University of Medical Science, Otsu, Shiga).

Co-Chairperson: Akira Okayama (The First Institute for Health Promotion and Health Care, Japan Anti-Tuberculosis Association, Tokyo) for the NIPPON DATA80, Tomonori Okamura (Department of Preventive Medicine and Public Health, Keio University, Tokyo) for the NIPPON DATA90.

Research members: Shigeyuki Saitoh (Department of 2nd Internal Medicine, Sapporo Medical University, Sapporo, Hokkaido), Kiyomi Sakata (Department of Hygiene and Preventive Medicine, Iwate Medical University, Morioka, Iwate), Atsushi Hozawa (Department of Public Health, Yamagata University Graduate School of Medicine, Yamagata), Takehito Hayakawa (Department of Hygiene and Preventive Medicine, Fukushima Medical University, Fukushima), Yosikazu Nakamura (Department of Public Health, Jichi Medical University, Shimotsuke, Tochigi), Yasuhiro Matsumura (Faculty of Healthcare, Kiryu University, Midori City, Gunma), Nobuo Nishi (Project for the National Health and Nutrition Survey, National Institute of Health and Nutrition, Tokyo), Nagako Okuda (The First Institute for Health Promotion and Health Care, Japan Anti-Tuberculosis Association, Tokyo), Toru Izumi (Faculty of Medicine, Kitasato University, Sagamihara, Kanagawa), Toshiyuki Ojima (Department of Community Health and Preventive Medicine, Hamamatsu University School of Medicine, Hamamatsu, Shizuoka), Koji Tamakoshi (Department of Public Health and Health Information Dynamics, Nagoya University Graduate School of Medicine, Nagoya, Aichi), Hideaki Nakagawa (Department of Epidemiology and Public Health, Kanazawa Medical University, Kanazawa, Ishikawa), Katsuyuki Miura, Takayoshi Ohkubo, Yoshikuni Kita, Aya Kadota (Department of Health Science, Shiga University of Medical Science, Otsu, Shiga), Yasuyuki Nakamura (Cardiovascular Epidemiology, Kyoto Women's University, Kyoto), Katsushi Yoshita (Osaka City University Graduate School of human life science, Osaka), Kazunori Kodama, Fumiyoshi Kasagi (Radiation Effects Research Foundation, Hiroshima), and Yutaka Kiyohara (Department of Environmental Medicine, Kyushu University, Fukuoka).

REFERENCES

[1] World Health Organization. World health statistics 2009. Geneva: World Health Organization; 2009.
[2] Statistics and Information Department, Minister's Secretariat, Ministry of Health, Labour and Welfare of Japan. Statistical abstracts on health and welfare in Japan 2008. Tokyo: Health and Welfare Statistics Association; 2009 (in Japanese).
[3] Kubo M, Kiyohara Y, Kato I, Tanizaki Y, Arima H, Tanaka K, et al. Trends in the incidence, mortality, and survival rate of cardiovascular disease in a Japanese community. Stroke 2003;34:2349–54.
[4] Fujishima M, Kiyohara Y, Ueda K, Hasuo Y, Kato I, Iwamoto H. Smoking as cardiovascular risk factor in low

cholesterol population: the Hisayama Study. Clin Exp Hypertens 1992;14:99–108.
[5] Rumana N, Kita Y, Turin TC, Murakami Y, Sugihara H, Morita Y, et al. Trend of increase in the incidence of acute myocardial infarction in a Japanese population: Takashima AMI Registry, 1990–2001. Am J Epidemiol 2008;167:1358–64.
[6] Franco OH, Steyerberg EW, Hu FB, Mackenbach J, Nusselder W. Associations of diabetes mellitus with total life expectancy and life expectancy with and without cardiovascular disease. Arch Intern Med 2007;167:1145–51.
[7] Jagger C, Goyder E, Clarke M, Brouard N, Arthur A. Active life expectancy in people with and without diabetes. J Public Health 2003;25:42.
[8] Rumana N, Turin TC, Miura K, Nakamura Y, Kita Y, Hayakawa T, et al. Prognostic value of ST-T abnormalities and left high R waves with cardiovascular mortality in Japanese (24-year follow-up of NIPPON DATA80). Am J Cardiol 2011;107:1718–24.
[9] Murakami Y, Ueshima H, Okamura T, Kadowaki T, Hozawa A, Kita Y, et al. Life expectancy among Japanese of different smoking status in Japan: NIPPON DATA80. J Epidemiol 2007;17:31–7.
[10] Kadota A, Hozawa A, Okamura T, Kadowaki T, Nakmaura K, Murakami Y, et al. Relationship between metabolic risk factor clustering and cardiovascular mortality stratified by high blood glucose and obesity: NIPPON DATA90, 1990–1999. Diabetes Care 2007;30:1533–8.
[11] Turin TC, Okuda N, Miura K, Nakamura Y, Rumana N, Ueshima H. Dietary intake of potassium and associated dietary factors among representative samples of Japanese general population: NIPPON DATA 80/90. J Epidemiol 2010;20:567–75.
[12] Iso H, Imano H, Kitamura A, Sato S, Naito Y, Tanigawa T, et al. Type 2 diabetes and risk of non-embolic ischaemic stroke in Japanese men and women. Diabetologia 2004;47:2137–44.
[13] Breslow NE, Day NE. Statistical methods in cancer research volume II—the analysis of case-control studies. Lyon: International Agency for Research on Cancer; 1980 . p. 41–81.
[14] Chiang CL. The life table and its applications. Malabar: Robert E. Krieger Publishing; 1984. p. 137–167.
[15] Rothman KJ. Epidemiology – an introduction. New York: Oxford University Press; 2002.
[16] Gu K, Cowie CC, Harris MI. Mortality in adults with and without diabetes in a national cohort of the US population, 1971–1993. Diabetes Care 1998;21:1138–45.
[17] Narayan KM, Boyle JP, Thompson TJ, Sorensen SW, Williamson DF. Lifetime risk for diabetes mellitus in the United States. JAMA 2003;290:1884–90.

(2) 日本人における高血圧と平均余命: NIPPON DATA80

研究協力者　Tanvir C Turin（University of Calgary　ﾘｻｰﾁﾚｼﾞﾃﾞﾝﾄ）
研究分担者　村上　義孝　（滋賀医科大学社会医学講座医療統計学部門　准教授）
研究代表者　三浦　克之　（滋賀医科大学社会医学講座公衆衛生学部門　教授）
研究協力者　Nahid Rumana　（前滋賀医科大学社会医学講座公衆衛生学部門　特別研究員）
研究分担者　喜多　義邦　（滋賀医科大学社会医学講座公衆衛生学部門　講師）
研究分担者　早川　岳人　（福島県立医科大学衛生学・予防医学講座　准教授）
研究分担者　岡村　智教　（慶應義塾大学医学部衛生学公衆衛生学　教授）
研究分担者　岡山　明　（(公財)結核予防会第一健康相談所　所長）
研究分担者　上島　弘嗣　（滋賀医科大学生活習慣病予防センター　特任教授）

高血圧が平均余命に及ぼす影響についてアジア人における検討は少ない。そこで、世界でも平均余命が長い国である日本人において検討した。40-85 までの男女において、正常血圧・高血圧（全体、ステージ 1, ステージ 2）の平均余命を生命表を用いて算出した。年齢階級別死亡率は、NIPPON DATA80 の追跡データより人年法で算出した。40 歳時の平均余命は、正常血圧男性で 41.7 歳、女性で 48.7 歳であったが、高血圧男性では 39.5 歳、女性では 45.8 歳と、男性で 2.2 年、女性で 2.9 年、高血圧者で短かった。高血圧のステージが上昇するほど平均余命は短縮した。こうした関連は、他の年齢においても男女とも同様であった。高血圧の予防は日本人の余命延長に重要であることが示された。

Hypertension Research (2012) 35, 954–958

www.nature.com/hr

ORIGINAL ARTICLE

Hypertension and life expectancy among Japanese: NIPPON DATA80

Tanvir Chowdhury Turin[1,2], Yoshitaka Murakami[3], Katsuyuki Miura[2], Nahid Rumana[2], Yoshikuni Kita[2], Takehito Hayakawa[4], Tomonori Okamura[5], Akira Okayama[6], Hirotsugu Ueshima[2,7] and of the NIPPON DATA80/90 Research Group[8]

Life expectancy (LE) is a measure that describes the health status of a population. The few published studies that have examined the impact of hypertension on LE were predominantly performed in Western populations. The effect of hypertension on LE has not been reported in an Asian population. Thus, we examined the impact of hypertension on LE in the Japanese population, which has the highest LE worldwide. The abridged life table method was applied to calculate the LEs of both normotensive and hypertensive men and women aged 40–85 years. Hypertensive participants were categorized as having either stage 1 or stage 2 hypertension. Age-specific mortality rates across different groups were estimated using the person–year method based on the follow-up data from a representative Japanese population in a national survey (NIPPON DATA80). The proportion of hypertensive patients in the baseline survey was 50.5% for men and 41.4% for women. The LE of 40-year-old men and women was 41.7 years and 48.7 years, respectively, in normotensive participants and 39.5 and 45.8 years, respectively, in hypertensive participants. The LE difference between normotensive and hypertensive participants was 2.2 years for men and 2.9 years for women. LE decreased with increasing stages of hypertension. Similar patterns of LE, with respect to blood pressure (BP) status, were observed in all index ages and for both genders. At the population level, hypertension leads to decreased LE and affects both genders similarly. Our findings highlight the importance of preventing high BP and the consequences of hypertension in Japanese population.
Hypertension Research (2012) **35,** 954–958; doi:10.1038/hr.2012.86; published online 5 July 2012

Keywords: blood pressure; Japan; life expectancy; middle age; mortality

INTRODUCTION

Studies have shown that hypertension, or high blood pressure (BP), is quite prevalent worldwide[1] and is a major risk factor for morbidity and mortality in young, middle-aged and elderly individuals of both genders.[2–4] Moreover, hypertension is also closely linked to the aging process, as the prevalence and the risk of hypertension increase with age.[5,6] A similar influence of age is also found with regard to mortality.[7,8] The measure life expectancy (LE), which is a comprehensive estimate of a given population's health status, provides a useful and direct means to communicate disease burden and can be used as a universal measure of health in a population. This information can be used to prioritize planning and policy making for the detection, treatment and control of various health conditions.

There are few published studies that have investigated the impact of hypertension on LE.[9–11] Although the impact of hypertension on premature death and LE has been estimated in Western populations, the effect of hypertension on LE has not been reported in Asian populations, including the Japanese population. This information will be of importance because it is unclear how hypertension affects LE in the Japanese population, which currently has the highest longevity worldwide. The present study examined the LE of a representative sample of Japanese population in which hypertension status varied. This is the first population-based Japanese study of LE for people with and without hypertension.

METHODS

Data source

The present study analyzed data from NIPPON DATA80 (National Integrated Project for Prospective Observation of Non-communicable Disease and its Trends in the Aged), which was collected from a baseline survey performed in 1980. The details of this cohort have been reported elsewhere.[3,12,13] In brief, 300 areas were selected by stratified random sampling from all over Japan, and

[1]Department of Medicine, University of Calgary, Calgary, Alberta, Canada; [2]Department of Health Science, Shiga University of Medical Science, Otsu, Japan; [3]Department of Medical Statistics, Shiga University of Medical Science, Otsu, Japan; [4]Department of Hygiene and Preventive Medicine, Fukushima Medical University, Fukushima, Japan; [5]Department of Preventive Medicine and Public Health, Keio University, Tokyo, Japan; [6]The First Institute for Health Promotion and Health Care, Tokyo, Japan and [7]Life-style Related Disease Prevention Center, Shiga University of Medical Science, Otsu, Japan
[8]Members of the NIPPON DATA80/90 Research Group are listed in the Appendix.
Correspondence: Dr TC Turin, Department of Medicine, University of Calgary, Calgary, Alberta, Canada.
E-mail: turin.chowdhury@ucalgary.ca or dr.turin@gmail.com
Received 30 November 2011; revised 21 March 2012; accepted 23 March 2012; published online 5 July 2012

a sample of residents aged 30 years or older in these areas was invited to participate. A total of 10 546 residents (4639 men and 5907 women) participated in the survey (response rate: 76.6%). The baseline surveys were carried out at local public health centers. The participants were followed for 24 years, until November 2004.

To identify death events among the cohort, we used national vital statistics. In accordance with Japan's Family Registration Law, all death certificates issued by the medical doctors are to be forwarded to the Ministry of Health, Labor and Welfare via the public health centers in the respective participant's area of residency. We confirmed death in each area by computer matching of vital statistics data using area, sex, date of birth and date of death as key codes. Permission to use the national vital statistics was obtained from the Management and Coordination Agency of the Government of Japan. In the present study, we excluded participants who had missing information at baseline or who were lost to follow-up ($n = 941$). Thus, the final sample consisted of 9605 participants (4228 men and 5377 women). There were no significant differences between the participants who were lost to follow-up and those who were included in the current study in terms of several risk factors. Approval for this study was obtained from the Institutional Review Board of Shiga University of Medical Science (no. 12-18 2000).

BP measurement and categories

Baseline BP was measured by trained observers using a standard mercury sphygmomanometer on the right arm of seated participants after at least 5 min of rest. Hypertension was defined as systolic BP$\geqslant$140 mm Hg and/or diastolic BP$\geqslant$90 mm Hg and/or taking antihypertensive medication. Participants with BP$<$140 mm Hg and diastolic BP$<$90 mm Hg were defined as normotensive. We further categorized the hypertensive participants, without regard to the use of antihypertensive medication, according to the classification by the JNC-7[14] as follows: stage 1 hypertension, systolic BP 140–159 mm Hg and/or diastolic BP 90–99 mm Hg, or stage 2 hypertension, systolic BP$\geqslant$160 mm Hg and/or diastolic BP$\geqslant$100 mm Hg. We decided not to consider treatment of hypertension in the categorization of our analyses because we wanted to evaluate the effect of increased BP levels, which can also arise in hypertensive patients under treatment. When the systolic and diastolic pressures fell into different categories, the higher category was selected for the purposes of classification.

Statistical analysis

Age-specific mortality rates for the cohort participants were calculated using the person–year method,[15] and age was considered in the timescale with synchronization with the follow-up. The age bands used in this calculation were defined in 5-year increments. The age categories began at age 40–44 years, and the highest age category was set at age 85 years and over. The abridged life table method was used to calculate life expectancies using age-specific mortality rates. The fraction of the last age interval of life[13,16] was used to construct an abridged life table. Those fractions were calculated from a complete life table for the year 1990 in Japan.[13] Each LE was calculated from age 40 to age 85 in 5-year intervals. We also calculated 95% confidence intervals for LE in each age group. All of the statistical analyses were performed using SAS release 9.2 (SAS Institute Inc., Cary, NC, USA).

RESULTS

Table 1 shows the basic characteristics of the participants with different hypertension statuses in the baseline survey. The proportion of hypertensive participants in the baseline survey was 50.5% for men and 41.4% for women. In men, 13.5% of the participants had stage 1 hypertension and 36.2% of the participants had stage 2 hypertension. In women, the respective proportions were 15.0% and 25.1%. Hypertensive patients were generally older and had higher mean plasma glucose and higher total blood cholesterol levels. This difference was observed in both men and women.

The overall LE of the 40-year-old participants, regardless of BP status, was 40.4 years for men and 47.0 years for women. These LE values were higher than the LEs in the complete life table for Japan from 1990. In that table, LE was 37.5 years for men and 42.9 years for women.[17] The observed differences were consistent across all age groups in both genders. Table 2 shows the LE among the participants with different BP statuses from age 40 to 85 years and over. LEs in 40-year-old men and women were 41.7 years and 48.7 years, respectively, in normotensive participants and 39.5 years and 45.8 years, respectively, in hypertensive participants. Thus, the LEs of 40-year-old normotensive participants were greater than those of hypertensive participants. Similar patterns of LE with respect to BP status were observed in all the age groups. The LEs in men with stage 1 hypertension were greater than those of men with stage 2 hypertension. Similar results were observed in women. The longer LE for participants with stage 1 hypertension in comparison with participants with stage 2 hypertension was observed across all age indices for both genders.

DISCUSSION

In this study, LE was estimated for Japanese men and women with and without diagnosed hypertension. The results attribute a significant loss of LE to hypertension. To the best of our knowledge, this is the first study to report the effect of the presence or absence of hypertension on LE in a Japanese population. We observed that the LE of hypertensive men and women was 2–3 years shorter than the LE of normotensive men and women, especially in the middle-aged categories. Increases in hypertension stage also inversely affected LE.

Similar to our observation, Loukine *et al.*[11] recently reported a 2–3 years difference in LE associated with hypertension in a Canadian population. They estimated the LE in 40-year-old men and women to be 41.9 years and 45.8 years, respectively, in normotensive subjects and 38.8 years and 43.7 years, respectively, in hypertensive subjects. After estimating the effect of hypertension on LE in an eastern Finland population, Kiiskinen *et al.*[10] reported that LE was shortened by 2.7 years in hypertensive men and 2.2 years in hypertensive women. Franco *et al.*,[9] studying the participants in the Framingham Heart Study, reported that the differences in LE between 50-year-old normotensive and hypertensive subjects were 5.1 years in men and 4.9 years in women. They estimated the LE in 50-year-old men and women to be 29.7 years and 34.3 years, respectively, in normotensive subjects and 24.6 years and 29.4 years, respectively, in hypertensive subjects. The effect of hypertension on LE in the Framingham Heart Study was much greater than in our Japanese study, the Canadian study and the Finish study. We also observed that the LE for women is higher than that for men, a direct result of higher mortality among men. A similar pattern was observed for the populations both with and without hypertension. Similar observations were reported for the Canadian population, for both subjects with and without hypertension. We observed that the reduction in LE was larger for men than for women. The estimates from other studies were also consistent: the decrease in LE was greater for men than for women.[10,11] It is important to note that direct comparability with our results was hampered by differences in methodology, data used, reporting year and characteristics of the populations studied. Among the subcategories of hypertension, stage 1 and stage 2, decreases in the LE of 40-year-olds were observed as the hypertension grade increased. This tendency was less pronounced when we measured LE in the older-age groups. This finding might be attributed to the small sample size of the older-age group.

Regarding the effect of hypertension on the LE of the elderly population, we observed that the presence of hypertension was associated with reduced LE. Severe hypertension led to reductions in LE. However, the overall impact of milder hypertension was much

Table 1 The basic characteristics of Japanese with different hypertension status in the baseline, NIPPON DATA80, Japan

		Blood pressure categories			
				Hypertension	
Gender	Variables	No hypertension	Hypertension	Stage 1	Stage 2
Men	Age, years (s.d.)	45.9 (11.9)	55.4 (12.9)	56.6 (13.2)	54.8 (12.7)
	BMI, $kg m^{-2}$ (s.d.)	22.1 (2.8)	22.9 (2.9)	22.3 (2.7)	23.1 (3.0)
	Height, cm (s.d.)	163.5 (19.5)	161.5 (19.3)	162.1 (35.8)	161.3 (6.5)
	Weight, kg (s.d.)	59.0 (19.5)	59.6 (9.5)	56.8 (9.0)	60.3 (9.5)
	Plasma glucose, $mg dl^{-1}$ (s.d.)	98.3 (29.2)	106.4 (35.3)	107.3 (37.0)	105.8 (34.4)
	Total cholesterol, $mg dl^{-1}$ (s.d.)	183.9 (31.9)	188.1 (33.7)	183.9 (31.7)	189.7 (34.1)
	Serum creatinine, $mg dl^{-1}$ (s.d.)	1.0 (0.1)	1.1 (0.3)	1.1 (0.2)	1.1 (0.3)
	Smoking, *n* (%)				
	Never smoker	357 (17.1)	417 (19.5)	95 (16.7)	315 (20.6)
	Current smoker	1388 (66.3)	1268 (59.4)	357 (62.7)	896 (58.5)
	Ex-smoker	346 (16.5)	445 (20.8)	116 (20.4)	316 (20.6)
	Unknown	2 (0.1)	5 (0.2)	1 (0.2)	4 (0.3)
	Drinking, *n* (%)				
	Never drinker	467 (22.3)	377 (17.7)	125 (22.0)	249 (16.3)
	Current drinker	1520 (72.6)	1613 (75.6)	403 (70.8)	1187 (77.5)
	Ex-drinker	104 (5.0)	141 (6.6)	41 (7.2)	91 (5.9)
	Unknown	2 (0.1)	4 (0.2)	0 (0.0)	4 (0.3)
Women	Age, years (s.d.)	45.8 (11.7)	58.8 (12.1)	58.7 (12.0)	57.9 (12.3)
	BMI, $kg m^{-2}$ (s.d.)	22.2 (3.1)	23.8 (3.6)	23.3 (3.4)	24.0 (3.7)
	Height, cm (s.d.)	151.2 (5.8)	148.3 (6.2)	148.2 (6.0)	148.4 (6.2)
	Weight, kg (s.d.)	50.8 (7.7)	52.4 (9.1)	51.2 (8.6)	53.1 (9.2)
	Plasma glucose, $mg dl^{-1}$ (s.d.)	96.7 (24.3)	107.0 (33.4)	108.2 (35.7)	106.4 (32.4)
	Total cholesterol, $mg dl^{-1}$ (s.d.)	185.5 (32.7)	199.6 (34.3)	197.7 (33.9)	200.3 (34.6)
	Serum creatinine, $mg dl^{-1}$ (s.d.)	0.8 (0.1)	0.9 (0.2)	0.9 (0.3)	0.9 (0.2)
	Smoking, *n* (%)				
	Never smoker	2801 (89.2)	1968 (88.4)	705 (87.6)	1201 (89.0)
	Current smoker	280 (8.9)	194 (8.7)	76 (9.4)	113 (8.4)
	Ex-smoker	56 (1.8)	63 (2.8)	23 (2.9)	36 (1.7)
	Unknown	5 (0.2)	1 (0.0)	1 (0.1)	0 (0.0)
	Drinking, *n* (%)				
	Never drinker	2405 (76.3)	1818 (81.7)	674 (83.7)	1084 (80.3)
	Current drinker	698 (22.2)	363 (16.3)	118 (14.7)	236 (17.5)
	Ex-drinker	43 (1.4)	40 (1.8)	13 (1.6)	25 (1.6)
	Unknown	5 (0.2)	5 (0.2)	0 (0.0)	5 (0.4)

Abbreviations: BMI, body mass index; NIPPON DATA80: National Integrated Project for Prospective Observation of Non-communicable Disease and its Trends in the Aged; s.d., standard deviation.

more limited. Given the aging of the Japanese population and that of the worldwide population, these LE findings reemphasize the importance of hypertension control, even in the elderly.

Our finding is generalizable to the Japanese population by virtue of the cohort we used for the LE estimation. The NIPPON DATA80 cohort was initially selected by stratified random sampling throughout Japan as part of a national survey. Comparing our results with the complete life table for the same period in Japan,[17] the overall LE of 40-year-old participants, regardless of BP status, was 40.4 years for men and 47.0 years for women. These were higher than the LEs from the complete life table in Japan in 1990, which were 37.5 years for men and 42.9 years for women. The LEs that we measured were greater than those from the complete life table. This difference might be attributed to the overall healthier status of our cohort. In the baseline survey, people with health problems, such as residents of long-term care facilities, could not participate in the survey. This exclusion criterion may have caused age-specific mortality rates to be lower than population as a whole, which could have resulted in the LE differences observed in this study. The stable population in the final age interval (age 85 and over) was calculated as the number of survivors 85 years or older divided by their death rate. Although this is an accepted way to analyze the final age interval for LE calculations, it may overestimate LE.[13,18] This overestimation also influences the difference between our results and those from the complete life table.

Possible misclassifications of long-term BP categories might also influence our results. The classification of hypertension status was made using only the information obtained from the baseline survey, with the assumption that individuals' hypertension status did not change during the follow-up period. This assumption would be violated if any normotensive participant became hypertensive with ageing. It is not possible to precisely ascertain how much change in hypertensive status occurred during the 24-year period. The influence of this misclassification might attenuate the LE differences observed among the groups, and misclassification might render our estimates more conservative. It should also be recognized that all of the LE differences observed in this study were not caused by hypertension

Table 2 Life expectancies of Japanese with different blood pressure status from NIPPON DATA80, 24-year follow-up, 1980–1999, Japan

		Blood pressure categories							
						Hypertension			
		No hypertension		*Hypertension*		*Stage 1*		*Stage 2*	
Gender	*Index age (years)*	*LE*	*95%CI*	*LE*	*95%CI*	*LE*	*95%CI*	*LE*	*95%CI*
Men									
	40	41.7	(41.0, 42.5)	39.5	(38.8, 40.3)	40.6	(39.2, 42.0)	39.2	(38.3, 40.1)
	45	36.9	(36.1, 37.7)	34.8	(34.1, 35.5)	35.6	(34.2, 37.0)	34.6	(33.8, 35.4)
	50	32.3	(31.6, 33.1)	30.5	(29.9, 31.1)	31.3	(30.0, 32.5)	30.3	(29.6, 31.0)
	55	27.8	(27.1, 28.5)	26.0	(25.4, 26.5)	26.9	(25.8, 28.1)	25.7	(25.0, 26.4)
	60	23.4	(22.7, 24.2)	21.9	(21.4, 22.4)	22.9	(21.9, 24.0)	21.6	(21.0, 22.2)
	65	19.4	(18.7, 20.1)	17.9	(17.4, 18.4)	18.6	(17.7, 19.6)	17.7	(17.1, 18.2)
	70	15.6	(14.9, 16.2)	14.2	(13.7, 14.6)	15.1	(14.3, 16.0)	13.9	(13.3, 14.4)
	75	12.2	(11.6, 12.8)	11.0	(10.6, 11.4)	11.7	(11.0, 12.5)	10.7	(10.2, 11.2)
	80	9.2	(8.7, 9.8)	8.5	(8.2, 8.9)	9.2	(8.6, 9.8)	8.3	(7.9, 8.7)
	85	7.2	(6.8, 7.7)	6.6	(6.4, 6.8)	7.1	(6.7, 7.5)	6.4	(6.2, 6.7)
Women									
	40	48.7	(48.0, 49.3)	45.8	(45.0, 46.6)	47.0	(45.9, 48.2)	44.9	(43.9, 46.0)
	45	43.9	(43.2, 44.5)	41.0	(40.3, 41.7)	42.0	(40.9, 43.2)	40.2	(39.3, 41.2)
	50	39.1	(38.5, 39.7)	36.5	(35.9, 37.1)	37.3	(36.3, 38.3)	35.9	(35.1, 36.7)
	55	34.3	(33.7, 35.0)	32.0	(31.4, 32.5)	32.9	(32.0, 33.7)	31.3	(30.5, 32.0)
	60	29.8	(29.2, 30.4)	27.6	(27.1, 28.0)	28.3	(27.5, 29.0)	26.9	(26.2, 27.5)
	65	25.3	(24.7, 25.9)	23.1	(22.7, 23.6)	23.7	(22.9, 24.4)	22.5	(21.9, 23.1)
	70	21.0	(20.4, 21.6)	19.0	(18.6, 19.5)	19.6	(18.9, 20.2)	18.5	(17.9, 19.0)
	75	17.1	(16.5, 17.6)	15.1	(14.7, 15.5)	15.4	(14.8, 16.0)	14.7	(14.2, 15.1)
	80	13.5	(13.0, 14.0)	11.8	(11.4, 12.1)	12.1	(11.6, 12.5)	11.3	(10.9, 11.7)
	85	10.5	(10.1, 11.0)	9.1	(8.9, 9.4)	9.2	(8.7, 9.4)	8.9	(8.6, 9.1)

Abbreviations: CI, confidence intervals; LE, life expectancy; NIPPON DATA80, National Integrated Project for Prospective Observation of Non-communicable Disease and its Trends in the Aged.
Hypertension stages are based on blood pressure measurement, irrespective of medication.

status alone; in fact, other factors in addition to hypertension also affected the mortality rate. The LE differences among the hypertension categories result from the hypertensive participants' risk factor profile, not from BP alone. Thus, in addition to hypertension, other factors simultaneously influenced the LE in our population, including smoking habits,[13] diabetes mellitus[19] and dyslipidemia. Alternatively, hypertension is a convenient marker that functions as a surrogate for health risks not controlled for in the analysis.

In conclusion, the LEs of participants with different hypertension statuses were examined using data from a nationwide cohort study in Japan. A gradual decrease in LE was observed when hypertension was present, and the decrease was greater with increasing disease severity in both men and women.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

ACKNOWLEDGEMENTS

This study was supported by a grant-in-aid from the Ministry of Health, Labor and Welfare under the auspices of the Japanese Association for Cerebro-cardiovascular Disease Control, a Research Grant for Cardiovascular Diseases (7A-2) from the Ministry of Health, Labor and Welfare, and a Health and Labor Sciences Research Grant, Japan (Comprehensive Research on Aging and Health (H11-Chouju-046, H14-Chouju-003, H17-Chouju-012, H19-Chouju-Ippan-014))and the Comprehensive Research on Life-Style Related Diseases Center, including Cardiovascular Diseases and Diabetes Mellitus (H22-Jyunkankitou-Seisyu-Sitei-017). Nahid Rumana is supported by a Research Fellowship and Research Grants-In-Aid (P-21.09139) from the Japan Society for the Promotion of Science (JSPS), Tokyo, Japan. Dr Tanvir Chowdhury Turin is supported by Fellowship Awards from the Canadian Institutes of Health Research (CIHR), Canadian Diabetes Association (CDA), and the Interdisciplinary Chronic Disease Collaboration (ICDC) team grant funded by Alberta Innovates—Health Solutions (AI-HS). We appreciate the members of the NIPPON DATA80/90 Research Group, who are listed in the Appendix.

1 Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK, He J. Global burden of hypertension: analysis of worldwide data. *Lancet* 2005; **365**: 217–223.
2 Gu Q, Burt VL, Paulose-Ram R, Yoon S, Gillum RF. High blood pressure and cardiovascular disease mortality risk among US adults: the third National Health and Nutrition Examination Survey mortality follow-up study. *Ann Epidemiol* 2008; **18**: 302–309.
3 Lida M, Ueda K, Okayama A, Kodama K, Sawai K, Shibata S, Tanaka S, Keijnkai T, Horibe H, Minowa M, Yanagawa H, Hashimoto T, Nippon Data 80 Research Group. Impact of elevated blood pressure on mortality from all causes, cardiovascular diseases, heart disease and stroke among Japanese: 14 year follow-up of randomly selected population from Japanese–NIPPON DATA80. *J Hum Hypertens* 2003; **17**: 851–857.
4 Murakami Y, Hozawa A, Okamura T, Ueshima H, The Evidence for Cardiovascular Prevention From Observational Cohorts in Japan Research Group. (EPOCH-JAPAN). Relation of blood pressure and all-cause mortality in 180,000 Japanese participants: pooled analysis of 13 cohort studies. *Hypertension* 2008; **51**: 1483–1491.
5 Franklin SS, Gustin W, Wong ND, Larson MG, Weber MA, Kannel WB, Levy D. Hemodynamic patterns of age-related changes in blood pressure: the Framingham Heart Study. *Circulation* 1997; **96**: 308–315.
6 Anderson Jr GH, Blakeman N, Streeten D. The effect of age on prevalence of secondary forms of hypertension in 4429 consecutively referred patients. *J Hypertens* 1994; **12**: 609–615.
7 Dunnell K. Ageing and mortality in the UK–national statistician's annual article on the population. *Popul Trends* 2008: 6–23.
8 Hoffmann R. Aging and Mortality. In: Hoffmann R (ed), *Socioeconomic Differences in Old Age Mortality.* Springer, Netherlands, 2008, pp. 5–14.

9 Franco OH, Peeters A, Bonneux L, De Laet C. Blood pressure in adulthood and life expectancy with cardiovascular disease in men and women: life course analysis. *Hypertension* 2005; **46**: 280–186.
10 Kiiskinen U, Vartiainen E, Puska P, Aromaa A. Long-term cost and life-expectancy consequences of hypertension. *J Hypertens* 1998; **16**: 1103–1112.
11 Loukine L, Waters C, Choi BC, Ellison J. Health-adjusted life expectancy among Canadian adults with and without hypertension. *Cardiol Res Pract* 2011; **2011**: 612968.
12 Rumana N, Turin TC, Miura K, Nakamura Y, Kita Y, Hayakawa T, Choudhury SR, Kadota A, Nagasawa SY, Fujioshi A, Takashima N, Okamura T, Okayama A, Ueshima H, NIPPON DATA80 Research Group. Prognostic value of ST-T abnormalities and left high R waves with cardiovascular mortality in Japanese (24-year follow-up of NIPPON DATA80). *Am J Cardiol* 2011; **107**: 1718–1724.
13 Murakami Y, Ueshima H, Okamura T, Kadowaki T, Hozawa A, Kita Y, Hayakawa T, Okayama A, NIPPON DATA80 Research Group. Life expectancy among Japanese of different smoking status in Japan: NIPPON DATA80. *J Epidemiol* 2007; **17**: 31–37.
14 Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL, Jones DW, Materson BJ, Oparil S, Wright JT, Roccella EJ, The National High Blood Pressure Education Program Coordinating Committee. Seventh Report of the Joint National Committee on prevention, detection, evaluation, and treatment of high blood pressure. *Hypertension* 2003; **42**: 1206–1252.
15 Breslow NE, Day NE. *Statistical Methods in Cancer Research Volume II-The analysis of case-control studies.* International Agency for Research on Cancer, Lyon, 1980, pp 41–81.
16 Chiang CL. *The Life Table and its Applications.* Robert E Krieger Publishing, Malabar, FL, 1984, pp 137–167.
17 Ministry of Health and Welfare. *The 18th Life Table.* Kosei Tokei Kyokai, Tokyo, 1998, pp 359–399.
18 Fukutomi K. Bias in the abridged life table constructed by a short method. *Bull Inst Public Health* 1984; **33**: 45–55.
19 Turin TC, Murakami Y, Miura K, Rumana N, Kadota A, Ohkubo T, Okamura T, Okayama A, Ueshima H. Diabetes and life expectancy among Japanese–NIPPON DATA80. *Diabetes Res Clin Pract* 2012; **96**: e18–e22.

APPENDIX

The NIPPON DATA80/90 research group

Chairperson: Hirotsugu Ueshima (Department of Health Science, Shiga University of Medical Science, Otsu, Shiga).

Co-Chairperson: NIPPON DATA80: Akira Okayama (The First Institute for Health Promotion and Health Care, Japan Anti-Tuberculosis Association, Tokyo); NIPPON DATA90: Tomonori Okamura (Department of Preventive Medicine and Public Health, Keio University, Tokyo).

Research members: Shigeyuki Saitoh (Department of 2nd Internal Medicine, Sapporo Medical University, Sapporo, Hokkaido), Kiyomi Sakata (Department of Hygiene and Preventive Medicine, Iwate Medical University, Morioka, Iwate), Atsushi Hozawa (Department of Public Health, Yamagata University Graduate School of Medicine, Yamagata), Takehito Hayakawa (Department of Hygiene and Preventive Medicine, Fukushima Medical University, Fukushima), Yosikazu Nakamura (Department of Public Health, Jichi Medical University, Shimotsuke, Tochigi), Yasuhiro Matsumura (Faculty of Health care, Kiryu University, Midori City, Gunma), Nobuo Nishi (Project for the National Health and Nutrition Survey, National Institute of Health and Nutrition, Tokyo), Nagako Okuda (The First Institute for Health Promotion and Health Care, Japan Anti-Tuberculosis Association, Tokyo), Toru Izumi (Faculty of Medicine, Kitasato University, Sagamihara, Kanagawa), Toshiyuki Ojima (Department of Community Health and Preventive Medicine, Hamamatsu University School of Medicine, Hamamatsu, Shizuoka), Koji Tamakoshi (Department of Public Health and Health Information Dynamics, Nagoya University Graduate School of Medicine, Nagoya, Aichi), Hideaki Nakagawa (Department of Epidemiology and Public Health, Kanazawa Medical University, Kanazawa, Ishikawa), Katsuyuki Miura, Takayoshi Ohkubo, Yoshikuni Kita, Aya Kadota (Department of Health Science, Shiga University of Medical Science, Otsu, Shiga), Yasuyuki Nakamura (Cardiovascular Epidemiology, Kyoto Women's University, Kyoto), Katsushi Yoshita (Osaka City University Graduate School of Human Life Science, Osaka), Kazunori Kodama, Fumiyoshi Kasagi (Radiation Effects Research Foundation, Hiroshima), and Yutaka Kiyohara (Department of Environmental Medicine, Kyushu University, Fukuoka).