表2．県北コホート参加者登録時基本データ

年齢階級	18-29	30-39	40-49	50-59	60-69	70-79	≥80	合計
男性 (n)	86	214	813	1,520	3,281	2,863	385	9,162
BMI	22.4 (3.8)	24.2 (3.5)	24.1 (3.1)	24.3 (3.0)	24.1 (2.9)	23.6 (3.0)	23.0 (2.9)	23.9 (3.0)
BMI≥25	25.6%	36.0%	34.9%	39.1%	36.3%	30.9%	21.3%	34.2%
BMI≥30	5.8%	5.6%	4.2%	4.2%	2.8%	2.2%	0.8%	3.0%
SBP	114.2 (11.6)	119.9 (15.7)	122.1 (16.4)	127.5 (19.0)	131.9 (19.7)	133.8 (19.5)	136.9 (20.7)	130.7 (19.6)
TC	171.7 (35.6)	192.3 (36.7)	197.1 (36.2)	195.8 (32.2)	191.4 (32.0)	188.0 (31.3)	184.2 (30.4)	191.1 (32.5)
中性脂肪	122.4 (85.6)	144.0 (97.1)	154.4 (106.6)	135.7 (93.5)	124.6 (83.3)	113.1 (68.8)	104.3 (54.1)	125.1 (83.6)
HDLC	53.7 (13.4)	55.3 (13.9)	56.4 (15.6)	56.8 (15.5)	56.1 (15.4)	55.5 (15.2)	54.3 (13.4)	56.0 (15.2)
LDLC	102.1 (33.5)	116.7 (32.7)	117.3 (32.5)	116.3 (29.4)	113.4 (29.4)	111.9 (27.6)	109.7 (27.5)	113.6 (29.3)
血糖	92.8 (14.6)	99.0 (30.1)	107.8 (35.9)	113.4 (35.4)	115.8 (34.6)	116.6 (36.7)	117.6 (34.5)	114.4 (35.5)
HbA_{1C}	4.68 (0.30)	4.81 (0.49)	4.99 (0.81)	5.12 (0.74)	5.18 (0.73)	5.20 (0.74)	5.17 (0.63)	5.14 (0.74)
心筋梗塞	0.0%	0.0%	0.0%	0.1%	0.8%	1.4%	1.3%	0.8%
脳卒中	0.0%	0.0%	0.1%	0.3%	0.4%	0.7%	0.3%	0.4%
糖尿病	0.0%	0.9%	3.8%	6.7%	8.4%	9.1%	7.8%	7.6%
高血圧	0.0%	10.7%	21.4%	35.4%	50.0%	55.9%	61.6%	46.0%
高脂血症	22.1%	30.4%	33.0%	33.3%	30.1%	29.0%	27.0%	30.3%
女性 (n)	180	620	1,980	4,017	6,095	4,006	412	17,310
BMI	21.7 (4.3)	22.5 (3.7)	23.4 (3.6)	24.0 (3.4)	24.3 (3.4)	24.3 (3.5)	24.0 (3.5)	24.0 (3.5)
BMI≥25	13.9%	22.1%	28.0%	35.1%	39.9%	40.4%	34.8%	36.5%
BMI≥30	6.7%	4.8%	5.3%	5.5%	5.5%	6.0%	3.5%	5.5%
SBP	102.1 (11.1)	107.5 (14.1)	115.1 (16.8)	121.9 (19.3)	127.9 (19.4)	132.3 (19.6)	135.3 (20.7)	125.2 (20.1)
TC	167.8 (29.0)	176.5 (30.0)	192.3 (31.6)	209.6 (32.7)	209.4 (30.8)	206.3 (30.3)	201.2 (33.1)	205.0 (32.4)
中性脂肪	75.7 (69.3)	89.3 (62.5)	98.2 (77.4)	112.1 (68.3)	117.5 (64.6)	117.5 (62.7)	113.2 (54.5)	112.5 (66.9)
HDLC	62.7 (14.6)	63.3 (14.1)	63.6 (14.5)	63.0 (14.4)	60.4 (14.2)	59.6 (14.3)	58.6 (13.4)	61.2 (14.4)
LDLC	95.1 (26.7)	100.8 (26.1)	113.1 (28.2)	126.1 (29.7)	127.0 (27.8)	124.8 (27.0)	121.5 (28.1)	123.3 (28.9)
血糖	90.7 (11.9)	94.1 (14.3)	100.7 (22.2)	104.4 (25.0)	108.0 (26.9)	110.9 (28.3)	116.6 (33.6)	106.5 (26.5)
HbA_{1C}	4.65 (0.28)	4.75 (0.41)	4.88 (0.52)	5.08 (0.64)	5.16 (0.66)	5.21 (0.62)	5.23 (0.72)	5.10 (0.63)
心筋梗塞	0.0%	0.0%	0.0%	0.0%	0.2%	0.6%	1.7%	0.3%
脳卒中	0.0%	0.2%	0.2%	0.2%	0.3%	0.2%	0.7%	0.2%
糖尿病	0.0%	0.2%	1.8%	3.0%	4.3%	5.9%	7.5%	4.0%
高血圧	0.6%	4.2%	12.3%	28.5%	43.5%	58.7%	63.8%	38.6%
高脂血症	8.9%	9.4%	20.9%	41.0%	44.2%	42.2%	35.9%	38.5%

表3．県北コホート参加者登録時基本データ，生活習慣関連項目

年齢階級	18-29	30-39	40-49	50-59	60-69	70-79	≥80	合計
男性 (n)	86	214	813	1,520	3,281	2,863	385	9,162
喫煙状況								
喫煙者	57.0%	58.9%	55.0%	41.4%	27.6%	21.9%	16.6%	31.1%
禁煙者	4.7%	14.0%	23.0%	25.5%	31.0%	38.0%	37.1%	31.2%
非喫煙者	38.4%	27.1%	22.0%	33.2%	41.5%	40.1%	46.2%	37.8%
飲酒状況								
週5日以上	26.7%	51.4%	55.2%	54.9%	46.1%	38.1%	29.4%	45.1%
機会的	32.6%	26.6%	23.1%	22.8%	24.0%	20.7%	17.7%	22.6%
禁酒者	1.2%	4.2%	2.2%	4.3%	8.9%	12.9%	13.0%	8.8%
非飲酒者	39.5%	17.8%	19.4%	18.0%	21.1%	28.3%	40.0%	23.6%
運動習慣								
60分を月8回以上	17.4%	8.4%	5.3%	9.8%	20.0%	21.2%	22.9%	17.2%
60分を月1回以上	37.2%	29.9%	25.7%	30.2%	40.6%	42.9%	41.6%	38.0%
女性 (n)	180	620	1,980	4,017	6,095	4,006	412	17,310
喫煙状況								
喫煙者	21.7%	15.2%	7.0%	3.4%	1.1%	0.7%	0.0%	2.9%
禁煙者	11.7%	9.4%	4.4%	1.2%	0.6%	0.5%	0.5%	1.6%
非喫煙者	66.7%	75.5%	88.6%	95.4%	98.4%	98.8%	99.5%	95.5%
飲酒状況								
週5日以上	7.8%	11.9%	9.8%	4.5%	3.0%	1.9%	2.9%	4.2%
機会的	34.4%	36.5%	27.4%	19.1%	11.4%	6.7%	4.4%	14.9%
禁酒者	8.9%	3.5%	1.9%	2.0%	1.1%	0.9%	1.5%	1.5%
非飲酒者	48.9%	48.1%	60.9%	74.4%	84.5%	90.4%	91.3%	79.3%
運動習慣								
60分を月8回以上	11.1%	6.3%	7.1%	10.8%	12.1%	10.2%	11.4%	10.6%
60分を月1回以上	26.1%	26.1%	27.1%	33.9%	35.8%	33.0%	29.6%	33.1%

表４．県北コホート参加者登録時基本データー栄養調査結果

年齢階級	18-29	30-39	40-49	50-59	60-69	70-79	≥80	合計
男性 (n)	69	182	679	1,255	2,550	1,399	175	6,309
総カロリー kcal/day	2500 ± 783	2436 ± 803	2585 ±802	2611 ± 823	2480 ± 786	2369 ± 755	2397 ± 877	2489 ± 796
炭水化物 g/day (%)	358.2 (57.4%)	342.8 (56.3%)	363.3 (56.5%)	361.4 (55.5%)	339.8 (55.1%)	321.9 (54.7%)	319.3 (53.9%)	342.4 (55.3%)
タンパク質 g/day (%)	83.6 (13.4%)	81.2 (13.5%)	85.9 (13.4%)	94.2 (14.5%)	97.3 (15.7%)	97.8 (16.5%)	101.8 (16.9%)	95.1 (15.3%)
脂肪 g/day (%)	63.8 (23.0%)	58.6 (21.9%)	58.0 (20.3%)	62.4 (21.4%)	63.3 (22.8%)	64.9 (24.3%)	71.3 (26.2%)	63.0 (22.6%)
飽和脂肪	16.6 (6.0%)	15.5 (5.8%)	14.5 (5.1%)	15.7 (5.4%)	15.8 (5.7%)	16.1 (6.1%)	17.6 (6.5%)	15.7 (5.7%)
1価不飽和	22.1 (8.0%)	20.3 (7.6%)	19.9 (7.0%)	21.1 (7.2%)	21.2 (7.6%)	21.7 (8.1%)	24.2 (8.8%)	21.2 (7.6%)
多価値不飽和	16.9 (6.1%)	15.2 (5.7%)	15.8 (5.5%)	16.8 (5.8%)	17.2 (6.2%)	17.7 (6.6%)	19.4 (7.1%)	17.1 (6.1%)
n-6PUFA	14.0 (5.1%)	12.2 (4.6%)	12.4 (4.4%)	12.7 (4.4%)	12.6 (4.5%)	12.9 (4.8%)	14.4 (5.3%)	12.7 (4.6%)
n-3PUFA	3.5 (1.3%)	3.2 (1.2%)	3.5 (1.2%)	4.0 (1.4%)	4.2 (1.5%)	4.4 (1.6%)	4.7 (1.7%)	4.1 (1.5%)
αリノレイン酸	2.3 (0.8%)	2.0 (0.7%)	2.1 (0.7%)	2.1 (0.7%)	2.1 (0.8%)	2.2 (0.8%)	2.5 (0.9%)	2.2 (0.8%)
EPA+DHA	1.2 (0.4%)	1.2 (0.5%)	1.4 (0.5%)	1.8 (0.6%)	2.1 (0.7%)	2.2 (0.8%)	2.2 (0.8%)	1.9 (0.7%)
n6/n3 ratio	4.2 ± 1.0	4.0 ± 0.8	3.8 ± 0.9	3.4 ± 0.9	3.2 ± 0.9	3.2 ± 1.0	3.3 ± 1.0	3.3 ± 1.0
コレステロール (mg/day)	353 ± 148	355 ± 152	375 ± 181	416 ± 210	431 ± 220	443 ± 232	480 ± 271	423 ± 218
食塩 (g/day)	13.8 ± 5.2	13.3 ± 4.6	14.4 ± 4.8	15.8 ± 5.5	16.6 ± 5.4	16.9 ± 5.6	17.5 ± 6.4	16.2 ± 5.5
女性 (n)	152	558	1,795	3,473	4,825	1,908	138	12,849
総カロリー kcal/day	1645 ± 492	1753 ± 503	1784 ± 499	1804 ± 530	1854 ± 580	1820 ± 583	1758 ± 576	1818 ± 553
炭水化物 g/day (%)	230.4 (55.9%)	245.8 (56.2%)	251.3 (56.6%)	257.1 (57.4%)	263.3 (57.4%)	259.5 (57.8%)	254.2 (58.7%)	258.1 (57.3%)
タンパク質 g/day (%)	58.7 (14.3%)	64.4 (14.7%)	67.8 (15.2%)	72.0 (15.9%)	77.4 (16.6%)	75.7 (16.5%)	72.9 (16.4%)	73.5 (16.1%)
脂肪 g/day (%)	49.4 (26.9%)	51.6 (26.4%)	52.6 (26.3%)	52.4 (25.8%)	53.9 (25.7%)	52.9 (25.5%)	50.3 (24.9%)	53.0 (25.8%)
飽和脂肪	14.4 (7.8%)	14.3 (7.3%)	14.0 (7.0%)	13.6 (6.7%)	13.8 (6.6%)	13.5 (6.5%)	12.9 (6.4%)	13.7 (6.7%)
1価不飽和	16.8 (9.2%)	17.6 (9.0%)	18.0 (9.0%)	17.6 (8.6%)	17.9 (8.5%)	17.6 (8.4%)	16.7 (8.2%)	17.7 (8.6%)
多価値不飽和	11.8 (6.5%)	12.9 (6.6%)	13.5 (6.8%)	13.8 (6.8%)	14.4 (6.9%)	14.2 (6.9%)	13.3 (6.6%)	14.0 (6.8%)
n-6PUFA	9.7 (5.3%)	10.5 (5.4%)	10.7 (5.3%)	10.4 (5.1%)	10.6 (5.1%)	10.5 (5.1%)	9.7 (4.8%)	10.5 (5.1%)
n-3PUFA	2.4 (1.0)	2.7 (1.2)	3.0 (1.3)	3.2 (1.6)	3.5 (1.8)	3.4 (1.8)	3.2 (1.9)	3.3 (1.7)
αリノレイン酸	1.6 (0.9%)	1.7 (0.9%)	1.8 (0.9%)	1.8 (0.9%)	1.8 (0.9%)	1.8 (0.9%)	1.7 (0.8%)	1.8 (0.9%)
EPA+DHA	0.8 (0.4%)	1.0 (0.5%)	1.2 (0.6%)	1.4 (0.7%)	1.6 (0.8%)	1.6 (0.8%)	1.5 (0.7%)	1.5 (0.7%)
n6/n3 ratio	4.2 ± 0.8	4.0 ± 0.8	3.8 ± 0.9	3.4 ± 0.9	3.3 ± 1.0	3.3 ± 1.0	3.3 ± 1.0	3.4 ± 1.0
コレステロール (mg/day)	293 ± 122	304 ± 132	317 ± 137	328 ± 162	350 ± 181	347 ± 184	341 ± 174	336 ± 169
食塩 (g/day)	9.6 ± 3.0	10.8 ± 3.4	11.5 ± 3.5	12.5 ± 4.1	13.6 ± 4.5	13.6 ± 4.6	13.3 ± 4.6	12.8 ± 4.3

表5．県北コホート参加者登録時基本データ－CRP，BNP，尿中微量アルブミン

年齢階級		18-29	30-39	40-49	50-59	60-69	70-79	≥80	合計
男性									
高感度CRP (n)		83	211	799	1,500	3,218	2,776	371	8,958
crude mean	(mg/L)	0.95 (2.84)	0.83 (1.95)	0.87 (1.87)	0.96 (2.15)	1.43 (4.80)	1.72 (5.91)	2.25 (7.53)	1.41 (4.78)
exclude high CRP* (n)		82	210	795	1,487	3,158	2,710	355	8,797
crude mean	(mg/L)	0.66 (1.08)	0.71 (0.97)	0.77 (1.16)	0.80 (1.16)	0.94 (1.25)	1.01 (1.32)	1.13 (1.35)	0.92 (1.25)
BNP (n)		46	131	597	1028	2134	1789	242	5967
crude mean	(pg/mL)	3.5 (5.8)	5.8 (6.6)	7.4 (9.4)	14.1 (21.6)	24.9 (34.4)	38.1 (56.2)	71.0 (117.9)	26.5 (47.1)
High BNP**	(%)	0.0%	0.0%	0.8%	3.8%	10.9%	20.7%	47.5%	12.8%
尿中アルブミン (n)		83	211	796	1,494	3,199	2,763	361	8,907
crude mean	(mg/L)	10.9 (11.4)	30.0 (122.7)	28.5 (137.5)	35.0 (136.8)	46.2 (228.9)	53.9 (179.1)	74.9 (208.7)	45.6 (189.3)
UACR	(mg/g)	8.4 (7.9)	24.5 (90.8)	27.8 (136.0)	37.3 (122.9)	56.4 (265.7)	67.5 (257.5)	101.0 (340.0)	54.7 (235.1)
マクロアルブミン尿除外後		83	208	788	1,462	3,097	2,656	336	8,630
crude mean	(mg/L)	10.9 (11.4)	18.8 (37.9)	17.6 (34.8)	20.7 (34.0)	24.1 (42.7)	29.3 (48.6)	34.3 (55.4)	24.7 (43.2)
UACR	(mg/g)	8.4 (7.9)	15.1 (32.7)	16.7 (28.4)	22.8 (36.1)	26.5 (40.0)	32.3 (44.6)	35.2 (43.7)	26.7 (40.1)
% of microalbuminuria‡		1.2%	6.7%	10.2%	18.3%	22.0%	28.1%	31.8%	22.0%
女性									
高感度CRP (n)		179	618	1,953	3,955	5,977	3,893	395	16,970
crude mean	(mg/L)	0.70 (1.70)	0.78 (2.32)	0.72 (1.94)	0.86 (2.88)	1.07 (3.00)	1.23 (3.75)	1.27 (2.66)	1.01 (3.03)
exclude high CRP* (n)		177	612	1,940	3,920	5,895	3,832	387	16,763
crude mean		0.56 (1.16)	0.61 (1.04)	0.60 (1.06)	0.68 (1.04)	0.78 (1.11)	0.86 (1.17)	0.97 (1.35)	0.75 (1.11)
BNP (n)		79	319	1,415	2,743	4,003	2,599	240	11,398
crude mean	(pg/mL)	8.3 (7.4)	9.6 (9.0)	13.9 (13.5)	16.1 (15.9)	23.8 (22.9)	35.7 (35.0)	58.9 (60.1)	23.7 (26.8)
High BNP**	(%)	0.0%	0.3%	1.8%	2.5%	9.2%	21.2%	42.1%	9.8%
尿中アルブミン (n)		176	610	1,932	3,918	5,938	3,856	385	16,815
crude mean	(mg/L)	17.0 (43.6)	14.5 (36.9)	17.7 (74.4)	17.9 (59.5)	24.7 (85.3)	36.5 (136.0)	52.9 (111.2)	25.2 (93.2)
UACR	(mg/g)	16.9 (55.7)	16.6 (36.5)	23.3 (83.5)	28.7 (86.5)	39.9 (131.1)	58.0 (205.0)	87.4 (249.0)	39.5 (141.3)
マクロアルブミン尿除外後		175	607	1,916	3,884	5,841	3,754	364	16,541
crude mean	(mg/L)	14.3 (23.2)	12.8 (26.3)	13.6 (23.9)	14.2 (24.3)	17.6 (26.9)	22.9 (31.0)	34.3 (45.6)	17.7 (27.8)
UACR	(mg/g)	12.9 (19.5)	14.8 (25.7)	17.8 (27.0)	22.5 (31.2)	28.2 (36.6)	35.2 (41.2)	47.2 (53.2)	27.0 (36.2)
% of microalbuminuria		6.3%	6.1%	12.0%	17.2%	24.8%	34.7%	47.0%	23.4%

表6．岩手県北コホート性別年齢階級別心房細動有所見者（度数）

	男性			女性			総数		
10歳階級	総数	心房細動有所見者	(%)	総数	心房細動有所見者	(%)	総数	心房細動有所見者	(%)
10-19	6	0	0	9		0	15	0	0.00%
20-29	80	0	0.00%	171		0.00%	251	0	0.00%
30-39	214	1	0.47%	620		0.00%	834	1	0.12%
40-49	813	6	0.74%	1979	1	0.05%	2792	7	0.25%
50-59	1520	19	1.25%	4010	7	0.17%	5530	26	0.47%
60-69	3281	104	3.17%	6062	33	0.54%	9343	137	1.47%
70-79	2863	150	5.24%	3949	57	1.44%	6812	207	3.04%
≧80	385	21	5.45%	400	12	3.00%	785	33	4.20%
総数	9162	301	3.29%	17200	110	0.64%	26362	411	1.56%

表7．観察開始時年齢階級別にみた死亡と脳卒中罹患の状況

	男性				女性			
観察開始時年齢	対象者数	観察人年	死亡数(率)	脳卒中罹患数(率)	対象者数	観察人年	死亡数(率)	脳卒中罹患数(率)
15-19	3	11.9	0 (0.0)	0 (0.0)	4	13.9	0 (0.0)	0 (0.0)
20-24	13	49.0	1 (20.4)	0 (0.0)	7	22.5	0 (0.0)	0 (0.0)
25-29	25	93.1	0 (0.0)	0 (0.0)	30	110.2	0 (0.0)	0 (0.0)
30-34	33	129.7	0 (0.0)	0 (0.0)	55	214.3	0 (0.0)	0 (0.0)
35-39	63	254.5	0 (0.0)	0 (0.0)	127	514.8	0 (0.0)	0 (0.0)
40-44	154	594.1	2 (3.4)	1 (1.7)	305	1179.1	0 (0.0)	0 (0.0)
45-49	220	875.4	0 (0.0)	1 (1.1)	412	1601.5	0 (0.0)	2 (1.3)
50-54	292	1142.9	3 (2.6)	6 (5.3)	618	2362.3	0 (0.0)	5 (2.1)
55-59	241	926.2	4 (4.3)	5 (5.5)	678	2593.3	3 (1.2)	2 (0.8)
60-64	409	1585.4	4 (2.5)	4 (2.5)	917	3540.5	6 (1.7)	14 (4.0)
65-69	614	2385.7	13 (5.4)	19 (8.1)	1,107	4304.3	17 (3.9)	15 (3.5)
70-74	623	2383.0	32 (13.4)	31 (13.4)	963	3729.5	21 (5.6)	19 (5.2)
75-79	341	1304.9	19 (14.6)	12 (9.5)	537	2114.7	16 (7.6)	22 (10.7)
80-84	106	420.5	8 (19.0)	3 (7.4)	133	508.5	7 (13.8)	7 (14.2)
85-89	27	91.3	4 (43.8)	1 (11.4)	26	101.3	1 (9.9)	0 (0.0)
90-94	3	11.0	1 (91.2)	0 (0.0)	1	4.3	0 (0.0)	0 (0.0)
計	3,167	12258.6	91 (7.4)	83 (6.9)	5,920	22915.2	71 (3.1)	86 (3.8)

死亡率・罹患率は対1,000人年
・循環器疾患の既往者を除く（自己回答または地域発症登録による確認）
・脳卒中罹患はTIAとして登録されている者を除く

ると，男性では3.5/1000人年（昭和60年の人口構成で年齢調整すると2.0/1000人年），女性では2.6/1000人年（同じく1.1/1000人年）となり，従来の報告とほぼ同様の罹患率であった。

表8－1は二戸地域のコホート研究参加者の要支援者ならびに要介護者の性年齢別度数表を示している。二戸地区の65歳以上の参加者4,371名中，男性要支援者は29名，要介護者は64名，女性では，それぞれ85名，71名が新規に認定されていた。脳卒中発症後に要支援または要介護1以上の認定を受けていた者の割合を見ると，男性では93人中25人（26.9%），女性は156人中23（14.7%）で，要支援または要介護１以上の介護認定者全体のおよそ20%に当たることが判明した。表8－2は新規要介護または要支援認定の発生率（/1000人年）を算出したものである。二戸地域の65歳以上の人口では，ほぼ15/1000人年の新規介護認定発生率であった。

表8−1．性別・年齢階級別の要支援・要介護人数（%）

観察開始時年齢(歳)	対象者数 a	要支援（%）	要介護1（%）	要介護2（%）	要介護3（%）	要介護4（%）	要介護5（%）	介護認定 b（%）
男性								
65-69	614	6 (1.0)	4 (0.7)	2 (0.3)	1 (0.2)	2 (0.3)	1 (0.2)	16 (2.6)
70-74	619	6 (1.0)	11 (1.8)	4 (0.6)	6 (1.0)	4 (0.6)	0 (0.0)	31 (5.0)
75-79	337	6 (1.8)	11 (3.3)	3 (0.9)	2 (0.6)	1 (0.3)	1 (0.3)	24 (7.1)
80-84	103	9 (8.7)	4 (3.9)	1 (1.0)	2 (1.9)	0 (0.0)	0 (0.0)	16 (15.5)
85-89	22	1 (4.5)	1 (4.5)	1 (4.5)	0 (0.0)	1 (4.5)	1 (4.5)	5 (22.7)
90-94	2	1 (50.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (50.0)
計	1,697	29 (1.7)	31 (1.8)	11 (0.6)	11 (0.6)	8 (0.5)	3 (0.2)	93 (5.5)
女性								
65-69	1,103	12 (1.1)	6 (0.5)	2 (0.2)	1 (0.1)	1 (0.1)	0 (0.0)	22 (2.0)
70-74	950	25 (2.6)	19 (2.0)	3 (0.3)	3 (0.3)	4 (0.4)	1 (0.1)	55 (5.8)
75-79	494	37 (7.5)	10 (2.0)	3 (0.6)	2 (0.4)	3 (0.6)	1 (0.2)	56 (11.3)
80-84	108	10 (9.3)	4 (3.7)	1 (0.9)	0 (0.0)	2 (1.9)	1 (0.9)	18 (16.7)
85-89	19	1 (5.3)	1 (5.3)	1 (5.3)	2 (10.5)	0 (0.0)	0 (0.0)	5 (26.3)
計	2,674	85 (3.2)	40 (1.5)	10 (0.4)	8 (0.3)	10 (0.4)	3 (0.1)	156 (5.8)

a, 登録時に介護認定（要支援および要介護1以上）を受けている者を除く。
b, 介護認定は要支援および要介護度1以上とした。

表8−2．性別・年齢階級別にみた介護認定の状況

男

観察開始時年齢	対象者数	介護認定観察人年	介護認定 /1,000人年
65-69	614	2360.5	16 (6.8)
70-74	619	2313.5	31 (13.4)
75-79	337	1251.5	24 (19.2)
80-84	103	374.7	16 (42.7)
85-89	22	60.9	5 (82.1)
90-94	2	6.2	1 (161.3)
計	1,697	6367.2	93 (14.6)

女

観察開始時年齢	対象者数	介護認定観察人年	介護認定 /1,000人年
65-69	1,103	4251.2	22 (5.2)
70-74	950	3570.9	55 (15.4)
75-79	494	1814.7	56 (30.9)
80-84	108	388.1	18 (46.4)
85-89	19	65.6	5 (76.3)
90-94	0	0.0	
計	2,674	10090.5	156 (15.5)

介護認定リスクを同定するに当たり，3.5年の観察期間では介護認定者が少ないため，本報告では，要支援者と介護認定者を併せた対象者を介護認定ありと定義して以下の解析を行い，介護認定に影響するリスク要因についての検討を行った。

表9は，登録調査開始当時に介護認定を受けていない，循環器疾患非合併者で，65歳以上の参加者を解析対象として，死亡に影響する要因についてCox比例ハザードモデルを用いて検討したものである。ここでは古典的循環器疾患危険因子（年齢，BMI，収縮期血圧，総コレステロール値，HDLコレステロール値，HbA1c値，飲酒習慣，運動習慣の有無，現在喫煙の有無）をとりあげた。平均3.5年の観察期間での解析結果，総死亡に影響する古典的危険因子として最も強く影響するのは年齢であった。女性では，BMIが高いほど，HDLコレステロール値が低いほど死亡のリスクが有意に上昇していた。男性では，HDLコレステロール値が低いほど，BMI低いほど死亡リスクがあがる傾向にあったが，有意ではなかった。

表10は脳卒中発症に影響する因子についてCox比例ハザードモデルを用いて検討したものである。脳卒中発症に影響する古典的危険因子として強く影響するのは血圧値と年齢であった。男女ともに収縮期血圧が高いほど脳卒中発症リスクが上昇していた。Coxの比例ハザードモデルでの検討では，それ以外の古典的危険因子は有意に発症には影響していなかった。

表11は，新規介護認定に影響する因子についてCox比例ハザードモデルを用いて検討したものである。平均3.5年の観察期間での解析結果，脳卒中発症と同様に強く影響しているのは年齢であった。年齢以外の項目に関しては，男性と女性で介護認定に影響する要因に違いがあった。年齢を調整した検討では，男性では，収縮期血圧が高いほど，血清総コレステロール値が低いほど介護認定

表9．死亡に影響する因子，Cox比例ハザードモデルによる検討

古典的危険因子	男性 HR	男性 HR (95.0% CI) 下限	男性 HR (95.0% CI) 上限	男性 p	女性 HR	女性 HR (95.0% CI) 下限	女性 HR (95.0% CI) 上限	女性 p
年齢調整ハザード比(HR)								
年齢	1.081	1.022	1.143	0.006	1.066	0.999	1.136	0.052
HDLC	0.985	0.966	1.006	0.160	0.968	0.945	0.991	0.008
年齢	1.082	1.022	1.144	0.006	1.077	1.009	1.150	0.027
BMI	0.936	0.836	1.048	0.253	1.105	1.012	1.207	0.025
多変量調整ハザード比(HR)								
年齢	1.086	1.025	1.150	0.005	1.070	1.002	1.143	0.042
HbA_{1C}	1.235	0.886	1.720	0.213	0.802	0.455	1.412	0.444
TC	1.000	0.990	1.010	0.987	0.995	0.984	1.006	0.335
HDLC	0.978	0.956	1.001	0.057	0.974	0.949	1.000	0.053
SBP (10mmHg)	1.007	0.992	1.022	0.359	0.998	0.982	1.015	0.834
BMI	0.892	0.787	1.012	0.075	1.105	1.005	1.216	0.040
喫煙者	1.336	0.604	2.958	0.474	.	.	.	.
禁煙者	1.471	0.686	3.157	0.321	.	.	.	.
常用飲酒者	1.750	0.797	3.843	0.163	.	.	.	.
機会的飲酒者	0.748	0.269	2.083	0.579	0.656	0.156	2.750	0.564
禁酒者	0.956	0.297	3.077	0.939	.	.	.	0.989
運動習慣	0.843	0.401	1.772	0.652	0.696	0.214	2.267	0.548

表10．新規脳卒中発症に影響する因子、Cox比例ハザードモデルによる検討

古典的危険因子	男性 HR	男性 HR (95.0% CI) 下限	男性 HR (95.0% CI) 上限	男性 *p*	女性 HR	女性 HR (95.0% CI) 下限	女性 HR (95.0% CI) 上限	女性 *p*
年齢調整ハザード比(HR)								
年齢	0.996	0.949	1.046	0.874	1.097	1.045	1.153	＜0.001
SBP	1.020	1.008	1.031	0.001	1.014	1.002	1.026	0.022
多変量調整ハザード比(HR)								
年齢	1.001	0.952	1.052	0.981	1.091	1.036	1.149	0.001
HbA_{1C}	0.990	0.720	1.361	0.949	1.078	0.757	1.536	0.676
TC	0.994	0.986	1.003	0.180	1.000	0.991	1.009	0.948
HDLC	0.998	0.981	1.016	0.851	0.991	0.971	1.011	0.367
SBP (10mmHg)	1.018	1.007	1.030	0.001	1.011	0.998	1.024	0.091
BMI	1.001	0.911	1.099	0.991	1.059	0.979	1.146	0.152
喫煙者	1.149	0.644	2.048	0.639	4.252	0.567	31.868	0.159
禁煙者	0.781	0.421	1.450	0.434	–	–	–	–
常用飲酒者	1.659	0.856	3.213	0.134	1.693	0.400	7.169	0.475
機会的飲酒者	0.953	0.407	2.230	0.911	1.141	0.409	3.186	0.801
禁酒者	1.728	0.744	4.012	0.203	–	–	–	–
運動習慣	0.844	0.449	1.584	0.597	1.491	0.727	3.059	0.276

表11．新規介護認定（要支援を含む）に影響する因子，Cox比例ハザードモデルによる検討

古典的危険因子	男性 HR	男性 HR (95.0% CI) 下限	男性 HR (95.0% CI) 上限	男性 *p*	女性 HR	女性 HR (95.0% CI) 下限	女性 HR (95.0% CI) 上限	女性 *p*
年齢調整ハザード比(HR)								
年齢	1.126	1.086	1.167	＜0.001	1.163	1.129	1.198	＜0.001
SBP	1.012	1.003	1.022	0.013	0.998	0.990	1.006	0.614
年齢	1.174	1.126	1.224	＜0.001	1.165	1.128	1.204	＜0.001
BMI	0.992	0.910	1.082	0.857	1.052	1.000	1.108	0.050
年齢	1.171	1.123	1.221	＜0.001	1.161	1.125	1.199	＜0.001
TC	0.991	0.983	0.999	0.033	0.996	0.990	1.002	0.162
多変量調整ハザード比(HR)								
年齢	1.132	1.091	1.174	＜0.001	1.158	1.123	1.194	＜0.001
HbA_{1C}	1.145	0.905	1.448	0.260	1.151	0.920	1.441	0.218
TC	0.994	0.987	1.001	0.113	0.993	0.988	0.999	0.023
HDLC	1.000	0.984	1.015	0.976	1.008	0.995	1.021	0.228
SBP (10mmHg)	1.012	1.002	1.023	0.015	0.997	0.988	1.005	0.426
BMI	0.977	0.903	1.057	0.561	1.065	1.014	1.119	0.012
喫煙者	1.278	0.769	2.124	0.344	1.723	0.234	12.659	0.593
禁煙者	0.947	0.568	1.578	0.834	4.601	1.128	18.760	0.033
常用飲酒者	1.853	1.043	3.294	0.036	1.245	0.454	3.420	0.670
機会的飲酒者	1.591	0.815	3.108	0.174	0.815	0.379	1.753	0.601
禁酒者	2.130	1.059	4.288	0.034	1.170	0.162	8.425	0.876
運動習慣	1.160	0.719	1.871	0.542	0.799	0.466	1.372	0.416

リスクが上昇する（それぞれHRは1.012，0.960）。女性ではBMIが高いほど介護認定リスクが上昇していた。多変量解析では，男性対象者では，収縮期血圧，常用飲酒，禁酒が介護認定リスクを上昇させていた。女性では，血清コレステロール値の低値，BMIの高値，禁煙が介護認定リスクを上昇させていた。

表12は脂肪酸摂取と新規介護認定についてのCox比例ハザードによる検討結果である。飽和脂肪酸摂取量が多いほど循環器疾患発症リスクが高くなることが示唆されているが，本検討では，女性では，飽和脂肪酸摂取が多いほど介護認定リスクがあがる傾向があった（HR1.129，p=0.08）。

表12．新規介護認定（要支援を含む）に影響する因子，Cox比例ハザードモデルによる検討
ー脂肪酸摂取量についての検討ー

古典的危険因子	男性 HR	男性 HR (95.0% CI) 下限	男性 HR (95.0% CI) 上限	男性 *p*	女性 HR	女性 HR (95.0% CI) 下限	女性 HR (95.0% CI) 上限	女性 *p*
年齢調整ハザード比(HR)								
年齢	1.211	1.144	1.282	<0.001	1.207	1.156	1.261	<0.001
飽和脂肪酸摂取	1.031	0.854	1.245	0.753	1.105	0.976	1.252	0.115
多変量調整ハザード比(HR)								
年齢	1.210	1.142	1.283	<0.001	1.221	1.166	1.279	<0.001
HbA_{1C}	1.226	0.811	1.853	0.335	0.927	0.606	1.418	0.728
TC	0.994	0.982	1.005	0.282	0.993	0.985	1.002	0.123
HDLC	0.985	0.960	1.011	0.259	1.007	0.989	1.025	0.463
SBP (10mmHg)	1.003	0.985	1.021	0.769	0.998	0.985	1.011	0.746
BMI	0.952	0.835	1.085	0.460	1.090	1.017	1.168	0.015
喫煙者	1.654	0.652	4.196	0.290	4.206	0.560	31.566	0.162
禁煙者	1.499	0.637	3.531	0.354	24.342	5.540	106.965	0.000
常用飲酒者	1.452	0.514	4.106	0.482	1.279	0.304	5.374	0.737
機会的飲酒者	2.526	0.928	6.875	0.070	0.918	0.331	2.548	0.870
禁酒者	1.907	0.564	6.439	0.299	–	–	–	–
運動習慣	1.317	0.617	2.810	0.477	0.603	0.241	1.508	0.279
不飽和脂肪酸摂取	1.114	0.910	1.364	0.297	1.005	0.872	1.158	0.942
飽和脂肪酸摂取	0.964	0.757	1.227	0.767	1.129	0.984	1.294	0.083

考　察

本研究結果を要約すると，岩手県北部地域の成人26,742名の参加者の登録時検査データの横断解析を行い，岩手県在住の現代日本人の古典的危険因子保有状況について，性別・年齢階級別にその平均値と割合を示すことでこころみた。その結果，現代日本人の血圧値，肥満者の割合，喫煙率，血清脂質値，糖尿病者割合，高脂血症者割合，栄養摂取状況が性年齢階級別に明らかになった。従来一般住民を対象として十分に検討されていなかった高感度CRP値，血漿BNP値，尿中微量アルブミン値について，性別・年齢階級別に明らかになった。平均3.5年の観察期間の追跡調査により，総死亡，脳卒中罹患率，心筋梗塞罹患率，心不全罹患率について明らかにした。同じ追跡調査期間で，新規介護認定発生率を明らかにした。脳卒中発症に影響するリスク要因，新規介護認定に影響するリスク要因について明らかにした。

横断解析の結果得られた知見で注目すべき点は，高脂血症，糖尿病，肥満者の割合が10歳階級別に明らかにされたことである。高脂血症は，男性では全ての年代で30％前後みられること，女性では40歳未満では10％未満であるの対して50歳以降では40％を超える。糖尿病有病率は年齢が上がるとともに上昇し，男性の60代8.4％，70代で9.1％であった。女性では，それぞれ4.3％，5.9％であった。日本人での世代別の糖尿病有病率は十分に検討されておらず，本研究では一地域での多数の一般住民を対象とした報告であることから，日本人糖尿病有病率を知るための貴重な資料となりえる。また肥満者についてみると，BMIは年齢が上がるとともに上昇し，BMIが25以上の軽度肥満の割合は，30代から60代の男性では35～40％にも達する。BMIが30を超える女性は50代以降で30％を超える。若い女性では，BMIの平均値を見た限りでは，肥満の問題はないように見受けられる。しかし，BMI30以上の高度肥満者割合に注目すると，男女ともに20代が最も高い。高度肥満は種々の疾患のハイリスク要因になっており，今後前向き調査を進めていくにあたり，20代の参加者の，高度肥満が予後に与える影響について慎重に観察していく必要がある。

登録後約４年を経過した時点での初期追跡調査結果で得られた結果で着目すべき点は，現在の日

本人の脳卒中罹患率と介護認定者率を地域ベースで明らかにした点である。1000人年あたりの罹患率が明らかにされたが，高齢化が進んだことで罹患率が過去の報告に比べ高くなっている。昭和60年の日本人基準人口で年齢調整をすると，従来の報告とほぼ同じ値となる[10]。日本人脳卒中罹患率の報告は，久山町研究と秋田県の研究報告が代表的なものである。久山町データの最も新しい1986－1996年のデータによると，脳卒中年間発症率は4.7/1000人年であり，県北地域の結果は久山町の結果に比べ高い[11]。

新規介護認定（要支援および要介護1以上）へのリスク要因の検討は従来多数例を対象とした報告はほとんど無いようである。3.5年という短い観察期間であったが，脳卒中罹患への影響と同様に血圧が高いほどリスクが高くなることが実証された。高血圧以外の古典的危険因子についてみると，新規介護認定へのリスク要因となっていたのは男女で違いがあった。男性では常用飲酒者や禁酒者で介護認定リスクが高くなっていた。女性では，血清総コレステロール値が低いほど，BMIが大きいほど介護認定リスクが高かった。やせの女性で介護認定リスクが高いことが示唆されているが，本研究では，BMIが非常に大きい女性でリスクが高いことが示唆され，やせの女性に関しては，リスクが有意に高いわけではなかった。今後観察期間を延ばして検討していく必要性がある。

脳卒中罹患や介護認定のリスク要因として，栄養についても検討が行われた。血圧に大きく影響する食塩摂取量は，脳卒中発症にも介護認定にも影響はしていなかった。むしろ今回の検討では，塩分摂取量が相対的に低い人ほど脳卒中発症や介護認定者になる傾向がみられた。飽和脂肪酸と不飽和脂肪酸摂取量は，循環器疾患発症に影響する因子として注目されている。本研究結果では，脳卒中発症リスク要因とはいえなかった。一方介護認定に関しては，女性では，飽和脂肪酸を多く取っている者ほど介護認定リスクがあがる傾向がみられた。多変量調整の結果でも傾向は認められることから，女性ではBMIの高値（本研究対象者ではBMI27以上）とともに飽和脂肪酸過剰摂取は高齢女性では十分に注意し，啓発活動が必要と考えられる。

謝　辞

本研究は，二戸医療圏，久慈医療圏，宮古医療圏の各市町村と，岩手県，岩手県予防医学協会，県北9県立病院の全面的な協力を仰いだ。データ収集にあたった各市町村職員ならびに岩手県環境保健センター職員，岩手県予防医学協会の看護師と臨床検査技師，各県立病院の担当職員および岩手県職員の方々，登録に従事したリサーチナースの方々に深い感謝の念を表する。

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引用文献

1）Baker W. Chapter 59:Prevention of Disability in Older Persons. 13th ed. East Norwalk: Prentice-Hall International Inc.;1992

2）Morrow D. Cardiovascular biomarkers: Pathophysiology and disease management. Totowa, New Jersey:Humana Press Inc;2006.

3）図説　統計でわかる介護保険2006　厚生統計協会2006年

4）Ohsawa M, et al. CRP levels are elevated in smokers but unrelated to the number of cigarettes and are decreased by long-term smoking cessation in male smokers. Prev Med 2005;41:651-6.

5）Nakamura M, et al. Comparison of positive cases for B-type natriuretic peptide and ECG testing for identification of precursor forms of heart failure in an elderly population. Int Heart J 2005;46:477-87.

6）Nakamura M, et al. Association between serum C-reactive protein levels and microal buminuria: a population-based cross-sectional study in northern Iwate, Japan. Intern Med 2004;43(10):919-25.

7）Ridker PM. Clinical application of C-reactive protein for Cradiovascular disease detection and prevention. Circulation 2003;107:363-9.

8）Schwab S, S CRDKK. Quantitation of proteinuria by the use of protein-to-creatinine ratios in single urine samples. Arch Intern Med 1987;147(5):943-4,.

9）Jensen J, Clausen P, Borch-Johnsen K, Jensen G, Feldt-Rasmussen B. Detecting microalbuminuria by urinary albumin/creatinine concentration ratio. Nephrol Dial Transplant 1997;12 Suppl 2:6-9.

10）Shimamoto T, Iso H, Iida M, Komachi Y. Epidemiology of cerebrovascular disease: stroke epidemic in Japan. J Epidemiol 1996; 6 (3 Suppl):S43-7.

11）藤島正敏，清原裕　日本人の脳卒中の時代的変化ー久山町研究　日本老年医学会雑誌2005年42巻１号58-60

PAPER

Differences in circadian variation of cerebral infarction, intracerebral haemorrhage and subarachnoid haemorrhage by situation at onset

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J Neurol Neurosurg Psychiatry 2006;**000**:1–6. doi: 10.1136/jnnp.2006.090373

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Received 17 February 2006
Revised version received 31 May 2006
Accepted 2 June 2006

Background: The precise time of stroke onset during sleep is difficult to specify, but this has a considerable influence on circadian variations of stroke onset.
Aim: To investigate circadian variations in situations at stroke onset—that is, in the waking state or during sleep—and their differences among subtypes.
Methods: 12 957 cases of first-ever stroke onset diagnosed from the Iwate Stroke Registry between 1991 and 1996 by computed tomography or magnetic resonance imaging were analysed. Circadian variations were compared using onset number in 2-h periods with relative risk for the expected number of the average of 12 2-h intervals in the waking state or during sleep in cerebral infarction (CIF), intracerebral haemorrhage (ICH) and subarachnoid haemorrhage (SAH).
Results: ICH and SAH showed bimodal circadian variations and CIF had a single peak in all situations at onset, whereas all three subtypes showed bimodal circadian variations of stroke onset in the waking state only. These variations were different in that CIF showed a bimodal pattern with a higher peak in the morning and a lower peak in the afternoon, whereas ICH and SAH had the same bimodal pattern with lower and higher peaks in the morning and afternoon, respectively.
Conclusions: Sleep or status in sleep tends to promote ischaemic stroke and suppress haemorrhagic stroke. Some triggers or factors that promote ischaemic stroke and prevent haemorrhagic stroke in the morning cause different variations in the waking state between ischaemic and haemorrhagic stroke.

Stroke occurrence shows chronobiological variations,[1] such as circannual variations, circaseptan variations and circadian variations. Various patterns have been reported but no conclusions have yet been reached on circadian variations. The circadian variations of stroke onset may differ according to subtype or reporter, and are classified as cerebral infarction (CIF) with a single peak[2–6] or double peaks,[7 8] subarachnoid haemorrhage (SAH) with a single peak[9] or double peaks,[6 10–14] and intracerebral haemorrhage (ICH) with double peaks.[6 10 12] Most previous studies have not treated the three major subtypes simultaneously. Only three reports[6–8] discussed all the three subtypes, but the number of cases of ICH, especially of SAH, was too small for investigation of circadian variation. This may have led to differences in the conceived patterns of circadian variation. Large numbers of cases in population-based samples are required to investigate and compare the circadian variations of stroke onset among subtypes. For investigation of the triggers and risk factors of stroke onset, it is necessary to determine the circadian variations of stroke onset with precise times. The precise time of stroke onset during sleep is difficult to specify, but this has a considerable influence on circadian variations of stroke onset.

We investigated circadian variation in stroke onset by situations at onset in CIF, ICH and SAH in a Japanese population, by using stroke registry data. We also investigated the differences in circadian variations, triggers and risk factors among subtypes.

PATIENTS AND METHODS

Stroke registry

A stroke registration programme has been instigated in the Iwate prefecture in the northern part of Honshu Island, Japan, which has a population of 1.4 million. The government of Iwate prefecture and the Iwate Medical Association have been coordinating this programme with all medical facilities (hospitals, medical offices and nursing homes) since January 1991. Registration forms are submitted to the registration office of the Iwate Medical Association by mail when a patient with stroke leaves the medical facility. All data are checked by trained staff for duplicate registration.

The registration form consists of information such as the patient's name, address, date of birth, stroke subtype, date of onset, situation at onset, symptoms and clinical findings, family history of apoplexy, histories of hypertension, diabetes and hyperlipidaemia, and use of antihypertensive or anticoagulant drugs before stroke onset. The results of computed tomography or magnetic resonance imaging (MRI), surgical treatment and outcome were registered. Stroke diagnostic criteria for CIF, ICH and SAH in this registry are based principally on the criteria established for the Monitoring System for Cardiovascular Disease commissioned by the Ministry of Health and Welfare.[15] These criteria correspond with those published by the World Health Organization[16] and define stroke as the sudden onset of neurological symptoms. Cases of traumatic ICH and SAH are not registered. A total of 16 997 cases (9121 men and 7876 women; average age 66.5 and 70.6 years, respectively) were registered between January 1991 and December 1996: 10 093 cases of CIF, 4603 cases of ICH, 1682 cases of SAH and the remaining 619 cases of other cerebrovascular stroke (transient ischaemic attack, cerebral venous thrombosis and unclassified stroke in the registry data). Registered patients hospitalised with stroke accounted for 97.5% (16 585/16 997) of the total

Abbreviations: CIF, cerebral infarction; ICH, intracerebral haemorrhage; MRI, magnetic resonance imaging; SAH, subarachnoid haemorrhage number of patients. The patients who were diagnosed using computed tomography or MRI accounted for 95.5% (16 240/16 997) of the total number. For our study, 619 patients with other cerebrovascular stroke were excluded. Furthermore, 649 patients diagnosed without computed tomography or MRI and 2772 patients with recurrent stroke were excluded. Our study was conducted using data for the remaining 12 957 patients (7575 with CIF, 3852 with ICH and 1530 with SAH) of first-ever stroke diagnosed using computed tomography or MRI.

Analysis of onset time

Onset time was registered in hourly intervals in the registry. In patients perceiving the occurrence of stroke on awakening, the time of perception was used as the onset time. When the precise onset time was not clear, whether the stroke occurred in the morning or in the afternoon was registered if possible. When the time of onset could not be identified, only the date of onset was registered.

The situation at stroke onset was registered in detail during exercise, during meals, while working, bathing, defecating or urinating, sleeping, drinking, chatting, watching television or in other situations. These situations were categorised simply as "in the waking state" or "during sleep". The cases in which onset time was not registered were categorised as "unknown situation".

For determination of the time of stroke onset, the day was divided into 12 2-h intervals. The cases in which onset times were registered in the morning or in the afternoon only were redistributed equally between pertinent intervals, and those in which onset time was not registered were redistributed equally into 12 intervals. Data were statistically analysed with χ^2 test for goodness of fit to the null model of equal distribution of stroke to evaluate the circadian variations in stroke onset. To estimate the relative risk (RR) of stroke occurring in a specific time period, the observed number of strokes was compared with the average number of 12 2-h intervals.

RESULTS

Table 1 shows the characteristics of the patients with first-ever stroke having CIF, ICH and SAH, diagnosed using computed tomography or MRI.

In all subtypes of stroke, men were about 5 years younger than women on average (men *v* women: CIF, 68.5 (11.5) *v* 73.1 (11.4); ICH, 62.9 (12.3) *v* 68.9 (12.4); SAH, 56.3 (13.4) *v* 62.8 (13.0)). Some data on the ages at onset were missing because the date of onset was not recorded in the registry.

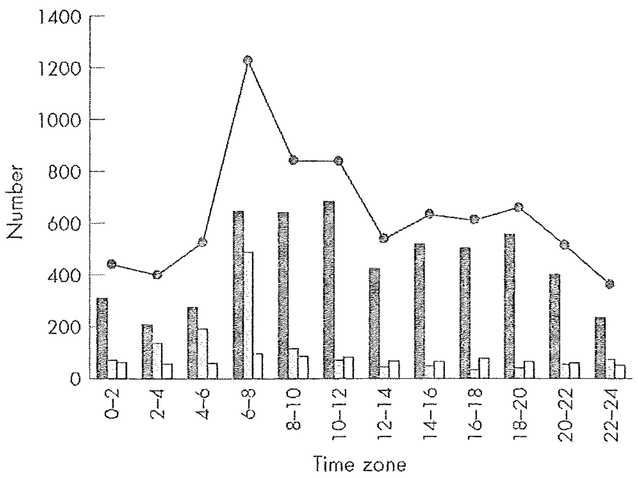

Figure 1 Time-specific onset number for 12 2-h intervals by situation at onset of cerebral infarction. Solid columns, in the waking state; shaded columns, during sleep; empty columns, unknown situation; solid circles, all onset situations.

Table 2 shows the percentages of cases in which the onset time was registered hourly, in the morning or afternoon, and unspecified cases, and the proportions of the categorised situation at onset (in the waking state, during sleep and unknown situation).

The percentage of cases of CIF registered hourly was less than those of ICH and SAH (66.8% *v* 82.0% and 85.5%, respectively; $p<0.05$). The percentages of specified cases were not markedly different between the sexes in any subtype. We found no significant differences in age between cases that were specified hourly, in the morning or afternoon, and unspecified cases in any subtype. The percentage of cases of CIF, registered hourly, in which stroke onset occurred while the patient was asleep was more than those of ICH and SAH (14.2% *v* 8.8% and 9.5%, respectively; $p<0.05$). The proportions of categorised situation at onset were similar between cases of ICH and SAH.

Time-specific onset numbers for 12 2-h periods

The time-specific onset numbers by sex were pooled because the characteristics of circadian variation were not markedly different between men and women in all subtypes (table 3).

Figure 1 shows the time-specific onset pattern of cases of CIF. In all onset situations, the circadian variation showed a sharp peak during the period from 06:00 to 07:59 (RR 194.0% (95% confidence interval (CI) 177.2% to 212.4%)), a small dip

Table 1 Characteristics of patients with first-ever stroke, diagnosed using computed tomography or magnetic resonance imaging

Variable	CIF, n=7575	ICH, n=3852	SAH, n=1530
Sex, n (%)			
Male	4238 (55.9)	2079 (54.0)	545 (35.6)
Female	3337 (44.1)	1773 (46.0)	985 (64.4)
Mean age (SD), years			
Men	68.5 (11.5)	62.9 (12.3)	56.3 (13.4)
Women	73.1 (11.4)	68.9 (12.4)	62.8 (13.0)
All	70.5 (11.7)	65.6 (12.7)	60.5 (13.5)
Age distribution (years), n (%)			
0–49	313 (4.1)	377 (9.8)	323 (21.1)
49–59	756 (10.0)	751 (19.5)	329 (21.5)
59–69	2007 (26.5)	1165 (30.2)	444 (29.0)
69–79	2433 (32.1)	883 (22.9)	281 (18.4)
79–	1574 (20.8)	549 (14.3)	110 (7.2)
Unknown	492 (6.5)	127 (3.3)	43 (2.8)

CIF, cerebral infarction; ICH, intracerebral haemorrhage; SAH, subarachnoid haemorrhage. 1

Table 2 Cases in which onset time was specified hourly, in the morning or afternoon, or was unspecified

	Cerebral infarction		Intracerebral haemorrhage		Subarachnoid haemorrhage	
	n	%	n	%	n	%
Hourly						
In the waking state	3726	49.2	2668	69.3	1104	72.2
During sleep	1079	14.2	341	8.8	146	9.5
Unknown situation	255	3.4	150	3.9	58	3.8
Morning or afternoon	788	10.4	233	6.1	74	4.8
Unspecified	1727	22.8	460	11.9	148	9.7
All	7575	100.0	3852	100.0	1530	100

around noon, a smaller second peak from 18:00 to 19:59 (RR 104.3% (95% CI 94.0% to 115.8%)) and a nadir during the night (χ^2 test, $p<0.001$). The cases in which onset occurred in the waking state showed two peaks: one from 10:00 to 11:59 (RR 152.2% (95% CI 136.0% to 170.4%)) and the other from 18:00 to 19:59 (RR 123.7% (95% CI 109.9% to 139.3%)), with a dip around noon and a nadir during the night (χ^2 test, $p<0.001$). The peak in the morning was higher than that in the afternoon. The cases in which onset occurred during sleep showed a single peak during the period from 06:00 to 07:59 (RR 426.6% (95% CI 353.1% to 515.5%); χ^2 test, $p<0.001$).

Figures 2 and 3 show the time-specific onset patterns of ICH and SAH. For all onset situations, two peaks were observed: one from 06:00 to 07:59 (RR 153.1% (95% CI 134.0% to 174.9%) and RR 144.1% (95% CI 116.2% to 178.5%), respectively) and the other from 18:00 to 19:59 (RR 165.8% (95% CI 145.4% to 189.0%) and RR 154.8% (95% CI 125.3% to 191.2%), respectively), with a dip around noon and a nadir during the night (χ^2 test, $p<0.001$). The cases in which onset occurred in the waking state showed variations similar to those seen in all cases. The cases with onset in the waking state showed two peaks: one from 06:00 to 07:59 (RR 133.0% (95% CI 114.3% to 154.8%) and RR 135.7% (95% CI 106.8% to 172.4%), respectively) and the other from 18:00 to
2 19:59 (RR 179.8% (95% CI 156.0% to 207.2%)) and from 16:00 to 17:59 (RR 168.0% (95% CI 133.7% to 211.1%)),
3 respectively (χ^2 test, $p<0.001$). The cases of ICH and SAH in which onset occurred during sleep showed a single peak in the period from 06:00 to 07:59 (RR 343.4% (95% CI 239.2% to 493.1%)) and from 04:00 to 05:59 (RR 252.8% (95% CI 123.2% to 457.5%)), respectively (χ^2 test, $p<0.001$).

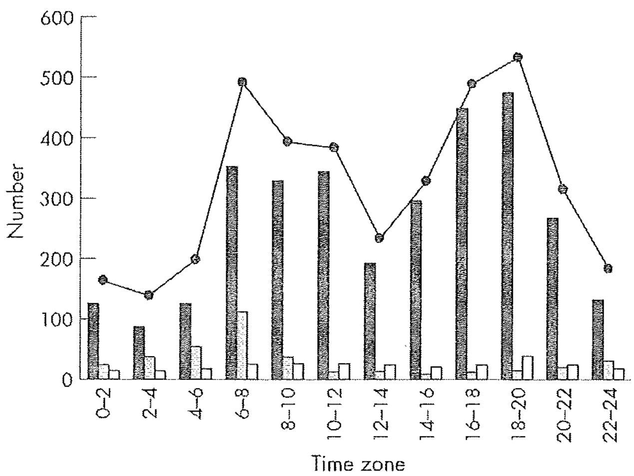

Figure 2 Time-specific onset number for 12 2-h intervals by onset situation of intracerebral haemorrhage. Solid columns, in the waking state; shaded columns, during sleep; empty columns, unknown situation; solid circles, all onset situations.

Table 3 Time-specific onset number by sex

	Cerebral infarction		Intracerebral haemorrhage		Subarachnoid haemorrhage	
Time interval (h)	Men	Women	Men	Women	Men	Women
0–2	112	89	48	51	22	30
2–4	84	74	54	20	10	22
4–6	176	108	81	52	39	43
6–8	529	455	251	175	55	107
8–10	342	256	172	157	45	84
10–12	344	253	180	138	52	77
12–14	217	141	119	64	26	57
14–16	257	194	156	122	39	64
16–18	244	188	212	227	55	127
18–20	267	213	231	251	53	121
20–22	195	140	130	135	25	76
22–24	109	73	72	61	32	47
Morning*	321	260	90	72	24	32
Afternoon†	108	99	45	26	11	7
Unspecified‡	933	794	238	222	57	91
All	4238	3337	2079	1773	545	985

*Onset time registered in the morning.
†Onset time registered in the afternoon.
‡Onset time not registered.

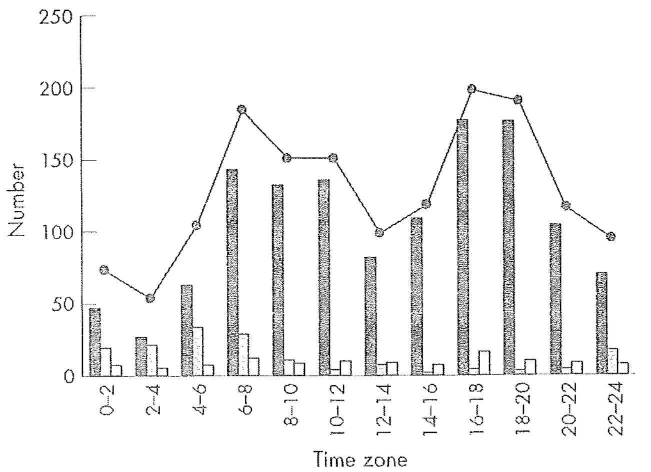

Figure 3 Time-specific onset number for 12 2-h intervals by onset situation of subarachnoid haemorrhage. Solid columns, in the waking state; shaded columns, during sleep; empty columns, unknown situation; solid circles, all onset situations.

DISCUSSION

Validation of cases in the stroke registry for this study

We used the stroke registry data from the Iwate prefecture. In this registry, the annual registration rates, which were considered to be the annual incidence rates of onset of first-ever stroke per 100 000 people from 1991 to 1996 were 88.9, 45.2 and 18.0 per year for CIF, ICH and SAH, respectively. The age-adjusted annual incidence rates of ICH and SAH, estimated using data from the 1985 Japanese population census, were similar to those of previous reports from Japan.[10 17 18] However, the rate for CIF was lower. The percentage of unregistered cases of CIF may be higher than those of ICH and SAH. The average ages of patients with CIF in our study were similar to those of patients in other studies based on the Japanese community.[17 18] The percentages of cases in which onset time was unspecified were similar to those of previous reports.[3 9 13 14 19–21] Therefore, there was probably no bias in the registry with regard to cases with a specific time zone or specific onset category.

Circadian variation of stroke onset

Previous studies showed that the circadian variation of stroke onset in patients with CIF had a single peak,[2–6] whereas those of patients with ICH[6 10 12] and SAH[6 10–14] had double peaks. Only three previous reports have discussed circadian variation of stroke onset separated on the basis of situation at onset—that is, in the waking state or during sleep[3 7 8]—but the numbers of cases included were too few (n = 914, 375 and 675, respectively) for conclusions to be drawn.

In our study, ICH and SAH showed bimodal circadian variations and CIF had a single peak for all cases in all onset situations, whereas all three subtypes showed bimodal circadian variations of stroke onset in the waking state only. This difference was due to the influence of cases of CIF in which onset occurred during sleep, which accounted for about 20% of the cases in all situations and were concentrated at the time of awakening. In contrast, the cases of ICH and SAH occurring during sleep, which accounted for about 10% of the cases in all situations, had a small influence but did not affect bimodal variations. This concentration at the time of wakening corresponded not to the concentration of stroke onset but to that of its recognition. This circadian variation of stroke onset for all cases is actually a sociological variation of stroke onset, and is information that is useful when accepting patients with stroke—for example, for ambulance or hospital services. If all the cases of stroke onset during sleep and with unknown situation occurred equally between midnight and 06:00, circadian rhythm did not lose its nadir during the night in ICH and SAH, but lost it in CIF. Lower blood pressure reduces the incidence of stroke, but nocturnal low blood pressure is a risk factor for ischaemic stroke.[22] Disordered breathing in sleep was reported to be a risk factor for ischaemic stroke onset at night.[23] This shows that sleep or status in sleep tends to promote ischaemic stroke and suppress haemorrhagic stroke.

In the waking state, bimodal circadian variations were different in that CIF showed a bimodal pattern with a higher peak in the morning and a lower peak in the afternoon, whereas ICH and SAH had a bimodal pattern with a lower peak in the morning and a higher peak in the afternoon. Onset time in the waking state was more accurate than those during sleep or with an unknown onset situation. The bimodal circadian variation of stroke onset while awake seems useful for investigation of the trigger for stroke onset. Several previous studies have concluded that arterial blood pressure is a trigger for haemorrhagic stroke onset.[9 11 13 14 20 24 25] Our results on ICH and SAH, showing very similar variations, indicated that the triggers for stroke onset were the same for ICH and SAH. Ischaemic and haemorrhagic stroke were reported previously as having the same trigger.[9] In our study, the results of bimodal circadian variation in the waking state for both ischaemic and haemorrhagic stroke indicated that both types of stroke have a common trigger. However, some other factors are required to explain the difference in heights of the peaks in the morning and afternoon between ischaemic and haemorrhagic stroke. Previous studies indicated increases in the levels of haematocrit, platelet aggregability and hypercoagulability in the morning.[26 27] These factors promote ischaemic events and prevent haemorrhagic events. The triggers for stroke onset seem to consist of two types of factor—that is, blood pressure, which is common to both ischaemic and hemorrhagic stroke and shows a bimodal pattern, and haemostatic functions, which promote ischaemic stroke and prevent haemorrhagic stroke in the morning.

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Competing interests: None declared.

REFERENCES

1 **Manfredini R**, Gallerani M, Portaluppi F, *et al.* Chronobiological patterns of onset of acute cerebrovascular diseases. *Thromb Res* 1997;**88**:451–63.
2 **Elliott WJ**. Circadian variation in the timing of stroke onset. A meta-analysis. *Stroke* 1998;**29**:992–6.
3 **Lago A**, Geffner D, Tembl J, *et al.* Circadian variation in acute ischemic stroke. A hospital-based study. *Stroke* 1998;**29**:1873–5.
4 **Argentino C**, Toni D, Rasura M, *et al.* Circadian variation in the frequency of ischemic stroke. *Stroke* 1990;**21**:387–9.
5 **Marler JR**, Price TR, Clark GL, *et al.* Morning increase in onset of ischemic stroke. *Stroke* 1989;**20**:473–6.
6 **Tsementzis SA**, Gill JS, Hitchcock ER, *et al.* Diurnal variation of and activity during the onset of stroke. *Neurosurgery* 1985;**17**:901–4.
7 **Ricci S**, Celani MG, Vitali R, *et al.* Diurnal and seasonal variations in the occurrence of stroke: a community-based study. *Neuroepidemiology* 1992;**11**:59–64.
8 **Wroe SJ**, Sandercock P, Bamford J, *et al.* Diurnal variation in incidence of stroke: Oxfordshire Community Stroke Project. *BMJ* 1992;**18**:155–7.
9 **Feigin VL**, Anderson CS, Anderson NE, *et al.* Is there a temporal pattern in the occurrence of subarachnoid hemorrhage in the southern hemisphere? Pooled data from 3 large, population-based incidence studies in Australasia, 1981 to 1997. *Stroke* 2001;**32**:613–9.

10 **Inagawa T**, Takechi A, Yahara K, *et al*. Primary intracerebral and aneurysmal subarachnoid hemorrhage in Izumo city, Japan. Part I: incidence and seasonal and diurnal variations. *J Neurosurg* 2000;**93**:958–66.
11 **Kleinpeter G**, Schatzer R, Böck F. Is blood pressure really a trigger for the circadian rhythm of subarachnoid hemorrhage? *Stroke* 1995;**26**:1805–10.
12 **Sloan MA**, Price TR, Foulkes MA, *et al*. Circadian rhythmicity of stroke onset. Intracerebral and subarachnoid hemorrhage. *Stroke* 1992;**23**:1420–6.
13 **Vermeer SE**, Rinkel GJE, Algra A. Circadian fluctuations in onset of subarachnoid hemorrhage. New data on aneurysmal and perimesencephalic hemorrhage and a systematic review. *Stroke* 1997;**28**:805–8.
14 **Gallerani M**, Portaluppi F, Maida G, *et al*. Circadian and circannual rhythmicity in the occurrence of subarachnoid hemorrhage. *Stroke* 1996;**27**:1793–7.
15 **Study Project of Monitoring System for Cardiovascular Disease commissioned by the Ministry of Health and Welfare**. *Manual for the registry and follow-up of stroke* [in Japanese]. Osaka, Japan: National Cardiovascular Center, 1988.
16 **World Health Organization MONICA Project**. *Event registration data component, MONICA manual version 1.1*, Document for meeting of MONICA Principal Investigators. Geneva: World Health Organization, 1986.
17 **Suzuki K**, Kutsuzawa T, Takita K, *et al*. Clinico-epidemiologic study of stroke in Akita, Japan. *Stroke* 1987;**18**:402–6.
18 **Kita Y**, Okayama A, Ueshima H, *et al*. Stroke incidence and case fatality in Shiga, Japan 1989–1993. *Int J Epidemiol* 1999;**28**:1059–65.
19 **Kelly-Hayes M**, Wolf PA, Kase CS, *et al*. Temporal patterns of stroke onset. The Framingham Study. *Stroke* 1995;**26**:1343–7.
20 **Nyquist PA**, Brown RD, Wiebers DO, *et al*. Circadian and seasonal occurrence of subarachnoid and intracerebral hemorrhage. *Neurology* 2001;**56**:190–3.
21 **Passero S**, Reale F, Ciacci G, *et al*. Differing temporal patterns of onset in subgroups of patients with intracerebral hemorrhage. *Stroke* 2000;**31**:1538–44.
22 **George S**, Kostas N, Kyriaki M, *et al*. Parallel morning and evening surge in stroke onset, blood pressure, and physical activity. *Stroke* 2002;**33**:1480–6.
23 **Iranzo A**, Santamaria J, Berenguer J, *et al*. Prevalence and clinical importance of sleep apnea in the first night after cerebral infarction. *Neurology* 2002;**58**:911–6.
24 **Fogelholm RR**, Turjanmaa VMH, Nuutila MT, *et al*. Diurnal blood pressure variations and onset of subarachnoid hemorrhage: a population-based study. *J Hypertens* 1995;**13**:495–8.
25 **Gallerani M**, Trappella G, Manfredini R, *et al*. Acute intracerebral haemorrhage: circadian and circannual patterns of onset. *Acta Neurol Scand* 1994;**89**:280–6.
26 **Andrews NP**, Gralnick HR, Merryman P, *et al*. Mechanisms underlying the morning increase in platelet aggregation: a flow cytometry study. *J Am Coll Cardiol* 1996;**28**:1789–95.
27 **Jafri SM**, VanRollins M, Ozawa T, *et al*. Circadian variation in platelet function in healthy volunteers. *Am J Cardiol* 1992;**69**:951–4.

透析患者の血清リンと循環器疾患合併症の関連

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要約

岩手県下 26 施設の成人透析患者 1260 名を対象に行った大規模横断研究のデータをもとに、心筋梗塞、脳血管疾患、末梢血管疾患と血清リン値との関連性について検討した。患者の平均年齢は 61.1 歳、男性割合は 64.2%、平均透析期間は 6.9 年であった。血清リン値は年齢が若い、透析年数が長い、女性患者で高値を示す割合が多かった。血清リン値が高い症例では有意に血圧が低かった。また、心筋梗塞、脳梗塞、脳出血と血清リン値の間には一定の関連性が認められなかったが、血清リン値が高い群ほど閉塞性動脈硬化症(ASO)の危険率が有意に高値であった。さらに、血清リン 1.0mm 区切りの細分化グループで ASO 合併率を比較したところ、血清リンが高いほど ASO 合併率の危険が高率である右肩上がりの傾向が認められた。

背　景

透析患者の高リン血症は軟部組織や血管の石灰化に影響を与えており、血清リンと冠動脈や心臓弁の石灰化との関連性が注目されている。冠動脈や弁の石灰化は心疾患発症の重要な危険因子であり、透析患者の死亡率に強く影響していると考えられている。K/DOQI ガイドラインでは、透析患者の血清リン値は 3.5mg/dl 以上、5.5mg/dl 以下にするよう推奨されているが、多くの透析患者はこの目標値に達していないのが現状である。血清リン値と心疾患との関連性が注目されていることから、透析患者での血清リン値と心疾患発症との関連性についての報告は多数みられるが、脳血管疾患や末梢血管疾患との関係について検討したものはほとんどみられない。本研究では、大規模横断研究のデータをもとに心筋梗塞、脳血管疾患（脳梗塞、脳出血）、末梢血管疾患（閉塞性動脈硬化症（ASO））と血清リン値との関連性について検討したので報告する。

対象と方法

岩手県下 5 つの保健医療圏にある合計 26 施設 1,506 名の成人透析患者を対象として、1,260 名から研究への参加について同意を得た。調査項目は生活問診、透析前後血圧測定、透析前血液検査、カルテ調査（治療内容、合併症、腎不全原疾患）である。透析前後の血圧値と血液検査値がそろった症例を解析対象とした。患者の血清リン値を検討したところ正規分布を示したため、対象を三分位で 3 群に分類した。3 群

間で背景因子（年齢、男性割合、透析期間、カルシウム値、カルシウムリン積値、透析前後平均血圧）と血清リンの関係をみた。また、循環器疾患合併率の関連因子を検討するためロジスティック回帰分析を行った。従属変数には循環器疾患（心筋梗塞、脳梗塞、脳出血、ASO）合併率、説明変数には血清P、先の解析で求めたリン関連因子、糖尿病性腎症、塩酸セベラマー内服率を投入した。サブ解析として血清リン3.5mg/dl以下の群を基準として1.0mg区切りでグループ化しASO合併率をトレンド検定にて比較した。

結　果

1. 患者背景

平均年齢は61.1歳。男性割合は64.2％、平均透析期間は6.9年であった。透析前平均血圧は108.3mmHg、透析後平均血圧は101.1mmHgであった。血清リンの平均値は6.2mg/dlで正規分布を示したが、DOPPS研究でも明らかになったように大半が上限の5.5mg/dlを超す値を示しガイドラインが推奨する範囲に入っていなかった。腎不全原疾患の内訳は、慢性糸球体腎炎が39.4％と最も多く、次いで糖尿病性腎症が32.9％であった。

2. 血清リンと背景因子

血清リン値は、年齢が若い、透析年数が長い、女性の患者で高値を示す割合が高かった。また、血清リン値が高い症例では有意に血圧は低値を