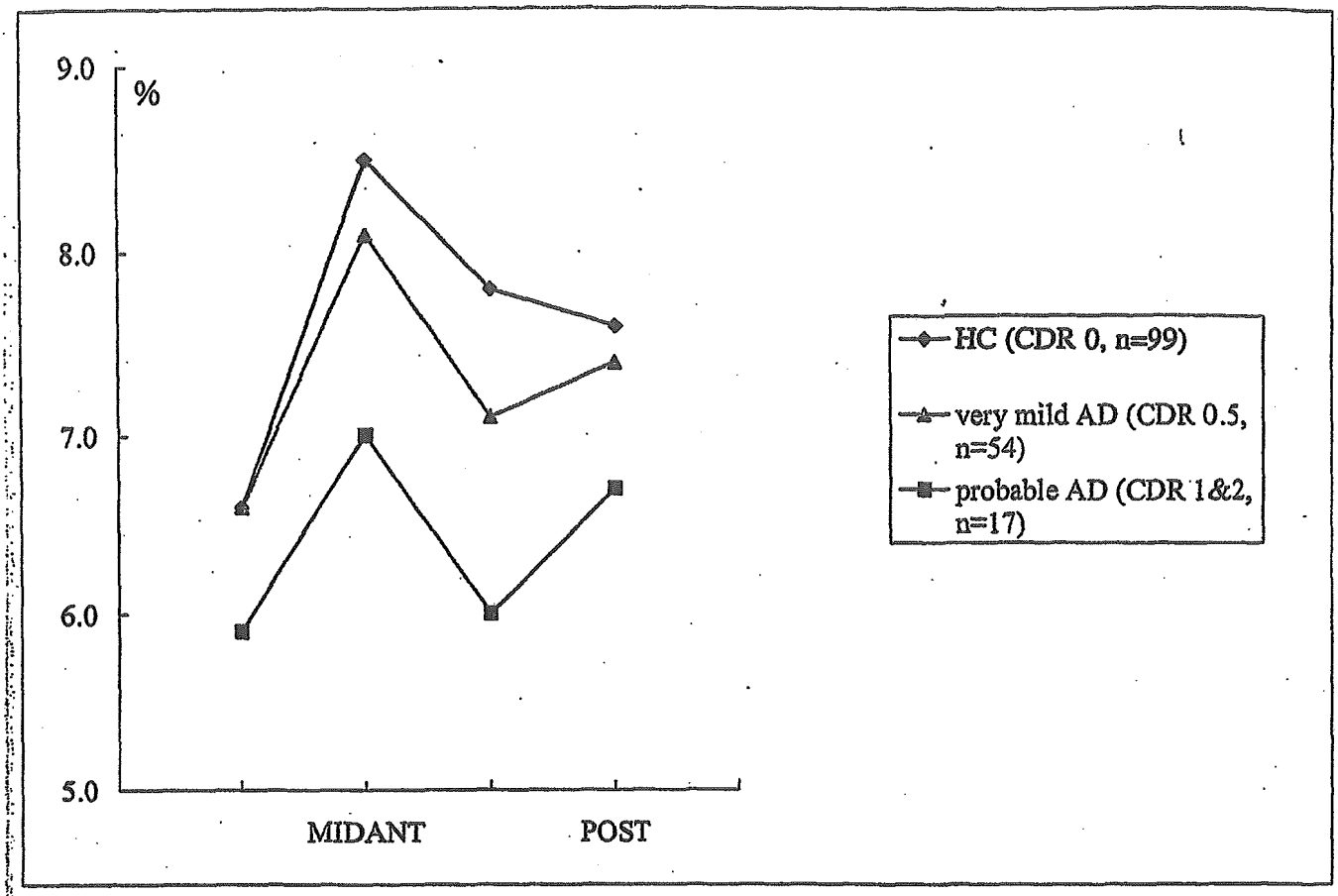

Figure 3. Regional CC measures in each CDR group. A one-way ANOVA with 4-repeated measurements disclosed a significant CDR group effect (F = 3.604, p = .029) without a covariant effect of age. A post hoc test indicated that the MIDPOST value of the CDR 1 & 2 group was significantly smaller than that of the CDR 0 group (p = .016). CC = corpus callosum; CDR = Clinical Dementia Rating; ANT = anterior; MIDANT = midanterior; MIDPOST = midposterior; POST = posterior; HC = healthy control; AD = Alzheimer's disease.

Table 3 demonstrates the results of the tests in each group. Findings were as follows: (a) All cognitive test scores of the AD groups were significantly lower than those of the HC groups, indicating a strong effect of diagnosis. (b) Among the HC groups, the group with greater CC atrophy manifested some frontal lobe impairment, as shown by the verbal fluency test, Digit Symbol test of the WAIS-R, and the TMT-B. (c) Among the AD groups, the AD-CC(+) group tended to score lower than the AD-CC(-) and HC-CC(+) groups on most cognitive tests. The AD-CC(-) group maintained a nonsignificant decline (but was lower) in the CASI subitem word fluency compared with that of the HC groups, whereas the AD-CC(+) groups showed a significant decline. As for the Digit Symbol test of the WAIS-R, the AD-CC(+) group was shown to have a significantly lower score compared with the respective values of all the other groups, including the AD-CC(-) group.

Combined Effect of WMH and CC Atrophy

There were significant Spearman correlations between the ratings of CC atrophy and WMH for both the HC and AD

TABLE 3. Cognitive Functions in Each Group

	HC (CDR 0)		AD (Very Mild AD & Probable AD)		*F* Values				
					Effects		Interactions	Covariances	
	CC(–)	CC(+)	CC(–)	CC(+)	Dx	CC	Dx*CC	Age	Education
Global function									
MMSE	25.9 (0.4)	26.5 (0.5)	22.8 (0.5)[ab]	21.1 (0.6)[ab]	65.972***	1.176	5.462*	8.417***	10.953***
CASI	85.7 (1.0)	85.1 (1.4)	78.4 (1.3)[ab]	73.3 (1.6)[ab]	48.956***	4.563*	2.897	7.191**	23.324***
Frontal function									
CASI subitem									
Attention	6.9 (0.2)	6.1 (0.2)	5.7 (0.2)[a]	5.9 (0.3)[a]	10.077***	1.782	4.779*	3.982*	11.864***
Word fluency	7.6 (0.3)	7.3 (0.4)	6.6 (0.4)	5.7 (0.4)[ab]	11.715***	2.543	0.737	0.189	2.233
Verbal fluency	7.8 (0.3)	6.3 (0.4)[a]	6.0 (0.4)[a]	4.9 (0.5)[a]	13.442***	9.842**	0.189	4.329*	13.678***
Digit Symbol	28.0 (0.9)	23.5 (1.3)[a]	21.4 (1.2)[a]	15.3 (1.5)[abc]	33.773***	18.093***	0.436	15.892***	19.964***
TMT-A, seconds	94.1 (9.5)	105.5 (13.3)	150.2 (12.5)[a]	168.4 (15.3)[ab]	21.013***	1.323	0.072	6.143*	2.127
TMT-B, seconds	226.4 (23.0)	286.0 (31.8)[a]	342.8 (37.4)[a]	503.9 (60.2)[ab]	16.567***	7.355**	1.621	0.000	7.308**
Completed TMT-B	48/65	25/34	18/41	7/30					

Note. Values in parentheses are *SE*. HC = healthy control; AD = Alzheimer's disease; CC = corpus callosum; CC(+) = CC atrophy; MMSE = Mini-Mental State Examination; CASI = Cognitive Abilities Screening Instrument; TMT = Trail Making Test; Dx = diagnosis (normal control vs. Alzheimer's disease); other abbreviations defined in Table 2.
[abc]Significantly different from HC-CC(–) group, HC-CC(+) group, AD-CC(–) group ($p < .05$), respectively.
*$p < .05$. **$p < .01$. ***$p < .005$ (two-way analysis of variance).

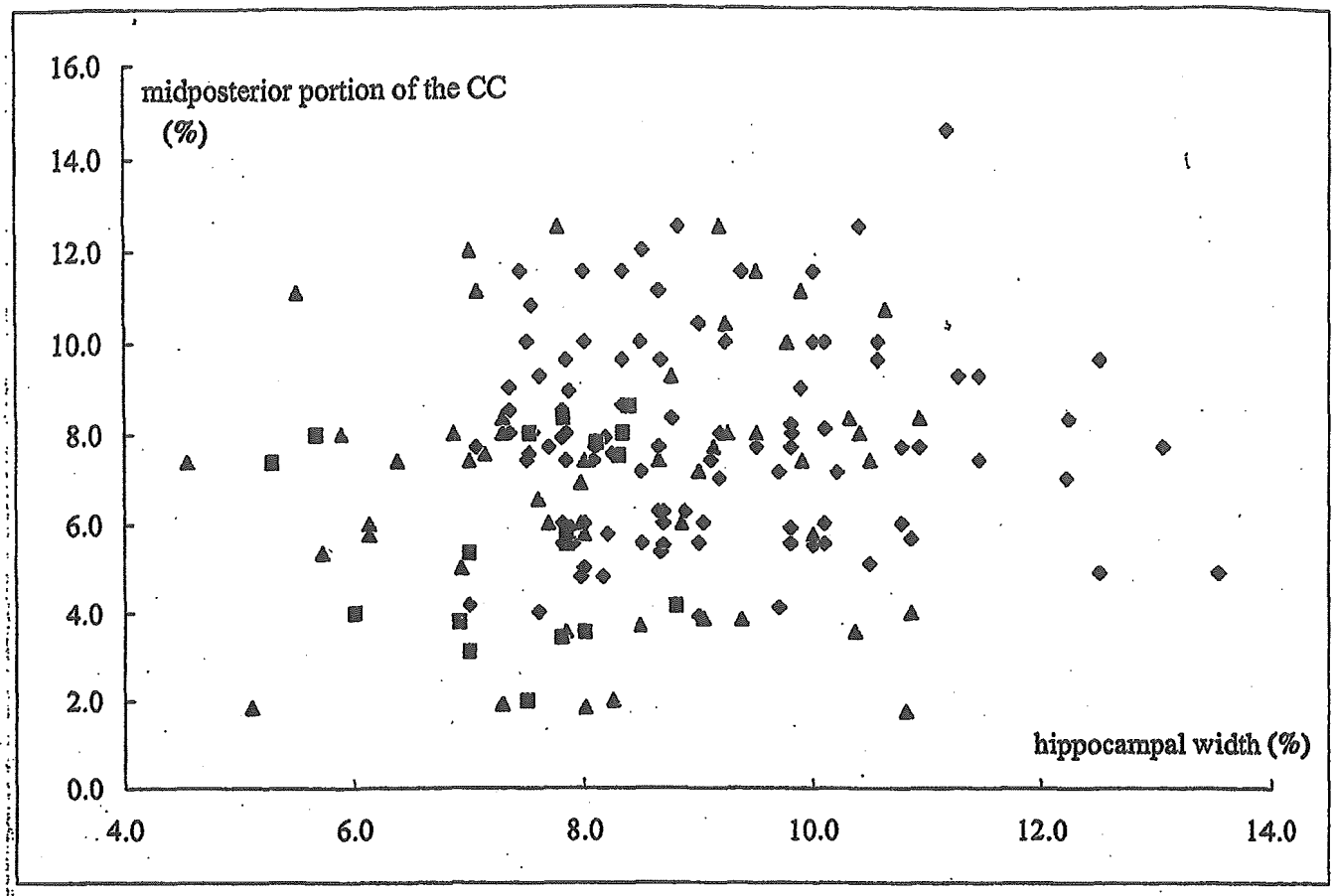

Figure 4. The distributions of the MIDPOST values and the hippocampal widths in each CDR group were plotted. Diamonds represent the CDR 0 participants, triangles indicate the CDR 0.5 patients, and rectangles show the CDR 1 & 2 patients. CC = corpus callosum; CDR = Clinical Dementia Rating; MIDPOST = midposterior.

group. They remained significant after partialling out of the effect of age and sex. Figure 5 illustrates the correlation for the HC group.

For the possible combined effect of CC atrophy and WMH, a three-way MANOVA was performed. For the verbal fluency test, there were significant effects of diagnosis ($F = 18.762$, $p < .001$) and CC atrophy ($F = 6.180$, $p = .014$) with an interaction of diagnosis, WMH, and CC atrophy ($F = 6.411$, $p = .012$). A post hoc test indicated that the HC-WMH(+)-CC(+) group had a significantly lower score than that of the HC-WMH(+)-CC(-) group ($p = .038$). Among the AD groups, no remarkable combined effect of WMH and CC atrophy was noted.

DISCUSSION

As earlier described, we hypothesized the results would be as follows: (1) Very mild AD patients (CDR 0.5) would show hippocampal atrophy independent of CC atrophy; (2) Probable AD patients would be indicated as having hippocampal and CC atrophy; (3) WMH would be correlated with CC atrophy in normal adults but not in AD patients; (4) Some frontal executive dysfunction would be associated with WMH and/or CC atrophy in healthy elderly adults but only with CC atrophy in AD patients. Our results proved the first, second, and fourth hypotheses. As for the third hypothesis, WMH was correlated with CC atrophy not only in healthy elderly adults but also in AD patients.

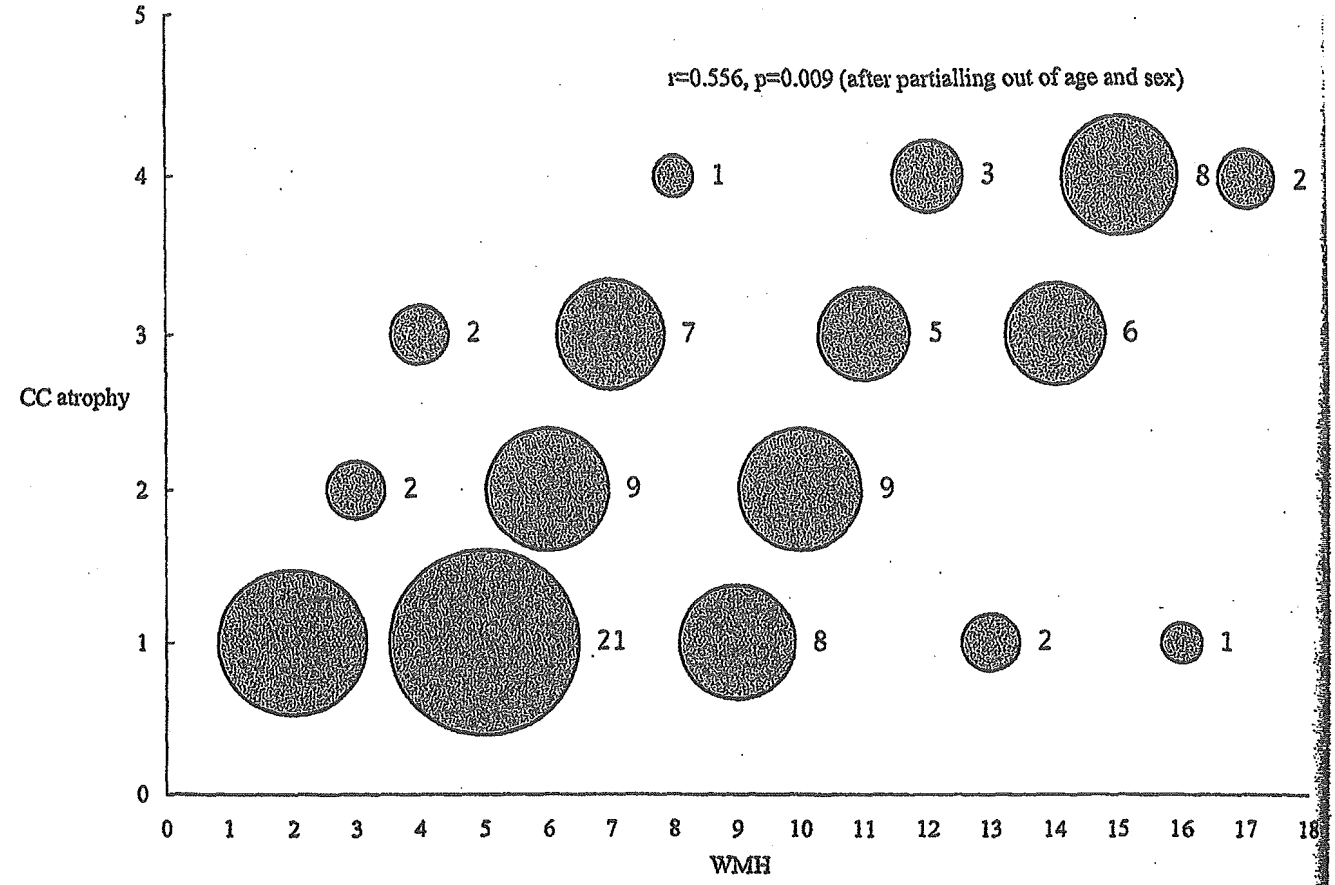

Figure 5. Correlation between WMH and CC atrophy in normal subjects. There was a significant Spearman correlation between the ratings of CC atrophy and WMH for the HC group (r = .509, p = .008; r = .518). This remained significant after partialling out of the effect of age and sex (r = .556, p = .009). Larger circles mean more participants at the same point. WMH = white matter hyperintensity; CC = corpus callosum; HC = healthy control.

Methodological Issues

Before discussing the results, we first of all should note some methodological issues. We used 170 randomly selected participants from a large population. Because the randomly selected 170 participants were the "representatives" of a total community of residents, there was a reasonable sample size of healthy adults and very mild AD cases, but the number of probable AD subjects was relatively small. Although more participants would have been better, economical constraints prevented us from using MRI on a larger sample. Regarding the MRI measurements, volumetric studies would have been better. In this study, however, because the volumes or areas could not be measured by the computer we used, two readers conducted systematic measurements twice, and the reproducibility was found to be high. We consider that the results revealed useful information on the relationship between CC atrophy, WMH, hippocampal atrophy, and cognitive impairment.

CC and Hippocampal Atrophy in Very Mild AD and Probable AD

According to the pathological stage model of AD (Braak & Braak, 1991), neurofibrillary tangles start to accumulate in the medial temporal lobe such as in the

entorhinal cortex and the hippocampus in very mild AD. As the disease progresses, the posterior neocortices become involved in such pathological changes, resulting in clinically probable AD. Hippocampal and entorhinal atrophy in probable AD has been found to cause a remote metabolic decline in the posterior neocortices (Yamaguchi et al., 1997), which has been supported by an experimental PET study of nonhuman primates (Meguro et al., 1999). Such posterior neocortical metabolic decline is associated with CC atrophy, especially in the posterior portion of the CC (Teipel et al., 1999).

The proven first and second hypotheses, i.e., that very mild AD shows hippocampal atrophy (Csernansky et al., 2000) and probable AD shows CC atrophy in addition to hippocampal atrophy, are reasonably supported by the abovementioned pathological model. We agree with Hampel and colleagues (2000) that CC atrophy could be an in vivo indicator of neocortical neuronal integrity. A longitudinal study demonstrating the temporal sequence of hippocampal and CC atrophy in very mild AD is needed.

Although we have not yet conducted a systematic analysis, several CDR 0 and 0.5 participants were found to become CDR 0.5 and 1, respectively, at the end of the 4-year follow-up period. The former participants showed hippocampal atrophy during this period without any remarkable CC change, whereas the latter participants manifested hippocampal and also CC atrophic changes (data not shown).

Correlations Between CC Atrophy and WMH in Normal Aging and AD

The correlation between CC atrophy and WMH in healthy elderly adults should be discussed first. We had previously found a correlation between CC atrophy and WMH in a cognitively normal group and some risk factors for stroke, but being stroke-free (Meguro et al., 2000). We discussed the fact that these risk factors may be associated with WMH and CC atrophy in the absence of a stroke, and consequently, one may argue that ischemia is possibly the mechanism by which risk factors induce such brain changes as seen on the MRIs. We had previously demonstrated (Meguro et al., 1998) that in those participants who were at risk for a stroke, but without any overt stroke attacks, there were significant correlations between the percent stenosis of the internal carotid artery (ICA) and the ipsilateral carotid blood flow (CaBF) and between stenosis of the ICA and hemispheric cerebral blood flow (CBF). There was also a significant relationship between CBF and CaBF in the severe WMH group. This indicated that such a group could have cerebral ischemia, resulting in WMH and CC atrophy being correlated. Based on longitudinal (Teipel et al., 2002) and cross-sectional (Teipel et al., 1998) studies, Teipel and colleagues found a significant relationship between the extent of WMH and CC atrophy in healthy older adults. Because WMH is commonly regarded as a measurement of primary subcortical disease, this association suggests that CC atrophy in healthy adults results from primary subcortical lesions to fiber tracts crossing the white matter.

Regarding AD, we found that CC atrophy and WMH were correlated contrary to the third hypothesis. CC atrophy could occur in AD as the result of Wallerian degeneration from Layer III and V, which are vulnerable to AD pathologic changes (Pearson et al., 1985). In addition, WMH could occur as in cases with the same

Wallerian degeneration (Leys et al., 1991). Vermersch and colleagues (1996) reported a correlation between CC size and the extent of WMH in AD. Teipel and coworkers (1998) found no such correlation in AD and interpreted the discrepancy as follows: namely, that the patients were older in the Vermersch study (1996) than in the Teipel study (1998). Because there is evidence that late-onset AD patients are more likely to exhibit AD-specific white matter pathology compared with early-onset AD patients, the contribution of white matter pathology to CC atrophy may increase with advanced age. Secondly, the AD group of the previous study included patients with extensive WMH, even large confluent areas. This may have resulted from the inclusion of patients with significant vascular comorbidity confounding the AD pathology. The mean age of our patients (very mild AD and probable AD) was 74.9 years, which was close to that of Vermersch (75.6 years). In addition, we also included those patients with extensive WMH lesions; thus vascular factors might have affected the relationship between CC atrophy and WMH. A further study is needed using larger samples of probable AD cases (not very mild AD) to clarify this topic.

Correlations With Frontal Executive Dysfunction

We found that CC atrophy negatively affected some frontal executive function in both groups. The combined effect of CC atrophy and WMH on the verbal fluency test was noted only in the HC group. In general, there are two types of verbal fluency tests: letter-based fluency tasks and category fluency tasks. Stuss and colleagues (1998) found that patients with left dorsolateral and/or striatal lesions were more impaired in the letter-based and category fluency performances than patients with right lesions.

For AD, greater impairment of category fluency than of letter-based fluency has been observed (Monsch et al., 1994). The CASI subitem word fluency measures category fluency, while the verbal fluency test in this study is letter-based. Although the effect of CC atrophy on category fluency was exhibited on AD participants in this study, no statistical difference was found between the two fluency tasks (chi-square test, data not shown). As for the regional difference of the CC, previous callosotomy studies have shown that the anterior part of the CC, rather than the sensory systems in each hemisphere, plays a role in the interaction between cognitive function (Sass et al., 1990). However, no remarkable regional difference was noted for the relationship between CC atrophy and verbal fluency tests in the two groups (data not shown), although the midposterior portion of the CC was affected in AD. This was probably because atrophic changes in the CC in AD are likely to be affected by widespread neocortical degeneration rather than the cases of callosotomy or focal vascular lesions.

REFERENCES

Barber, R., Scheltens, P., Gholkar, A., Ballard, C., McKeith, I., et al. (1999). White matter lesions on magnetic resonance imaging in dementia with Lewy bodies, Alzheimer's disease, vascular dementia, and normal aging. *Journal of Neurology, Neurosurgery, and Psychiatry, 67*, 66-72.

Black, S. E., Moffat, S. D., Yu, D. C., Parker, J., Stanchev, P., et al. (2000). Callosal atrophy correlated with temporal lobe vol-

ume and mental status in Alzheimer's disease. *Canadian Journal of Neurological Science, 27*, 204-209.

Braak, H., & Braak, E. (1991). Neuropathological stageing of Alzheimer-related changes. *Acta Neuropathologica, 82*, 239-259.

Csernansky, J. G., Wang, L., Joshi, S., Miller, J. P., Gado, M., et al. (2000). Early DAT is distinguished from aging by the high-dimensional mapping of the hippocampus. *Neurology, 55*, 1636-1643.

Deweer, B., Lehericy, S., & Pillon, B. (1995). Memory disorders in probable Alzheimer's disease: The role of hippocampal atrophy as shown with MRI. *Journal of Neurology, Neurosurgery, and Psychiatry, 58*, 590-597.

Erkinjuntti, T., Lee, D. H., & Gao, F. (1993). Temporal lobe atrophy on magnetic resonance imaging in the diagnosis of early Alzheimer's disease. *Archives of Neurology, 50*, 305-310.

Fazekas, F., Kleimert, R., & Offenbacher, H. (1993). Pathologic correlates of incidental MRI white matter hyperintensities. *Neurology, 43*, 1683-1689.

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-mental state": A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research, 12*, 189-198.

Graham, D. I. (1992). Hypoxia and vascular disorders. In J. H. Adams & L. W. Duchen (Eds.), *Greenfield's neuropathology* (pp. 153-268). London: Edward Arnold.

Hampel, H., Teipel, S. J., Alexander, G. E., Horwitz, B., Pietrini, P., et al. (2000). Corpus callosum measurement as an in vivo indicator for neocortical neuronal integrity, but not white matter pathology, in Alzheimer's disease. *Annals of the New York Academy of Sciences, 903*, 470-476.

Hampel, H., Teipel, S. J., Alexander, G. E., Horwitz, B., Teichberg, D., et al. (1998). Corpus callosum atrophy is a possible indicator of region- and cell type-specific neuronal degeneration in Alzheimer's disease: A magnetic resonance imaging analysis. *Archives of Neurology, 55*, 193-198.

Haxby, J. V., Grady, C. L., Koss, E., Horwitz, B., Heston, L., et al. (1990). Longitudinal study of cerebral metabolic asymmetries and associated neuropsychological patterns in early dementia of the Alzheimer type. *Archives of Neurology, 47*, 753-760.

Hughes, C. P., Berg, L., Danziger, W. L., Coben, L. A., & Martin, R. L. (1982). A new clinical scale for the staging of dementia. *British Journal of Psychiatry, 140*, 566-572.

Innocenti, G. M. (1986). General organization of callosal connections in the cerebral cortex. In E. G. Jones & A. Peters (Eds.), *Cerebral cortex* (5th ed., pp. 291-353). New York: Plenum.

Ishii, H., Meguro, K., Ishizaki, J., Shimada, M., Yamaguchi, S., et al. (1999). Prevalence of senile dementia in a rural community in Japan: The Tajiri Project. *Archives of Gerontology and Geriatrics, 29*, 249-265.

Ishizaki, J., Meguro, K., Ambo, H., Shimada, M., Yamaguchi S., et al. (1998). A normative, community-based study of Mini-Mental State in the elderly: The effect of age and educational level. *Journal of Gerontology: Psychological Sciences, 53B*, 359-363.

Janowsky, J. S., Kaye, J. A., & Carper, R. A. (1996). Atrophy of the corpus callosum in Alzheimer's disease versus healthy aging. *Journal of the American Geriatrics Society, 44*, 798-803.

Jobst, K. A., Smith, A. D., Szatmari, M., Esiri, M., Jaskowski, A., et al. (1994). Rapidly progressing atrophy of medial temporal lobe in Alzheimer's disease. *Lancet, 343*, 829-830.

Jobst, K. A., Smith, A. D., Szatmari, M., Molyneux, A., Esiri, M. E., et al. (1992). Detection in life of confirmed Alzheimer's disease using a simple measurement of medial temporal lobe atrophy by computed tomography. *Lancet, 340*, 1179-1183.

Kertesz, A., Polk, M., & Carr, T. (1990). Cognition and white matter changes on

magnetic resonance imaging in dementia. *Archives of Neurology, 47*, 387-391.

Kobayashi, S., Okada, K., Koide, H., Bokura, H., & Yamauchi, S. (1997). Subcortical silent brain infarction as a risk factor for clinical stroke. *Stroke, 28*, 1932-1939.

Laakso, M. P., Soininen, H., Partanen, K., Helkala, E. L., Hartikainen, P., et al. (1995). Volumes of hippocampus, amygdala and frontal lobes in the MRI-based diagnosis of early Alzheimer's disease: Correlation with memory functions. *Journal of Neural Transmission, 9*, 73-86.

Leys, D., Pruvo, J. P., Parent, M., Vermersch, P., Soetaert, G., et al. (1991). Could Wallerian degeneration contribute to "leuko-araiosis" in subjects free of any vascular disorder? *Journal of Neurology, Neurosurgery, and Psychiatry, 54*, 46-50.

Lyoo, I. K., Satlin, A., Lee, C. K., & Renshaw, P. F. (1997). Regional atrophy of the corpus callosum in subjects with Alzheimer's disease and multi-infarct dementia. *Psychiatry Research: Neuroimaging, 74*, 63-72.

McKeith, L. G., Galasjo, D., Kosaka, K., Perry, E. K., Dickson, D. W., et al. (1996). Consensus guidelines for the clinical and pathologic diagnosis of dementia with Lewy bodies: Report of the Consortium on DLB International Workshop. *Neurology, 47*, 1113-1124.

McKhann, G., Drachman, D., Folstein, M., Katzman, R., Price, D., et al. (1984). Clinical diagnosis of Alzheimer's disease: Report of the NINCDS-ADRDA Work Group Under the Auspices of Department of Health and Human Services Task Force on Alzheimer's disease. *Neurology, 34*, 939-944.

Meguro, K., Blaizot, X., Kondoh, Y., LeMestric, C., Baron, J. C., et al. (1999). Neocortical and hippocampal glucose hypometabolism following neurotoxic lesions of the entorhinal and perirhinal cortices in the non-human primate as shown by PET: Implications for Alzheimer's disease. *Brain, 122*, 1519-1531.

Meguro, K., Constans, J. M., Courtheoux, P., Theron, J., Viader, F., et al. (2000). Atrophy of the corpus callosum correlates with white matter lesions in patients with cerebral ischaemia. *Neuroradiology, 42*, 413-419.

Meguro, K., Hatazawa, J., Itoh, M., Miyazawa, H., Matsuzawa, T., et al. (1998). Cerebral blood flow correlated with carotid blood flow in neurologically normal elderly with severe white matter lesions. *European Journal of Neurology, 5*, 143-149.

Meguro, K., Hatazawa, J., Yamaguchi, T., Itoh, M., Matsuzawa, T., et al. (1990). Cerebral circulation and oxygen metabolism associated with subclinical periventricular hyperintensity as shown by magnetic resonance imaging. *Annals of Neurology, 28*, 378-383.

Meguro, K., Sekita, Y., Yamaguchi, T., Yamada, K., Hishinuma, T., et al. (1992). A study of periventricular hyperintensity I. normal brain aging. *Archives of Gerontology and Geriatrics, 14*, 183-191.

Meguro, K., Yamaguchi, T., Hishinuma, T., Miyazawa, H., Ono, S., et al. (1993). Periventricular hyperintensity on magnetic resonance imaging correlated with brain ageing and atrophy. *Neuroradiology, 35*, 125-129.

Monsch, A. U., Bondi, M. W., Butters, N., Salmon, D. P., Katzman, R., et al. (1994). A comparison of category and letter fluency in Alzheimer's disease and Huntington's disease. *Neuropsychology, 8*, 25-30.

Morris, J. C., McKeel, D. W. Jr., Storandt, M., Rubin, E. H., Price, J. L., et al. (1991). Very mild Alzheimer's disease: Informant-based clinical, psychometric, and pathologic distinction from normal aging. *Neurology, 41*, 469-478.

Otoyama, W., Niina, R., Homma, A., Sanada, J., Takahashi, M., et al. (2000). Inter-rater reliability of the Japanese version of Clinical Dementia Rating (CDR). *Japanese Journal of Geriatric Psychiatry, 11*, 521-527.

Pearson, R. C. S., Esiri, M. M., Hiorns, R. W., Wilcock, G. K., & Powell, T. P. S. (1985). Anatomical correlates of the distribution of the pathological changes in the neocortex in Alzheimer's disease. *Proceedings of the National Academy of Sciences for the USA, 82*, 4531-4534.

Pozzilli, C., Bastianello, S., Padovani, A., Passafiume, D., Millefiorini, E., et al. (1991). Anterior corpus callosum atrophy and verbal fluency in multiple sclerosis. *Cortex, 27*, 441-445.

Roman, G. C., Tatemichi, T. K., Erkinjuntti, T., Cummings, J. L., Masdeau, J. C., et al. (1993). Vascular dementia: Diagnostic criteria for research studies. Report of the NINDS-AIREN International Workshop. *Neurology, 43*, 250-260.

Sass, K. J., Novelly, R. A., Spencer, D. D., & Spencer, S. S. (1990). Post callosotomy language impairments in patients with crossed cerebral dominance. *Journal of Neurosurgery, 72*, 85-90.

Stuss, D. T., Alexander, M. P., Hamer, L., Palumbo, C., Dempster, R., et al. (1998). The effects of focal anterior and posterior brain lesions on verbal fluency. *Journal of the International Neuropsychological Society, 4*, 265-278.

Teipel, S. J., Bayer, W., Alexander, G. E., Zebuhr, Y., Teichberg, D., et al. (2002). Progression of corpus callosum atrophy in Alzheimer's disease. *Archives of Neurology, 59*, 243-248.

Teipel, S. J., Hampel, H., Alexander, G. E., Schapiro, M. B., Horwitz, B., et al. (1998). Dissociation between corpus callosum atrophy and white matter pathology in Alzheimer's disease. *Neurology, 51*, 1381-1385.

Teipel, S. J., Hampel, H., Pietrini, P., Alexander, G. E., Horwitz, B., et al. (1999). Region-specific corpus callosum atrophy correlates with the regional pattern of cortical glucose metabolism in Alzheimer's disease. *Archives of Neurology, 56*, 467-473.

Teng, E. L., Hasegawa, K., Homma, A., Imai, Y., Larson, E., et al. (1994). The Cognitive Ability Screening Instrument (CASI): A practical test for cross-cultural epidemiological studies of dementia. *International Psychogeriatrics, 6*, 45-58.

Vermersch, P., Roche, J., Hamon, M., Daems-Monpeirt, C., Pruvo, P., et al. (1996). White matter magnetic resonance imaging hyperintensity in Alzheimer's disease: Correlations with corpus callosum atrophy. *Journal of Neurology, 243*, 231-234.

Yamaguchi, S., Meguro, K., Itoh, M., Hayasaka, C., Shimada, M., et al. (1997). Decreased cortical glucose metabolism correlates with hippocampal atrophy in Alzheimer's disease as shown by MRI and PET. *Journal of Neurology, Neurosurgery, and Psychiatry, 62*, 596-600.

Yamanouchi, H., Fukuyama, H., Harada, K., Katsumi, Y., Dong, Y., et al. (1993). Callosal atrophy parallels decreased cortical oxygen metabolism and neuropsychological impairment in Alzheimer's disease. *Archives of Neurology, 50*, 1070-1074.

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2次医療圏における保健医療福祉の連携システム構築の方法論と評価に関する研究 —問合せ・相談等の実態調査—

信川 益明[1] 北本 清[1] 稲田 紘[2] 関田 康慶[3] 大河原 健[4] 名和 肇[5] 大原 達美[5]
杏林大学医学部 総合医療学教室[1] 東京大学大学院 工学系研究科精密機械工学専攻[2]
東北大学大学院 経済学研究科[3] コロンビア大学 日本経済研究所[4]
東京医科大学 医療情報学教室[5]

A Study on construction and evaluation of health care, medical care and welfa re collaboration system in a medical care service area - a survey of inquiry and consultation -

Masuaki Nobukawa[1] KIyoshi Kitamoto[1] Hiroshi Inada[2] Yasuyoshi Sekita[3] Ken Okawara[4] Hajime Nawa[5] Tatsumi Ohara[5]
Department of Medical Systems and General Medicine,Kyorin University School of Medicine[1]
Graduate School of Engineering,The University of Tokyo[2]
Graduate School of Economics,TohokuUniversity[3]
Columbia University Graduate School of Business Center on Japanese Economy and Business[4]
Department of Medical Informatics,Tokyo Medical University[5]

Abstract: We studied medical information of health centers for health care and welfare collaboration system in the North-Tama-South medical care service area. We investigated and analyzed data regarding medical infomation of 3 health centers in Musashino City, Mitaka City, Chofu City, Fuchu City, Koganei City and Komae City. We concluded that it was necessary to build a suitable medical information network system of health centers and that the medical information network system required to construct health care and welfare collaboration system in a medical care service area.

Keywords: Medical care service area, Medical care function collaboration, medical information

1. 研究目的

住民が身近な地域で適切な医療・福祉・保健サービスを受けられるように医療機関、社会福祉施設、保健所等が各々の機能分担と連携をを図り、医療機能、福祉機能、保健機能を相互に利用し合うことによって効果的な医療福祉保健の供給体制を確立することが不可欠である。そのためにも2次医療圏における医療福祉保健の連携システムが必要である。これらの状況を踏まえて、大都市の二次医療圏における保健医療福祉の連携システムを調査、分析し、実際に機能させる上で重要である保健所を中心とした連携普及のためのシステム構築の方法論と評価のあり方について検討した。

2. 研究方法

2.1「都民からの問合せ・相談等」実態把握調査

2.1.1 調査対象

北多摩南部医圏内の保健所3ヵ所（東京都狛江調布保健所、東京都三鷹武蔵野保健所、東京都府中小金井保健所）である。調査者は、3ヵ所の保健所職員全員である。

2.1.2 調査項目

調査項目は、相談者、受理方法、都民からの問い合わせ・相談等の内容、対応、相談結果、他機関紹介、記入者の所属等である。住民からの問合せ・相談件数は、41件であった。これらについて分析した。その結果を踏まえて、保健所における連携活動および二次医療圏における保健医療福祉の連携の在り方について検討した。

3. 研究結果

3.1 受付者所属別相談件数

相談件数は41件であった。分野別では、医療12件、保健10件、福祉8件、複合1件、その他10件であった。

3.2 相談者と相談内容

相談者の内訳は、市民34件、作業所職員、市職員、市福祉ワーカー、小学校職員、警察署、保育園、保健センターが各1件であった。医療・医療機関5件、保健5件、難病4件、福祉4件、精神3件、予防接種2件、痴呆、介護、訪問、乳児が各1件、その他11件であった。

相談者の割合は、83%が市民が占めていた。相談内容の割合は、医療に関することが29%と最も多く、次いで、保健に関することが24%、福祉に関することが20%であった。

4. 考察

相談者の割合は、83%が市民が占めていた。相談内容の割合は、医療に関することが29%と最も多く、次いで、保健に関することが24%、福祉に関することが20%であった。キーワード別の相談内容の割合は、医療機関に関することが12%、保健に関することが12%、難病に関することが10%、福祉に関することが10%、精神に関することが7%、健康診断に関することが7%と多くを占めていた。

今後は、研究で明らかとなった保健・医療・福祉の連携を展開する上での問題を具体的に解決する方策を保健所、医療施設、社会福祉施設などの現場において実施し、加えて、解決策実施前後の地域における連携普及の現状を調査分析し、普及状況について解決策実施前後の評価を行うことが必要である。この評価結果に基づき、解決策の改善を図ることができ、延いては、住民サービスの向上を一層推進するためのより良いシステムを構築することが期待できる。[1,2,3,4,5]

5. 結論

「都民からの問合せ・相談等」の実態把握調査を実施した結果、相談者の割合は83%が住民が占めていた。相談内容は、医療に関することが29%と最も多く、次いで、保健、福祉に関することであった。保健所、医療施設、社会福祉施設等の関係者が住民、患者、利用者に対して、相談内容について適切に説明できるためのマニュアルの作成など、保健・医療・福祉に関する情報を迅速、的確に検索・利用できる情報システムの構築が重要である。

保健所はこれまで役割を果たしてきているが、より有用・有効な連携活動を行っていくことが必要である。また、二次医療圏において保健所は、各種のネットワーク構築の際の中核として活躍することが必要である。

参考文献

[1] 信川益明他:2次医療圏における保健医療福祉の連携システム構築の方法論と評価に関する研究ー保健医療福祉連携システムに関する実態調査ー. 医療情報学 22 (Supple.) 267-268, 2002.

[2] 信川益明他:2次医療圏における保健医療福祉の連携システム構築の方法論と評価に関する研究ー医療連携の広域化に関する実態調査ー. 医療情報学 20 Supple. 2, 704-705,2000.

[3] 信川益明他、2次医療圏における保健医療福祉の連携システム構築の方法論と評価に関する研究ー2次医療圏内の病院の医療連携に関する実態調査ー、第19回医療情報学連合大会論文集、710-711、1999.

[4] 信川益明他、武蔵野市医療機能モデル連携事業と情報ネットワークシステム、医療情報学、18、285-289、1998.

[5] 信川益明他、地域医療機能連携に必要な情報に関する研究ー健康に関する調査分析ー、第15回医療情報学連合大会論文集、96-96、1995.

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ORIGINAL ARTICLES

Multiple Risk Factors Syndrome in Japanese Male Subjects Using Automatic Multiphasic Health Testing and Service Data: A Work-site Cohort Study

Hiroki Sugimori [1]; Yukihiro Yamada[2]; Machi Suka[1]; Toshiaki Tanaka[1]; Takashi Izuno[3]; Ayano Kiyota[4]; Yukiyasu Iida[5]; and Katsumi Yoshida[1]

[1]Department of Preventive Medicine, St. Marianna University, School of Medicine, [2]Health Center, Head Quarter, Mitsukoshi Department Store, [3]Department of Hygiene, Toho University, School of Medicine, [4]Department of Primary Care Medicine, St. Marianna University, School of Medicine, and [5]Department of Biomedical Engineering, Toin University of Yokohama

ABSTRACT

Objectives To demonstrate the relationships between multiple risk factor syndrome (MRFS) and atherosclerotic events, comparing with hypercholesterolemia group (hTC), in male Japanese, by conducting a work-site cohort study.

Methods From 1986 to 1992, 163 male subjects (MRFS group: n=87; hTC group: n=76) aged 30 years or more, working at a single department store in Tokyo were enrolled, and followed-up until 1998 to observe the occurrence of atherosclerotic events (coronary heart diseases, cerebral infarctions and retinal artery hemorrhages). By using annual health-checkups data in Automatic Multiphasic Health Testing and Service (AMHTS) , we defined MRFS group as subjects who met the following criteria: high blood pressure (diastolic blood pressure≧90 mmHg and/or systolic blood pressure≧150 mmHg, or the initiation of hypertension therapy), hypertriglyceridemia (serum triglycerides≧160 mg/*dl*), hyperglycemia (defined by the criteria by Japan Diabetes Society, 1970), and obesity (BMI: ≧24.0 kg/m^2) at baseline. To compare MRFS group, we also defined hTC group as subjects whose serum total cholesterol level at baseline was 280 mg/*dl* or more.

Results Eight coronary heart disease cases, 3 cerebral infarction cases and 4 retinal artery hemorrhage cases were observed in MRFS group. On the other hand, no atherosclerotic case was observed in hTC group during the period. Mantel-Haenszel procedure showed that age-adjusted atherosclerosis incidence was significantly higher in MRFS group than that in hTC group (p<0.05). In MRFS group, proportion of both glucose intolerance (fast plasma glucose≧140 mg/*dl*) and obesity (BMI≧25 kg/m^2) showed significant difference between atherosclerotic cases and non-cases.

Conclusions MRFS group are more likely to experience atherosclerotic events compared with hTC group. Moreover, since proportion of both glucose intolerance and obesity in atherosclerotic cases is higher than those in non-cases among MRFS group, improved control of both plasma glucose level and body weight (BMI) are strongly recommended in MRFS in terms of preventing atherosclerotic outcome.

Key Words Multiple Risk Factor Syndrome; AMHTS; Cohort Study; Deadly Quartet; Work-site; Japanese

INTRODUCTION

In recent years it has been proposed that hypertension is part of a cluster of metabolic risk factors involving hyperlipidemia and hyperglycemia, with hyperinsulinemia as the common link.[1], [2] The link is known as 'Multiple Risk Factor Syndrome (MRFS)' or 'Metabolic Syndrome X[1]' or 'Deadly Quartet[2]' or 'Insulin Resistant Syndrome[3]'. Furthermore, researchers also reported close relationships between MRFS and systemic atherosclerotic vascular disease such as coronary heart disease (CHD).[1], [4]

However, in Japan few longitudinal studies have undergone assessment of the risk of MRFS regarding atherosclerotic vascular outcomes. The majority of the studies have concentrated on selected clinical sample, and it appears that either limited or no evidences have been demonstrated by epidemiological studies.

Moreover, although hypercholesterolemia has been already established as a risk factor of CHD and managed intensely and routinely in health promotion fields, such as the Automatic Multiphasic Health Testing and Services (AMHTS), a cluster of subclinical metabolic risk factors seemed to be passed by and noticed insufficiently. One main purpose of this study is to strike a note of warning to health care professionals in AMHTS against such a cluster, MRFS. We should attach weight to assessment of not only abnormality of single item of laboratory data but also an aggregation (cluster) of metabolic abnormalities. Therefore, we designed this study to focus on the comparison between MRFS and severe hypercholesterolemia in this study in terms of occurrence of atherosclerotic events in Japanese middle-aged male workers.

SUBJECTS AND METHODS

We conducted a work-site cohort study at a single department store company in Tokyo. From 1986 to 1992, the company had an average annual participation of 2,849 male employees in the regular health-checkups at Mitsukoshi Multiphasic Health Testing and Service (Mitsukoshi Health and Welfare Foundation, Tokyo). Of those health screened in the AMHTS, 206 male participants, aged 30 years or more at baseline, were designed to allocate into the two groups by the following criteria: MRFS group and hTC group. However, since 6 subjects met both criteria and 37 subjects in hTC group had been initiated medication during follow-up period, we excluded 43 cases from the analysis. Thus, 163 final eligible subjects (MRFS group: n=87; hTC group: n=76) were enrolled into this study, and followed up until 1998 over 6 years on average to observe the occurrence of three atherosclerotic events: CHD, cerebral infarctions and retinal artery hemorrhages.

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[1]Address; Department of Preventive Medicine, St. Marianna University, School of Medicine, 2-16-1, Sugao, Miyamae-ku, Kawasaki-shi, 216-8555 Japan. TEL: 81-44-977-4350, FAX: 81-44-977-8111, ext. 3416, E-mail: hsugimor@marianna-u.ac.jp .

[2]Address; Health Center, Head Quarter, Mitsukoshi Department Store, 1-4-1, Nihonbashi-Muromachi, Chuo-ku, Tokyo, 103-8001, Japan

[3]Address; Department of Hygiene, Toho University, School of Medicine, 5-21-16, Oomori-Nishi, Oota-ku, Tokyo, 143-8555, Japan

[4]Address; Department of Primary Care Medicine, St. Marianna University, School of Medicine, 2-16-1, Sugao, Miyamae-ku, Kawasaki, 216-8555, Japan

[5]Address; Department of Biomedical Engineering, Toin University of Yokohama, 1614, Kurogane-cho, Aoba-ku, Yokohama, 225-8502, Japan

Table 1 Baseline statistics of MRFS group and hTC group.

item	criteria	MRFS group (n=87)		hTC group (n=76)		chi-square test
blood pressure	SBP≧150 mmHg and/or DBP≧90 mmHg or Therapy	87	100.0%	15	19.7%	<0.01
BMI	BMI≧24 kg/m^2	87	100.0%	52	68.4%	<0.01
glucose intolerance[§]		87	100.0%	20	26.3%	<0.01
serum total cholesterol (TC)	TC≧240 mg/dl	58	66.7%	76	100.0%	<0.01
serum triglycerides (TG)	TG≧160 mg/dl	87	100.0%	69	90.8%	<0.01
serum uric acid (UA)	UA≧8.0 mg/dl	39	44.8%	22	28.9%	0.12
liver function	AST≧50 IU/l and/or ALT≧50 IU/l and/or γ-GTP≧50 IU/l	66	75.9%	51	67.1%	0.22
smoking habits	smoker	25	28.7%	32	42.1%	0.07
alcohol habits	drinking habits: every day	42	48.3%	33	43.4%	0.54
		mean	SD	mean	SD	t-test
atherogenic index		4.5	1.4	5.2	2.0	0.01

[§] Definition of diabetic or impaired glucose tolerance by 75g OGTT were shown in the text
Abbrebiation: MRFS: Multiple risk factors syndrome, SBP: systolic blood pressure, DBP: diastolic blood pressure, BMI: body mass index, AST: asparate aminotransferase, ALT: alanine aminotransferase, γ-GTP: gamma-Glutamyl transpeptitide

To compare with hTC group, we defined MRFS group, by referring to the "Deadly Quartet[2]", as subjects who met all of the following criteria in the initial year (baseline): high blood pressure recorded on at least two measurements (diastolic blood pressure ≧90 mmHg and/or systolic blood pressure ≧150 mmHg, or the initiation of anti-hypertension therapy), hypertriglyceridemia (serum triglycerides: TG ≧160 mg/dl), hyperglycemia (defined by the criteria by Japan Diabetes Society. 1970, see *1), and obesity (body mass index: BMI ≧24.0 kg/m^2). On the other, we defined hTC group as subjects whose serum total cholesterol level (TC) was severe (≧280 mg/dl or more) at the initial year.[5] All subjects were from similar socioeconomic and occupational background (i.e. sales person), and all were physically active at baseline (without clinical evidence of cardiovascular, cerbrovascular, and renal disease, history of receiving any medical treatment).

Blood pressure was measured on the right arm with the participant in a sitting position, and after 4 minutes rest using a calibrated mercury sphygmomanometer. BMI is expressed as weight (kilograms) per height (meters) squared. Weight and height was measured without shoes and in light clothing. The blood samples of lipids were obtained after an overnight fasting of 10 to 14 hours on the morning (around 8 AM). All biochemical assays were completed by using an automated autoanalyzer (HITACHI Co., Ltd. type 7250) at the Mitsukoshi AMHTS where quality control of blood sample analysis have been certificated by The Japan Society of Multiphasic Health Testing and Service (JMHTS). Blood samples were analyzed with popular standardized reagents in Japan: DETERMINER-L TC2 (KYOWA MEDEX Co., Ltd.) for total cholesterol and high-density lipoprotein cholesterol, TG-L (SEROTEC Co., Ltd.) for triglycerides, and CICALIQUID GLUCOSE for glucose (KANTO KAGAKU Co).

The presence of CHD was defined as an event of myocardial infarction and angina pectoris diagnosed by cardiologists with cardio-angiographies (CAG). The presence of cerebral infarction was defined as an event of cerebral infarction diagnosed with magnetic resonance imaging (MRI). The presence of eyeground bleeding was diagnosed by ophthalmologists with the regular eyeground checkups as a part of the regular health-checkups in the AMHTS. These events were confirmed by reviewing of both personnel management records and medical records, by an occupational physician in this company.

First, we compared the characteristics concerning the risk factors of atherosclerosis between MRFS group and hTC group. In both groups, frequencies of 9 risk factors for atherosclerosis, that is BMI, blood pressure, TC, TG, glucose tolerance, liver function, serum uric acid (UA), alcohol drinking habits, smoking habits were evaluated. Furthermore, the atherogenic index (<TC−HDL>/HDL) was assessed where "HDL" identifies high-density lipoprotein cholesterol.

In this study, mean age of baseline in MRFS group (46.7±7.1 year old) was significantly higher than that in hTC group (42.7±7.3 year old). To adjust age confounding regarding occurrence of atherosclerotic events, we used Mantel-Haenszel procedure (we used 0.5 instead of 0 for the cell value in the approximate calculations[7]).

Statistical analysis was performed by using SAS programs Version 6.12 (SAS Institute, Cary, NC.).[7] Our study was conducted in accordance with the recommendations outlined in the Declaration of Helsinki (revised in 1983, 2000) and an ILO code of practice in 1997 (the Protection of worker's personal data).

RESULTS

Table 1 demonstrates the characteristics of both MRFS group and hTC group at baseline. Differences between both groups in blood pressure, BMI, glucose tolerance, and TG were statistically significant (p<0.05). Differences in other risk factors, that is liver function, UA, alcohol habits, and smoking habits were not significant. The observational period also showed no statistical significance.

Table 2 shows the numbers of atherosclerotic events during the follow-up period. In MRFS group 8 CHD cases (9.2%), 3 cerebral

*1 Hyperglycemia is diagnosed as 'diabetic' or 'impaired glycemia' as follows: 'diabetic' type is defined when fasting plasma glucose (FPG) is 140 mg/dl or higher, and/or plasma glucose 2 hour after 75 glucose load (2hPG) is 200 mg/dl or higher. Casual plasma glucose higher than 200 mg/dl is also regarded as indicating diabetic type. Normal type is defined when FPG is below 110 mg/dl and 2hPG below 140 mg/dl; 'impaired glycemia (borderline type)' is defined in those who belong neither to diabetic nor to normal type.[6]

Table 2 Numbers of atherosclerotic events during the follow-up period.

Age (y.o)	atherosclerotic events: MRFS: cardiovascular disease	cerebral infarction	retinal artery hemorrhage	total		hTC		Fisher's Exact Probabability Test
30–39	0	0	3	3/31	9.7%	0/13	0.0%	0.34
40–49	3	2	1	6/43	14.0%	0/37	0.0%	0.02
50–	5	1	0	6/13	46.2%	0/12	0.0%	<0.01
total	8	3	4	15/87	17.2%	0/76	0.0%	<0.01[§]

[§] *p*-value was calculated by Mantel-Haenszel procedure
(denote that 0.5 was used instead of 0 in the approximate calculations)

Table 3 Baseline statistics of MRFS by outcome.

item	criteria	MRFS group: case (*n*=15)		non case (*n*=72)		chi-square test
blood pressure	SBP≧160 mmHg and/or DBP≧95 mmHg or Therapy	7	46.7%	30	41.7%	0.72
BMI	BMI≧25 kg/m^2	14	93.3%	47	65.3%	0.03
glucose intolerance	FPG≧140	3	20.0%	4	5.6%	<0.01
serum total cholesterol (TC)	TC≧240 mg/d*l*	8	53.3%	50	69.4%	0.23
serum triglycerides (TG)	TG≧200 mg/d*l*	8	53.3%	44	61.1%	0.58
serum uric acid (UA)	UA≧8.0 mg/d*l*	6	40.0%	33	45.8%	0.68
liver function	AST≧50 IU/*l* and/or ALT≧50 IU/*l* and/or γ-GTP≧50 IU/*l*	12	80.0%	54	75.0%	0.68
smoking habits	smoker	5	33.3%	20	27.8%	0.67
alcohol habits	drinking habits: every day	8	53.3%	34	47.2%	0.67

case: atherosclerosis events occured
Abbrebiation: MRFS: Multiple risk factors syndrome, SBP: systolic blood pressure, DBP: diastolic blood pressure, BMI: body mass index, AST: asparate aminotransferase, ALT: alanine aminotransferase, γ-GTP: gamma-Glutamyl transpeptitide

infarction cases (3.4%) and 4 retinal artery hemorrhage cases (4.6%), for a total of 15 (17.2%) atherosclerotic events were observed during the average 6.8 years of follow-up. Incidence of atherosclerotic events increased with age strata. On the contrary, none of atherosclerotic events was observed in hTC group during the average 7.9 years of follow-up. The Mantel-Haenszel procedure showed that age-adjusted atherosclerosis incidence was significantly higher in MRFS group than that in hTC group ($p<0.05$). No death case was observed in both MRFS group and hTC group.

Table 3 shows the baseline statistics of MRFS group by their outcome. To prove difference between cases and non-cases, we used other different criteria in Table 3, regarding blood pressure (SBP ≧160 mmHg and/or DBP ≧95 mmHg or Therapy), BMI (BMI ≧25 kg/m^2), glucose intolerance (FPG ≧140 mg/d*l*), and serum triglycerides (TG ≧200 mg/d*l*). Both glucose intolerance and BMI showed significant difference between cases (MRFS subjects who developed atherosclerotic events) and non-cases (MRFS subjects who did not develop atherosclerotic events).

DISCUSSION

In Japan, workers tend to work in the same company for a long time, that is 'life-long employment', and workers in this study are no exception. It is rational and worthy to utilize the AMHTS data in Japanese workers and to conduct a longitudinal epidemiological study for elucidating health risks.

This study demonstrated close relationships between MRFS and the occurrence of atherosclerotic events in Japanese male workers, comparing with the severe hypercholesterolemia group. The health professionals in AMHTS should bear in mind the hazard of clustered moderate metabolic risks, that is MRFS, as well as a single severe risk such as hTC.

Fifteen atherosclerosis events had occurred in MRFS group while no atherosclerotic case emerged in hTC group. Results from the large trial (MRFIT) suggested that diabetes is a strong, independent risk factor for CHD mortality over and above the effect of TC, blood pressure, and smoking habits.[8] Therefore, although our outcome value was morbidity, one possible reason for incidence difference between our both groups might be explained by the existence of hyperglycemia. Moreover, Haffner *et al.* demonstrated type-2 diabetic subjects even without clinical CHD had extensive atherosclerosis in the carotid artery, which is similar to non-diabetic patients with clinical CHD.[9] Although our criteria contained not only established diabetes but subclinical cases, namely 'impaired glycemia (borderline type)', the recent study[10] showed that no apparent threshold effect in glycated hemoglobin A1c (HbA1c) existed in terms of mortality, and the study concluded importance of preventive efforts in a diabetic subclinical group. Hyperglycemia is one of the main components of MRFS, which might be attributable to increase atherosclerotic incidence in MRFS group. We found that proportion of glucose intolerance (FPG ≧140 mg/d*l*) showed significant difference between MRFS cases and non-cases (Table 3). This result also confirmed the importance of hyperglycemia component in MRFS. Early preventive intervention for including education for glucose intolerance in AMHTS is strongly recommended.

The relationships of hypercholesterolemia to atherosclerotic events, such as CHD are now well established.[11], [12] However, although CHD and stroke share many of the same risk factors, the relationship of cholesterol to stroke remains controversial.[8], [13] This might be alternative reason for the risk difference between MRFS group and hTC group.

Our study presents several limitations: the short period of follow-up, the limited number of events, the truncation and the potential bias such as selection bias and measurement bias. It should be noted that the number of atherosclerotic events in MRFS group was only 15 cases, and, as consequence, the reliability and the stability of risk difference are not fully taken in. In addition, since we defined the both groups by a single measurement of each component data per person (baseline), thus tending to produce misclassification (regression dilution bias).[14]

We excluded 37 participants who had initiated medication during follow-up and this might be another limitation for our study. Difference between this excluded 37 medicated participants and 76 eligible hTC subjects in the frequencies of high blood pressure showed statistically significant (19.7% vs. 37.8%). However, differences in the mean TC level, BMI, glucose intolerance, TC, TG, smoking habits, alcohol habits were similar in both groups and did not reach statistically significance.

In summary, we found that atherosclerotic events occur more frequently in MRFS than in hTC group in worksite. In Japan, both cardio- and cerebro-vascular disease is major part of the public health concerns, because of its high prevalence and its unfavorable QOL due to a marked degree of consequent disability. Our findings suggest that a cluster of subclinical metabolic risk factors accelerate occurrences of atherosclerotic outcome, and we should focus intensely on a linkage of those risks, that is hyperglycemia, high blood pressure, obesity, and hypertriglyceridemia, as well as single hypercholesterolemia that is known widely as a potential atherosclerotic risk factor. Our MRFS group analysis showed that proportion of both glucose intolerance and obesity in atherosclerotic cases is higher than those in non-cases, and these results suggested that controls of both plasma glucose level and body weight (BMI) should be improved in MRFS in terms of preventing atherosclerotic outcome.

REFERENCES

[1] Reaven, G.M.: Banting Lecture, 1988. Role of Insulin Resistance in Human Disease, Diabetes, 37 (12): 1595-1607, 1988

[2] Kaplan, N.M.: The Deadly Quartet. Upper-body obesity, glucose Intolerance, Hypertriglyceridemia, and Hypertension, Arch Intern Med, 149 (7): 1514-1520, 1989

[3] DeFronzo, R.A., Ferrannini, E.: Insulin Resistance. A Multifaceted Syndrome Responsible for NIDDM, Obesity, Hypertension, Dyslipidemia, and Atherosclerotic Cardiovascular Disease, Diabetes Care, 14 (3): 173-194, 1991

[4] Trevisan, M., Liu, J., Bahsas, F.B., Menotti, A.: Syndrome X and Mortality: A Population-based Study. Risk Factor and Life Expectancy Research Group, Am J Epidemiol, 148 (10): 958-966, 1998

[5] Stamler, J.S., Daviglus, M.L., Garside, D.B., Dyer, A.R., Greenkland, P., Neaton, J.D.: Relationship of Baseline Cholesterol Levels in 3 Large Cohorts of Younger Men to Long-term Coronary, Cardiovascular, and All-cause Mortality and to Longevity, JAMA, 284: 311-318, 2000

[6] Report of the Committee of Japan Diabetes Society on the Classification and Diagnostic Criteria of Diabetes Mellitus, The Committee of Japan Diabetes Society (JDS) for the Diagnostic Criteria of Diabetes Mellitus,1970

[7] SAS Institute Inc. SAS User's Guide Statistics, Version 6 First Edition. Cary, North Carolina: SAS Institute Inc., 1993

[8] Stamler, J., Vaccaro, O., Neaton, J.D., Wentworth, D.: Diabetes, Other Risk Factors, and 12-yr Cardiovascular Mortality for Men Screened in the Multiple Risk Factor Intervention Trial, Diabetes Care, 16 (2): 434-444, 1993

[9] Haffner, S.M., D'Agostino, R., Saad, S.M., O'Leary, D., Savage, P.J., Rewers, M., Selby, J., Bergman, R.N., Mykkaänen, L.: Carotid Artery Atherosclerosis in Type-2 Diabetic and Nondiabetic Subjects with and without Symptomatic Coronary Artery Disease (The Insulin Resistance Atherosclerosis Study), Am J Cardiol, 85: 1395-1400, 2000

[10] Khaw, K.T., Wareham, N., Luben, R., Bingham, S., Oakes, S., Welch, A.: Glycated Haemoglobin, Diabetes, and Mortality in Men in Norfolk Cohort of European Prospective Investigation of Cancer and Nutrition (EPIC-Norfolk), BMJ, 322: 1-6, 2001

[11] NCEP Expert Panel, Summary of the Second Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults, JAMA, 269 (23): 3015-3023, 1993

[12] Stamler, J., Stamler, R., Neaton, J.D., Wentworth, D., Daviglus, M.L., Garside, D., Dyer, A.R., Liu, K., Greenland, P.: Low Risk-factor Profile and Long-term Cardiovascular and Noncardiovascular Mortality and Life Expectancy: Findings for 5 Large Cohorts of Young Adult and Middle-aged Men and Women, JAMA, 282 (21): 2012-2018, 1999

[13] Atkins, D., Psaty, B.M., Koepsell, T.D., Longstreth, W.T. Jr., Larson, E.B.: Cholesterol Reduction and the Risk for Stroke in Men. A Meta-analysis of Randomized, Controlled Trials, Ann Intern Med, 119 (2): 136-145, 1993

[14] MacMahon, S., Peto, R., Cutler, J., Collins, R., Sorlie, P., Neaton, J., Abbott, R., Godwin, J., Dyer, A., Stamler, J.: Blood Pressure, Stroke, and Coronary Heart Disease. Part 1, Prolonged Differences in Blood Pressure: Prospective Observational Studies Corrected for the Regression Dilution Bias, Lancet, 335 (8692): 765-774, 1990

インターネットを用いた地域健康管理支援システムの構築

○ 稲田　紘[1]、関田　康慶[2]、片山　文善[3]、
狩野晋一朗[4]、布田　譲[4]、佐久間一郎[4]
池見学園[1]、東北大学大学院経済学研究科[2]、
ネクストウェア㈱[3]、東京大学大学院新領域創成科学研究科[4]

A Community Health Control Support Information System by using Internet

Hiroshi Inada[1], Yasuyoshi Sekita[2], Fumiyoshi Katayama[3],
Shinichiro Kano[4], Yuzuru Fuda[4], Ichiro Sakuma[4]
Ikemi Gakuen[1], Graduate School of Economics, Tohoku University[2], Nextware Ltd.[3],
Graduate School of Frontier Sciences, The University of Tokyo[4]

1．はじめに

生活習慣病予防のための健康管理を地域で行うことの重要性から、宮城県田尻町では、これまでにスキップ情報システムという地域保健・医療・福祉連携支援情報システムの構築・運用をはかり、保健・医療・福祉の関係職員が住民のデータを共有することなどにより、各サービスの実施に役立てている。このうち健康管理に関しては、本システムで健診結果の異常が示された住民を対象に健康教室を開き、保健指導を行ってきたが、働き盛りの人々にとって、健康教室に出席することは容易ではない。そこで本研究では、Web を用いたスキップネット健康管理支援システム（仮称）を新たに開発し、ＰＤＡや携帯電話のような携帯端末から、個人健診データの検索や保健指導情報の取得などを可能にしようとした。

2．方　法

本システムの機能である①個人健診情報蓄積管理、②健康相談、③生活習慣病指導の３つのサブシステムのうち、まず①に関するものと、③の一部に関するシステムを試作した。①では、住民個人の時系列健診データの把握と、住民が自分のデータをＰＤＡから検索可能とするシステムの構築を試みた。また③に関しては、異常な健診結果を示す住民を対象に、ライフスタイルに関する一般的な保健指導情報を提供しうる機能を持たせた。これらのシステムの構築にあたり、実際の健診データベースは用いず、人為的に作成した小規模の模擬健診データベースを使用した。またＰＤＡとしてザウルスを用い、試用実験を行った。

3．結果および考察

50 例ほどの個人情報（ＩＤ番号、氏名など）と架空の健診データ（身長、体重、血圧、血液・尿など生化学検査ほか）からなる小規模模擬健診データベースを作成し、該当する住民の健診データをＰＤＡから検索可能とした。このため、田尻町のホームページからリンク可能な（現時点ではまだリンクをとっていない）スキップネット健康管理支援システムの Web サイトを構築し、検索する住民のＩＤ番号、氏名（漢字）および６桁の英数字によるパスワードを入力することにより、当該住民の健診データを表示可能にした。今回の試作システムはモデルにすぎないので、生活習慣病指導という観点から、肥満、高血圧症、高脂血症、脳卒中、虚血性心疾患、糖尿病（高血糖症）、痛風（高尿酸血症）の予防に関連する身長・体重およびＢＭＩ（Body Mass Index）、血圧、空腹時血糖、血清総コレステロール、血清尿酸の各表示値にとどめた。そして、ザウルスから所定の個人情報を入力することにより、健診データの検索を試み、所望の結果を得た（図１にその一例を示す）。

次に保健指導情報の提供に関しては、前記の各検査値が一定の閾値を超える異常値を示した場合、その検査値に* を記すとともに、所定の操作により、保健指導情報（たとえば高脂血症の場合、脂肪の多い食餌を控え、運動することを奨励するなど）が表示されるようにした。

今回の試用実験の結果、住民が携帯端末により、どこからでも自分の健診データと、それに付随する保健指導情報を取得することができ、本システムが地域の健康管理に有用なことが窺われた。

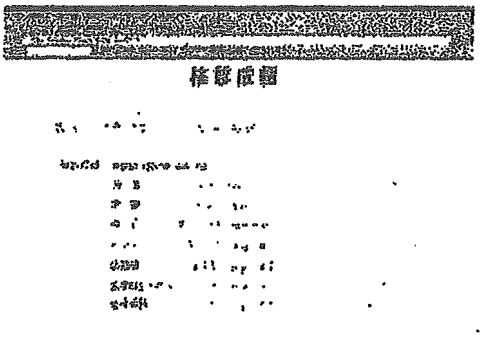


図１　個人健診データの検索結果の一例

インターネットを用いた地域健康管理支援システムの構築に関する研究

稲田 紘[1] 西村治彦[1] 堀尾裕幸[1] 東ますみ[1] 水野(松本)由子[1] 狩野晋一朗[2] 片山文雄[3] 関田康慶[4]

兵庫県立大学大学院応用情報科学研究科[1] 東京大学大学院新領域創成科学研究科[2] ネクストウェア(株)[3] 東北大学大学院経済学研究科[4]

A Study on Construction of Community Health Control Suppo System by using Internet

Hiroshi Inada[1] Haruhiko Nishimura[1] Hiroyuki Horio[1] Masumi Azuma[1] Yuko Mizuno-Matsu Shinichiro Kano[2] Fumiyoshi Katayama[3] Yasuyoshi Sekita[4]

Graduate School of Applied Informatics, University of Hyogo[1]
Graduate School of Frontier Sciences, The University of Tokyo[2] Nextware Ltd.[3]
Graduate School of Economics, Tohoku University[4]

Abstract: It is very important to provide community health services in cooperation with medical and welfare in the super-aged society in near future. In Tajiri Town, Miyagi Prefecture, a community health, mec welfare services cooperation support information system called SKIP information system has been cor and operated for this purpose. As one of functions for health services, we have developed SKIPNET healt support system by applying Internet. By using the system, inhabitants who are in the prime of life an easy to attend health school for instruction of health control can obtain their health-check data and in information of the lifestyles for diseases prevention everywhere with a mobile terminals such as a PI cellular phone. From the results of trials of this system, it is considered to be useful for community healt services.

Keywords: community health services, SKIP information system, SKIPNET health control su system, Internet, mobile terminal

1. はじめに

最近、健康増進法の施行などにより、個人の健康志向の高まりが見られるとともに、これを支援する地域や職域における保健サービスのサポート体制が重要となってきている。一方、超高齢社会を目前にした今日、地域における保健サービスは医療・福祉との連携のもとに提供される必要性が増してきている。宮城県田尻町では、1997年に保健・医療・福祉の複合施設であるスキップセンターを建設し、連携活動の拠点とするとともに、IT(情報技術)の応用により、医師、看護師、保健師、介護福祉士など関係者間における保健・医療・福祉に関する情報の共有と流通の円滑化をはかるため、スキップ情報システムという地域保健・医療・福祉連携支援情報システムの構築・運用してきた。

このうち保健サービスに関しては、本システムで健診結果の異常が示された住民を対象に健康教室を開き、保健指導を行ってきたが、40歳代～50歳代男性のいわゆる働き盛りの人々にとって、健康教室に出席することは容易ではない。そこで本研究では、インターネットを用いたスキップネット健康管理支援システムを新たに開発した。そして、パソコン以外にもPDAや携帯電話のような携帯端末を用いて、住民が自宅など、いずれの場所からも個人健診データの検索や保健指導情報の取得するとともに、これに基づいて保健サービするにあたり、システムを活用する保健ボティアとしての保健推進員を支援するネッステムの構築について計画した(図1)。

2. システムの機能

本システムではサブシステムとして、①個報蓄積管理、②生活習慣病予防のため導の機能を持たせることにした。これらに関するものとして、住民個人の時系列タの把握と、住民が自分のデータを携帯検索可能とするシステムの構築を試みたに関しては、異常な健診結果を示す住に、生活習慣病予防のためのライフスタる一般的な保健指導情報を提供したり、住民個人ごとに保健指導や健康相談に情報や、保健推進員のようなボランティ詳しい保健情報を提供するシステムを構した。

3. システムの内容

本システムの構築にあたり、受診者のインドコンセントを取ることの困難性から、実データベースは用いず、人為的に作成

の模擬健診データベースを使用した。また今回は携帯端末として、代表的なPDAであるザウルスを用い、試用実験を行った。100例ほどの個人情報（ID番号、氏名など）と主な検査データ（身長、体重、血圧、血液検査データなど）からなる小規模模擬健診データベースを作成し、該当する住民の健診データをPDAから検索可能となるようにした。

3.1 住民個人の時系列健診データの把握

田尻町のホームページからリンク可能なスキップネット健康管理支援システムのWebサイトを構築し、検索する住民のID番号、氏名（漢字）および6桁の英数字によるパスワードを入力することにより、当該住民の健診データを表示可能にした。今回の試作システムでは、生活習慣病指導という観点から、肥満、高血圧症、高脂血症、脳卒中、虚血性心疾患、糖尿病（高血糖症）、痛風（高尿酸血症）の予防に関連する身長・体重およびBMI（Body Mass Index）、血圧、空腹時血糖、血清総コレステロール、血清トリグリセライド、血清尿酸の各データの検索およびこれらの値の表示にとどめた。そして、ザウルスから所定の個人情報を入力することにより、健診データの検索を試み、所望の結果を得た。

3.2 生活習慣病予防のための保健指導情報の提供

次に生活習慣病予防のための一般的な保健指導情報の提供に関しては、前記の各検査値が一定の閾値を超える異常値を示した場合、それに応じた保健指導情報（たとえば高尿酸血症の場合、プリン体の豊富な食餌を控え、体重を減量することを奨励するなど）が表示されるようにした（例として、肥満に対する保健指導情報の画面を図2に示す）。

また、保健師が住民ごとに個別の保健指導を行う場合には、対象となる個人の過去に遡って5回分までの健診データの推移を把握するとともに、健診データに基づく判定ロジックにより、簡単なコメントを参照できるようにした。

4. 考察および結語

今回は小規模のモデルシステムの開発にとどまってはいるが、試用実験の結果、住民が携帯端末により、どこからでも自分の健診データと、それに付随する保健指導情報を取得することが可能なことが示され、本システムが地域の健康管理支援に有用なことが窺われた。また、個別指導に関しても保健師の支援に役立つのみならず、保健推進員のような町のボランティアの組織化にも資することが期待された。

本研究では、ネットワークと携帯端末の健康管理に対する試行例を示したが、今後、このようなユビキタス医療の実現は、超高齢社会における地域や在宅における健康管理を支援する有用なツールになるものと期待される。

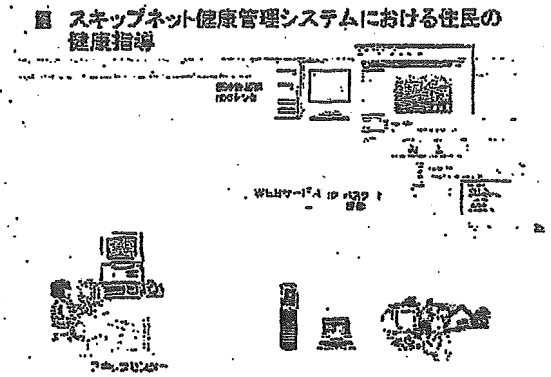


図1 スキップネット健康管理システムの概念

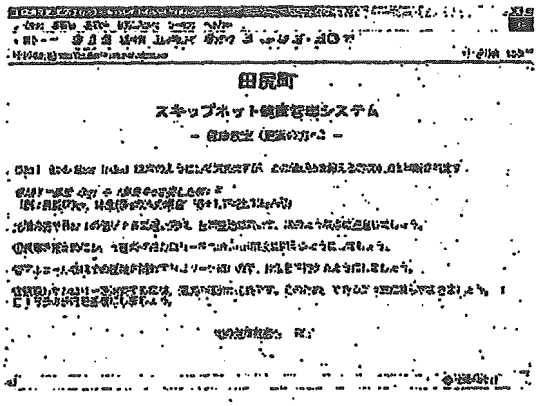


図2 肥満に対する保健指導情報の画面例

OS1-1003

地域保健指導支援ネットワークの構築について

片山　文善[1)]、菅沼　香緒理[1)]、狩野　晋一朗[2)]、関田　康慶[3)]、稲田　紘[4)]
[1)]ネクストウェア株式会社、[2)]東京大学大学院新領域創成科学研究科、
[3)]東北大学大学院経済学研究科、[4)]兵庫県立大学大学院応用情報科学研究科

A Study on Construction of a Network System for Community Health Instruction Support

Fumiyoshi Katayama[1)], Kaori Suganuma[1)], Shinichiro Kano[2)], Yasuyoshi Sekita[3)], Hiroshi Inada[4)]
1) Nextware Ltd., [2)]Graduate School of New Frontier Sciences, The University of Tokyo,
[3)]Graduate School of Economics, Tohoku University, [4)]Graduate School of Applied Informatics, University of Hyogo

1．緒言

地域における保健サービスの実施においてＩＴ技術の活用を積極的に図る試みは、多くの地域や職域で行われている。

一方、健康増進法の施行などで個人の健康志向に対する認識の高まりとこれを支援する地域や職域のサポート体制が重要になってきており、そのポイントは、個々の住民に合った個別健康指導の手法といわれている。また、今後は、地域や職域におけるこのようなしくみが医療費と直結することも予想される。

本研究を進める宮城県田尻町においても「保健サービスの向上をめざした地域保健、医療、福祉支援情報システムに関する研究」により、地域でのニーズや医療・福祉サービスとの連携の重要性が立証されている。

今回は、これらの研究を踏まえて保健サービスを実施するにあたり、地域の住民のために、システムとそれを活用する保健師、健康指導推進員のスキルをどの様に確保し、住民とのネットワーク造りをどの様に構築するかという課題に取り組んでいるので紹介する。

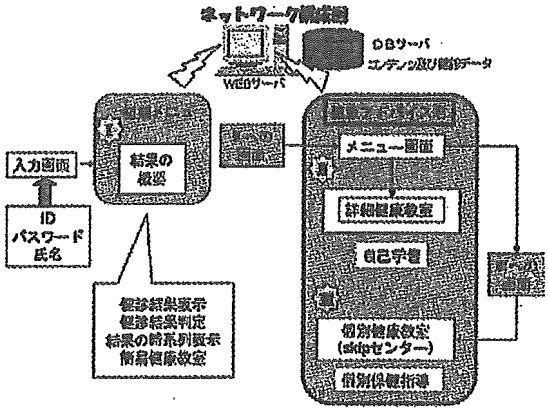
2．ネットワークの概要

図に、ネットワークの概要を示す。一般のまちのホームページから個人保健情報の閲覧ができるホームページ【Ⅰ】にリンクすることができる。ここでは、健康診断の結果から過去の健診データを含めて５回までのデータの推移と健診データに基づく判定ロジックにより、簡単なコメントを参照することができる。

第２の段階として、詳細の情報【Ⅱ】の提供を行う。さらに【Ⅲ】の段階では、保健センターでの個別指導を受けるためのメニューが用意されており、健康指導コースへの予約申込み画面を用意して、保健センターに出向いて対面の指導を受ける機会をつくることができる。

保健師は、アンケート調査と生活習慣指導ソフトウエアにより生活習慣の改善の指導を継続的にできる。

ソフトウエアは、個々の疾患の指導を行うための情報提供のコンテンツと指導履歴の保存機能を有する。また、オプション機能により個人の検診データをグラフ化して表示することができる。



3．現状と考察

生活習慣の個別指導の必要性は、立証されているがベテランの指導者が長期にわたる介入を必要とするため人数が限られ、費用対効果を疑問視する声も上がっている。

本研究においては、システム導入前よりも導入後の方が、より多くの住民に対応できるようになると予測している。

さらに指導の方法にインターネットによる遠隔指導や携帯電話やモバイル端末の活用による情報提供などの手法も採用して行くことが必要と考えている。

システム導入により指導プログラムがある水準で維持できるために、ベテランの保健師だけでなく、看護師や管理栄養士など就労していない住民の参加を求め、健康指導推進員の様な住民の組織化することも可能になる。本研究では、指導者の育成プログラムの検証も企画している。

2418 インターネットによる地域健康管理支援システムの構築

兵庫県立大学大学院 応用情報科学研究科
ヘルスケア情報科学コース[1]、
東京大学大学院 新領域創成科学研究科[2]、
ネクストウェア株式会社[3]、
東北大学大学院経済学研究科[4]
○稲田 紘[1]、狩野 晋一朗[2]、片山 文善[3]、
関田 康慶[4]

【目的】宮城県田尻町では、スキップ情報システムという地域保健・医療・福祉連携支援情報システムを構築済みで、これまで本システムにより、健診結果が異常な住民を対象に健康教室を開き、保健指導を実施してきたが、40歳代～50歳代のいわゆる働き盛りの人々にとって健康教室に出席することは容易ではない。そこで、インターネットを応用した健康管理支援システムを構築し、保健指導を容易にして、地域保健サービスの向上をはかろうとした。

【対象・方法】本システムでは、これまでの住民健診データベースに基づく個人健診情報を蓄積し、Webを用いて検索することを可能にするとともに、これに保健指導システムの機能を付加した。すなわち、住民は、このシステムにより、ＰＤＡや携帯電話機のような携帯端末を用いて、スキップ情報システムの健診データベースに蓄積された自分のデータを検索することができるが、その際、異常な検査結果を示す住民にはその結果とともに、それに関する一般的な保健指導情報（生活習慣病予防を主とする）の提供をはかることを可能とした。

【結果・考察】システム的にはすでに構築済みであるが、時間などの関係などもあり、多くの住民個人の同意を得るまでには至っていないので、今回は100例ほどの個人情報（ＩＤ番号、氏名など）および主な検査データ（身長、体重、血圧、各種血液検査データなど）からなるデータベースを別途作成し、これに基づいて、該当する住民が自分のデータや保健情報を携帯端末から呼び出す実験を試みたところ、所望の結果を得た。今回は小規模のモデル実験にとどまり、ユーザインターフェイスにも考慮が必要なことが指摘されたものの、本システムは地域健康管理支援に有用なことが窺われた。