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OLDER PEOPLE WITH DIABETES HAVE HIGHER RISK OF DEPRESSION, COGNITIVE AND FUNCTIONAL IMPAIRMENTS: IMPLICATIONS FOR DIABETES SERVICES

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Abstract: *Objectives:* To examine the relationship between diabetes and impairments in functional and cognitive status as well as depression in older people. *Design:* Cross-sectional study. *Setting:* Elderly Health Centres (EHC) in Hong Kong. *Participants:* 66,813 older people receiving baseline assessment at EHC in 1998 to 2001. *Measurements:* Diabetes status was defined by self-report and blood glucose tests. Functional status was assessed by 5 items of instrumental activities of daily living (IADL) and 7 items of activities of daily living (ADL). Cognitive status was screened by the Abbreviated Mental Test—Hong Kong version (AMT). Depressive symptoms were screened by the Geriatric Depression Scale—Chinese version (GDS). *Results:* Among the subjects, 10.4% reported having regular treatment for diabetes, 3.4% had diabetes but were not receiving regular treatment, and 86.2% did not have diabetes. After controlling for age, sex and education level, those having regular treatment for diabetes were 1.7 times more likely (OR=1.65, 95% CI: 1.51-1.80) to have functional impairment, 1.3 times more likely (OR=1.28, 95% CI: 1.11-1.48) to have cognitive impairment and 1.3 times more likely (OR=1.35, 95% CI: 1.25-1.46) to have depression, than older people without diabetes. *Conclusion:* Older people with diabetes may be less capable of managing the disease than the younger ones as a result of increased risk of both physical and cognitive impairment. This study provided further evidence for the need of an international consensus statement regarding care of diabetes in older people.

Key words: Diabetes mellitus, ageing, health care delivery.

Introduction

Data from a survey in Hong Kong showed that the prevalence of self-reported diabetes among population aged 65 and above was highest among all the age groups at 13.5% in 2003-2004 (1). This prevalence is comparable to that in the United States, the United Kingdom and Australia (2) and, as in these countries, the Hong Kong population is ageing (3). While there is no clear evidence of either an increasing or decreasing trend in the prevalence rate of diabetes, the increasing number of older people with diabetes can be expected to increase markedly over time (1, 2, 4, 5).

Among adults who reported doctor-diagnosed diabetes in Hong Kong, about half of them were aged 65 and above (1). With population ageing, it is expected that by 2036, over 70% of the diagnosed adult cases of diabetes would come from the older population (2). The increasing age profile of people with diabetes implies that they will also have a higher degree of dependency and more co-morbidity. In 2006, de Rekeneire (6) also highlighted the fact that the increase in diabetes prevalence in an ageing population would result in a dramatic increase in the prevalence of diabetes-related complications such as cognitive impairment. Langa et al. (7) showed that informal caregivers had to spend extra time in dealing with functional limitations related to older people with diabetes. In addition, cognitive impairment among older people with diabetes may result in lower capability in adhering to medical regime and diabetes self-management (8-10). Depression, which may be more common among people with diabetes, was also associated with lower adherence to disease management recommendations including exercise, diet and medications (11).

While it is well-known that older people with diabetes faces challenges resulting from related functional and cognitive impairments as well as depression, the provision of health and social care services for diabetes, in general, had not been developed to address the special needs of these older people with diabetes. Despite the large number of studies in diabetes, a limited number of studies were carried out in older people with diabetes. While this observation may be related to the vulnerability of older people or research ethics issues, Paolisso and Sinclair (12) suggested another possibility that special needs of the older patients were often not recognized.

In Hong Kong, although diabetes services are well structured, with clear service targets and regular screening provided in the public as well as the private sector, the complex needs of elderly people have largely been ignored. For example regular assessment often focuses on the screening for diabetic complications but does not include assessment of cognitive function, mobility disability, functional impairments, and depression, which constitute cornerstones of comprehensive geriatric assessment. Furthermore, although nurse led diabetes education and management including dietary and medication administration/compliance components are in place, services too rigidly adhere to protocols which are not tailored for older people. For example, older patients have to visit different supporting services in different locations, and they have

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difficulty in navigating these services. As a result, reflections from elderly groups in the community frequently reveal difficulties in following lifestyle and disease management advice as well as problems in comprehension regarding the disease and complications

Previous studies in Hong Kong showed that older people with diabetes had functional impairment and depression (13-15). However, these studies were conducted in the early nineties which may or may not reflect the most up-to-date situation. The objectives of this study are (i) to examine the relationship between diabetes and impairments in functional and cognitive status as well as depression in the Hong Kong older population and (ii) to assess the implication for health and social services in care of older people with diabetes in future.

Methods

Study Population

The Department of Health of Hong Kong Special Administrative Region has launched 18 Elderly Health Centres (EHCs) since July 1998. The purpose of EHCs is to deliver primary care services for the population aged 65 and above in Hong Kong through a multi-disciplinary team approach. Services provided by the EHCs include health assessment, physical check-up, individual health counselling, health education and general out-patient service. All Hong Kong residents aged 65 and above are eligible and encouraged to enroll as members of EHCs. Members visit EHCs for assessments and treatments. It is a routine procedure to provide all new members on enrollment with a baseline comprehensive health assessment. During health assessment, the member is interviewed by trained nurses using a standardized questionnaire, followed by physical examination by doctors. Laboratory and radiological tests are prescribed according to the presence of clinical indications. The questionnaire obtains information on the socio-demographic characteristics, social factors, lifestyles factors and physical health. In addition, the members are assessed on the functional ability, and tested on the cognitive function and the presence of depressive symptoms. For people who are cognitively impaired, depressed or not suitable to respond to the questionnaire, their caregivers will act as proxy to provide objective information, whereas subjective information will not be collected. When abnormalities are detected, the attending doctor will provide management accordingly. The problems detected can either be managed at EHC or referred to specialist clinics of public hospitals for further management. The membership for EHCs lasts for one year. Upon expiry, the members may re-enroll. Members undergo the first health assessment at enrollment (baseline assessment), then at subsequent re-enrollments. Details of the baseline assessment are presented elsewhere (16, 17). In this study, 66,813 people aged 65 and above enrolled for the first time to the EHCs in July 1998 to December 2001 were included.

Measurements

In the EHC baseline assessment, cognitive status was screened by the Abbreviated Mental Test—Hong Kong version (AMT) and a cut-off point of 6 was used as the indicator of having cognitive impairment (18). The sensitivity and specificity of the AMT screening criteria are 96% and 94%, respectively. Depressive symptoms were screened by the Geriatric Depression Scale—Chinese version (GDS) and a cut-off point of 8 was used as the indicator of being depressed (19). The sensitivity and specificity of the GDS screening criteria are 96.3% and 87.5%, respectively. Functional status was assessed by 5 items of instrumental activities of daily living (IADL) and 7 items of activities of daily living (ADL). The items included telephone, traveling, shopping, preparing meals, handling money, bathing, toileting, walking, transfer, dressing, feeding and grooming. These items were commonly used in ADL and IADL scales (20). The purpose of screening was to identify people who might need interventions. Hence, people who could not perform independently in any of the 12 items were considered as having function impairment. As the questions were not developed for research purpose, reliability and sensitivity of this screening criteria were not estimated.

Besides reporting their known diabetes status, all EHC members underwent fasting plasma glucose test at baseline assessment. Fasting was defined as no caloric intake for at least 8 hours and venous blood was taken for the test. All samples were tested in the same government pathology laboratory. If fasting plasma glucose >= 7 mmol/L, diabetes is confirmed if a diagnostic fasting or 2-hr plasma glucose value is repeated in a different setting. The subjects were classified into three groups by the diabetes status, namely (i) having regular treatment for diabetes, (ii) not having regular treatment for diabetes, and (iii) no diabetes. Those with regular treatment for diabetes included those with regular follow-up by public or private medical doctor or other health professional (dieticians) with or without drug treatment for diabetes prior to the EHC baseline assessment. Those without regular treatment for diabetes included those with newly diagnosed diabetes by the EHC baseline assessment, as well as those with known diabetes but without regular follow-up by medical doctor or other health professional prior to EHC baseline assessment.

Statistical Analysis

Chi-square tests were used to determine whether there was an association between diabetes status and the subjects' characteristics. Association between diabetes status (having regular treatment for diabetes vs without diabetes) and functional, cognitive and depression status was further examined by logistic regression, controlling for age, sex and education level and odds ratios (OR) were estimated. All data analyses were performed using Stata version 10. A significance level of 0.05 was used.

The statistical power was estimated as 0.97 for functional impairment, 0.69 for cognitive impairment and 0.99 for

depression, assuming the true OR was 1.2; the power would increase to 1.00, 0.95 and 1.00 respectively, assuming the true OR was 1.3. The lower statistical power for the analyses on cognitive impairment was due to the lower prevalence of cognitive impairment as compared to functional impairment and depression.

Results

Characteristics of the subjects are shown in Table 1 and Chi-square tests showed significant associations between the characteristics of the subjects and the diabetes status. Of those enrolled in the EHC between 1998 and 2001, 10.4% reported having regular treatment for diabetes, 3.4% were diagnosed to have diabetes but without regular treatment, and the remaining 86.2% did not have diabetes. The prevalence rates of diabetes were similar for the male and female. The prevalence rate of diabetes among those aged 85 and above were lower than those aged below 85, which might be due to the survival of the fittest. The diabetes prevalence rates were similar among different education levels, those with higher education level tended to be less likely to receive regular treatment.

Table 1
Characteristics of older people aged 65 and above receiving baseline assessment at Elderly Health Centres in 1998-2001, by diabetes status (N= 66,813)

Characteristics	With regular treatment for diabetes n (%)	Without regular treatment for diabetes n (%)	Without diabetes n (%)	p-value of $\chi 2$ test
All	6,929 (10.4)	2,293 (3.4)	57,591 (86.2)	
Gender				0.000
Male	2,207 (9.7)	885 (3.9)	19,584 (86.4)	
Female	4,722 (10.7)	1,408 (3.2)	38,007 (86.1)	
Age in years				0.000
65-74	4,963 (10.5)	1,666 (3.5)	40,725 (86.0)	
75-84	1,810 (10.5)	568 (3.3)	14,915 (86.2)	
85+	156 (7.2)	59 (2.7)	1,951 (90.1)	
Education level				0.038
Primary or below	5,777 (10.4)	1,851 (3.3)	47,722 (86.2)	
Secondary	918 (10.2)	342 (3.8)	7,725 (86.0)	
Tertiary	234 (9.4)	100 (4.0)	2,143 (86.5)	
Functional impairment				0.000
Yes	717 (14.3)	168 (3.4)	4,121 (82.3)	
No	6,210 (10.0)	2,125 (3.4)	53,465 (86.5)	
Cognitive impairment				0.018
Yes (AMT <6)	232 (12.3)	67 (3.6)	1,588 (84.2)	
No (AMT ≥ 6)	6,689 (10.3)	2,226 (3.4)	55,960 (86.3)	
Depression				0.000
Yes (GDS ≥ 8)	848 (13.2)	208 (3.2)	5,369 (83.6)	
No (GDS < 8)	6,075 (10.1)	2,084 (3.5)	52,170 (86.5)	

AMT, Abbreviated Mental Test—Hong Kong version; GDS, Geriatric Depression Scale—Chinese version.

Among the people with regular treatment for diabetes, 10.4% had functional impairment (in any of the 12 ADL and IADL items), 3.4% had cognitive impairment (AMT<6) and 12.2% had depressive symptoms (GDS≥8). This compares with 7.2%, 2.8%, 9.3% for the same problems in those without diabetes, as shown in Table 2.

Table 2
The percentage of functional impairment, cognitive impairment and depression among people with regular treatment for diabetes and people without diabetes

Characteristics	With regular treatment for diabetes n (%)	Without diabetes n (%)	Adjusted* OR (95% CI)
Functional impairment			
Yes	717 (10.4)	4,121 (7.2)	1.65 (1.51-1.80)
No	6,210 (89.6)	53,465 (92.8)	
Cognitive impairment			
Yes (AMT < 6)	232 (3.4)	1,588 (2.8)	1.28 (1.11-1.48)
No (AMT ≥ 6)	6,689 (96.6)	55,960 (97.2)	
Depression			
Yes (GDS ≥ 8)	848 (12.2)	5,369 (9.3)	1.35 (1.25-1.46)
No (GDS < 8)	6,075 (87.8)	52,170 (90.7)	

AMT, Abbreviated Mental Test—Hong Kong version; GDS, Geriatric Depression Scale—Chinese version; * Adjusted for age, sex and education level

Logistic regression models showed that after controlling for age, sex and education level, diabetes status was still significantly associated with functional and cognitive impairments, as well as depression. Compared to older people without diabetes, those having regular treatment for diabetes were 1.7 times more likely (OR=1.65, 95% CI: 1.51-1.80) to have functional impairment, 1.3 times more likely (OR=1.28, 95% CI: 1.11-1.48) to have cognitive impairment and 1.3 times more likely (OR=1.35, 95% CI: 1.25-1.46) to have depression.

Discussion

This study draws attention to the fact that older people with diabetes have higher risk of functional impairment, cognitive impairment and depression. Therefore they may be less capable of managing the disease than younger patients as a result of increased risk of both physical and cognitive impairments. For example, elderly people with diabetes, especially for those whose cognitive status was declining, may find it more difficult to follow complex drug regimes (particularly involving insulin injections) or to use monitoring devices such as blood glucose meters. In addition, they may find it hard to remember the dietary control and other healthy lifestyle advices and thus having more difficulties in changing their long-standing lifestyles. Elderly people, particularly those with functional and cognitive impairments, may find it difficult to cope with multiple service providers in multiple locations. Moreover, older people with diabetes are more likely to be depressed, which further affects the adherence to management recommendations.

These findings underscore the need for adopting an elder-oriented approach in care of older people with diabetes as a

cornerstone in health and social services, in addition to the need for screening of diabetes and its complications, and optimizing disease control. This approach should address the following needs. Firstly, in view of the increased predisposition to functional and cognitive impairments and depression, there is a need to carry out comprehensive geriatric assessment covering physical, functional, psychological, nutritional and social domains to guide management plan, in addition to the current diabetes complications screening. Secondly, there is a need to consider care in the context of a social unit, recognizing that a proportion of the older population, particularly those with cognitive impairment, is less able to achieve lifestyle modification, to manage complex drug regimes and to handle gadgets and information technology. In addition, for those with function and cognitive impairments, visiting a one-stop unit for diabetes care is much easier than coping with multiple service providers at multiple sites. Care would ideally be provided in a user friendly and convenient community setting integrating medical and social activities for management and maintenance. Eye care is particularly important since deterioration in vision leads to decline in functional impairment and higher risk of depression. Finally, due to the advancing age of people with diabetes, there is a need to consider the trajectory of the disease in the context of increasing frailty and the proximity to end of life, in management of the disease versus the usual 'static' system based approach governed by guidelines.

Although these needs have been articulated by geriatricians and guidelines published during the past decade in the United Kingdom (21) and the United States (22), they have yet to be incorporated into specialized diabetes services in a systematic way. A possible explanation is the uncertainty regarding which specialty service should provide care. Indeed, a multi-disciplinary approach in providing diabetic is necessary. Ideally those providing care should have up-to-date knowledge and experience in all aspects of diabetes management, and at the same time be able to take into account the elder-oriented approach described above, and be conversant with available social services and support network. Any district wide service should include these expertises at primary and secondary levels. There is also a need for improved professional training in the elder-oriented approach, or an approach that taken into account broader dimensions including functional and cognitive limitations. The awareness that older people with diabetes have associate functional limitations (23), cognitive dysfunction that impacts on self-care and use of care services (10, 24, 25) including admission to long term residential care and its consequences on management (26-28), and the impact of visual impairment on quality of life (29) needs to be widely promulgated among all health care professionals who look after elderly people with diabetes. In addition to the existing structured diabetes screening programmes, a minimum core assessment criteria including basic assessment for ADL, cooperative function, GDS, and gait and balance measure such as the timed "up and go" test widely used by physiotherapist, has been proposed (30). Recently, the European Diabetes Working Party for Older People (EDWPOP) has been advocating clinical guidelines for older people with diabetes (12).

Except for EHCs, which provide elder-oriented primary care services through a multi-disciplinary team approach, the health service response in Hong Kong has been on screening and improved control, without the elder-oriented approach. For example cognitive assessment is not included in diabetes screening. Improving population control would be difficult if these aspects are not taken into account. Instead, a multi-dimensional approach emphasizing prevention of diabetes and its complication and treatment for vascular diseases has to be adopted (12). In practice, closer cooperation between diabetologists, geriatricians, and primary care doctors, working in a coordinated way in easily accessible community centres, may meet the increasing need for screening and management of the growing number of elderly people with diabetes.

Strengths and limitations of the study

A total of 66,813 older people from all districts in Hong Kong were included in this study. The EHC database provided substantially larger number of subjects than studies based on sampling. In addition, undiagnosed diabetes cases were confirmed by blood glucose tests, which provided accurate diabetes status for the group without diabetes. However, as this study was based on secondary analysis of service records, possible confounders might exist. For example, members enrolled to EHC might not be representative of the Hong Kong population. Physically or cognitively frail elders who were not able to visit these centres might be excluded. In addition, some of the self-reported data on regular follow-up could not be verified and detailed information of diabetes (e.g. diabetes type, complications, HbA1c, other metabolic parameters, use of conventional, complementary or Chinese medicine) were not available for this study. The finding that those with tertiary level education were less likely to be receiving regular treatment for diabetes prior to baseline assessment is intriguing but difficult to explain. More in-depth analyses are recommended for future studies.

Conclusions

Our findings showed that older people with regular treatment for diabetes in Hong Kong were associated with higher risk of functional and cognitive impairments as well as depression, as compared to those without diabetes. As a result, older people with diabetes may be less capable of managing the disease in the current health and social services settings, as compared to the younger people with diabetes. Our findings would be of interest to the international community, as providing further evidence for the need of an international consensus statement regarding care of diabetes in older people, which is being developed by the European Association for the Study of Diabetes (EASD) Global Initiative for Diabetes in Older People, in conjunction with the International Association of

Gerontology and the American Medical Directors Association.

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